

CAMBRIDGE IGCSE CHEMISTRY 0620
CLASSIFIED PAST PAPERS 2018-2022

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Cambridge IGCSE Chemistry 0620 – Paper 2 Classified Questions

Topic	<p style="text-align: center;"><u>1. States of Matter</u></p> <p style="text-align: center;"><u>1.1 Solids, liquids and gases</u></p>
Content	<ol style="list-style-type: none"> 1. State the distinguishing properties of solids, liquids and gases 2. Describe the structures of solids, liquids and gases in terms of particle separation, arrangement and motion 3. Describe changes of state in terms of melting, boiling, evaporating, freezing and condensing 4. Describe the effects of temperature and pressure on the volume of a gas 5. Explain changes of state in terms of kinetic particle theory, including the interpretation of heating and cooling curves 6. Explain, in terms of kinetic particle theory, the effects of temperature and pressure on the volume of a gas
m22-p22-Q2	<p>In which state does 1 dm³ of methane contain the most particles?</p> <p>A gas at 100 °C</p> <p>B gas at room temperature</p> <p>C liquid</p> <p>D solid</p>
w21-p21-q1	<p>Decane has a freezing point of –30 °C and a boiling point of 174 °C.</p> <p>A small sample of decane is placed in an open beaker in an oven at a temperature of 120 °C and at atmospheric pressure for 24 hours.</p> <p>What happens to the sample of decane?</p> <p>A It boils.</p> <p>B It evaporates.</p> <p>C It melts.</p> <p>D It sublimes.</p>
s21-p23-q2	<p>A 1 cm³ sample of substance X is taken. This is sample 1.</p> <p>X is then converted to a different physical state and a 1 cm³ sample is taken. This is sample 2.</p> <p>Sample 2 contains more particles in the 1 cm³ than sample 1.</p> <p>Which process caused this increase in the number of particles in 1 cm³?</p> <p>A boiling of liquid X</p> <p>B condensation of gaseous X</p> <p>C evaporation of liquid X</p> <p>D sublimation of solid X</p>

m21-p22-q1	<p>Which row about a change of state is correct?</p> <table><tr><td></td><td>change of state</td><td>energy change</td><td>process</td></tr><tr><td>A</td><td>solid → liquid</td><td>heat given out</td><td>melting</td></tr><tr><td>B</td><td>gas → liquid</td><td>heat taken in</td><td>evaporation</td></tr><tr><td>C</td><td>solid → gas</td><td>heat taken in</td><td>sublimation</td></tr><tr><td>D</td><td>liquid → solid</td><td>heat given out</td><td>condensing</td></tr></table>		change of state	energy change	process	A	solid → liquid	heat given out	melting	B	gas → liquid	heat taken in	evaporation	C	solid → gas	heat taken in	sublimation	D	liquid → solid	heat given out	condensing
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w20-p23-q2	<p>When a dark grey solid element is heated, it changes directly into a purple gas.</p> <p>Which word describes this change?</p> <p>A boiling</p> <p>B evaporation</p> <p>C melting</p> <p>D sublimation</p>																				
w20-p23-q3	<p>Nickel(II) sulfate is a green solid that is soluble in water.</p> <p>Which method is used to obtain a pure sample of nickel(II) sulfate crystals from a mixture of nickel(II) sulfate and sand?</p> <p>A Heat the mixture with water and distil it to give nickel(II) sulfate.</p> <p>B Heat the mixture with water and leave it to crystallise.</p> <p>C Heat the mixture with water and filter off the nickel(II) sulfate.</p> <p>D Heat the mixture with water, filter and allow the solution to crystallise.</p>																				
s20-p23-q1	<p>A mixture of ice and water is left to stand and the ice melts.</p> <p>Which row describes what happens as the ice is melting?</p> <table><tr><td></td><td>temperature of mixture</td><td>energy changes</td></tr><tr><td>A</td><td>increases</td><td>average kinetic energy of particles increases</td></tr><tr><td>B</td><td>increases</td><td>energy is used to overcome attractive forces</td></tr><tr><td>C</td><td>stays the same</td><td>average kinetic energy of particles increases</td></tr><tr><td>D</td><td>stays the same</td><td>energy is used to overcome attractive forces</td></tr></table>		temperature of mixture	energy changes	A	increases	average kinetic energy of particles increases	B	increases	energy is used to overcome attractive forces	C	stays the same	average kinetic energy of particles increases	D	stays the same	energy is used to overcome attractive forces					
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s20-p22-q1
s20-p21-q1

A mixture of ice and water is left to stand and the ice melts.

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	temperature of mixture	energy changes
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m19-p22-q1

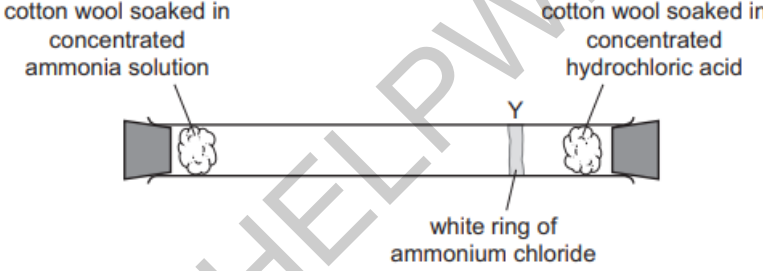
Pure water boils at 100 °C.

What happens to the water particles when water boils?

- A** They gain energy and move further apart.
- B** They gain energy and stay close together.
- C** They lose energy and move further apart.
- D** They lose energy and stay close together.

Topic	<u>1. States of Matter</u>															
	1.2 Diffusion															
Content	1. Describe and explain diffusion in terms of kinetic particle theory 2. Describe and explain the effect of relative molecular mass on the rate of diffusion of gases															
m22-p22-q1	Which gas has the fastest rate of diffusion? A H ₂ B CH ₄ C CO ₂ D SO ₂															
w21-p23-q1	<p>Brownian motion and the diffusion of gases provide evidence for the particulate nature of matter.</p> <p>Which row identifies an example of Brownian motion and how molecular mass determines the rate of diffusion of gas molecules?</p> <table><tr><th></th><th>Brownian motion</th><th>diffusion</th></tr><tr><td>A</td><td>pollen grains in water are seen to move randomly</td><td>heavier gas molecules diffuse more quickly</td></tr><tr><td>B</td><td>pollen grains in water are seen to move randomly</td><td>lighter gas molecules diffuse more quickly</td></tr><tr><td>C</td><td>salt dissolves faster in hot water than in cold water</td><td>heavier gas molecules diffuse more quickly</td></tr><tr><td>D</td><td>salt dissolves faster in hot water than in cold water</td><td>lighter gas molecules diffuse more quickly</td></tr></table>		Brownian motion	diffusion	A	pollen grains in water are seen to move randomly	heavier gas molecules diffuse more quickly	B	pollen grains in water are seen to move randomly	lighter gas molecules diffuse more quickly	C	salt dissolves faster in hot water than in cold water	heavier gas molecules diffuse more quickly	D	salt dissolves faster in hot water than in cold water	lighter gas molecules diffuse more quickly
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w21-p22-q1	<p>An experiment is set up as shown.</p> <div><div>cotton wool soaked in ammonia</div><div>cotton wool soaked in hydrochloric acid</div></div> <p>After several minutes, a white ring of ammonium chloride appears as shown.</p> <div><div>ammonium chloride</div></div> <p>Which statement explains the observation after several minutes?</p> <p>A Ammonia gas diffuses faster than hydrogen chloride gas because its molecules have a lower molecular mass.</p> <p>B Ammonia gas diffuses faster than hydrogen chloride gas because its molecules have a higher molecular mass.</p> <p>C Ammonia gas diffuses slower than hydrogen chloride gas because its molecules have a lower molecular mass.</p> <p>D Ammonia gas diffuses slower than hydrogen chloride gas because its molecules have a higher molecular mass.</p>															

w21-p23-q1 w20-p22-q1 w20-p21-q1	<p>Which gas has the slowest rate of diffusion?</p> <p>A H₂ B NH₃ C CH₄ D CO₂</p>															
m20-p21-q1	<p>The formula of methane is CH₄ and the formula of ethane is C₂H₆.</p> <p>Which row describes diffusion and the relative rates of diffusion of methane and ethane?</p> <table><tr><th></th><th>description of diffusion</th><th>relative rate of diffusion</th></tr><tr><td>A</td><td>particles move from a high concentration to a low concentration</td><td>ethane diffuses more quickly than methane</td></tr><tr><td>B</td><td>particles move from a high concentration to a low concentration</td><td>methane diffuses more quickly than ethane</td></tr><tr><td>C</td><td>particles move from a low concentration to a high concentration</td><td>ethane diffuses more quickly than methane</td></tr><tr><td>D</td><td>particles move from a low concentration to a high concentration</td><td>methane diffuses more quickly than ethane</td></tr></table>		description of diffusion	relative rate of diffusion	A	particles move from a high concentration to a low concentration	ethane diffuses more quickly than methane	B	particles move from a high concentration to a low concentration	methane diffuses more quickly than ethane	C	particles move from a low concentration to a high concentration	ethane diffuses more quickly than methane	D	particles move from a low concentration to a high concentration	methane diffuses more quickly than ethane
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w19-p23-q1	<p>Which two gases will diffuse at the same rate, at the same temperature?</p> <p>A carbon monoxide and carbon dioxide B carbon monoxide and nitrogen C chlorine and fluorine D nitrogen and oxygen</p>															
w19-p22-q1	<p>The rate of diffusion of a gas depends on its molecular mass and the temperature.</p> <p>Which combination of molecular mass and temperature gives the slowest rate of diffusion?</p> <table><tr><th></th><th>molecular mass</th><th>temperature</th></tr><tr><td>A</td><td>high</td><td>high</td></tr><tr><td>B</td><td>high</td><td>low</td></tr><tr><td>C</td><td>low</td><td>high</td></tr><tr><td>D</td><td>low</td><td>low</td></tr></table>		molecular mass	temperature	A	high	high	B	high	low	C	low	high	D	low	low
	molecular mass	temperature														
A	high	high														
B	high	low														
C	low	high														
D	low	low														

w19-p21-q1	<p>Samples of four gases are released in a room at the same time.</p> <p>The gases are carbon dioxide, CO_2, hydrogen chloride, HCl, hydrogen sulfide, H_2S, and nitrogen dioxide, NO_2.</p> <p>Which gas diffuses fastest?</p> <p>A carbon dioxide B hydrogen chloride C hydrogen sulfide D nitrogen dioxide</p>
s19-p22-q1	<p>The apparatus shown is set up. After 20 minutes a white ring of ammonium chloride is seen at position Y.</p>  <p>Which statement about the molecules of ammonia and hydrogen chloride is correct?</p> <p>A Molecules in ammonia have a larger M_r than molecules of hydrogen chloride and so they move more slowly. B Molecules in ammonia have a larger M_r than molecules of hydrogen chloride and so they move more quickly. C Molecules in ammonia have a smaller M_r than molecules of hydrogen chloride and so they move more slowly. D Molecules in ammonia have a smaller M_r than molecules of hydrogen chloride and so they move more quickly.</p>
s19-p21-q1	<p>Which statement explains why ammonia gas, NH_3, diffuses at a faster rate than hydrogen chloride gas, HCl?</p> <p>A Ammonia expands to occupy all of the space available. B Ammonia has a smaller relative molecular mass than hydrogen chloride. C Ammonia is an alkali and hydrogen chloride is an acid. D Ammonia molecules diffuse in all directions at the same time.</p>

w18-p22-q1

Oxygen and fluorine are gaseous elements next to each other in the Periodic Table.

Under the same conditions of temperature and pressure, oxygen diffuses1..... than fluorine because its2..... is less than that of fluorine.

Which words correctly complete gaps 1 and 2?

	1	2
A	faster	molecular mass
B	faster	reactivity
C	slower	molecular mass
D	slower	reactivity

w18-p21-q1

When smoke particles are observed with a microscope they are seen to move around randomly. This is called Brownian motion.

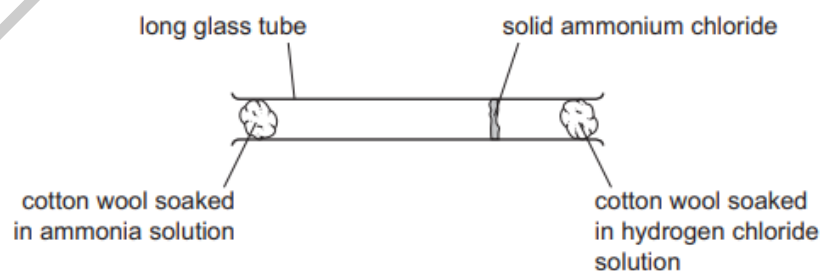
What causes Brownian motion?

- A** diffusion of the smoke particles
- B** molecules in the air hitting the smoke particles
- C** sublimation of the smoke particles
- D** the smoke particles hitting the walls of the container

s18-p23-q1

Ammonia gas is reacted with hydrogen chloride gas using the apparatus shown.

Solid ammonium chloride is produced.

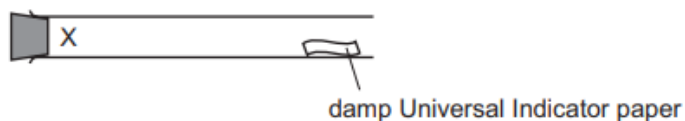


Which statement explains why the solid ammonium chloride is formed nearer to the hydrogen chloride?

- A** Ammonia solution is a base and hydrogen chloride solution is an acid.
- B** Ammonia molecules diffuse more slowly than hydrogen chloride molecules.
- C** Hydrogen chloride has a greater molecular mass than ammonia.
- D** Hydrogen chloride moves by Brownian motion.

s18-p22-q1

A gas is released at point X in the apparatus shown.



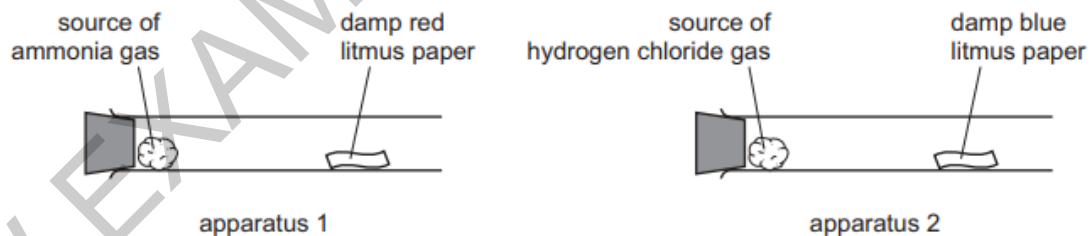
Which gas turns the damp Universal Indicator paper red most quickly?

- A ammonia, NH_3
- B chlorine, Cl_2
- C hydrogen chloride, HCl
- D sulfur dioxide, SO_2

s18-p21-q1

A student investigated the diffusion of ammonia gas, NH_3 , and hydrogen chloride gas, HCl .

Two sets of apparatus were set up as shown at room temperature and pressure.



The damp red litmus paper in apparatus 1 changed colour after 30 seconds.

How long does it take for the damp blue litmus paper to change colour in apparatus 2?

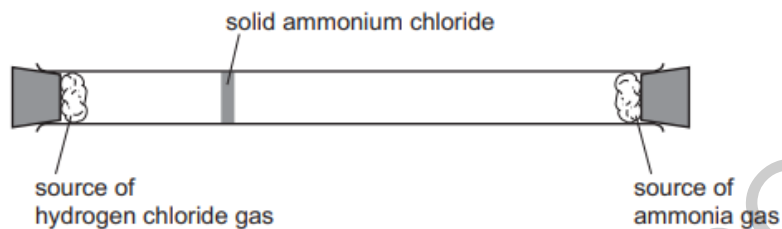
- A 64 seconds
- B 30 seconds
- C 21 seconds
- D The blue litmus paper would not change colour.

m18-p22-q1

Hydrogen chloride gas, HCl , reacts with ammonia gas, NH_3 , to form solid ammonium chloride.

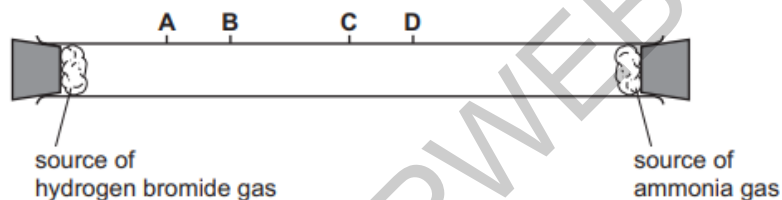
The apparatus is set up as shown.

After a few minutes, solid ammonium chloride forms where the two gases meet.



The experiment is repeated using hydrogen bromide, HBr , in place of hydrogen chloride.

How far along the tube does the solid ammonium bromide form?



m18-p22-q2

Substance L melts at -7°C and is a brown liquid at room temperature.

Which temperature is the boiling point of pure L?

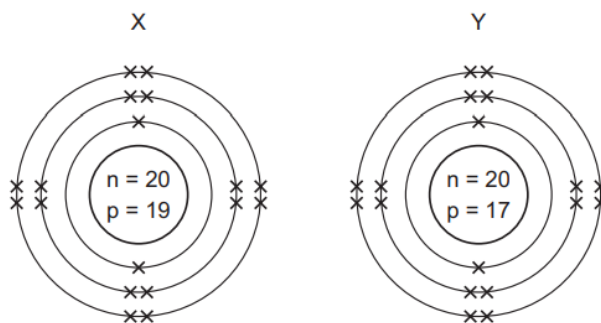
- A -77°C
- B -7°C to $+7^\circ\text{C}$
- C 59°C
- D 107°C to 117°C

Topic	<p align="center"><u>2. Atoms, elements and compounds</u></p> <p align="center">2.1 Elements, compounds and mixtures</p>
Content	<p>1. Describe the differences between elements, compounds and mixtures</p>
	<p align="center">NO QUESTIONS FROM THIS SECTION IN LAST FIVE YEARS</p>

Topic	<p align="center"><u>2. Atoms, elements and compounds</u></p> <p align="center">2.2 Atomic structures and periodic tables</p>
Content	<ol style="list-style-type: none"> Describe the structure of the atom as a central nucleus containing neutrons and protons surrounded by electrons in shells State the relative charges and relative masses of a proton, a neutron and an electron Define proton number/ atomic number as the number of protons in the nucleus of an atom Define mass number/nucleon number as the total number of protons and neutrons in the nucleus of an atom Determine the electronic configuration of elements and their ions with proton number 1 to 20, e.g. 2,8,3 State that: (a) Group VIII noble gases have a full outer shell (b) the number of outer shell electrons is equal to the group number in Groups I to VII (c) the number of occupied electron shells is equal to the period number
w21-p23-q4	<p>The nucleus of a particular atom consists of nineteen particles.</p> <p>Nine of them are positively charged and ten of them are uncharged.</p> <p>Which statement about this nucleus is correct?</p> <p>A The nucleus has a nucleon number of nine.</p> <p>B The nucleus has a nucleon number of ten.</p> <p>C The nucleus has a proton number of nine.</p> <p>D The nucleus has a proton number of ten.</p>
s21-p23-q4 s21-p22-q4 s21-p21-q4	<p>Element X has 7 protons.</p> <p>Element Y has 8 more protons than X.</p> <p>Which statement about element Y is correct?</p> <p>A Y has more electron shells than X.</p> <p>B Y has more electrons in its outer shell than X.</p> <p>C Y is in a different group of the Periodic Table from X.</p> <p>D Y is in the same period of the Periodic Table as X.</p>
m21-p22-q22	<p>Metal X reacts with non-metal Y to form an ionic compound with the formula X_2Y.</p> <p>Which statements are correct?</p> <ol style="list-style-type: none"> X is in Group I of the Periodic Table. X is in Group II of the Periodic Table. Y is in Group VI of the Periodic Table. Y is in Group VII of the Periodic Table. <p>A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4</p>

w20-p23-q6
w20-p22-q6
w20-p21-q6

The arrangements of the electrons in two ions formed from elements X and Y are shown.



Which equation represents the reaction between elements X and Y?

- A** $X_2 + 2Y \rightarrow 2X^+ + 2Y^-$
B $X_2 + 2Y \rightarrow 2X^- + 2Y^+$
C $2X + Y_2 \rightarrow 2X^+ + 2Y^-$
D $2X + Y_2 \rightarrow 2X^- + 2Y^+$

w21-p21-q32

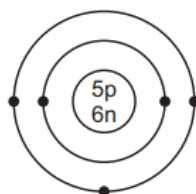
Iron can be protected from rusting by attaching a piece of a more reactive metal, e.g. magnesium, to the iron.

Which equation represents the reaction that takes place?

- A** $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$
B $Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$
C $Mg(s) \rightarrow Mg^{2+}(aq) + 2e^-$
D $Mg^{2+}(aq) + 2e^- \rightarrow Mg(s)$

s20-p23-q4

The structure of an atom of element X is shown.



key
 ● = electron
 n = neutron
 p = proton

What is element X?

- A** boron
B carbon
C sodium
D sulfur

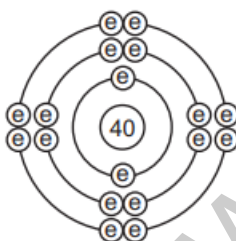
s20-p23-q24

Which statement about the noble gases is correct?

- A** Argon is used in light bulbs and balloons.
B Helium reacts with oxygen in the air.
C They all have full outer electron shells.
D They are all diatomic molecules.

s20-p22-q4

The diagram shows the electronic structure of a particle with a nucleon number (mass number) of 40.



The table shows the suggestions that three students, 1, 2 and 3, made to identify the particle.

	student		
	1	2	3
particle	Ar	Cl	Ca ²⁺

Which students are correct?

- A** 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

s20-p22-q4

The atomic number and nucleon number of a potassium atom are shown.

	potassium atom
atomic number	19
nucleon number	39

How many protons, neutrons and electrons are in a potassium ion, K⁺?

	protons	neutrons	electrons
A	19	20	18
B	19	20	20
C	20	19	18
D	20	19	19

s19-p23-q22	<p>Gas G has 10 electrons. Gas H has eight more electrons than gas G. Both gases are monoatomic.</p> <p>Which statement about G and H is correct?</p> <p>A Both gases are in the same group of the Periodic Table.</p> <p>B Both gases are in the same period of the Periodic Table.</p> <p>C Both gases are very reactive.</p> <p>D Gas G has a higher atomic mass than gas H.</p>
s19-p21-q4	<p>Which statement about an atom of fluorine, $^{19}_9\text{F}$, is correct?</p> <p>A It contains more protons than neutrons.</p> <p>B It contains a total of 28 protons, neutrons and electrons.</p> <p>C Its isotopes contain different numbers of protons.</p> <p>D Its nucleus contains 9 neutrons.</p>
s19-p21-22	<p>Which statement about elements in Group VIII of the Periodic Table is correct?</p> <p>A They all have a full outer shell of electrons.</p> <p>B They all react with Group I elements to form ionic compounds.</p> <p>C They are all diatomic molecules.</p> <p>D They are all liquids at room temperature.</p>
w18-p22-q3	<p>How many neutrons are present in the atom $^{45}_{21}\text{X}$?</p> <p>A 21 B 24 C 45 D 66</p>
s18-p21-q21	<p>Which element is in the same period of the Periodic Table as silicon?</p> <p>A germanium</p> <p>B scandium</p> <p>C sodium</p> <p>D strontium</p>

m18-p22-q21

The Periodic Table lists all the known elements.

Elements are arranged in order of 1 number.

The melting points of Group I elements 2 down the group.

The melting points of Group VII elements 3 down the group.

Which words correctly complete gaps 1, 2 and 3?

	1	2	3
A	nucleon	decrease	increase
B	nucleon	increase	decrease
C	proton	decrease	increase
D	proton	increase	decrease

Topic	<u>2. Thermal physics</u> 2.3 Isotopes																				
Content	<ol style="list-style-type: none">1. Define isotopes as different atoms of the same element that have the same number of protons but different numbers of neutrons2. Interpret and use symbols for atoms, e.g. $^{12}_6\text{C}$, and ions, e.g. $^{35}_{17}\text{Cl}^-$3. State that isotopes of the same element have the same chemical properties because they have the same number of electrons and therefore the same electronic configuration4. Calculate the relative atomic mass of an element from the relative masses and abundances of its isotopes																				
m22-p22-q3	<p>Which statement explains why isotopes of the same element have the same chemical properties?</p> <p>A They have the same electronic structure.</p> <p>B They have the same relative mass.</p> <p>C They have the same nucleon number.</p> <p>D They have the same proton number.</p>																				
w21-p22-q4	<p>How many protons, neutrons and electrons are there in one atom of the isotope $^{27}_{13}\text{Al}$?</p> <table><tr><th></th><th>protons</th><th>neutrons</th><th>electrons</th></tr><tr><td>A</td><td>13</td><td>13</td><td>13</td></tr><tr><td>B</td><td>13</td><td>14</td><td>13</td></tr><tr><td>C</td><td>14</td><td>13</td><td>13</td></tr><tr><td>D</td><td>14</td><td>14</td><td>13</td></tr></table>		protons	neutrons	electrons	A	13	13	13	B	13	14	13	C	14	13	13	D	14	14	13
	protons	neutrons	electrons																		
A	13	13	13																		
B	13	14	13																		
C	14	13	13																		
D	14	14	13																		
s21-p23-q7	<p>Which statement about isotopes of the same element is correct?</p> <p>A They have different numbers of electrons.</p> <p>B They have different numbers of neutrons.</p> <p>C They have different numbers of protons.</p> <p>D They have the same mass number.</p>																				

s21-p22-q8	<p>Some information about particles P, Q, R and S is shown.</p> <table><tr><td></td><td>nucleon number</td><td>number of neutrons</td><td>number of electrons</td></tr><tr><td>P</td><td>12</td><td>6</td><td>6</td></tr><tr><td>Q</td><td>24</td><td>12</td><td>10</td></tr><tr><td>R</td><td>16</td><td>8</td><td>10</td></tr><tr><td>S</td><td>14</td><td>8</td><td>6</td></tr></table> <p>Which two particles are isotopes of the same element?</p> <p>A P and Q B P and S C Q and R D R and S</p>		nucleon number	number of neutrons	number of electrons	P	12	6	6	Q	24	12	10	R	16	8	10	S	14	8	6
	nucleon number	number of neutrons	number of electrons																		
P	12	6	6																		
Q	24	12	10																		
R	16	8	10																		
S	14	8	6																		
s21-p21-q9	<p>2.56 g of a metal oxide, MO_2, is reduced to 1.92 g of the metal, M.</p> <p>What is the relative atomic mass of M?</p> <p>A 48 B 96 C 128 D 192</p>																				
m21-p22-Q4	<p>Which statement about the atoms of all the isotopes of carbon is correct?</p> <p>A They are all radioactive.</p> <p>B They have the same mass.</p> <p>C They have the same number of neutrons.</p> <p>D They have the same number of electrons in the outer shell.</p>																				
w20-p22-q3	<p>Which statement about isotopes is correct?</p> <p>A They have different proton numbers.</p> <p>B They have different chemical properties.</p> <p>C They have the same nucleon number.</p> <p>D They have the same number of electrons in their outer shell.</p>																				

w20-p22-q25

Which row about elements in the Periodic Table is correct?

	statement 1	statement 2
A	two elements in the same group have similar chemical properties	metals are on the left of the table
B	two elements in the same group have similar chemical properties	metals are on the right of the table
C	two elements in the same period have similar chemical properties	metals are on the left of the table
D	two elements in the same period have similar chemical properties	metals are on the right of the table

w20-p21-q5

The atomic structure of four particles are shown.

	electrons	protons	neutrons
P	18	17	18
Q	18	17	20
R	17	17	18
S	17	17	20

Which particles have the same chemical properties?

A P and R only **B** P and S **C** P, Q and R **D** R and S

m20-p22-q5

 $^{14}_6\text{C}$ and $^{12}_6\text{C}$ are isotopes of carbon.

Which statement about these isotopes is correct?

- A** $^{12}_6\text{C}$ is more reactive than $^{14}_6\text{C}$ because the atoms have less mass.
- B** $^{12}_6\text{C}$ is more reactive than $^{14}_6\text{C}$ because the atoms have different numbers of neutrons.
- C** The reactions of $^{12}_6\text{C}$ are similar to $^{14}_6\text{C}$ because they have the same number of outer shell electrons.
- D** The reactions of $^{12}_6\text{C}$ are similar to $^{14}_6\text{C}$ because they have the same number of protons in the nucleus.

w19-p23-q5	<p>The numbers of protons, neutrons and electrons present in the atoms P, Q, R and S are shown.</p> <table><tr><th>atom</th><th>number of protons</th><th>number of neutrons</th><th>number of electrons</th></tr><tr><td>P</td><td>4</td><td>5</td><td>4</td></tr><tr><td>Q</td><td>5</td><td>6</td><td>5</td></tr><tr><td>R</td><td>6</td><td>6</td><td>6</td></tr><tr><td>S</td><td>6</td><td>7</td><td>6</td></tr></table> <p>Which atoms are isotopes of the same element?</p> <p>A P and Q only B Q and R only C R and S only D P and S only</p>	atom	number of protons	number of neutrons	number of electrons	P	4	5	4	Q	5	6	5	R	6	6	6	S	6	7	6
atom	number of protons	number of neutrons	number of electrons																		
P	4	5	4																		
Q	5	6	5																		
R	6	6	6																		
S	6	7	6																		
w19-p23-q6	<p>Carbon has three isotopes, ^{12}C, ^{13}C and ^{14}C.</p> <p>Why do all three isotopes have the same chemical properties?</p> <p>A They all have the same atomic mass. B They all have the same number of electrons in their outer shell. C They all have the same number of electron shells. D They all have the same number of nucleons.</p>																				
w19-p22-q6	<p>Rubidium has two isotopes, $^{85}_{37}\text{Rb}$ and $^{87}_{37}\text{Rb}$.</p> <p>Which statement explains why both isotopes have the same chemical properties?</p> <p>A They have the same number of protons. B They have the same number of outer shell electrons. C They have different numbers of neutrons. D They have different mass numbers.</p>																				
w19-p21-q5	<p>An isotope of chromium is represented by $^{52}_{24}\text{Cr}$.</p> <p>Which statement about an atom of this isotope of chromium is correct?</p> <p>A It contains 24 electrons. B It contains 24 neutrons. C It contains 28 protons. D It contains 52 neutrons.</p>																				

w19-p21-q6

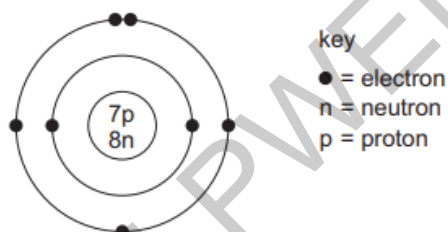
Element X has two isotopes, $^{12}_6\text{X}$ and $^{14}_6\text{X}$.

Which statement about these isotopes is correct?

- A** They have different chemical properties because they have different numbers of neutrons.
- B** They have the same chemical properties because they have the same number of outer shell electrons.
- C** They have the same nucleon number because the sum of the number of protons and electrons is the same.
- D** They have different positions in the Periodic Table because they have different numbers of neutrons.

s19-p23-q4

The structure of an atom is shown.



Which element is the atom an isotope of?

- A** nitrogen
- B** oxygen
- C** phosphorus
- D** titanium

s19-p22-q4

What is an isotope of $^{31}_{15}\text{E}$?

- A** $^{31}_{14}\text{E}$
- B** $^{33}_{15}\text{E}$
- C** $^{31}_{16}\text{E}$
- D** $^{33}_{16}\text{E}$

m19-p22-q5

Which row describes isotopes of the same element?

	number of protons	number of neutrons
A	different	different
B	different	same
C	same	different
D	same	same

w18-p23-q3	<p>Which statement describes isotopes?</p> <p>A Isotopes of the same element have different electron arrangements.</p> <p>B Isotopes of the same element have different nuclear charges.</p> <p>C Isotopes of the same element have nuclei with masses that are the same.</p> <p>D Isotopes of the same element have the same number of protons.</p>																																										
w18-p23-q4	<p>X and Y are both atoms.</p> <p>X and Y have the same chemical properties as each other.</p> <p>Which row describes the atomic structures of X and Y?</p> <table><tr><th></th><th colspan="3">X</th><th colspan="3">Y</th></tr><tr><th></th><th>protons</th><th>neutrons</th><th>electrons</th><th>protons</th><th>neutrons</th><th>electrons</th></tr><tr><td>A</td><td>6</td><td>6</td><td>6</td><td>6</td><td>6</td><td>7</td></tr><tr><td>B</td><td>6</td><td>6</td><td>6</td><td>6</td><td>8</td><td>6</td></tr><tr><td>C</td><td>6</td><td>6</td><td>6</td><td>16</td><td>16</td><td>16</td></tr><tr><td>D</td><td>7</td><td>6</td><td>7</td><td>6</td><td>6</td><td>7</td></tr></table>		X			Y				protons	neutrons	electrons	protons	neutrons	electrons	A	6	6	6	6	6	7	B	6	6	6	6	8	6	C	6	6	6	16	16	16	D	7	6	7	6	6	7
	X			Y																																							
	protons	neutrons	electrons	protons	neutrons	electrons																																					
A	6	6	6	6	6	7																																					
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C	6	6	6	16	16	16																																					
D	7	6	7	6	6	7																																					
w18-p22-q4	<p>Two naturally occurring isotopes of oxygen are ^{16}O and ^{17}O.</p> <p>Which statement is correct?</p> <p>A Both isotopes react with iron to form rust.</p> <p>B Neither isotope reacts with iron to form rust.</p> <p>C Only ^{16}O reacts with iron to form rust.</p> <p>D Only ^{17}O reacts with iron to form rust.</p>																																										
w18-p21-q4	<p>Which statement about the isotopes of an element is correct?</p> <p>A Their physical properties are different because they have different proton numbers.</p> <p>B Their atomic masses are different because they have different numbers of electron shells.</p> <p>C They have the same chemical properties because they have the same number of electrons in their outer shells.</p> <p>D They have the same physical properties because they have the same number of neutrons in their nuclei.</p>																																										

S18-p23-q5

Iron has an atomic number of 26. It occurs as the isotopes ^{54}Fe , ^{56}Fe , ^{57}Fe and ^{58}Fe .

Which statement explains why these isotopes have the same chemical properties?

- A They have similar mass numbers.
- B They have the same number of electrons in their outer shells.
- C They have the same number of neutrons in their nuclei.
- D They have the same number of protons in their nuclei.

S18-p22-q5

Which pair shows particles with the same chemical properties?

- A $^{23}_{11}\text{M}$ and $^{23}_{11}\text{M}^+$
- B $^{23}_{11}\text{M}$ and $^{24}_{11}\text{M}$
- C $^{23}_{11}\text{M}$ and $^{23}_{12}\text{M}$
- D $^{24}_{11}\text{M}^+$ and $^{24}_{12}\text{M}^+$

S18-p21-q5

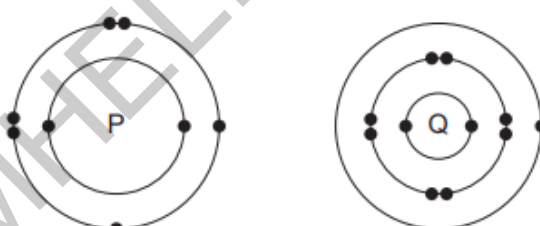
Chlorine exists as two common isotopes, ^{35}Cl and ^{37}Cl .

Information about these two isotopes is shown.

	number of protons	number of neutrons	number of electron shells
^{35}Cl	17	18	3
^{37}Cl	17	20	3

Which statement explains why the two isotopes are of the same element?

- A Both have the same number of electron shells.
- B Both have the same number of protons.
- C Both have 7 outer shell electrons.
- D ^{37}Cl has 2 more neutrons than ^{35}Cl .

Topic	<p align="center"><u>2. Thermal physics</u></p> <p align="center">2.4 Ions and ionic bonds</p>
Content	<ol style="list-style-type: none"> Describe the formation of positive ions, known as cations, and negative ions, known as anions State that an ionic bond is a strong electrostatic attraction between oppositely charged ions Describe the formation of ionic bonds between elements from Group I and Group VII, including the use of dot-and-cross diagrams Describe the properties of ionic compounds: <ol style="list-style-type: none"> high melting points and boiling points good electrical conductivity when aqueous or molten and poor when solid Describe the giant lattice structure of ionic compounds as a regular arrangement of alternating positive and negative ions Describe the formation of ionic bonds between ions of metallic and non-metallic elements, including the use of dot-and-cross diagrams Explain in terms of structure and bonding the properties of ionic compounds:
m22-p22-q4	<p>The electronic structures of atoms P and Q are shown.</p> <div style="text-align: center;">  </div> <p>P and Q form an ionic compound.</p> <p>What is the formula of the compound?</p> <p>A PQ B P₂Q C P₂Q₃ D PQ₂</p>
m22-p22-q10	<p>Caesium fluoride is an ionic compound.</p> <p>Which statements about caesium fluoride are correct?</p> <ol style="list-style-type: none"> It conducts electricity when solid. It has a high melting point. It is soluble in water. It is highly volatile. <p>A 1 and 2 B 1 and 4 C 2 and 3 D 3 and 4</p>

w21-p23-q6

A Group I element combines with a Group VII element and forms an ionic bond.

Which row shows how the electronic structures change?

	Group I element		Group VII element	
	before bonding	after bonding	before bonding	after bonding
A	2,8,1	2,8,2	2,7	2,6
B	2,8	2,7	2,8	2,8,1
C	2,8,1	2,8	2,7	2,8
D	2,8	2,8,1	2,8	2,7

w21-p23-q21
w21p21-q21

A period of the Periodic Table is shown.

group	I	II	III	IV	V	VI	VII	VIII
element	R	S	T	V	W	X	Y	Z

The letters are not their chemical symbols.

Which statement is correct?

- A** Element R does not conduct electricity.
- B** Elements R and Y react together to form an ionic compound.
- C** Element Z exists as a diatomic molecule.
- D** Element Z reacts with element T.

w21-p23-q22

Part of the Periodic Table is shown.

[illegible]

Which pairs of the elements J, K, L, M and N react together to form a product with a 1 : 1 ratio?

- A** J and L K and M
B J and M K and N
C J and N K and L
D J and N K and M

w21-p22-q21

A period of the Periodic Table is shown.

group	I	II	III	IV	V	VI	VII	VIII
element	R	S	T	V	W	X	Y	Z

The letters are not their chemical symbols.

Which statement is correct?

- A** Element R does not conduct electricity.
- B** Elements R and Y react together to form an ionic compound.
- C** Element Z exists as a diatomic molecule.
- D** Element Z reacts with element T.

s21-p22-q7

Chemical compounds formed from a Group I element and a Group VII element contain ionic bonds.

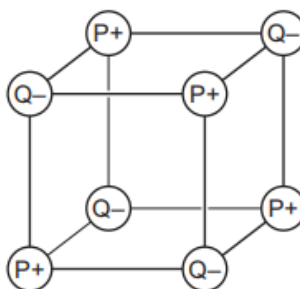
How are the ionic bonds formed?

- A** Electrons are transferred from Group VII atoms to Group I atoms.
- B** Electrons are shared between Group I atoms and Group VII atoms.
- C** Electrons are lost by Group I atoms and Group VII atoms.
- D** Electrons are transferred from Group I atoms to Group VII atoms.

s21-p21-q8

Two elements, P and Q, are in the same period of the Periodic Table.

P and Q react together to form an ionic compound. Part of the lattice of this compound is shown.



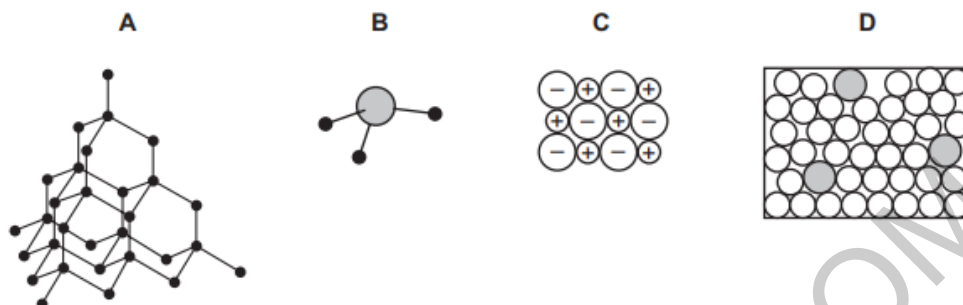
Which statement is correct?

- A** An ion of P has more electrons than an ion of Q.
- B** Element P is non-metallic.
- C** P is to the left of Q in the Periodic Table.
- D** The formula of the compound is P_4Q_4 .

m21-p22-q6	<p>Lithium and fluorine react to form lithium fluoride.</p> <p>A student writes three statements about the reaction.</p> <div><div>1</div>Lithium atoms lose an electron when they react.</div> <div><div>2</div>Each fluoride ion has one more electron than a fluorine atom.</div> <div><div>3</div>Lithium fluoride is a mixture of elements.</div> <p>Which statements are correct?</p> <p>A 1 and 2 only B 1 and 3 only C 2 and 3 only D 1, 2 and 3</p>															
m21-p22-q8	<p>Magnesium oxide has a high melting point.</p> <p>Carbon dioxide has a low melting point.</p> <p>Which row identifies the attractive forces that are broken when these compounds are melted?</p> <table><tr><th></th><th>magnesium oxide</th><th>carbon dioxide</th></tr><tr><td>A</td><td>strong attractions between molecules</td><td>weak attractions between atoms</td></tr><tr><td>B</td><td>strong attractions between molecules</td><td>weak attractions between molecules</td></tr><tr><td>C</td><td>strong attractions between ions</td><td>weak attractions between atoms</td></tr><tr><td>D</td><td>strong attractions between ions</td><td>weak attractions between molecules</td></tr></table>		magnesium oxide	carbon dioxide	A	strong attractions between molecules	weak attractions between atoms	B	strong attractions between molecules	weak attractions between molecules	C	strong attractions between ions	weak attractions between atoms	D	strong attractions between ions	weak attractions between molecules
	magnesium oxide	carbon dioxide														
A	strong attractions between molecules	weak attractions between atoms														
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D	strong attractions between ions	weak attractions between molecules														
w20-p23-q9 w20-p22-q9 w20-p21-q9	<p>Rubidium is in Group I of the Periodic Table and bromine is in Group VII.</p> <p>Rubidium reacts with bromine to form an ionic compound.</p> <p>Which row shows the electron change taking place for rubidium and the correct formula of the rubidium ion?</p> <table><tr><th></th><th>electron change</th><th>formula of ion formed</th></tr><tr><td>A</td><td>electron gained</td><td>Rb⁺</td></tr><tr><td>B</td><td>electron gained</td><td>Rb⁻</td></tr><tr><td>C</td><td>electron lost</td><td>Rb⁺</td></tr><tr><td>D</td><td>electron lost</td><td>Rb⁻</td></tr></table>		electron change	formula of ion formed	A	electron gained	Rb ⁺	B	electron gained	Rb ⁻	C	electron lost	Rb ⁺	D	electron lost	Rb ⁻
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A	electron gained	Rb ⁺														
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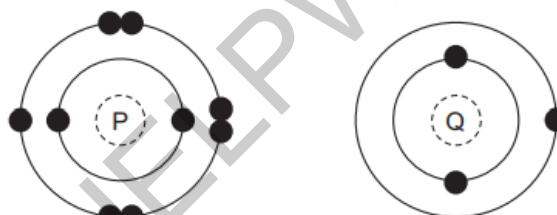
w20-p22-q29

Which diagram best represents the structure of a substance that is a good conductor of electricity at 25 °C?



s20-p23-q5
s20-p22-q5
s20-p21-q5

The electronic structures of two atoms, P and Q, are shown.



P and Q combine together to form a compound.

What is the type of bonding in the compound and what is the formula of the compound?

	type of bonding	formula
A	ionic	PQ
B	ionic	PQ ₂
C	covalent	PQ ₂
D	covalent	PQ

s20-p23-q7

Why does magnesium oxide, MgO, have a very high melting point?

- A** There is a very strong double bond between magnesium and oxygen.
- B** There is a very strong attractive force between the magnesium oxide molecules.
- C** The oxide ions are strongly attracted to positive ions.
- D** The magnesium ions are strongly attracted to a sea of electrons.

m20-p22-q4	<p>Lithium reacts with fluorine to form the compound lithium fluoride.</p> <p>Which statement about this reaction is correct?</p> <p>A Each fluorine atom gains one electron.</p> <p>B Each fluorine atom gains two or more electrons.</p> <p>C Each fluorine atom loses one electron.</p> <p>D Each fluorine atom loses two or more electrons.</p>
w19-p23-q4	<p>Which statement about an ionic compound is not correct?</p> <p>A It conducts electricity when dissolved in water.</p> <p>B It has a high melting point due to strong attractive forces between ions.</p> <p>C It has a regular lattice of oppositely charged ions in a 'sea of electrons'.</p> <p>D The ionic bonds are formed between metallic and non-metallic elements.</p>
w19-p22-q4 w19-p21-q4	<p>Which statement about an ionic compound is not correct?</p> <p>A It conducts electricity when dissolved in water.</p> <p>B It has a high melting point due to strong attractive forces between ions.</p> <p>C It has a regular lattice of oppositely charged ions in a 'sea of electrons'.</p> <p>D The ionic bonds are formed between metallic and non-metallic elements.</p>
s19-p23-q6	<p>Which statement describes the structure of an ionic compound?</p> <p>A It is a giant lattice of oppositely charged ions.</p> <p>B It is a giant lattice of positive ions in a 'sea' of electrons.</p> <p>C It is a giant molecule of oppositely charged ions.</p> <p>D It is a simple molecule of oppositely charged ions.</p>

s19-p23-q21	<p>Which statement about the properties of elements in Group I and in Group VII is correct?</p> <p>A Bromine displaces iodine from an aqueous solution of potassium iodide.</p> <p>B Chlorine, bromine and iodine are diatomic gases at room temperature.</p> <p>C Lithium, sodium and potassium are soft non-metals.</p> <p>D Lithium, sodium and potassium have an increasing number of electrons in their outer shells.</p>																				
s19-p22-q6 s19-p21-q6	<p>Which statement describes the structure of an ionic compound?</p> <p>A It is a giant lattice of oppositely charged ions.</p> <p>B It is a giant lattice of positive ions in a 'sea' of electrons.</p> <p>C It is a giant molecule of oppositely charged ions.</p> <p>D It is a simple molecule of oppositely charged ions.</p>																				
m19-p22-q6	<p>Which row describes the structure of the positive ion in sodium chloride?</p> <table><tr><th></th><th>protons</th><th>electrons</th><th>neutrons</th></tr><tr><td>A</td><td>11</td><td>11</td><td>12</td></tr><tr><td>B</td><td>11</td><td>10</td><td>12</td></tr><tr><td>C</td><td>17</td><td>17</td><td>18</td></tr><tr><td>D</td><td>17</td><td>18</td><td>18</td></tr></table>		protons	electrons	neutrons	A	11	11	12	B	11	10	12	C	17	17	18	D	17	18	18
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B	11	10	12																		
C	17	17	18																		
D	17	18	18																		
w18-p22-q6	<p>Potassium bromide and methanol are both compounds.</p> <p>Their melting points are different.</p> <p>Which row is correct?</p> <table><tr><th></th><th>substance with the higher melting point</th><th>reason why the melting points are different</th></tr><tr><td>A</td><td>methanol</td><td>the attractive forces between oppositely charged ions is greater than the attractive forces between molecules</td></tr><tr><td>B</td><td>methanol</td><td>the attractive forces between molecules is greater than the attractive forces between oppositely charged ions</td></tr><tr><td>C</td><td>potassium bromide</td><td>the attractive forces between oppositely charged ions is greater than the attractive forces between molecules</td></tr><tr><td>D</td><td>potassium bromide</td><td>the attractive forces between molecules is greater than the attractive forces between oppositely charged ions</td></tr></table>		substance with the higher melting point	reason why the melting points are different	A	methanol	the attractive forces between oppositely charged ions is greater than the attractive forces between molecules	B	methanol	the attractive forces between molecules is greater than the attractive forces between oppositely charged ions	C	potassium bromide	the attractive forces between oppositely charged ions is greater than the attractive forces between molecules	D	potassium bromide	the attractive forces between molecules is greater than the attractive forces between oppositely charged ions					
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D	potassium bromide	the attractive forces between molecules is greater than the attractive forces between oppositely charged ions																			

m18-p22-q4	<p>Caesium, Cs, is an element in Group I of the Periodic Table.</p> <p>When caesium reacts it forms a positive ion, Cs^+.</p> <p>How is a caesium ion formed?</p> <p>A A caesium atom gains a proton.</p> <p>B A caesium atom gains an electron.</p> <p>C A caesium atom loses an electron.</p> <p>D A caesium atom shares an electron.</p>
m18-p22-q22	<p>Metal X reacts with non-metal Y to form an ionic compound with the formula X_2Y.</p> <p>Which statements are correct?</p> <p>1 X is in Group I of the Periodic Table.</p> <p>2 X is in Group II of the Periodic Table.</p> <p>3 Y is in Group VI of the Periodic Table.</p> <p>4 Y is in Group VII of the Periodic Table.</p> <p>A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4</p>

Topic	<p align="center"><u>2. Thermal physics</u></p> <p align="center">2.5 Simple molecules and covalent bonds</p>
Content	<ol style="list-style-type: none"> 1. State that a covalent bond is formed when a pair of electrons is shared between two atoms leading to noble gas electronic configurations 2. Describe the formation of covalent bonds in simple molecules, including H₂, Cl₂, H₂O, CH₄, NH₃ and HCl. Use dot-and-cross diagrams to show the electronic configurations in these and similar molecules 3. Describe in terms of structure and bonding the properties of simple molecular compounds: <ol style="list-style-type: none"> (a) low melting points and boiling points (b) poor electrical conductivity 4. Describe the formation of covalent bonds in simple molecules, including CH₃OH, C₂H₄, O₂, CO₂ and N₂. Use dot-and-cross diagrams to show the electronic configurations in these and similar molecules 5. Explain in terms of structure and bonding the properties of simple molecular compounds: <ol style="list-style-type: none"> (a) low melting points and boiling points in terms of weak intermolecular forces (specific types of intermolecular forces are not required) (b) poor electrical conductivity
w21-p23-q7 w21-p21-q7	<p>Which statement describes the attractive forces between molecules?</p> <p>A They are strong covalent bonds which hold molecules together.</p> <p>B They are strong ionic bonds which hold molecules together.</p> <p>C They are weak forces formed between covalently-bonded molecules.</p> <p>D They are weak forces which hold ions together in a lattice.</p>
w21-p23-q8	<p>Which diagram shows the outer electron arrangement in a molecule of carbon dioxide?</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;"> <p>A</p> </div> <div style="text-align: center;"> <p>B</p> </div> <div style="text-align: center;"> <p>C</p> </div> <div style="text-align: center;"> <p>D</p> </div> </div>

w21-p22-q7	<p>Which statement describes the attractive forces between molecules?</p> <p>A They are strong covalent bonds which hold molecules together.</p> <p>B They are strong ionic bonds which hold molecules together.</p> <p>C They are weak forces formed between covalently-bonded molecules.</p> <p>D They are weak forces which hold ions together in a lattice.</p>
w21-p21-q35	<p>Which molecule contains only single covalent bonds?</p> <p>A propane</p> <p>B propanoic acid</p> <p>C propene</p> <p>D propyl propanoate</p>
s21-p23-q5 s21-p22-q5	<p>A covalent molecule Q contains only six shared electrons.</p> <p>What is Q?</p> <p>A ammonia, NH_3</p> <p>B chlorine, Cl_2</p> <p>C methane, CH_4</p> <p>D water, H_2O</p>
s21-p21-q5	<p>A covalent molecule Q contains only six shared electrons.</p> <p>What is Q?</p> <p>A ammonia, NH_3</p> <p>B chlorine, Cl_2</p> <p>C methane, CH_4</p> <p>D water, H_2O</p>

s21-p21-q24

Element R forms a covalent compound R_2Si with silicon.

Which row describes R?

	metallic or non-metallic character	group number in the Periodic Table
A	metallic	II
B	metallic	VI
C	non-metallic	II
D	non-metallic	VI

m21-p22-q7

How many electrons are used to form covalent bonds in a molecule of methanol, CH_3OH ?

A 5 **B** 6 **C** 8 **D** 10

w20-p23-q5

Molecules containing only non-metal atoms are covalently bonded.

The formulae of four covalently bonded molecules are given below:

- 1 nitrogen, N_2
- 2 carbon dioxide, CO_2
- 3 ethene, C_2H_4
- 4 methanol, CH_3OH

Which of the molecules contain double bonds?

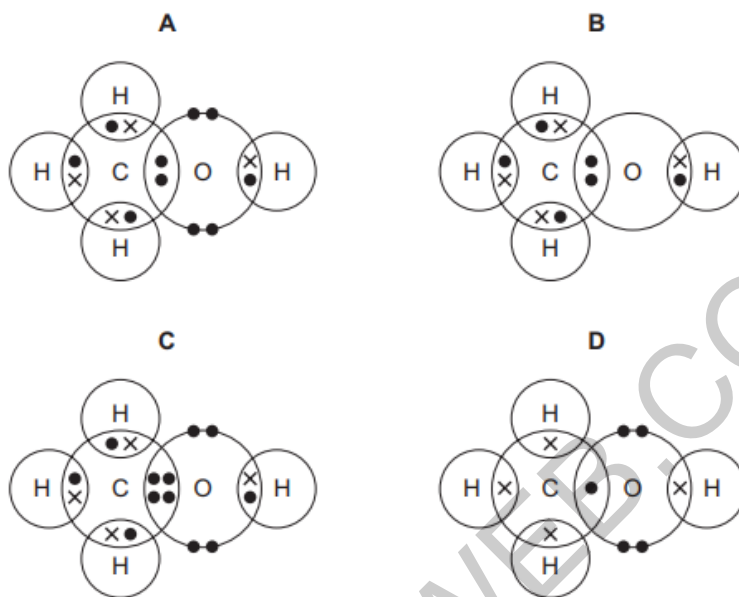
A 1 and 4 **B** 2 and 3 **C** 2 and 4 **D** 4 only

w20-p22-q7

Which row identifies compounds that contain single covalent bonds only, double covalent bonds only or both single and double covalent bonds?

	single covalent bonds only	double covalent bonds only	both single and double covalent bonds
A	C_2H_4	CH_3OH	CO_2
B	CH_3OH	C_2H_4	CO_2
C	CH_3OH	CO_2	C_2H_4
D	CO_2	C_2H_4	CH_3OH

w20-p21-q7

Which diagram shows the outer shell electron arrangement in a molecule of methanol, CH_3OH ?

s20-p22-q7

The bonding, structure and melting point of sodium chloride and sulfur dichloride are shown.

compound	bonding	structure	melting point/ $^{\circ}\text{C}$
sodium chloride	ionic	giant lattice	801
sulfur dichloride	covalent	simple molecular	-121

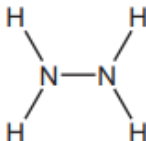
Why does sulfur dichloride have a lower melting point than sodium chloride?

- A** The covalent bonds in sulfur dichloride are weaker than the attractive forces between molecules in sodium chloride.
- B** The covalent bonds in sulfur dichloride are weaker than the ionic bonds in sodium chloride.
- C** The attractive forces between molecules in sulfur dichloride are weaker than the attractive forces between molecules in sodium chloride.
- D** The attractive forces between molecules in sulfur dichloride are weaker than the ionic bonds in sodium chloride.

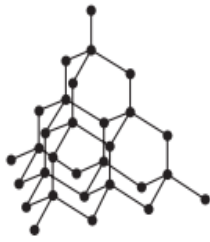
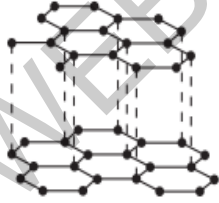
s20-p21-q7

Which statement explains why methane has a lower boiling point than water?

- A** Methane has weaker covalent bonds than water.
- B** Methane has weaker attractive forces than water.
- C** Methane molecules are heavier than water molecules.
- D** Methane molecules have more bonds than water molecules.

m20-p22-q6	<p>The molecular structure of hydrazine, N_2H_4, is shown.</p> <div></div> <p>Which description of the bonding in hydrazine is not correct?</p> <p>A Each nitrogen atom has a non-bonding pair of electrons. B Each nitrogen atom has four bonding pairs of electrons. C Each nitrogen atom shares one of its electrons with a nitrogen atom. D Each nitrogen atom shares two of its electrons with hydrogen atoms.</p>												
w19-p22-q5	<p>What is the total number of electrons in one molecule of ammonia, NH_3?</p> <p>A 6 B 8 C 10 D 11</p>												
s19-p23-q5	<p>Which row describes the formation of single covalent bonds in methane?</p> <table><tr><td>A</td><td>atoms share a pair of electrons</td><td>both atoms gain a noble gas electronic structure</td></tr><tr><td>B</td><td>atoms share a pair of electrons</td><td>both atoms have the same number of electrons in their outer shell</td></tr><tr><td>C</td><td>electrons are transferred from one atom to another</td><td>both atoms gain a noble gas electronic structure</td></tr><tr><td>D</td><td>electrons are transferred from one atom to another</td><td>both atoms have the same number of electrons in their outer shell</td></tr></table>	A	atoms share a pair of electrons	both atoms gain a noble gas electronic structure	B	atoms share a pair of electrons	both atoms have the same number of electrons in their outer shell	C	electrons are transferred from one atom to another	both atoms gain a noble gas electronic structure	D	electrons are transferred from one atom to another	both atoms have the same number of electrons in their outer shell
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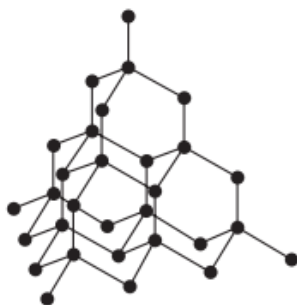
w18-p23-q5	<p>Which covalent molecule contains two atoms bonded together by exactly four shared electrons?</p> <p>A N_2 B C_3H_8 C CH_3OH D CH_3COOH</p>
w18-p23-q6	<p>The formula of ammonia is NH_3.</p> <p>Which statement about a molecule of ammonia is correct?</p> <p>A The bonding in a molecule of ammonia is ionic.</p> <p>B The nitrogen atom has a noble gas configuration, the hydrogen atoms do not.</p> <p>C The nitrogen atom shares all of its electrons with hydrogen atoms.</p> <p>D There are six shared electrons in a molecule of ammonia.</p>
w18-p22-q5	<p>How many electrons are used to form covalent bonds in a molecule of methanol, CH_3OH?</p> <p>A 5 B 6 C 8 D 10</p>
w18-p21-q5	<p>Which two molecules contain the same number of electrons?</p> <p>A Cl_2 and SO_2</p> <p>B CH_4 and H_2O</p> <p>C CO and NH_3</p> <p>D CO_2 and HCl</p>

Topic	<p align="center"><u>2. Thermal physics</u></p> <p align="center">2.6 Giant covalent structures</p>
Content	<ol style="list-style-type: none"> Describe the giant covalent structures of graphite and diamond Relate the structures and bonding of graphite and diamond to their uses, limited to: <ol style="list-style-type: none"> graphite as a lubricant and as an electrode diamond in cutting tools Describe the giant covalent structure of silicon(IV) oxide, SiO₂ Describe the similarity in properties between diamond and silicon(IV) oxide, related to their structures
m22-p22-q7	<p>Which pair of statements about diamond and graphite is correct?</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p align="center">diamond graphite</p> <ol style="list-style-type: none"> Diamond and graphite are both pure carbon. They are both macromolecules. Diamond and graphite can both be used as electrodes. Graphite is also used as a lubricant. Diamond has covalent bonds. Graphite has ionic bonds. Diamond is hard with a high melting point. Graphite is soft with a low melting point.
w21-p22-q6	<p>Some properties of diamond are shown.</p> <ol style="list-style-type: none"> It is very hard. Every atom forms four bonds. It does not conduct electricity. <p>Which properties are also shown by silicon(IV) oxide?</p> <p>A 1 only B 1 and 2 C 1 and 3 D 2 and 3</p>
w21-p22-q8	<p>Which substance is described as a macromolecule?</p> <ol style="list-style-type: none"> ammonia graphite iron sodium chloride

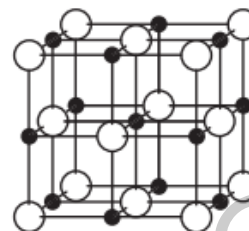
w21-p21-q8	<p>Which statement about carbon is correct?</p> <p>A Diamond and graphite both have simple molecular structures.</p> <p>B Diamond and graphite are both used to make cutting tools.</p> <p>C Each carbon atom in diamond is bonded to three other carbon atoms.</p> <p>D Graphite conducts electricity and has a giant covalent structure.</p>
s21-p23-q8	<p>The element silicon has the same structure as diamond.</p> <p>Which statement about silicon is correct?</p> <p>A Every silicon atom is bonded to three other atoms only.</p> <p>B Silicon has a high melting point.</p> <p>C Silicon is a good conductor of electricity.</p> <p>D Silicon is used as a lubricant.</p>
s21-p23-q20	<p>Information about element J is shown.</p> <ul style="list-style-type: none"> • Its atoms have four electrons in their outer shell. • It is a non-metal. • Its oxide has a macromolecular structure. • It has a high melting point. <p>What is J?</p> <p>A beryllium</p> <p>B carbon</p> <p>C silicon</p> <p>D sulfur</p>

s21-p21-q6

The arrangement of particles in each of two solids, S and T, are shown.



S



T

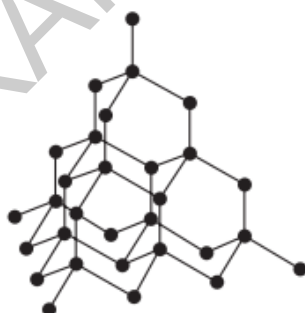
What are S and T?

	S	T
A	diamond	silicon(IV) oxide
B	diamond	sodium chloride
C	graphite	silicon(IV) oxide
D	graphite	sodium chloride

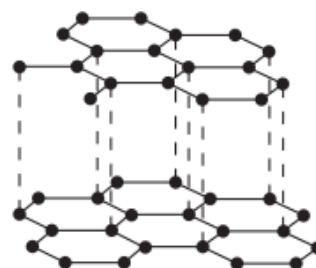
m21-p22-q5

Which diagram represents the structure of silicon(IV) oxide?

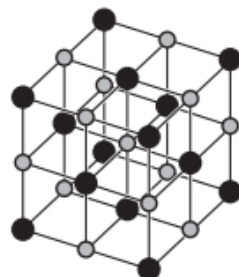
A



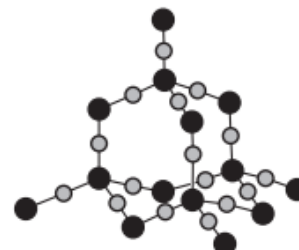
B



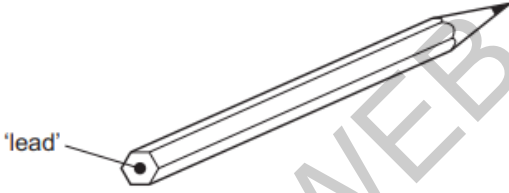
C



D



<p>w20-p23-q10 w20-p22-q10 w20-p21-q10</p>	<p>Which statement explains why graphite is used as a lubricant?</p> <p>A All bonds between the atoms are weak.</p> <p>B It conducts electricity.</p> <p>C It has a low melting point.</p> <p>D Layers in the structure can slide over each other.</p>
<p>w20-p21-q8</p>	<p>Which statement about silicon dioxide, SiO_2, is correct?</p> <p>A It conducts electricity because it contains free electrons.</p> <p>B It is a macromolecule with four oxygen atoms bonded to each silicon atom.</p> <p>C It is a simple covalent molecule.</p> <p>D Its structure is similar to graphite.</p>
<p>w19-p23-q7</p>	<p>Silicon(IV) oxide is a covalently bonded compound.</p> <p>Which statements are correct?</p> <ol style="list-style-type: none"> 1 Silicon atoms form four single bonds in silicon(IV) oxide. 2 Oxygen atoms form two double bonds in silicon(IV) oxide. 3 Silicon(IV) oxide has a high melting point. 4 Silicon(IV) oxide contains one silicon atom and four oxygen atoms. <p>A 1 and 2 only B 1 and 3 only C 2 and 3 only D 3 and 4 only</p>
<p>w19-p22-q7</p>	<p>Which statement about the structure and properties of silicon(IV) oxide is not correct?</p> <p>A It has a giant structure similar to that of diamond.</p> <p>B It has a high melting point due to the strong attractive force between molecules.</p> <p>C There are strong covalent bonds between silicon and oxygen.</p> <p>D There are no free electrons, so silicon(IV) oxide does not conduct electricity.</p>

w19-p21-q7	<p>How are the structures of diamond and silicon(IV) oxide similar?</p> <p>A Molecules of both diamond and silicon(IV) oxide are held together by weak attractive forces.</p> <p>B They both contain atoms arranged in planes held together by weak bonds.</p> <p>C They both contain ions that are free to move.</p> <p>D The carbon in diamond and the silicon in silicon(IV) oxide each have four covalent bonds.</p>
s18-p23-q4 s18-p22-q4 s18-p21-q4	<p>The 'lead' in a pencil is made of a mixture of graphite and clay.</p>  <p>When the percentage of graphite is increased, the pencil slides across the paper more easily.</p> <p>Which statement explains this observation?</p> <p>A Graphite has a high melting point.</p> <p>B Graphite is a form of carbon.</p> <p>C Graphite is a lubricant.</p> <p>D Graphite is a non-metal.</p>
s18-p23-q6	<p>How many silicon atoms are bonded to each oxygen atom in a crystal of silicon(IV) oxide?</p> <p>A 1 B 2 C 3 D 4</p>
s18-p23-q7 s18-p22-q7	<p>Which substance is not a macromolecule?</p> <p>A diamond</p> <p>B graphite</p> <p>C silicon(IV) oxide</p> <p>D sulfur</p>

s18-p22-q6	<p>Which substances have similar structures?</p> <p>A diamond and graphite</p> <p>B diamond and silicon(IV) oxide</p> <p>C graphite and poly(ethene)</p> <p>D graphite and silicon(IV) oxide</p>
s18-p21-q6	<p>Which substance is not a macromolecule?</p> <p>A diamond</p> <p>B graphite</p> <p>C silicon(IV) oxide</p> <p>D sulfur</p>
m18-p22-q6	<p>Three statements about diamond, graphite and silicon(IV) oxide are listed.</p> <ol style="list-style-type: none"> 1 Diamond and graphite both have giant covalent structures. 2 In silicon(IV) oxide, silicon and oxygen atoms are joined together by covalent bonds throughout the whole structure. 3 Diamond and silicon(IV) oxide have similar structures. <p>Which statements are correct?</p> <p>A 1, 2 and 3 B 1 and 2 only C 1 and 3 only D 2 and 3 only</p>

Topic	<u>2. Thermal physics</u> 2.7 Metallic bonding															
Content	<ol style="list-style-type: none">Describe metallic bonding as the electrostatic attraction between the positive ions in a giant metallic lattice and a 'sea' of delocalised electronsExplain in terms of structure and bonding the properties of metals:<ol style="list-style-type: none">good electrical conductivitymalleability and ductility															
m22-p22-q6	<p>Which row explains why copper is a good conductor of electricity at room temperature?</p> <table><tr><td></td><td>copper ions move freely</td><td>electrons move freely</td></tr><tr><td>A</td><td>no</td><td>no</td></tr><tr><td>B</td><td>no</td><td>yes</td></tr><tr><td>C</td><td>yes</td><td>no</td></tr><tr><td>D</td><td>yes</td><td>yes</td></tr></table>		copper ions move freely	electrons move freely	A	no	no	B	no	yes	C	yes	no	D	yes	yes
	copper ions move freely	electrons move freely														
A	no	no														
B	no	yes														
C	yes	no														
D	yes	yes														
w21-p23-q25	<p>Which statement is correct for all metals?</p> <p>A They conduct electricity when molten.</p> <p>B They gain electrons when they form ions.</p> <p>C They have a low density.</p> <p>D They have a low melting point.</p>															
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w21-p21-q4	<p>Which statement explains why metals conduct electricity when solid?</p> <p>A They have atoms which are free to move.</p> <p>B They have electrons which are free to move.</p> <p>C They have molecules which are free to move.</p> <p>D They have positive ions which are free to move.</p>																				
s21-p23-q6	<p>Which statement explains why metals are malleable?</p> <p>A The atoms release electrons to become cations.</p> <p>B The electrons are free to move.</p> <p>C The electrons and the cations are attracted to each other.</p> <p>D The layers of ions can slide over each other.</p>																				
s21-p21-q7	<p>Which statement about metals is correct?</p> <p>A Metals conduct electricity when molten because negative ions are free to move.</p> <p>B Metals conduct electricity when solid because positive ions are free to move.</p> <p>C Metals are malleable because the bonds between the atoms are weak.</p> <p>D Metals are malleable because the layers of ions can slide over each other.</p>																				
w20-p23-q8	<p>Sodium reacts with chlorine to form sodium chloride.</p> <p>Which row describes the bonding in the three substances?</p> <table><tr><td></td><td>sodium</td><td>chlorine</td><td>sodium chloride</td></tr><tr><td>A</td><td>covalent</td><td>covalent</td><td>covalent</td></tr><tr><td>B</td><td>covalent</td><td>metallic</td><td>ionic</td></tr><tr><td>C</td><td>metallic</td><td>covalent</td><td>ionic</td></tr><tr><td>D</td><td>metallic</td><td>metallic</td><td>covalent</td></tr></table>		sodium	chlorine	sodium chloride	A	covalent	covalent	covalent	B	covalent	metallic	ionic	C	metallic	covalent	ionic	D	metallic	metallic	covalent
	sodium	chlorine	sodium chloride																		
A	covalent	covalent	covalent																		
B	covalent	metallic	ionic																		
C	metallic	covalent	ionic																		
D	metallic	metallic	covalent																		

s20-p23-q6	<p>Caesium is a metal in Group I of the Periodic Table.</p> <p>Which description of the bonding in caesium is correct?</p> <p>A electrostatic attraction between oppositely charged ions</p> <p>B electrostatic attraction between positive metal ions and mobile electrons</p> <p>C neighbouring metal atoms sharing pairs of electrons</p> <p>D strong attractive forces between atoms</p>															
s20-p23-q25	<p>Which property is shown by all metals?</p> <p>A They are extracted from their ores by heating with carbon.</p> <p>B They conduct electricity.</p> <p>C They form acidic oxides.</p> <p>D They react with hydrochloric acid to form hydrogen.</p>															
s20-p22-q6	<p>Which statement about the structure of a metal explains why metals are malleable?</p> <p>A The electrons can move freely throughout the lattice.</p> <p>B The layers of metal ions can slide over each other.</p> <p>C The metal ions are positively charged.</p> <p>D There is a strong force of attraction between the metal ions and the electrons.</p>															
s20-p22-q25 s20-p21-q25	<p>Which property is shown by all metals?</p> <p>A They are extracted from their ores by heating with carbon.</p> <p>B They conduct electricity.</p> <p>C They form acidic oxides.</p> <p>D They react with hydrochloric acid to form hydrogen.</p>															
s20-p21-q6	<p>Which row contains a description of metallic bonding and a property that is explained by reference to metallic bonding?</p> <table><tr><th></th><th>description of metallic bonding</th><th>property explained by metallic bonding</th></tr><tr><td>A</td><td>a lattice of negative ions in a sea of electrons</td><td>a metal will react with an acid, producing hydrogen</td></tr><tr><td>B</td><td>a lattice of negative ions in a sea of electrons</td><td>a piece of a metal can be moulded into different shapes</td></tr><tr><td>C</td><td>a lattice of positive ions in a sea of electrons</td><td>a metal will react with an acid, producing hydrogen</td></tr><tr><td>D</td><td>a lattice of positive ions in a sea of electrons</td><td>a piece of a metal can be moulded into different shapes</td></tr></table>		description of metallic bonding	property explained by metallic bonding	A	a lattice of negative ions in a sea of electrons	a metal will react with an acid, producing hydrogen	B	a lattice of negative ions in a sea of electrons	a piece of a metal can be moulded into different shapes	C	a lattice of positive ions in a sea of electrons	a metal will react with an acid, producing hydrogen	D	a lattice of positive ions in a sea of electrons	a piece of a metal can be moulded into different shapes
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m20-p22-q7	<p>Solid X has a high boiling point.</p> <p>Its structure has positive ions surrounded by a sea of electrons.</p> <p>Which other properties does solid X have?</p> <p>A brittle and an electrical conductor</p> <p>B brittle and an insulator</p> <p>C malleable and an electrical conductor</p> <p>D malleable and an insulator</p>
w19-p23-q8	<p>Which statement describes the structure of copper?</p> <p>A It has a lattice of negative ions in a 'sea of electrons'.</p> <p>B It has a lattice of negative ions in a 'sea of protons'.</p> <p>C It has a lattice of positive ions in a 'sea of electrons'.</p> <p>D It has a lattice of positive ions in a 'sea of protons'.</p>
w19-p22-q8	<p>Which statement describes the structure of copper?</p> <p>A It has a lattice of negative ions in a 'sea of electrons'.</p> <p>B It has a lattice of negative ions in a 'sea of protons'.</p> <p>C It has a lattice of positive ions in a 'sea of electrons'.</p> <p>D It has a lattice of positive ions in a 'sea of protons'.</p>
w19-p22-q26 w19-p21-q26	<p>Some properties of substance X are listed.</p> <ul style="list-style-type: none"> It conducts electricity when molten. It has a high melting point. It burns in oxygen and the oxide dissolves in water to give a solution with pH 11. <p>What is X?</p> <p>A a covalent compound</p> <p>B a macromolecule</p> <p>C a metal</p> <p>D an ionic compound</p>

w19-p21-q8	<p>Which statement describes the structure of copper?</p> <p>A It has a lattice of negative ions in a 'sea of electrons'.</p> <p>B It has a lattice of negative ions in a 'sea of protons'.</p> <p>C It has a lattice of positive ions in a 'sea of electrons'.</p> <p>D It has a lattice of positive ions in a 'sea of protons'.</p>
m19-p22-q7	<p>Which statement about copper, diamond and silicon(IV) oxide is correct?</p> <p>A Copper and silicon(IV) oxide have similar electrical conductivity.</p> <p>B In diamond the carbon atoms are covalently bonded as flat sheets.</p> <p>C In silicon(IV) oxide the silicon and oxygen atoms are covalently bonded as flat sheets.</p> <p>D The structure of copper includes a lattice of positive ions.</p>
w18-p21-q6	<p>Which statement describes the lattice structure of a metal?</p> <p>A The lattice consists of alternating positive ions and negative ions.</p> <p>B The lattice consists of neutral atoms arranged in layers.</p> <p>C The lattice consists of positive ions in a 'sea of electrons'.</p> <p>D The lattice consists of neutral atoms in a 'sea of electrons'.</p>
s18-p21-q7	<p>Copper is a metallic element.</p> <p>Which statements about copper are correct?</p> <ol style="list-style-type: none"> 1 Copper is malleable because layers of ions are in fixed positions and cannot move. 2 The structure of copper consists of negative ions in a lattice. 3 Copper conducts electricity because electrons can move through the metal. 4 Electrons hold copper ions together in a lattice by electrostatic attraction. <p>A 1 and 2 B 2, 3 and 4 C 2 and 3 only D 3 and 4 only</p>

m18-p22-q5

The structure of copper is described as a lattice of positive ions in a 'sea of electrons'.

Which statements are correct?

- 1 Copper has a high melting point because of the strong electrostatic attraction between the positive ions and the 'sea of electrons'.
- 2 Copper is malleable because the layers of atoms in the lattice can slide over each other.
- 3 Copper atoms can be oxidised to form copper ions by losing electrons.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Topic	<p style="text-align: center;"><u>3. Stoichiometry</u></p> <p style="text-align: center;">3.1 Formulae</p>
Content	<ol style="list-style-type: none"> 1. State the formulae of the elements and compounds named in the subject content 2. Define the molecular formula of a compound as the number and type of different atoms in one molecule 3. Deduce the formula of a simple compound from the relative numbers of atoms present in a model or a diagrammatic representation 4. Construct word equations and symbol equations to show how reactants form products, including state symbols 5. Define the empirical formula of a compound as the simplest whole number ratio of the different atoms or ions in a compound 6. Deduce the formula of an ionic compound from the relative numbers of the ions present in a model or a diagrammatic representation or from the charges on the ions 7. Construct symbol equations with state symbols, including ionic equations 8. Deduce the symbol equation with state symbols for a chemical reaction, given relevant information
m22-p22-q8	<p>Sodium nitride contains the nitride ion, N^{3-}.</p> <p>Sodium nitride is unstable and decomposes into its elements.</p> <p>What is the equation for the decomposition of sodium nitride?</p> <p>A $2\text{NaN}_3 \rightarrow 2\text{Na} + 3\text{N}_2$</p> <p>B $2\text{Na}_3\text{N} \rightarrow 6\text{Na} + \text{N}_2$</p> <p>C $2\text{NaN}_3 \rightarrow \text{Na}_2 + 3\text{N}_2$</p> <p>D $2\text{Na}_3\text{N} \rightarrow 6\text{Na} + 2\text{N}$</p>
m22-p22-q9	<p>Compound X contains carbon, hydrogen and oxygen only.</p> <p>By mass, it contains 26.7% carbon and 2.2% hydrogen.</p> <p>What is the empirical formula of X?</p> <p>A CHO B C_2HO C CH_2O D CHO_2</p>

w21-p23-q9	<p>Aluminium oxide is an ionic compound containing Al^{3+} ions and O^{2-} ions.</p> <p>Aluminium hydroxide is an ionic compound containing Al^{3+} ions and OH^- ions.</p> <p>In which row are the formulae for aluminium oxide and aluminium hydroxide correct?</p> <table><tr><td></td><td>aluminium oxide</td><td>aluminium hydroxide</td></tr><tr><td>A</td><td>Al_2O_3</td><td>$\text{Al}(\text{OH})_3$</td></tr><tr><td>B</td><td>Al_3O_2</td><td>AlOH_3</td></tr><tr><td>C</td><td>Al_2O_3</td><td>AlOH_3</td></tr><tr><td>D</td><td>Al_3O_2</td><td>$\text{Al}(\text{OH})_3$</td></tr></table>		aluminium oxide	aluminium hydroxide	A	Al_2O_3	$\text{Al}(\text{OH})_3$	B	Al_3O_2	AlOH_3	C	Al_2O_3	AlOH_3	D	Al_3O_2	$\text{Al}(\text{OH})_3$
	aluminium oxide	aluminium hydroxide														
A	Al_2O_3	$\text{Al}(\text{OH})_3$														
B	Al_3O_2	AlOH_3														
C	Al_2O_3	AlOH_3														
D	Al_3O_2	$\text{Al}(\text{OH})_3$														
w21-p21-q6	<p>The equation for the reaction of iron(III) oxide with carbon monoxide is shown.</p> $\text{Fe}_2\text{O}_3(\text{s}) + 3\text{CO}(\text{g}) \rightarrow 2\text{Fe}(\text{s}) + 3\text{CO}_2(\text{g})$ <p>What is the maximum mass of iron that can be made from 480 g of iron(III) oxide?</p> <p>A 56 g B 112 g C 168 g D 336 g</p>															
w21-p21-q9	<p>The formula of an aluminium ion is Al^{3+}.</p> <p>What is the formula of aluminium sulfate?</p> <p>A Al_2SO_4 B $\text{Al}(\text{SO}_4)_2$ C $\text{Al}_2(\text{SO}_4)_3$ D $\text{Al}_3(\text{SO}_4)_2$</p>															
s21-p23-q12	<p>Gas syringe X contains 100 cm^3 of hydrogen bromide gas, HBr.</p> <p>Gas syringe Y contains 100 cm^3 of carbon dioxide gas. The volume of each gas is measured at room temperature and pressure.</p> <p>Which statement is correct?</p> <p>A The mass of HBr is less than the mass of CO_2.</p> <p>B The number of molecules of HBr equals the number of molecules of CO_2.</p> <p>C The gas in syringe X contains more atoms than the gas in syringe Y.</p> <p>D The number of moles of HBr is more than the number of moles of CO_2.</p>															

s20-p23-q8	<p>Aluminium metal reacts with iron(III) oxide to form aluminium oxide and iron.</p> <p>Which chemical equation for the reaction between aluminium and iron(III) oxide is correct?</p> <p>A $\text{FeO} + \text{Al} \rightarrow \text{AlO} + \text{Fe}$</p> <p>B $\text{Fe}_2\text{O} + 2\text{Al} \rightarrow \text{Al}_2\text{O} + 2\text{Fe}$</p> <p>C $\text{Fe}_2\text{O}_3 + \text{Al} \rightarrow \text{Al}_2\text{O}_3 + \text{Fe}$</p> <p>D $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$</p>																											
s20-p21-q8	<p>A solution of iron(III) sulfate reacts with aqueous sodium hydroxide to form a red-brown precipitate.</p> <p>What is the balanced equation, including state symbols, for the reaction?</p> <p>A $\text{FeSO}_4(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow \text{Fe}(\text{OH})_2(\text{s}) + \text{Na}_2\text{SO}_4(\text{aq})$</p> <p>B $\text{FeSO}_4(\text{l}) + 2\text{NaOH}(\text{l}) \rightarrow \text{Fe}(\text{OH})_2(\text{s}) + \text{Na}_2\text{SO}_4(\text{l})$</p> <p>C $\text{Fe}_2(\text{SO}_4)_3(\text{aq}) + 6\text{NaOH}(\text{aq}) \rightarrow 2\text{Fe}(\text{OH})_3(\text{s}) + 3\text{Na}_2\text{SO}_4(\text{aq})$</p> <p>D $\text{Fe}_2(\text{SO}_4)_3(\text{l}) + 6\text{NaOH}(\text{aq}) \rightarrow 2\text{Fe}(\text{OH})_3(\text{s}) + 3\text{Na}_2\text{SO}_4(\text{l})$</p>																											
m20-p22-q8	<p>The formulae of some ions are shown.</p> <table><tr><th>positive ions</th><th>negative ions</th></tr><tr><td>Al^{3+}</td><td>Cl^-</td></tr><tr><td>Fe^{2+}</td><td>N^{3-}</td></tr><tr><td>Mg^{2+}</td><td>NO_3^-</td></tr><tr><td>Na^+</td><td>O^{2-}</td></tr><tr><td>Zn^{2+}</td><td>SO_4^{2-}</td></tr></table> <p>In which row is the formula not correct?</p> <table><tr><th></th><th>compound</th><th>formula</th></tr><tr><td>A</td><td>aluminium oxide</td><td>Al_2O_3</td></tr><tr><td>B</td><td>iron(II) nitride</td><td>Fe_2N_3</td></tr><tr><td>C</td><td>sodium sulfate</td><td>Na_2SO_4</td></tr><tr><td>D</td><td>zinc nitrate</td><td>$\text{Zn}(\text{NO}_3)_2$</td></tr></table>	positive ions	negative ions	Al^{3+}	Cl^-	Fe^{2+}	N^{3-}	Mg^{2+}	NO_3^-	Na^+	O^{2-}	Zn^{2+}	SO_4^{2-}		compound	formula	A	aluminium oxide	Al_2O_3	B	iron(II) nitride	Fe_2N_3	C	sodium sulfate	Na_2SO_4	D	zinc nitrate	$\text{Zn}(\text{NO}_3)_2$
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C	sodium sulfate	Na_2SO_4																										
D	zinc nitrate	$\text{Zn}(\text{NO}_3)_2$																										

w19-p22-q12

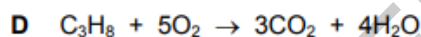
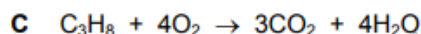
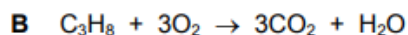
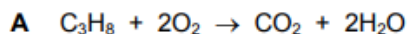
What are the ionic half-equations for the electrode reactions during the electrolysis of concentrated aqueous sodium chloride?

	anode	cathode
A	$\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$	$\text{H}_2 \rightarrow 2\text{H}^+ + 2\text{e}^-$
B	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$
C	$\text{H}_2 \rightarrow 2\text{H}^+ + 2\text{e}^-$	$\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$
D	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$

s19-p23-q7

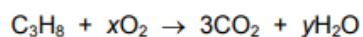
When propane burns in air, carbon dioxide and water are formed.

What is the chemical equation for this reaction?



s19-p21-q7

Propane burns in oxygen.



Which values of x and y balance the equation?

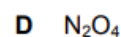
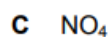
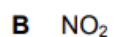
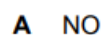
	x	y
A	5	4
B	7	4
C	10	8
D	13	8

m19-p22-q8

An oxide of nitrogen has the following composition by mass: N, 30.4%; O, 69.6%.

It has a relative molecular mass of 92.

What is the molecular formula of the oxide of nitrogen?



w18-p23-q9	<p>Iron(III) chromate is a yellow solid. It contains the ions Fe^{3+} and CrO_4^{2-}.</p> <p>What is the formula of iron(III) chromate?</p> <p>A FeCrO_4 B $\text{Fe}_3(\text{CrO}_4)_2$ C Fe_2CrO_4 D $\text{Fe}_2(\text{CrO}_4)_3$</p>										
w18-p22-q9	<p>The formulae of some ions are shown.</p> <table border="1"> <thead> <tr> <th>positive ion</th><th>negative ion</th></tr> </thead> <tbody> <tr> <td>Ti^{4+}</td><td>PO_4^{3-}</td></tr> <tr> <td>Al^{3+}</td><td>SO_4^{2-}</td></tr> <tr> <td>Mg^{2+}</td><td>NO_3^-</td></tr> <tr> <td>K^+</td><td>Cl^-</td></tr> </tbody> </table> <p>Which formula is not correct?</p> <p>A $\text{Al}_3(\text{SO}_4)_2$ B K_3PO_4 C $\text{Mg}(\text{NO}_3)_2$ D TiCl_4</p>	positive ion	negative ion	Ti^{4+}	PO_4^{3-}	Al^{3+}	SO_4^{2-}	Mg^{2+}	NO_3^-	K^+	Cl^-
positive ion	negative ion										
Ti^{4+}	PO_4^{3-}										
Al^{3+}	SO_4^{2-}										
Mg^{2+}	NO_3^-										
K^+	Cl^-										
w18-p21-q9	<p>Iron can react with sulfur to form two ionic compounds.</p> <p>The iron is present as Fe^{2+} in one compound and as Fe^{3+} in the other compound.</p> <p>The sulfur ion is present as S^{2-} in both compounds.</p> <p>What are the formulae of the two compounds?</p> <p>A FeS and Fe_2S_3 B FeS and Fe_3S_2 C FeS_2 and Fe_3S_2 D FeS_2 and Fe_2S_3</p>										
s18-p23-q8	<p>An experiment was done to determine the formula of a hydrocarbon, C_xH_y.</p> <p>10 cm^3 of the gaseous hydrocarbon, C_xH_y, was burned in an excess of oxygen to form 20 cm^3 of carbon dioxide and 30 cm^3 of water vapour.</p> <p>What is C_xH_y?</p> <p>A CH_4 B C_2H_4 C C_2H_6 D C_3H_8</p>										

Topic	<p style="text-align: center;"><u>3. Stoichiometry</u></p> <p style="text-align: center;">3.2 Relative masses of atoms and molecules</p>
Content	<ol style="list-style-type: none"> Describe relative atomic mass, A_r, as the average mass of the isotopes of an element compared to 1/12th of the mass of an atom of ^{12}C Define relative molecular mass, M_r, as the sum of the relative atomic masses. Relative formula mass, M_r, will be used for ionic compounds Calculate reacting masses in simple proportions. Calculations will not involve the mole concept
w20-p23-q11 w20-p22-q11 w20-p21-q11	<p>The relative atomic mass of chlorine is 35.5.</p> <p>When calculating relative atomic mass, which particle is the mass of a chlorine atom compared to?</p> <p>A a neutron B a proton C an atom of carbon-12 D an atom of hydrogen-1</p>
m18-p22-q37	<p>Three chemical reactions are shown.</p> <ol style="list-style-type: none"> catalytic addition of steam to ethene combustion of ethanol fermentation of glucose <p>In which of the reactions does the relative molecular mass of the carbon-containing compound decrease?</p> <p>A 1 and 2 B 1 only C 2 and 3 D 3 only</p>

Topic	<p style="text-align: center;"><u>3. Waves</u></p> <p style="text-align: center;">3.3 The mole of the Avogadro constant</p>
Content	<ol style="list-style-type: none"> 1. State that concentration can be measured in g /dm³ or mol/dm³ 2. State that the mole, mol, is the unit of amount of substance and that one mole contains 6.02×10^{23} particles, e.g. atoms, ions, molecules; this number is the Avogadro constant 3. Use the relationship amount of substance (mol) = mass (g) molar mass (g /mol) to calculate: <ol style="list-style-type: none"> (a) amount of substance (b) mass (c) molar mass (d) relative atomic mass or relative molecular/formula mass (e) number of particles, using the value of the Avogadro constant 4. Use the molar gas volume, taken as 24dm³ at room temperature and pressure, r.t.p., in calculations involving gases 5. Calculate stoichiometric reacting masses, limiting reactants, volumes of gases at r.t.p., volumes of solutions and concentrations of solutions expressed in g /dm³ and mol/dm³ , including conversion between cm³ and dm³ 6. Use experimental data from a titration to calculate the moles of solute, or the concentration or volume of a solution 7. Calculate empirical formulae and molecular formulae, given appropriate data 8. Calculate percentage yield, percentage composition by mass and percentage purity, given appropriate data
m22-p22-q12	<p>Calcium carbonate, CaCO₃, reacts with dilute hydrochloric acid to produce carbon dioxide.</p> <p>The equation for the reaction is shown. The relative formula mass of calcium carbonate is 100.</p> $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ <p>10g of calcium carbonate is reacted with an excess of dilute hydrochloric acid.</p> <p>Which mass of carbon dioxide is produced?</p> <p>A 2.2g B 2.8g C 4.4g D 44g</p>
w21-p23-q13	<p>What is the concentration of the solution when 31.8g of sodium carbonate, Na₂CO₃, is dissolved in water to make a solution of 250 cm³?</p> <p>A 0.075 mol / dm³</p> <p>B 0.30 mol / dm³</p> <p>C 1.2 mol / dm³</p> <p>D 1.5 mol / dm³</p>

w21-p22-q9	<p>The equation for the reaction of sodium with water is shown.</p> $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ <p>What is the volume of hydrogen gas, measured at r.t.p., produced when 18.4 g of sodium reacts with excess water?</p> <p>A 9.6 dm³ B 15.0 dm³ C 19.2 dm³ D 30.0 dm³</p>															
s21-p23-q11	<p>The equation for the decomposition of calcium carbonate is shown.</p> $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ <p>What mass of calcium oxide is produced when 10 g of calcium carbonate is heated?</p> <p>A 4.4 g B 5.0 g C 5.6 g D 10.0 g</p>															
s21-p23-q37	<p>How much hydrogen is needed to react completely with 0.02 moles of butene to make butane?</p> <p>A 0.24 dm³ B 0.48 dm³ C 0.96 dm³ D 1.20 dm³</p>															
s21-p22-q9	<p>Chlorine gas will react with iron metal.</p> <p>Exactly 21.3 g of chlorine reacts with 11.2 g of iron.</p> <p>How many iron atoms react with 30 molecules of chlorine?</p> <p>A 10 B 15 C 20 D 30</p>															
s21-p22-q11	<p>A reaction involving aluminium is shown.</p> $x\text{Al} + y\text{O}_2 + 6\text{H}_2\text{O} \rightarrow x\text{Al}(\text{OH})_3$ <p>Which values of x and y balance the equation?</p> <table><tr><td></td><td>x</td><td>y</td></tr><tr><td>A</td><td>2</td><td>3</td></tr><tr><td>B</td><td>3</td><td>2</td></tr><tr><td>C</td><td>3</td><td>4</td></tr><tr><td>D</td><td>4</td><td>3</td></tr></table>		x	y	A	2	3	B	3	2	C	3	4	D	4	3
	x	y														
A	2	3														
B	3	2														
C	3	4														
D	4	3														

w20-p23-q12 w20-p22-q13 w20-p21-q13	<p>What is the empirical formula of an oxide of iron, formed by reacting 2.24 g of iron with 0.96 g of oxygen?</p> <p>A FeO B Fe₂O C Fe₂O₃ D Fe₃O₄</p>
w20-p22-q34	<p>The element sulfur is found in a number of different minerals.</p> <p>Which mineral contains the greatest percentage by mass of sulfur?</p> <p>A barite, BaSO₄ B galena, PbS C gypsum, CaSO₄ D pyrite, FeS₂</p>
s20-p23-q9 s20-p22-q9 s20-p21-q9	<p>The Haber process is a reversible reaction.</p> $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$ <p>The reaction has a 30% yield of ammonia.</p> <p>Which volume of ammonia gas, NH₃, measured at room temperature and pressure, is obtained by reacting 0.75 moles of hydrogen with excess nitrogen?</p> <p>A 3600 cm³ B 5400 cm³ C 12 000 cm³ D 18 000 cm³</p>
m20-p22-q9	<p>The equation for the decomposition of magnesium nitrate is shown.</p> $2\text{Mg}(\text{NO}_3)_2(\text{s}) \rightarrow 2\text{MgO}(\text{s}) + 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$ <p>Which volume of gas is produced when 0.1 moles of magnesium nitrate is decomposed completely?</p> <p>A 1.2 dm³ B 4.8 dm³ C 6.0 dm³ D 8.4 dm³</p>
w19-p23-q9	<p>Magnesium carbonate decomposes on heating to form magnesium oxide and carbon dioxide as shown.</p> $\text{MgCO}_3 \rightarrow \text{MgO} + \text{CO}_2$ <p>How much magnesium carbonate is needed to make 5.0 g of magnesium oxide?</p> <p>A 3.5 g B 4.0 g C 6.5 g D 10.5 g</p>

w19-p23-q10	<p>90 g of glucose is dissolved in water.</p> <p>The glucose solution is fermented.</p> $\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2\text{CO}_2 + 2\text{C}_2\text{H}_5\text{OH}$ <p style="text-align: center;">glucose, $M_r = 180$ ethanol, $M_r = 46$</p> <p>After the fermentation finishes, 6.8 g of ethanol is obtained from the solution.</p> <p>What is the percentage yield of ethanol?</p> <p>A 7.4 B 7.6 C 14.8 D 29.6</p>
w19-p22-q9	<p>Phosphorus reacts with oxygen to form phosphorus(III) oxide as shown.</p> $4\text{P(s)} + 3\text{O}_2\text{(g)} \rightarrow 2\text{P}_2\text{O}_3\text{(s)}$ <p>Which mass of phosphorus(III) oxide is produced from 6.2 g of phosphorus?</p> <p>A 1.1 g B 5.5 g C 11.0 g D 22.0 g</p>
w19-p22-q10	<p>Calcium carbonate is heated. Calcium oxide and carbon dioxide gas are formed.</p> <p>The equation for the reaction is shown.</p> $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ <p>225 kg of calcium carbonate is heated until there is no further change in mass.</p> <p>The yield of calcium oxide is 85 kg.</p> <p>What is the percentage yield?</p> <p>A 37.8% B 47.2% C 67.5% D 85.0%</p>
w19-p21-q9	<p>Four fertilisers are each supplied in 100 kg bags.</p> <p>Which fertiliser supplies the greatest mass of nitrogen per 100 kg bag?</p> <p>A ammonium nitrate, NH_4NO_3 B ammonium phosphate, $(\text{NH}_4)_3\text{PO}_4$ C ammonium sulfate, $(\text{NH}_4)_2\text{SO}_4$ D urea, $\text{CO}(\text{NH}_2)_2$</p>

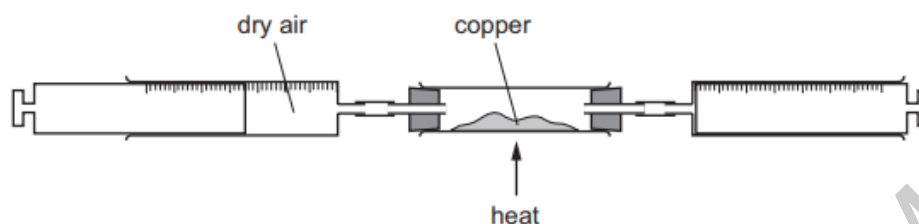
w19-p21-q10	<p>Calcium carbonate reacts with dilute hydrochloric acid.</p> <p>The equation for the reaction is shown.</p> $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ <p>1.00 g of calcium carbonate is added to 50.0 cm³ of 0.0500 mol/dm³ hydrochloric acid.</p> <p>Which volume of carbon dioxide is made in this reaction?</p> <p>A 30 cm³ B 60 cm³ C 120 cm³ D 240 cm³</p>
s19-p23-q8	<p>What is the concentration of a solution that contains 25.0 g NaOH in 500 cm³ of water?</p> <p>A 0.125 mol/dm³ B 0.800 mol/dm³ C 1.25 mol/dm³ D 3.20 mol/dm³</p>
s19-p22-q8	<p>25.0 cm³ of 0.100 mol/dm³ aqueous sodium hydroxide is neutralised by 24.6 cm³ of dilute sulfuric acid.</p> <p>What is the concentration of the dilute sulfuric acid?</p> <p>A 0.0508 mol/dm³ B 0.0984 mol/dm³ C 0.102 mol/dm³ D 0.203 mol/dm³</p>
s19-p21-q8	<p>A tablet contains 0.080 g of ascorbic acid ($M_r = 176$).</p> <p>What is the concentration of ascorbic acid when one tablet is dissolved in 200 cm³ of water?</p> <p>A 9.1×10^{-5} mol/dm³ B 4.5×10^{-4} mol/dm³ C 9.1×10^{-2} mol/dm³ D 2.3×10^{-3} mol/dm³</p>

m19-p22-q9	<p>Calcium carbonate reacts with dilute hydrochloric acid according to the equation shown.</p> $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$ <p>10 g of calcium carbonate is reacted with 100 cm³ of 1 mol/dm³ hydrochloric acid.</p> <p>The following statements are made.</p> <ol style="list-style-type: none"> 1 1.2 dm³ of carbon dioxide is formed. 2 5.6 g of calcium chloride is formed. 3 4.8 g of carbon dioxide is formed. 4 No calcium carbonate is left when the reaction is completed. <p>Which statements about the reaction are correct?</p> <p>A 1 and 2 B 1 and 4 C 2 and 3 D 3 and 4</p>
w18-p23-q7	<p>Which gas sample has the greatest mass?</p> <p>A 5.0 moles of Cl₂</p> <p>B 10.0 moles of O₂</p> <p>C 15.0 moles of N₂</p> <p>D 20.0 moles of H₂</p>
w18-p23-q8	<p>Which sample of magnesium chloride, MgCl₂, contains the same number of moles as 69.6 g of potassium sulfate, K₂SO₄?</p> <p>A 19.0 g B 28.5 g C 38.0 g D 47.5 g</p>
w18-p22-q7	<p>Which gas sample contains the smallest number of molecules?</p> <p>A 4 g of helium</p> <p>B 16 g of oxygen</p> <p>C 28 g of carbon monoxide</p> <p>D 28 g of nitrogen</p>

w18-p22-q8	<p>The equation for the reaction between calcium carbonate and dilute nitric acid is shown.</p> $\text{CaCO}_3(\text{s}) + 2\text{HNO}_3(\text{aq}) \rightarrow \text{Ca}(\text{NO}_3)_2(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$ <p>25 g of calcium carbonate is reacted with an excess of dilute nitric acid.</p> <p>Which mass of calcium nitrate and which volume of carbon dioxide is produced at room temperature and pressure?</p> <table><tr><th></th><th>mass of calcium nitrate / g</th><th>volume of carbon dioxide / dm³</th></tr><tr><td>A</td><td>29</td><td>6</td></tr><tr><td>B</td><td>29</td><td>12</td></tr><tr><td>C</td><td>41</td><td>6</td></tr><tr><td>D</td><td>41</td><td>12</td></tr></table>		mass of calcium nitrate / g	volume of carbon dioxide / dm ³	A	29	6	B	29	12	C	41	6	D	41	12
	mass of calcium nitrate / g	volume of carbon dioxide / dm ³														
A	29	6														
B	29	12														
C	41	6														
D	41	12														
w18-p21-q7	<p>Which gas sample contains the most molecules?</p> <p>A 24 dm³ of carbon dioxide, CO₂</p> <p>B 4 g of hydrogen, H₂</p> <p>C 36 dm³ of hydrogen chloride, HCl</p> <p>D 14 g of nitrogen, N₂</p>															
w18-p21-q8	<p>A student mixed together 25.0 cm³ of 1.00 mol/dm³ hydrochloric acid and 25.0 g of calcium carbonate.</p> $2\text{HCl}(\text{aq}) + \text{CaCO}_3(\text{s}) \rightarrow \text{CaCl}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$ <p>What is the maximum volume of carbon dioxide gas that could be collected at room temperature and pressure?</p> <p>A 300 dm³ B 6.00 dm³ C 0.600 dm³ D 0.300 dm³</p>															
s18-p23-q9	<p>4.00 g of solid sodium hydroxide is added to water to make a solution with a concentration of 0.200 mol/dm³.</p> <p>What is the volume of water used?</p> <p>A 0.5 cm³ B 20 cm³ C 500 cm³ D 2000 cm³</p>															

s18-p23-q28
s18-p22-q28
s18-p21-q28

Dry air is passed over hot copper until all the oxygen has reacted.



The volume of gas at the end of the reaction is 120 cm^3 .

What is the starting volume of dry air?

- A** 132 cm^3 **B** 152 cm^3 **C** 180 cm^3 **D** 570 cm^3

s18-p22-q8

The equation for the reaction between potassium carbonate and nitric acid is shown.



Which volume of carbon dioxide is produced from 69 g of potassium carbonate?

- A** 6 dm^3 **B** 12 dm^3 **C** 24 dm^3 **D** 48 dm^3

s18-p22-q9

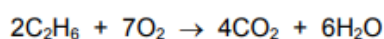
A solution of sodium carbonate, Na_2CO_3 , has a concentration of 0.03 mol/dm^3 .

Which mass of sodium carbonate is dissolved in 1 dm^3 of this solution?

- A** 1.06 g **B** 3.18 g **C** 10.60 g **D** 31.80 g

s18-p21-q8

The equation for the combustion of ethane is shown.



Which volume of carbon dioxide, at room temperature and pressure, is formed when 0.5 moles of ethane burn?

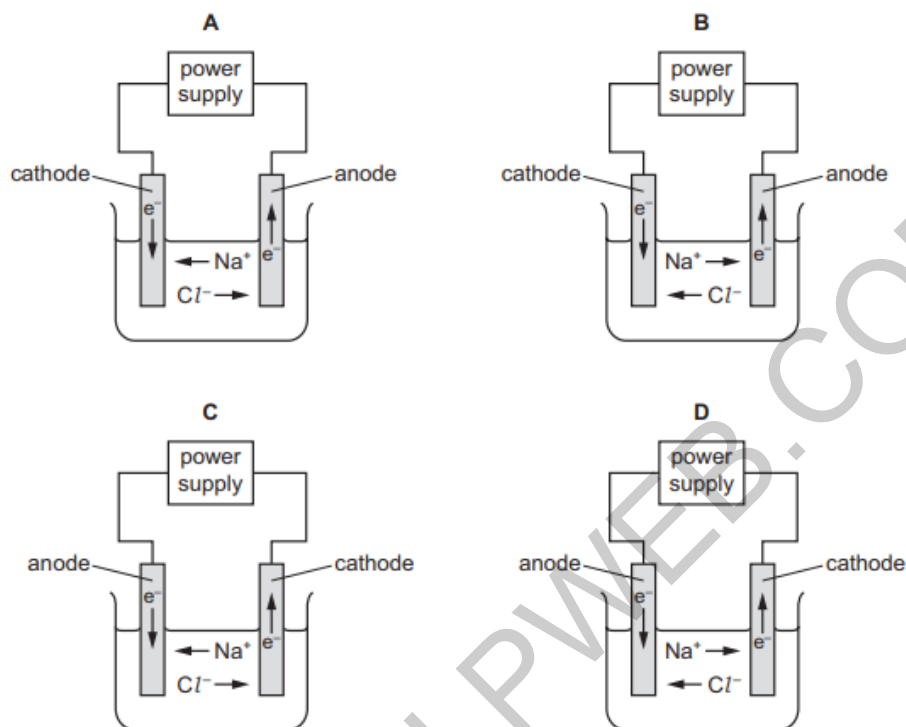
- A** 48 dm^3 **B** 24 dm^3 **C** 12 dm^3 **D** 6 dm^3

s18-p21-q9	<p>A solution of ethanoic acid, CH_3COOH, has a concentration of 2 mol/dm^3.</p> <p>Which statement about this solution is correct?</p> <p>A 20 g of ethanoic acid is dissolved in 10 cm^3 of water.</p> <p>B 30 g of ethanoic acid is dissolved in 250 cm^3 of water.</p> <p>C 60 g of ethanoic acid is dissolved in 1 dm^3 of water.</p> <p>D 120 g of ethanoic acid is dissolved in 2 dm^3 of water.</p>
m18-p22-q7	<p>The concentration of a hydrochloric acid solution is 0.5 mol/dm^3.</p> <p>How many moles of hydrochloric acid are present in 25 cm^3 of this solution?</p> <p>A 0.0125 B 0.0200 C 12.5 D 20.0</p>
m18-p22-q8	<p>A sample of an iron oxide contains 50.4 g of iron and 21.6 g of oxygen.</p> <p>What is the empirical formula of the iron oxide?</p> <p>A FeO B FeO₃ C Fe₂O₃ D Fe₃O₂</p>

Topic	<p style="text-align: center;"><u>4. Electrochemistry</u></p> <p style="text-align: center;">4.1 Electrolysis</p>
Content	<ol style="list-style-type: none"> 1. Define electrolysis as the decomposition of an ionic compound, when molten or in aqueous solution, by the passage of an electric current 2. Identify in simple electrolytic cells: <ol style="list-style-type: none"> (a) the anode as the positive electrode (b) the cathode as the negative electrode (c) the electrolyte as the molten or aqueous substance that undergoes electrolysis 3. Identify the products formed at the electrodes and describe the observations made during the electrolysis of: <ol style="list-style-type: none"> (a) molten lead(II) bromide (b) concentrated aqueous sodium chloride (c) dilute sulfuric acid using inert electrodes made of platinum or carbon/ graphite 4. State that metals or hydrogen are formed at the cathode and that non-metals (other than hydrogen) are formed at the anode 5. Predict the identity of the products at each electrode for the electrolysis of a binary compound in the molten state 6. State that metal objects are electroplated to improve their appearance and resistance to corrosion 7. Describe how metals are electroplated 8. Describe the transfer of charge during electrolysis to include: <ol style="list-style-type: none"> (a) the movement of electrons in the external circuit (b) the loss or gain of electrons at the electrodes (c) the movement of ions in the electrolyte 9. Identify the products formed at the electrodes and describe the observations made during the electrolysis of aqueous copper(II) sulfate using inert carbon/ graphite electrodes and when using copper electrodes 10. Predict the identity of the products at each electrode for the electrolysis of a halide compound in dilute or concentrated aqueous solution 11. Construct ionic half-equations for reactions at the anode (to show oxidation) and at the cathode (to show reduction)

m22-p22-q11

Which diagram shows the direction of movement of ions and electrons during the electrolysis of molten sodium chloride?



m22-p22-q13

Molten sodium chloride and concentrated aqueous sodium chloride are electrolysed using platinum electrodes.

What are the products at the negative electrode (cathode) in each electrolysis?

	molten sodium chloride	concentrated aqueous sodium chloride
A	hydrogen	hydrogen
B	hydrogen	sodium
C	sodium	hydrogen
D	sodium	sodium

m22-p22-q14

An object is electroplated with silver using an aqueous silver salt as the electrolyte.

Which row is correct?

	the object to be electroplated is the	the other electrode is made from
A	anode	carbon
B	anode	silver
C	cathode	carbon
D	cathode	silver

w21-p23-q10	<p>Effervescence is observed at the negative electrode (cathode) during the electrolysis of concentrated aqueous sodium chloride.</p> <p>Which element is produced at the negative electrode (cathode)?</p> <p>A chlorine</p> <p>B hydrogen</p> <p>C oxygen</p> <p>D sodium</p>																				
w21-p22-q10	<p>Iron can be electroplated with zinc to make it resistant to corrosion.</p> <p>Which row about electroplating iron with zinc is correct?</p> <table><tr><td></td><td>positive electrode (anode)</td><td>negative electrode (cathode)</td><td>electrolyte</td></tr><tr><td>A</td><td>iron</td><td>zinc</td><td>iron nitrate</td></tr><tr><td>B</td><td>iron</td><td>zinc</td><td>zinc nitrate</td></tr><tr><td>C</td><td>zinc</td><td>iron</td><td>iron nitrate</td></tr><tr><td>D</td><td>zinc</td><td>iron</td><td>zinc nitrate</td></tr></table>		positive electrode (anode)	negative electrode (cathode)	electrolyte	A	iron	zinc	iron nitrate	B	iron	zinc	zinc nitrate	C	zinc	iron	iron nitrate	D	zinc	iron	zinc nitrate
	positive electrode (anode)	negative electrode (cathode)	electrolyte																		
A	iron	zinc	iron nitrate																		
B	iron	zinc	zinc nitrate																		
C	zinc	iron	iron nitrate																		
D	zinc	iron	zinc nitrate																		
w21-p22-q13	<p>Concentrated aqueous sodium chloride is electrolysed.</p> <p>Which equation represents the reaction at the cathode?</p> <p>A $\text{Na}^+ + \text{e}^- \rightarrow \text{Na}$</p> <p>B $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$</p> <p>C $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$</p> <p>D $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$</p>																				
w21-p21-q10	<p>Which statements about the products of electrolysis, using inert electrodes, are correct?</p> <p>1 When molten lead(II) bromide is electrolysed, bromine is formed at the cathode.</p> <p>2 When dilute sulfuric acid is electrolysed, oxygen is formed at the anode.</p> <p>3 When concentrated aqueous sodium chloride is electrolysed, sodium is formed at the cathode.</p> <p>4 When concentrated hydrochloric acid is electrolysed, chlorine is formed at the anode.</p> <p>A 1 and 2 B 1 and 3 C 2 and 4 D 3 and 4</p>																				

s21-p23-q10 s21-P22-q10 s21-p21-q10	<p>In separate experiments, electricity was passed through concentrated aqueous sodium chloride and molten lead(II) bromide.</p> <p>What would happen in both experiments?</p> <p>A A halogen would be formed at the anode.</p> <p>B A metal would be formed at the cathode.</p> <p>C Hydrogen would be formed at the anode.</p> <p>D Hydrogen would be formed at the cathode.</p>															
s21-p21-q11	<p>What is the ionic half-equation for the reaction that occurs at the cathode when molten lead(II) bromide is electrolysed?</p> <p>A $\text{Pb}^{2+} + 2\text{e}^{-} \rightarrow \text{Pb}$</p> <p>B $2\text{Br}^{-} \rightarrow \text{Br}_2 + 2\text{e}^{-}$</p> <p>C $\text{Br}_2 + 2\text{e}^{-} \rightarrow 2\text{Br}^{-}$</p> <p>D $\text{Pb} \rightarrow \text{Pb}^{2+} + 2\text{e}^{-}$</p>															
m21-p22-q12	<p>During the electrolysis of dilute sulfuric acid, hydrogen is collected at the cathode.</p> <p>What is the ionic half-equation for this reaction?</p> <p>A $\text{H}^{+} + \text{e}^{-} \rightarrow \text{H}$</p> <p>B $\text{H}^{+} \rightarrow \text{H} + \text{e}^{-}$</p> <p>C $2\text{H}^{+} + 2\text{e}^{-} \rightarrow \text{H}_2$</p> <p>D $2\text{H}^{+} \rightarrow \text{H}_2 + 2\text{e}^{-}$</p>															
w20-p23-q13	<p>Electrolysis is carried out on dilute aqueous potassium bromide.</p> <p>Which products are formed at the anode and the cathode?</p> <table><tr><td></td><td>anode</td><td>cathode</td></tr><tr><td>A</td><td>bromine</td><td>hydrogen</td></tr><tr><td>B</td><td>bromine</td><td>potassium</td></tr><tr><td>C</td><td>hydrogen</td><td>bromine</td></tr><tr><td>D</td><td>hydrogen</td><td>potassium</td></tr></table>		anode	cathode	A	bromine	hydrogen	B	bromine	potassium	C	hydrogen	bromine	D	hydrogen	potassium
	anode	cathode														
A	bromine	hydrogen														
B	bromine	potassium														
C	hydrogen	bromine														
D	hydrogen	potassium														

w20-p22-q12

Universal indicator solution is added to a neutral solution of concentrated aqueous sodium chloride.

The solution, which contains H^+ (hydrogen), Na^+ (sodium), Cl^- (chloride) and OH^- (hydroxide) ions, is electrolysed.

The product at the cathode is hydrogen gas and the product at the anode is chlorine gas.

What happens to the colour of the indicator **in the solution** during electrolysis?

- A The colour changes from blue to green.
- B The colour changes from blue to red.
- C The colour changes from green to blue.
- D The colour changes from green to red.

w20-p21-q14

Which reaction takes place at the cathode during the electrolysis of molten nickel(II) chloride?

- A $\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$
- B $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$
- C $\text{Ni} \rightarrow \text{Ni}^{2+} + 2\text{e}^-$
- D $\text{Ni}^{2+} + 2\text{e}^- \rightarrow \text{Ni}$

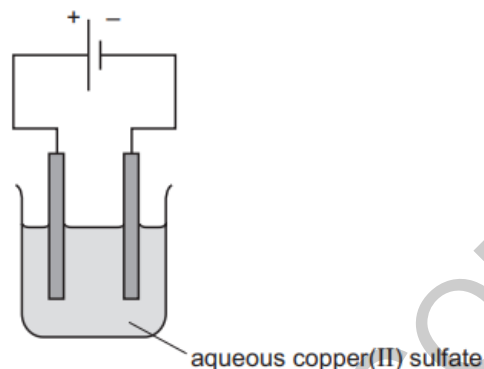
s20-p23-q10

Which row describes the reactions during the electrolysis of dilute aqueous sodium chloride?

	anode (+) reaction	cathode (–) reaction
A	$\text{H}_2 \rightarrow 2\text{H}^+ + 2\text{e}^-$	$2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^- \rightarrow 4\text{OH}^-$
B	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	$4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$
C	$2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^- \rightarrow 4\text{OH}^-$	$\text{H}_2 \rightarrow 2\text{H}^+ + 2\text{e}^-$
D	$4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$

s20-p23-q11
s20-p22-q11
s20-p21-q11

The electrolysis of aqueous copper(II) sulfate, using inert electrodes, is shown.



Which statement about a reaction at an electrode is correct?

- A Copper ions gain electrons at the negative electrode.
- B Copper ions gain electrons at the positive electrode.
- C Hydrogen ions gain electrons at the negative electrode.
- D Hydrogen ions gain electrons at the positive electrode.

s20-p22-q10

Electrolytes can be broken down by electrolysis.

Which rows are correct for each electrolyte?

	electrolyte	reaction at cathode	product at anode
1	dilute aqueous sodium chloride	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	oxygen
2	concentrated hydrochloric acid	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	chlorine
3	molten aluminium oxide	$2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$	aluminium
4	concentrated aqueous sodium bromide	$\text{Na}^+ + \text{e}^- \rightarrow \text{Na}$	bromine

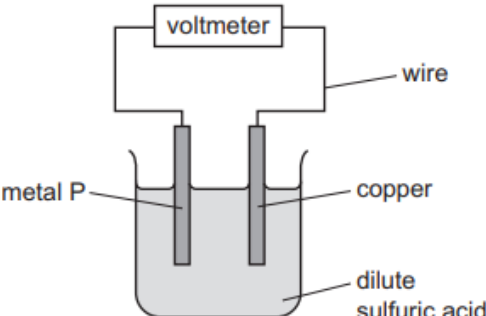
- A 1 and 2 B 1 and 4 C 2 and 3 D 3 and 4

s20-p21-q10

Dilute aqueous sodium chloride is electrolysed using platinum electrodes.

What is the half-equation for the reaction at the cathode?

- A $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$
- B $\text{Na}^+ + \text{e}^- \rightarrow \text{Na}$
- C $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$
- D $4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$

m20-p22-q10	<p>Which statements about the electrolysis of molten lead(II) bromide are correct?</p> <ol style="list-style-type: none"> 1 Lead ions move to the anode and are oxidised. 2 Lead ions move to the cathode and are reduced. 3 Bromide ions move to the anode and are oxidised. 4 Bromide ions move to the cathode and are reduced. <p>A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4</p>
m20-p22-q11	<p>Aqueous copper(II) sulfate is electrolysed using carbon electrodes.</p> <p>Which statement is correct?</p> <p>A Bubbles of hydrogen are formed at the anode.</p> <p>B Bubbles of oxygen gas are formed at the cathode.</p> <p>C Copper is deposited at the anode.</p> <p>D The blue colour of the solution fades.</p>
w19-p23-q11	<p>The diagram shows a simple cell.</p>  <p>Which metal P produces the smallest voltage?</p> <p>A calcium</p> <p>B iron</p> <p>C magnesium</p> <p>D zinc</p>

w19-p23-q12
w19-p21-q12

What are the ionic half-equations for the electrode reactions during the electrolysis of concentrated aqueous sodium chloride?

	anode	cathode
A	$\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$	$\text{H}_2 \rightarrow 2\text{H}^+ + 2\text{e}^-$
B	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$
C	$\text{H}_2 \rightarrow 2\text{H}^+ + 2\text{e}^-$	$\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$
D	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$

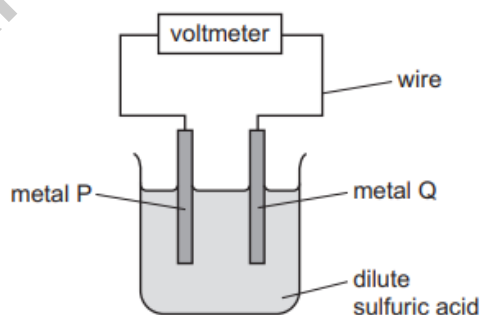
w19-p23-q27

Which statement about metals and their uses is correct?

- A** Aluminium is used in the manufacture of aircraft because it has a high density.
- B** Copper is used to make cooking utensils because it is a poor conductor of heat.
- C** Mild steel is used to make car bodies because it is brittle and breaks easily.
- D** Stainless steel is used to make cutlery because it is resistant to corrosion.

w19-p22-q11

The diagram shows a simple cell.



Which pair of metals produces the largest voltage?

	metal P	metal Q
A	magnesium	iron
B	magnesium	copper
C	zinc	iron
D	zinc	copper

w19-p21-q11

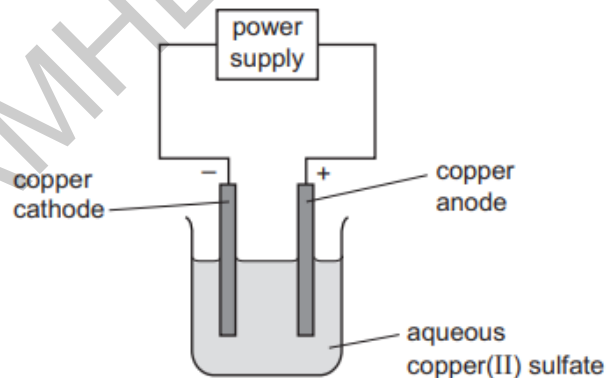
Which rows correctly show cathode and anode products from the electrolysis of the named electrolyte?

	electrolyte	cathode product	anode product
1	copper(II) sulfate solution using copper electrodes	copper	oxygen
2	molten lead(II) bromide	lead	bromine
3	dilute sodium bromide solution	hydrogen	oxygen
4	copper(II) sulfate solution using carbon electrodes	hydrogen	oxygen

A 1 and 2 only **B** 1 and 4 only **C** 2 and 3 only **D** 3 and 4 only

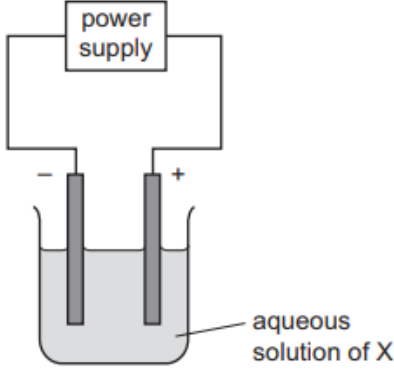
s19-p23-q9

An aqueous solution of copper(II) sulfate was electrolysed using copper electrodes.



Which equation for the reaction at the anode is correct?

- A** $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$
B $\text{Cu} + 2\text{e}^- \rightarrow \text{Cu}^{2+}$
C $\text{Cu}^{2+} \rightarrow \text{Cu} + 2\text{e}^-$
D $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$

s19-p22-q9	<p>The diagram shows the electrolysis of an aqueous solution of X using inert electrodes.</p>  <p>Hydrogen is produced at the cathode and chlorine is produced at the anode.</p> <p>What is X?</p> <p>A concentrated copper(II) chloride solution B concentrated hydrochloric acid C dilute hydrochloric acid D dilute sodium chloride solution</p>
s19-p21-q9	<p>Which statement about the electrolysis of copper(II) sulfate solution using carbon electrodes is correct?</p> <p>A A colourless gas is produced at the anode. B A colourless gas is produced at the cathode. C The colour of the electrolyte remains the same. D The mass of both electrodes remains constant.</p>
m19-p22-q10	<p>Which substance is not produced during the electrolysis of concentrated aqueous sodium chloride?</p> <p>A chlorine B hydrogen C sodium D sodium hydroxide</p>

m19-p22-q11

Aqueous copper(II) sulfate is electrolysed using copper electrodes.

What are the ionic half-equations for the reactions that occur at each electrode?

	anode	cathode
A	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$	$\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$
B	$\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$
C	$4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$	$\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$
D	$4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$

w18-p23-q10

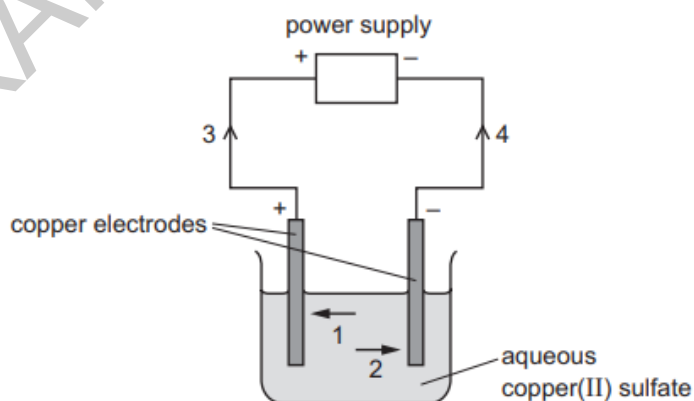
Electrolysis of copper(II) sulfate can be done using either carbon electrodes or copper electrodes.

Which statement describes what happens at the positive electrode?

- A** Copper is deposited if the electrode is made from carbon.
- B** Copper is deposited if the electrode is made from copper.
- C** Oxygen gas is produced if the electrode is made from carbon.
- D** Oxygen gas is produced if the electrode is made from copper.

w18-p23-q11

The diagram shows a circuit used to electrolyse aqueous copper(II) sulfate.

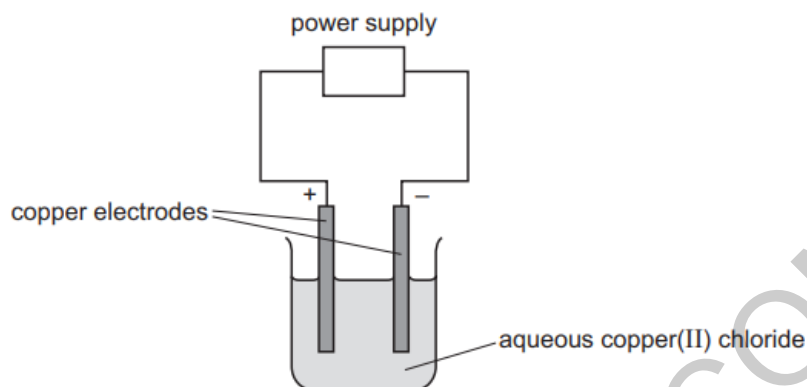


Which arrows indicate the movement of the copper ions in the electrolyte and of the electrons in the external circuit?

	copper ions	electrons
A	1	3
B	1	4
C	2	3
D	2	4

w18-p22-q10

Concentrated aqueous copper(II) chloride is electrolysed using copper electrodes as shown.

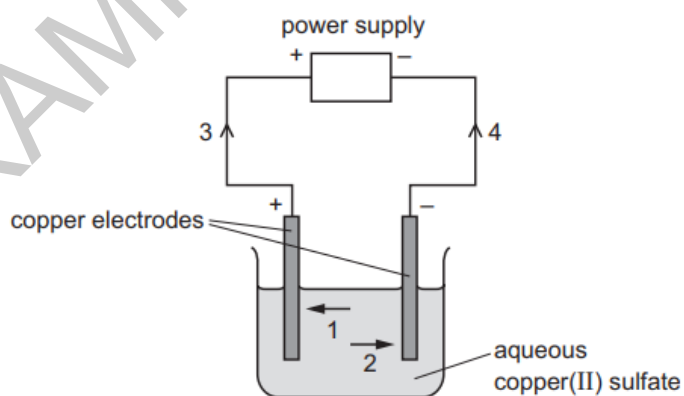


What happens to the mass of each electrode during this process?

	positive electrode	negative electrode
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

w18-p22-q11

The diagram shows a circuit used to electrolyse aqueous copper(II) sulfate.



Which arrows indicate the movement of the copper ions in the electrolyte and of the electrons in the external circuit?

	copper ions	electrons
A	1	3
B	1	4
C	2	3
D	2	4

w18-p21-q10

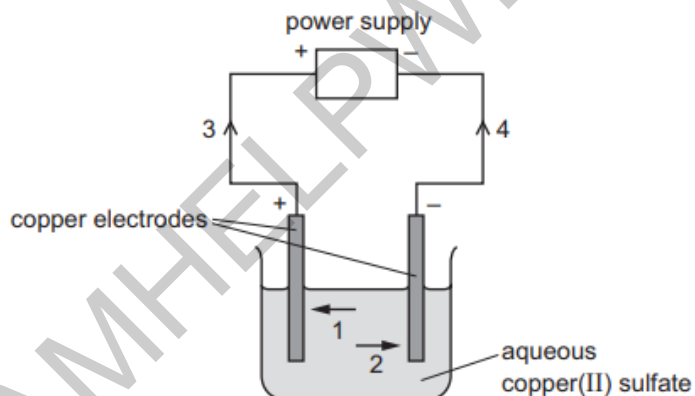
Aqueous copper(II) sulfate is electrolysed using carbon electrodes.

What is the product at each electrode?

	product at the positive electrode	product at the negative electrode
A	copper	oxygen
B	hydrogen	oxygen
C	oxygen	copper
D	oxygen	hydrogen

w18-p21-q11

The diagram shows a circuit used to electrolyse aqueous copper(II) sulfate.



Which arrows indicate the movement of the copper ions in the electrolyte and of the electrons in the external circuit?

	copper ions	electrons
A	1	3
B	1	4
C	2	3
D	2	4

s18-p23-q10

Aqueous copper(II) sulfate is electrolysed using copper electrodes.

Which statement is correct?

- A** Oxygen gas is produced at the positive electrode.
- B** The blue colour of the solution gradually fades.
- C** The concentration of copper ions in the solution stays the same.
- D** The mass of the negative electrode decreases.

s18-p23-q11
s18-p22-q11
s18-p21-q11

Dilute sulfuric acid is electrolysed using inert electrodes.

What are the ionic half-equations for the reactions that take place at each electrode?

	positive electrode	negative electrode
A	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	$4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$
B	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	$4\text{OH}^- + 4\text{H}^+ \rightarrow 4\text{H}_2\text{O}$
C	$4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$
D	$4\text{OH}^- + 4\text{H}^+ \rightarrow 4\text{H}_2\text{O}$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$

s18-p22-q10

Aqueous copper(II) sulfate is electrolysed using copper electrodes.

Which statement about the electrolysis is **not** correct?

- A** An oxidation reaction occurs at the positive electrode.
- B** The current is carried through the electrolyte by ions.
- C** The negative electrode gains mass.
- D** The number of copper(II) ions in the electrolyte decreases.

s18-p21-q10

Aqueous copper(II) sulfate is electrolysed using copper electrodes.

Which statement is correct?

- A** A reduction reaction occurs at the positive electrode.
- B** The blue colour of the solution becomes darker.
- C** The concentration of copper ions in the solution decreases.
- D** The mass of the negative electrode increases.

m18-p22-q9

A solution of copper(II) sulfate can be electrolysed using copper electrodes or carbon electrodes.

Which statements are correct?

- 1 Using copper electrodes, oxygen gas forms at the anode.
- 2 Using copper electrodes, copper atoms lose electrons at the anode.
- 3 Using carbon electrodes, copper metal forms at the cathode.
- 4 Using carbon electrodes, copper ions gain electrons at the cathode.

- A** 1 and 2 **B** 1 and 3 **C** 2, 3 and 4 **D** 4 only

Topic	<p style="text-align: center;"><u>4. Electrochemistry</u></p> <p style="text-align: center;">4.2 Hydrogen–oxygen fuel cells</p>
Content	<p>1. State that a hydrogen–oxygen fuel cell uses hydrogen and oxygen to produce electricity with water as the only chemical product Supplement</p> <p>2. Describe the advantages and disadvantages of using hydrogen–oxygen fuel cells in comparison with gasoline /petrol engines in vehicles</p>
w21-p23-q14	<p>A fuel cell is used to generate electricity.</p> <p>Which chemicals are used in a fuel cell?</p> <p>A hydrogen and methane</p> <p>B hydrogen and oxygen</p> <p>C nitrogen and methane</p> <p>D nitrogen and oxygen</p>
w21-p21-q12	<p>Hydrogen is used as a fuel in rockets and is also used in hydrogen fuel cells.</p> <p>Which statements are correct?</p> <p>1 Both uses produce water vapour.</p> <p>2 Burning hydrogen produces polluting gases.</p> <p>3 A fuel cell produces electricity.</p> <p>A 1, 2 and 3 B 1 and 3 only C 1 only D 2 and 3 only</p>
s21-p21-q13	<p>Which equation represents a reaction that takes place in a fuel cell?</p> <p>A $C + O_2 \rightarrow CO_2$</p> <p>B $2H_2 + O_2 \rightarrow 2H_2O$</p> <p>C $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$</p> <p>D $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$</p>
m21-p22-q15	<p>Hydrogen fuel cells can be used to power cars.</p> <p>Which statements about a fuel cell are correct?</p> <p>1 The balanced equation for the reaction is $H_2 + O_2 \rightarrow H_2O$.</p> <p>2 The fuel cell generates electricity.</p> <p>3 In the fuel cell hydrogen is reduced.</p> <p>4 The reactants are gases at room temperature.</p> <p>A 1 and 2 B 1 and 3 C 2 and 4 D 3 and 4</p>

<p>s20-p23-q13 s20-p22-q13 s20-p21-q13</p>	<p>Which statements about hydrogen fuel cells are correct?</p> <ol style="list-style-type: none"> 1 Water is formed as the only waste product. 2 Both water and carbon dioxide are formed as waste products. 3 The overall reaction is $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$. 4 The overall reaction is endothermic. <p>A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4</p>
<p>m20-p22-q13</p>	<p>Which statements about hydrogen fuel cells are correct?</p> <ol style="list-style-type: none"> 1 The reaction between hydrogen and oxygen is endothermic. 2 The waste product in a hydrogen fuel cell is water. 3 A chemical reaction in the cell produces hydrogen which is used as the fuel. 4 A hydrogen fuel cell is used to generate electricity. <p>A 1 and 2 B 1 and 3 C 2 and 4 D 3 and 4</p>
<p>w19-p23-q14</p>	<p>Which gases are used to generate electricity in a fuel cell?</p> <p>A carbon dioxide and oxygen B hydrogen and methane C hydrogen and oxygen D methane and carbon dioxide</p>
<p>w19-p22-q14 w19-p21-q14</p>	<p>Which gases are used to generate electricity in a fuel cell?</p> <p>A carbon dioxide and oxygen B hydrogen and methane C hydrogen and oxygen D methane and carbon dioxide</p>
<p>s19-p23-q11</p>	<p>Which statement about a fuel cell in a car is correct?</p> <p>A The fuel cell produces heat, which powers the car. B The fuel cell is supplied with hydrogen directly from the air. C The only emission from a fuel cell is nitrogen gas, which is non-polluting. D The fuel cell produces electricity, which powers an electric motor.</p>

s19-p22-q11

Fuel cells are used as energy sources in cars.

Which row gives a fuel used in a fuel cell and the products formed?

	fuel in a fuel cell	products formed
A	hydrogen	carbon dioxide and water
B	hydrogen	water only
C	petrol	carbon dioxide and water
D	petrol	water only

s19-p21-q11

Which statement about the hydrogen fuel cell is **not** correct?

- A** Chemical energy is converted into electrical energy.
- B** Hydrogen is oxidised.
- C** The reaction that takes place is endothermic.
- D** Water is the only product.

m19-p22-q14

Hydrogen-oxygen fuel cells can be used to power cars. Platinum is used as a catalyst.

The amount of energy produced per gram is shown for three fuels.

fuel	energy produced per g of fuel / kJ
hydrogen	143
methane	55
petrol	44

Which statement is correct and is an advantage of a hydrogen-oxygen fuel cell?

- A** Hydrogen is difficult to store.
- B** Hydrogen produces less energy per gram than methane or petrol.
- C** Platinum is rare and expensive.
- D** The only product is water.

m18-p22-q35

Statement 1 Hydrogen is used as a fuel.

Statement 2 When hydrogen burns in the air to form water, heat energy is produced.

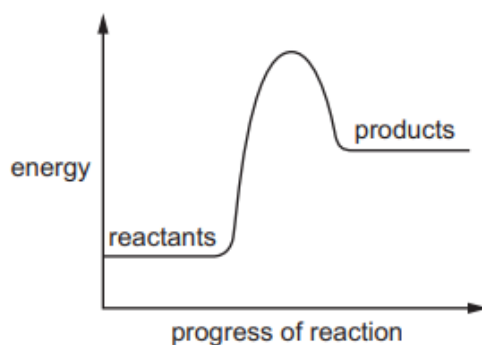
Which is correct?

- A** Both statements are correct and statement 2 explains statement 1.
- B** Both statements are correct but statement 2 does not explain statement 1.
- C** Statement 1 is correct but statement 2 is incorrect.
- D** Statement 2 is correct but statement 1 is incorrect.

Topic	<u>5. Chemical Energetics</u>															
	5.1 Exothermic and endothermic reactions															
Content	<ol style="list-style-type: none">1. State that an exothermic reaction transfers thermal energy to the surroundings leading to an increase in the temperature of the surroundings2. State that an endothermic reaction takes in thermal energy from the surroundings leading to a decrease in the temperature of the surroundings3. Interpret reaction pathway diagrams showing exothermic and endothermic reactions4. State that the transfer of thermal energy during a reaction is called the enthalpy change, ΔH, of the reaction. ΔH is negative for exothermic reactions and positive for endothermic reactions5. Define activation energy, E_a, as the minimum energy that colliding particles must have to react6. Draw and label reaction pathway diagrams for exothermic and endothermic reactions using information provided, to include:<ol style="list-style-type: none">(a) reactants(b) products(c) enthalpy change of the reaction, ΔH(d) activation energy, E_a7. State that bond breaking is an endothermic process and bond making is an exothermic process and explain the enthalpy change of a reaction in terms of bond breaking and bond making8. Calculate the enthalpy change of a reaction using bond energies															
m22-pP22-q15	<p>Which row describes the changes that occur in an endothermic reaction?</p> <table><tr><th></th><th>energy change</th><th>temperature</th></tr><tr><td>A</td><td>energy given out to the surroundings</td><td>decreases</td></tr><tr><td>B</td><td>energy given out to the surroundings</td><td>increases</td></tr><tr><td>C</td><td>energy taken in from the surroundings</td><td>decreases</td></tr><tr><td>D</td><td>energy taken in from the surroundings</td><td>increases</td></tr></table>		energy change	temperature	A	energy given out to the surroundings	decreases	B	energy given out to the surroundings	increases	C	energy taken in from the surroundings	decreases	D	energy taken in from the surroundings	increases
	energy change	temperature														
A	energy given out to the surroundings	decreases														
B	energy given out to the surroundings	increases														
C	energy taken in from the surroundings	decreases														
D	energy taken in from the surroundings	increases														
m22-p22-q17	<p>Which statement about endothermic and exothermic reactions is correct?</p> <ol style="list-style-type: none">A In an endothermic reaction, less energy is absorbed in bond breaking than is released in bond forming.B In an endothermic reaction, the activation energy is always higher than in an exothermic reaction.C In an exothermic reaction, more energy is absorbed in bond breaking than is released in bond forming.D In an exothermic reaction, the reactants are higher on an energy level diagram than the products.															

w21-p23-q11

The energy level diagram for a chemical reaction is shown.

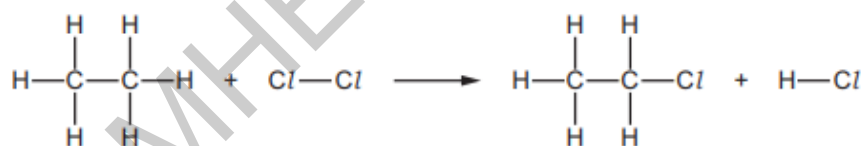


Which statement about this reaction is correct?

- A** The reaction is endothermic and energy is given out to the surroundings.
- B** The reaction is endothermic and energy is taken in from the surroundings.
- C** The reaction is exothermic and energy is given out to the surroundings.
- D** The reaction is exothermic and energy is taken in from the surroundings.

w21-p23-q12
w21-P22-q11
w21-p21-q11

Chlorine reacts with ethane to produce chloroethane and hydrogen chloride.



The reaction is exothermic.

The bond energies are shown in the table.

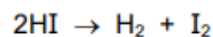
bond	bond energy in kJ/mol
C-Cl	+340
C-C	+350
C-H	+410
Cl-Cl	+240
H-Cl	+430

What is the energy change for the reaction?

- A** -1420 kJ/mol
- B** -120 kJ/mol
- C** +120 kJ/mol
- D** +1420 kJ/mol

s21-p23-q17

The equation for the decomposition of hydrogen iodide is shown.



Some bond energies are shown.

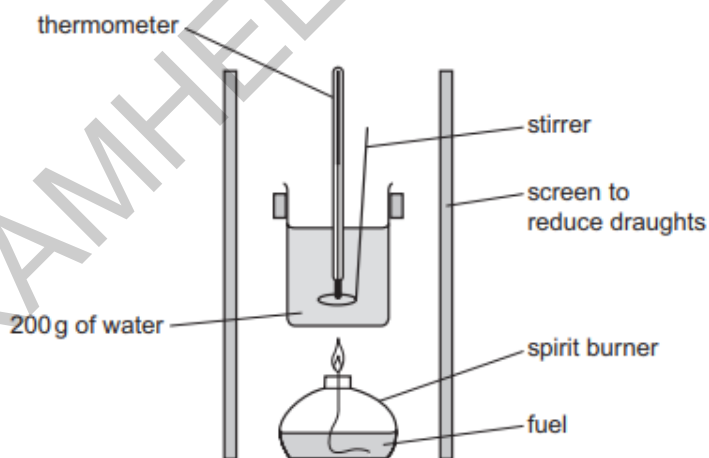
bond	bond energy in kJ/mol
H–H	440
I–I	150
H–I	300

What is the energy change for the reaction?

- A** –290 kJ/mol **B** –10 kJ/mol **C** +10 kJ/mol **D** +290 kJ/mol

s21-p22-q12

Four different fuels are used to heat a beaker of water, for the same amount of time, using the apparatus shown.



The initial temperature of the water and the temperature after heating by the fuel are recorded.

Which fuel releases the most heat energy?

	initial temperature /°C	temperature after heating /°C
A	17	46
B	24	52
C	26	61
D	30	62

s21-p22-q20

The equation shows the reaction between hydrogen and oxygen.



The bond energies are shown.

	bond energy in kJ/mol
H-H	436
O=O	495
O-H	463

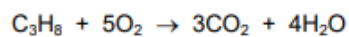
Which row shows the energy change and the type of reaction?

	energy change in kJ/mol	type of reaction
A	441	exothermic
B	441	endothermic
C	485	exothermic
D	485	endothermic

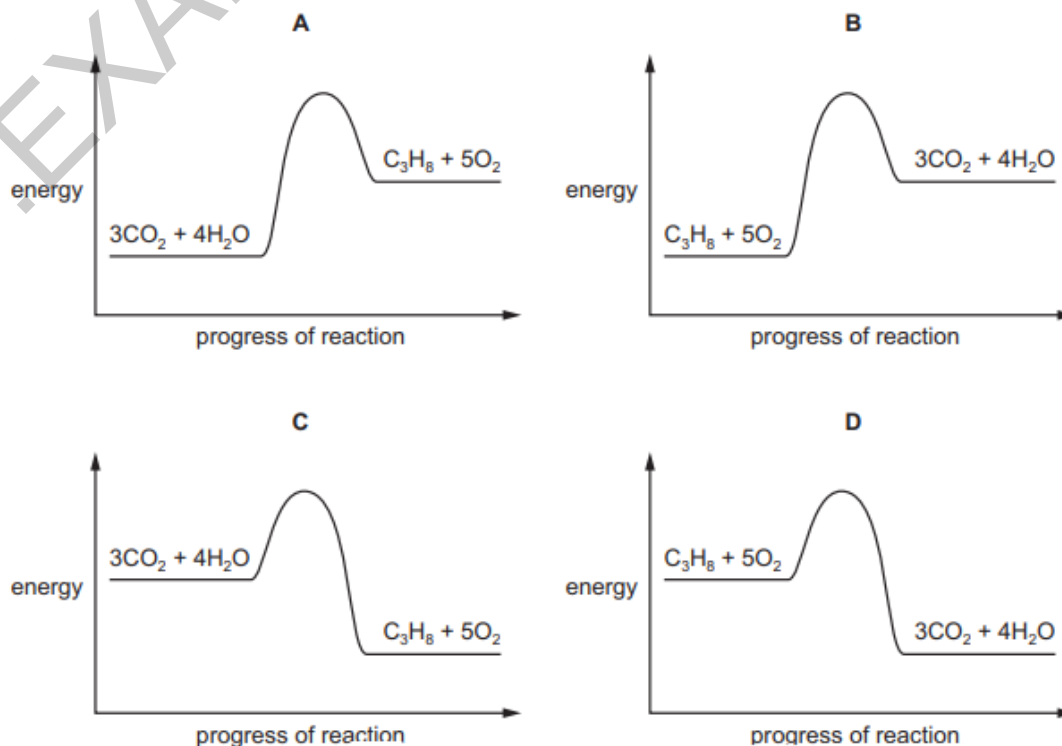
s21-p21-q12

The complete combustion of propane is exothermic.

The equation for this reaction is shown.

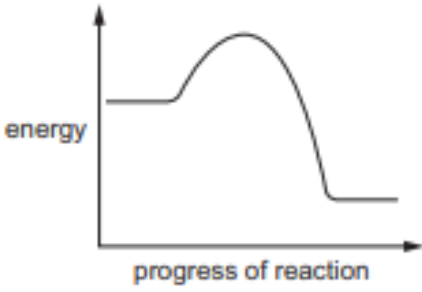
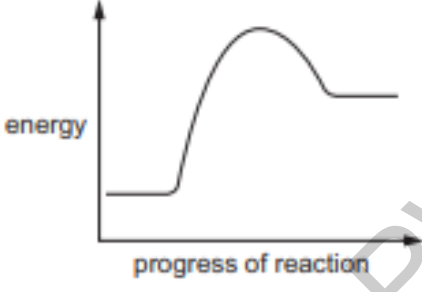
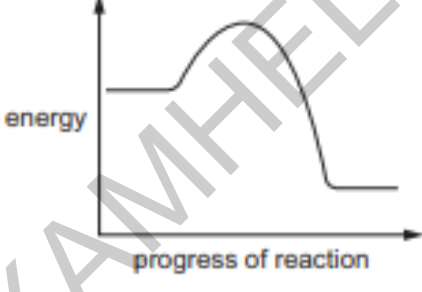
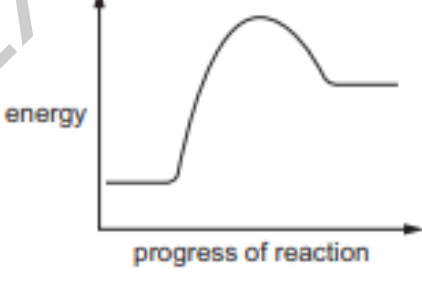


Which energy level diagram represents the complete combustion of propane?



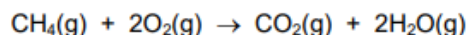
m21-p22-q13

Which row describes an endothermic reaction?

	energy level diagram	energy transfer
A		energy is transferred from the surroundings to the reaction
B		energy is transferred from the surroundings to the reaction
C		energy is transferred from the reaction to the surroundings
D		energy is transferred from the reaction to the surroundings

m21-p22-q14

The equation for the complete combustion of methane is shown.



The bond energies are shown in the table.

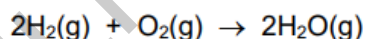
bond	bond energy in kJ/mol
C–H	+410
C=O	+805
O–H	+460
O=O	+496

What is the energy change for the reaction?

- A** –818 kJ/mol **B** –359 kJ/mol **C** –323 kJ/mol **D** +102 kJ/mol

w20-p23-q16

The reaction between hydrogen and oxygen releases 486 kJ/mol of energy.



The bond energy of H–H is 436 kJ/mol and that of H–O is 464 kJ/mol.

What is the bond energy of O=O?

- A** 430 kJ/mol
B 458 kJ/mol
C 498 kJ/mol
D 984 kJ/mol

w20-p22-q14

The combustion of methane is exothermic.

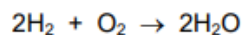


Which statement about this reaction is correct?

- A** The energy needed to break the bonds in methane and oxygen is greater than the energy released in making new bonds in carbon dioxide and water.
B The energy needed to break the bonds in methane and oxygen is less than the energy released in making new bonds in carbon dioxide and water.
C The energy released in breaking bonds in methane and oxygen is greater than the energy needed to make new bonds in carbon dioxide and water.
D The energy released in breaking bonds in methane and oxygen is less than the energy needed to make new bonds in carbon dioxide and water.

w20-p22-q15

Hydrogen reacts with oxygen in a fuel cell.



The reaction is exothermic.

286 kJ of energy is released for every mole of water formed.

Which volume of hydrogen gas, measured at room temperature and pressure, would react with oxygen with the release of 7000 J of energy?

- A** 587 cm³ **B** 1175 cm³ **C** 587 dm³ **D** 1175 dm³

w20-p21-q5

Sodium nitrate is added to water in a beaker and stirred until it dissolves.

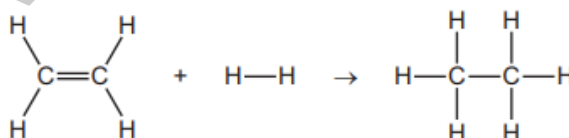
At the end of the experiment, the beaker feels cold.

Which row describes the reaction?

	temperature of solution	type of reaction
A	decreases	endothermic
B	decreases	exothermic
C	increases	endothermic
D	increases	exothermic

w20-p21-q17

Ethene reacts with hydrogen to form ethane.



The bond energies are shown in the table.

bond	bond energy in kJ/mol
C–C	+350
C–H	+410
H–H	+436
C=C	+614

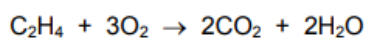
What is the energy change for the reaction?

- A** –290 kJ/mol
B –120 kJ/mol
C +120 kJ/mol
D +290 kJ/mol

s20-p23-q12

Ethene gas, C_2H_4 , is completely burned in excess oxygen to form carbon dioxide and water.

The equation for this exothermic reaction is shown.



The table shows the bond energies involved in the reaction.

bond	bond energy (kJ/mol)
C=C	614
C-H	413
O=O	495
C=O	799
O-H	467

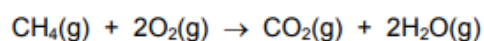
What is the total energy change in this reaction?

- A -954 kJ/mol
- B -1010 kJ/mol
- C -1313 kJ/mol
- D -1369 kJ/mol

s20-p22-q12

Methane burns in excess oxygen.

The equation is shown.



Bond energies are shown.

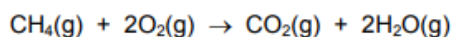
bond	bond energy /kJ mol ⁻¹
C=O	805
C-H	410
O=O	496
O-H	460

What is the energy change for the reaction?

- A $(4 \times 410 + 2 \times 496) - (2 \times 805 + 4 \times 460)$
- B $(2 \times 805 + 2 \times 460) - (410 + 2 \times 496)$
- C $(410 + 2 \times 496) - (805 + 2 \times 460)$
- D $(410 + 496) - (805 + 460)$

s20-p21-q12

The equation for the complete combustion of methane gas is shown.



Bond energies are shown.

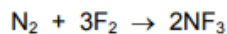
bond	bond energy in kJ/mol
C-H	412
H-O	463
C=O	743
O=O	498

What is the overall energy change, in kJ/mol, for the above reaction?

- A** -1192 **B** -694 **C** +694 **D** +1192

m20-p22-q12

Nitrogen trifluoride, NF_3 , is used in the manufacture of certain types of solar panels. The equation for the formation of nitrogen trifluoride is shown.



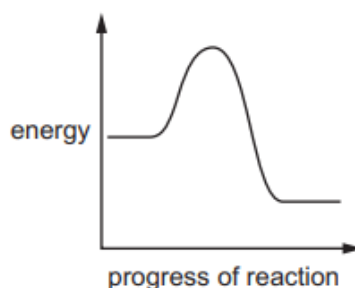
type of bond	bond energy (kJ mol ⁻¹)
N≡N	+950
F-F	+150
N-F	+280

Using the table of bond energies, what is the energy change for this reaction?

- A** -560 kJ mol⁻¹
B -280 kJ mol⁻¹
C +280 kJ mol⁻¹
D +3080 kJ mol⁻¹

w19-p23-q13

An energy level diagram for a reaction is shown.



Which statement and explanation about this reaction are correct?

	statement	explanation
A	the reaction is endothermic	the products have more energy than the reactants
B	the reaction is endothermic	the products have less energy than the reactants
C	the reaction is exothermic	the products have more energy than the reactants
D	the reaction is exothermic	the products have less energy than the reactants

w19-p22-q13

The temperature of the water in two beakers, X and Y, is measured as 21.5 °C.

5 g of sodium chloride is dissolved in the water in beaker X. The temperature changes to 18.0 °C.

5 g of calcium oxide is dissolved in the water in beaker Y. The temperature changes to 29.4 °C.

Which types of process are occurring in beakers X and Y?

	X	Y
A	endothermic	endothermic
B	endothermic	exothermic
C	exothermic	endothermic
D	exothermic	exothermic

w19-p21-q13

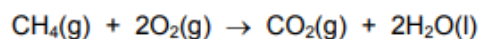
Which statements about endothermic reactions are correct?

- 1 The energy of the products is greater than the energy of the reactants.
- 2 The energy of the reactants is greater than the energy of the products.
- 3 The temperature of the surroundings increases during the reaction.
- 4 The temperature of the surroundings decreases during the reaction.

A 1 and 3 only **B** 1 and 4 only **C** 2 and 3 only **D** 2 and 4 only

s19-p23-q12

Methane burns in oxygen to form carbon dioxide and water.



The bond energies are shown in the table.

bond	bond energy in kJ/mol
C–H	410
C–O	360
C=O	805
O–H	460
O–O	146
O=O	496

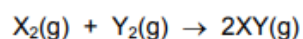
What is the energy change for this reaction?

A –818 kJ/mol **B** –102 kJ/mol **C** +102 kJ/mol **D** +818 kJ/mol

s19-p22-q12

Two elements, X and Y, react together to form a covalent molecule as shown.

The reaction is exothermic.



The bond energies are shown in the table.

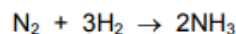
bond	bond energy in kJ/mol
X–X	436
Y–Y	242
X–Y	431

What is the energy change for the reaction?

A +184 kJ/mol **B** –184 kJ/mol **C** +247 kJ/mol **D** –247 kJ/mol

s19-p21-q12

Nitrogen reacts with hydrogen to produce ammonia.



The reaction is exothermic. The bond energies are shown in the table.

bond	bond energy in kJ/mol
$\text{N}\equiv\text{N}$	945
$\text{H}-\text{H}$	436
$\text{N}-\text{H}$	390

What is the energy change for this reaction?

- A -1473 kJ/mol
- B -87 kJ/mol
- C 87 kJ/mol
- D 1473 kJ/mol

m19-p22-q12

10 g of ammonium nitrate is added to water at 25 °C and the mixture stirred.

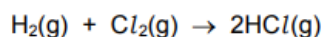
The ammonium nitrate dissolves and, after one minute, the temperature of the solution is 10 °C.

Which word describes this change?

- A endothermic
- B exothermic
- C neutralisation
- D reduction

m19-p22-q13

Hydrogen reacts with chlorine according to the following equation.



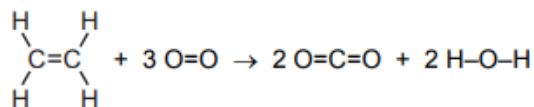
The reaction is exothermic.

Which statement about this reaction is correct?

- A Energy absorbed for bond breaking is greater than the energy released in bond making.
- B Energy absorbed for bond breaking is less than the energy released in bond making.
- C Energy released in bond breaking is greater than the energy absorbed in bond making.
- D Energy released in bond breaking is less than the energy absorbed in bond making.

w18-p23-q12

Ethene burns in oxygen to form carbon dioxide and water vapour.



The bond energies are shown in the table.

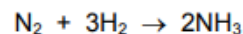
bond	bond energy in kJ/mol
C=C	+610
C-H	+410
O=O	+497
C=O	+805
O-H	+460

What is the energy change for the reaction?

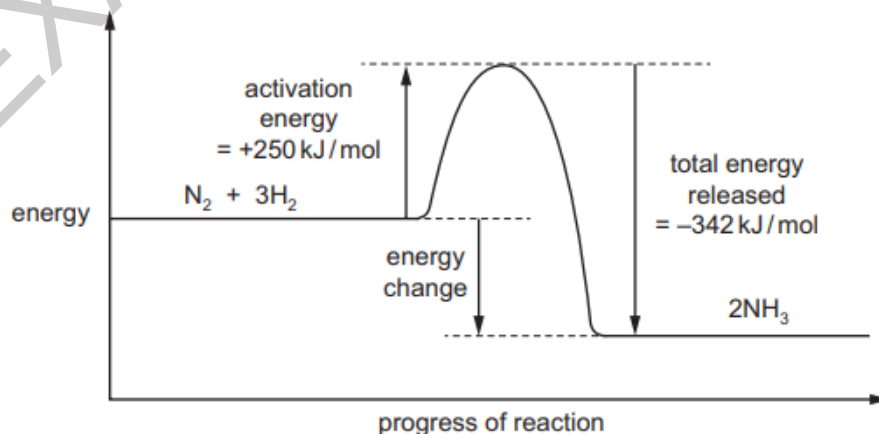
- A -2959 kJ/mol
- B -2313 kJ/mol
- C -1319 kJ/mol
- D -399 kJ/mol

w18-p23-q13

The equation for the formation of ammonia is shown.



The energy level diagram for the reaction is shown.

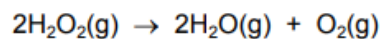


What is the energy change for the reaction?

- A -592 kJ/mol
- B -92 kJ/mol
- C +92 kJ/mol
- D +592 kJ/mol

w18-p22-q12

Hydrogen peroxide, $\text{H}-\text{O}-\text{O}-\text{H}$, decomposes to form water and oxygen.



The bond energies are shown in the table. The reaction is exothermic.

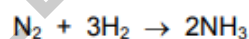
bond	bond energy in kJ/mol
O–H	+460
O–O	+150
O=O	+496

What is the energy change for the reaction?

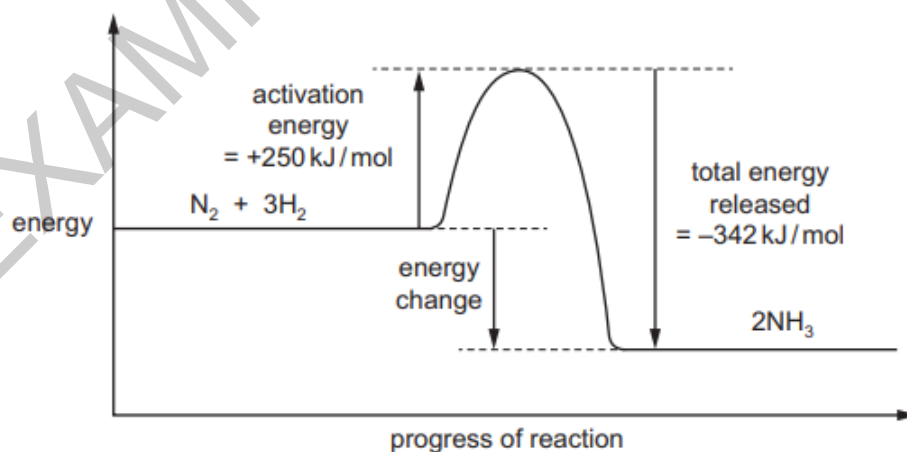
- A** –346 kJ/mol **B** –196 kJ/mol **C** +196 kJ/mol **D** +346 kJ/mol

w18-p22-q13
w18-p21-q13

The equation for the formation of ammonia is shown.



The energy level diagram for the reaction is shown.

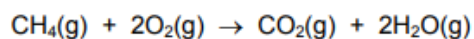


What is the energy change for the reaction?

- A** –592 kJ/mol
B –92 kJ/mol
C +92 kJ/mol
D +592 kJ/mol

w18-p21-q12

Methane burns in an excess of oxygen. The equation is shown.



The bond energies are shown in the table.

bond	bond energy in kJ/mol
C–H	+410
C=O	+805
O–H	+460
O=O	+496

What is the energy change for the reaction?

- A +818 kJ/mol
- B +102 kJ/mol
- C –359 kJ/mol
- D –818 kJ/mol

w18-p21-q34

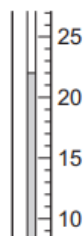
Which reaction is endothermic?

- A $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
- B $\text{CaO} + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O}$
- C $2\text{Ca} + \text{O}_2 \rightarrow 2\text{CaO}$
- D $\text{Ca} + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2$

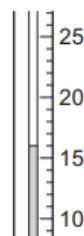
S18-p23-q3

Solid R reacted with dilute sulfuric acid.

The initial temperature of the dilute sulfuric acid and the final temperature of the solution are shown.



initial temperature
of the dilute
sulfuric acid (°C)



final temperature
of the solution (°C)

What was the change in temperature in °C?

- A –6
- B –4
- C 4
- D 6

s18-p23-q12

Information about two reactions is given.

- The neutralisation reaction between citric acid and sodium hydrogencarbonate is endothermic.
- The displacement reaction between magnesium and carbon dioxide is exothermic.

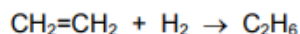
Which statements about the two reactions are correct?

- 1 The energy of the products formed in the neutralisation reaction is greater than the energy of the reactants.
- 2 The energy of magnesium and carbon dioxide is greater than the energy of magnesium oxide and carbon.
- 3 In an exothermic reaction, the energy required to break the bonds is greater than the energy released when the new bonds are formed.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

s18-p23-q13

Ethene reacts with hydrogen. The equation is shown.



The bond energies are shown in the table. The reaction is exothermic.

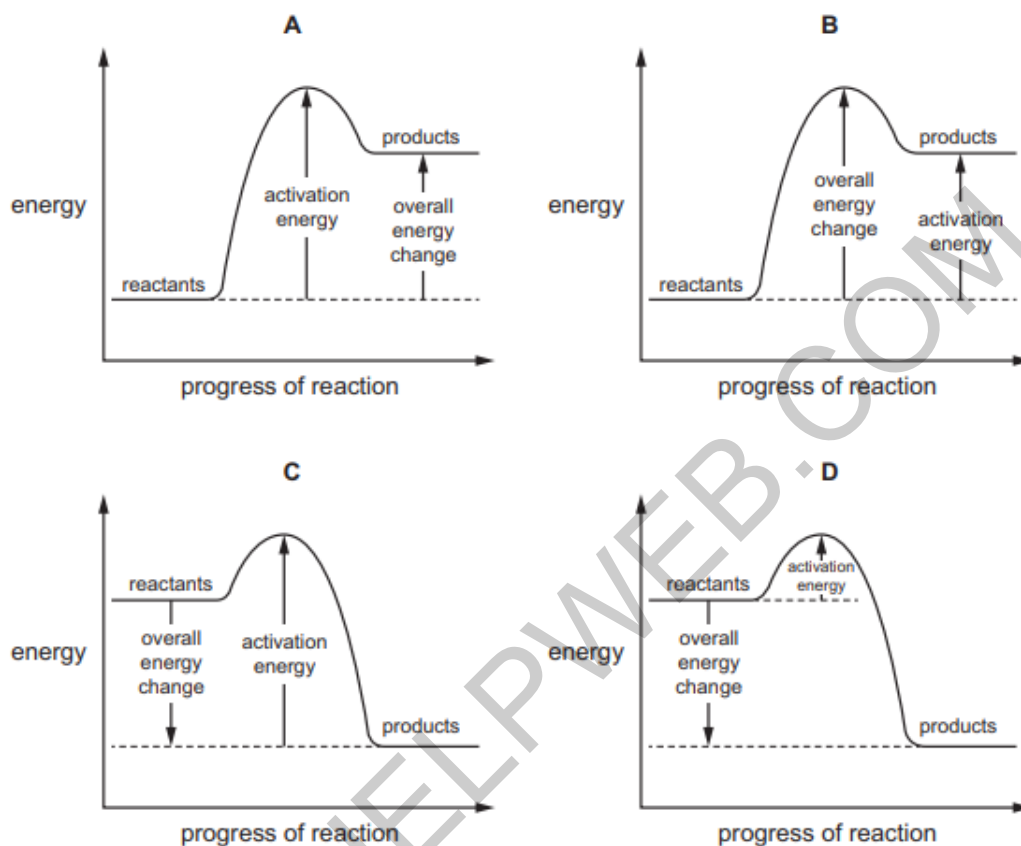
bond	bond energy in kJ/mol
C–C	+350
C=C	+610
C–H	+410
H–H	+436

What is the energy change for the reaction?

A –560 kJ/mol **B** –124 kJ/mol **C** +486 kJ/mol **D** +5496 kJ/mol

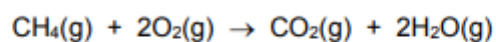
s18-p22-q12

Which diagram is a correctly labelled energy level diagram for an endothermic reaction?



Ss18-p22-q13

The equation for the complete combustion of methane is shown.



The bond energies are shown in the table.

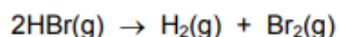
bond	bond energy in kJ/mol
C–H	+410
C=O	+805
O–H	+460
O=O	+496

What is the energy change for the reaction?

A –818 kJ/mol **B** –359 kJ/mol **C** –323 kJ/mol **D** +102 kJ/mol

s18-p21-q13

Hydrogen bromide decomposes to form hydrogen and bromine. The equation is shown.



The bond energies are shown in the table. The reaction is endothermic.

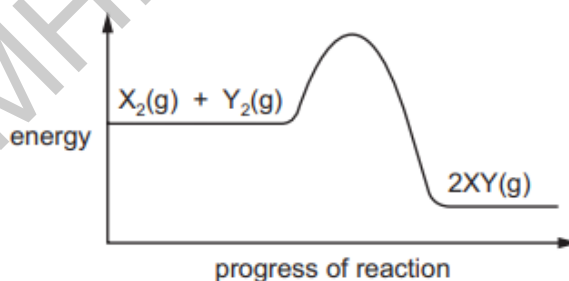
bond	bond energy in kJ/mol
Br–Br	+193
H–Br	+366
H–H	+436

What is the energy change for the reaction?

- A** +263 kJ/mol **B** +103 kJ/mol **C** –103 kJ/mol **D** –263 kJ/mol

m18-p22-q11

The energy level diagram for the reaction between X_2 and Y_2 to form XY gas is shown.

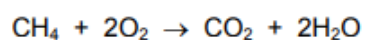


Which statement is correct?

- A** Energy is released when X_2 and Y_2 bonds are broken.
B Energy is needed to form XY bonds.
C The energy change, ΔH , for the reaction is negative.
D The reaction is endothermic.

m18-p22-q12

Methane burns in oxygen to form carbon dioxide and water.

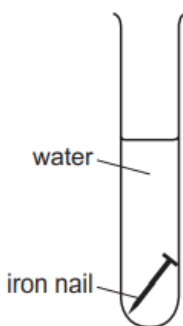
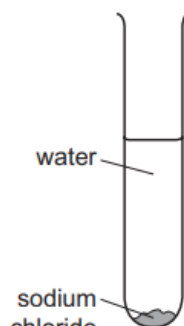
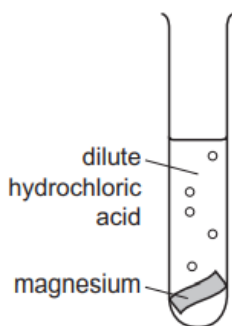
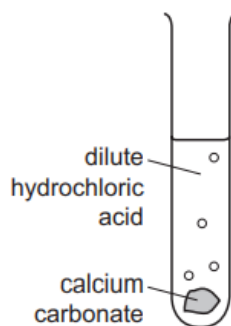


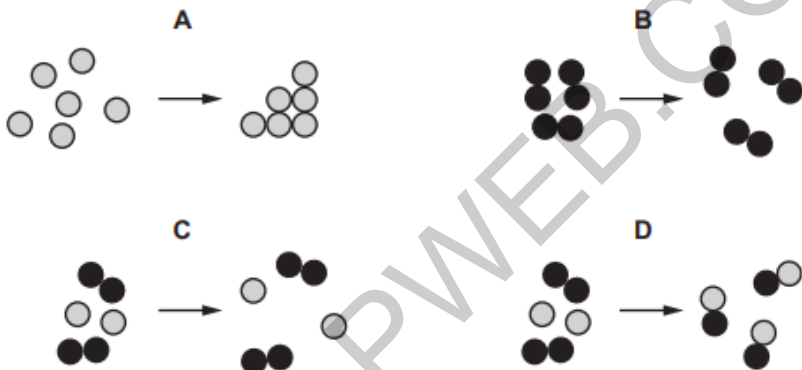
The bond energies are shown in the table.

bond	bond energy in kJ/mol
C–H	+410
C=O	+805
O–H	+460
O=O	+496

What is the energy change for the reaction?

- A** –818 kJ/mol
- B** –323 kJ/mol
- C** +323 kJ/mol
- D** +818 kJ/mol

Topic	6. Chemical Reactions 6.1 Physical and chemical changes															
Content	1. Identify physical and chemical changes, and describe the differences between them															
s21-p23-q14 s21-p22-q14 s21-p21-q14	<p>When sulfur is heated it undergoes a1..... change as it melts.</p> <p>Further heating causes the sulfur to undergo a2..... change and form sulfur dioxide.</p> <p>Which words complete gaps 1 and 2?</p> <table><tr><th></th><th>1</th><th>2</th></tr><tr><td>A</td><td>chemical</td><td>chemical</td></tr><tr><td>B</td><td>chemical</td><td>physical</td></tr><tr><td>C</td><td>physical</td><td>chemical</td></tr><tr><td>D</td><td>physical</td><td>physical</td></tr></table>		1	2	A	chemical	chemical	B	chemical	physical	C	physical	chemical	D	physical	physical
	1	2														
A	chemical	chemical														
B	chemical	physical														
C	physical	chemical														
D	physical	physical														
w20-p23-q14 w20-p21-q16	<p>Which substance does not require oxygen in order to produce energy?</p> <p>A coal</p> <p>B hydrogen</p> <p>C natural gas</p> <p>D ^{235}U</p>															
s20-p23-q14	<p>In which tube is a physical change taking place?</p> <div><div><p>A</p><p>water</p><p>iron nail</p></div><div><p>B</p><p>water</p><p>sodium chloride</p></div><div><p>C</p><p>dilute hydrochloric acid</p><p>magnesium</p></div><div><p>D</p><p>dilute hydrochloric acid</p><p>calcium carbonate</p></div></div>															

s20-p22-q14	<p>Which list contains only chemical changes?</p> <p>A melting, evaporating, dissolving</p> <p>B rusting, freezing, subliming</p> <p>C neutralisation, polymerisation, combustion</p> <p>D boiling, condensing, distillation</p>															
s20-p21-q14	<p>Which diagram represents a chemical change?</p> 															
m20-p22-q14	<p>Which change is a physical change?</p> <p>A Copper(II) carbonate changes colour from green to black when it is heated, and stays black when it cools.</p> <p>B Ethanol reacts with oxygen to form carbon dioxide and water.</p> <p>C Hydrogen peroxide decomposes into water and oxygen when it is boiled.</p> <p>D Ice forms liquid water when it is heated.</p>															
w19-p23-q15	<p>A sequence of changes involving sulfur is shown.</p> $\text{S(s)} \xrightarrow{\text{change 1}} \text{S(l)} \xrightarrow{\text{change 2}} \text{SO}_2\text{(g)}$ <p>Which row describes the changes?</p> <table><tr><th></th><th>change 1</th><th>change 2</th></tr><tr><td>A</td><td>chemical</td><td>chemical</td></tr><tr><td>B</td><td>chemical</td><td>physical</td></tr><tr><td>C</td><td>physical</td><td>chemical</td></tr><tr><td>D</td><td>physical</td><td>physical</td></tr></table>		change 1	change 2	A	chemical	chemical	B	chemical	physical	C	physical	chemical	D	physical	physical
	change 1	change 2														
A	chemical	chemical														
B	chemical	physical														
C	physical	chemical														
D	physical	physical														

w19-p22-q15

Which row identifies a chemical and a physical change?

	chemical change	physical change
A	boiling ethanol	burning ethanol
B	burning ethanol	evaporating ethanol
C	dissolving ethanol in water	burning ethanol
D	evaporating ethanol	dissolving ethanol in water

w19-p21-q15

Which is a chemical change?

- A** boiling water
- B** cooking an egg
- C** dissolving sugar
- D** melting ice cubes

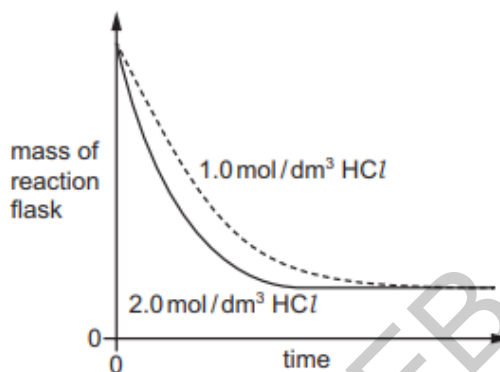
Topic	<u>6. Chemical Reactions</u> 6.2 Rate of reaction															
Content	<ol style="list-style-type: none">Describe the effect on the rate of reaction of:<ol style="list-style-type: none">changing the concentration of solutionschanging the pressure of gaseschanging the surface area of solidschanging the temperatureadding or removing a catalyst, including enzymesState that a catalyst increases the rate of a reaction and is unchanged at the end of a reactionDescribe practical methods for investigating the rate of a reaction including change in mass of a reactant or a product and the formation of a gasInterpret data, including graphs, from rate of reaction experimentsDescribe collision theory in terms of: (a) number of particles per unit volume (b) frequency of collisions between particles (c) kinetic energy of particles (d) activation energy, E_aDescribe and explain the effect on the rate of reaction of:<ol style="list-style-type: none">changing the concentration of solutionschanging the pressure of gaseschanging the surface area of solidschanging the temperatureadding or removing a catalyst, including enzymes using collision theoryState that a catalyst decreases the activation energy, E_a, of a reactionEvaluate practical methods for investigating the rate of a reaction including change in mass of a reactant or a product and the formation of a gas															
m22-p22-q19	<p>How does increasing the concentration affect the reacting particles in a chemical reaction?</p> <table><tr><th></th><th>increases the collision rate</th><th>increases the proportion of particles with the activation energy</th></tr><tr><td>A</td><td>✓</td><td>✗</td></tr><tr><td>B</td><td>✓</td><td>✓</td></tr><tr><td>C</td><td>✗</td><td>✗</td></tr><tr><td>D</td><td>✗</td><td>✓</td></tr></table>		increases the collision rate	increases the proportion of particles with the activation energy	A	✓	✗	B	✓	✓	C	✗	✗	D	✗	✓
	increases the collision rate	increases the proportion of particles with the activation energy														
A	✓	✗														
B	✓	✓														
C	✗	✗														
D	✗	✓														

w21-p23-q17

Excess dilute hydrochloric acid is added to equal masses of powdered calcium carbonate in two separate experiments.

Two different concentrations of hydrochloric acid are used. The temperature in both experiments is the same.

The results show the change in mass of the reaction flask measured over time.



Why is the rate of reaction for the 1.0 mol/dm³ hydrochloric acid slower?

	collision energy	collision rate
A	lower	higher
B	lower	lower
C	same as for 2.0 mol/dm ³	higher
D	same as for 2.0 mol/dm ³	lower

w21-p21-q13

Which statements about the effect of increasing the temperature on the rate of a reaction are correct?

- 1 It increases the rate of a reaction.
- 2 It increases the activation energy.
- 3 It increases the frequency of collisions.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

s21-p23-q15
s21-p22-q15
s21-p21-q15

Four statements about the effect of increasing temperature on a reaction are shown.

- 1 The activation energy becomes lower.
- 2 The particles move faster.
- 3 There are more collisions between reacting particles per second.
- 4 There are more collisions which have energy greater than the activation energy.

Which statements are correct?

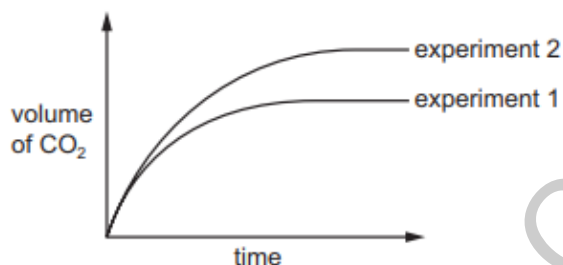
A 1, 2 and 3 **B** 1, 3 and 4 **C** 2, 3 and 4 **D** 2 and 3 only

s21-p22-q13

An excess of calcium carbonate reacts with dilute hydrochloric acid. The volume of carbon dioxide produced is measured at regular time intervals. The results are shown as experiment 1.

The experiment is repeated with only **one** change to the reaction conditions.

The results are shown as experiment 2.

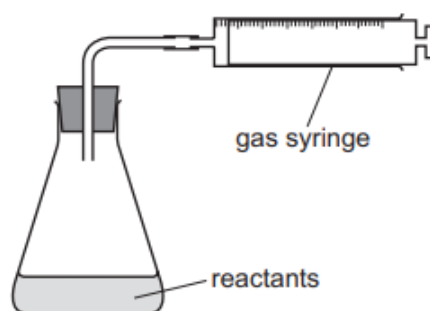


Which change is made in experiment 2?

- A The concentration of the acid is increased.
- B The volume of acid is increased.
- C The mass of calcium carbonate is increased.
- D The calcium carbonate is powdered.

m21-p22-q16

The apparatus shown is used to measure the rate of a reaction.



Which equation represents a reaction where the rate can be measured using this apparatus?

- A $\text{Mg(s)} + 2\text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(g)}$
- B $\text{HCl(aq)} + \text{NaOH(aq)} \rightarrow \text{NaCl(aq)} + \text{H}_2\text{O(l)}$
- C $\text{Fe(s)} + \text{CuSO}_4\text{(aq)} \rightarrow \text{Cu(s)} + \text{FeSO}_4\text{(aq)}$
- D $2\text{Na(s)} + \text{Br}_2\text{(l)} \rightarrow 2\text{NaBr(s)}$

w20-p23-q19

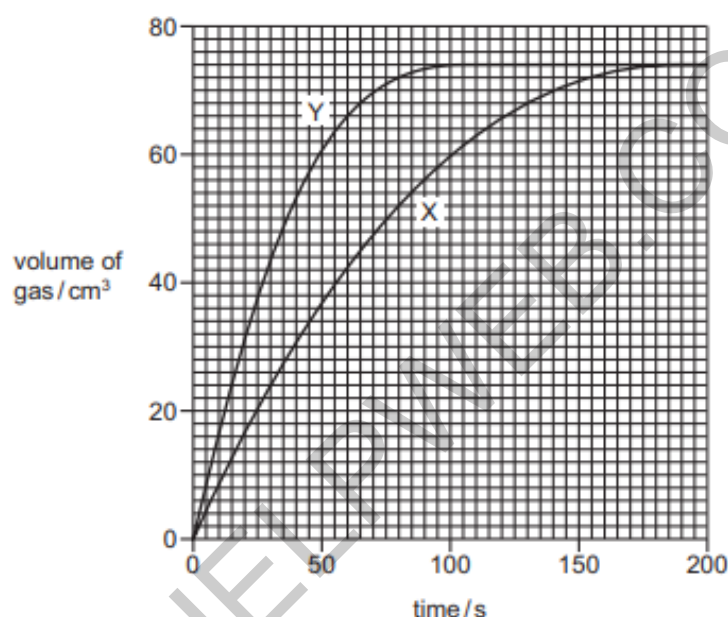
An excess of calcium carbonate is added to dilute hydrochloric acid, X.

The carbon dioxide gas given off is collected and its volume recorded at regular time intervals.

Line X on the graph shows the results obtained.

The experiment is repeated using dilute hydrochloric acid, Y.

Line Y on the graph shows the results obtained.

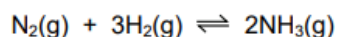


Which statement about the two hydrochloric acid samples, X and Y, is correct?

- A** They had the same volume but Y had higher concentration.
- B** They had the same concentration but Y had a larger volume.
- C** X had a higher concentration but Y had a larger volume.
- D** Y had a higher concentration but X had a larger volume.

w20-p23-q32

Ammonia is manufactured in an exothermic reaction.



What is the effect of lowering the pressure on the rate of formation of ammonia and percentage yield of ammonia at equilibrium?

	rate of formation	percentage yield
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

w20-p22-q17	<p>Nitrogen, N_2, and hydrogen, H_2, can be converted into ammonia, NH_3, using a catalyst.</p> <p>What is the purpose of the catalyst?</p> <p>A to increase the amount of ammonia produced</p> <p>B to increase the rate of reaction</p> <p>C to reduce the amount of reactants needed</p> <p>D to reduce the rate of reaction</p>
w20-p21-q18	<p>A sign displayed in a flour mill is shown.</p> <div> </div> <p>Which statement explains why there is a danger of explosion in a flour mill?</p> <p>A Flour burns very quickly because it is a fine powder.</p> <p>B Flour is a catalyst for combustion.</p> <p>C Flour mills get hot and speed up the rate of combustion.</p> <p>D The combustion of flour is exothermic.</p>
w20-p21-q19	<p>A student investigates the effect of concentration on the rate of reaction between calcium carbonate and hydrochloric acid. He follows the method shown.</p> <ul style="list-style-type: none"> Place 1 g of calcium carbonate in a conical flask. Add excess hydrochloric acid. Let the reaction continue until no more gas is made. Repeat the experiment with different concentrations of hydrochloric acid. <p>Which essential step has been left out of the method if he is to work out the rate of the reaction?</p> <p>A heating the reaction mixture</p> <p>B placing a bung in the flask</p> <p>C timing the reaction</p> <p>D using a catalyst</p>

s20-p23-q15

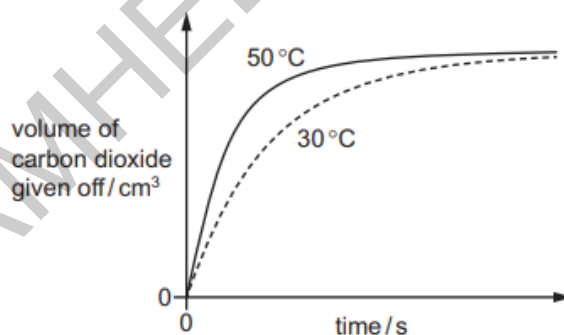
A chemical reaction occurs when the reacting particles collide.

Which reaction conditions would produce the greatest rate of particle collisions?

	concentration of acid	reaction temperature
A	decrease	decrease
B	no change	increase
C	increase	increase
D	increase	no change

s20-p22-q15

The results of adding excess marble chips (calcium carbonate) to hydrochloric acid at 50 °C and at 30 °C are shown. Only the temperature is changed.



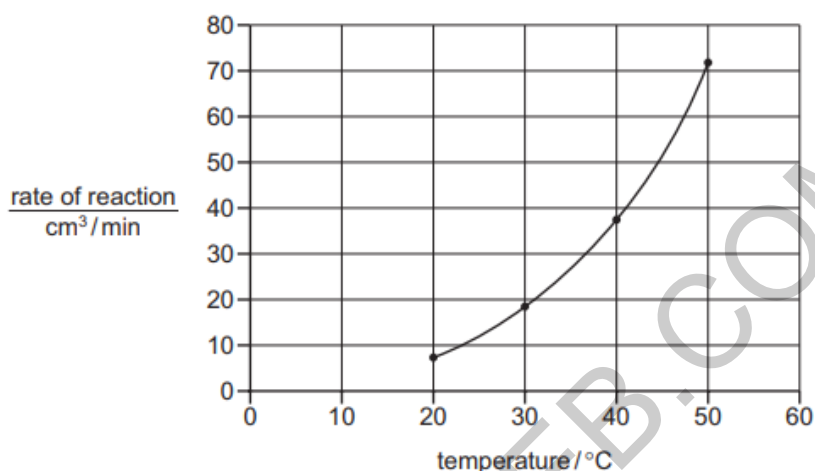
Which row describes the reacting particles at 30 °C compared to those at 50 °C?

	collision rate	collision energy
A	higher	higher
B	higher	lower
C	lower	higher
D	lower	lower

s20-p21-q15

The rate of reaction between calcium carbonate chips and hydrochloric acid is studied by collecting the volume of gas released in one minute at different temperatures.

A graph of rate of reaction against temperature is shown.



Which statement fully explains why increasing the temperature has this effect on the rate?

- A** The kinetic energy of the particles increases so the collisions are harder.
- B** The number of collisions between particles increases.
- C** The activation energy needed for the particles to react is reduced.
- D** There are more frequent collisions between particles with enough energy to react.

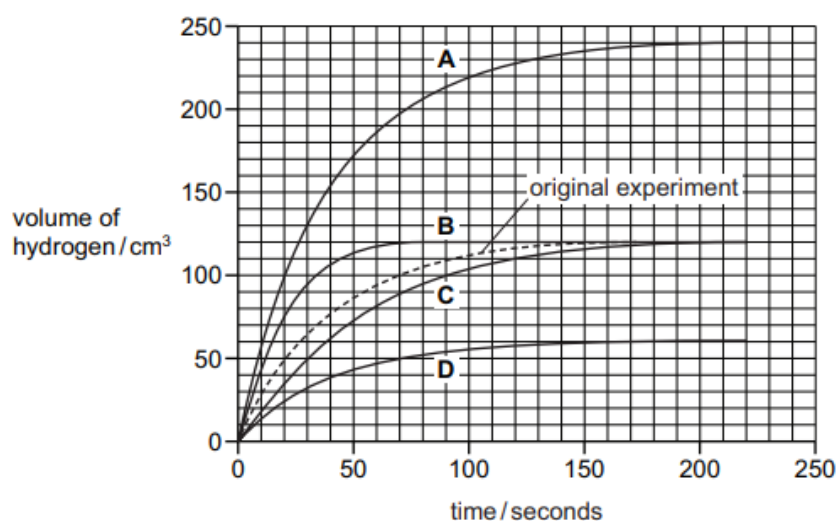
m20-p22-q15

A student adds excess magnesium ribbon to 10 cm³ of 0.5 mol / dm³ sulfuric acid.

The hydrogen gas is collected and its volume measured every 10 seconds.

The experiment is repeated using the same mass of magnesium ribbon with 5 cm³ of 0.5 mol / dm³ sulfuric acid added to 5 cm³ of water.

Which graph shows the results of the second experiment?



w19-p23-q16

Magnesium reacts with dilute hydrochloric acid.

Which statement about the particles in the reaction is correct?

A Increasing the concentration of dilute hydrochloric acid increases the collision rate but has no effect on the activation energy.

B Increasing the concentration of dilute hydrochloric acid increases the collision rate and the activation energy.

C Increasing the temperature of the reaction increases the activation energy.

D Increasing the temperature of the reaction causes all collisions to lead to a reaction.

w19-p22-q16

A sample of dilute nitric acid is added to lumps of limestone in a conical flask. The conical flask is placed on a balance and the loss in mass is measured.

A second sample of nitric acid of a different concentration is separately tested. All other conditions are kept the same.

The loss in mass in 1 minute at each concentration of nitric acid is shown.

concentration in mol/dm ³	loss in mass in 1 minute / g
0.5	0.15
1.0	0.25

Which row describes and explains the results obtained using 1.0 mol/dm³ nitric acid compared with 0.5 mol/dm³ nitric acid?

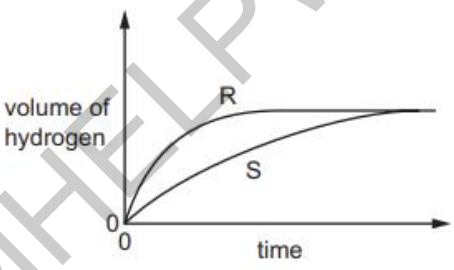
	description	explanation
A	decrease in reaction rate	decrease in particle collision energy
B	decrease in reaction rate	increase in particle collision rate
C	increase in reaction rate	increase in particle collision rate
D	increase in reaction rate	increase in particle collision rate and collision energy

w19-p21-q16

The rate of reaction between magnesium and dilute hydrochloric acid is increased by increasing the concentration of the acid.

How does this affect the reacting particles?

	collision rate of particles	proportion of particles with sufficient energy to react
A	increases	increases
B	increases	stays the same
C	stays the same	increases
D	stays the same	stays the same

s19-p23-q13	<p>Which change in reaction conditions increases both the collision rate and the proportion of molecules with sufficient energy to react?</p> <p>A addition of a catalyst</p> <p>B increasing the concentration of a reactant</p> <p>C increasing the surface area of a reactant</p> <p>D increasing the temperature of the reaction</p>
s19-p23-q19	<p>Solutions of acid R and acid S have the same concentration.</p> <p>The same volume of each acid at the same temperature is reacted with the same mass of magnesium ribbon.</p> <p>The volume of hydrogen produced is measured.</p> <p>The results are shown.</p>  <p>Which statement about the reactions is correct?</p> <p>A Acid S reacts faster than acid R.</p> <p>B The final volume of hydrogen produced in each reaction is different.</p> <p>C Acid R is a stronger acid than acid S.</p> <p>D Acid S is a stronger acid than acid R.</p>
s19-p22-q13 s19-p21-q13	<p>Which change in reaction conditions increases both the collision rate and the proportion of molecules with sufficient energy to react?</p> <p>A addition of a catalyst</p> <p>B increasing the concentration of a reactant</p> <p>C increasing the surface area of a reactant</p> <p>D increasing the temperature of the reaction</p>

m19-p22-q15

A student adds dilute hydrochloric acid at two different temperatures to two different lumps of limestone. The lumps of limestone have the same mass.

The carbon dioxide gas produced is collected in a gas syringe.

The volume of carbon dioxide collected in 1 minute at each temperature is shown.

temperature / °C	volume of carbon dioxide produced in 1 minute / cm ³
25	10
50	40

Which row describes and explains the results obtained at 50 °C compared with 25 °C?

	reaction rate	energy of collisions
A	higher	lower
B	higher	higher
C	lower	lower
D	lower	higher

w18-p23-q14

Dilute hydrochloric acid reacts with 1 g of limestone.

Which conditions produce the fastest rate of reaction?

- A** 2 mol/dm³ hydrochloric acid and a single lump of limestone
- B** 4 mol/dm³ hydrochloric acid and a single lump of limestone
- C** 4 mol/dm³ hydrochloric acid and small pieces of limestone
- D** 4 mol/dm³ hydrochloric acid and powdered limestone

w18-p22-q14

The rate of reaction between magnesium ribbon and 2 mol/dm³ hydrochloric acid at 25 °C to produce hydrogen gas is measured.

In another experiment, either the concentration of the hydrochloric acid or the temperature is changed. All other conditions are kept the same.

Which conditions increase the rate of reaction?

- A** 1 mol/dm³ hydrochloric acid at 25 °C
- B** 2 mol/dm³ hydrochloric acid at 10 °C
- C** 2 mol/dm³ hydrochloric acid at 20 °C
- D** 3 mol/dm³ hydrochloric acid at 25 °C

w18-p21-q14	<p>The effects of a change in conditions on a chemical reaction are listed.</p> <ol style="list-style-type: none">1 The total number of collisions per minute increased.2 The number of effective collisions per minute increased.3 The average energy of the particles increased. <p>Which change in conditions caused all of these effects?</p> <p>A addition of a catalyst</p> <p>B increasing the concentration of a solution of a reactant</p> <p>C increasing the surface area of a solid reactant</p> <p>D increasing the temperature</p>															
s18-p23-q14 s18-p22-q14 s18-p21-q14	<p>Which row describes the effects of increasing both concentration and temperature on the collisions between reacting particles?</p> <table><tr><td></td><td>increasing concentration</td><td>increasing temperature</td></tr><tr><td>A</td><td>more collisions per second only</td><td>more collisions per second only</td></tr><tr><td>B</td><td>more collisions per second and more collisions with sufficient energy to react</td><td>more collisions per second only</td></tr><tr><td>C</td><td>more collisions per second only</td><td>more collisions per second and more collisions with sufficient energy to react</td></tr><tr><td>D</td><td>more collisions per second and more collisions with sufficient energy to react</td><td>more collisions per second and more collisions with sufficient energy to react</td></tr></table>		increasing concentration	increasing temperature	A	more collisions per second only	more collisions per second only	B	more collisions per second and more collisions with sufficient energy to react	more collisions per second only	C	more collisions per second only	more collisions per second and more collisions with sufficient energy to react	D	more collisions per second and more collisions with sufficient energy to react	more collisions per second and more collisions with sufficient energy to react
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A	more collisions per second only	more collisions per second only														
B	more collisions per second and more collisions with sufficient energy to react	more collisions per second only														
C	more collisions per second only	more collisions per second and more collisions with sufficient energy to react														
D	more collisions per second and more collisions with sufficient energy to react	more collisions per second and more collisions with sufficient energy to react														
m18-p22-q15	<p>In which reaction is the rate of reaction not affected by light?</p> <p>A the conversion of carbon dioxide and water to glucose and oxygen in green plants</p> <p>B the reaction of bromine with ethene</p> <p>C the reaction of chlorine with methane</p> <p>D the reduction of silver ions to silver</p>															
m18-p22-q16	<p>Calcium carbonate reacts with dilute hydrochloric acid to form bubbles of carbon dioxide.</p> <p>At a higher temperature, the same reaction is faster.</p> <p>Which row explains this observation?</p> <table><tr><td></td><td>collision rate</td><td>number of molecules with sufficient energy to react</td></tr><tr><td>A</td><td>increases</td><td>more</td></tr><tr><td>B</td><td>increases</td><td>the same</td></tr><tr><td>C</td><td>stays the same</td><td>more</td></tr><tr><td>D</td><td>stays the same</td><td>the same</td></tr></table>		collision rate	number of molecules with sufficient energy to react	A	increases	more	B	increases	the same	C	stays the same	more	D	stays the same	the same
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Topic	6. Chemical Reactions																									
	6.3 Reversible reaction and equilibrium																									
Content	<div><div><div>1. State that some chemical reactions are reversible as shown by the symbol \rightleftharpoons</div><div>2. Describe how changing the conditions can change the direction of a reversible reaction for:<div>(a) the effect of heat on hydrated compounds</div><div>(b) the addition of water to anhydrous compounds limited to copper(II) sulfate and cobalt(II) chloride</div></div><div>3. State that a reversible reaction in a closed system is at equilibrium when:<div>(a) the rate of the forward reaction is equal to the rate of the reverse reaction</div><div>(b) the concentrations of reactants and products are no longer changing</div></div><div>4. Predict and explain, for a reversible reaction, how the position of equilibrium is affected by:<div>(a) changing temperature</div><div>(b) changing pressure</div><div>(c) changing concentration</div><div>(d) using a catalyst using information provided</div></div><div>5. State the symbol equation for the production of ammonia in the Haber process, $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$</div><div>6. State the sources of the hydrogen (methane) and nitrogen (air) in the Haber process</div><div>7. State the typical conditions in the Haber process as 450°C, 20000kPa / 200atm and an iron catalyst</div><div>8. State the symbol equation for the conversion of sulfur dioxide to sulfur trioxide in the Contact process, $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$</div><div>9. State the sources of the sulfur dioxide (burning sulfur or roasting sulfide ores) and oxygen (air) in the Contact process</div><div>10. State the typical conditions for the conversion of sulfur dioxide to sulfur trioxide in the Contact process as 450°C, 200kPa / 2atm and a vanadium(V) oxide catalyst</div><div>11. Explain, in terms of rate of reaction and position of equilibrium, why the typical conditions stated are used in the Haber process and in the Contact process, including safety considerations and economics</div></div></div>																									
m22-p22-q18	<div><div>The reaction used to manufacture ammonia from nitrogen and hydrogen is reversible.</div><div>An equilibrium is established between ammonia, nitrogen and hydrogen.</div><div>Which statement describes the equilibrium?</div><div><div>A Both the forward reaction and the backward reaction have the same rate.</div><div>B The rate of the backward reaction is greater than the rate of the forward reaction.</div><div>C The rate of the forward reaction is greater than the rate of the backward reaction.</div><div>D The forward and backward reactions have both stopped.</div></div></div>																									
m22-p22-q29	<div><div>Ammonia is produced using the Haber process.</div><div>Which row shows the source of the raw materials and the reaction conditions?</div><table><tr><td></td><td>source of nitrogen</td><td>source of hydrogen</td><td>temperature /$^\circ\text{C}$</td><td>pressure /atm</td></tr><tr><td>A</td><td>air</td><td>hydrocarbons</td><td>200</td><td>200</td></tr><tr><td>B</td><td>hydrocarbons</td><td>air</td><td>450</td><td>2</td></tr><tr><td>C</td><td>air</td><td>hydrocarbons</td><td>450</td><td>200</td></tr><tr><td>D</td><td>air</td><td>hydrocarbons</td><td>450</td><td>2</td></tr></table></div>		source of nitrogen	source of hydrogen	temperature / $^\circ\text{C}$	pressure /atm	A	air	hydrocarbons	200	200	B	hydrocarbons	air	450	2	C	air	hydrocarbons	450	200	D	air	hydrocarbons	450	2
	source of nitrogen	source of hydrogen	temperature / $^\circ\text{C}$	pressure /atm																						
A	air	hydrocarbons	200	200																						
B	hydrocarbons	air	450	2																						
C	air	hydrocarbons	450	200																						
D	air	hydrocarbons	450	2																						

m22-p22-q30	<p>How many species are acting as bases in this reversible reaction?</p> $\text{HNO}_3 + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{NO}_3^-$ <p>A 3 B 2 C 1 D 0</p>
m22-p22-q31	<p>The equation for a reaction occurring in the Contact process is shown.</p> $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$ <p>What is the catalyst used in this reaction?</p> <p>A iron B phosphoric(V) acid C sulfuric acid D vanadium(V) oxide</p>
w21-p23-q15	<p>Sulfuric acid is manufactured using the Contact process. One of the reactions is shown.</p> $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$ <p>The forward reaction is exothermic.</p> <p>statement 1 The equation has more molecules on the left-hand side than on the right-hand side. statement 2 Using a higher pressure shifts the equilibrium to the left. statement 3 Higher temperatures increase the rate of reaction. statement 4 Increasing the temperature shifts the equilibrium to the right.</p> <p>Which alternative is correct?</p> <p>A Statement 1 is correct and explains statement 2. B Statement 1 and statement 3 are correct. C Statement 2 and statement 4 are correct. D Statement 3 is correct and explains statement 4.</p>
w21-p23-q30	<p>Which process is used to produce hydrogen for the Haber process?</p> <p>A electrolysis of water B reacting aluminium with sodium hydroxide C reacting iron with sulfuric acid D reacting methane with steam</p>

w21-p23-q31	<p>One of the steps in manufacturing sulfuric acid in the Contact process is shown.</p> $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$ <p>Which catalyst is used to increase the rate of this reaction?</p> <p>A aluminium oxide</p> <p>B iron</p> <p>C phosphoric acid</p> <p>D vanadium(V) oxide</p>															
w21-p22-q20	<p>The equation shown represents a reaction at equilibrium.</p> <p>m and n represent the balancing numbers for the reactant and product respectively.</p> $m\text{P}(\text{g}) \rightleftharpoons n\text{Q}(\text{g})$ <p>A high temperature increases the concentration of Q.</p> <p>A high pressure increases the concentration of Q.</p> <p>Which statement about the reaction is correct?</p> <p>A The forward reaction is exothermic and m is greater than n.</p> <p>B The forward reaction is exothermic and m is less than n.</p> <p>C The forward reaction is endothermic and m is greater than n.</p> <p>D The forward reaction is endothermic and m is less than n.</p>															
w21-p22-q29	<p>Which conditions are used in the Haber process?</p> <table><tr><td></td><td>temperature / °C</td><td>pressure / atmospheres</td></tr><tr><td>A</td><td>100</td><td>10</td></tr><tr><td>B</td><td>450</td><td>10</td></tr><tr><td>C</td><td>450</td><td>200</td></tr><tr><td>D</td><td>1000</td><td>500</td></tr></table>		temperature / °C	pressure / atmospheres	A	100	10	B	450	10	C	450	200	D	1000	500
	temperature / °C	pressure / atmospheres														
A	100	10														
B	450	10														
C	450	200														
D	1000	500														
w21-p22-q31	<p>Which reaction involving sulfur dioxide is correct?</p> <p>A It is produced during the extraction of zinc from zinc blende.</p> <p>B It reacts with concentrated sulfuric acid to form oleum.</p> <p>C It reacts with sulfur to form sulfur trioxide.</p> <p>D It turns an acidified solution of potassium manganate(VII) purple.</p>															

w21-p21-q14	<p>Ammonia is made by reacting nitrogen with hydrogen.</p> <p>The equation for the reaction is shown.</p> $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$ <p>The forward reaction is exothermic.</p> <p>Which changes in temperature and pressure decrease the yield of ammonia?</p> <table><tr><td></td><td>temperature</td><td>pressure</td></tr><tr><td>A</td><td>decrease</td><td>decrease</td></tr><tr><td>B</td><td>decrease</td><td>increase</td></tr><tr><td>C</td><td>increase</td><td>decrease</td></tr><tr><td>D</td><td>increase</td><td>increase</td></tr></table>		temperature	pressure	A	decrease	decrease	B	decrease	increase	C	increase	decrease	D	increase	increase
	temperature	pressure														
A	decrease	decrease														
B	decrease	increase														
C	increase	decrease														
D	increase	increase														
w21-p21-q30	<p>Which statements about the Haber process are correct?</p> <ol style="list-style-type: none">One of the raw materials is extracted from liquid air by fractional distillation.One of the raw materials is produced by the reaction of steam and methane.The catalyst for the Haber process is vanadium(V) oxide. <p>A 1 only B 1 and 2 only C 2 and 3 only D 1, 2 and 3</p>															
w21-p21-q31	<p>Which raw material is used in the Contact process?</p> <p>A air B ammonia C carbon D nitrogen</p>															
s21-p23-q28	<p>Ammonia is made from nitrogen and hydrogen. The equation for the reaction is shown.</p> $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$ <p>The forward reaction is exothermic.</p> <p>Which conditions give the greatest equilibrium yield of ammonia?</p> <table><tr><td></td><td>temperature / °C</td><td>pressure / atm</td></tr><tr><td>A</td><td>200</td><td>15</td></tr><tr><td>B</td><td>200</td><td>150</td></tr><tr><td>C</td><td>500</td><td>15</td></tr><tr><td>D</td><td>500</td><td>150</td></tr></table>		temperature / °C	pressure / atm	A	200	15	B	200	150	C	500	15	D	500	150
	temperature / °C	pressure / atm														
A	200	15														
B	200	150														
C	500	15														
D	500	150														

s21-P23-q30	<p>Which substance is used as a catalyst in the manufacture of sulfuric acid by the Contact process?</p> <p>A iron</p> <p>B nickel</p> <p>C phosphoric acid</p> <p>D vanadium(V) oxide</p>																				
s21-P22-q17	<p>When bismuth(III) chloride, BiCl_3, reacts with water, a white precipitate of bismuth(III) oxychloride, BiOCl, is formed. The equation for the reaction is shown.</p> $\text{BiCl}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{BiOCl}(\text{s}) + 2\text{H}^+(\text{aq}) + 2\text{Cl}^-(\text{aq})$ <p>The reaction is in equilibrium.</p> <p>Which changes cause the white precipitate to dissolve?</p> <p>1 adding acid</p> <p>2 adding water</p> <p>3 adding sodium chloride solution</p> <p>A 1 and 2 only B 1 and 3 only C 2 and 3 only D 1, 2 and 3</p>																				
s21-P22-q30	<p>Which natural resource cannot provide a raw material for the manufacture of ammonia?</p> <p>A air</p> <p>B limestone</p> <p>C petroleum</p> <p>D water</p>																				
s21-P22-q31	<p>Ammonia is made in the Haber process.</p> <p>Which conditions are used in the Haber process?</p> <table><tr><th></th><th>temperature / °C</th><th>pressure / atmospheres</th><th>catalyst used</th></tr><tr><td>A</td><td>450</td><td>200</td><td>iron</td></tr><tr><td>B</td><td>450</td><td>5</td><td>vanadium(V) oxide</td></tr><tr><td>C</td><td>200</td><td>450</td><td>iron</td></tr><tr><td>D</td><td>200</td><td>5</td><td>vanadium(V) oxide</td></tr></table>		temperature / °C	pressure / atmospheres	catalyst used	A	450	200	iron	B	450	5	vanadium(V) oxide	C	200	450	iron	D	200	5	vanadium(V) oxide
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B	450	5	vanadium(V) oxide																		
C	200	450	iron																		
D	200	5	vanadium(V) oxide																		

s21-p21-q17	<p>Which statement about a reaction in equilibrium is correct?</p> <p>A Both the forward and the backward reactions are proceeding at the same rate.</p> <p>B Neither the forward nor the backward reaction is proceeding.</p> <p>C The amount of product present is no longer affected by changes in temperature or pressure.</p> <p>D The amount of product present is only affected by a change in pressure.</p>
s21-p21-q29	<p>Ammonia is made by reacting nitrogen with hydrogen in the Haber process.</p> <p>The equation for the process is shown.</p> $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ <p>Which changes in reaction conditions would produce a greater yield of ammonia?</p> <p>1 adding more iron catalyst</p> <p>2 increasing the reaction pressure</p> <p>3 increasing the particle size of the iron catalyst</p> <p>A 1 only B 2 only C 1 and 2 D 2 and 3</p>
s21-p21-q31	<p>Which catalyst is used in the Contact process?</p> <p>A calcium oxide</p> <p>B iron</p> <p>C manganese(II) oxide</p> <p>D vanadium(V) oxide</p>
m21-p22-q32	<p>Which substance is used as a bleach in the manufacture of paper?</p> <p>A carbon dioxide</p> <p>B nitrogen dioxide</p> <p>C silicon dioxide</p> <p>D sulfur dioxide</p>
w20-p23-q31	<p>What is the catalyst in the Haber process?</p> <p>A Fe B Ni C Pt D V₂O₅</p>

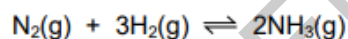
w20-p23-q34

Which row shows the conditions used for the manufacture of sulfuric acid in the Contact process?

	pressure / atm	temperature / °C	catalyst
A	250	200	vanadium(V) oxide
B	2	450	vanadium(V) oxide
C	250	200	iron
D	2	450	iron

w20-p22-q18

Ammonia is produced by the Haber process. The equation is shown.



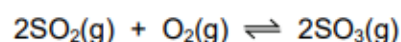
The forward reaction is exothermic.

Which statement is correct?

- A** Increasing pressure decreases the yield of ammonia, but speeds up the reaction.
- B** Increasing temperature decreases the yield of ammonia, but speeds up the reaction.
- C** Increasing the concentration of hydrogen and nitrogen results in a lower yield of ammonia.
- D** Increasing the temperature increases the yield of ammonia and speeds up the reaction.

w21-p21-q20

The reaction between sulfur dioxide and oxygen is shown.



The reaction is exothermic.

Which of the changes shifts the position of equilibrium to the right?

- 1 Increase the concentration of oxygen.
- 2 Increase the pressure.
- 3 Increase the temperature.

- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 only

w21-p21-q31	<p>Ammonia is manufactured using the Haber process.</p> <p>Which statement about this process is correct?</p> <p>A The catalyst used for this reaction is vanadium pentoxide.</p> <p>B The hydrogen used is extracted from air.</p> <p>C Using a high pressure increases the yield of ammonia.</p> <p>D Using a high temperature increases the yield of ammonia.</p>															
w21-p21-q33	<p>Which row describes two uses of sulfur dioxide?</p> <table><tr><th></th><th>use 1</th><th>use 2</th></tr><tr><td>A</td><td>bleaching paper pulp</td><td>neutralising acidic industrial waste</td></tr><tr><td>B</td><td>bleaching paper pulp</td><td>preserving food and drink</td></tr><tr><td>C</td><td>extracting iron from hematite</td><td>neutralising acidic industrial waste</td></tr><tr><td>D</td><td>extracting iron from hematite</td><td>preserving food and drink</td></tr></table>		use 1	use 2	A	bleaching paper pulp	neutralising acidic industrial waste	B	bleaching paper pulp	preserving food and drink	C	extracting iron from hematite	neutralising acidic industrial waste	D	extracting iron from hematite	preserving food and drink
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D	extracting iron from hematite	preserving food and drink														
s20-p23-q16	<p>At room temperature, the conversion of nitrogen dioxide, NO_2, into dinitrogen tetroxide, N_2O_4, is reversible.</p> $2\text{NO}_2(\text{g}) \rightleftharpoons \text{N}_2\text{O}_4(\text{g})$ <p style="text-align: center;">brown gas colourless gas</p> <p>The forward reaction is exothermic.</p> <p>Which changes cause the equilibrium to shift to the left?</p> <table><tr><th></th><th>pressure</th><th>temperature</th></tr><tr><td>A</td><td>decrease</td><td>decrease</td></tr><tr><td>B</td><td>decrease</td><td>increase</td></tr><tr><td>C</td><td>increase</td><td>decrease</td></tr><tr><td>D</td><td>increase</td><td>increase</td></tr></table>		pressure	temperature	A	decrease	decrease	B	decrease	increase	C	increase	decrease	D	increase	increase
	pressure	temperature														
A	decrease	decrease														
B	decrease	increase														
C	increase	decrease														
D	increase	increase														

s20-p23-q29	<p>Which substances can be used to detect the presence of water?</p> <ol style="list-style-type: none"> 1 cobalt(II) chloride 2 copper(II) sulfate 3 litmus 4 methyl orange <p>A 1 and 2 B 1 and 3 C 2 and 4 D 3 and 4</p>
s20-p23-q31	<p>Hydrogen and nitrogen react to form ammonia in the Haber process.</p> $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ <p>The forward reaction is exothermic.</p> <p>Which statements about the process are correct?</p> <ol style="list-style-type: none"> 1 Nitrogen is obtained from the air. 2 Increasing the temperature of the reaction increases the yield of ammonia. 3 Increasing the reaction pressure increases the yield of ammonia. 4 Vanadium(V) oxide is used as a catalyst. <p>A 1 and 2 B 1 and 3 C 2 and 3 D 3 and 4</p>
s20-p23-q34	<p>Which reaction in the Contact process is catalysed by vanadium(V) oxide?</p> <p>A $\text{S(s)} + \text{O}_2\text{(g)} \rightarrow \text{SO}_2\text{(g)}$</p> <p>B $2\text{SO}_2\text{(g)} + \text{O}_2\text{(g)} \rightarrow 2\text{SO}_3\text{(g)}$</p> <p>C $\text{SO}_3\text{(g)} + \text{H}_2\text{SO}_4\text{(l)} \rightarrow \text{H}_2\text{S}_2\text{O}_7\text{(l)}$</p> <p>D $\text{H}_2\text{S}_2\text{O}_7\text{(l)} + \text{H}_2\text{O(l)} \rightarrow 2\text{H}_2\text{SO}_4\text{(l)}$</p>

s20-p22-q16

Methane reacts with steam and an equilibrium is reached.



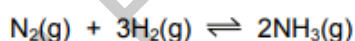
The forward reaction is endothermic.

Which row shows how the amount of hydrogen at equilibrium changes when the pressure or temperature is changed as indicated?

	change in temperature	change in pressure	amount of hydrogen
A	decrease	no change	increase
B	increase	no change	decrease
C	no change	increase	decrease
D	no change	decrease	decrease

s20-p22-q31

In the Haber process, nitrogen and hydrogen are reacted to make ammonia.



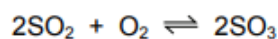
The forward reaction is exothermic.

Which conditions produce the maximum yield of ammonia?

	pressure	temperature
A	high	high
B	high	low
C	low	high
D	low	low

s20-p22-q34

One of the reactions used in the manufacture of sulfuric acid is shown.



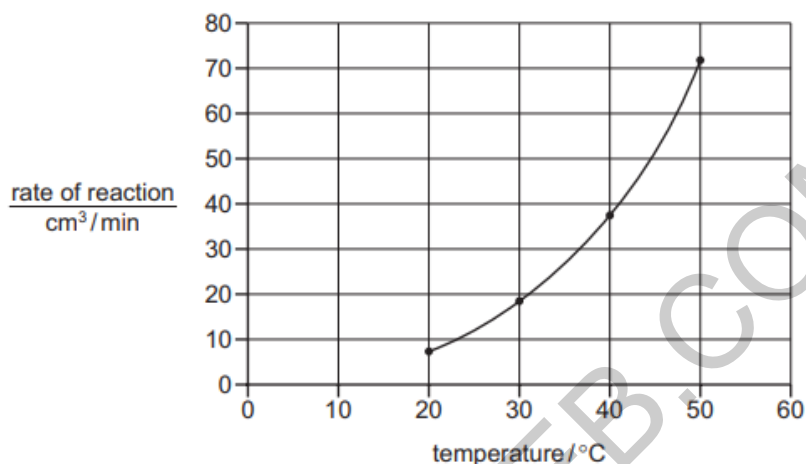
Which catalyst is used to increase the rate of this reaction?

- A** iron
- B** manganese(IV) oxide
- C** vanadium(V) oxide
- D** nickel

s20-p21-q16

The rate of reaction between calcium carbonate chips and hydrochloric acid is studied by collecting the volume of gas released in one minute at different temperatures.

A graph of rate of reaction against temperature is shown.

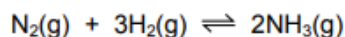


Which statement fully explains why increasing the temperature has this effect on the rate?

- A** The kinetic energy of the particles increases so the collisions are harder.
- B** The number of collisions between particles increases.
- C** The activation energy needed for the particles to react is reduced.
- D** There are more frequent collisions between particles with enough energy to react.

s20-p21-q31

Ammonia is manufactured by the Haber process.



What are the conditions used in the Haber process?

	temperature / °C	pressure / atm
A	400	100
B	400	300
C	20	300
D	20	100

s20-p21-q34

The Contact process is used to manufacture concentrated sulfuric acid and consists of four steps.

Which step involves a catalyst?

- A** production of sulfur dioxide gas
- B** production of sulfur trioxide gas
- C** production of oleum
- D** production of concentrated sulfuric acid

m20-p22-q16

An equilibrium reaction is shown.



The forward reaction is endothermic.

What is the effect of changing the temperature and pressure on the equilibrium position?

	increasing temperature	increasing pressure
A	moves to the left	moves to the left
B	moves to the left	moves to the right
C	moves to the right	moves to the left
D	moves to the right	moves to the right

m20-p22-q34

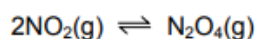
Which row describes the conditions used in the manufacture of sulfuric acid by the Contact process?

	catalyst	pressure	temperature
A	iron	high	high
B	iron	low	low
C	vanadium(V) oxide	high	low
D	vanadium(V) oxide	low	high

w19-p23-q17

Two molecules of nitrogen dioxide combine in a reversible reaction to form dinitrogen tetroxide.

The forward reaction is exothermic.



Which changes in reaction conditions would **both** increase the amount of dinitrogen tetroxide at equilibrium?

- A** decreasing the temperature and decreasing the pressure
- B** decreasing the temperature and increasing the pressure
- C** increasing the temperature and decreasing the pressure
- D** increasing the temperature and increasing the pressure

w19-p23-q34
w19-p22-q34
w19-p21-q34

Ammonium sulfate is used as a fertiliser.

It is made from ammonia and sulfuric acid.

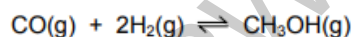
Which words complete gaps 1, 2 and 3?

The1..... is made by the2..... process in which3..... is used as a catalyst.

	1	2	3
A	ammonia	Contact	iron
B	ammonia	Haber	vanadium(V) oxide
C	sulfuric acid	Contact	vanadium(V) oxide
D	sulfuric acid	Haber	iron

w19-p22-q17

When carbon monoxide reacts with hydrogen, methanol is formed.



The forward reaction is exothermic.

Which statements are correct?

- 1 There are more moles of gas on the left-hand side of the reaction.
- 2 Increasing the temperature increases the amount of methanol at equilibrium.
- 3 Increasing the pressure increases the amount of methanol at equilibrium.
- 4 Increasing the initial amount of hydrogen decreases the amount of methanol at equilibrium.

A 1 and 2 only **B** 1 and 3 only **C** 2 and 4 only **D** 3 and 4 only

w19-p21-q17

Dinitrogen tetroxide, N_2O_4 , is converted into nitrogen dioxide, NO_2 , in a reversible reaction.



The forward reaction is endothermic.

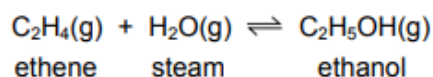
Which conditions give the highest equilibrium yield of nitrogen dioxide?

	pressure / atmospheres	temperature
A	2	high
B	2	low
C	50	high
D	50	low

s19-p23-q14 s19-p22-q14 s19-p21-q14	<p>When blue-green crystals of nickel(II) sulfate are heated, water is produced and a yellow solid remains. When water is added to the yellow solid, the blue-green colour returns.</p> <p>Which process describes these changes?</p> <p>A combustion</p> <p>B corrosion</p> <p>C neutralisation</p> <p>D reversible reaction</p>																				
s19-p23-q15	<p>A reaction between nitrogen and oxygen is shown. The forward reaction is endothermic.</p> $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}(\text{g})$ <p>Which change increases the equilibrium yield of nitrogen monoxide, NO?</p> <p>A decreasing the pressure</p> <p>B decreasing the temperature</p> <p>C increasing the pressure</p> <p>D increasing the temperature</p>																				
s19-p23-q32	<p>Ammonia is manufactured in an exothermic reaction.</p> $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$ <p>What is the effect of lowering the temperature on the rate of formation and equilibrium yield of ammonia?</p> <table><tr><td></td><td>rate of formation</td><td>equilibrium yield</td></tr><tr><td>A</td><td>decreases</td><td>decreases</td></tr><tr><td>B</td><td>decreases</td><td>increases</td></tr><tr><td>C</td><td>increases</td><td>decreases</td></tr><tr><td>D</td><td>increases</td><td>increases</td></tr></table>		rate of formation	equilibrium yield	A	decreases	decreases	B	decreases	increases	C	increases	decreases	D	increases	increases					
	rate of formation	equilibrium yield																			
A	decreases	decreases																			
B	decreases	increases																			
C	increases	decreases																			
D	increases	increases																			
s19-p23-q33 s19-p22-q33 s19-p21-q33	<p>Which row shows the conditions used in the Contact process?</p> <table><tr><td></td><td>temperature / °C</td><td>pressure / atm</td><td>catalyst</td></tr><tr><td>A</td><td>25</td><td>2</td><td>iron</td></tr><tr><td>B</td><td>25</td><td>200</td><td>iron</td></tr><tr><td>C</td><td>450</td><td>2</td><td>vanadium(V) oxide</td></tr><tr><td>D</td><td>450</td><td>200</td><td>vanadium(V) oxide</td></tr></table>		temperature / °C	pressure / atm	catalyst	A	25	2	iron	B	25	200	iron	C	450	2	vanadium(V) oxide	D	450	200	vanadium(V) oxide
	temperature / °C	pressure / atm	catalyst																		
A	25	2	iron																		
B	25	200	iron																		
C	450	2	vanadium(V) oxide																		
D	450	200	vanadium(V) oxide																		

s19-p22-q15e

The equation for the manufacture of ethanol is shown.



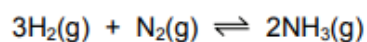
What is the effect of doubling the pressure on this reaction?

- A** decreases the rate of formation of ethanol
- B** increases the yield of ethene
- C** decreases the rate of formation of ethene
- D** increases the yield of ethanol

s19-p22-q32
s19-p21-q31

Ammonia is produced in the Haber process.

The equation for the reaction is shown.



The forward reaction is exothermic.

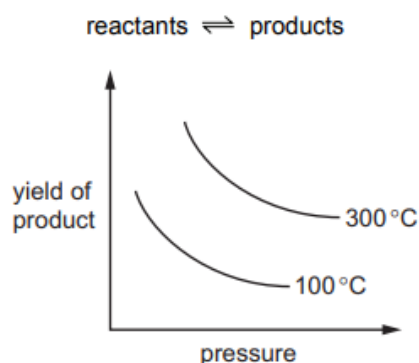
Which conditions of temperature and pressure produce the highest yield of ammonia?

	temperature	pressure
A	high	high
B	high	low
C	low	high
D	low	low

s19-p21-q15

The graph shows how the yield of product in a reversible reaction changes as the temperature and pressure are changed.

All reactants and products are gases.



Which row is correct for this reversible reaction?

	side of reaction with fewer moles	forward reaction
A	reactant	exothermic
B	reactant	endothermic
C	product	endothermic
D	product	exothermic

m19-p22-q16

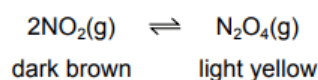
Which reaction is reversible?

- A** $\text{Cu} + \text{ZnSO}_4 \rightarrow \text{CuSO}_4 + \text{Zn}$
- B** $\text{CuO} + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{H}_2\text{O}$
- C** $\text{CuO} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O}$
- D** $\text{CuSO}_4 \cdot 5\text{H}_2\text{O} \rightarrow \text{CuSO}_4 + 5\text{H}_2\text{O}$

m19-p22-q17

Some nitrogen dioxide gas was put in a gas syringe. The end of the gas syringe is sealed.

A reversible reaction occurs. The reaction reaches equilibrium.



The forward reaction is exothermic.

Which statement about the reaction is correct?

- A** If the gas syringe is placed in a cold water bath, the colour becomes darker.
- B** If the gas syringe is placed in a hot water bath, the colour becomes lighter.
- C** If the volume in the gas syringe is increased, the colour becomes lighter.
- D** If the volume in the gas syringe is decreased, the colour becomes lighter.

m19-p22-q33	<p>The raw materials for the Haber process are hydrogen and nitrogen.</p> <p>What are the sources of the hydrogen and nitrogen?</p> <p>A hydrogen from ethanol and nitrogen from NPK fertilisers</p> <p>B hydrogen from methane and nitrogen from air</p> <p>C hydrogen from sulfuric acid and nitrogen from air</p> <p>D hydrogen from water and nitrogen from ammonium nitrate</p>															
m19-p22-q35	<p>The Contact process is used to make sulfuric acid.</p> <p>The steps in the process are listed.</p> <p>1 Dissolve sulfur trioxide in 98% concentrated sulfuric acid.</p> <p>2 Heat sulfur strongly in air.</p> <p>3 Add oleum to water.</p> <p>4 Pass sulfur dioxide over a vanadium(V) oxide catalyst.</p> <p>Which sequence of steps is correct?</p> <p>A 4 → 1 → 2 → 3</p> <p>B 4 → 2 → 3 → 1</p> <p>C 2 → 1 → 4 → 3</p> <p>D 2 → 4 → 1 → 3</p>															
w18-p23-q15	<p>The reversible reaction between methane and steam is shown.</p> $\text{CH}_4(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}(\text{g}) + 3\text{H}_2(\text{g})$ <p>The forward reaction is endothermic.</p> <p>Which changes in pressure and temperature move the equilibrium to the right?</p> <table><tr><td></td><td>pressure</td><td>temperature</td></tr><tr><td>A</td><td>decrease</td><td>decrease</td></tr><tr><td>B</td><td>decrease</td><td>increase</td></tr><tr><td>C</td><td>increase</td><td>decrease</td></tr><tr><td>D</td><td>increase</td><td>increase</td></tr></table>		pressure	temperature	A	decrease	decrease	B	decrease	increase	C	increase	decrease	D	increase	increase
	pressure	temperature														
A	decrease	decrease														
B	decrease	increase														
C	increase	decrease														
D	increase	increase														

w18-p23-q28	<p>Ammonia is manufactured by the Haber process from nitrogen and hydrogen.</p> <p>Which row gives the main sources of these two gases?</p> <table><tr><td></td><td>hydrogen</td><td>nitrogen</td></tr><tr><td>A</td><td>air</td><td>air</td></tr><tr><td>B</td><td>air</td><td>natural gas</td></tr><tr><td>C</td><td>natural gas</td><td>air</td></tr><tr><td>D</td><td>natural gas</td><td>natural gas</td></tr></table>		hydrogen	nitrogen	A	air	air	B	air	natural gas	C	natural gas	air	D	natural gas	natural gas
	hydrogen	nitrogen														
A	air	air														
B	air	natural gas														
C	natural gas	air														
D	natural gas	natural gas														
w18-p23-q33	<p>Which statement about sulfur or one of its compounds is correct?</p> <p>A Sulfur occurs naturally as the element sulfur.</p> <p>B Sulfur dioxide is used to kill bacteria in drinking water.</p> <p>C Sulfuric acid is a weak acid.</p> <p>D Dilute sulfuric acid is a dehydrating agent.</p>															
w18-p22-q15	<p>Methanol is prepared by the reversible reaction shown.</p> $\text{CO(g)} + 2\text{H}_2\text{(g)} \rightleftharpoons \text{CH}_3\text{OH(g)}$ <p>The forward reaction is exothermic.</p> <p>Which conditions produce the highest equilibrium yield of methanol?</p> <table><tr><td></td><td>temperature</td><td>pressure</td></tr><tr><td>A</td><td>high</td><td>high</td></tr><tr><td>B</td><td>high</td><td>low</td></tr><tr><td>C</td><td>low</td><td>high</td></tr><tr><td>D</td><td>low</td><td>low</td></tr></table>		temperature	pressure	A	high	high	B	high	low	C	low	high	D	low	low
	temperature	pressure														
A	high	high														
B	high	low														
C	low	high														
D	low	low														
w18-p22-q28	<p>Which statement about the Haber process is correct?</p> <p>A The hydrogen used is obtained from the air.</p> <p>B The nitrogen used is obtained from nitrates in the soil.</p> <p>C Nitrogen reacts with hydrogen to make ammonia.</p> <p>D The reaction takes place at room temperature and pressure.</p>															

w18-p22-q33 w18-p21-q33	<p>Which statement about sulfur or one of its compounds is correct?</p> <p>A Sulfur occurs naturally as the element sulfur.</p> <p>B Sulfur dioxide is used to kill bacteria in drinking water.</p> <p>C Sulfuric acid is a weak acid.</p> <p>D Dilute sulfuric acid is a dehydrating agent.</p>															
w18-p21-q15	<p>When BiCl_3 reacts with water, a white precipitate of BiOCl is formed. The equation for the reaction is shown.</p> $\text{BiCl}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{BiOCl}(\text{s}) + 2\text{HCl}(\text{aq})$ <p>Which statements are correct?</p> <p>1 The reaction is reversible.</p> <p>2 When dilute hydrochloric acid is added to the reaction mixture, more of the white precipitate forms.</p> <p>3 When aqueous sodium hydroxide is added to the reaction mixture, more of the white precipitate forms.</p> <p>A 1, 2 and 3 B 1 and 2 only C 1 and 3 only D 2 and 3 only</p>															
w18-p21-q28	<p>Which statement describes the role of iron in the Haber process?</p> <p>A It is used as a catalyst.</p> <p>B It is used as a reducing agent.</p> <p>C It is used to condense the ammonia gas into a liquid.</p> <p>D It is used to increase the yield of ammonia.</p>															
s18-p23-q15	<p>In the Contact process, sulfur dioxide is converted into sulfur trioxide in a reversible reaction.</p> $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$ <p>The forward reaction is exothermic.</p> <p>Which conditions give the highest yield of sulfur trioxide at equilibrium?</p> <table><tr><td></td><td>pressure / atmospheres</td><td>temperature</td></tr><tr><td>A</td><td>0.5</td><td>high</td></tr><tr><td>B</td><td>0.5</td><td>low</td></tr><tr><td>C</td><td>1.5</td><td>high</td></tr><tr><td>D</td><td>1.5</td><td>low</td></tr></table>		pressure / atmospheres	temperature	A	0.5	high	B	0.5	low	C	1.5	high	D	1.5	low
	pressure / atmospheres	temperature														
A	0.5	high														
B	0.5	low														
C	1.5	high														
D	1.5	low														

s18-p23-q31
s18-p22-q31
s18-p21-q31

Ammonia is manufactured by reacting hydrogen with nitrogen in the Haber process.

Which row describes the sources of hydrogen and nitrogen and the conditions used in the manufacture of ammonia in the Haber process?

	source of hydrogen	source of nitrogen	temperature of reaction / °C	pressure of reaction / atm
A	air	natural gas	250	2
B	air	natural gas	250	200
C	natural gas	air	450	2
D	natural gas	air	450	200

s18-p23-q33

Element Z forms an oxide, ZO_2 . Three uses of ZO_2 are listed.

- bleaching agent
- killing bacteria
- manufacturing an important acid

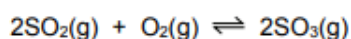
What is Z?

- A** carbon
B lead
C nitrogen
D sulfur

s18-p22-q15

Sulfur dioxide reacts with oxygen at 2 atmospheres pressure. The forward reaction is exothermic.

The equation for the reaction is shown.



The reaction reaches equilibrium. The pressure is then doubled.

How and why does the amount of sulfur trioxide formed change?

	amount of sulfur trioxide	reason
A	decreases	the forward reaction is exothermic
B	decreases	there are fewer molecules on the right
C	increases	the forward reaction is exothermic
D	increases	there are fewer molecules on the right

s18-p22-q33

Which row describes the uses of sulfur and sulfur dioxide?

	sulfur	sulfur dioxide
A	extraction of aluminium	food preservative
B	extraction of aluminium	water treatment
C	manufacture of sulfuric acid	food preservative
D	manufacture of sulfuric acid	water treatment

s18-p21-q15

The formation of sulfur trioxide is a reversible reaction.

The equation is shown.



The forward reaction is exothermic.

Which conditions produce the highest equilibrium yield of sulfur trioxide?

	pressure	temperature
A	high	high
B	high	low
C	low	high
D	low	low

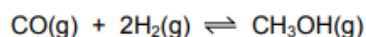
s18-p21-q33

Which statement about sulfur and its compounds is **not** correct?

- A** Sulfur dioxide is used as a food preservative.
- B** Sulfur dioxide turns acidified aqueous potassium manganate(VII) from purple to colourless.
- C** Sulfur forms a basic oxide.
- D** Sulfur is used in the manufacture of sulfuric acid.

m18-p22-q13

Methanol is made by reacting carbon monoxide with hydrogen. The reaction is reversible.



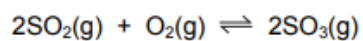
The forward reaction is exothermic.

Which combination of temperature and pressure gives the highest equilibrium yield of methanol?

	temperature /°C	pressure /atmospheres
A	200	10
B	200	200
C	600	10
D	600	200

m18-p22-q33

The equation for the formation of sulfur trioxide from sulfur dioxide is shown.



The forward reaction is exothermic.

Which combination of pressure and temperature gives the highest equilibrium yield of sulfur trioxide?

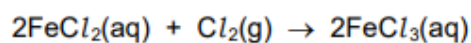
	pressure	temperature
A	high	high
B	high	low
C	low	high
D	low	low

Topic	6. Chemical Reactions															
	6.4 Redox															
Content	<div><div><div>1. Use a Roman numeral to indicate the oxidation number of an element in a compound</div><div>2. Define redox reactions as involving simultaneous oxidation and reduction</div><div>3. Define oxidation as gain of oxygen and reduction as loss of oxygen</div><div>4. Identify redox reactions as reactions involving gain and loss of oxygen</div><div>5. Identify oxidation and reduction in redox reactions</div><div>6. Define oxidation in terms of: (a) loss of electrons (b) an increase in oxidation number</div><div>7. Define reduction in terms of: (a) gain of electrons (b) a decrease in oxidation number</div><div>8. Identify redox reactions as reactions involving gain and loss of electrons</div><div>9. Identify redox reactions by changes in oxidation number using: (a) the oxidation number of elements in their uncombined state is zero (b) the oxidation number of a monatomic ion is the same as the charge on the ion (c) the sum of the oxidation numbers in a compound is zero (d) the sum of the oxidation numbers in an ion is equal to the charge on the ion</div><div>10. Identify redox reactions by the colour changes involved when using acidified aqueous potassium manganate(VII) or aqueous potassium iodide</div><div>11. Define an oxidising agent as a substance that oxidises another substance and is itself reduced</div><div>12. Define a reducing agent as a substance that reduces another substance and is itself oxidised</div><div>13. Identify oxidising agents and reducing agents in redox reactions</div></div></div>															
w21-p23-q16 w21-p21-q16	<div><div>Iron(II) chloride solution reacts with chlorine gas.</div><div>The equation is shown.</div><div>$2\text{FeCl}_2(\text{aq}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{FeCl}_3(\text{aq})$</div><div>Which statements about this reaction are correct?</div><div><div><div>1 Fe²⁺ ions are reduced to Fe³⁺ ions.</div><div>2 Chlorine acts as a reducing agent.</div><div>3 Fe²⁺ ions each lose an electron.</div><div>4 Cl₂ molecules are reduced to Cl⁻ ions.</div></div><div><div>A 1 and 2</div><div>B 2 and 3</div><div>C 2 and 4</div><div>D 3 and 4</div></div></div></div>															
w21-p23-q20	<div><div>Which row describes an acid and an oxidising agent?</div><table><tr><td></td><td>acid</td><td>oxidising agent</td></tr><tr><td>A</td><td>proton acceptor</td><td>electron acceptor</td></tr><tr><td>B</td><td>proton acceptor</td><td>electron donor</td></tr><tr><td>C</td><td>proton donor</td><td>electron acceptor</td></tr><tr><td>D</td><td>proton donor</td><td>electron donor</td></tr></table></div>		acid	oxidising agent	A	proton acceptor	electron acceptor	B	proton acceptor	electron donor	C	proton donor	electron acceptor	D	proton donor	electron donor
	acid	oxidising agent														
A	proton acceptor	electron acceptor														
B	proton acceptor	electron donor														
C	proton donor	electron acceptor														
D	proton donor	electron donor														

w21-p22-q16

Iron(II) chloride solution reacts with chlorine gas.

The equation is shown.



Which statements about this reaction are correct?

- 1 Fe^{2+} ions are reduced to Fe^{3+} ions.
- 2 Chlorine acts as a reducing agent.
- 3 Fe^{2+} ions each lose an electron.
- 4 Cl_2 molecules are reduced to Cl^- ions.

A 1 and 2 **B** 2 and 3 **C** 2 and 4 **D** 3 and 4

s21-p23-Q9

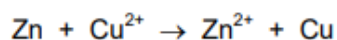
Three ionic compounds of vanadium have the formulae V_2O , VCl_2 and V_2O_3 .

What is the charge on the vanadium ion in each compound?

	V_2O	VCl_2	V_2O_3
A	+1	-2	+2
B	+1	+2	+3
C	+2	-2	+2
D	+2	+2	+3

s21-p23-q16
s21-p22-q16
s21-p21-q16

An example of a redox reaction is shown.



Which statement about the reaction is correct?

- A** Zn is the oxidising agent and it oxidises Cu^{2+} .
- B** Zn is the oxidising agent and it reduces Cu^{2+} .
- C** Zn is the reducing agent and it oxidises Cu^{2+} .
- D** Zn is the reducing agent and it reduces Cu^{2+} .

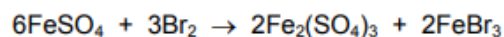
s21-p23-q32	<p>The formulae of two compounds of manganese are MnO_2 and KMnO_4.</p> <p>In these two compounds the oxidation state of potassium is +1 and the oxidation state of oxygen is -2.</p> <p>What are the oxidation states of manganese in each of these two compounds?</p> <table><tr><td></td><td>MnO_2</td><td>KMnO_4</td></tr><tr><td>A</td><td>+2</td><td>+3</td></tr><tr><td>B</td><td>+2</td><td>+7</td></tr><tr><td>C</td><td>+4</td><td>+3</td></tr><tr><td>D</td><td>+4</td><td>+7</td></tr></table>		MnO_2	KMnO_4	A	+2	+3	B	+2	+7	C	+4	+3	D	+4	+7					
	MnO_2	KMnO_4																			
A	+2	+3																			
B	+2	+7																			
C	+4	+3																			
D	+4	+7																			
m21-p22-q18	<p>Magnesium reacts with copper(II) oxide to give magnesium oxide and copper.</p> <p>Which substance is the oxidising agent in this reaction?</p> <p>A copper</p> <p>B copper(II) oxide</p> <p>C magnesium</p> <p>D magnesium oxide</p>																				
w20-p23-q17	<p>Which reaction of hydrochloric acid is a redox reaction?</p> <p>A $2\text{Na} + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2$</p> <p>B $\text{Na}_2\text{O} + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O}$</p> <p>C $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$</p> <p>D $\text{Na}_2\text{CO}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$</p>																				
w20-p23-q29	<p>The equation for the reaction between iron(III) oxide and carbon monoxide is shown.</p> $\text{Fe}_2\text{O}_3 + x\text{CO} \rightarrow y\text{Fe} + z\text{CO}_2$ <p>Which values of x, y and z balance the equation?</p> <table><tr><td></td><td>x</td><td>y</td><td>z</td></tr><tr><td>A</td><td>2</td><td>2</td><td>2</td></tr><tr><td>B</td><td>2</td><td>3</td><td>3</td></tr><tr><td>C</td><td>3</td><td>1</td><td>3</td></tr><tr><td>D</td><td>3</td><td>2</td><td>3</td></tr></table>		x	y	z	A	2	2	2	B	2	3	3	C	3	1	3	D	3	2	3
	x	y	z																		
A	2	2	2																		
B	2	3	3																		
C	3	1	3																		
D	3	2	3																		

w20-p22-q8	<p>Ethyl methanoate, HCOOC_2H_5, burns in excess oxygen to produce carbon dioxide and water.</p> <p>The equation is shown.</p> $2\text{HCOOC}_2\text{H}_5 + x\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$ <p>What is the value of x?</p> <p>A 2 B 7 C 9 D 18</p>
w20-p22-q19	<p>During the manufacture of sulfuric acid, sulfur dioxide is converted to sulfur trioxide.</p> $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$ <p>Which type of reaction is this?</p> <p>A displacement B neutralisation C oxidation D thermal decomposition</p>
w20-p22-q20	<p>The equation for a redox reaction is shown.</p> $2\text{FeSO}_4 + \text{Cl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{Fe}_2(\text{SO}_4)_3 + 2\text{HCl}$ <p>Which element is reduced?</p> <p>A chlorine B iron C oxygen D sulfur</p>
w21-p21-q21	<p>The reaction between chlorine and bromide ions is a redox reaction.</p> $\text{Cl}_2 + 2\text{Br}^- \rightarrow 2\text{Cl}^- + \text{Br}_2$ <p>What is the change in oxidation state of the reducing agent in this reaction?</p> <p>A -2 to 0 B -1 to 0 C 0 to -1 D 0 to +1</p>

s20-p23-q17	<p>The equation for the reaction between zinc and aqueous copper(II) sulfate is shown.</p> $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$ <p>Which statement is correct?</p> <p>A The oxidation state of the oxidising agent has changed from 0 to +2.</p> <p>B The oxidation state of the reducing agent has changed from 0 to +2.</p> <p>C The oxidation state of the reducing agent has changed from +2 to 0.</p> <p>D This is not a redox reaction. The solution changes from colourless to blue.</p>															
s20-p21-q17	<p>The equations for two reactions of iodide ions are shown.</p> <p>reaction 1 $2\text{I}^-(\text{aq}) + \text{H}_2\text{O}_2(\text{aq}) \rightarrow \text{I}_2(\text{aq}) + 2\text{OH}^-(\text{aq})$</p> <p>reaction 2 $\text{I}^-(\text{aq}) + \text{Ag}^+(\text{aq}) \rightarrow \text{AgI}(\text{s})$</p> <p>Which statement is correct?</p> <p>A Both reactions are redox reactions.</p> <p>B Neither reaction is a redox reaction.</p> <p>C Only reaction 1 is a redox reaction.</p> <p>D Only reaction 2 is a redox reaction.</p>															
m20-p22-q17	<p>In which reaction is the underlined compound acting as a reducing agent?</p> <p>A $\underline{\text{CO}_2} + \text{C} \rightarrow 2\text{CO}$</p> <p>B $2\text{CuO} + \underline{\text{C}} \rightarrow 2\text{Cu} + \text{CO}_2$</p> <p>C $\underline{\text{Fe}_2\text{O}_3} + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$</p> <p>D $\text{CaCO}_3 + \underline{2\text{HCl}} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$</p>															
w19-p22-q18	<p>In the blast furnace, iron is formed when iron(III) oxide reacts with carbon monoxide in a redox reaction.</p> $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$ <p>Which substance is the oxidising agent and which substance is the reducing agent?</p> <table><tr><td></td><td>oxidising agent</td><td>reducing agent</td></tr><tr><td>A</td><td>CO</td><td>Fe₂O₃</td></tr><tr><td>B</td><td>CO₂</td><td>Fe</td></tr><tr><td>C</td><td>Fe</td><td>CO₂</td></tr><tr><td>D</td><td>Fe₂O₃</td><td>CO</td></tr></table>		oxidising agent	reducing agent	A	CO	Fe ₂ O ₃	B	CO ₂	Fe	C	Fe	CO ₂	D	Fe ₂ O ₃	CO
	oxidising agent	reducing agent														
A	CO	Fe ₂ O ₃														
B	CO ₂	Fe														
C	Fe	CO ₂														
D	Fe ₂ O ₃	CO														

w19-p21-q18

The equation for the reaction between iron(II) sulfate and bromine is shown.

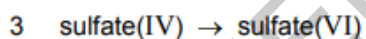
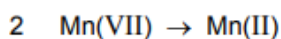
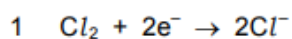


Which row identifies the oxidising agent and the reducing agent?

	oxidising agent	reducing agent
A	Br_2	FeSO_4
B	FeSO_4	Br_2
C	FeBr_3	$\text{Fe}_2(\text{SO}_4)_3$
D	$\text{Fe}_2(\text{SO}_4)_3$	FeBr_3

s19-p23-q16

Which changes represent reduction?



A 1 and 2

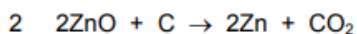
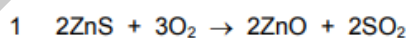
B 1 and 3

C 1 only

D 2 only

s19-p23-q25

Zinc is extracted from its ore, zinc blende, using two chemical reactions.

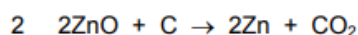
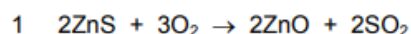


Which substance is reduced in reactions 1 and 2?

	reaction 1	reaction 2
A	O_2	C
B	O_2	ZnO
C	ZnS	C
D	ZnS	ZnO

s19-p22-q25
s19-p21-q25

Zinc is extracted from its ore, zinc blende, using two chemical reactions.

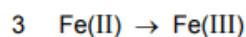
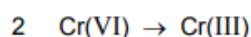
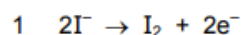


Which substance is reduced in reactions 1 and 2?

	reaction 1	reaction 2
A	O ₂	C
B	O ₂	ZnO
C	ZnS	C
D	ZnS	ZnO

s19-p21-q16

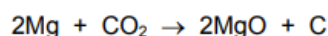
Which changes represent oxidation?



A 1 and 2 **B** 1 and 3 **C** 1 only **D** 2 only

m19-p22-q18

The reaction between magnesium and carbon dioxide is shown in the equation.

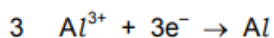
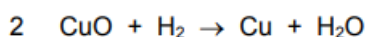
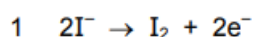


Which statement describes what happens in this reaction?

- A** Carbon is oxidised.
B Magnesium is reduced.
C Neither oxidation nor reduction happens.
D The carbon in carbon dioxide is reduced.

m19-p22-q19

Which changes involve reduction?



A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

w18-p23-q16

The equation for the reaction between zinc and copper(II) oxide is shown.



Which row shows the oxidising agent and the reducing agent?

	oxidising agent	reducing agent
A	CuO	Cu
B	CuO	Zn
C	Zn	CuO
D	Zn	ZnO

w18-p22-q16

The thermite reaction can be used to produce iron from iron(III) oxide.

The equation for the reaction is shown.



Which statements about this reaction are correct?

- 1 Aluminium is the oxidising agent.
- 2 Aluminium is less reactive than iron.
- 3 Electrons are transferred from aluminium to iron.
- 4 The iron in the iron(III) oxide is reduced.

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

w18-p22-q24

Heating copper(II) carbonate produces copper(II) oxide and carbon dioxide.

Heating the copper(II) oxide formed with carbon produces copper.

Which processes are involved in this conversion of copper(II) carbonate to copper?

- A** sublimation followed by oxidation
- B** sublimation followed by reduction
- C** thermal decomposition followed by oxidation
- D** thermal decomposition followed by reduction

w18-p21-q16	<p>An excess of iron(II) chloride is added to acidified potassium manganate(VII).</p> <p>Which statements are correct?</p> <ol style="list-style-type: none"> 1 The purple colour disappears. 2 Iron(II) is reduced to iron(III). 3 Manganate(VII) ions are oxidised to manganese(II) ions. 4 Potassium manganate(VII) is an oxidising agent. <p>A 1 and 2 B 1 and 4 C 2 and 3 D 3 and 4</p>
s18-p23-q16	<p>The equation for a redox reaction is shown.</p> $2\text{Fe}^{3+} + \text{Zn} \rightarrow 2\text{Fe}^{2+} + \text{Zn}^{2+}$ <p>Which statements are correct?</p> <ol style="list-style-type: none"> 1 Fe^{3+} is reduced to form Fe^{2+}. 2 Zn oxidises the Fe^{3+} ions. 3 Fe^{3+} is an oxidising agent. <p>A 1, 2 and 3 B 1 and 2 only C 1 and 3 only D 2 and 3 only</p>
s18-p22-q16	<p>Iron(II) chloride solution reacts with chlorine gas.</p> <p>The equation is shown.</p> $2\text{FeCl}_2(\text{aq}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{FeCl}_3(\text{aq})$ <p>Which statements about this reaction are correct?</p> <ol style="list-style-type: none"> 1 Fe^{2+} ions are reduced to Fe^{3+} ions. 2 Chlorine acts as a reducing agent. 3 Fe^{2+} ions each lose an electron. 4 Cl_2 molecules are reduced to Cl^- ions. <p>A 1 and 2 B 2 and 3 C 2 and 4 D 3 and 4</p>

s18-p21-q16

Chlorine displaces iodide ions from potassium iodide.

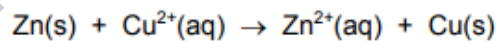


What is the oxidising agent?

- A** chloride ions
- B** chlorine
- C** iodide ions
- D** iodine

m18-p22-q14

The ionic equation for the reaction between zinc and aqueous copper ions is shown.




Which statement about this reaction is correct?

- A** Copper ions are oxidised and their oxidation state changes.
- B** Copper ions are reduced because they lose electrons.
- C** Zinc atoms are oxidised and their oxidation state changes.
- D** Zinc atoms are reduced because they gain electrons.

Topic	7. Acid, Bases and Salts															
	7.1 The characteristic properties of acids and bases															
Content	<div><div><div>1. Describe the characteristic properties of acids in terms of their reactions with: (a) metals (b) bases (c) carbonates</div><div>2. Describe acids in terms of their effect on: (a) litmus (b) thymolphthalein (c) methyl orange</div><div>3. State that bases are oxides or hydroxides of metals and that alkalis are soluble bases</div><div>4. Describe the characteristic properties of bases in terms of their reactions with: (a) acids (b) ammonium salts</div><div>5. Describe alkalis in terms of their effect on: (a) litmus (b) thymolphthalein (c) methyl orange</div><div>6. State that aqueous solutions of acids contain H⁺ ions and aqueous solutions of alkalis contain OH⁻ ion</div><div>7. Describe how to compare hydrogen ion concentration, neutrality, relative acidity and relative alkalinity in terms of colour and pH using universal indicator paper</div><div>8. Describe the neutralisation reaction between an acid and an alkali to produce water, H⁺ (aq) + OH⁻ (aq) → H₂O(l)</div><div>9. Define acids as proton donors and bases as proton acceptors</div><div>10. Define a strong acid as an acid that is completely dissociated in aqueous solution and a weak acid as an acid that is partially dissociated in aqueous solution</div><div>11. State that hydrochloric acid is a strong acid, as shown by the symbol equation, HCl(aq) → H⁺ (aq) + Cl⁻ (aq)</div><div>12. State that ethanoic acid is a weak acid, as shown by the symbol equation, CH₃COOH(aq) ⇌ H⁺ (aq) + CH₃COO⁻ (aq)</div></div></div>															
m22-p22-q20	<div><div>Methyl orange is added to dilute hydrochloric acid and to aqueous sodium hydroxide.</div><div>What is the colour of the methyl orange in each solution?</div><table><tr><td></td><td>colour in dilute hydrochloric acid</td><td>colour in aqueous sodium hydroxide</td></tr><tr><td>A</td><td>orange</td><td>red</td></tr><tr><td>B</td><td>red</td><td>yellow</td></tr><tr><td>C</td><td>red</td><td>orange</td></tr><tr><td>D</td><td>yellow</td><td>red</td></tr></table></div>		colour in dilute hydrochloric acid	colour in aqueous sodium hydroxide	A	orange	red	B	red	yellow	C	red	orange	D	yellow	red
	colour in dilute hydrochloric acid	colour in aqueous sodium hydroxide														
A	orange	red														
B	red	yellow														
C	red	orange														
D	yellow	red														

m22-p22-q23	<p>Aqueous ethanoic acid is a weak acid.</p> <p>Aqueous sodium hydroxide is a strong base.</p> <p>Aqueous ethanoic acid is neutralised by aqueous sodium hydroxide.</p> <p>Which statements are correct?</p> <ol style="list-style-type: none">1 Aqueous ethanoic acid accepts protons from hydroxide ions.2 The aqueous ethanoic acid used is fully dissociated into ions.3 The aqueous sodium hydroxide used is fully dissociated into ions.4 The reaction produces a salt and water. <p>A 1 and 2 B 1 and 3 C 2 and 4 D 3 and 4</p>															
w21-p23-q18	<p>Basic oxides are neutralised by acidic oxides.</p> <p>Which element forms an oxide that neutralises calcium oxide?</p> <p>A hydrogen</p> <p>B magnesium</p> <p>C sodium</p> <p>D sulfur</p>															
w21-p22-q17	<p>Which statements about acids and bases are correct?</p> <ol style="list-style-type: none">1 An acid reacts with a metal to give off hydrogen.2 A base reacts with an ammonium salt to give off ammonia.3 An acid reacts with a carbonate to give off carbon dioxide.4 Alkaline solutions are orange in methyl orange. <p>A 1, 2 and 3 B 1, 2 and 4 C 1, 3 and 4 D 2, 3 and 4</p>															
w21-p21-q17	<p>Which row describes the properties of an acid?</p> <table><tr><th></th><th>property 1</th><th>property 2</th></tr><tr><td>A</td><td>proton acceptor</td><td>pH less than 7</td></tr><tr><td>B</td><td>proton acceptor</td><td>pH more than 7</td></tr><tr><td>C</td><td>proton donor</td><td>pH less than 7</td></tr><tr><td>D</td><td>proton donor</td><td>pH more than 7</td></tr></table>		property 1	property 2	A	proton acceptor	pH less than 7	B	proton acceptor	pH more than 7	C	proton donor	pH less than 7	D	proton donor	pH more than 7
	property 1	property 2														
A	proton acceptor	pH less than 7														
B	proton acceptor	pH more than 7														
C	proton donor	pH less than 7														
D	proton donor	pH more than 7														

w21-p21-q25	<p>Which statement is correct for all metals?</p> <p>A They conduct electricity when molten.</p> <p>B They gain electrons when they form ions.</p> <p>C They have a low density.</p> <p>D They have a low melting point.</p>																				
s21-p23-q1 s21-p22-q1 s21-p21-q1	<p>A gas is released at point P in the apparatus shown.</p> <div><p>damp universal indicator paper</p></div> <p>Which gas turns the damp universal indicator paper red most quickly?</p> <p>A ammonia, NH_3</p> <p>B chlorine, Cl_2</p> <p>C hydrogen chloride, HCl</p> <p>D sulfur dioxide, SO_2</p>																				
s21-p23-q31	<p>Metal X is a good conductor of electricity and is used for electrical wiring.</p> <p>Metal Y is used to make an alloy which is resistant to corrosion and is used to make cutlery.</p> <p>Metal Z is light and strong and is used in the manufacture of aircraft.</p> <p>What are X, Y and Z?</p> <table><tr><th></th><th>X</th><th>Y</th><th>Z</th></tr><tr><td>A</td><td>aluminium</td><td>iron</td><td>copper</td></tr><tr><td>B</td><td>copper</td><td>iron</td><td>aluminium</td></tr><tr><td>C</td><td>aluminium</td><td>copper</td><td>iron</td></tr><tr><td>D</td><td>copper</td><td>aluminium</td><td>iron</td></tr></table>		X	Y	Z	A	aluminium	iron	copper	B	copper	iron	aluminium	C	aluminium	copper	iron	D	copper	aluminium	iron
	X	Y	Z																		
A	aluminium	iron	copper																		
B	copper	iron	aluminium																		
C	aluminium	copper	iron																		
D	copper	aluminium	iron																		
s21-p21-q21	<p>In which equation is the underlined reactant acting as a base?</p> <p>A $\text{CH}_3\text{COO}^- + \underline{\text{H}_3\text{O}^+} \rightarrow \text{CH}_3\text{COOH} + \text{H}_2\text{O}$</p> <p>B $\underline{\text{NH}_4^+} + \text{OH}^- \rightarrow \text{NH}_3 + \text{H}_2\text{O}$</p> <p>C $\text{CO}_2 + 2\underline{\text{H}_2\text{O}} \rightarrow \text{H}_3\text{O}^+ + \text{HCO}_3^-$</p> <p>D $\underline{\text{H}^+} + \text{OH}^- \rightarrow \text{H}_2\text{O}$</p>																				

m21-p22-q21	<p>Which statements about strong acids are correct?</p> <ol style="list-style-type: none"> 1 They have a high concentration of OH^- ions. 2 They have a pH value of 1. 3 They completely ionise in water. 4 They turn red litmus blue. <p>A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4</p>
w20-p23-q7	<p>Magnesium reacts with sulfuric acid.</p> <p>What are the formulae of the products formed in this reaction?</p> <p>A MgSO_4 and H_2 B MgSO_4 and H_2O C $\text{Mg}(\text{SO}_4)_2$ and H_2 D $\text{Mg}(\text{SO}_4)_2$ and H_2O</p>
w20-p22-q21	<p>The equation shows a reaction between aqueous hydrogen bromide and aqueous ammonia.</p> $\text{HBr}(\text{aq}) + \text{NH}_3(\text{aq}) \rightarrow \text{NH}_4^+(\text{aq}) + \text{Br}^-(\text{aq})$ <p>Which statement describes the role of aqueous hydrogen bromide?</p> <p>A It is a catalyst. B It is a reducing agent. C It is a proton acceptor. D It is a proton donor.</p>
w20-p21-q11	<p>Sodium carbonate reacts with sulfuric acid to form carbon dioxide, water and a sodium salt.</p> <p>An incomplete equation for the reaction is shown.</p> $\text{Na}_2\text{CO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \dots\dots\dots$ <p>What is the formula of the sodium salt?</p> <p>A $\text{Na}_2(\text{SO}_4)_2$ B $\text{Na}(\text{SO}_4)_2$ C Na_2SO_4 D NaSO_4</p>

w20-p21-q22	<p>What is a characteristic of acids?</p> <p>A Acids turn methyl orange indicator yellow.</p> <p>B Acids have a high pH value.</p> <p>C Acids react with ammonium salts to give ammonia gas.</p> <p>D Acids react with carbonates to produce salts.</p>															
w21-p21-q39	<p>Which statements about aqueous ethanoic acid are correct?</p> <p>1 It is an alkane.</p> <p>2 It reacts with sodium carbonate to form carbon dioxide.</p> <p>3 It changes the colour of litmus solution from blue to red.</p> <p>4 It is a hydrocarbon.</p> <p>A 1 and 2 B 1 and 4 C 2 and 3 D 3 and 4</p>															
s20-p23-q19 s20-p22-q19 s20-p21-q19	<p>Which statement describes a weak acid?</p> <p>A It is a proton acceptor and is fully ionised in aqueous solution.</p> <p>B It is a proton acceptor and is partially ionised in aqueous solution.</p> <p>C It is a proton donor and is fully ionised in aqueous solution.</p> <p>D It is a proton donor and is partially ionised in aqueous solution.</p>															
s20-p22-q38	<p>An organic compound, P, reacts with zinc to produce a gas, Q.</p> <p>What are P and Q?</p> <table><tr><td></td><td>P</td><td>Q</td></tr><tr><td>A</td><td>ethanoic acid</td><td>carbon dioxide</td></tr><tr><td>B</td><td>ethanoic acid</td><td>hydrogen</td></tr><tr><td>C</td><td>ethanol</td><td>carbon dioxide</td></tr><tr><td>D</td><td>ethanol</td><td>hydrogen</td></tr></table>		P	Q	A	ethanoic acid	carbon dioxide	B	ethanoic acid	hydrogen	C	ethanol	carbon dioxide	D	ethanol	hydrogen
	P	Q														
A	ethanoic acid	carbon dioxide														
B	ethanoic acid	hydrogen														
C	ethanol	carbon dioxide														
D	ethanol	hydrogen														

s20-p21-q38

Some properties of an organic compound J are listed.

- It is a liquid at room temperature.
- It is soluble in water.
- A solution of J reacts with calcium carbonate to form carbon dioxide.
- A solution of J has a pH of 3.

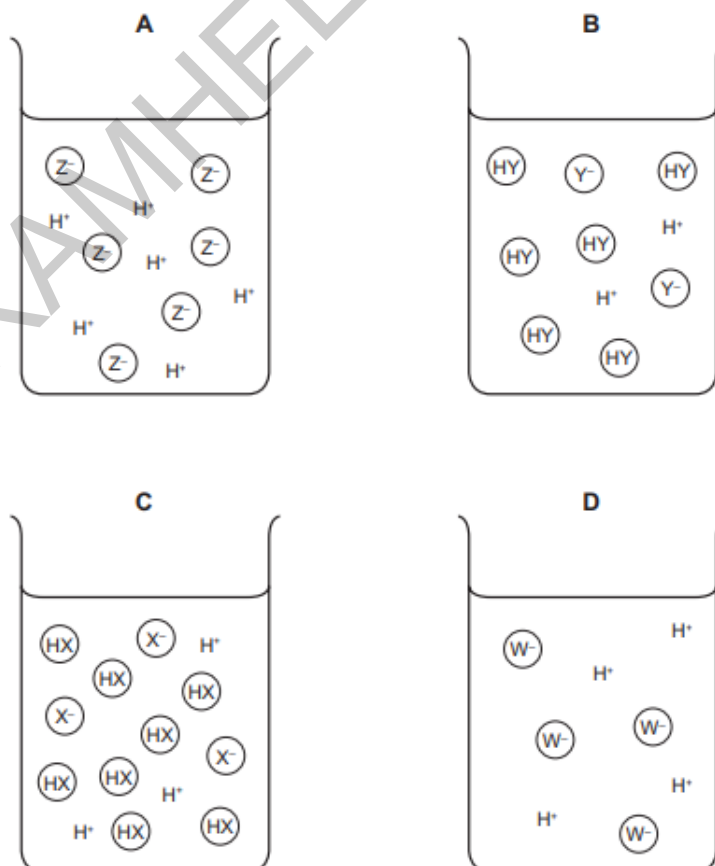
In which homologous series does J belong?

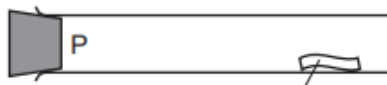
- A** alkane
B alkene
C alcohol
D carboxylic acid

m20-p22-q19

Four different acids are dissolved in water.

Which beaker contains the most concentrated strong acid solution?



w19-p23-q20	<p>Which statements about dilute sulfuric acid are correct?</p> <p>1 It turns red litmus paper blue. 2 It reacts with magnesium(II) oxide to form magnesium(II) sulfate and water. 3 It reacts with magnesium to form magnesium(II) sulfate and carbon dioxide. 4 Its pH is below pH 7.</p> <p>A 1 and 2 only B 1 and 3 only C 2 and 4 only D 3 and 4 only</p>															
w19-p22-q20	<p>Which statement describes the properties of hydrochloric acid?</p> <p>A Carbon dioxide is produced when limestone reacts with hydrochloric acid. B Hydrogen is produced when sodium hydroxide reacts with hydrochloric acid. C Methyl orange turns yellow in strong hydrochloric acid. D Red litmus paper turns blue when dipped into hydrochloric acid.</p>															
w19-p21-q20	<p>Carbonic acid is a weak acid formed when carbon dioxide dissolves in water.</p> <p>What is the pH of the solution?</p> <p>A 1 B 5 C 7 D 9</p>															
s19-p23-q1	<p>Hydrogen chloride gas ($M_r = 36.5$) is released at P in the apparatus shown.</p> <p>The Universal Indicator paper turns red after 38 s.</p> <div style="text-align: center;"><p>Universal Indicator paper</p></div> <p>The experiment is repeated using sulfur dioxide ($M_r = 64$).</p> <p>What is the result for sulfur dioxide?</p> <table border="1"><thead><tr><th></th><th>Universal Indicator turns</th><th>time for Universal Indicator to change colour / s</th></tr></thead><tbody><tr><td>A</td><td>blue</td><td>26</td></tr><tr><td>B</td><td>blue</td><td>51</td></tr><tr><td>C</td><td>red</td><td>26</td></tr><tr><td>D</td><td>red</td><td>51</td></tr></tbody></table>		Universal Indicator turns	time for Universal Indicator to change colour / s	A	blue	26	B	blue	51	C	red	26	D	red	51
	Universal Indicator turns	time for Universal Indicator to change colour / s														
A	blue	26														
B	blue	51														
C	red	26														
D	red	51														

s19-p23-q38	<p>Which statement about aqueous ethanoic acid is correct?</p> <p>A It reacts with metal carbonates to form salts, hydrogen and water.</p> <p>B It reacts with metal oxides to form salts and oxygen.</p> <p>C It reacts with reactive metals to form salts and hydrogen.</p> <p>D It turns damp red litmus paper blue.</p>																				
s19-p22-q19	<p>Which row shows the difference between a weak acid and a strong acid?</p> <table><tr><th></th><th>weak acid</th><th>strong acid</th></tr><tr><td>A</td><td>fully ionised</td><td>partially ionised</td></tr><tr><td>B</td><td>concentrated</td><td>dilute</td></tr><tr><td>C</td><td>dilute</td><td>concentrated</td></tr><tr><td>D</td><td>partially ionised</td><td>fully ionised</td></tr></table>		weak acid	strong acid	A	fully ionised	partially ionised	B	concentrated	dilute	C	dilute	concentrated	D	partially ionised	fully ionised					
	weak acid	strong acid																			
A	fully ionised	partially ionised																			
B	concentrated	dilute																			
C	dilute	concentrated																			
D	partially ionised	fully ionised																			
s19-p22-q38	<p>What are the properties of aqueous ethanoic acid?</p> <table><tr><th></th><th>decolourises bromine water</th><th>reacts with calcium carbonate to make carbon dioxide</th><th>turns damp red litmus blue</th></tr><tr><td>A</td><td>✓</td><td>✓</td><td>✗</td></tr><tr><td>B</td><td>✓</td><td>✗</td><td>✓</td></tr><tr><td>C</td><td>✗</td><td>✓</td><td>✗</td></tr><tr><td>D</td><td>✗</td><td>✗</td><td>✓</td></tr></table>		decolourises bromine water	reacts with calcium carbonate to make carbon dioxide	turns damp red litmus blue	A	✓	✓	✗	B	✓	✗	✓	C	✗	✓	✗	D	✗	✗	✓
	decolourises bromine water	reacts with calcium carbonate to make carbon dioxide	turns damp red litmus blue																		
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B	✓	✗	✓																		
C	✗	✓	✗																		
D	✗	✗	✓																		
s19-p21-q19	<p>Ethanoic acid is a weak acid.</p> <p>Hydrochloric acid is a strong acid.</p> <p>Which statements are correct?</p> <ol style="list-style-type: none">1 Ethanoic acid molecules are partially dissociated into ions.2 1.0 mol/dm³ ethanoic acid has a higher pH than 1.0 mol/dm³ hydrochloric acid.3 Ethanoic acid is always more dilute than hydrochloric acid.4 Ethanoic acid is a proton acceptor. <p>A 1 and 2 B 1 and 3 C 2 and 4 D 3 and 4</p>																				

s19-p21-q38	<p>Which statements about aqueous ethanoic acid are correct?</p> <ol style="list-style-type: none">1 Ethanoic acid contains the functional group -COOH.2 Ethanoic acid reacts with carbonates to produce hydrogen.3 Ethanoic acid turns Universal Indicator paper blue.4 Ethanoic acid has a pH lower than pH 7. <p>A 1 and 2 B 1 and 3 C 1 and 4 D 2 and 4</p>															
w18-p23-q19	<p>Solution Q is warmed with ammonium chloride.</p> <p>In a separate experiment, solution Q is added to methyl orange.</p> <p>Which observations show that solution Q is basic?</p> <table><tr><th></th><th>warmed with ammonium chloride</th><th>added to methyl orange</th></tr><tr><td>A</td><td>gas is produced</td><td>turns red</td></tr><tr><td>B</td><td>gas is produced</td><td>turns yellow</td></tr><tr><td>C</td><td>no reaction</td><td>turns red</td></tr><tr><td>D</td><td>no reaction</td><td>turns yellow</td></tr></table>		warmed with ammonium chloride	added to methyl orange	A	gas is produced	turns red	B	gas is produced	turns yellow	C	no reaction	turns red	D	no reaction	turns yellow
	warmed with ammonium chloride	added to methyl orange														
A	gas is produced	turns red														
B	gas is produced	turns yellow														
C	no reaction	turns red														
D	no reaction	turns yellow														
w18-p22-q18	<p>When dilute sulfuric acid is added to solid X, a colourless solution is formed and a gas is produced.</p> <p>What is X?</p> <p>A copper(II) oxide B sodium oxide C copper(II) carbonate D sodium carbonate</p>															
w18-p22-q19	<p>A few drops of methyl orange are added to a reaction mixture.</p> <p>During the reaction, a gas is produced and the methyl orange turns from red to orange.</p> <p>What are the reactants?</p> <p>A aqueous sodium hydroxide and ammonium chloride B aqueous sodium hydroxide and calcium carbonate C dilute hydrochloric acid and magnesium D dilute hydrochloric acid and aqueous sodium hydroxide</p>															

w18-p21-q19	<p>Potassium hydroxide is a base.</p> <p>Which statement describes a reaction of potassium hydroxide?</p> <p>A Chlorine is formed when it is heated with ammonium chloride.</p> <p>B It turns Universal Indicator green.</p> <p>C It reacts with an acid to produce a salt and water.</p> <p>D It turns methyl orange red.</p>
s18-p23-q18	<p>The equation represents an equilibrium in aqueous ammonia.</p> $\text{NH}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{NH}_4^+(\text{aq}) + \text{OH}^-(\text{aq})$ <p>How does aqueous ammonia behave in this reaction?</p> <p>A as a strong acid</p> <p>B as a strong base</p> <p>C as a weak acid</p> <p>D as a weak base</p>
s18-p23-q20 s18-p22-q20 s18-p21-q20	<p>Which methods are suitable for preparing both zinc sulfate and copper(II) sulfate?</p> <ol style="list-style-type: none"> 1 reacting the metal oxide with warm dilute aqueous sulfuric acid 2 reacting the metal with dilute aqueous sulfuric acid 3 reacting the metal carbonate with dilute aqueous sulfuric acid <p>A 1, 2 and 3 B 1 and 2 only C 1 and 3 only D 2 and 3 only</p>
s18-p22-q18	<p>Which statement about acids and bases is correct?</p> <p>A A base is a donor of hydrogen ions.</p> <p>B An acid is an acceptor of protons.</p> <p>C A strong acid is fully ionised in aqueous solution.</p> <p>D A weak acid cannot be used to neutralise a strong base.</p>

s18-p21-q18

Which solution has the lowest pH?

A 0.1 mol/dm³ ammonia solution

B 0.1 mol/dm³ ethanoic acid

C 0.1 mol/dm³ lithium hydroxide

D 0.1 mol/dm³ nitric acid

m18-p22-q17

Ethanoic acid reacts with water to produce an acidic solution.

Which row describes the roles of ethanoic acid and water in this reaction?

	ethanoic acid	water
A	accepts a proton	donates a proton
B	accepts an electron	donates an electron
C	donates a proton	accepts a proton
D	donates an electron	accepts an electron

m18-p22-q20

Which method is used to make the salt copper(II) sulfate?

A dilute acid + alkali

B dilute acid + carbonate

C dilute acid + metal

D dilute acid + non-metal oxide

m18-p22-q34

The diagram shows the pH values of the soil in two parts of a garden, X and Y.

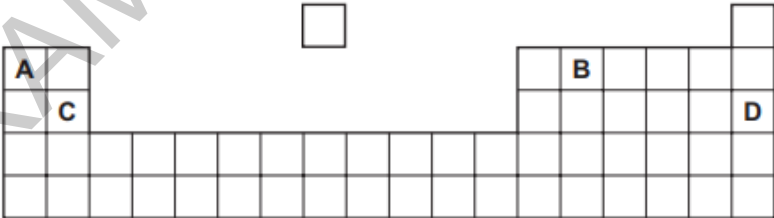
X pH 7.0	Y pH 5.5
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Lime is used to neutralise the soil in one part of the garden.

To which part of the garden should the lime be added and why?

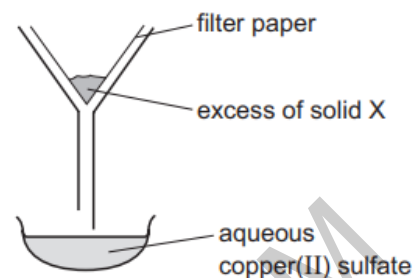
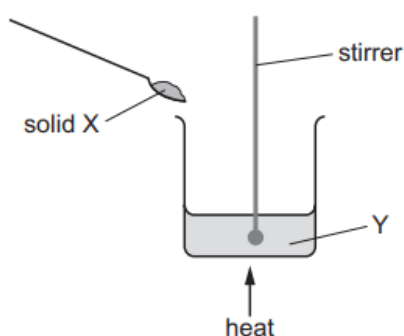
	part of the garden	because lime is
A	X	acidic
B	X	basic
C	Y	acidic
D	Y	basic

Topic	7. Acid, Bases and Salts															
	7.2 Oxides															
Content	<div>1. Classify oxides as acidic, including SO₂ and CO₂, or basic, including CuO and CaO, related to metallic and non-metallic character Supplement</div> <div>2. Describe amphoteric oxides as oxides that react with acids and with bases to produce a salt and water</div> <div>3. Classify Al₂O₃ and ZnO as amphoteric oxide</div>															
m22-p22-q21	<p>Zinc oxide is an amphoteric oxide.</p> <p>Which types of substances will react with zinc oxide?</p> <p>A acids and bases</p> <p>B acids only</p> <p>C bases only</p> <p>D neither acids nor bases</p>															
w21-p23-q19	<p>Four solid oxides are added to dilute hydrochloric acid and aqueous sodium hydroxide.</p> <p>Which row describes an amphoteric oxide?</p> <table><tr><td></td><td>hydrochloric acid</td><td>sodium hydroxide</td></tr><tr><td>A</td><td>✓</td><td>✓</td></tr><tr><td>B</td><td>X</td><td>✓</td></tr><tr><td>C</td><td>✓</td><td>X</td></tr><tr><td>D</td><td>X</td><td>X</td></tr></table> <p>key</p> <p>✓ = reacts</p> <p>X = does not react</p>		hydrochloric acid	sodium hydroxide	A	✓	✓	B	X	✓	C	✓	X	D	X	X
	hydrochloric acid	sodium hydroxide														
A	✓	✓														
B	X	✓														
C	✓	X														
D	X	X														
Ww21-p22-q18	<p>Oxide 1 is a solid that reacts with dilute hydrochloric acid.</p> <p>Oxide 2 is a gas that reacts with sodium hydroxide solution.</p> <p>What are the formulae of the oxides?</p> <table><tr><td></td><td>oxide 1</td><td>oxide 2</td></tr><tr><td>A</td><td>CaO</td><td>MgO</td></tr><tr><td>B</td><td>MgO</td><td>NO₂</td></tr><tr><td>C</td><td>NO₂</td><td>SO₂</td></tr><tr><td>D</td><td>SO₂</td><td>CaO</td></tr></table>		oxide 1	oxide 2	A	CaO	MgO	B	MgO	NO ₂	C	NO ₂	SO ₂	D	SO ₂	CaO
	oxide 1	oxide 2														
A	CaO	MgO														
B	MgO	NO ₂														
C	NO ₂	SO ₂														
D	SO ₂	CaO														

w21-p21-q18	<p>Which element forms an amphoteric oxide?</p> <p>A aluminium</p> <p>B carbon</p> <p>C magnesium</p> <p>D silicon</p>															
s21-p23-q18 s21-p22-q18 s21-p21-q18	<p>Element X forms an oxide, XO, that neutralises sulfuric acid.</p> <p>Which row describes X and XO?</p> <table><tr><th></th><th>element X</th><th>nature of oxide, XO</th></tr><tr><td>A</td><td>metal</td><td>acidic</td></tr><tr><td>B</td><td>metal</td><td>basic</td></tr><tr><td>C</td><td>non-metal</td><td>acidic</td></tr><tr><td>D</td><td>non-metal</td><td>basic</td></tr></table>		element X	nature of oxide, XO	A	metal	acidic	B	metal	basic	C	non-metal	acidic	D	non-metal	basic
	element X	nature of oxide, XO														
A	metal	acidic														
B	metal	basic														
C	non-metal	acidic														
D	non-metal	basic														
m21-p22-Q19	<p>Part of the Periodic Table is shown.</p> <p>Which element forms an acidic oxide?</p> 															
w20-p23-q23 w20-p22-q23 w20-p21-q23	<p>Zinc oxide is an amphoteric oxide.</p> <p>Which row describes the reactions of zinc oxide?</p> <table><tr><th></th><th>reaction with alkalis</th><th>reaction with acids</th></tr><tr><td>A</td><td>✓</td><td>✓</td></tr><tr><td>B</td><td>✓</td><td>x</td></tr><tr><td>C</td><td>x</td><td>✓</td></tr><tr><td>D</td><td>x</td><td>x</td></tr></table>		reaction with alkalis	reaction with acids	A	✓	✓	B	✓	x	C	x	✓	D	x	x
	reaction with alkalis	reaction with acids														
A	✓	✓														
B	✓	x														
C	x	✓														
D	x	x														

s20-p23-q20
s20-p22-q20
s20-p21-q20

The apparatus shown is used to prepare aqueous copper(II) sulfate.



What are X and Y?

	X	Y
A	copper	aqueous iron(II) sulfate
B	copper(II) chloride	dilute sulfuric acid
C	copper(II) oxide	dilute sulfuric acid
D	sulfur	aqueous copper(II) chloride

m20-p22-q18

X, Y and Z are oxides of elements in the same row of the Periodic Table.

Some information about each oxide is shown.

oxide	solubility in water	ability to neutralise an acid	ability to neutralise an alkali
X	soluble	x	✓
Y	insoluble	✓	✓
Z	slightly soluble	✓	x

key
✓ = able
x = not able

Which types of oxides are X, Y and Z?

	X	Y	Z
A	acidic	amphoteric	basic
B	amphoteric	basic	basic
C	basic	amphoteric	acidic
D	basic	acidic	amphoteric

m20-p22-q26

Four metals, iron, copper, magnesium and Y, are heated separately with their oxides.

The results are shown.

metal	magnesium oxide	Y oxide	copper oxide	iron oxide
Y	x	x	✓	✓
magnesium	x	✓	✓	✓
copper	x	x	x	x
iron	x	x	x	x

key

✓ = reacts

x = no reaction

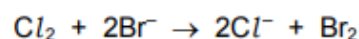
What is the order of reactivity of the metals, least reactive first?

	least reactive \longrightarrow most reactive			
A	copper	iron	Y	magnesium
B	copper	Y	iron	magnesium
C	magnesium	iron	Y	copper
D	magnesium	Y	iron	copper

w19-p23-q19

Chlorine displaces bromine from aqueous potassium bromide.

The ionic equation for the reaction is shown.



Which statement about this reaction is correct?

- A** Bromide ions act as an oxidising agent.
- B** Bromide ions are oxidised when electrons are lost.
- C** Chlorine acts as a reducing agent.
- D** Chlorine is reduced when electrons are lost.

w19-p23-q28

Which word equation represents a reaction which occurs?

- A** sodium oxide + carbon \rightarrow sodium + carbon dioxide
- B** sodium oxide + iron \rightarrow sodium + iron(II) oxide
- C** iron(II) oxide + copper \rightarrow iron + copper(II) oxide
- D** iron(III) oxide + carbon \rightarrow iron + carbon dioxide

w19-p22-q19	<p>Which oxide is classified as an amphoteric oxide?</p> <p>A aluminium oxide</p> <p>B calcium oxide</p> <p>C copper(II) oxide</p> <p>D nitrogen oxide</p>															
w19-p21-q19	<p>Which statement about amphoteric oxides is correct?</p> <p>A They are made by combining an acidic oxide with a basic oxide.</p> <p>B They react with water to give a solution of pH 7.</p> <p>C They react with both acids and bases.</p> <p>D They do not react with acids or bases.</p>															
s19-p23-q17	<p>Which statement about carbon monoxide and aluminium oxide is correct?</p> <p>A Carbon monoxide and aluminium oxide are both amphoteric.</p> <p>B Carbon monoxide and aluminium oxide are both neutral.</p> <p>C Carbon monoxide is amphoteric but aluminium oxide is neutral.</p> <p>D Carbon monoxide is neutral but aluminium oxide is amphoteric.</p>															
s19-p22-q17	<p>Which type of oxide are carbon monoxide and aluminium oxide?</p> <table><tr><td></td><td>carbon monoxide</td><td>aluminium oxide</td></tr><tr><td>A</td><td>acidic</td><td>amphoteric</td></tr><tr><td>B</td><td>acidic</td><td>basic</td></tr><tr><td>C</td><td>neutral</td><td>amphoteric</td></tr><tr><td>D</td><td>neutral</td><td>basic</td></tr></table>		carbon monoxide	aluminium oxide	A	acidic	amphoteric	B	acidic	basic	C	neutral	amphoteric	D	neutral	basic
	carbon monoxide	aluminium oxide														
A	acidic	amphoteric														
B	acidic	basic														
C	neutral	amphoteric														
D	neutral	basic														

s19-p21-q17	<p>Nitrogen(I) oxide, N_2O, nitrogen(II) oxide, NO, and carbon monoxide, CO, are all non-metal oxides.</p> <p>They do not react with acids or bases.</p> <p>Which statement is correct?</p> <p>A They are acidic oxides.</p> <p>B They are amphoteric oxides.</p> <p>C They are basic oxides.</p> <p>D They are neutral oxides.</p>															
m19-p22-q21	<p>Which statement describes a chemical property of aluminium oxide, Al_2O_3?</p> <p>A It reacts with acids but not with bases.</p> <p>B It reacts with acids and bases.</p> <p>C It reacts with bases but not with acids.</p> <p>D It reacts with water.</p>															
m19-p22-q27	<p>In which reaction does Fe(s) form ions when the mixture is heated?</p> <p>A $\text{Fe(s)} + \text{CaO(s)}$</p> <p>B $\text{Fe(s)} + \text{MgO(s)}$</p> <p>C $\text{Fe(s)} + \text{ZnO(s)}$</p> <p>D $\text{Fe(s)} + \text{CuO(s)}$</p>															
w18-p23-q17	<p>The results of some experiments with sulfur dioxide are shown.</p> <table><tr><th>experiment</th><th>description</th><th>result</th></tr><tr><td>1</td><td>mix with dilute hydrochloric acid</td><td>does not react</td></tr><tr><td>2</td><td>mix with concentrated sodium hydroxide</td><td>a salt forms</td></tr><tr><td>3</td><td>add Universal Indicator</td><td>Universal Indicator turns purple</td></tr><tr><td>4</td><td>add acidified aqueous potassium manganate(VII)</td><td>purple solution turns colourless</td></tr></table> <p>Which results are correct?</p> <p>A 1, 2 and 4 B 2, 3 and 4 C 1 and 2 only D 3 and 4 only</p>	experiment	description	result	1	mix with dilute hydrochloric acid	does not react	2	mix with concentrated sodium hydroxide	a salt forms	3	add Universal Indicator	Universal Indicator turns purple	4	add acidified aqueous potassium manganate(VII)	purple solution turns colourless
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w18-p22-q17	<p>In which row are the oxides correctly identified?</p> <table><tr><th></th><th>acidic</th><th>basic</th></tr><tr><td>A</td><td>magnesium oxide, calcium oxide</td><td>sulfur dioxide, carbon dioxide</td></tr><tr><td>B</td><td>magnesium oxide, sulfur dioxide</td><td>carbon dioxide, calcium oxide</td></tr><tr><td>C</td><td>sulfur dioxide, carbon dioxide</td><td>calcium oxide, magnesium oxide</td></tr><tr><td>D</td><td>sulfur dioxide, magnesium oxide</td><td>calcium oxide, carbon dioxide</td></tr></table>		acidic	basic	A	magnesium oxide, calcium oxide	sulfur dioxide, carbon dioxide	B	magnesium oxide, sulfur dioxide	carbon dioxide, calcium oxide	C	sulfur dioxide, carbon dioxide	calcium oxide, magnesium oxide	D	sulfur dioxide, magnesium oxide	calcium oxide, carbon dioxide																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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w18-p21-q17	<p>Part of the Periodic Table is shown.</p> <p>Which element forms an oxide that reacts with dilute acid to form a salt and water?</p> 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Topic	<u>7. Acid, Bases and Salts</u> 7.3 Preparation of salts															
Content	<ol style="list-style-type: none">Describe the preparation, separation and purification of soluble salts by reaction of an acid with:<ol style="list-style-type: none">an alkali by titrationexcess metalexcess insoluble baseexcess insoluble carbonateDescribe the general solubility rules for salts:<ol style="list-style-type: none">sodium, potassium and ammonium salts are solublenitrate are solublechlorides are soluble, except lead and silversulfates are soluble, except barium, calcium and leadcarbonates are insoluble, except sodium, potassium and ammoniumhydroxides are insoluble, except sodium, potassium, ammonium and calcium (partially)Define a hydrated substance as a substance that is chemically combined with water and an anhydrous substance as a substance containing no waterDescribe the preparation of insoluble salts by precipitationDefine the term water of crystallisation as the water molecules present in hydrated crystals, including $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ and $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$															
m22-p22-q22	<p>Information about some silver compounds is shown.</p> <table><tr><th>compound</th><th>formula</th><th>solubility in water</th></tr><tr><td>silver carbonate</td><td>Ag_2CO_3</td><td>insoluble</td></tr><tr><td>silver chloride</td><td>AgCl</td><td>insoluble</td></tr><tr><td>silver nitrate</td><td>AgNO_3</td><td>soluble</td></tr><tr><td>silver oxide</td><td>Ag_2O</td><td>insoluble</td></tr></table> <p>Which equation shows a reaction which cannot be used to make a silver salt?</p> <p>A $\text{AgNO}_3(\text{aq}) + \text{HCl}(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{HNO}_3(\text{aq})$</p> <p>B $\text{Ag}_2\text{O}(\text{s}) + 2\text{HNO}_3(\text{aq}) \rightarrow 2\text{AgNO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l})$</p> <p>C $\text{Ag}_2\text{CO}_3(\text{s}) + 2\text{HNO}_3(\text{aq}) \rightarrow 2\text{AgNO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$</p> <p>D $2\text{Ag}(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow 2\text{AgCl}(\text{s}) + \text{H}_2(\text{g})$</p>	compound	formula	solubility in water	silver carbonate	Ag_2CO_3	insoluble	silver chloride	AgCl	insoluble	silver nitrate	AgNO_3	soluble	silver oxide	Ag_2O	insoluble
compound	formula	solubility in water														
silver carbonate	Ag_2CO_3	insoluble														
silver chloride	AgCl	insoluble														
silver nitrate	AgNO_3	soluble														
silver oxide	Ag_2O	insoluble														
w21-p22-q22	<p>All metal nitrates are soluble in water.</p> <p>All metal chlorides are soluble except silver and lead.</p> <p>All metal carbonates are insoluble except sodium and potassium.</p> <p>Which aqueous solutions produce a precipitate when mixed together?</p> <ol style="list-style-type: none">silver nitrate + sodium carbonatesilver nitrate + sodium chloridebarium nitrate + potassium chloride <p>A 1 and 2 only B 1 and 3 only C 2 and 3 only D 1, 2 and 3</p>															

s21-p23-q25

Some metal nitrates and carbonates decompose when heated strongly.

Metal Q has a nitrate that decomposes to give a salt and a colourless gas only.

The carbonate of metal Q does not decompose when heated with a Bunsen burner.

What is metal Q?

- A calcium
- B copper
- C sodium
- D zinc

s21-p22-q19

Information about the solubility of salts is shown.

salt	solubility
chlorides	soluble (except for lead(II) chloride and silver chloride)
nitrates	soluble
sulfates	soluble (except for barium sulfate and lead(II) sulfate)

Aqueous solutions of which two compounds would produce a precipitate when added together?

- A $\text{Ba}(\text{NO}_3)_2$ and CaCl_2
- B CuSO_4 and $\text{Zn}(\text{NO}_3)_2$
- C KCl and Na_2SO_4
- D $\text{Pb}(\text{NO}_3)_2$ and MgSO_4

m21-p22-q17

P is a hydrated metal salt with a blue colour. When P is heated, water is given off, leaving solid Q.

R is a hydrated metal salt with a pink colour. When R is heated, water is given off, leaving solid S.

Which row gives the name of P and the colour of S?

	name of P	colour of S
A	hydrated cobalt(II) chloride	blue
B	hydrated cobalt(II) chloride	white
C	hydrated copper(II) sulfate	blue
D	hydrated copper(II) sulfate	white

w20-p23-q22	<p>An aqueous cation reacts with aqueous sodium hydroxide to form a white precipitate.</p> <p>The precipitate is insoluble in excess sodium hydroxide.</p> <p>What is the aqueous cation?</p> <p>A aluminium ion</p> <p>B calcium ion</p> <p>C chromium ion</p> <p>D zinc ion</p>															
w20-p23-q35	<p>Which calcium compound does not neutralise an acid soil?</p> <p>A calcium oxide</p> <p>B calcium sulfate</p> <p>C calcium hydroxide</p> <p>D calcium carbonate</p>															
w20-p22-q22	<p>The equations for three reactions are shown.</p> <p>1 $\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{KI}(\text{aq}) \rightarrow \text{PbI}_2(\text{s}) + 2\text{KNO}_3(\text{aq})$</p> <p>2 $2\text{AgNO}_3(\text{aq}) + \text{CuI}_2(\text{aq}) \rightarrow \text{Cu}(\text{NO}_3)_2(\text{aq}) + 2\text{AgI}(\text{s})$</p> <p>3 $\text{CuO}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{CuSO}_4(\text{aq}) + \text{H}_2\text{O}(\text{l})$</p> <p>Which reactions are suitable for making a salt by precipitation?</p> <p>A 1 and 2 only B 1 and 3 only C 2 and 3 only D 1, 2 and 3</p>															
s20-p23-q21	<p>Which two compounds would react together to form the insoluble salt lead(II) chloride?</p> <table><tr><th></th><th>compound</th><th>solubility in water</th></tr><tr><td>1</td><td>lead(II) nitrate</td><td>yes</td></tr><tr><td>2</td><td>lead(II) sulfate</td><td>no</td></tr><tr><td>3</td><td>silver chloride</td><td>no</td></tr><tr><td>4</td><td>sodium chloride</td><td>yes</td></tr></table> <p>A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4</p>		compound	solubility in water	1	lead(II) nitrate	yes	2	lead(II) sulfate	no	3	silver chloride	no	4	sodium chloride	yes
	compound	solubility in water														
1	lead(II) nitrate	yes														
2	lead(II) sulfate	no														
3	silver chloride	no														
4	sodium chloride	yes														

s20-p23-q38	<p>A small quantity of a solid chemical is added to a large excess of aqueous ethanoic acid.</p> <p>No bubbles of gas are seen and the solid dissolves to give a colourless solution.</p> <p>What was the solid chemical?</p> <p>A calcium hydroxide B copper(II) oxide C magnesium D sodium carbonate</p>
s20-p22-q21	<p>Which process is not used in the preparation of an insoluble salt?</p> <p>A filtration B washing C crystallisation D drying</p>
s20-p21-q21	<p>Lead(II) sulfate is an insoluble salt.</p> <p>Which method is suitable for obtaining solid lead(II) sulfate?</p> <p>A Mix aqueous lead(II) nitrate and aqueous potassium sulfate, heat to evaporate all of the water, collect the solid and then wash and dry it. B Mix aqueous lead(II) nitrate and aqueous potassium sulfate, filter, collect the filtrate, crystallise, then wash and dry the crystals. C Mix aqueous lead(II) nitrate and dilute sulfuric acid, filter, then wash and dry the residue. D Titrate aqueous lead(II) hydroxide with dilute sulfuric acid, crystallise, then wash and dry the crystals.</p>
w19-p21-q22	<p>Lead(II) sulfate is an insoluble salt.</p> <p>Which process is not used to prepare a pure sample of this salt?</p> <p>A crystallisation B drying C filtration D precipitation</p>

m19-p22-q20	<p>Barium hydroxide is an alkali. It reacts with hydrochloric acid.</p> <p>How does the pH of the hydrochloric acid change as an excess of aqueous barium hydroxide is added?</p> <p>A The pH decreases from pH 14 and becomes constant at pH 7.</p> <p>B The pH decreases from pH 14 to about pH 1.</p> <p>C The pH increases from pH 1 and becomes constant at pH 7.</p> <p>D The pH increases from pH 1 to about pH 14.</p>
m19-p22-q23	<p>Four stages used to prepare an insoluble salt are listed.</p> <ol style="list-style-type: none"> 1 drying 2 filtration 3 precipitation 4 washing <p>In which order are the stages done?</p> <p>A 2 → 1 → 3 → 4</p> <p>B 3 → 2 → 4 → 1</p> <p>C 3 → 4 → 1 → 2</p> <p>D 4 → 3 → 2 → 1</p>
w18-p23-q18	<p>A white precipitate is produced when small amounts of two colourless solutions are mixed together.</p> <p>Which pairs of solutions produce a white precipitate?</p> <ol style="list-style-type: none"> 1 sodium hydroxide and zinc nitrate 2 sodium hydroxide and aluminium chloride 3 barium chloride and sulfuric acid 4 acidified barium nitrate and potassium sulfate <p>A 1, 2, 3 and 4</p> <p>B 1, 2 and 4 only</p> <p>C 1 and 2 only</p> <p>D 2 only</p>

w18-p23-q20	<p>Some general rules for the solubility of salts in water are listed.</p> <ul style="list-style-type: none">Carbonates are insoluble (except ammonium carbonate, potassium carbonate and sodium carbonate).Chlorides are soluble (except lead(II) chloride and silver chloride).Nitrates are soluble.Sulfates are soluble (except barium sulfate, calcium sulfate and lead(II) sulfate). <p>Which substances produce an insoluble salt when aqueous solutions of them are mixed?</p> <p>A barium chloride and magnesium nitrate B calcium chloride and ammonium nitrate C silver nitrate and zinc chloride D sodium carbonate and potassium sulfate</p>															
w18-p22-q20 w18-p21-q20	<p>Some general rules for the solubility of salts in water are listed.</p> <ul style="list-style-type: none">Carbonates are insoluble (except ammonium carbonate, potassium carbonate and sodium carbonate).Chlorides are soluble (except lead(II) chloride and silver chloride).Nitrates are soluble.Sulfates are soluble (except barium sulfate, calcium sulfate and lead(II) sulfate). <p>Which substances produce an insoluble salt when aqueous solutions of them are mixed?</p> <p>A barium chloride and magnesium nitrate B calcium chloride and ammonium nitrate C silver nitrate and zinc chloride D sodium carbonate and potassium sulfate</p>															
s18-p23-q19	<p>An excess of aqueous sodium sulfate was added to aqueous barium chloride and the mixture was filtered.</p> <p>Which row shows the identity of the residue and the substances present in the filtrate?</p> <table><tr><th></th><th>residue</th><th>substances in filtrate</th></tr><tr><td>A</td><td>barium sulfate</td><td>barium chloride and sodium chloride</td></tr><tr><td>B</td><td>barium sulfate</td><td>sodium chloride and sodium sulfate</td></tr><tr><td>C</td><td>sodium chloride</td><td>barium chloride and sodium sulfate</td></tr><tr><td>D</td><td>sodium chloride</td><td>barium sulfate and sodium sulfate</td></tr></table>		residue	substances in filtrate	A	barium sulfate	barium chloride and sodium chloride	B	barium sulfate	sodium chloride and sodium sulfate	C	sodium chloride	barium chloride and sodium sulfate	D	sodium chloride	barium sulfate and sodium sulfate
	residue	substances in filtrate														
A	barium sulfate	barium chloride and sodium chloride														
B	barium sulfate	sodium chloride and sodium sulfate														
C	sodium chloride	barium chloride and sodium sulfate														
D	sodium chloride	barium sulfate and sodium sulfate														

s18-p22-q19

The solubility of some salts is shown.

	chloride	nitrate	sulfate	carbonate
barium	soluble	soluble	insoluble	insoluble
lead(II)	insoluble	soluble	insoluble	insoluble
potassium	soluble	soluble	soluble	soluble
zinc	soluble	soluble	soluble	insoluble

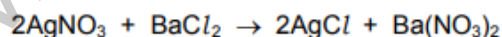
Which two aqueous solutions produce an insoluble salt when mixed together?

- A** barium chloride and zinc nitrate
- B** barium nitrate and lead(II) nitrate
- C** lead(II) nitrate and potassium carbonate
- D** potassium nitrate and zinc sulfate

s18-p21-q19

A student mixes silver nitrate and barium chloride to form a white precipitate of silver chloride.

The equation is shown.



Which row describes the solubility of the salts?

	soluble	insoluble
A	silver nitrate	barium chloride, barium nitrate and silver chloride
B	silver nitrate and barium chloride	barium nitrate and silver chloride
C	silver nitrate, barium chloride and barium nitrate	silver chloride
D	silver nitrate, barium chloride and silver chloride	barium nitrate

Topic	<p style="text-align: center;"><u>8. The Periodic Table</u></p> <p style="text-align: center;">8.1 Arrangement of elements</p>
Content	<ol style="list-style-type: none"> 1. Describe the Periodic Table as an arrangement of elements in periods and groups and in order of increasing proton number/ atomic number 2. Describe the change from metallic to non-metallic character across a period 3. Describe the relationship between group number and the charge of the ions formed from elements in that group 4. Explain similarities in the chemical properties of elements in the same group of the Periodic Table in terms of their electronic configuration 5. Explain how the position of an element in the Periodic Table can be used to predict its properties 6. Identify trends in groups, given information about the elements
w21-p21-q20	<p>Moving from right to left across the Periodic Table the elements show increasing metallic character.</p> <p>Why does metallic character increase from right to left across a period?</p> <p>A The atoms have more electrons in their outer shells.</p> <p>B The atoms more readily gain electrons to form negative ions.</p> <p>C The atoms more readily lose electrons to form positive ions.</p> <p>D The charge on the nucleus of each atom gets larger.</p>
s21-p22-q22	<p>Which statement about the trends shown by the elements of Period 3 in the Periodic Table is not correct?</p> <p>A The elements become less metallic across the period.</p> <p>B The group number increases across the period.</p> <p>C The number of electron shells increases across the period.</p> <p>D The number of outer electrons increases across the period.</p>
m21-p22-q10	<p>A compound has the formula XF_2 and has a relative mass of 70.</p> <p>What is element X?</p> <p>A gallium</p> <p>B germanium</p> <p>C sulfur</p> <p>D ytterbium</p>

w20-p23-q20	<p>Period 3 of the Periodic Table contains the elements sodium to argon.</p> <p>Element Q is a non-metal from this period.</p> <p>Which statement about Q is correct?</p> <p>A It conducts electricity.</p> <p>B It has a lower proton number than sodium.</p> <p>C It has electrons in only three shells.</p> <p>D It is malleable.</p>																									
w20-p22-q26	<p>A new element oxfordium, Ox, was discovered with the following properties.</p> <table><tr><td>solubility</td><td>electrical conduction</td><td>formula of element</td><td>bonding in a molecule of Ox₂</td></tr><tr><td>insoluble in water</td><td>doesn't conduct</td><td>Ox₂</td><td>Ox≡Ox</td></tr></table> <p>In which group of the Periodic Table should the new element be placed?</p> <p>A Group III</p> <p>B Group V</p> <p>C Group VII</p> <p>D Group VIII</p>	solubility	electrical conduction	formula of element	bonding in a molecule of Ox ₂	insoluble in water	doesn't conduct	Ox ₂	Ox≡Ox																	
solubility	electrical conduction	formula of element	bonding in a molecule of Ox ₂																							
insoluble in water	doesn't conduct	Ox ₂	Ox≡Ox																							
s20-p23-q23 s20-p22-q23 s20-p21-q23	<p>The properties of the element titanium, Ti, can be predicted from its position in the Periodic Table.</p> <p>Which row identifies the properties of titanium?</p> <table><tr><td></td><td>can be used as a catalyst</td><td>conducts electricity when solid</td><td>has low density</td><td>forms coloured compounds</td></tr><tr><td>A</td><td>✓</td><td>✓</td><td>✓</td><td>x</td></tr><tr><td>B</td><td>✓</td><td>✓</td><td>x</td><td>✓</td></tr><tr><td>C</td><td>✓</td><td>x</td><td>✓</td><td>✓</td></tr><tr><td>D</td><td>x</td><td>✓</td><td>✓</td><td>✓</td></tr></table>		can be used as a catalyst	conducts electricity when solid	has low density	forms coloured compounds	A	✓	✓	✓	x	B	✓	✓	x	✓	C	✓	x	✓	✓	D	x	✓	✓	✓
	can be used as a catalyst	conducts electricity when solid	has low density	forms coloured compounds																						
A	✓	✓	✓	x																						
B	✓	✓	x	✓																						
C	✓	x	✓	✓																						
D	x	✓	✓	✓																						
s20-p21-q22	<p>A Group I metal (lithium, sodium or potassium) is reacted with a Group VII element (chlorine, bromine or iodine).</p> <p>Which compound is formed when the Group I metal of highest density reacts with the Group VII element of lowest density?</p> <p>A lithium chloride</p> <p>B potassium chloride</p> <p>C potassium iodide</p> <p>D lithium iodide</p>																									

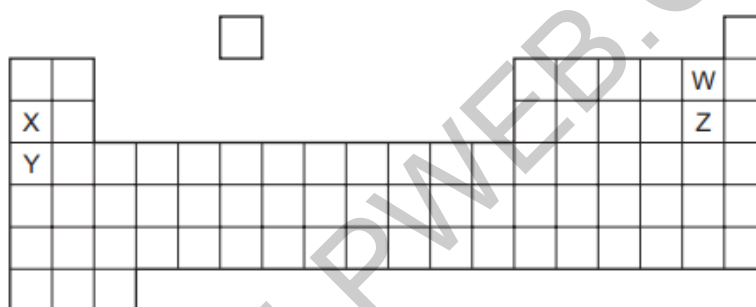
m20-p22-q22

Which statement about the Periodic Table is correct?

- A** Most metallic elements are on the left.
- B** Elements in the same period have the same number of outer electrons.
- C** Elements on the left are usually gases.
- D** The relative atomic mass of the elements increases from right to left.

m20-p22-q23

The diagram shows elements W, X, Y and Z in a section of the Periodic Table.



Which statement about the reactivity of the elements is correct?

- A** X is more reactive than Y, and W is more reactive than Z.
- B** X is more reactive than Y, and Z is more reactive than W.
- C** Y is more reactive than X, and W is more reactive than Z.
- D** Y is more reactive than X, and Z is more reactive than W.

w19-p23-q26

Some properties of substance X are listed.

- It conducts electricity when molten.
- It has a high melting point.
- It burns in oxygen and the oxide dissolves in water to give a solution with pH 11.

What is X?

- A** a covalent compound
B a macromolecule
C a metal
D an ionic compound

w19-p21-q23

Part of the Periodic Table is shown.

Which element is used to provide an inert atmosphere?

A simplified periodic table with 18 columns and 4 rows. The elements are labeled A, B, C, and D. A is in the top row, 10th column. B is in the second row, 16th column. C is in the third row, 18th column. D is in the fourth row, 11th column.

s19-p23-q18

The positions of elements W, X, Y and Z in the Periodic Table are shown.

Diagram 1 shows the periodic table with elements W, X, Y and Z marked.

Which elements form basic oxides?

A W, X and Y **B** W and X only **C** Y only **D** Z only

s19-p23-q20

Part of the Periodic Table is shown.

Diagram 1: A simplified periodic table with 18 columns and 4 rows. The elements are arranged as follows:

The elements are labeled as follows:

- X is in the 2nd column, 3rd row.
- Y is in the 10th column, 3rd row.
- Z is in the 18th column, 3rd row.
- W is in the 13th column, 2nd row.

Which row describes W, X, Y and Z?

	metal	non-metal
A	X	W, Y and Z
B	X and Y	W and Z
C	W and Z	X and Y
D	W, Y and Z	X

s19-p23-q24

Magnesium nitrate, magnesium hydroxide and magnesium carbonate all decompose when heated.

Which statement about these decomposition reactions is correct?

- A** Magnesium carbonate decomposes to release carbon dioxide and oxygen.
- B** Magnesium hydroxide decomposes to release hydrogen and oxygen.
- C** Magnesium hydroxide decomposes to release water vapour.
- D** Magnesium nitrate decomposes to release oxygen only.

s19-p22-q18
s19-p21-q18

The positions of elements W, X, Y and Z in the Periodic Table are shown.

Which elements form basic oxides?

- A** W, X and Y
- B** W and X only
- C** Y only
- D** Z only

s19-p22-q20

Part of the Periodic Table is shown.

Which row describes the properties of X, Y and Z?

	good conductor of electricity	high melting point
A	X	Z
B	Y	Z and X
C	Y and Z	Z
D	Z and X	X

s19-p21-q20

The properties of an element are shown.

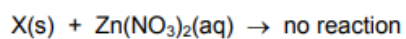
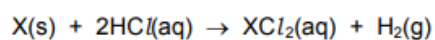
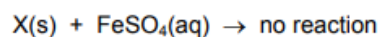
electrical conductivity	density	reaction with water
high	low	reacts violently with cold water

Which element has these properties?

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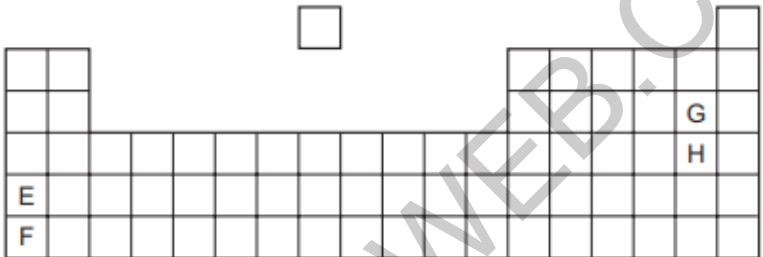
m18-p22-q26

A sample of solid X was added to three different solutions to predict the position of X in the reactivity series.



Which other solution would react with solid X?

- A** $\text{CaSO}_4(\text{aq})$ **B** $\text{CuSO}_4(\text{aq})$ **C** $\text{MgSO}_4(\text{aq})$ **D** $\text{Na}_2\text{SO}_4(\text{aq})$

Topic	<p align="center">8. The Periodic Table</p> <p align="center">8.2 Group I properties</p>
<p>Content</p>	<p>1. Describe the Group I alkali metals, lithium, sodium and potassium, as relatively soft metals with general trends down the group, limited to:</p> <ul style="list-style-type: none"> (a) decreasing melting point (b) increasing density (c) increasing reactivity <p>2. Predict the properties of other elements in Group I, given information about the elements</p>
<p>s21-p22-q23</p>	<p>The diagram shows the positions of elements E, F, G and H in the Periodic Table.</p>  <p>Which statements about elements E, F, G and H are correct?</p> <ul style="list-style-type: none"> 1 E has a higher density than F. 2 E has a higher melting point than F. 3 G has a darker colour than H. 4 G has a lower melting point than H. <p>A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4</p>
<p>s21-p22-q26</p>	<p>Some metal nitrates and carbonates decompose when heated strongly.</p> <p>Metal Q has a nitrate that decomposes to give a salt and a colourless gas only.</p> <p>The carbonate of metal Q does not decompose when heated with a Bunsen burner.</p> <p>What is metal Q?</p> <ul style="list-style-type: none"> A calcium B copper C sodium D zinc

s21-p21-q25

Some properties of metal J are listed.

- J does not react with cold water.
- J reacts with dilute hydrochloric acid.
- No reaction occurs when the oxide of J is heated with carbon.

What is J?

- A** copper
B iron
C magnesium
D sodium

m21-p22-q23

The table gives some properties of Group IV elements.

element	density g/cm ³	boiling point /°C
carbon	2.2	4827
silicon		
germanium	5.3	2830
tin	5.8	2270
lead	11.3	1755

Which row describes the properties of silicon?

	density g/cm ³	boiling point /°C
A	2.3	3 265
B	3.1	1 997
C	6.2	2 920
D	24.6	11 682

m21-p22-q24

The metal beryllium does not react with cold water.

It reacts with hydrochloric acid but cannot be extracted from its ore by using carbon.

Where is beryllium placed in the reactivity series?

magnesium

A

zinc

B

iron

C

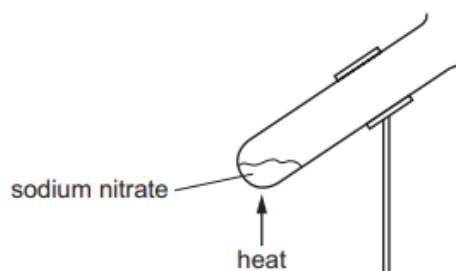
copper

D

w20-p23-q26	<p>Elements in Group II of the Periodic Table show the same trends in their reaction with water and their density as Group I.</p> <p>Which row shows how the properties of barium compare with calcium?</p> <table><tr><td></td><td>reaction with water</td><td>density</td></tr><tr><td>A</td><td>faster</td><td>higher</td></tr><tr><td>B</td><td>faster</td><td>lower</td></tr><tr><td>C</td><td>slower</td><td>higher</td></tr><tr><td>D</td><td>slower</td><td>lower</td></tr></table>		reaction with water	density	A	faster	higher	B	faster	lower	C	slower	higher	D	slower	lower
	reaction with water	density														
A	faster	higher														
B	faster	lower														
C	slower	higher														
D	slower	lower														
s20-p23-q22	<p>The elements in Group I include lithium, sodium and potassium.</p> <p>Which statements about these elements are correct?</p> <ol style="list-style-type: none">1 Sodium is denser than lithium.2 Lithium has a lower melting point than potassium.3 Potassium is a relatively soft metal.4 Sodium is less reactive than lithium but more reactive than potassium. <p>A 1 and 2 B 1 and 3 C 2 and 4 D 3 and 4</p>															
s20-p23-q26	<p>A salt is heated strongly. The only products are a white solid and a colourless gas.</p> <p>What is the salt?</p> <p>A copper(II) carbonate B potassium carbonate C calcium nitrate D sodium nitrate</p>															
s20-p22-q22	<p>Which statement about Group I and Group VII elements is correct?</p> <p>A Group VII elements are monoatomic non-metals. B Lithium is more reactive with water than caesium. C The melting points of Group I metals increase down the group. D Potassium bromide reacts with chlorine to produce an orange solution.</p>															

s20-p21-q26

Sodium nitrate is a white crystalline solid that decomposes on heating.



Which row describes the decomposition products formed when sodium nitrate is heated strongly?

	solid products	gaseous products
A	sodium nitrite	NO_2 and O_2
B	sodium nitrite	O_2 only
C	sodium oxide	NO_2 and O_2
D	sodium oxide	O_2 only

m20-p22-q25

Sodium is a Group I metal.

Which property, that is typical of most metals, is **not** shown by sodium?

- A** conductor of heat
- B** high melting point
- C** malleable
- D** shiny

s19-p22-q21

The melting points and boiling points of the elements of Group I of the Periodic Table are shown.

element	melting point / $^{\circ}\text{C}$	boiling point / $^{\circ}\text{C}$
lithium	181	1330
sodium	98	883
potassium	63	759
rubidium	39	688
caesium	28	671

Which pair of elements are liquid at 800°C ?

- A** caesium and rubidium
- B** potassium and sodium
- C** lithium and sodium
- D** potassium and caesium

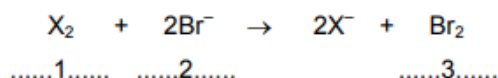
s19-p21-q21	<p>Which statement about elements in Group I and Group VII of the Periodic Table is correct?</p> <p>A Bromine reacts with potassium chloride to produce chlorine.</p> <p>B Iodine is a monatomic non-metal.</p> <p>C Lithium has a higher melting point than potassium.</p> <p>D Sodium is more reactive with water than potassium.</p>															
m19-p22-q29	<p>Which metal carbonate does not produce carbon dioxide when it is heated?</p> <p>A copper(II) carbonate</p> <p>B iron(II) carbonate</p> <p>C potassium carbonate</p> <p>D zinc carbonate</p>															
w18-p23-q21	<p>Elements in Group I of the Periodic Table react with water.</p> <p>Which row describes the products made in the reaction and the trend in reactivity of the elements?</p> <table><tr><th></th><th>products</th><th>trend in reactivity</th></tr><tr><td>A</td><td>metal hydroxide and hydrogen</td><td>less reactive down the group</td></tr><tr><td>B</td><td>metal hydroxide and hydrogen</td><td>more reactive down the group</td></tr><tr><td>C</td><td>metal oxide and hydrogen</td><td>less reactive down the group</td></tr><tr><td>D</td><td>metal oxide and hydrogen</td><td>more reactive down the group</td></tr></table>		products	trend in reactivity	A	metal hydroxide and hydrogen	less reactive down the group	B	metal hydroxide and hydrogen	more reactive down the group	C	metal oxide and hydrogen	less reactive down the group	D	metal oxide and hydrogen	more reactive down the group
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Topic	8. The Periodic Table																																				
	8.3 Group VII properties																																				
Content	<div>1. Describe the Group VII halogens, chlorine, bromine and iodine, as diatomic non-metals with general trends down the group, limited to:<div>(a) increasing density</div><div>(b) decreasing reactivity</div></div> <div>2. State the appearance of the halogens at r.t.p. as:<div>(a) chlorine, a pale yellow-green gas</div><div>(b) bromine, a red-brown liquid</div><div>(c) iodine, a grey-black solid</div></div> <div>3. Describe and explain the displacement reactions of halogens with other halide ions</div> <div>4. Predict the properties of other elements in Group VII, given information about the elements</div>																																				
w21-p22-q12	<div>Chlorine gas is bubbled into aqueous potassium iodide.</div> <div>What is the ionic equation for the reaction that takes place?</div> <div>A $\text{Cl} + \text{I}^- \rightarrow \text{Cl}^- + \text{I}$</div> <div>B $\text{Cl}_2 + 2\text{I}^- \rightarrow \text{Cl}_2^- + \text{I}_2$</div> <div>C $\text{Cl}_2 + 2\text{I}^- \rightarrow 2\text{Cl}^- + \text{I}_2$</div> <div>D $\text{Cl}_2 + 2\text{I}^- \rightarrow 2\text{Cl}^- + 2\text{I}$</div>																																				
w21-p21-q22	<div>Group VII elements show trends in their physical properties going down the group.</div> <table><tr><td>element</td><td>X</td><td>Y</td><td>Z</td></tr><tr><td>chlorine</td><td>−101</td><td>−34</td><td>0.003</td></tr><tr><td>bromine</td><td>−7</td><td>59</td><td>3.1</td></tr><tr><td>iodine</td><td>114</td><td>184</td><td>4.9</td></tr></table> <div>Which row shows the missing headings for the properties in the table?</div> <table><tr><td></td><td>X</td><td>Y</td><td>Z</td></tr><tr><td>A</td><td>density in g / cm³</td><td>boiling point in °C</td><td>melting point in °C</td></tr><tr><td>B</td><td>melting point in °C</td><td>boiling point in °C</td><td>density in g / cm³</td></tr><tr><td>C</td><td>boiling point in °C</td><td>density in g / cm³</td><td>melting point in °C</td></tr><tr><td>D</td><td>boiling point in °C</td><td>melting point in °C</td><td>density in g / cm³</td></tr></table>	element	X	Y	Z	chlorine	−101	−34	0.003	bromine	−7	59	3.1	iodine	114	184	4.9		X	Y	Z	A	density in g / cm ³	boiling point in °C	melting point in °C	B	melting point in °C	boiling point in °C	density in g / cm ³	C	boiling point in °C	density in g / cm ³	melting point in °C	D	boiling point in °C	melting point in °C	density in g / cm ³
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w20-p23-q25	<div>Which statement about the halogens and their compounds is correct?</div> <div>A The colour of the element gets lighter going down Group VII.</div> <div>B The elements get less dense going down Group VII.</div> <div>C When chlorine is added to sodium iodide solution, iodine is formed.</div> <div>D When iodine is added to sodium bromide solution, bromine is formed.</div>																																				

w20-p21-q26	<p>The positions of four elements in the Periodic Table are shown.</p> <p>Which element is a gas that displaces iodine from sodium iodide?</p> <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><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w18-p22-q22
w18-p21-q22

The equation shows the reaction between a halogen and aqueous bromide ions.



Which words complete gaps 1, 2 and 3?

	1	2	3
A	chlorine	brown	colourless
B	chlorine	colourless	brown
C	iodine	brown	colourless
D	iodine	colourless	brown

s18-p23-q21

Which element is classified as a non-metal in the Periodic Table?

- A** calcium
- B** chlorine
- C** chromium
- D** copper

s18-p22-q22

Chlorine, bromine and iodine are elements in Group VII of the Periodic Table.

Which statement about these elements is **not** correct?

- A** The colour gets darker down the group.
- B** The density increases down the group.
- C** They are all gases at room temperature and pressure.
- D** They are all non-metals.

s18-p21-q22

Which statement about the halogens is correct?

- A** A sample of bromine reacts with potassium chloride solution.
- B** A sample of bromine reacts with potassium iodide solution.
- C** A sample of chlorine has a higher density than a sample of bromine.
- D** A sample of chlorine is a darker colour than a sample of bromine.

Topic	<p align="center">8. The Periodic Table</p> <p align="center">8.4 Transition elements</p>										
Content	<p>1. Describe the transition elements as metals that:</p> <ul style="list-style-type: none"> (a) have high densities (b) have high melting points (c) form coloured compounds (d) often act as catalysts as elements and in compounds Supplement <p>2. Describe transition elements as having ions with variable oxidation numbers, including iron(II) and iron(III)</p>										
m22-p22-q24	<p>Three properties of element X are listed.</p> <ul style="list-style-type: none"> • It contains atoms with a full outer shell of electrons. • It is monoatomic. • It is unreactive. <p>In which part of the Periodic Table is the element placed?</p> <p>A Group I</p> <p>B Group VII</p> <p>C Group VIII</p> <p>D transition elements</p>										
m22-p22-q28	<p>The table gives some properties of an element.</p> <table border="1"> <tbody> <tr> <td>melting point in °C</td><td>3422</td></tr> <tr> <td>appearance of the element</td><td>grey</td></tr> <tr> <td>appearance of the chloride of the element</td><td>dark blue</td></tr> <tr> <td>density in g/cm³</td><td>19.2</td></tr> <tr> <td>electrical conductivity when solid</td><td>good</td></tr> </tbody> </table> <p>Which other property does this element have?</p> <p>A acts as a catalyst</p> <p>B brittle</p> <p>C forms an acidic oxide</p> <p>D highly reactive with water</p>	melting point in °C	3422	appearance of the element	grey	appearance of the chloride of the element	dark blue	density in g/cm ³	19.2	electrical conductivity when solid	good
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appearance of the chloride of the element	dark blue										
density in g/cm ³	19.2										
electrical conductivity when solid	good										
w21-p23-q23	<p>Which property is shown by transition metals but not shown by Group I metals?</p> <p>A good electrical conductivity</p> <p>B good thermal conductivity</p> <p>C loss of electrons to form positive ions</p> <p>D variable oxidation states</p>										

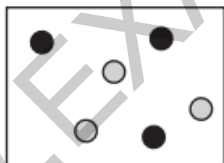
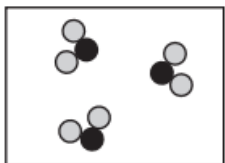
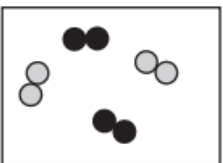
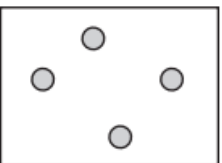
w21-p22-q23	<p>Which row describes properties of transition elements?</p> <table><tr><th></th><th>property 1</th><th>property 2</th><th>property 3</th></tr><tr><td>A</td><td>coloured compounds</td><td>high density</td><td>variable oxidation states</td></tr><tr><td>B</td><td>high density</td><td>high melting point</td><td>one oxidation state</td></tr><tr><td>C</td><td>high melting point</td><td>coloured compounds</td><td>one oxidation state</td></tr><tr><td>D</td><td>low melting point</td><td>high density</td><td>variable oxidation states</td></tr></table>		property 1	property 2	property 3	A	coloured compounds	high density	variable oxidation states	B	high density	high melting point	one oxidation state	C	high melting point	coloured compounds	one oxidation state	D	low melting point	high density	variable oxidation states	
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w21-p21-q23	<p>Some properties of two metals, G and H, are shown.</p> <table><tr><th>metal G</th><th>metal H</th></tr><tr><td>the formula of the chloride is GCl</td><td>high melting point</td></tr><tr><td>reacts with cold water</td><td>has more than one oxidation state</td></tr></table> <p>Which row about metals G and H is correct?</p> <table><tr><th></th><th>metal G</th><th>metal H</th></tr><tr><td>A</td><td>in Group I of the Periodic Table</td><td>in Group II of the Periodic Table</td></tr><tr><td>B</td><td>in Group I of the Periodic Table</td><td>transition metal</td></tr><tr><td>C</td><td>in Group II of the Periodic Table</td><td>in Group I of the Periodic Table</td></tr><tr><td>D</td><td>in Group II of the Periodic Table</td><td>transition metal</td></tr></table>	metal G	metal H	the formula of the chloride is GCl	high melting point	reacts with cold water	has more than one oxidation state		metal G	metal H	A	in Group I of the Periodic Table	in Group II of the Periodic Table	B	in Group I of the Periodic Table	transition metal	C	in Group II of the Periodic Table	in Group I of the Periodic Table	D	in Group II of the Periodic Table	transition metal
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s21-p23-q21	<p>Which property is shown by transition elements?</p> <p>A low density</p> <p>B low melting point</p> <p>C variable oxidation state</p> <p>D white compounds</p>																					
s21-p22-q24	<p>When aqueous iodine is added to a solution of vanadium ions, V^{2+}, the V^{2+} ions each lose one electron.</p> <p>Which property of transition elements is shown by this reaction?</p> <p>A Transition elements have variable oxidation states.</p> <p>B Transition elements form a stable $1+$ ion.</p> <p>C Transition elements are oxidising agents.</p> <p>D Transition elements can act as catalysts.</p>																					

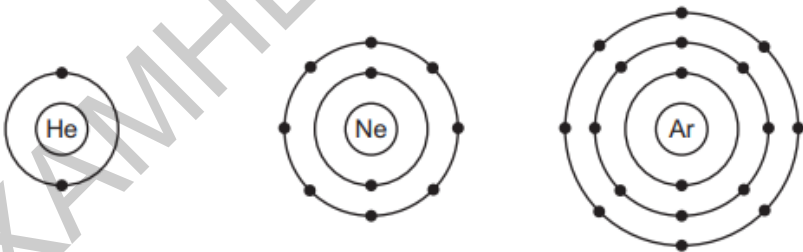
s21-p21-q23	<p>Which elements in the table are transition elements?</p> <table border="1"> <thead> <tr> <th>element</th><th>property</th></tr> </thead> <tbody> <tr> <td>E</td><td>forms E^{3+} ions only</td></tr> <tr> <td>F</td><td>forms F^+ and F^{2+} ions</td></tr> <tr> <td>G</td><td>forms only white salts</td></tr> <tr> <td>H</td><td>used in catalytic converters</td></tr> </tbody> </table> <p>A E and G B E and H C F and G D F and H</p>	element	property	E	forms E^{3+} ions only	F	forms F^+ and F^{2+} ions	G	forms only white salts	H	used in catalytic converters
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m21-p22-q28	<p>The properties of an element are listed.</p> <p>Its melting point is 3414°C.</p> <p>Some of its compounds are catalysts.</p> <p>It has variable oxidation states.</p> <p>Where is the element found in the Periodic Table?</p> <p>A alkali metals B halogens C noble gases D transition elements</p>										
w20-p23-q21	<p>Which metal has variable oxidation states?</p> <p>A aluminium B calcium C copper D sodium</p>										
w20-p22-q28	<p>Transition elements can have variable oxidation states.</p> <p>Which pair of compounds shows a transition element in two different oxidation states?</p> <p>A Cr_2O_3 and $\text{Cr}_2(\text{SO}_4)_3$ B Cu_2O and CuCO_3 C ZnS and ZnSO_4 D NiO and $\text{Ni}(\text{NO}_3)_2$</p>										

m20-p22-q24	<p>Some properties of substances are listed.</p> <ol style="list-style-type: none"> 1 They conduct electricity. 2 They have low densities. 3 They have high melting points. 4 They are malleable. <p>Which properties are shown by transition metals?</p> <p>A 1 and 3 only B 1 and 4 only C 1, 2 and 3 D 1, 3 and 4</p>
w19-p23-q18	<p>Chlorine displaces bromine from aqueous potassium bromide.</p> <p>The ionic equation for the reaction is shown.</p> $\text{Cl}_2 + 2\text{Br}^- \rightarrow 2\text{Cl}^- + \text{Br}_2$ <p>Which statement about this reaction is correct?</p> <p>A Bromide ions act as an oxidising agent. B Bromide ions are oxidised when electrons are lost. C Chlorine acts as a reducing agent. D Chlorine is reduced when electrons are lost.</p>
w19-p23-q25	<p>Iron reacts with dilute hydrochloric acid to form iron(II) chloride, FeCl_2. Iron reacts with chlorine to form iron(III) chloride, FeCl_3.</p> <p>Which property of transition elements is shown by this information?</p> <p>A Transition elements have high melting points. B Transition elements can act as catalysts. C Transition elements have variable oxidation states. D Transition elements have coloured compounds.</p>
w19-p22-q25	<p>Iron(II) ions can be oxidised to iron(III) ions by hydrogen peroxide.</p> <p>Which statement explains why iron is a transition element?</p> <p>A Iron is a transition element because it can be oxidised. B Iron is a transition element because it has variable oxidation states. C Iron is a transition element because it takes part in redox reactions. D Iron is a transition element because it reacts with chlorine.</p>

w19-p21-q25	<p>Which pair of compounds shows that transition elements have variable oxidation states?</p> <p>A Cr_2O_3 and CrBr_3</p> <p>B CuSO_4 and CuCl_2</p> <p>C Fe_2O_3 and FeCl_2</p> <p>D NiO and NiCl_2</p>																									
s18-p23-q23	<p>Which row describes a typical transition element?</p> <table><tr><th></th><th>density in g/cm^3</th><th>melting point in $^\circ\text{C}$</th><th>boiling point in $^\circ\text{C}$</th><th>colour of oxide</th></tr><tr><td>A</td><td>0.97</td><td>98</td><td>883</td><td>white</td></tr><tr><td>B</td><td>2.64</td><td>769</td><td>1382</td><td>white</td></tr><tr><td>C</td><td>3.10</td><td>-7</td><td>59</td><td>yellow</td></tr><tr><td>D</td><td>8.96</td><td>1085</td><td>2562</td><td>red</td></tr></table>		density in g/cm^3	melting point in $^\circ\text{C}$	boiling point in $^\circ\text{C}$	colour of oxide	A	0.97	98	883	white	B	2.64	769	1382	white	C	3.10	-7	59	yellow	D	8.96	1085	2562	red
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s18-p22-q23	<p>Which row describes the properties of a transition element?</p> <table><tr><th></th><th>property 1</th><th>property 2</th></tr><tr><td>A</td><td>forms colourless compounds</td><td>acts as a catalyst</td></tr><tr><td>B</td><td>forms colourless compounds</td><td>low electrical conductivity</td></tr><tr><td>C</td><td>high density</td><td>acts as a catalyst</td></tr><tr><td>D</td><td>high density</td><td>low electrical conductivity</td></tr></table>		property 1	property 2	A	forms colourless compounds	acts as a catalyst	B	forms colourless compounds	low electrical conductivity	C	high density	acts as a catalyst	D	high density	low electrical conductivity										
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s18-p21-q23	<p>Which row shows the catalytic activity of transition elements and their compounds?</p> <table><tr><th></th><th>catalytic activity of transition elements</th><th>catalytic activity of compounds of transition elements</th></tr><tr><td>A</td><td>good</td><td>good</td></tr><tr><td>B</td><td>good</td><td>poor</td></tr><tr><td>C</td><td>poor</td><td>good</td></tr><tr><td>D</td><td>poor</td><td>poor</td></tr></table>		catalytic activity of transition elements	catalytic activity of compounds of transition elements	A	good	good	B	good	poor	C	poor	good	D	poor	poor										
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Topic	<p align="center">8. The Periodic Table</p> <p align="center">8.5 Noble gases</p>
Content	1. Describe the Group VIII noble gases as unreactive, monatomic gases and explain this in terms of electronic configuration
w21-p23-o24 w21-p21-o24	<p>The noble gases are in Group VIII of the Periodic Table.</p> <p>Which statement explains why noble gases are unreactive?</p> <p>A They all have eight electrons in their outer shells.</p> <p>B They all have full outer shells.</p> <p>C They are all gases.</p> <p>D They are all monoatomic.</p>
w21-p22-o24	<p>The noble gases are in Group VIII of the Periodic Table.</p> <p>Which statement explains why noble gases are unreactive?</p> <p>A They all have eight electrons in their outer shells.</p> <p>B They all have full outer shells.</p> <p>C They are all gases.</p> <p>D They are all monoatomic.</p>
s21-p23-o22	<p>Helium and neon exist as monoatomic gases at room temperature and pressure.</p> <p>statement 1 Helium and neon have eight electrons in their outer shell.</p> <p>statement 2 Helium and neon are unreactive.</p> <p>Which option is correct?</p> <p>A Statement 1 and statement 2 are incorrect.</p> <p>B Statement 1 is correct and explains statement 2.</p> <p>C Statement 1 is correct, but does not explain statement 2.</p> <p>D Statement 1 is incorrect, but statement 2 is correct.</p>
s21-p21-q22	<p>Why is helium used to fill balloons?</p> <p>A Helium is monoatomic.</p> <p>B Helium is in Group VIII of the Periodic Table.</p> <p>C Helium has a full outer electron shell.</p> <p>D Helium is less dense than air.</p>

m21-p22-q2	<p>Gases are separated from liquid air by fractional distillation.</p> <p>The boiling points of four gases are shown.</p> <p>Which gas is both monoatomic and a liquid at -200°C?</p> <table><tr><th></th><th>gas</th><th>boiling point/$^{\circ}\text{C}$</th></tr><tr><td>A</td><td>argon</td><td>-186</td></tr><tr><td>B</td><td>helium</td><td>-269</td></tr><tr><td>C</td><td>neon</td><td>-246</td></tr><tr><td>D</td><td>nitrogen</td><td>-196</td></tr></table>		gas	boiling point/ $^{\circ}\text{C}$	A	argon	-186	B	helium	-269	C	neon	-246	D	nitrogen	-196
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w20-p23-q27 w20-p22-q27 w20-p21-q27	<p>A flammable gas needs to be removed from a tank at an industrial plant.</p> <p>For safety reasons, an inert gas is used.</p> <p>Which gas is suitable?</p> <p>A argon</p> <p>B hydrogen</p> <p>C methane</p> <p>D oxygen</p>															
s20-p22-q24	<p>Which diagram shows a mixture of noble gases?</p> <div><p>A</p></div> <div><p>B</p></div> <div><p>C</p></div> <div><p>D</p></div>															
s20-p21-q24	<p>A balloon is filled with helium. Helium is a noble gas and makes the balloon rise up in the air.</p> <p>The density of air is 1.23 g/dm^3.</p> <p>Which gas is helium?</p> <table><tr><th></th><th>density in g/dm^3</th><th>reaction with oxygen</th></tr><tr><td>A</td><td>0.0899</td><td>burns rapidly</td></tr><tr><td>B</td><td>0.179</td><td>does not react with oxygen</td></tr><tr><td>C</td><td>1.78</td><td>does not react with oxygen</td></tr><tr><td>D</td><td>3.75</td><td>does not react with oxygen</td></tr></table>		density in g/dm^3	reaction with oxygen	A	0.0899	burns rapidly	B	0.179	does not react with oxygen	C	1.78	does not react with oxygen	D	3.75	does not react with oxygen
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w19-p23-q23	<p>Which statement describes a gas which is in Group VIII of the Periodic Table?</p> <p>A A colourless gas that helps substances burn.</p> <p>B A pollutant gas present in car exhausts.</p> <p>C A gas that is less dense than air and makes a 'pop' sound with a lighted splint.</p> <p>D A gas that is used in lamps.</p>																				
w19-p22-q23	<p>Helium is a noble gas.</p> <p>Which statement about helium is correct?</p> <p>A It has eight electrons in its outer shell.</p> <p>B It is a diatomic gas.</p> <p>C It is reactive.</p> <p>D It is used for filling balloons.</p>																				
s19-p22-q22	<p>The electronic structures of helium, neon and argon are shown.</p> <div></div> <p>Which row describes these gases?</p> <table><tr><th></th><th>reactivity</th><th>form of the gas</th><th>electronic structure</th></tr><tr><td>A</td><td>reactive</td><td>monoatomic</td><td>incomplete outer shell of electrons</td></tr><tr><td>B</td><td>unreactive</td><td>diatomic</td><td>complete outer shell of electrons</td></tr><tr><td>C</td><td>unreactive</td><td>diatomic</td><td>incomplete outer shell of electrons</td></tr><tr><td>D</td><td>unreactive</td><td>monoatomic</td><td>complete outer shell of electrons</td></tr></table>		reactivity	form of the gas	electronic structure	A	reactive	monoatomic	incomplete outer shell of electrons	B	unreactive	diatomic	complete outer shell of electrons	C	unreactive	diatomic	incomplete outer shell of electrons	D	unreactive	monoatomic	complete outer shell of electrons
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m19-p22-q26	<p>Which statement explains why elements in Group VIII of the Periodic Table are unreactive?</p> <p>A They are monatomic gases.</p> <p>B They form stable diatomic molecules.</p> <p>C They have a full outer shell of electrons.</p> <p>D They share electrons with each other.</p>																				

w18-p23-q1

Gases are separated from liquid air by fractional distillation. The boiling points of four gases are shown.

Which gas is both monatomic and a liquid at -200°C ?

	gas	boiling point/ $^{\circ}\text{C}$
A	argon	-186
B	helium	-269
C	neon	-246
D	nitrogen	-196

w18-p23-q23
w18-p22-q23
w18-p21-q23

An inert gas R is used to fill weather balloons.

Which descriptions of R are correct?

	number of outer shell electrons in atoms of R	structure of gas R
A	2	diatomic molecules
B	2	single atoms
C	8	diatomic molecules
D	8	single atoms

Topic	9. Metals																																								
	9.1 Properties of metals																																								
Content	<div>1. Compare the general physical properties of metals and non-metals, including:<div>(a) thermal conductivity</div><div>(b) electrical conductivity</div><div>(c) malleability and ductility</div><div>(d) melting points and boiling points</div></div> <div>2. Describe the general chemical properties of metals, limited to their reactions with:<div>(a) dilute acids</div><div>(b) cold water and steam</div><div>(c) oxygen</div></div>																																								
s21-p22-q	<div>Information about four substances E, F, G and H is shown.</div> <table><tr><td></td><td>melting point / °C</td><td>electrical conductivity</td></tr><tr><td>E</td><td>1710</td><td>does not conduct when solid</td></tr><tr><td>F</td><td>3500</td><td>conducts when solid</td></tr><tr><td>G</td><td>120</td><td>does not conduct</td></tr><tr><td>H</td><td>801</td><td>conducts when molten</td></tr></table> <div>E, F, G and H are graphite, poly(ethene), sodium chloride and silicon(IV) oxide but not in that order.</div> <div>What are E, F, G and H?</div> <table><tr><td></td><td>E</td><td>F</td><td>G</td><td>H</td></tr><tr><td>A</td><td>graphite</td><td>poly(ethene)</td><td>silicon(IV) oxide</td><td>sodium chloride</td></tr><tr><td>B</td><td>sodium chloride</td><td>graphite</td><td>poly(ethene)</td><td>silicon(IV) oxide</td></tr><tr><td>C</td><td>poly(ethene)</td><td>sodium chloride</td><td>graphite</td><td>silicon(IV) oxide</td></tr><tr><td>D</td><td>silicon(IV) oxide</td><td>graphite</td><td>poly(ethene)</td><td>sodium chloride</td></tr></table>		melting point / °C	electrical conductivity	E	1710	does not conduct when solid	F	3500	conducts when solid	G	120	does not conduct	H	801	conducts when molten		E	F	G	H	A	graphite	poly(ethene)	silicon(IV) oxide	sodium chloride	B	sodium chloride	graphite	poly(ethene)	silicon(IV) oxide	C	poly(ethene)	sodium chloride	graphite	silicon(IV) oxide	D	silicon(IV) oxide	graphite	poly(ethene)	sodium chloride
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D	silicon(IV) oxide	graphite	poly(ethene)	sodium chloride																																					
w20-p23-q16	<div>Which substance does not require oxygen in order to produce energy?</div> <div>A coal</div> <div>B hydrogen</div> <div>C natural gas</div> <div>D ²³⁵U</div>																																								

s20-p23-q28

P, Q, R and S are four metals.

P displaces Q from a solution of its sulfate.

Q reacts with hydrochloric acid and can be extracted from its ore using carbon.

R does not react with hydrochloric acid.

The carbonate of S does not decompose when heated strongly.

What is the order of reactivity of the metals, starting with the most reactive?

	most reactive		→	least reactive	
A	R	P	Q	S	
B	R	Q	P	S	
C	S	P	Q	R	
D	S	Q	P	R	

s19-p22-q7

Calcium metal reacts with water to form a solution of calcium hydroxide and hydrogen gas.

Which equation is correct?

- A** $\text{Ca(s)} + \text{H}_2\text{O(aq)} \rightarrow \text{CaOH(aq)} + \text{H(g)}$
B $\text{Ca(s)} + 2\text{H}_2\text{O(aq)} \rightarrow \text{Ca(OH)}_2\text{(s)} + 2\text{H}_2\text{(g)}$
C $\text{Ca(s)} + 2\text{H}_2\text{O(l)} \rightarrow \text{Ca(OH)}_2\text{(aq)} + \text{H}_2\text{(g)}$
D $\text{Ca(s)} + \text{H}_2\text{O(l)} \rightarrow \text{CaOH(l)} + \text{H(g)}$

s19-p22-q24

A student heated the carbonates and nitrates of sodium and copper.

The results are shown.

	compound heated	gases released	solid formed
1	sodium carbonate	carbon monoxide	sodium oxide
2	copper(II) carbonate	carbon dioxide	copper
3	sodium nitrate	oxygen only	sodium nitrite
4	copper(II) nitrate	nitrogen dioxide and oxygen	copper(II) oxide

Which rows describe the correct results?

- A** 1 and 3 **B** 2 and 3 **C** 3 and 4 **D** 4 only

m19-p22-q28

The list gives the order of some metals and hydrogen in the reactivity series.

Metal X is also included.

most reactive K
Mg
Zn
H
X
least reactive Cu

Which row correctly shows the properties of metal X?

	reacts with dilute acids	oxide reduced by carbon
A	no	no
B	no	yes
C	yes	no
D	yes	yes

s18-p21-q24

The following statements are made about the metals copper, iron, magnesium and zinc.

- 1 Their oxides are acidic.
- 2 They all conduct electricity in the solid state.
- 3 They all have high melting points.
- 4 They all react with dilute acids to form hydrogen.

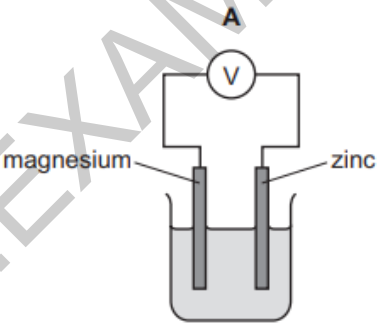
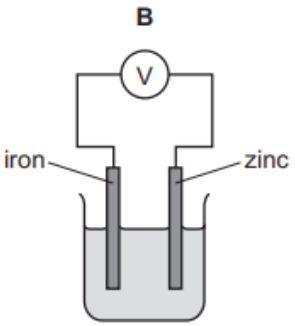
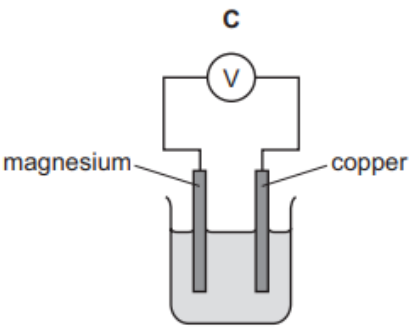
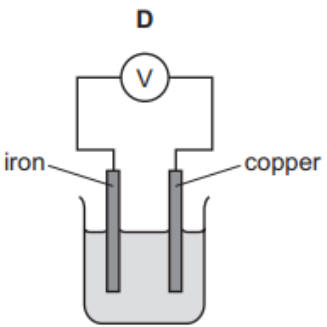
Which statements are correct?

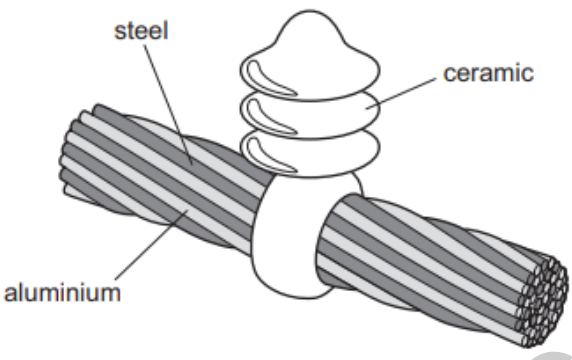
A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

m18-p22-q24

Which two properties are physical properties of **all** pure metals?

	property 1	property 2
A	brittle	poor conductor of heat
B	good conductor of electricity	malleable
C	good conductor of heat	low melting point
D	malleable	low density

Topic	<p style="text-align: center;">9. Metals</p> <p style="text-align: center;">9.2 Uses of metals</p>
Content	<p>1. Describe the uses of metals in terms of their physical properties, including:</p> <ul style="list-style-type: none"> (a) aluminium in the manufacture of aircraft because of its low density (b) aluminium in the manufacture of overhead electrical cables because of its low density and good electrical conductivity (c) aluminium in food containers because of its resistance to corrosion (d) copper in electrical wiring because of its good electrical conductivity and ductility
W21-P22-Q27 W21-P21-Q27	<p>Aluminium objects do not need protection from corrosion.</p> <p>Iron objects must be protected from corrosion.</p> <p>Which statement explains why aluminium resists corrosion?</p> <ul style="list-style-type: none"> A Aluminium does not form ions easily. B Aluminium does not react with water or air. C Aluminium has a protective oxide layer. D Aluminium is below iron in the reactivity series.
S21-P23-Q13	<p>Which simple cell produces the most electrical energy?</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>A</p>  </div> <div style="text-align: center;"> <p>B</p>  </div> </div> <div style="text-align: right; margin-top: 10px;"> <p>key</p> <p>(V) = voltmeter</p> </div> <div style="display: flex; justify-content: space-around; align-items: flex-start; margin-top: 20px;"> <div style="text-align: center;"> <p>C</p>  </div> <div style="text-align: center;"> <p>D</p>  </div> </div>

m21-p22-q11	<p>The diagram shows a section of an overhead power cable.</p>  <p>Which statement explains why a particular substance is used?</p> <p>A Aluminium has a low density and is a good conductor of electricity. B Ceramic is a good conductor of electricity. C Steel can rust in damp air. D Steel is more dense than aluminium.</p>
m21-p22-q26	<p>Which statements about the uses of metals are correct?</p> <ol style="list-style-type: none"> 1 Iron is used to make aircraft because iron has a low density. 2 Copper is used to make electric cables because copper is a good conductor of electricity. 3 Aluminium is used to make brass because aluminium is strong and hard. 4 Iron is mixed with additives to make an alloy used in chemical plant. <p>A 1 and 2 B 3 and 4 C 1 and 3 D 2 and 4</p>
w21-p21-q30	<p>What is the symbol of the metal used in the manufacture of aircraft because of its strength and low density?</p> <p>A Al B Cu C Fe D Zn</p>
m20-p22-q28	<p>Some properties of aluminium are listed.</p> <ol style="list-style-type: none"> 1 It conducts heat. 2 It has a low density. 3 It is strong. 4 It is resistant to corrosion. <p>Which of these properties make aluminium suitable for making food containers for chilled food products?</p> <p>A 1, 2 and 4 B 1, 3 and 4 C 1 only D 4 only</p>

w19-p22-q27	<p>Which row describes the uses of aluminium, copper and mild steel?</p> <table><tr><td></td><td>aluminium</td><td>copper</td><td>mild steel</td></tr><tr><td>A</td><td>aircraft bodies</td><td>electrical wiring</td><td>car bodies</td></tr><tr><td>B</td><td>car bodies</td><td>cooking utensils</td><td>electrical wiring</td></tr><tr><td>C</td><td>electrical wiring</td><td>aircraft bodies</td><td>food containers</td></tr><tr><td>D</td><td>food containers</td><td>aircraft bodies</td><td>cooking utensils</td></tr></table>		aluminium	copper	mild steel	A	aircraft bodies	electrical wiring	car bodies	B	car bodies	cooking utensils	electrical wiring	C	electrical wiring	aircraft bodies	food containers	D	food containers	aircraft bodies	cooking utensils
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w19-p21-q27	<p>Which statement is correct?</p> <p>A Aluminium is used in the manufacture of aircraft because it has a high density.</p> <p>B Copper is used for cooking utensils because it is a good conductor of heat.</p> <p>C Mild steel is used for car bodies because it is resistant to corrosion.</p> <p>D Stainless steel is used for cutlery because it is a conductor of electricity.</p>																				
s19-p23-q27	<p>Aluminium is used to make containers for storing food.</p> <p>Which property makes it suitable for this use?</p> <p>A conducts heat</p> <p>B low density</p> <p>C resists corrosion</p> <p>D shiny surface</p>																				
s19-p22-q27	<p>Which property of aluminium makes it useful in the manufacture of aircraft?</p> <p>A conducts electricity</p> <p>B high boiling point</p> <p>C low density</p> <p>D silver colour</p>																				
s19-p21-q27	<p>Why is aluminium used to make containers for storing food?</p> <p>A It conducts electricity.</p> <p>B It has a high melting point.</p> <p>C It is resistant to corrosion.</p> <p>D It is strong.</p>																				

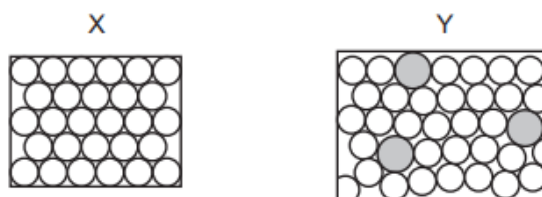
w18-p23-q26 w18-p21-q26	<p>Which row describes the use of a metal and the property upon which the use depends?</p> <table><tr><td></td><td>metal</td><td>use</td><td>property</td></tr><tr><td>A</td><td>aluminium</td><td>aircraft bodies</td><td>aluminium is a heat conductor</td></tr><tr><td>B</td><td>aluminium</td><td>cooking utensils</td><td>aluminium has a low density</td></tr><tr><td>C</td><td>copper</td><td>cooking utensils</td><td>copper has a high density</td></tr><tr><td>D</td><td>copper</td><td>electrical wiring</td><td>copper is a good conductor of electricity</td></tr></table>		metal	use	property	A	aluminium	aircraft bodies	aluminium is a heat conductor	B	aluminium	cooking utensils	aluminium has a low density	C	copper	cooking utensils	copper has a high density	D	copper	electrical wiring	copper is a good conductor of electricity
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D	copper	electrical wiring	copper is a good conductor of electricity																		
w18-p22-q26	<p>Which statement about the uses of metals is not correct?</p> <p>A Aluminium is used in aircraft because of its strength and good electrical conductivity.</p> <p>B Copper is used in electrical wiring because of its good electrical conductivity.</p> <p>C Stainless steel resists corrosion and is used to make cutlery.</p> <p>D Transition elements are often used as catalysts.</p>																				
s18-p23-q27	<p>Which statement explains why aluminium is used to manufacture aircraft?</p> <p>A It has a low density.</p> <p>B It is a good conductor of electricity.</p> <p>C It is a good conductor of heat.</p> <p>D It is ductile.</p>																				
s18-p21-q27	<p>Which statement explains why aluminium is used in the manufacture of aircraft?</p> <p>A It conducts heat well.</p> <p>B It has a low density.</p> <p>C It is a good conductor of electricity.</p> <p>D It is easy to recycle.</p>																				
m18-p22-q27	<p>Which statement about the uses of aluminium, copper and iron is correct?</p> <p>A Aluminium is used for aircraft manufacture because it has a high density.</p> <p>B Aluminium is used for food containers because it is a good conductor of electricity.</p> <p>C Copper is used for cooking utensils because it is a good conductor of heat.</p> <p>D Stainless steel is used for car bodies because it corrodes easily.</p>																				

Topic	<p style="text-align: center;"><u>9. Metals</u></p> <p style="text-align: center;">9.3 Alloys and their properties</p>
Content	<ol style="list-style-type: none"> Describe an alloy as a mixture of a metal with other elements, including: <ol style="list-style-type: none"> brass as a mixture of copper and zinc stainless steel as a mixture of iron and other elements such as chromium, nickel and carbon State that alloys can be harder and stronger than the pure metals and are more useful Describe the uses of alloys in terms of their physical properties, including stainless steel in cutlery because of its hardness and resistance to rusting Identify representations of alloys from diagrams of structure Explain in terms of structure how alloys can be harder and stronger than the pure metals because the different sized atoms in alloys mean the layers can no longer slide over each other
m22-p22-q27	<p>Metal M is mixed with copper to produce brass.</p> <p>What is M?</p> <p>A chromium B nickel C vanadium D zinc</p>
w21-p23-q5 w21-p21-q5	<p>Which description of brass is correct?</p> <p>A alloy B compound C element D non-metal</p>
w21-p23-q26	<p>Chromium is a more reactive metal than iron but less reactive than zinc.</p> <p>Which statements are correct?</p> <ol style="list-style-type: none"> Chromium does not react with dilute hydrochloric acid. Chromium oxide is reduced when it is heated with carbon. Chromium reacts with zinc oxide to form zinc. Chromium reacts with steam to form hydrogen gas. <p>A 1 and 2 B 1 and 3 C 2 and 4 D 3 and 4</p>

w21-p22-q5	<p>Which description of brass is correct?</p> <p>A alloy</p> <p>B compound</p> <p>C element</p> <p>D non-metal</p>																																			
s21-p22-q28	<p>Mild steel consists mostly of iron. Mild steel can be prevented from rusting by a process called galvanising.</p> <p>Copper is not a very strong metal, however if it is mixed with a suitable metal a strong alloy called brass is produced.</p> <p>Which statement is correct?</p> <p>A Copper corrodes very quickly when wet and brass does not.</p> <p>B Copper is mixed with zinc to produce brass.</p> <p>C Galvanising mild steel changes it from a pure metal into an alloy.</p> <p>D When a steel object is galvanised this means it is coated with a thin layer of tin.</p>																																			
s21-p21-q28	<p>Different types of steel alloys are manufactured by changing the percentage of carbon in the alloy.</p> <p>The properties of four steel alloys are shown.</p> <table><tr><th>alloy mixture</th><th>percentage of carbon in the alloy</th><th>strength of the alloy</th><th>hardness of the alloy</th></tr><tr><td>1</td><td>0.00 to 0.20</td><td>high</td><td>low</td></tr><tr><td>2</td><td>0.21 to 0.30</td><td>high</td><td>medium</td></tr><tr><td>3</td><td>0.31 to 0.40</td><td>medium</td><td>high</td></tr><tr><td>4</td><td>0.41 to 1.50</td><td>low</td><td>high</td></tr></table> <p>What are the properties of the steel alloy containing 0.23% of carbon?</p> <table><tr><th></th><th>strength</th><th>hardness</th></tr><tr><td>A</td><td>high</td><td>low</td></tr><tr><td>B</td><td>low</td><td>high</td></tr><tr><td>C</td><td>high</td><td>medium</td></tr><tr><td>D</td><td>medium</td><td>high</td></tr></table>	alloy mixture	percentage of carbon in the alloy	strength of the alloy	hardness of the alloy	1	0.00 to 0.20	high	low	2	0.21 to 0.30	high	medium	3	0.31 to 0.40	medium	high	4	0.41 to 1.50	low	high		strength	hardness	A	high	low	B	low	high	C	high	medium	D	medium	high
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	strength	hardness																																		
A	high	low																																		
B	low	high																																		
C	high	medium																																		
D	medium	high																																		

s19-p23-q23
s19-p22-q23
s19-p21-q23

The diagrams show the structure of two substances used to make electrical conductors.

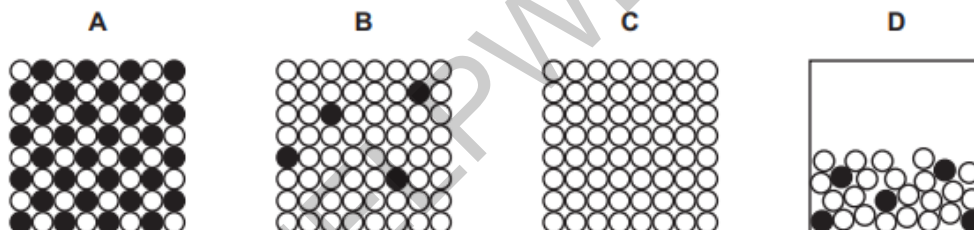


Which statement correctly describes X and Y?

- A** X is a pure metal and Y is a compound.
B X is a pure metal and Y is an alloy.
C X is a solid and Y is a liquid.
D X is harder and stronger than Y.

s18-p23-q24

Which diagram represents a solid alloy?



s18-p22-q24

Stainless steel is an alloy of iron, carbon and other metals.

Which row is correct?

	stainless steel is harder than pure iron	stainless steel resists corrosion better than pure iron
A	✓	✓
B	✓	x
C	x	✓
D	x	x

s18-p22-q27

Which row describes the use of an alloy and the property upon which the use depends?

	alloy	use	property
A	mild steel	cutlery	resistant to corrosion
B	mild steel	machinery	strong
C	stainless steel	cutlery	low density
D	stainless steel	machinery	good conductor of electricity

Topic	<div>9. Metals</div> <div>9.4 Reactivity series</div>															
Content	<div><div>1. State the order of the reactivity series as: potassium, sodium, calcium, magnesium, aluminium, carbon, zinc, iron, hydrogen, copper, silver, gold</div><div>2. Describe the reactions, if any, of:<div><div>(a) potassium, sodium and calcium with cold water</div><div>(b) magnesium with steam</div><div>(c) magnesium, zinc, iron, copper, silver and gold with dilute hydrochloric acid and explain these reactions in terms of the position of the metals in the reactivity series</div></div></div><div>3. Deduce an order of reactivity from a given set of experimental results</div><div>4. Describe the relative reactivities of metals in terms of their tendency to form positive ions, by displacement reactions, if any, with the aqueous ions of magnesium, zinc, iron, copper and silver</div><div>5. Explain the apparent unreactivity of aluminium in terms of its oxide layer</div></div>															
w21-p23-q27	<div>Aluminium objects do not need protection from corrosion.</div> <div>Iron objects must be protected from corrosion.</div> <div>Which statement explains why aluminium resists corrosion?</div> <div><div>A Aluminium does not form ions easily.</div><div>B Aluminium does not react with water or air.</div><div>C Aluminium has a protective oxide layer.</div><div>D Aluminium is below iron in the reactivity series.</div></div>															
s21-p23-q26	<div>Which compounds are released by the extraction of zinc from zinc blende and by respiration?</div> <table><tr><td></td><td>extraction of zinc</td><td>respiration</td></tr><tr><td>A</td><td>CO₂ and SO₂</td><td>CO₂ only</td></tr><tr><td>B</td><td>CO₂ and SO₂</td><td>CO₂ and H₂O</td></tr><tr><td>C</td><td>CO₂ only</td><td>CO₂ only</td></tr><tr><td>D</td><td>CO₂ only</td><td>CO₂ and H₂O</td></tr></table>		extraction of zinc	respiration	A	CO ₂ and SO ₂	CO ₂ only	B	CO ₂ and SO ₂	CO ₂ and H ₂ O	C	CO ₂ only	CO ₂ only	D	CO ₂ only	CO ₂ and H ₂ O
	extraction of zinc	respiration														
A	CO ₂ and SO ₂	CO ₂ only														
B	CO ₂ and SO ₂	CO ₂ and H ₂ O														
C	CO ₂ only	CO ₂ only														
D	CO ₂ only	CO ₂ and H ₂ O														
s21-p22-q25	<div>A piece of aluminium is dropped into dilute hydrochloric acid.</div> <div>No immediate reaction is observed.</div> <div>Which statement explains this observation?</div> <div><div>A Aluminium does not neutralise acids.</div><div>B Aluminium is a non-metal so does not react with acids.</div><div>C Aluminium is below hydrogen in the reactivity series.</div><div>D Aluminium is covered in an unreactive oxide layer.</div></div>															

s21-p21-q26	<p>Some metal nitrates and carbonates decompose when heated strongly.</p> <p>Metal Q has a nitrate that decomposes to give a salt and a colourless gas only.</p> <p>The carbonate of metal Q does not decompose when heated with a Bunsen burner.</p> <p>What is metal Q?</p> <p>A calcium</p> <p>B copper</p> <p>C sodium</p> <p>D zinc</p>
w20-p23-q28	<p>An experiment is performed to determine the order of reactivity of metals X and Y compared to lead.</p> <p>Strips of each metal were added to separate test-tubes containing aqueous lead(II) nitrate, $\text{Pb}(\text{NO}_3)_2$.</p> <p>The results are shown.</p> <div> </div> <p>What is the order of reactivity, least reactive first?</p> <p>A $\text{Pb} \rightarrow \text{X} \rightarrow \text{Y}$</p> <p>B $\text{X} \rightarrow \text{Y} \rightarrow \text{Pb}$</p> <p>C $\text{X} \rightarrow \text{Pb} \rightarrow \text{Y}$</p> <p>D $\text{Y} \rightarrow \text{Pb} \rightarrow \text{X}$</p>
w20-p22-q30	<p>Why is aluminium metal unreactive with air?</p> <p>A It is covered with a layer of oxide.</p> <p>B It is low in the reactivity series.</p> <p>C It is produced by electrolysis of its oxide.</p> <p>D It melts at a high temperature.</p>

w20-p21-q25

Elements P and Q have the same number of electron shells.

Q has more electrons in its outer shell than P.

Which statements are correct?

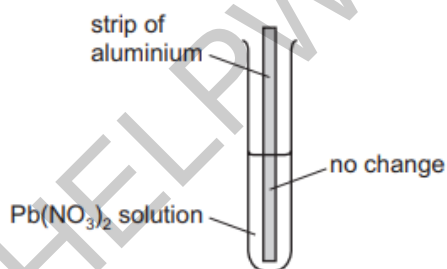
- 1 P and Q are in the same group of the Periodic Table.
- 2 P and Q are in the same period of the Periodic Table.
- 3 P has a greater tendency to form positive ions than Q.
- 4 The oxides of Q are more basic than those of P.

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

w21-p21-q28

A strip of aluminium is placed into a test-tube containing aqueous lead(II) nitrate and left for several minutes.

Aluminium is higher than lead in the reactivity series.



Which statement explains why lead is **not** displaced by this strip of aluminium?

- A** A thin insoluble layer of aluminium nitrate forms on the aluminium.
- B** Nitrate ions are reduced in aqueous solution.
- C** The ionic bonds between lead and nitrate ions are too strong.
- D** There is an unreactive oxide layer on the aluminium.

s20-p22-q26

Many metal carbonates decompose when they are heated.

Which row describes what happens when potassium carbonate, calcium carbonate and copper(II) carbonate are heated using a Bunsen burner?

	decomposes easily	decomposes with difficulty	does not decompose at Bunsen temperatures
A	calcium carbonate	copper(II) carbonate	potassium carbonate
B	copper(II) carbonate	calcium carbonate	potassium carbonate
C	copper(II) carbonate	potassium carbonate	calcium carbonate
D	potassium carbonate	calcium carbonate	copper(II) carbonate

s20-p21-q28	<p>Element Y reacts with copper(II) oxide to form copper.</p> <p>Element Y will not react with zinc oxide. Copper has no reaction with zinc oxide.</p> <p>What is the order of reactivity of these three elements, most reactive first?</p> <p>A Cu → Y → Zn</p> <p>B Cu → Zn → Y</p> <p>C Zn → Cu → Y</p> <p>D Zn → Y → Cu</p>																										
w19-p23-q24 w19-p22-q24 w19-p21-q24	<p>Which pair of elements reacts together most violently?</p> <p>A chlorine and lithium</p> <p>B chlorine and potassium</p> <p>C iodine and lithium</p> <p>D iodine and potassium</p>																										
w19-p22-q28	<p>The properties of four metals are listed.</p> <ul style="list-style-type: none">• Metal W does not react with dilute hydrochloric acid.• Metal X reacts with dilute hydrochloric acid.• Metal Y displaces metal X from an aqueous solution of its ions.• Metal Z reacts with water and dilute hydrochloric acid. <p>What is the order of reactivity of the metals?</p> <table><tr><td></td><td>most reactive</td><td colspan="3">→</td><td>least reactive</td></tr><tr><td>A</td><td>W</td><td>X</td><td>Y</td><td>Z</td></tr><tr><td>B</td><td>W</td><td>Y</td><td>X</td><td>Z</td></tr><tr><td>C</td><td>Z</td><td>X</td><td>Y</td><td>W</td></tr><tr><td>D</td><td>Z</td><td>Y</td><td>X</td><td>W</td></tr></table>		most reactive	→			least reactive	A	W	X	Y	Z	B	W	Y	X	Z	C	Z	X	Y	W	D	Z	Y	X	W
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A	W	X	Y	Z																							
B	W	Y	X	Z																							
C	Z	X	Y	W																							
D	Z	Y	X	W																							
w19-p21-q28	<p>Iron rusts but aluminium does not easily corrode.</p> <p>Which statement explains why aluminium does not easily corrode?</p> <p>A It is an alloy.</p> <p>B It is below iron in the reactivity series.</p> <p>C It is not a transition element.</p> <p>D Its surface is protected by an oxide layer.</p>																										

s19-p23-q26
s19-p21-q26

Four metals, zinc, M, copper and magnesium, are reacted with aqueous solutions of their nitrates.

The results are shown.

metal	magnesium nitrate	M nitrate	copper nitrate	zinc nitrate
magnesium		✓	✓	✓
zinc	x	✓	✓	
M	x		✓	x
copper	x	x		x

key

✓ = reacts

x = no reaction

What is the order of reactivity of these four metals starting with the most reactive?

- A** copper → zinc → M → magnesium
B copper → M → zinc → magnesium
C magnesium → M → zinc → copper
D magnesium → zinc → M → copper

s19-p22-q16

The ionic equation for the reaction of aqueous potassium bromide with chlorine gas is shown.



Which statement is correct?

- A** Bromide ions are oxidised by gaining electrons.
B Bromide ions are oxidised by losing electrons.
C Chlorine is oxidised by gaining electrons.
D Chlorine is oxidised by losing electrons.

s19-p22-q26

Four metals, zinc, M, copper and magnesium, are reacted with aqueous solutions of their nitrates.

The results are shown.

metal	magnesium nitrate	M nitrate	copper nitrate	zinc nitrate
magnesium		✓	✓	✓
zinc	x	✓	✓	
M	x		✓	x
copper	x	x		x

key

✓ = reacts

x = no reaction

What is the order of reactivity of these four metals starting with the most reactive?

- A** copper → zinc → M → magnesium
B copper → M → zinc → magnesium
C magnesium → M → zinc → copper
D magnesium → zinc → M → copper

m19-p22-q24

The elements sodium to argon form Period 3 of the Periodic Table.

Which row describes the trend across Period 3 from left to right?

	number of outer shell electrons	metallic character	group number
A	decreases	decreases	decreases
B	decreases	increases	decreases
C	increases	decreases	increases
D	increases	increases	increases

w18-p22-q25

Four metals, W, X, Y and Z, are separately reacted with water and dilute hydrochloric acid.

The results are shown.

	metal			
	W	X	Y	Z
reaction with water	fizzes	no reaction	fizzes vigorously	no reaction
reaction with dilute hydrochloric acid	fizzes	no reaction	fizzes violently	fizzes

What is the order of reactivity of the four metals starting with the least reactive?

	least reactive		→	most reactive	
A	X	W		Z	Y
B	X	Z		W	Y
C	Y	W		Z	X
D	Y	Z		W	X

w18-p21-q25

Metal X reacts with steam but not with cold water.

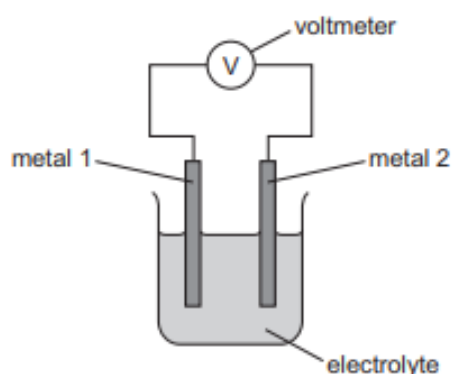
What is X?

- A** calcium
- B** copper
- C** sodium
- D** zinc

w18-p21-q27	<p>Aluminium objects do not need protection from corrosion.</p> <p>Iron objects must be protected from corrosion.</p> <p>Why does aluminium resist corrosion?</p> <p>A Aluminium does not form ions easily.</p> <p>B Aluminium does not react with water or air.</p> <p>C Aluminium has a protective oxide layer.</p> <p>D Aluminium is below iron in the reactivity series.</p>																									
s18-p23-q25	<p>The ionic equations for four reactions are shown.</p> $Z + X^{2+} \rightarrow Z^{2+} + X$ $Z + 2W^{+} \rightarrow Z^{2+} + 2W$ $X + 2W^{+} \rightarrow X^{2+} + 2W$ $Y + Z^{2+} \rightarrow Y^{2+} + Z$ <p>What is the order of reactivity of the four metals, W, X, Y and Z?</p> <table><tr><td></td><td>most reactive</td><td>→</td><td>least reactive</td><td></td></tr><tr><td>A</td><td>W</td><td>X</td><td>Z</td><td>Y</td></tr><tr><td>B</td><td>X</td><td>W</td><td>Y</td><td>Z</td></tr><tr><td>C</td><td>Y</td><td>Z</td><td>X</td><td>W</td></tr><tr><td>D</td><td>Z</td><td>W</td><td>X</td><td>Y</td></tr></table>		most reactive	→	least reactive		A	W	X	Z	Y	B	X	W	Y	Z	C	Y	Z	X	W	D	Z	W	X	Y
	most reactive	→	least reactive																							
A	W	X	Z	Y																						
B	X	W	Y	Z																						
C	Y	Z	X	W																						
D	Z	W	X	Y																						
s18-p22-q25	<p>Metal X is more reactive than metal Y. Metal Y is more reactive than metal Z.</p> <p>Which statement is correct?</p> <p>A When metal X is placed in a solution of Y sulfate, there is no reaction.</p> <p>B When metal X is placed in a solution of Z sulfate, a reaction occurs.</p> <p>C When metal Y is placed in a solution of Z sulfate, there is no reaction.</p> <p>D When metal Z is placed in a solution of X sulfate, a reaction occurs.</p>																									
s18-p21-q25	<p>Silver is a less reactive metal than cadmium.</p> <p>Cadmium is a less reactive metal than barium.</p> <p>Which statement is correct?</p> <p>A Barium does not react when heated with silver oxide.</p> <p>B Cadmium displaces barium from a solution of barium chloride.</p> <p>C Cadmium displaces silver from a solution of silver nitrate.</p> <p>D Cadmium reacts when heated with barium oxide.</p>																									

m18-p22-q10

Pairs of metals are connected together to make a simple cell, as shown.



The table shows the reading on the voltmeter when different metals are used.

		metal 2			
		beryllium	cerium	cobalt	manganese
metal 1	beryllium	0.00 V	+0.64 V	-1.57 V	-0.67 V
	cerium		0.00 V	-2.21 V	-1.30 V
	cobalt			0.00 V	+0.90 V
	manganese				0.00 V

If metal 2 is more reactive than metal 1, the voltage measured is positive.

The greater the difference in reactivity of the metals, the larger the reading on the voltmeter.

What is the order of reactivity?

	most reactive	→			least reactive
A	cerium	beryllium	cobalt	manganese	
B	cerium	beryllium	manganese	cobalt	
C	cobalt	manganese	beryllium	cerium	
D	cobalt	manganese	cerium	beryllium	

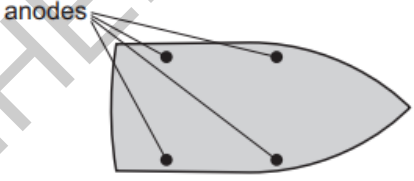
m18-p22-q23

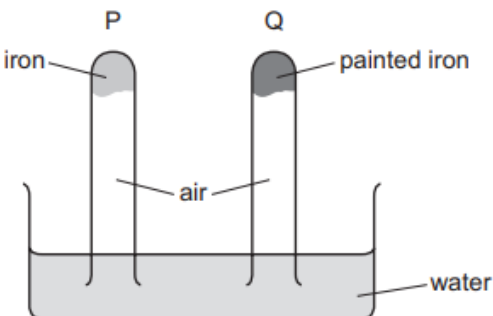
Which statements about Group I and Group VII elements are correct?

- 1 In Group I, lithium is more reactive than potassium.
- 2 In Group VII, chlorine is more reactive than fluorine.

	statement 1	statement 2
A	✓	✓
B	✓	x
C	x	✓
D	x	x

Topic	<p style="text-align: center;"><u>9. Metals</u></p> <p style="text-align: center;">9.5 Corrosion of metals</p>
Content	<ol style="list-style-type: none"> 1. State the conditions required for the rusting of iron and steel to form hydrated iron(III) oxide 2. State some common barrier methods, including painting, greasing and coating with plastic 3. Describe how barrier methods prevent rusting by excluding oxygen or water 4. Describe the use of zinc in galvanising as an example of a barrier method and sacrificial protection 5. Explain sacrificial protection in terms of the reactivity series and in terms of electron loss
w21-p23-q29	<p>Ships are made of steel, an alloy of iron.</p> <p>Blocks of magnesium are attached to the underside of ships to prevent rusting.</p> <p>Which statement explains how the magnesium prevents rusting?</p> <p>A Magnesium oxidises instead of iron.</p> <p>B Magnesium stops air and water getting to the iron.</p> <p>C The magnesium forms an alloy with iron which does not corrode.</p> <p>D The magnesium reacts with rust as soon as it is formed.</p>
w21-p22-q28	<p>Which statements explain why zinc is used to protect iron from rusting?</p> <ol style="list-style-type: none"> 1 Zinc is more reactive than iron. 2 Zinc is less reactive than iron. 3 Zinc can form alloys with iron. 4 Zinc acts as a sacrificial metal. <p>A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4</p>
w21-p21-q29	<p>Covering iron with zinc prevents the iron from rusting even when the zinc is scratched.</p> <p>Covering iron with tin prevents the iron from rusting, but when the tin is scratched the iron underneath starts to rust.</p> <p>Which statement is correct?</p> <p>A Both tin and zinc prevent iron from rusting by sacrificial protection.</p> <p>B Both tin and zinc prevent iron from rusting by stopping water and carbon dioxide reaching the iron.</p> <p>C Tin is more reactive than iron and prevents iron from rusting until it is scratched.</p> <p>D Zinc loses electrons more easily than iron and prevents iron from rusting by corroding first.</p>

s21-p23-q24	<p>Which statement explains why galvanising prevents iron from rusting?</p> <p>A Zinc is more reactive than iron and corrodes in preference to iron.</p> <p>B Zinc is more reactive than iron and loses electrons less easily than iron.</p> <p>C Zinc is less reactive than iron and corrodes in preference to iron.</p> <p>D Zinc is less reactive than iron and loses electrons more easily than iron.</p>
w21-p21-q29	<p>Which statements about the metal zinc are correct?</p> <p>1 It is extracted from the ore bauxite.</p> <p>2 It is used to galvanise steel.</p> <p>3 It is used to make the alloy brass.</p> <p>4 It reacts with dilute hydrochloric acid to produce hydrogen gas.</p> <p>A 2 and 3 only B 1, 2 and 4 C 1, 3 and 4 D 2, 3 and 4</p>
s20-p23-q32	<p>The diagram shows the positions of sacrificial anodes on the steel hull of a yacht.</p>  <p>Which metal is used to make the anodes?</p> <p>A calcium</p> <p>B copper</p> <p>C sodium</p> <p>D zinc</p>
s20-p22-q28	<p>Four iron nails are added to four different metal sulfate solutions.</p> <p>In which solution does a displacement reaction occur?</p> <p>A copper(II) sulfate</p> <p>B magnesium sulfate</p> <p>C sodium sulfate</p> <p>D zinc sulfate</p>

s20-p22-q32	<p>Which process, used to prevent iron from rusting, involves sacrificial protection?</p> <p>A alloying</p> <p>B electroplating</p> <p>C galvanising</p> <p>D painting</p>															
s20-p21-q32	<p>Coating iron helps to prevent rusting.</p> <p>Which coating will continue to protect the iron even when the coating is damaged?</p> <p>A copper</p> <p>B paint</p> <p>C plastic</p> <p>D zinc</p>															
m20-p22-q32	<p>Zinc is used to cover iron to prevent it from rusting.</p> <p>Why is zinc a suitable metal to use?</p> <p>A Iron is more reactive than zinc.</p> <p>B Iron atoms are bigger than zinc atoms.</p> <p>C Zinc is more reactive than iron.</p> <p>D Zinc atoms are bigger than iron atoms.</p>															
s19-p23-q30 s19-p22-q31 s19-p21-q30	<p>The diagram shows an experiment to investigate how paint affects the rusting of iron.</p>  <p>What happens to the water level in tubes P and Q?</p> <table><tr><th></th><th>tube P</th><th>tube Q</th></tr><tr><td>A</td><td>falls</td><td>rises</td></tr><tr><td>B</td><td>no change</td><td>rises</td></tr><tr><td>C</td><td>rises</td><td>falls</td></tr><tr><td>D</td><td>rises</td><td>no change</td></tr></table>		tube P	tube Q	A	falls	rises	B	no change	rises	C	rises	falls	D	rises	no change
	tube P	tube Q														
A	falls	rises														
B	no change	rises														
C	rises	falls														
D	rises	no change														

w18-p23-q25

Calcium reacts with cold water to produce hydrogen.

Lead reacts slowly when heated in air to form an oxide but has almost no reaction with steam.

Silver does not react with either air or water.

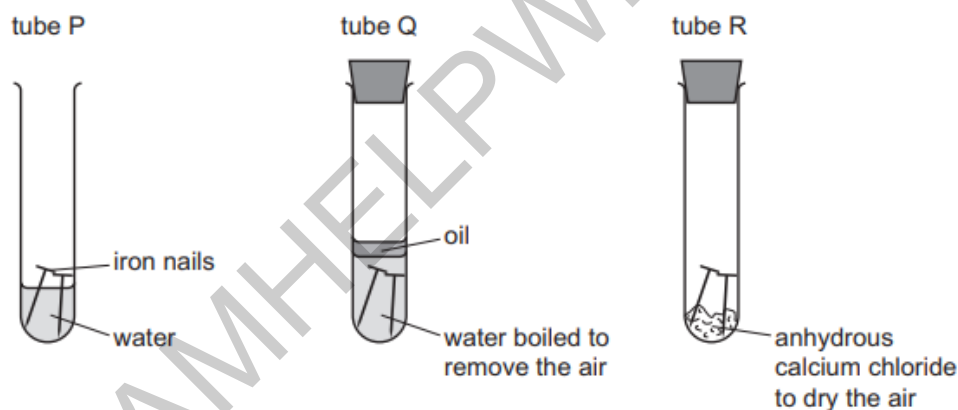
Zinc reacts when heated with steam to produce hydrogen.

What is the order of reactivity starting with the least reactive?

	least reactive \longrightarrow most reactive			
A	calcium	lead	zinc	silver
B	calcium	zinc	lead	silver
C	silver	lead	zinc	calcium
D	silver	zinc	lead	calcium

w18-p23-q31
w18-p22-q31
w18-p21-q31

The diagrams show experiments involving the rusting of iron.



A student predicted the following results.

- 1 In tube P, the iron nails rust.
- 2 In tube Q, the iron nails do not rust.
- 3 In tube R, the iron nails do not rust.

Which predictions are correct?

- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

s18-p23-q29
s18-p22-q29
s18-p21-q29

A steel bicycle which had been left outdoors for several months was starting to rust.

What would **not** reduce the rate of corrosion?

- A** Remove the rust and paint the bicycle.
B Remove the rust and store the bicycle in a dry shed.
C Remove the rust and wipe the bicycle with a clean, damp cloth.
D Remove the rust and wipe the bicycle with an oily cloth.

Topic	<p align="center">9. Metals</p> <p align="center">9.6 Extraction of metals</p>
Content	<ol style="list-style-type: none"> Describe the ease in obtaining metals from their ores, related to the position of the metal in the reactivity series Describe the extraction of iron from hematite in the blast furnace, limited to: <ol style="list-style-type: none"> the burning of carbon (coke) to provide heat and produce carbon dioxide the reduction of carbon dioxide to carbon monoxide the reduction of iron(III) oxide by carbon monoxide the nitrateposition of calcium carbonate /limestone to produce calcium oxide the formation of slag Symbol equations are not required State that the main ore of aluminium is bauxite and that aluminium is extracted by electrolysis State the symbol equations for the extraction of iron from hematite <ol style="list-style-type: none"> $C + O_2 \rightarrow CO_2$ $C + CO_2 \rightarrow 2CO$ $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ $CaCO_3 \rightarrow CaO + CO_2$ $CaO + SiO_2 \rightarrow CaSiO_3$ Describe the extraction of aluminium from purified bauxite / aluminium oxide, including: <ol style="list-style-type: none"> the role of cryolite why the carbon anodes need to be regularly replaced the reactions at the electrodes, including ionic half-equations Details of the purification of bauxite are not required
m22-p22-q25	<p>Which word equation represents a reaction that occurs?</p> <p>A sodium oxide + carbon → sodium + carbon dioxide</p> <p>B sodium oxide + iron → sodium + iron(II) oxide</p> <p>C iron(II) oxide + copper → iron + copper(II) oxide</p> <p>D iron(III) oxide + carbon → iron + carbon dioxide</p>
m22-p22-q26	<p>Which statement about the extraction of aluminium is correct?</p> <p>A Aluminium is formed at the cathode during the electrolysis of aluminium oxide.</p> <p>B Hematite is mainly aluminium oxide.</p> <p>C Molten cryolite is used to raise the melting point of the aluminium oxide.</p> <p>D Oxygen gains electrons at the anode during the electrolysis of aluminium oxide.</p>
m22-p22-q34	<p>Which statements about lime are correct?</p> <ol style="list-style-type: none"> Lime is made by heating calcium carbonate (limestone). Lime is used to desulfurise flue gases. Lime is used to treat alkaline soil. The chemical name for lime is calcium oxide. <p>A 1 and 3 B 1, 2 and 4 C 1 and 4 only D 2, 3 and 4</p>

w21-p22-q26	<p>Carbon dioxide is produced during the extraction of aluminium from bauxite.</p> <p>Which statement describes how this carbon dioxide is made?</p> <p>A Carbon monoxide reduces aluminium oxide forming carbon dioxide and aluminium.</p> <p>B Carbon is burned in the blast furnace to release heat energy.</p> <p>C Oxygen made in the process reacts with the carbon electrode.</p> <p>D The ore of aluminium undergoes thermal decomposition.</p>
w21-p21-q26	<p>Which statement about the extraction of metals is correct?</p> <p>A Aluminium is extracted from the ore bauxite by electrolysis.</p> <p>B Aluminium is extracted from the ore hematite by electrolysis.</p> <p>C Iron is extracted from the ore bauxite by electrolysis.</p> <p>D Iron is extracted from the ore hematite by electrolysis.</p>
s21-p23-q29	<p>Which reaction does not occur during the extraction of iron from hematite in a blast furnace?</p> <p>A $C + O_2 \rightarrow CO_2$</p> <p>B $CaO + SiO_2 \rightarrow CaSiO_3$</p> <p>C $CO_2 + C \rightarrow 2CO$</p> <p>D $4Fe + 3O_2 \rightarrow 2Fe_2O_3$</p>
s21-p23-q33	<p>Which statement about calcium carbonate is correct?</p> <p>A It is made by the thermal decomposition of limestone.</p> <p>B It is used to neutralise alkaline soils.</p> <p>C It is a reactant in the test for carbon dioxide.</p> <p>D It is used to remove impurities in iron extraction.</p>
s21-p22-q27	<p>Aluminium is extracted from its ore by electrolysis.</p> <p>Which equation represents the reaction that occurs at the anode during the electrolysis?</p> <p>A $Al^{3+} + 3e^- \rightarrow Al$</p> <p>B $Al^{3+} \rightarrow Al + 3e^-$</p> <p>C $2O^{2-} \rightarrow O_2 + 4e^-$</p> <p>D $2O^{2-} + 2e^- \rightarrow O_2$</p>

s21-p22-q33	<p>The equations represent two reactions, P and Q, of lime (calcium oxide).</p> <p>P $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$</p> <p>Q $\text{CaO} + \text{SO}_2 \rightarrow \text{CaSO}_3$</p> <p>In which processes do the reactions occur?</p> <table><tr><th></th><th>P</th><th>Q</th></tr><tr><td>A</td><td>extraction of iron</td><td>extraction of iron</td></tr><tr><td>B</td><td>extraction of iron</td><td>flue gas desulfurisation</td></tr><tr><td>C</td><td>flue gas desulfurisation</td><td>extraction of iron</td></tr><tr><td>D</td><td>flue gas desulfurisation</td><td>flue gas desulfurisation</td></tr></table>		P	Q	A	extraction of iron	extraction of iron	B	extraction of iron	flue gas desulfurisation	C	flue gas desulfurisation	extraction of iron	D	flue gas desulfurisation	flue gas desulfurisation
	P	Q														
A	extraction of iron	extraction of iron														
B	extraction of iron	flue gas desulfurisation														
C	flue gas desulfurisation	extraction of iron														
D	flue gas desulfurisation	flue gas desulfurisation														
s21-p21-q27	<p>Which substances are used in the extraction of aluminium?</p> <p>A bauxite and cryolite</p> <p>B bauxite and hematite</p> <p>C cryolite and zinc blende</p> <p>D hematite and zinc blende</p>															
m21-p22-q9	<p>The ionic half-equation for the formation of oxygen during the electrolysis of aluminium oxide is shown.</p> $x\text{O}^{2-} \rightarrow \text{O}_2 + y\text{e}^-$ <p>What are the values of x and y?</p> <table><tr><th></th><th>x</th><th>y</th></tr><tr><td>A</td><td>1</td><td>2</td></tr><tr><td>B</td><td>1</td><td>4</td></tr><tr><td>C</td><td>2</td><td>2</td></tr><tr><td>D</td><td>2</td><td>4</td></tr></table>		x	y	A	1	2	B	1	4	C	2	2	D	2	4
	x	y														
A	1	2														
B	1	4														
C	2	2														
D	2	4														
m21-p22-q25	<p>Why is cryolite used in the extraction of aluminium from bauxite?</p> <p>A as a catalyst for the process</p> <p>B as a solvent for aluminium oxide</p> <p>C it stops the carbon anodes burning away</p> <p>D it reduces aluminium ions in aluminium oxide</p>															

m21-p22-q27

Which row describes the reactions of magnesium hydroxide and magnesium oxide?

	effect of heat on hydroxide	effect of heating oxide with carbon
A	forms magnesium oxide	magnesium and carbon dioxide formed
B	forms magnesium oxide	no reaction
C	no reaction	magnesium and carbon dioxide formed
D	no reaction	no reaction

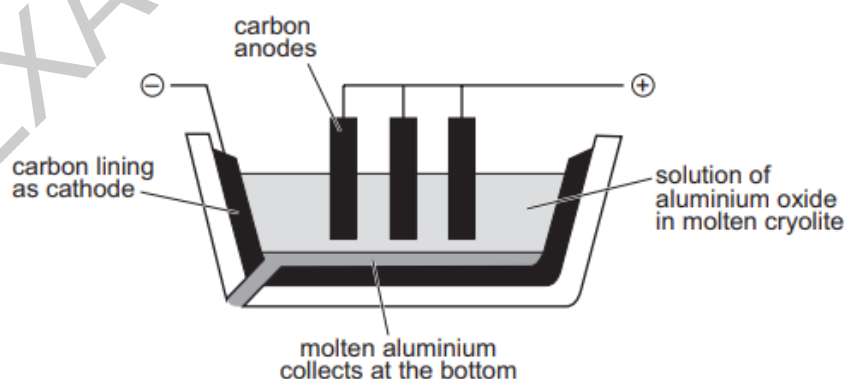
m21-p22-q33

What is an industrial use of calcium carbonate?

- A** cracking of hydrocarbons
- B** manufacture of aluminium
- C** manufacture of cement
- D** purification of water

w20-p22-q31

The apparatus used for the extraction of aluminium oxide by electrolysis is shown.



Which equation represents a reaction taking place at the anode?

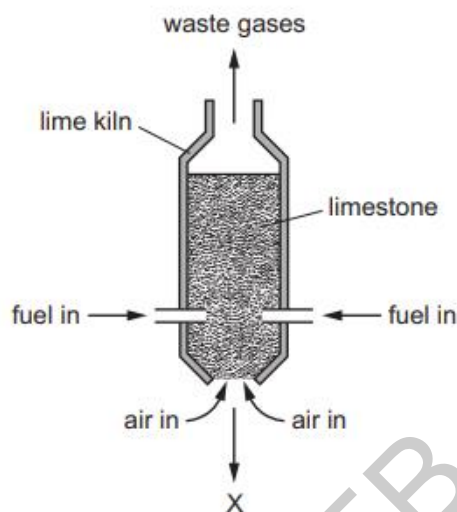
- A** $\text{O} + 2\text{e}^- \rightarrow \text{O}^{2-}$
- B** $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$
- C** $\text{Al}^{3-} \rightarrow \text{Al} + 3\text{e}^-$
- D** $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$

S20-p23-q27 S20-p22-q27 S20-p21-q27	<p>Molten iron from the blast furnace contains impurities.</p> <p>The process of turning the impure iron into steel involves blowing oxygen into the molten iron and adding calcium oxide.</p> <p>What are the reasons for blowing in oxygen and adding calcium oxide?</p> <table><tr><th></th><th>blowing in oxygen</th><th>adding calcium oxide</th></tr><tr><td>A</td><td>carbon is removed by reacting with oxygen</td><td>reacts with acidic impurities making slag</td></tr><tr><td>B</td><td>carbon is removed by reacting with oxygen</td><td>reacts with slag and so removes it</td></tr><tr><td>C</td><td>iron reacts with the oxygen</td><td>reacts with acidic impurities making slag</td></tr><tr><td>D</td><td>iron reacts with the oxygen</td><td>reacts with slag and so removes it</td></tr></table>		blowing in oxygen	adding calcium oxide	A	carbon is removed by reacting with oxygen	reacts with acidic impurities making slag	B	carbon is removed by reacting with oxygen	reacts with slag and so removes it	C	iron reacts with the oxygen	reacts with acidic impurities making slag	D	iron reacts with the oxygen	reacts with slag and so removes it
	blowing in oxygen	adding calcium oxide														
A	carbon is removed by reacting with oxygen	reacts with acidic impurities making slag														
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C	iron reacts with the oxygen	reacts with acidic impurities making slag														
D	iron reacts with the oxygen	reacts with slag and so removes it														
s20-p23-q33 s20-p22-q33 s20-p21-q33	<p>A student suggests three uses of calcium carbonate (limestone).</p> <p>1 manufacture of cement</p> <p>2 manufacture of iron</p> <p>3 treating alkaline soils</p> <p>Which suggestions are correct?</p> <p>A 1 and 2 only B 1 and 3 only C 2 and 3 only D 1, 2 and 3</p>															
m20-p22-q27	<p>Aluminium is extracted from bauxite by electrolysis.</p> <p>Which statement is correct?</p> <p>A Aluminium ions are oxidised to form aluminium.</p> <p>B The cathode has to be replaced regularly because it reacts with the oxygen which is formed.</p> <p>C Cryolite is added to remove impurities.</p> <p>D Carbon dioxide is produced at the anode.</p>															
w19-p23-q29	<p>Why is cryolite used in the extraction of aluminium by electrolysis?</p> <p>A It changes bauxite to aluminium oxide.</p> <p>B It decreases the melting point of the aluminium.</p> <p>C It dissolves the aluminium oxide.</p> <p>D It protects the anodes from corrosion.</p>															

w19-p23-q35	<p>Which type of reaction occurs when lime is manufactured from limestone?</p> <p>A combustion</p> <p>B neutralisation</p> <p>C redox</p> <p>D thermal decomposition</p>
w19-p22-q29	<p>Which statement about the extraction of aluminium from aluminium oxide is correct?</p> <p>A Aluminium is formed at the positive electrode during electrolysis.</p> <p>B Pure aluminium oxide is dissolved in molten cryolite.</p> <p>C Pure aluminium oxide is electrolysed using aluminium as the positive electrode.</p> <p>D Pure aluminium oxide is heated with carbon to form carbon dioxide and aluminium.</p>
w19-p21-q29	<p>Which statement about the extraction of aluminium is correct?</p> <p>A Aluminium is formed at the cathode during the electrolysis of aluminium oxide.</p> <p>B Hematite is mainly aluminium oxide.</p> <p>C Molten cryolite is used to raise the melting point of the aluminium oxide.</p> <p>D Oxygen gains electrons at the anode during the electrolysis of aluminium oxide.</p>
w19-p21-q35	<p>Which statement about the carbon cycle is correct?</p> <p>A Carbon is absorbed from the atmosphere by combustion and released into it by respiration.</p> <p>B Carbon is absorbed from the atmosphere by photosynthesis and released into it by combustion.</p> <p>C Carbon is absorbed from the atmosphere by both respiration and combustion.</p> <p>D Carbon is released into the atmosphere by both photosynthesis and respiration.</p>
s19-p23-q10	<p>In the manufacture of aluminium by electrolysis, aluminium oxide is dissolved in molten cryolite.</p> <p>Why is cryolite used?</p> <p>A It lowers the melting point of the aluminium.</p> <p>B It makes the aluminium a better conductor.</p> <p>C It removes impurities from the aluminium.</p> <p>D The mixture has a lower melting point than pure aluminium oxide.</p>

s19-p23-q34
s19-p22-q34
s19-p21-q34

The diagram represents a lime kiln used to heat limestone to a very high temperature.

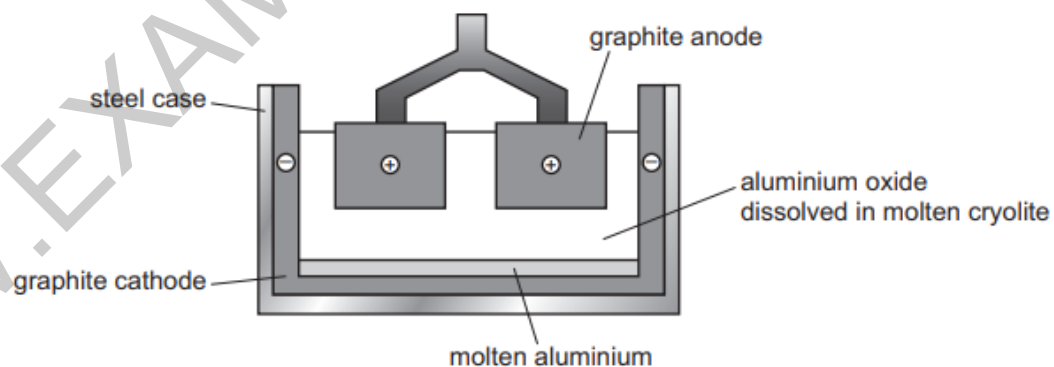


What leaves the kiln at X?

- A calcium carbonate
- B calcium hydroxide
- C calcium oxide
- D calcium sulfate

s19-p22-q10

Aluminium is extracted by electrolysis as shown.



Which row shows the ionic half-equations at the cathode and the anode?

	cathode	anode
A	$\text{Al}^{3+} \rightarrow \text{Al} + 3\text{e}^-$	$2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$
B	$\text{Al}^{3+} \rightarrow \text{Al} + 3\text{e}^-$	$2\text{O}^{2-} + 4\text{e}^- \rightarrow \text{O}_2$
C	$\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$	$2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$
D	$\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$	$2\text{O}^{2-} + 4\text{e}^- \rightarrow \text{O}_2$

s19-p21-q10	<p>Aluminium metal is extracted from aluminium oxide by electrolysis.</p> <p>Which ionic half-equation describes a reaction that occurs at the named electrode?</p> <table><tr><th></th><th>ionic half-equation</th><th>electrode</th></tr><tr><td>A</td><td>$2\text{O}^{2-} \rightarrow \text{O}_2 + 2\text{e}^-$</td><td>anode</td></tr><tr><td>B</td><td>$\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$</td><td>anode</td></tr><tr><td>C</td><td>$2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$</td><td>cathode</td></tr><tr><td>D</td><td>$\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$</td><td>cathode</td></tr></table>		ionic half-equation	electrode	A	$2\text{O}^{2-} \rightarrow \text{O}_2 + 2\text{e}^-$	anode	B	$\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$	anode	C	$2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$	cathode	D	$\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$	cathode
	ionic half-equation	electrode														
A	$2\text{O}^{2-} \rightarrow \text{O}_2 + 2\text{e}^-$	anode														
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D	$\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$	cathode														
m19-p22-q30	<p>Which statement about the extraction of metals is correct?</p> <p>A Aluminium is extracted by the electrolysis of hematite.</p> <p>B Cryolite acts as a reducing agent in the extraction of aluminium.</p> <p>C Zinc is extracted by the electrolysis of zinc blende.</p> <p>D Zinc is obtained by heating zinc oxide with coke.</p>															
w18-p23-q27	<p>Which statement about the manufacture of aluminium by electrolysis is correct?</p> <p>A Aluminium ions are oxidised to aluminium by gaining electrons.</p> <p>B Aluminium is extracted from its ore hematite.</p> <p>C Molten cryolite is used to dissolve the aluminium oxide.</p> <p>D Oxygen is formed at the negative electrode.</p>															
w18-p23-q34	<p>Which equation represents the formation of lime?</p> <p>A $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$</p> <p>B $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$</p> <p>C $\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{H}_2$</p> <p>D $\text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$</p>															

w18-p22-q27	<p>Bauxite contains aluminium oxide.</p> <p>Aluminium is extracted from aluminium oxide by electrolysis.</p> <p>Why is cryolite added to the electrolytic cell used to extract aluminium?</p> <p>A Cryolite prevents the carbon anodes being burned away.</p> <p>B Cryolite removes impurities from the bauxite.</p> <p>C Cryolite increases the rate at which aluminium ions are discharged.</p> <p>D Molten cryolite dissolves the aluminium oxide.</p>															
w18-p22-q34	<p>What is not a use of lime?</p> <p>A It is used as a bleach in the manufacture of wood pulp.</p> <p>B It is used to desulfurise flue gases.</p> <p>C It is used to neutralise acidic industrial waste.</p> <p>D It is used to treat acidic soil.</p>															
w18-p21-q24	<p>A student heated copper(II) carbonate and copper(II) nitrate in separate test-tubes.</p> <p>Both compounds decomposed.</p> <p>Which row shows the gases produced from each reaction?</p> <table><tr><td></td><td>copper(II) carbonate</td><td>copper(II) nitrate</td></tr><tr><td>A</td><td>carbon dioxide</td><td>nitrogen dioxide only</td></tr><tr><td>B</td><td>carbon dioxide</td><td>oxygen only</td></tr><tr><td>C</td><td>carbon dioxide</td><td>oxygen and nitrogen dioxide</td></tr><tr><td>D</td><td>oxygen</td><td>oxygen and nitrogen dioxide</td></tr></table>		copper(II) carbonate	copper(II) nitrate	A	carbon dioxide	nitrogen dioxide only	B	carbon dioxide	oxygen only	C	carbon dioxide	oxygen and nitrogen dioxide	D	oxygen	oxygen and nitrogen dioxide
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A	carbon dioxide	nitrogen dioxide only														
B	carbon dioxide	oxygen only														
C	carbon dioxide	oxygen and nitrogen dioxide														
D	oxygen	oxygen and nitrogen dioxide														
s18-p23-q26	<p>Which equation represents the first stage in the extraction of zinc from zinc blende?</p> <p>A $2\text{ZnS} + 3\text{O}_2 \rightarrow 2\text{ZnO} + 2\text{SO}_2$</p> <p>B $\text{ZnS} + \text{H}_2\text{O} \rightarrow \text{ZnO} + \text{H}_2\text{S}$</p> <p>C $\text{ZnO} + \text{CO} \rightarrow \text{Zn} + \text{CO}_2$</p> <p>D $\text{ZnO} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2\text{O}$</p>															

s18-p23-q34	<p>Limestone is an important material with many uses.</p> <p>Limestone is heated to produce1..... and carbon dioxide.</p> <p>This reaction is called2..... .</p> <p>Which words correctly complete gaps 1 and 2?</p> <table><tr><td></td><td>1</td><td>2</td></tr><tr><td>A</td><td>lime</td><td>neutralisation</td></tr><tr><td>B</td><td>lime</td><td>thermal decomposition</td></tr><tr><td>C</td><td>slaked lime</td><td>neutralisation</td></tr><tr><td>D</td><td>slaked lime</td><td>thermal decomposition</td></tr></table>		1	2	A	lime	neutralisation	B	lime	thermal decomposition	C	slaked lime	neutralisation	D	slaked lime	thermal decomposition
	1	2														
A	lime	neutralisation														
B	lime	thermal decomposition														
C	slaked lime	neutralisation														
D	slaked lime	thermal decomposition														
s18-p22-q26	<p>Which statement about the industrial extraction of zinc is correct?</p> <p>A Cryolite is added to lower the melting point.</p> <p>B Molten zinc oxide is electrolysed.</p> <p>C Zinc oxide is heated with coke.</p> <p>D Zinc sulfide is heated with coke.</p>															
s18-p22-q34	<p>Limestone is used in many industrial processes.</p> <p>In which process is it not used?</p> <p>A manufacture of alkenes</p> <p>B manufacture of cement</p> <p>C manufacture of iron</p> <p>D manufacture of lime</p>															
s18-p21-q26	<p>Aluminium metal is extracted from aluminium oxide using electrolysis.</p> <p>Which statement about the extraction process is not correct?</p> <p>A A large amount of electricity is required.</p> <p>B Molten cryolite is used to dissolve the aluminium oxide.</p> <p>C Oxygen gas is released which reacts to form carbon dioxide.</p> <p>D The negative electrodes burn away and have to be replaced.</p>															

s18-p21-q34	<p>Which process is used to convert limestone (calcium carbonate) into lime?</p> <p>A electrolysis</p> <p>B fractional distillation</p> <p>C incomplete combustion</p> <p>D thermal decomposition</p>
m18-p22-q25	<p>Aluminium is extracted from aluminium oxide using electrolysis.</p> <p>Carbon dioxide is formed in this process.</p> <p>Which equation shows the formation of carbon dioxide during the extraction of aluminium from aluminium oxide by electrolysis?</p> <p>A $\text{Al}_2(\text{CO}_3)_3 \rightarrow \text{Al}_2\text{O}_3 + 3\text{CO}_2$</p> <p>B $\text{Al}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Al} + 3\text{CO}_2$</p> <p>C $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$</p> <p>D $\text{C}^{4+} + 2\text{O}^{2-} \rightarrow \text{CO}_2$</p>

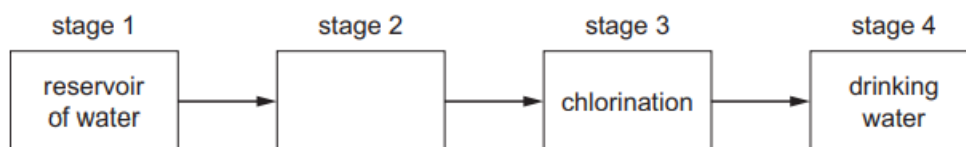
Topic	<p align="center"><u>10. Chemistry of the Environment</u></p> <p align="center">10.1 Water</p>
Content	<ol style="list-style-type: none"> Describe chemical tests for the presence of water using anhydrous cobalt(II) chloride and anhydrous copper(II) sulfate Describe how to test for the purity of water using melting point and boiling point Explain that distilled water is used in practical chemistry rather than tap water because it contains fewer chemical impurities State that water from natural sources may contain substances, including: <ol style="list-style-type: none"> dissolved oxygen metal compounds plastics sewage harmful microbes nitrate from fertilisers phosphates from fertilisers and detergents State that some of these substances are beneficial, including: <ol style="list-style-type: none"> dissolved oxygen for aquatic life some metal compounds provide essential minerals for life State that some of these substances are potentially harmful, including: <ol style="list-style-type: none"> some metal compounds are toxic some plastics harm aquatic life sewage contains harmful microbes which cause disease nitrate and phosphate lead to deoxygenation of water and damage to aquatic life. Details of the eutrophication process are not required Describe the treatment of the domestic water supply in terms of: <ol style="list-style-type: none"> sedimentation and filtration to remove solids use of carbon to remove tastes and odours chlorination to kill microbes
w21-p23-q32 w21-p22-q32 w21-p21-q32	<p>Lime (calcium oxide) is used to treat waste water from a factory.</p> <p>Which substance is removed by the lime?</p> <p>A ammonia</p> <p>B sodium chloride</p> <p>C sodium hydroxide</p> <p>D sulfuric acid</p>
w21-p22-q15	<p>Solid X is heated strongly.</p> <p>The colour of the solid changes from blue to white.</p> <p>What is solid X?</p> <p>A anhydrous cobalt(II) chloride</p> <p>B calcium carbonate</p> <p>C hydrated copper(II) sulfate</p> <p>D lead(II) bromide</p>

w21-p21-q15	<p>X is a pink solid.</p> <p>Y is a blue solid.</p> <p>When X is heated, water is produced and the solid turns blue.</p> <p>When water is added to Y, the solid turns pink.</p> <p>What are X and Y?</p> <table><tr><th></th><th>X</th><th>Y</th></tr><tr><td>A</td><td>anhydrous cobalt(II) chloride</td><td>hydrated cobalt(II) chloride</td></tr><tr><td>B</td><td>hydrated cobalt(II) chloride</td><td>anhydrous cobalt(II) chloride</td></tr><tr><td>C</td><td>anhydrous copper(II) sulfate</td><td>hydrated copper(II) sulfate</td></tr><tr><td>D</td><td>hydrated copper(II) sulfate</td><td>anhydrous copper(II) sulfate</td></tr></table>		X	Y	A	anhydrous cobalt(II) chloride	hydrated cobalt(II) chloride	B	hydrated cobalt(II) chloride	anhydrous cobalt(II) chloride	C	anhydrous copper(II) sulfate	hydrated copper(II) sulfate	D	hydrated copper(II) sulfate	anhydrous copper(II) sulfate
	X	Y														
A	anhydrous cobalt(II) chloride	hydrated cobalt(II) chloride														
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C	anhydrous copper(II) sulfate	hydrated copper(II) sulfate														
D	hydrated copper(II) sulfate	anhydrous copper(II) sulfate														
s21-p23-q23	<p>What are possible effects of an inadequate water supply during a drought?</p> <p>1 crop failure</p> <p>2 wastage of water</p> <p>3 human disease</p> <p>4 death of farm animals</p> <p>A 1, 2 and 3 B 1 and 2 only C 1, 3 and 4 D 3 and 4 only</p>															
s21-p22-q29	<p>Water is used for the irrigation of crops and for drinking water.</p> <p>For which uses must water be chlorinated?</p> <table><tr><th></th><th>irrigation</th><th>drinking</th></tr><tr><td>A</td><td>✓</td><td>✓</td></tr><tr><td>B</td><td>✓</td><td>x</td></tr><tr><td>C</td><td>x</td><td>✓</td></tr><tr><td>D</td><td>x</td><td>x</td></tr></table>		irrigation	drinking	A	✓	✓	B	✓	x	C	x	✓	D	x	x
	irrigation	drinking														
A	✓	✓														
B	✓	x														
C	x	✓														
D	x	x														
s20-p22-q29	<p>Which statement about pure water is not correct?</p> <p>A It condenses at 100 °C.</p> <p>B It freezes at 0 °C.</p> <p>C It turns cobalt(II) chloride paper blue.</p> <p>D It turns anhydrous copper(II) sulfate blue.</p>															

m20-p22-q2	<p>Which test is used to show that a sample of water is pure?</p> <p>A Evaporate the water to see if any solids remain.</p> <p>B Heat the water to check its boiling point.</p> <p>C Test with anhydrous cobalt(II) chloride.</p> <p>D Use universal indicator paper to check its pH.</p>
m20-p22-q29	<p>Water is treated at a waterworks to make it fit to drink.</p> <p>What is present in the water when it leaves the waterworks?</p> <p>A bacteria only</p> <p>B bacteria and insoluble substances</p> <p>C chlorine compounds only</p> <p>D chlorine compounds and soluble substances</p>
w19-p22-q30 w19-p21-q30	<p>River water contains soluble impurities, insoluble impurities and bacteria.</p> <p>River water is made safe to drink by filtration and chlorination.</p> <p>Which statement is correct?</p> <p>A Filtration removes bacteria and insoluble impurities, and chlorination removes soluble impurities.</p> <p>B Filtration removes insoluble impurities, and chlorination kills the bacteria.</p> <p>C Filtration removes soluble and insoluble impurities, and chlorination kills the bacteria.</p> <p>D Filtration removes soluble impurities and bacteria, and chlorination removes insoluble impurities.</p>
s19-p23-q28 s19-p22-q29 s19-p21-q28	<p>Water can be treated by filtration then chlorination.</p> <p>Which uses do not need water of this quality?</p> <ol style="list-style-type: none"> 1 water for cooling in industry 2 water for washing clothes 3 water for drinking <p>A 1, 2 and 3 B 1 and 2 only C 1 and 3 only D 2 and 3 only</p>

m19-p22-q31

The diagram shows how water is treated to make it suitable for drinking.



What happens in stage 2?

- A** condensation
- B** sublimation
- C** evaporation
- D** filtration

m18-p22-q29

Water must be purified before it is suitable for use in the home.

Which processes are used to remove solid impurities and to kill bacteria?

	to remove solid impurities	to kill bacteria
A	chlorination	chlorination
B	chlorination	filtration
C	filtration	chlorination
D	filtration	filtration

Topic	<p align="center">10. Chemistry of the Environment</p> <p align="center">10.2 Fertilisers</p>
Content	<p>1. State that ammonium salts and nitrates are used as fertilisers</p> <p>2. Describe the use of NPK fertilisers to provide the elements nitrogen, phosphorus and potassium for improved plant growth</p>
m21-p22-q30	<p>Which combination of chemical compounds can be used to produce the fertiliser shown?</p> <div> </div> <p> A $(\text{NH}_4)_3\text{PO}_4$, KCl B NH_4NO_3, $\text{Ca}_3(\text{PO}_4)_2$ C NH_4NO_3, $\text{CO}(\text{NH}_2)_2$ D NH_4NO_3, K_2SO_4, $(\text{NH}_4)_2\text{SO}_4$ </p>
m20-p22-q33	<p>Fertilisers are mixtures of different compounds used to increase the growth of crops.</p> <p>Which pair of substances contain the three essential elements for plant growth?</p> <p> A ammonium nitrate and calcium phosphate B ammonium nitrate and potassium chloride C ammonium phosphate and potassium chloride D potassium nitrate and calcium carbonate </p>
s18-p23-q30 s18-p22-q30 s18-p21-q30	<p>Which statements about water are correct?</p> <ol style="list-style-type: none"> Household water contains dissolved salts. Water for household use is filtered to remove soluble impurities. Water is treated with chlorine to kill bacteria. Water is used in industry for cooling. <p> A 1, 2, 3 and 4 B 1, 2 and 3 only C 1, 3 and 4 only D 2, 3 and 4 only </p>

m18-p22-q31

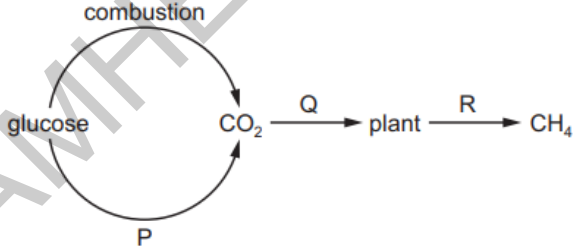
Which pair of compounds would make an NPK fertiliser?

- A** ammonium sulfate and potassium phosphate
- B** calcium hydroxide and ammonium nitrate
- C** calcium phosphate and potassium chloride
- D** potassium nitrate and ammonium sulfate

Topic	10. Chemistry of the Environment																					
	10.3 Air quality and climate																					
Content	<div><div><div>1. State the composition of clean, dry air as approximately 78% nitrogen, N2 , 21% oxygen, O2 and the remainder as a mixture of noble gases and carbon dioxide, CO2</div><div>2. State the source of each of these air pollutants, limited to:<div><div>(a) carbon dioxide from the complete combustion of carbon-containing fuels</div><div>(b) carbon monoxide and particulates from the incomplete combustion of carbon-containing fuels</div><div>(c) methane from the decomposition of vegetation and waste gases from digestion in animals</div><div>(d) oxides of nitrogen from car engines</div><div>(e) sulfur dioxide from the combustion of fossil fuels which contain sulfur compounds</div></div></div><div>3. State the adverse effect of these air pollutants, limited to:<div><div>(a) carbon dioxide: higher levels of carbon dioxide leading to increased global warming, which leads to climate change</div><div>(b) carbon monoxide: toxic gas</div><div>(c) particulates: increased risk of respiratory problems and cancer</div><div>(d) methane: higher levels of methane leading to increased global warming, which leads to climate change</div><div>(e) oxides of nitrogen: acid rain, photochemical smog and respiratory problems</div><div>(f) sulfur dioxide: acid rain</div></div></div><div>4. State and explain strategies to reduce the effects of these environmental issues, limited to:<div><div>(a) climate change: planting trees, reduction in livestock farming, decreasing use of fossil fuels, increasing use of hydrogen and renewable energy, e.g. wind, solar</div><div>(b) acid rain: use of catalytic converters in vehicles, reducing emissions of sulfur dioxide by using low-sulfur fuels and flue gas desulfurisation with calcium oxide</div></div></div><div>5. Describe photosynthesis as the reaction between carbon dioxide and water to produce glucose and oxygen in the presence of chlorophyll and using energy from light</div><div>6. State the word equation for photosynthesis, carbon dioxide + water → glucose + oxygen</div><div>7. Describe how the greenhouse gases carbon dioxide and methane cause global warming, limited to:<div><div>(a) the absorption, reflection and emission of thermal energy</div><div>(b) reducing thermal energy loss to space</div></div></div><div>8. Explain how oxides of nitrogen form in car engines and describe their removal by catalytic converters, e.g. $2\text{CO} + 2\text{NO} \rightarrow 2\text{CO}_2 + \text{N}_2$</div><div>9. State the symbol equation for photosynthesis, $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$</div></div></div>																					
m22-p22-q32	<div><div>Which information about carbon dioxide and methane is correct?</div><table><tr><td></td><td></td><td>carbon dioxide</td><td>methane</td><td rowspan="5"><div>key ✓ = correct ✗ = not correct</div></td></tr><tr><td>A</td><td>formed when vegetation decomposes</td><td>✓</td><td>✗</td></tr><tr><td>B</td><td>greenhouse gas</td><td>✓</td><td>✓</td></tr><tr><td>C</td><td>present in unpolluted air</td><td>✗</td><td>✗</td></tr><tr><td>D</td><td>produced during respiration</td><td>✗</td><td>✓</td></tr></table></div>			carbon dioxide	methane	<div>key ✓ = correct ✗ = not correct</div>	A	formed when vegetation decomposes	✓	✗	B	greenhouse gas	✓	✓	C	present in unpolluted air	✗	✗	D	produced during respiration	✗	✓
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C	present in unpolluted air	✗	✗																			
D	produced during respiration	✗	✓																			

W21-P23-Q28	<p>Which statement describes how oxides of nitrogen are formed in a car engine?</p> <p>A Nitrogen from the air reacts with oxygen from petrol.</p> <p>B Nitrogen from the air reacts with oxygen from the air.</p> <p>C Nitrogen from petrol reacts with oxygen from petrol.</p> <p>D Nitrogen from petrol reacts with oxygen from the air.</p>															
W21-P23-Q34 W21-P21-Q34	<p>Fuel X produces carbon dioxide and water when it is burned in air. So does fuel Y.</p> <p>What could X and Y be?</p> <table><tr><td></td><td>X</td><td>Y</td></tr><tr><td>A</td><td>C</td><td>H₂</td></tr><tr><td>B</td><td>C</td><td>C₈H₁₈</td></tr><tr><td>C</td><td>CH₄</td><td>H₂</td></tr><tr><td>D</td><td>CH₄</td><td>C₈H₁₈</td></tr></table>		X	Y	A	C	H ₂	B	C	C ₈ H ₁₈	C	CH ₄	H ₂	D	CH ₄	C ₈ H ₁₈
	X	Y														
A	C	H ₂														
B	C	C ₈ H ₁₈														
C	CH ₄	H ₂														
D	CH ₄	C ₈ H ₁₈														
W21-P22-Q14	<p>Which statements about hydrogen are correct?</p> <p>1 When hydrogen is burned, heat energy is released.</p> <p>2 When hydrogen is used in a fuel cell, electrical energy is generated.</p> <p>3 When hydrogen is used as a fuel, water is the only product.</p> <p>A 1, 2 and 3 B 1 and 2 only C 1 only D 3 only</p>															
W21-P22-Q30	<p>Which process does not produce a greenhouse gas?</p> <p>A acid rain on limestone buildings</p> <p>B combustion of wood</p> <p>C digestion in cows</p> <p>D zinc reacting with sulfuric acid</p>															

w21-p22-q34	<p>Fuel X produces carbon dioxide and water when it is burned in air. So does fuel Y.</p> <p>What could X and Y be?</p> <table><tr><td></td><td>X</td><td>Y</td></tr><tr><td>A</td><td>C</td><td>H₂</td></tr><tr><td>B</td><td>C</td><td>C₈H₁₈</td></tr><tr><td>C</td><td>CH₄</td><td>H₂</td></tr><tr><td>D</td><td>CH₄</td><td>C₈H₁₈</td></tr></table>		X	Y	A	C	H ₂	B	C	C ₈ H ₁₈	C	CH ₄	H ₂	D	CH ₄	C ₈ H ₁₈
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A	C	H ₂														
B	C	C ₈ H ₁₈														
C	CH ₄	H ₂														
D	CH ₄	C ₈ H ₁₈														
w21-p22-q36	<p>Which statement about ethene is correct?</p> <p>A It has the chemical formula C₂H₆.</p> <p>B It burns in excess oxygen producing carbon dioxide and water.</p> <p>C It reacts with Br₂ to produce an orange solution.</p> <p>D It reacts with oxygen to form ethanol.</p>															
s21-p23-q27	<p>Which gas is an air pollutant that causes acid rain?</p> <p>A argon</p> <p>B carbon monoxide</p> <p>C methane</p> <p>D nitrogen dioxide</p>															
s21-p22-q21	<p>Burning fossil fuels releases sulfur dioxide which leads to acid rain.</p> <p>Which ion in the rain water causes it to be acidic?</p> <p>A H⁺ B OH⁻ C O²⁻ D SO₄²⁻</p>															
s21-p22-q32	<p>Which process in the carbon cycle is responsible for removing carbon dioxide from the atmosphere?</p> <p>A combustion</p> <p>B decomposition</p> <p>C photosynthesis</p> <p>D respiration</p>															

m21-pP22-q29	<p>Petrol burns in a car engine to produce waste gases which leave through the car exhaust.</p> <p>One of these waste gases is an oxide of nitrogen.</p> <p>Which statement describes how this oxide of nitrogen is formed?</p> <p>A Carbon dioxide reacts with nitrogen in the catalytic converter.</p> <p>B Nitrogen reacts with oxygen in the car engine.</p> <p>C Nitrogen reacts with oxygen in the catalytic converter.</p> <p>D Petrol combines with nitrogen in the car engine.</p>																				
m21-p22-q31	<p>Which process does not produce carbon dioxide?</p> <p>A combustion of a hydrocarbon</p> <p>B photosynthesis</p> <p>C reaction between an acid and a metal carbonate</p> <p>D respiration</p>																				
w20-p23-q33 w20-p22-q33 w20-p21-q34	<p>Part of the carbon cycle is shown.</p>  <p>What are processes P, Q and R?</p> <table><tr><th></th><th>P</th><th>Q</th><th>R</th></tr><tr><td>A</td><td>decomposition</td><td>respiration</td><td>photosynthesis</td></tr><tr><td>B</td><td>respiration</td><td>photosynthesis</td><td>decomposition</td></tr><tr><td>C</td><td>respiration</td><td>decomposition</td><td>photosynthesis</td></tr><tr><td>D</td><td>photosynthesis</td><td>respiration</td><td>decomposition</td></tr></table>		P	Q	R	A	decomposition	respiration	photosynthesis	B	respiration	photosynthesis	decomposition	C	respiration	decomposition	photosynthesis	D	photosynthesis	respiration	decomposition
	P	Q	R																		
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B	respiration	photosynthesis	decomposition																		
C	respiration	decomposition	photosynthesis																		
D	photosynthesis	respiration	decomposition																		
s20-p23-q30	<p>Which processes increase the amount of carbon dioxide in the atmosphere?</p> <p>1 burning ethanol</p> <p>2 farming cattle</p> <p>3 growing trees</p> <p>A 1, 2 and 3 B 1 and 2 only C 1 and 3 only D 2 and 3 only</p>																				

s20-p22-q30

Three processes in the carbon cycle are shown.

- 1 Methane reacts with oxygen producing carbon dioxide and water.
- 2 Carbon dioxide and water are absorbed and used by plants to make oxygen.
- 3 Oxygen is used by living things to release energy.

Which processes have taken place?

	1	2	3
A	combustion	photosynthesis	respiration
B	combustion	respiration	photosynthesis
C	photosynthesis	combustion	respiration
D	respiration	photosynthesis	combustion

s20-p21-q30

Which process removes carbon dioxide from the atmosphere?

- A** combustion
- B** decomposition
- C** photosynthesis
- D** respiration

m20-p22-q30

Sulfur dioxide, carbon monoxide and oxides of nitrogen are common gaseous pollutants found in the air.

Which pollutants contribute to acid rain?

- A** carbon monoxide and sulfur dioxide
- B** oxides of nitrogen and sulfur dioxide
- C** oxides of nitrogen only
- D** sulfur dioxide only

m20-p22-q31

Oxides of nitrogen, such as NO and NO₂, are formed in the petrol engines of cars.

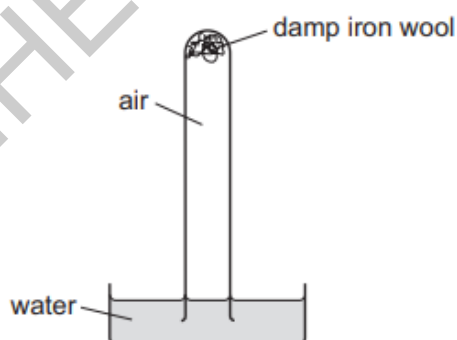
They are removed from the exhaust gases by reactions in the car's catalytic converter.

Which row describes how oxides of nitrogen are formed in a petrol engine, and a reaction that happens in the catalytic converter?

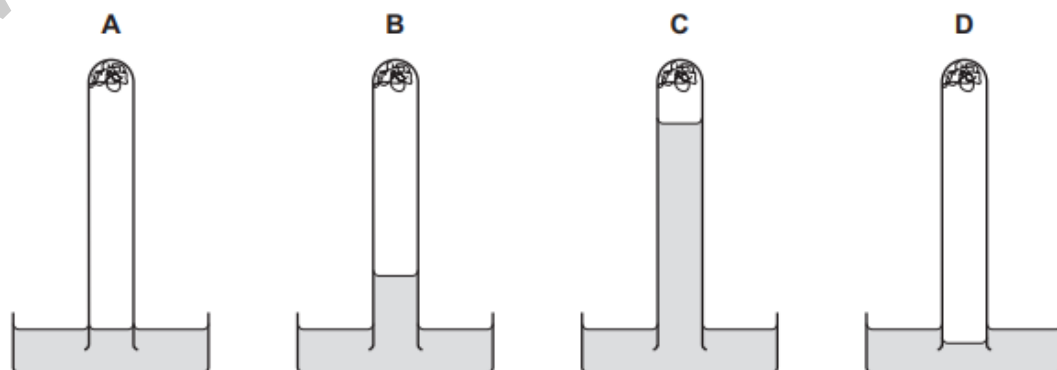
	how oxides of nitrogen are formed	a reaction that happens in the catalytic converter
A	by the reaction between nitrogen and oxygen from the air	$2\text{NO} + 2\text{CO} \rightarrow \text{N}_2 + 2\text{CO}_2$
B	by the reaction between nitrogen and oxygen from the air	$2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$
C	by the reaction between nitrogen compounds in petrol and oxygen from the air	$2\text{NO} + 2\text{CO} \rightarrow \text{N}_2 + 2\text{CO}_2$
D	by the reaction between nitrogen compounds in petrol and oxygen from the air	$2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$

w19-p23-q32
w19-p22-q32
w19-p21-q32

The apparatus shown is set up and left for a week.



Which diagram shows the level of the water at the end of the week?



w19-p23-q33

The following processes are part of the carbon cycle.

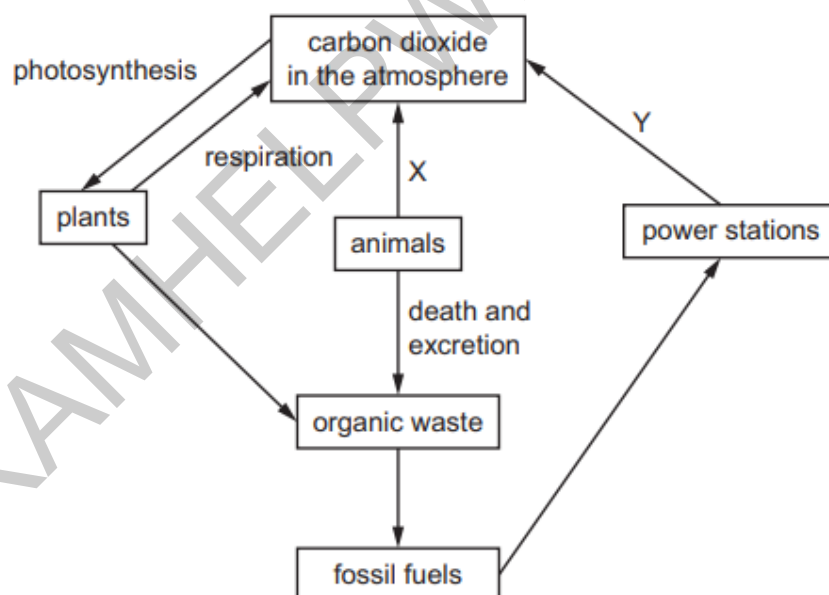
- 1 photosynthesis
- 2 combustion
- 3 respiration

Which processes decrease the amount of carbon dioxide in the atmosphere?

- A** 1 only **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

w19-p22-q33

The diagram represents an outline of the carbon cycle.



Which processes are X and Y?

	X	Y
A	combustion	respiration
B	decomposition	respiration
C	photosynthesis	combustion
D	respiration	combustion

w19-p22-q35	<p>Which statement about limestone and lime is correct?</p> <p>A Limestone combines with water to produce slaked lime.</p> <p>B Lime is obtained from limestone by oxidation.</p> <p>C Lime is used in the desulfurisation of flue gases.</p> <p>D Lime is used in the treatment of alkaline soil.</p>															
w19-p21-q33	<p>Which statement about the carbon cycle is correct?</p> <p>A Carbon is absorbed from the atmosphere by combustion and released into it by respiration.</p> <p>B Carbon is absorbed from the atmosphere by photosynthesis and released into it by combustion.</p> <p>C Carbon is absorbed from the atmosphere by both respiration and combustion.</p> <p>D Carbon is released into the atmosphere by both photosynthesis and respiration.</p>															
s19-p23-q29	<p>Catalytic converters in car exhausts change polluting gases into non-polluting gases.</p> <p>Which statements about oxides of nitrogen and car engines are correct?</p> <p>1 The nitrogen in oxides of nitrogen comes from compounds in petrol.</p> <p>2 The oxygen in oxides of nitrogen comes from the air in the car engine.</p> <p>3 Catalytic converters convert oxides of nitrogen into nitrogen and other gases.</p> <p>A 1 and 2 B 2 and 3 C 2 only D 3 only</p>															
s19-p23-q31	<p>Which row about the carbon cycle is correct?</p> <table><tr><td></td><td>process for removing carbon dioxide from the atmosphere</td><td>process for returning carbon dioxide to the atmosphere</td></tr><tr><td>A</td><td>photosynthesis</td><td>combustion of hydrocarbons</td></tr><tr><td>B</td><td>photosynthesis</td><td>cracking of hydrocarbons</td></tr><tr><td>C</td><td>respiration</td><td>combustion of hydrocarbons</td></tr><tr><td>D</td><td>respiration</td><td>cracking of hydrocarbons</td></tr></table>		process for removing carbon dioxide from the atmosphere	process for returning carbon dioxide to the atmosphere	A	photosynthesis	combustion of hydrocarbons	B	photosynthesis	cracking of hydrocarbons	C	respiration	combustion of hydrocarbons	D	respiration	cracking of hydrocarbons
	process for removing carbon dioxide from the atmosphere	process for returning carbon dioxide to the atmosphere														
A	photosynthesis	combustion of hydrocarbons														
B	photosynthesis	cracking of hydrocarbons														
C	respiration	combustion of hydrocarbons														
D	respiration	cracking of hydrocarbons														

s19-p22-q28

The exhaust gases from cars contain oxides of nitrogen.

How are these oxides of nitrogen formed?

- A** Nitrogen and oxygen from the air react together at the high temperatures in the engine.
- B** Nitrogen and oxygen from the petrol react together in the car exhaust.
- C** Nitrogen from the petrol reacts with oxygen at the high temperatures in the engine.
- D** Nitrogen reacts with oxygen from the air in the catalytic converter.

s19-p22-q30

Some of the processes involved in the carbon cycle are shown.

1 glucose + oxygen → carbon dioxide + water

2 carbon dioxide + water → glucose + oxygen

3 methane + oxygen → carbon dioxide + water

What are the names of these processes?

	1	2	3
A	combustion	respiration	photosynthesis
B	photosynthesis	combustion	respiration
C	respiration	combustion	photosynthesis
D	respiration	photosynthesis	combustion

s19-p21-q29

Oxides of nitrogen are formed in car engines and are a source of air pollution.

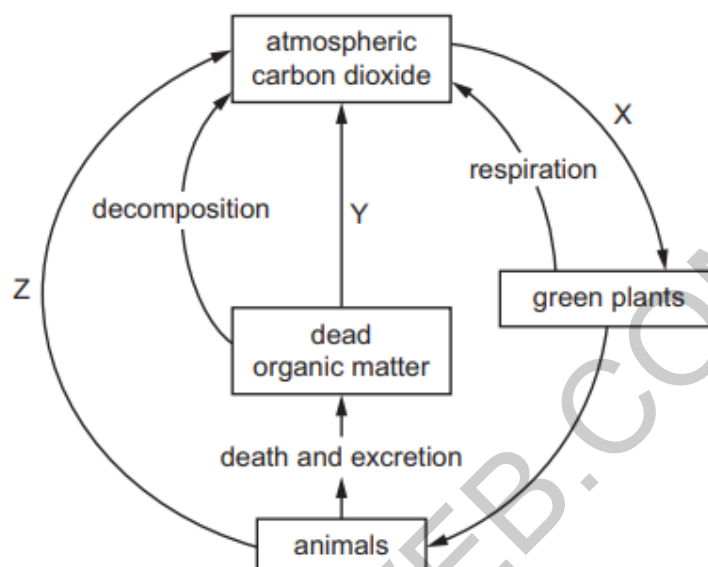
To decrease this pollution, catalytic converters are fitted to car exhausts.

What happens to the oxides of nitrogen in the catalytic converter?

- A** combustion
- B** cracking
- C** oxidation
- D** reduction

s19-p21-q32

The carbon cycle is shown.



Which row describes processes X, Y and Z?

	X	Y	Z
A	respiration	combustion	photosynthesis
B	respiration	photosynthesis	combustion
C	photosynthesis	combustion	respiration
D	photosynthesis	respiration	combustion

m19-p22-q34

Which process removes carbon dioxide from the Earth's atmosphere?

- A** combustion
- B** heating limestone
- C** photosynthesis
- D** respiration

w18-p23-q29

Which equation represents the incomplete combustion of propane, C_3H_8 ?

- A** $2C_3H_8 + 7O_2 \rightarrow 6CO + 8H_2O$
- B** $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$
- C** $2C_3H_8 + 11O_2 \rightarrow 6CO + 16H_2O$
- D** $C_3H_8 + 7O_2 \rightarrow 3CO_2 + 8H_2O$

<p>w18-p23-q30 w18-p22-q30 w18-p21-q30</p>	<p>Argon is a noble gas used to fill light bulbs.</p> <p>What is the approximate percentage of argon in air?</p> <p>A 1% B 20% C 79% D 99%</p>
<p>w18-p23-q32</p>	<p>Which statement about the carbon cycle is correct?</p> <p>A Animals and plants need carbon dioxide for respiration.</p> <p>B Combustion of plants and natural gas produces carbon dioxide.</p> <p>C Plants produce glucose from carbon dioxide and oxygen.</p> <p>D Oxygen is produced by both animals and plants.</p>
<p>w18-p22-q29</p>	<p>Which statements about sulfur dioxide pollution are correct?</p> <p>1 It increases the pH of rivers.</p> <p>2 It damages limestone buildings.</p> <p>3 It causes respiratory problems.</p> <p>A 1 only B 2 only C 1 and 3 D 2 and 3</p>
<p>w18-p22-q32</p>	<p>In the carbon cycle, which two processes add carbon dioxide to the atmosphere?</p> <p>A combustion and carbonate formation</p> <p>B combustion and photosynthesis</p> <p>C combustion and respiration</p> <p>D respiration and photosynthesis</p>

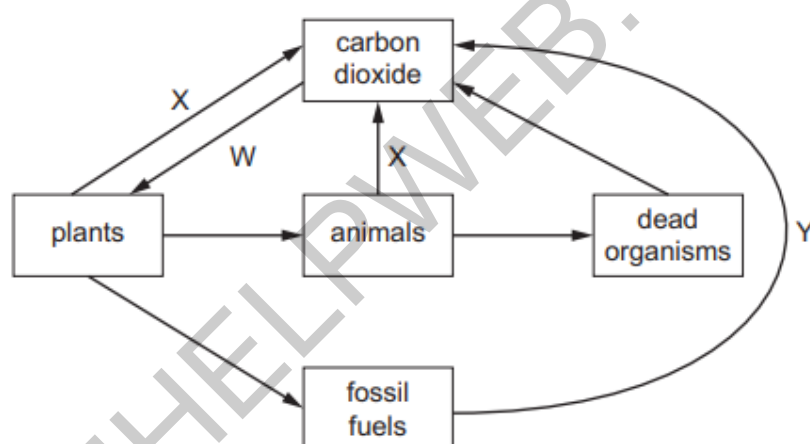
w18-p21-q29

Which statement about air pollutants is **not** correct?

- A** Carbon monoxide is formed from the complete combustion of petroleum.
- B** Lead compounds are formed from some types of petrol.
- C** Oxides of nitrogen are formed from the combustion reactions inside car engines.
- D** Sulfur dioxide is formed from the combustion of coal.

w18-p21-q32

A diagram of the carbon cycle is shown.



Which processes are represented by the letters W, X and Y?

	W	X	Y
A	photosynthesis	combustion	respiration
B	photosynthesis	respiration	combustion
C	respiration	combustion	photosynthesis
D	respiration	photosynthesis	combustion

s18-p23-q32
s18-p22-q32
s18-p21-q32

Which statements about the carbon cycle are correct?

- 1 Carbon dioxide is added to the atmosphere by respiration.
- 2 Carbon dioxide is added to the atmosphere by combustion of coal.
- 3 Carbon dioxide is removed from the atmosphere by photosynthesis.

- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

s18-p21-q12	<p>Plant cells use energy from sunlight for photosynthesis.</p> <p>Which row describes and explains the energy change that occurs?</p> <table><tr><td></td><td>type of energy change</td><td>explanation</td></tr><tr><td>A</td><td>endothermic</td><td>less energy is released making bonds than is absorbed to break bonds</td></tr><tr><td>B</td><td>endothermic</td><td>more energy is released making bonds than is absorbed to break bonds</td></tr><tr><td>C</td><td>exothermic</td><td>less energy is released making bonds than is absorbed to break bonds</td></tr><tr><td>D</td><td>exothermic</td><td>more energy is released making bonds than is absorbed to break bonds</td></tr></table>		type of energy change	explanation	A	endothermic	less energy is released making bonds than is absorbed to break bonds	B	endothermic	more energy is released making bonds than is absorbed to break bonds	C	exothermic	less energy is released making bonds than is absorbed to break bonds	D	exothermic	more energy is released making bonds than is absorbed to break bonds					
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m18-p22-q28	<p>Air is a mixture of gases.</p> <p>The melting and boiling points of some gases present in clean, dry air are shown.</p> <p>In the fractional distillation of liquid air, which gas boils first?</p> <table><tr><td></td><td>gas</td><td>melting point / °C</td><td>boiling point / °C</td></tr><tr><td>A</td><td>argon</td><td>−189</td><td>−186</td></tr><tr><td>B</td><td>krypton</td><td>−157</td><td>−153</td></tr><tr><td>C</td><td>nitrogen</td><td>−210</td><td>−196</td></tr><tr><td>D</td><td>oxygen</td><td>−219</td><td>−183</td></tr></table>		gas	melting point / °C	boiling point / °C	A	argon	−189	−186	B	krypton	−157	−153	C	nitrogen	−210	−196	D	oxygen	−219	−183
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C	nitrogen	−210	−196																		
D	oxygen	−219	−183																		
m18-p22-q30	<p>Which processes do not produce carbon dioxide?</p> <p>1 heating limestone</p> <p>2 burning gasoline in car engines</p> <p>3 photosynthesis</p> <p>4 production of nylon</p> <p>A 1 and 2 B 1 and 3 C 2 and 4 D 3 and 4</p>																				
m18-p22-q32	<p>Which pollutant gas is produced by the decomposition of vegetation?</p> <p>A carbon monoxide</p> <p>B methane</p> <p>C nitrogen dioxide</p> <p>D sulfur dioxide</p>																				

Topic	<p style="text-align: center;"><u>11. Organic Chemistry</u></p> <p style="text-align: center;">11.1 Formulae, functional groups and terminology</p>
Content	<ol style="list-style-type: none"> 1. Draw and interpret the displayed formula of a molecule to show all the atoms and all the bonds 2. Write and interpret general formulae of compounds in the same homologous series, limited to: <ol style="list-style-type: none"> (a) alkanes, $C_n H_{2n+2}$ (b) alkenes, $C_n H_{2n}$ (c) alcohols, $C_n H_{2n+1}OH$ (d) carboxylic acids, $C_n H_{2n+1}COOH$ 3. Identify a functional group as an atom or group of atoms that determine the chemical properties of a homologous series 4. State that a homologous series is a family of similar compounds with similar chemical properties due to the presence of the same functional group 5. State that a saturated compound has molecules in which all carbon–carbon bonds are single bonds 6. State that an unsaturated compound has molecules in which one or more carbon–carbon bonds are not single bonds 7. State that a structural formula is an unambiguous description of the way the atoms in a molecule are arranged, including $CH_2=CH_2$, CH_3CH_2OH, CH_3COOCH_3 8. Define structural isomers as compounds with the same molecular formula, but different structural formulae, including C_4H_{10} as $CH_3CH_2CH_2CH_3$ and $CH_3CH(CH_3)CH_3$ and C_4H_8 as $CH_3CH_2CH=CH_2$ and $CH_3CH=CHCH_3$ 9. Describe the general characteristics of a homologous series as: <ol style="list-style-type: none"> (a) having the same functional group (b) having the same general formula (c) differing from one member to the next by a $-CH_2-$ unit (d) displaying a trend in physical properties (e) sharing similar chemical properties
m22-p22-q37	<p>Carboxylic acids are made by the oxidation of alcohols.</p> <p>Which carboxylic acid is produced from CH_3CH_2OH?</p> <p>A butanoic acid</p> <p>B ethanoic acid</p> <p>C methanoic acid</p> <p>D propanoic acid</p>
q21-p23-q36	<p>Which statement describes the members of a homologous series?</p> <p>A compounds with the same physical properties</p> <p>B compounds containing the same functional group</p> <p>C compounds containing the same number and type of bonds</p> <p>D compounds obtained from the same raw material</p>

w21-p23-q37

The structures of two compounds are shown.



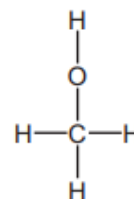
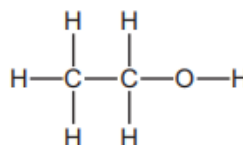
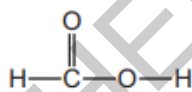
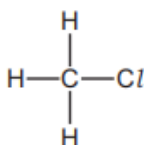
Which statements about these compounds are correct?

- 1 They have the same molecular formula.
- 2 They have similar chemical properties.
- 3 They are structural isomers.

A 1 only **B** 1 and 2 **C** 2 and 3 **D** 1 and 3

w21-p22-q35

The structures of four organic molecules are shown.



How many different homologous series are represented by these molecules?

A 1 **B** 2 **C** 3 **D** 4

w21-p22-q38

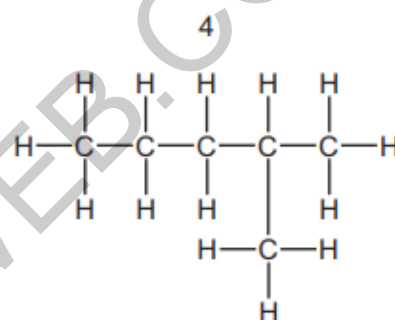
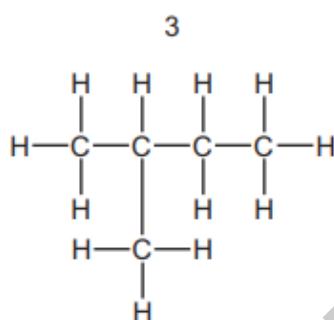
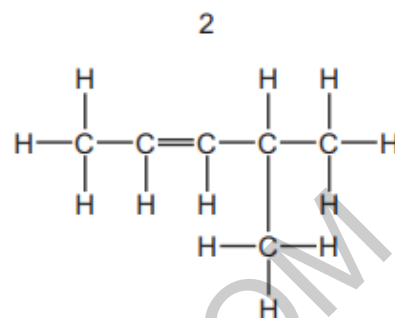
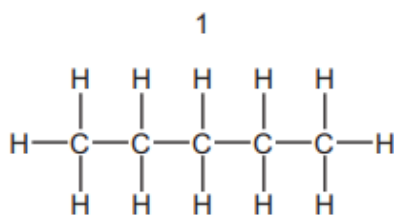
Which statements about unsaturated hydrocarbons are correct?

- 1 They contain both single and double bonds.
- 2 They turn aqueous bromine from colourless to brown.
- 3 They can be manufactured by cracking.

A 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

s21-p23-q35

The diagrams show the structural formulae of four compounds.



Which two compounds are structural isomers?

A 1 and 3**B** 1 and 4**C** 2 and 3**D** 2 and 4

s21-p22-q35

Which pair of formulae represents two alkanes?

A CH_4 and C_8H_{18} **B** C_2H_6 and C_5H_8 **C** C_3H_6 and C_5H_{12} **D** C_{10}H_8 and C_4H_8

s21-p22-q36

Which statement about alkanes is correct?

A They burn in oxygen.**B** They contain carbon, hydrogen and oxygen atoms.**C** They contain double bonds.**D** They contain ionic bonds.

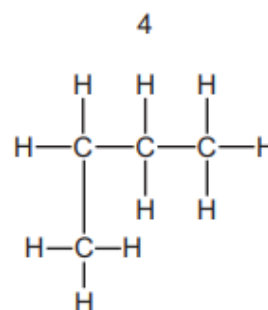
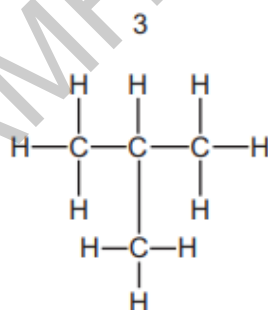
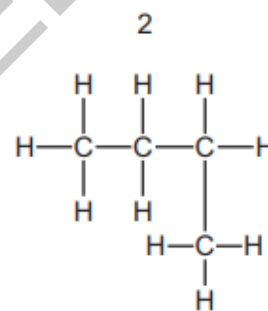
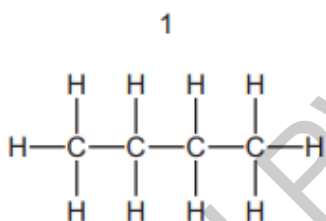
s21-p21-q35

Which statement about homologous series and isomerism is correct?

- A** Butane and butene are structural isomers.
- B** Compounds in the same homologous series have the same general formula.
- C** Compounds in the same homologous series have the same molecular formula.
- D** Structural isomers have different molecular formulae.

w20-p22-q36

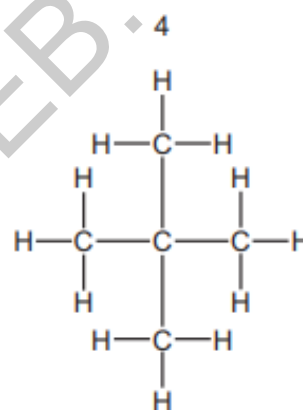
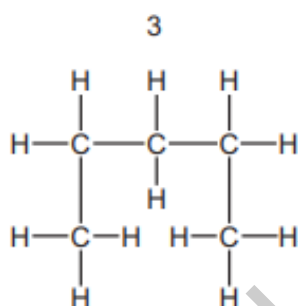
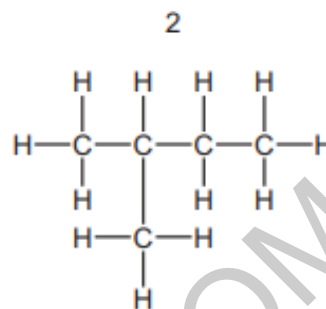
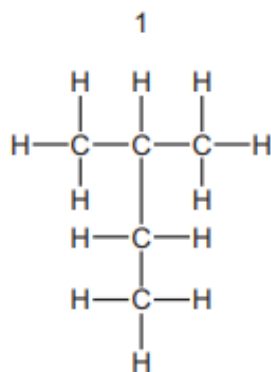
Which structures are structural isomers of each other?



- A** 1, 2, 3 and 4
- B** 1, 2 and 4 only
- C** 1 and 3 only
- D** 2 and 4 only

w21-p21-q35

The structures of four organic molecules are shown.



Which molecules are structural isomers of structure 1?

- A** 2 and 4 **B** 2 only **C** 3 and 4 **D** 3 only

s20-p23-q36

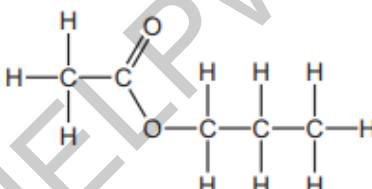
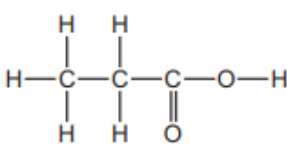
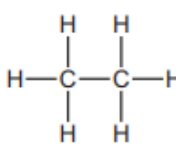
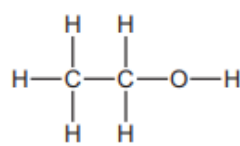
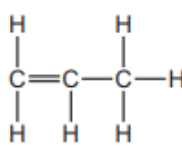
Which statement about a homologous series is correct?

- A** All members have the same general formula.
B All members have the same molecular formula.
C All members have similar physical properties.
D Members show a trend in their chemical properties.

s20-p23-q37 s20-p22-q37 s20-p21-q37	<p>Increasing the number of atoms in one molecule of a hydrocarbon increases the amount of energy released when it burns.</p> <p>What is the correct order?</p> <table><tr><td></td><td>less energy released</td><td>→</td><td>more energy released</td></tr><tr><td>A</td><td>ethene</td><td>ethane</td><td>methane</td></tr><tr><td>B</td><td>ethene</td><td>methane</td><td>ethane</td></tr><tr><td>C</td><td>methane</td><td>ethane</td><td>ethene</td></tr><tr><td>D</td><td>methane</td><td>ethene</td><td>ethane</td></tr></table>		less energy released	→	more energy released	A	ethene	ethane	methane	B	ethene	methane	ethane	C	methane	ethane	ethene	D	methane	ethene	ethane
	less energy released	→	more energy released																		
A	ethene	ethane	methane																		
B	ethene	methane	ethane																		
C	methane	ethane	ethene																		
D	methane	ethene	ethane																		
s20-p22-q36	<p>Which statement about compounds in the same homologous series is correct?</p> <p>A They have the same chemical properties because they have the same number of carbon atoms.</p> <p>B They have the same physical properties because they have the same number of carbon atoms.</p> <p>C They have different chemical properties because they have different numbers of carbon atoms.</p> <p>D They have different physical properties because they have different numbers of carbon atoms.</p>																				
s20-p21-q36	<p>Which statement about homologous series is correct?</p> <p>A Members of a homologous series have the same structural formula.</p> <p>B Members of a homologous series all have similar chemical properties.</p> <p>C Members of a homologous series all have similar physical properties.</p> <p>D Members of all homologous series are hydrocarbons.</p>																				
s19-p23-q36	<p>Which statements about homologous series are correct?</p> <p>1 All members have similar chemical properties.</p> <p>2 All members have the same molecular mass.</p> <p>3 Ethane and ethene are members of the same homologous series.</p> <p>4 Ethane and propane are members of the same homologous series.</p> <p>A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4</p>																				

s19-p22-q36	<p>Which statement about homologous series is not correct?</p> <p>A All homologous series are hydrocarbons.</p> <p>B Members of a homologous series have the same functional group.</p> <p>C Members of a homologous series have similar chemical properties.</p> <p>D The alkanes are an example of a homologous series.</p>															
s19-p21-q36	<p>Why is ethanol a member of the homologous series of alcohols but propane is not?</p> <p>A Ethanol has two carbon atoms per molecule but propane has three.</p> <p>B Ethanol can be made from ethene but propane is obtained from petroleum.</p> <p>C Ethanol is a liquid but propane is a gas.</p> <p>D Ethanol contains the same functional group as other alcohols but propane does not.</p>															
m19-p22-q37	<p>Which statement about members of a homologous series is correct?</p> <p>A Successive members differ by CH_3.</p> <p>B Successive members have a molecular mass that differs by 14.</p> <p>C They have the same molecular formula.</p> <p>D They have identical physical properties.</p>															
m19-p22-q39	<p>The structure of a compound, G, is shown.</p> <p>G is in the same homologous series as ethanoic acid.</p> <div>$\begin{array}{ccccccc} & \text{H} & & \text{H} & & \text{O} & \\ & & & & & & \\ \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - \text{O} - \text{H} \\ & & & & & & \\ & \text{H} & & \text{H} & & & \end{array}$</div> <p>Which row describes some of the properties of an aqueous solution of G?</p> <table><tr><td></td><td>produces a gas with magnesium</td><td>turns methyl orange yellow</td></tr><tr><td>A</td><td>no</td><td>yes</td></tr><tr><td>B</td><td>no</td><td>no</td></tr><tr><td>C</td><td>yes</td><td>no</td></tr><tr><td>D</td><td>yes</td><td>yes</td></tr></table>		produces a gas with magnesium	turns methyl orange yellow	A	no	yes	B	no	no	C	yes	no	D	yes	yes
	produces a gas with magnesium	turns methyl orange yellow														
A	no	yes														
B	no	no														
C	yes	no														
D	yes	yes														

w18-p23-q36 W18-p22-q36 W18-p21-q36	<p>Which two compounds are molecules which both contain a double bond?</p> <p>A ethane and ethanoic acid</p> <p>B ethane and ethanol</p> <p>C ethene and ethanoic acid</p> <p>D ethene and ethanol</p>															
s18-p23-q36	<p>Methane, ethane and propane belong to a family of hydrocarbons called alkanes.</p> <p>What is the general formula of an alkane?</p> <p>A C_nH_{2n} B C_nH_{2n+1} C C_nH_{2n-1} D C_nH_{2n+2}</p>															
m18-p22-q36	<p>Which row identifies compounds in the same homologous series?</p> <table><tr><td></td><td>chemical properties</td><td>functional group</td></tr><tr><td>A</td><td>different</td><td>different</td></tr><tr><td>B</td><td>different</td><td>same</td></tr><tr><td>C</td><td>similar</td><td>different</td></tr><tr><td>D</td><td>similar</td><td>same</td></tr></table>		chemical properties	functional group	A	different	different	B	different	same	C	similar	different	D	similar	same
	chemical properties	functional group														
A	different	different														
B	different	same														
C	similar	different														
D	similar	same														

Topic	11. Organic Chemistry															
	11.2 Naming organic compounds															
Content	<ol style="list-style-type: none"> Name and draw the displayed formulae of: <ol style="list-style-type: none"> methane and ethane ethene ethanol ethanoic acid the products of the reactions stated in sections 11.4–11.7 State the type of compound present, given a chemical name ending in -ane, -ene, -ol, or -oic acid or from a molecular formula or displayed formula Name and draw the structural and displayed formulae of unbranched: <ol style="list-style-type: none"> alkanes alkenes, including but-1-ene and but-2-ene alcohols, including propan-1-ol, propan-2-ol, butan-1-ol and butan-2-ol carboxylic acids containing up to four carbon atoms per molecule Name and draw the displayed formulae of the unbranched esters which can be made from unbranched alcohols and carboxylic acids, each containing up to four carbon atoms 															
m22-p22-q33	<p>The structure of an ester is shown.</p>  <p>What are the names of the carboxylic acid and the alcohol that react together to form this ester?</p> <table border="1"> <thead> <tr> <th></th><th>carboxylic acid</th><th>alcohol</th></tr> </thead> <tbody> <tr> <td>A</td><td>ethanoic acid</td><td>ethanol</td></tr> <tr> <td>B</td><td>ethanoic acid</td><td>propan-1-ol</td></tr> <tr> <td>C</td><td>propanoic acid</td><td>ethanol</td></tr> <tr> <td>D</td><td>propanoic acid</td><td>propan-1-ol</td></tr> </tbody> </table>		carboxylic acid	alcohol	A	ethanoic acid	ethanol	B	ethanoic acid	propan-1-ol	C	propanoic acid	ethanol	D	propanoic acid	propan-1-ol
	carboxylic acid	alcohol														
A	ethanoic acid	ethanol														
B	ethanoic acid	propan-1-ol														
C	propanoic acid	ethanol														
D	propanoic acid	propan-1-ol														
m22-p22-q35	<p>Which structure is correctly named?</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>A</p>  <p>ethanoic acid</p> </div> <div style="text-align: center;"> <p>B</p>  <p>ethene</p> </div> <div style="text-align: center;"> <p>C</p>  <p>ethanol</p> </div> <div style="text-align: center;"> <p>D</p>  <p>propane</p> </div> </div>															

m22-p22-q39	<p>Which statements about ethanol are correct?</p> <ol style="list-style-type: none"> 1 Ethanol is used as a solvent. 2 Ethanol can be made directly from ethane. 3 Ethanol is a covalent compound. <p>A 1 only B 1 and 2 C 1 and 3 D 2 and 3</p>
w21-p23-q33	<p>What is the structure of propanol?</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>A</p> $\begin{array}{c} \text{H} & \text{H} & \text{O} \\ & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{O}-\text{H} \\ & \\ \text{H} & \text{H} \end{array}$ </div> <div style="text-align: center;"> <p>B</p> $\begin{array}{c} \text{H} & \text{O} \\ & \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\ \\ \text{H} \end{array}$ </div> </div> <div style="display: flex; justify-content: space-around; align-items: flex-start; margin-top: 20px;"> <div style="text-align: center;"> <p>C</p> $\begin{array}{c} \text{H} & \text{H} & \text{H} \\ & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{O}-\text{H} \\ & & \\ \text{H} & \text{H} & \text{H} \end{array}$ </div> <div style="text-align: center;"> <p>D</p> $\begin{array}{c} \text{H} & \text{H} \\ & \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\ & \\ \text{H} & \text{H} \end{array}$ </div> </div>
w21-p22-q33	<p>What is the structure of the ester formed from ethanoic acid and propanol?</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>A</p> $\begin{array}{c} \text{H} & \text{H} & \text{O} \\ & & \\ \text{H}-\text{C}-\text{C}-\text{C} & \text{O} & \text{H} \\ & & \\ \text{H} & \text{H} & \text{H} \end{array}$ </div> <div style="text-align: center;"> <p>B</p> $\begin{array}{c} \text{H} & \text{H} & \text{O} \\ & & \\ \text{H}-\text{C}-\text{C}-\text{C} & \text{H} & \\ & & \\ \text{H} & \text{H} & \text{H} \\ & & \\ & & \text{H}-\text{C}-\text{H} \\ & & \\ & & \text{H}-\text{C}-\text{O}-\text{H} \\ & & \\ & & \text{H} \end{array}$ </div> </div> <div style="display: flex; justify-content: space-around; align-items: flex-start; margin-top: 20px;"> <div style="text-align: center;"> <p>C</p> $\begin{array}{c} \text{H} & \text{O} \\ & \\ \text{H}-\text{C}-\text{C} & \text{H} \\ & \\ \text{H} & \text{H} \\ & \\ & \text{H}-\text{C}-\text{H} \\ & \\ & \text{H}-\text{C}-\text{H} \\ & \\ & \text{H}-\text{C}-\text{O}-\text{H} \\ & \\ & \text{H} \end{array}$ </div> <div style="text-align: center;"> <p>D</p> $\begin{array}{c} \text{H} & \text{O} \\ & \\ \text{H}-\text{C}-\text{C} & \text{O} & \text{H} \\ & & \\ \text{H} & \text{H} & \text{H} \end{array}$ </div> </div>

s21-p22-q34	<p>Which statement about ethanol is not correct?</p> <p>A Ethanol can be made by fermentation.</p> <p>B Ethanol is oxidised to make ethanoic acid.</p> <p>C Ethanol reacts with oxygen exothermically, making it a good fuel.</p> <p>D Ethanol reacts with propanoic acid to make propyl ethanoate.</p>
s21-p21-q33	<p>What is the structure of butanoic acid?</p> <p>A $\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$</p> <p>B $\text{CH}_3\text{CH}_2\text{CH}_2\text{CO}_2\text{H}$</p> <p>C $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CO}_2\text{H}$</p> <p>D $\text{CH}_3\text{CH}_2\text{CH}_2\text{CO}_2\text{CH}_3$</p>
s21-p21-q34	<p>Compound Z contains carbon, hydrogen and oxygen.</p> <p>Molecules of compound Z have four hydrogen atoms and two carbon atoms.</p> <p>Compound Z can be made by oxidation of an alcohol.</p> <p>What is compound Z?</p> <p>A ethene</p> <p>B ethanol</p> <p>C ethanoic acid</p> <p>D methyl methanoate</p>
w20-p22-q35	<p>Which structure represents a molecule of ethanol?</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>A</p> <pre> H H H — C — C — H H H </pre> </div> <div style="text-align: center;"> <p>B</p> <pre> H H \ / C = C / \ H H </pre> </div> <div style="text-align: center;"> <p>C</p> <pre> H H H — C — C — O — H H H </pre> </div> <div style="text-align: center;"> <p>D</p> <pre> H O // H — C — C — O — H H </pre> </div> </div>

m20-p22-q39

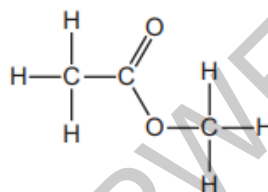
Ethanoic acid is a typical carboxylic acid.

Which statement about ethanoic acid is correct?

- A** It can be oxidised to produce ethanol.
- B** It is a proton acceptor.
- C** It is fully dissociated in water.
- D** It reacts with ethanol to produce ethyl ethanoate and water.

s19-p23-q39

The structure of ester W is shown.

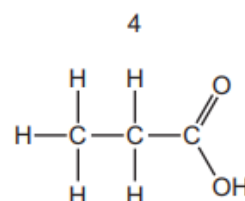
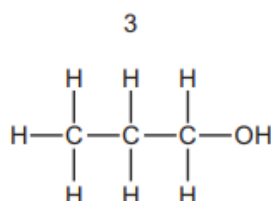
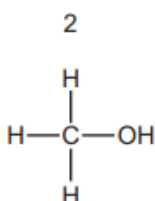
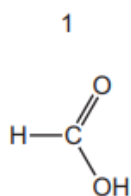


Which row gives the names of ester W and the carboxylic acid and alcohol from which it is made?

	name of ester W	carboxylic acid	alcohol
A	ethyl methanoate	ethanoic acid	methanol
B	ethyl methanoate	methanoic acid	ethanol
C	methyl ethanoate	ethanoic acid	methanol
D	methyl ethanoate	methanoic acid	ethanol

s19-p22-q39

The structures of four molecules are shown.

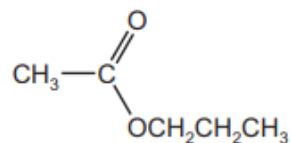


Which molecules react together to form the ester propyl methanoate?

- A** 1 and 2
- B** 1 and 3
- C** 2 and 4
- D** 3 and 4

s19-p21-q39

The structure of an ester is shown.



What is the name of the ester?

- A** ethyl propanoate
B methyl propanoate
C propyl ethanoate
D propyl methanoate

w18-p21-q38

When the alcohol $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ reacts with the carboxylic acid $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ an ester is formed.

What is the name and structural formula of this ester?

	name	structural formula
A	butyl propanoate	$\text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$
B	butyl propanoate	$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_2\text{CH}_2\text{CH}_3$
C	propyl butanoate	$\text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$
D	propyl butanoate	$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_2\text{CH}_2\text{CH}_3$

s18-p23-q39

Which esters have the molecular formula $\text{C}_5\text{H}_{10}\text{O}_2$?

- 1 ethyl propanoate
 2 propyl ethanoate
 3 butyl methanoate
 4 methyl butanoate

- A** 1, 2, 3 and 4
B 1, 2 and 3 only
C 1 and 2 only
D 3 and 4 only

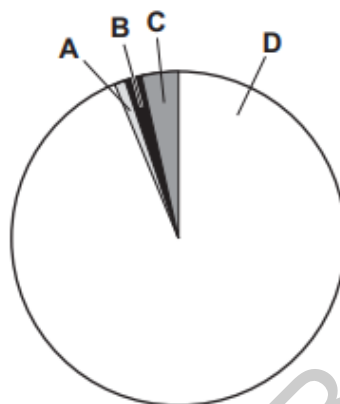
s18-p22-q39	<p>What is the name of the organic product of the reaction shown?</p> $\text{CH}_3\text{COOH} + \text{CH}_3\text{CH}_2\text{OH} \rightarrow$ <p> A ethyl ethanoate B ethyl methanoate C methyl ethanoate D methyl propanoate </p>
s18-p21-q39	<p>Which structural formula represents methyl propanoate?</p> <p> A $\text{CH}_3\text{CH}_2\text{COOCH}_3$ B $\text{CH}_3\text{COOCH}_2\text{CH}_2\text{CH}_3$ C $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_3$ D $\text{HCOOCH}_2\text{CH}_2\text{CH}_3$ </p>
m18-p22-q39	<p>Which substances react together to form ethyl propanoate?</p> <p> A ethanoic acid and propanol B ethanol and propene C ethene and propanol D propanoic acid and ethanol </p>

Topic	<p align="center"><u>11. Organic Chemistry</u></p> <p align="center">11.3 Fuels</p>
Content	<ol style="list-style-type: none"> 1. Name the fossil fuels: coal, natural gas and petroleum 2. Name methane as the main constituent of natural gas 3. State that hydrocarbons are compounds that contain hydrogen and carbon only 4. State that petroleum is a mixture of hydrocarbons 5. Describe the separation of petroleum into useful fractions by fractional distillation 6. Describe how the properties of fractions obtained from petroleum change from the bottom to the top of the fractionating column, limited to: <ol style="list-style-type: none"> (a) decreasing chain length (b) higher volatility (c) lower boiling points (d) lower viscosity 7. Name the uses of the fractions as: <ol style="list-style-type: none"> (a) refinery gas fraction for gas used in heating and cooking (b) gasoline /petrol fraction for fuel used in cars (c) naphtha fraction as a chemical feedstock (d) kerosene /paraffin fraction for jet fuel (e) diesel oil/ gas oil fraction for fuel used in diesel engines (f) fuel oil fraction for fuel used in ships and home heating systems (g) lubricating oil fraction for lubricants, waxes and polishes (h) bitumen fraction for making roads
m22-p22-q16	<p>Which statement about fuels is correct?</p> <p>A Heat energy is only produced by burning fuels.</p> <p>B Hydrogen is used as a fuel although it is difficult to store.</p> <p>C Methane is a good fuel because it produces only water when burned.</p> <p>D Uranium is burned in air to produce energy.</p>
w21-p23-q35	<p>What is the main constituent of natural gas?</p> <p>A hydrogen</p> <p>B carbon monoxide</p> <p>C methane</p> <p>D nitrogen</p>

m21-p22-q35

The pie chart represents the composition of natural gas.

Which sector represents methane?



m20-p22-q35

Petroleum is an important raw material that is separated into useful products.

Which terms describe petroleum and the method used to separate it?

	description	separation method
A	compound	cracking
B	compound	fractional distillation
C	mixture	cracking
D	mixture	fractional distillation

w19-p23-q36

Which statement is correct?

- A** Bitumen is used as a fuel for ships.
- B** Coal, natural gas and oxygen are all fuels.
- C** Hydrogen is the main constituent of natural gas.
- D** Petroleum is separated into useful substances by fractional distillation.

w19-p22-q36

Some fractions obtained from petroleum are listed.

	fraction	use	position collected in the fractionating column
1	gasoline	waxes and polishes	below refinery gas
2	bitumen	making roads	above kerosene
3	kerosene	jet fuel	below gasoline
4	refinery gas	heating and cooking	above gasoline

Which rows are correct?

- A** 1, 3 and 4
- B** 2, 3 and 4
- C** 3 and 4 only
- D** 4 only

w19-p21-q36

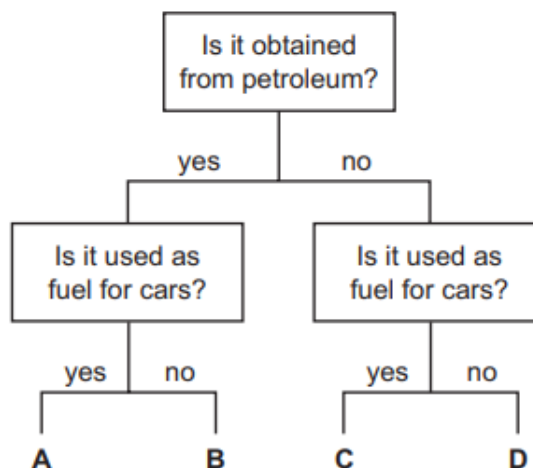
Petroleum is separated by fractional distillation.

Which statement about the fractions produced is correct?

- A** Bottled gas for heating and cooking is obtained from the naphtha fraction.
- B** Diesel oil is used as a fuel for jet aircraft.
- C** Substances used to make polishes are obtained from the lubricating fraction.
- D** The kerosene fraction contains many useful waxes.

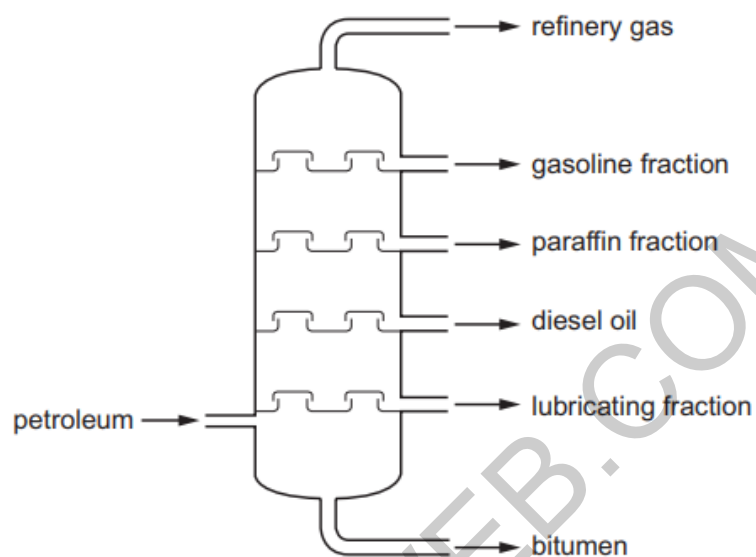
s19-p23-q35
s19-p22-q35
s19-p21-q35

Which fuel could be gasoline?



m19-p22-q36

The fractional distillation of petroleum is shown.



Which fraction is the least volatile?

- A** bitumen
- B** diesel oil
- C** gasoline fraction
- D** refinery gas

s18-p23-q35
s18-p22-q35
s18-p21-q35

What is **not** the correct use of the fraction named?

	name of fraction	use
A	fuel oil	making waxes
B	gas oil	fuel in diesel engines
C	kerosene	jet fuel
D	naphtha	making chemicals

Topic	<p align="center">11. Organic Chemistry</p> <p align="center">11.4 Alkanes</p>
Content	<ol style="list-style-type: none"> 1. State that the bonding in alkanes is single covalent and that alkanes are saturated hydrocarbons 2. Describe the properties of alkanes as being generally unreactive, except in terms of combustion and substitution by chlorine Supplement 3. State that in a substitution reaction one atom or group of atoms is replaced by another atom or group of atoms 4. Describe the substitution reaction of alkanes with chlorine as a photochemical reaction, with ultraviolet light providing the activation energy, E_a, and draw the structural or displayed formulae of the products, limited to monosubstitution
w21-p23-q38	<p>Some reactions of substance Q are shown.</p> <div style="text-align: center; margin: 10px 0;"> $\begin{array}{ccccc} & \text{add steam} & & \text{add bromine} & \\ & \text{under pressure} & & & \\ & \text{and a catalyst} & & & \\ \text{ethanol is made} & \longleftarrow & \text{Q} & \longrightarrow & \text{1,2-dibromoethane} \\ & & & & \text{is made} \\ & & \downarrow \text{add hydrogen} & & \\ & & \text{and a catalyst} & & \\ & & \text{P} & & \end{array}$ </div> <p>What is P?</p> <p>A ethane</p> <p>B ethanoic acid</p> <p>C ethene</p> <p>D poly(ethene)</p>
w21-p22-q19	<p>Which reaction is a photochemical reaction?</p> <p>A addition of bromine to propene</p> <p>B esterification of ethanol and ethanoic acid</p> <p>C oxidation of ethanol</p> <p>D substitution of methane with chlorine</p>
w21-p21-q36	<p>Alkanes react with chlorine to form chloroalkanes.</p> <p>Which statement about the reactions of alkanes with chlorine is correct?</p> <p>A Alkanes react with chlorine by addition.</p> <p>B The gaseous product turns red litmus blue.</p> <p>C The chlorine atom in chloroethane is covalently bonded.</p> <p>D The general formula of the chloroalkanes is $C_nH_{2n}Cl$.</p>

s21-p23-q36	<p>Which statement about alkanes is correct?</p> <p>A They burn in oxygen.</p> <p>B They contain carbon, hydrogen and oxygen atoms.</p> <p>C They contain double bonds.</p> <p>D They contain ionic bonds.</p>															
s21-p21-q36	<p>Which statement about alkanes is correct?</p> <p>A They burn in oxygen.</p> <p>B They contain carbon, hydrogen and oxygen atoms.</p> <p>C They contain double bonds.</p> <p>D They contain ionic bonds.</p>															
m21-p22-q34	<p>Propane reacts with chlorine.</p> <p>Which row shows a condition required for this reaction and identifies the type of reaction?</p> <table><tr><th></th><th>condition</th><th>type of reaction</th></tr><tr><td>A</td><td>phosphoric acid catalyst</td><td>addition</td></tr><tr><td>B</td><td>phosphoric acid catalyst</td><td>substitution</td></tr><tr><td>C</td><td>ultraviolet light</td><td>addition</td></tr><tr><td>D</td><td>ultraviolet light</td><td>substitution</td></tr></table>		condition	type of reaction	A	phosphoric acid catalyst	addition	B	phosphoric acid catalyst	substitution	C	ultraviolet light	addition	D	ultraviolet light	substitution
	condition	type of reaction														
A	phosphoric acid catalyst	addition														
B	phosphoric acid catalyst	substitution														
C	ultraviolet light	addition														
D	ultraviolet light	substitution														
w20-p23-q18	<p>Which reaction is an example of a photochemical reaction?</p> <p>A glucose forming carbon dioxide and water</p> <p>B magnesium reacting with oxygen</p> <p>C potassium reacting with water</p> <p>D silver chloride forming silver metal</p>															

w21-p21-q36	<p>Which chemical equation for the substitution of an alkane with chlorine is correct?</p> <p>A $\text{C}_3\text{H}_8 + \text{Cl}_2 \rightarrow \text{C}_3\text{H}_7\text{Cl} + \text{HCl}$</p> <p>B $\text{C}_3\text{H}_6 + \text{Cl}_2 \rightarrow \text{C}_3\text{H}_6\text{Cl}_2$</p> <p>C $\text{C}_3\text{H}_8 + \text{Cl}_2 \rightarrow \text{C}_3\text{H}_6\text{Cl}_2 + \text{H}_2$</p> <p>D $\text{C}_3\text{H}_6 + \text{Cl}_2 \rightarrow \text{C}_3\text{H}_5\text{Cl} + \text{HCl}$</p>
s20-p23-q39	<p>Alkanes undergo substitution reactions with chlorine in the presence of ultraviolet light.</p> <p>Which equation shows a reaction of this type?</p> <p>A $\text{C}_3\text{H}_6 + \text{Cl}_2 \rightarrow \text{C}_3\text{H}_6\text{Cl}_2$</p> <p>B $\text{C}_3\text{H}_8 + \text{Cl}_2 \rightarrow \text{C}_3\text{H}_6\text{Cl}_2 + \text{H}_2$</p> <p>C $\text{C}_3\text{H}_8 + 2\text{Cl}_2 \rightarrow \text{C}_3\text{H}_6\text{Cl}_2 + 2\text{HCl}$</p> <p>D $\text{C}_3\text{H}_6 + \text{Cl}_2 \rightarrow \text{C}_3\text{H}_5\text{Cl} + \text{HCl}$</p>
s20-p22-q39	<p>Alkanes undergo substitution reactions in the presence of UV light.</p> <p>Which equation represents a substitution reaction of ethane?</p> <p>A $\text{C}_2\text{H}_6 + \text{Cl}_2 \rightarrow \text{C}_2\text{H}_4 + 2\text{HCl}$</p> <p>B $\text{C}_2\text{H}_6 + \text{Cl}_2 \rightarrow \text{C}_2\text{H}_5\text{Cl} + \text{HCl}$</p> <p>C $\text{C}_2\text{H}_6 + \text{Cl}_2 \rightarrow \text{C}_2\text{H}_4\text{Cl}_2 + \text{H}_2$</p> <p>D $\text{C}_2\text{H}_6 + \text{HCl} \rightarrow \text{C}_2\text{H}_5\text{Cl} + \text{H}_2$</p>
s20-p21-q39	<p>Ethane, C_2H_6, reacts with chlorine in a substitution reaction.</p> <p>What are the products of this reaction?</p> <p>A chloroethane and hydrogen</p> <p>B chloroethane and hydrogen chloride</p> <p>C chloroethene and hydrogen</p> <p>D chloroethene and hydrogen chloride</p>

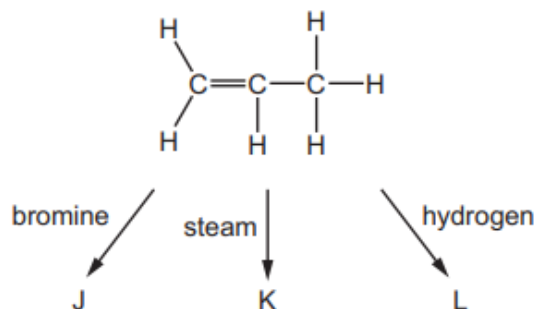
s19-p23-q37	<p>Which type of reaction takes place when methane reacts with chlorine in the presence of ultraviolet light?</p> <p>A addition B cracking C polymerisation D substitution</p>
s19-p22-q37	<p>In bright sunlight, ethane and chlorine combine in substitution reactions.</p> <p>Which compound is not formed in these reactions?</p> <p>A C_2H_3Cl B C_2H_5Cl C $C_2H_4Cl_2$ D HCl</p>
s19-p21-q37	<p>Chlorine reacts with methane.</p> <p>Which statements are correct?</p> <ol style="list-style-type: none"> 1 The reaction takes place in the dark. 2 The reaction of chlorine with methane forms chloromethane. 3 Chloromethane reacts with chlorine to produce dichloromethane. 4 The reaction of chlorine with methane is an addition reaction. <p>A 1 and 2 B 1 and 3 C 2 and 3 D 3 and 4</p>
w18-p23-q35 w18-p22-q35 w18-p21-q35	<p>Which equation representing a reaction of methane is correct?</p> <p>A $CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$ B $CH_4 + Cl_2 \rightarrow CH_4Cl_2$ C $CH_4 + Cl_2 \rightarrow CH_2Cl_2 + H_2$ D $2CH_4 + 2Cl_2 \rightarrow 2CH_3Cl + Cl_2 + H_2$</p>

Topic	<p align="center">11. Organic Chemistry</p> <p align="center">11.5 Alkenes</p>
Content	<ol style="list-style-type: none"> 1. State that the bonding in alkenes includes a double carbon–carbon covalent bond and that alkenes are unsaturated hydrocarbons 2. Describe the manufacture of alkenes and hydrogen by the cracking of larger alkane molecules using a high temperature and a catalyst 3. Describe the reasons for the cracking of larger alkane molecules 4. Describe the test to distinguish between saturated and unsaturated hydrocarbons by their reaction with aqueous bromine Supplement 5. State that in an addition reaction only one product is formed 6. Describe the properties of alkenes in terms of addition reactions with: <ol style="list-style-type: none"> (a) bromine or aqueous bromine (b) hydrogen in the presence of a nickel catalyst (c) steam in the presence of an acid catalyst and draw the structural or displayed formulae of the products
m22-p22-q38	<p>Propene, C_3H_6, reacts with bromine, Br_2, in an addition reaction.</p> <p>Which structure represents the product of this reaction?</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;"> <p>A</p> <pre> H H H H — C — C — C — H Br H H </pre> </div> <div style="text-align: center;"> <p>B</p> <pre> H Br H H — C — C — C — H H Br H </pre> </div> <div style="text-align: center;"> <p>C</p> <pre> H H H H — C — C — C — H Br Br H </pre> </div> <div style="text-align: center;"> <p>D</p> <pre> H H H Br — C — C — C — Br H H H </pre> </div> </div>
w21-p21-q33	<p>An alkane molecule of molecular formula C_8H_{18} undergoes cracking. The equation for the reaction is shown.</p> $C_8H_{18} \rightarrow Q + 2R$ <p>Substance R has two carbon atoms per molecule and decolourises aqueous bromine.</p> <p>What is substance Q?</p> <ol style="list-style-type: none"> A butane B butene C ethane D ethene

w21-p21-q38	<p>Propene reacts with steam to form propanol.</p> $\text{C}_3\text{H}_6(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightarrow \text{C}_3\text{H}_7\text{OH}(\text{g})$ <p>Which type of reaction takes place?</p> <p>A addition B condensation C oxidation D substitution</p>
s21-pP21-q38	<p>P, Q, R and S are four organic compounds.</p> <p>P is an unsaturated hydrocarbon.</p> <p>Q burns but otherwise is unreactive.</p> <p>R contains a C–C single bond and a C=C double bond.</p> <p>S undergoes addition polymerisation.</p> <p>Which compounds are alkenes?</p> <p>A P and R only B P, R and S C P, Q and S D Q, R and S</p>
w20-p23-q36	<p>Which product is obtained when bromine reacts with propene, $\text{CH}_3\text{CH}=\text{CH}_2$?</p> <p>A $\text{CH}_3\text{CH}=\text{CHBr}$ B $\text{CH}_3\text{CBr}=\text{CHBr}$ C $\text{CH}_3\text{CH}_2\text{CHBr}_2$ D $\text{CH}_3\text{CHBrCH}_2\text{Br}$</p>
w20-p22-q37	<p>Which molecule is not produced by an addition reaction of ethene?</p> <p>A CH_3CH_3 B $\text{CH}_2\text{BrCH}_2\text{Br}$ C $\text{CH}_3\text{CH}_2\text{OH}$ D $\text{CH}_3\text{CH}_2\text{CH}_3$</p>

W21-p21-q37

Propene is an alkene that reacts with bromine, steam and hydrogen as shown.



What are the products of these reactions?

	J	K	L
A	bromopropane	propanol	butane
B	dibromopropane	propanoic acid	propane
C	dibromopropane	propanol	propane
D	bromopropane	propanoic acid	butane

m20-p22-q36

Which statements about propene are correct?

- 1 Propene contains only single bonds.
- 2 Propene decolourises bromine water.
- 3 Propene is obtained by cracking.
- 4 Propene is a hydrocarbon.

A 1 and 4 **B** 2, 3 and 4 **C** 2 and 4 only **D** 4 only

w19-p23-q37
w19-p22-q37
w19-p21-q37

Which products are obtained by the cracking of an alkane?

	alkene	hydrogen	water
A	✓	✓	✓
B	✓	✓	x
C	✓	x	✓
D	x	✓	✓

<p>S18-p23-q37 S18-p22-q37 S18-p21-q37</p>	<p>Which substances can be obtained by cracking hydrocarbons?</p> <p>A ethanol and ethene</p> <p>B ethanol and hydrogen</p> <p>C ethene and hydrogen</p> <p>D ethene and poly(ethene)</p>
<p>S18-p22-q36</p>	<p>Which statement about alkenes is not correct?</p> <p>A They decolourise aqueous bromine.</p> <p>B They only contain the elements carbon and hydrogen.</p> <p>C They react with hydrogen to form alkanes.</p> <p>D They react with steam to produce carboxylic acids.</p>
<p>S18-p21-q36</p>	<p>Which reaction is not a reaction which alkenes undergo?</p> <p>A bromination</p> <p>B hydration</p> <p>C hydrogenation</p> <p>D hydrolysis</p>

Topic	11. Organic Chemistry 11.6 Alcohols															
Content	<ol style="list-style-type: none">Describe the manufacture of ethanol by:<ol style="list-style-type: none">fermentation of aqueous glucose at 25–35°C in the presence of yeast and in the absence of oxygencatalytic addition of steam to ethene at 300°C and 6000kPa /60 atm in the presence of an acid catalystDescribe the combustion of ethanolState the uses of ethanol as:<ol style="list-style-type: none">a solventa fuel SupplementDescribe the advantages and disadvantages of the manufacture of ethanol by:<ol style="list-style-type: none">fermentationcatalytic addition of steam to ethane															
w21-p22-q37	<p>Ethanol is manufactured by fermentation of sugars or by catalytic hydration of ethene.</p> <p>Which row states an advantage of each method?</p> <table><tr><th></th><th>fermentation</th><th>hydration</th></tr><tr><td>A</td><td>produces purer ethanol</td><td>is a batch process</td></tr><tr><td>B</td><td>produces purer ethanol</td><td>is a continuous process</td></tr><tr><td>C</td><td>uses a renewable resource</td><td>is a batch process</td></tr><tr><td>D</td><td>uses a renewable resource</td><td>is a continuous process</td></tr></table>		fermentation	hydration	A	produces purer ethanol	is a batch process	B	produces purer ethanol	is a continuous process	C	uses a renewable resource	is a batch process	D	uses a renewable resource	is a continuous process
	fermentation	hydration														
A	produces purer ethanol	is a batch process														
B	produces purer ethanol	is a continuous process														
C	uses a renewable resource	is a batch process														
D	uses a renewable resource	is a continuous process														
s21-p23-q38	<p>What is an advantage of the fermentation process for producing ethanol compared with the catalytic addition of steam to ethene?</p> <p>A Fermentation requires less heat energy.</p> <p>B Ethanol from fermentation needs to be distilled.</p> <p>C Raw materials for fermentation are non-renewable.</p> <p>D The fermentation process is carried out in batches rather than continuously.</p>															
s21-p21-q30	<p>Which process removes carbon dioxide from the atmosphere?</p> <p>A combustion of fossil fuels</p> <p>B fermentation</p> <p>C photosynthesis</p> <p>D respiration</p>															

s21-p21-q37	<p>What is an advantage of manufacturing ethanol by fermentation?</p> <p>A The process is very fast.</p> <p>B The ethanol requires no separation.</p> <p>C The raw materials used are renewable.</p> <p>D There are no other products formed.</p>																				
m21-p22-q36	<p>Which statement describes the reaction between ethene and steam?</p> <p>A a cracking reaction which produces ethane and hydrogen gas as products</p> <p>B an addition reaction which produces ethanol as the only product</p> <p>C an oxidation reaction which produces ethanoic acid as the only product</p> <p>D a slow reaction producing ethanol and carbon dioxide</p>																				
w20-p23-q15	<p>Ethanol is used as a fuel.</p> $\text{ethanol} + \text{oxygen} \rightarrow \text{carbon dioxide} + \text{water}$ <p>Which statements are correct?</p> <p>1 The reaction is endothermic.</p> <p>2 The products have more energy than the reactants.</p> <p>3 The oxygen for this reaction comes from the air.</p> <p>4 The temperature of the reaction mixture rises during this reaction.</p> <p>A 1 and 2 B 1 and 3 C 2 and 4 D 3 and 4</p>																				
w20-p23-q38 w20-p22-q38 w20-p21-q38	<p>The flow chart shows the preparation of ethanol and some important chemistry of ethanol.</p> $\text{substance X} \xrightarrow{\text{fermentation}} \text{ethanol} \xrightarrow{\text{process Y}} \text{carbon dioxide} + \text{substance Z}$ <p>What are X, Y and Z?</p> <table><tr><td></td><td>X</td><td>Y</td><td>Z</td></tr><tr><td>A</td><td>yeast</td><td>combustion</td><td>oxygen</td></tr><tr><td>B</td><td>glucose</td><td>combustion</td><td>steam</td></tr><tr><td>C</td><td>glucose</td><td>polymerisation</td><td>water</td></tr><tr><td>D</td><td>yeast</td><td>fermentation</td><td>glucose</td></tr></table>		X	Y	Z	A	yeast	combustion	oxygen	B	glucose	combustion	steam	C	glucose	polymerisation	water	D	yeast	fermentation	glucose
	X	Y	Z																		
A	yeast	combustion	oxygen																		
B	glucose	combustion	steam																		
C	glucose	polymerisation	water																		
D	yeast	fermentation	glucose																		

s20-p23-q35	<p>Ethanol is produced by:</p> <p>1 the catalytic addition of steam to ethene</p> <p>2 fermentation.</p> <p>Which statement is correct?</p> <p>A Both processes require similar amounts of energy.</p> <p>B Both processes use a catalyst.</p> <p>C Process 1 uses a renewable resource.</p> <p>D Process 2 produces the purest ethanol.</p>																									
s20-p22-q35	<p>Ethanol is made on an industrial scale by the fermentation of sugars or by the reaction of ethene with steam in the presence of a suitable catalyst.</p> <p>What is a disadvantage of making ethanol from ethene rather than by fermentation?</p> <p>A A continuous production process is used.</p> <p>B A non-renewable raw material is used.</p> <p>C The product is very pure.</p> <p>D The rate of reaction is very high.</p>																									
s20-p21-q35	<p>Which row about the production of ethanol by fermentation is correct?</p> <table><tr><th></th><th>raw materials</th><th>energy requirement</th><th>rate of reaction</th></tr><tr><td>A</td><td>non-renewable</td><td>high</td><td>slow</td></tr><tr><td>B</td><td>renewable</td><td>low</td><td>slow</td></tr><tr><td>C</td><td>non-renewable</td><td>low</td><td>fast</td></tr><tr><td>D</td><td>renewable</td><td>high</td><td>fast</td></tr></table>		raw materials	energy requirement	rate of reaction	A	non-renewable	high	slow	B	renewable	low	slow	C	non-renewable	low	fast	D	renewable	high	fast					
	raw materials	energy requirement	rate of reaction																							
A	non-renewable	high	slow																							
B	renewable	low	slow																							
C	non-renewable	low	fast																							
D	renewable	high	fast																							
m20-p22-q37	<p>Which row describes the production of ethanol and its properties?</p> <table><tr><th></th><th>can be made from glucose</th><th>can be made from ethene</th><th>is used as a fuel</th><th>is used as a solvent</th></tr><tr><td>A</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>B</td><td>✓</td><td>x</td><td>✓</td><td>✓</td></tr><tr><td>C</td><td>x</td><td>✓</td><td>✓</td><td>x</td></tr><tr><td>D</td><td>x</td><td>✓</td><td>x</td><td>✓</td></tr></table> <p>key ✓ = yes x = no</p>		can be made from glucose	can be made from ethene	is used as a fuel	is used as a solvent	A	✓	✓	✓	✓	B	✓	x	✓	✓	C	x	✓	✓	x	D	x	✓	x	✓
	can be made from glucose	can be made from ethene	is used as a fuel	is used as a solvent																						
A	✓	✓	✓	✓																						
B	✓	x	✓	✓																						
C	x	✓	✓	x																						
D	x	✓	x	✓																						

w19-p23-q38	<p>Which products are obtained by the cracking of an alkane?</p> <table><tr><td></td><td>alkene</td><td>hydrogen</td><td>water</td></tr><tr><td>A</td><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>B</td><td>✓</td><td>✓</td><td>x</td></tr><tr><td>C</td><td>✓</td><td>x</td><td>✓</td></tr><tr><td>D</td><td>x</td><td>✓</td><td>✓</td></tr></table>		alkene	hydrogen	water	A	✓	✓	✓	B	✓	✓	x	C	✓	x	✓	D	x	✓	✓
	alkene	hydrogen	water																		
A	✓	✓	✓																		
B	✓	✓	x																		
C	✓	x	✓																		
D	x	✓	✓																		
w19-p22-q38	<p>Ethanol is produced by fermentation or by the reaction of ethene with steam.</p> <p>Which row is correct?</p> <table><tr><td></td><td>by fermentation</td><td>from ethene</td></tr><tr><td>A</td><td>uses a temperature of 100 °C</td><td>uses a temperature of 350 °C</td></tr><tr><td>B</td><td>needs yeast as a catalyst</td><td>does not need a catalyst</td></tr><tr><td>C</td><td>very slow reaction</td><td>very fast reaction</td></tr><tr><td>D</td><td>high yield of ethanol</td><td>low yield of ethanol</td></tr></table>		by fermentation	from ethene	A	uses a temperature of 100 °C	uses a temperature of 350 °C	B	needs yeast as a catalyst	does not need a catalyst	C	very slow reaction	very fast reaction	D	high yield of ethanol	low yield of ethanol					
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D	high yield of ethanol	low yield of ethanol																			
w19-p21-q38	<p>Ethanol is manufactured by the catalytic addition of steam to ethene and by fermentation.</p> <p>Which statement describes an advantage of fermentation compared to the catalytic addition of steam to ethene?</p> <p>A Fermentation is a more rapid reaction.</p> <p>B Fermentation produces a purer product.</p> <p>C Fermentation uses a higher temperature.</p> <p>D Fermentation uses renewable resources.</p>																				
m19-p22-w38	<p>Ethanol is manufactured on a large scale by fermentation.</p> <p>Which statement about fermentation is correct?</p> <p>A It is a continuous process.</p> <p>B A renewable raw material is used.</p> <p>C It is a very fast reaction.</p> <p>D The ethanol produced is pure.</p>																				

w18-p23-q37
w18-p22-q37
w18-p21-q37

Ethanol can be formed by:

- 1 fermentation
- 2 reaction between steam and ethene.

Which of these processes use a catalyst?

	1	2
A	✓	✓
B	✓	x
C	x	✓
D	x	x

w18-p23-q38

Sugar can be fermented to produce ethanol.

Some of the stages in the process to produce and purify ethanol are listed.

- 1 Leave in a warm place.
- 2 Add yeast.
- 3 Fractionally distil the solution.
- 4 Dissolve the sugar in water.
- 5 Filter to remove the yeast.
- 6 Crush some sugar cane.

What is the correct order of these stages?

- A 4 → 6 → 2 → 1 → 5 → 3
- B 6 → 4 → 1 → 2 → 5 → 3
- C 6 → 4 → 2 → 1 → 3 → 5
- D 6 → 4 → 2 → 1 → 5 → 3

w18-p22-q38

Ethanol is manufactured from ethene.

What is an advantage of this process?

- A It is a continuous process.
- B It has high labour costs.
- C It needs high temperature and pressure.
- D It uses non-renewable materials.

s18-p23-q38	<p>Which row describes an advantage and a disadvantage of making ethanol by fermentation?</p> <table><tr><td></td><td>advantage</td><td>disadvantage</td></tr><tr><td>A</td><td>uses a renewable resource</td><td>occurs at a slow rate</td></tr><tr><td>B</td><td>needs a high temperature</td><td>produces impure ethanol as a product</td></tr><tr><td>C</td><td>produces pure ethanol as a product</td><td>needs a high temperature</td></tr><tr><td>D</td><td>occurs at a slow rate</td><td>uses a non-renewable resource</td></tr></table>		advantage	disadvantage	A	uses a renewable resource	occurs at a slow rate	B	needs a high temperature	produces impure ethanol as a product	C	produces pure ethanol as a product	needs a high temperature	D	occurs at a slow rate	uses a non-renewable resource
	advantage	disadvantage														
A	uses a renewable resource	occurs at a slow rate														
B	needs a high temperature	produces impure ethanol as a product														
C	produces pure ethanol as a product	needs a high temperature														
D	occurs at a slow rate	uses a non-renewable resource														
s18-p22-q38	<p>Two processes used for the large-scale production of ethanol are shown.</p> <p>process 1 A compound containing carbon, hydrogen and oxygen is used to produce ethanol.</p> <p>process 2 A compound containing carbon and hydrogen only is used to produce ethanol.</p> <p>Which statement is correct?</p> <p>A Process 1 uses a renewable starting material.</p> <p>B Process 1 is done at a very high temperature.</p> <p>C Process 2 involves fermentation.</p> <p>D Process 2 is done at room temperature.</p>															
s18-p21-q38	<p>Ethanol is produced by fermentation or from ethene.</p> <p>What is a disadvantage of producing ethanol by fermentation?</p> <p>A Distillation is needed to purify the ethanol produced.</p> <p>B Fermentation uses glucose from plants.</p> <p>C Fermentation is catalysed by enzymes in yeast.</p> <p>D Fermentation occurs at a low temperature and pressure.</p>															
m18-p22-q38	<p>How is ethanol produced by fermentation?</p> <p>A using anaerobic conditions at 30 °C</p> <p>B using anaerobic conditions at 450 °C</p> <p>C using steam at 30 °C</p> <p>D using steam at 450 °C</p>															

Topic	<u>11. Organic Chemistry</u> 11.7 Carboxylic acids															
Content	<ol style="list-style-type: none">Describe the reaction of ethanoic acid with:<ol style="list-style-type: none">metalsbasescarbonates including names and formulae of the salts producedDescribe the formation of ethanoic acid by the oxidation of ethanol:<ol style="list-style-type: none">with acidified aqueous potassium manganate(VII)by bacterial oxidation during vinegar productionDescribe the reaction of a carboxylic acid with an alcohol using an acid catalyst to form an ester															
w21-p21-q39	<p>Which statement about aqueous ethanoic acid is correct?</p> <p>A It reacts with magnesium to produce a salt and hydrogen.</p> <p>B It reacts with sodium hydroxide to produce a salt and hydrogen.</p> <p>C It reacts with ammonium salts to produce ammonia.</p> <p>D It turns red litmus blue.</p>															
s21-p23-q34	<p>Ethanol is reacted with acidified potassium manganate(VII).</p> <p>Which row describes the type of reaction and the type of organic compound formed?</p> <table><tr><th></th><th>type of reaction</th><th>organic compound</th></tr><tr><td>A</td><td>oxidation</td><td>carboxylic acid</td></tr><tr><td>B</td><td>oxidation</td><td>alkene</td></tr><tr><td>C</td><td>dehydration</td><td>carboxylic acid</td></tr><tr><td>D</td><td>dehydration</td><td>alkene</td></tr></table>		type of reaction	organic compound	A	oxidation	carboxylic acid	B	oxidation	alkene	C	dehydration	carboxylic acid	D	dehydration	alkene
	type of reaction	organic compound														
A	oxidation	carboxylic acid														
B	oxidation	alkene														
C	dehydration	carboxylic acid														
D	dehydration	alkene														
s21-p22-q37	<p>Which statements about ethanoic acid are correct?</p> <ol style="list-style-type: none">It is a strong acid.It reacts with ethanol to form an ester.It has the formula CH_3COOH. <p>A 1 and 2 only B 1 and 3 only C 2 and 3 only D 1, 2 and 3</p>															

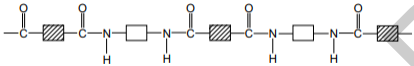
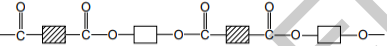
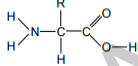
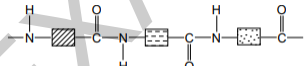
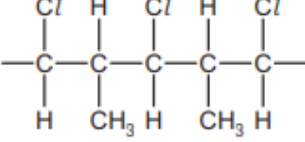
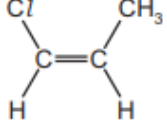
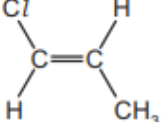
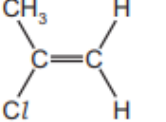
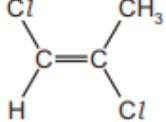
w20-p23-q37	<p>Propanol is oxidised by acidified potassium manganate(VII) in a similar way to ethanol.</p> <p>Which compound is produced by the oxidation of propanol with acidified potassium manganate(VII)?</p> <p>A $\text{CH}_3\text{CH}_2\text{OH}$</p> <p>B $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$</p> <p>C CH_3COOH</p> <p>D $\text{CH}_3\text{CH}_2\text{COOH}$</p>
m20-p22-q38	<p>Ethanoic acid is a typical carboxylic acid.</p> <p>Which statement about ethanoic acid is correct?</p> <p>A It can be oxidised to produce ethanol.</p> <p>B It is a proton acceptor.</p> <p>C It is fully dissociated in water.</p> <p>D It reacts with ethanol to produce ethyl ethanoate and water.</p>
w18-p23-q39	<p>Which statement about ethanoic acid is correct?</p> <p>A It contains a $-\text{C}_2\text{H}_5$ group.</p> <p>B It is a strong acid.</p> <p>C It is formed by the reduction of ethanol.</p> <p>D It reacts with alcohols to form esters.</p>
w18-p22-q39	<p>Which reaction can be used to make ethanoic acid?</p> <p>A oxidation of ethanol</p> <p>B oxidation of ethene</p> <p>C reduction of ethanol</p> <p>D reduction of ethene</p>

w18-p21-q39

A solution of ethanol and water is left to stand in an open beaker in a warm room for three weeks.

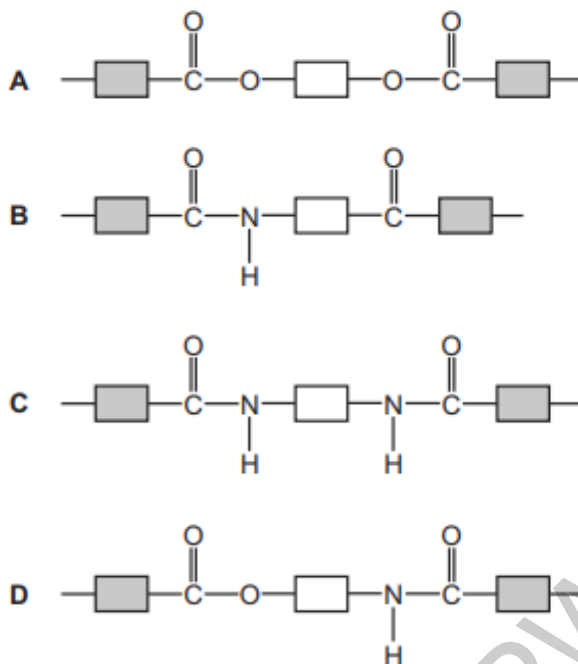
Which statement explains what happens to the ethanol in the solution?

- A** The ethanol is dehydrated to ethene.
- B** The ethanol is hydrolysed to ethene.
- C** The ethanol is oxidised to ethanoic acid.
- D** The ethanol is reduced to ethanoic acid.

Topic	11. Organic Chemistry
	11.8 Polymers
Content	<ol style="list-style-type: none"> Define polymers as large molecules built up from many smaller molecules called monomers Describe the formation of poly(ethene) as an example of addition polymerisation using ethene monomers State that plastics are made from polymers Describe how the properties of plastics have implications for their disposal Describe the environmental challenges caused by plastics, limited to: <ol style="list-style-type: none"> disposal in land fill sites accumulation in oceans formation of toxic gases from burning Identify the repeat units and/or linkages in addition polymers and in condensation polymers Deduce the structure or repeat unit of an addition polymer from a given alkene and vice versa Deduce the structure or repeat unit of a condensation polymer from given monomers and vice versa, limited to: <ol style="list-style-type: none"> polyamides from a dicarboxylic acid and a diamine polyesters from a dicarboxylic acid and a diol Describe the differences between addition and condensation polymerisation Describe and draw the structure of: <ol style="list-style-type: none"> nylon, a polyamide  <ol style="list-style-type: none"> PET, a polyester  State that PET can be converted back into monomers and re-polymerised Describe proteins as natural polyamides and that they are formed from amino acid monomers with the general structure:  Describe and draw the structure of proteins as: 
m22-p22-q36	<p>The structure of part of a polymer is shown.</p>  <p>Which monomers can be used to make this polymer?</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;"> <p>1</p>  </div> <div style="text-align: center;"> <p>2</p>  </div> <div style="text-align: center;"> <p>3</p>  </div> <div style="text-align: center;"> <p>4</p>  </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> A 1 and 2 B 1 and 4 C 2 and 3 D 3 and 4 </div>

m22-p22-q40
w20-p22-q40

Which diagram represents the structure of nylon?



w21-p23-q39

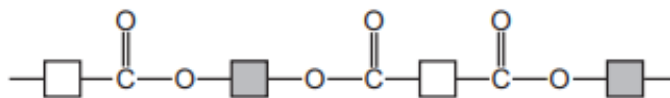
Proteins and starch are natural polymers.

Which row identifies the method of polymerisation of proteins and starch?

	proteins	starch
A	addition	addition
B	condensation	condensation
C	addition	condensation
D	condensation	addition

w21-p23-q40
w21-p22-q40
w21-p21-q40

The diagram shows the partial structure of *Terylene*.



From which pair of compounds is it made?

- A** $\text{HO}-\text{C}(=\text{O})-\text{square}-\text{C}(=\text{O})-\text{OH}$ + $\text{HO}-\text{grey}-\text{OH}$
- B** $\text{HO}-\text{square}-\text{C}(=\text{O})-\text{OH}$ + $\text{HO}-\text{grey}-\text{C}(=\text{O})-\text{OH}$
- C** $\text{HO}-\text{square}-\text{OH}$ + $\text{HO}-\text{C}(=\text{O})-\text{grey}-\text{C}(=\text{O})-\text{OH}$
- D** $\text{HO}-\text{C}(=\text{O})-\text{square}-\text{C}(=\text{O})-\text{OH}$ + $\text{HO}-\text{C}(=\text{O})-\text{grey}-\text{C}(=\text{O})-\text{OH}$

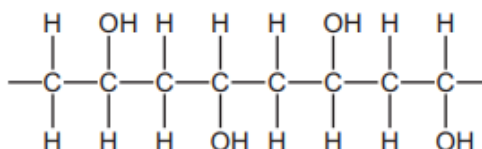
w21-p22-q39

Which polymers have the same linkage between monomer units?

- A** carbohydrate and polyamide
B carbohydrate and polyester
C protein and polyamide
D protein and polyester

w21-p21-q37

Part of the structure of a very large molecule is shown.

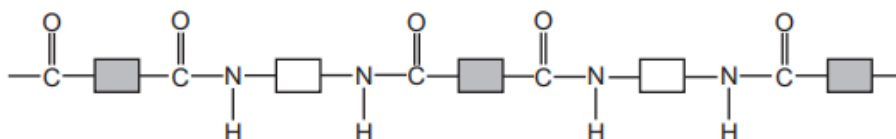


Which term describes the small unit used to make this molecule?

- A** hydrocarbon
B monomer
C polymer
D saturated

s21-p23-q39
s21-p21-q39

The structure of a synthetic polymer is shown.



The structure shows that it is a1..... . It is formed by2..... polymerisation.

Which words complete gaps 1 and 2?

	1	2
A	polyamide	addition
B	polyamide	condensation
C	polyester	addition
D	polyester	condensation

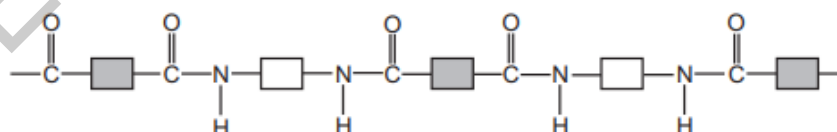
s21-p23-q40
s21-p22-q40
s21-p21-q40

Which substance is a natural polymer?

- A** ethene
- B** *Terylene*
- C** nylon
- D** protein

s21-p22-q39

The structure of a synthetic polymer is shown.

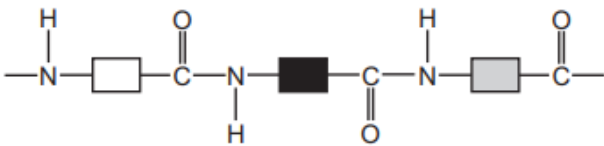


The structure shows that it is a1..... . It is formed by2..... polymerisation.

Which words complete gaps 1 and 2?

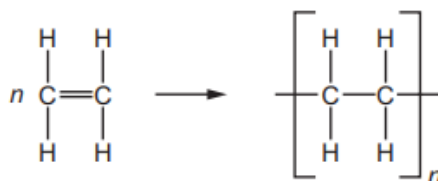
	1	2
A	polyamide	addition
B	polyamide	condensation
C	polyester	addition
D	polyester	condensation

w20-p23-q39	<p>Which equation represents the formation of poly(propene) from propene?</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>A</p> $n \begin{array}{c} \text{CH}_3 \text{ H} \\ \quad \\ \text{C} = \text{C} \\ \quad \\ \text{H} \quad \text{H} \end{array} \longrightarrow \left(\begin{array}{c} \text{CH}_3 \text{ H} \\ \quad \\ -\text{C} - \text{C}- \\ \quad \\ \text{H} \quad \text{H} \end{array} \right)_n$ </div> <div style="text-align: center;"> <p>B</p> $n \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{C} = \text{C} \\ \quad \\ \text{H} \quad \text{H} \end{array} \longrightarrow \left(\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ -\text{C} - \text{C}- \\ \quad \\ \text{H} \quad \text{H} \end{array} \right)_n$ </div> <div style="text-align: center;"> <p>C</p> $n \begin{array}{c} \text{CH}_3 \text{ H} \\ \quad \\ \text{C} = \text{C} \\ \quad \\ \text{H} \quad \text{H} \end{array} \longrightarrow \left(\begin{array}{c} \text{CH}_3 \text{ H} \\ \quad \\ -\text{C} = \text{C}- \\ \quad \\ \text{H} \quad \text{H} \end{array} \right)_n$ </div> <div style="text-align: center;"> <p>D</p> $n \begin{array}{c} \text{CH}_3 \text{ H} \\ \quad \\ \text{C} = \text{C} \\ \quad \\ \text{H} \quad \text{H} \end{array} \longrightarrow \left(\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \\ -\text{C} - \text{C} - \text{C}- \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \end{array} \right)_n$ </div> </div>
w20-p23-q40	<p>Which type of linkage joins the amino acids in a protein?</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>A</p> $\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{N}- \\ \\ \text{H} \end{array}$ </div> <div style="text-align: center;"> <p>B</p> $\begin{array}{c} \quad \\ -\text{C}-\text{C}- \\ \quad \end{array}$ </div> <div style="text-align: center;"> <p>C</p> $\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{O}- \end{array}$ </div> <div style="text-align: center;"> <p>D</p> $-\text{O}-$ </div> </div>
w20-p22-q39	<p>Which statement about nylon and <i>Terylene</i> is correct?</p> <p>A Nylon and <i>Terylene</i> are made from monomers with C=C bonds.</p> <p>B Nylon and <i>Terylene</i> contain the same linkage.</p> <p>C Nylon is a polyester.</p> <p>D <i>Terylene</i> is made from two different monomers.</p>
w21-p21-q40	<p>The structure of a polymer is shown.</p> $\left[\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ -\text{C} - \text{C}- \\ \quad \\ \text{H} \quad \text{CH}_3 \end{array} \right]_n$ <p>Which monomer forms this polymer?</p> <p>A ethane</p> <p>B ethene</p> <p>C propane</p> <p>D propene</p>

s20-p23-q40	<p>Which statement about carbohydrates and proteins is correct?</p> <p>A Carbohydrates and proteins are constituents of food.</p> <p>B Carbohydrates and proteins are natural polymers used to make larger molecules called monomers.</p> <p>C Carbohydrates and proteins are synthetic polymers.</p> <p>D Carbohydrates and proteins cause pollution as they are non-biodegradable.</p>
s20-p22-q40	<p>Which substances are natural polymers?</p> <p>1 proteins</p> <p>2 carbohydrates</p> <p>3 nylon</p> <p>4 poly(ethene)</p> <p>A 1 and 2 B 1 and 3 C 2 and 3 D 3 and 4</p>
s20-p21-q40	<p>Which polymers or types of polymer are synthetic?</p> <p>1 carbohydrates</p> <p>2 nylon</p> <p>3 proteins</p> <p>4 Terylene</p> <p>A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4</p>
m20-p22-q40	<p>The structure of a polymer is shown.</p>  <p>Which statements about the polymer are correct?</p> <p>1 The polymer is nylon.</p> <p>2 The polymer is formed by condensation polymerisation.</p> <p>3 There are ester linkages between the monomers.</p> <p>A 1 and 2 B 2 and 3 C 2 only D 3 only</p>

w19-p23-q39
w19-p22-q39
w19-p21-q39

The diagram shows the structure of a monomer and of the polymer made from it.



What are the monomer and polymer?

	monomer	polymer
A	ethane	poly(ethane)
B	ethane	poly(ethene)
C	ethene	poly(ethane)
D	ethene	poly(ethene)

w19-p23-q40

Proteins and starch are both natural polymers.

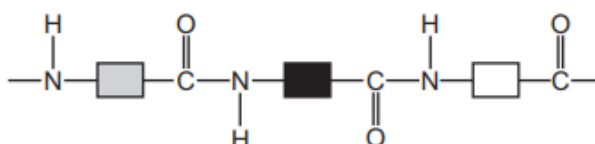
Both proteins and starch are hydrolysed by dilute acids.

What are the products of hydrolysis of proteins and of starch?

	products of hydrolysis of proteins	products of hydrolysis of starch
A	amines and carboxylic acids	simple sugars
B	amines and carboxylic acids	alcohols and carboxylic acids
C	amino acids	simple sugars
D	amino acids	alcohols and carboxylic acids

w19-p22-q40

The structure of a naturally occurring polymer, X, is shown.



What is X?

- A** an amino acid
- B** a carbohydrate
- C** a protein
- D** a sugar

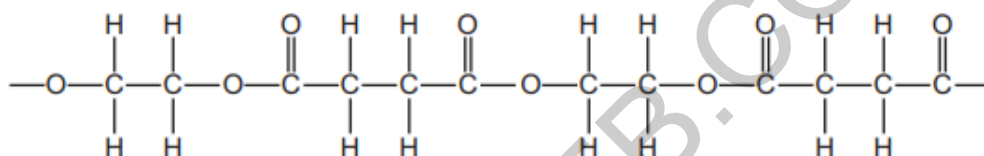
w19-p21-q40

Which polymers possess the same linkage?

- A** nylon and protein
B protein and starch
C starch and nylon
D nylon and *Terylene*

s19-23-q40

A section of a polymer is shown.



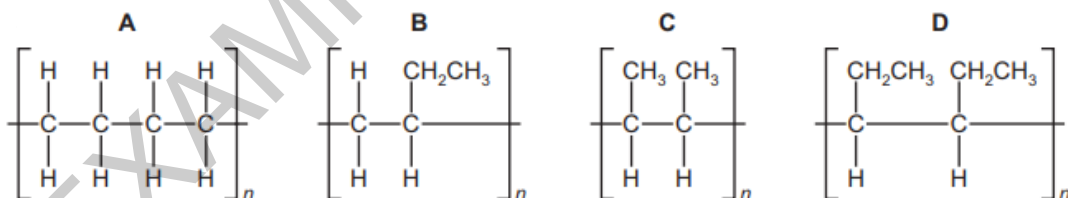
How many different types of monomer units formed this section of polymer?

- A** 1 **B** 2 **C** 3 **D** 4

s19-p22-q40

But-1-ene has the structure $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$.

What is the structure of poly(but-1-ene)?



s19-p21-q40

The structure of a polymer is shown.



Which type of polymer is shown and by which process is it formed?

	type of polymer	formed by
A	carbohydrate	addition polymerisation
B	carbohydrate	condensation polymerisation
C	polyester	addition polymerisation
D	polyester	condensation polymerisation

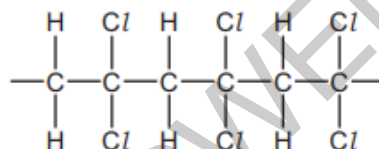
m19-p22-q40

Which statement about polymers is correct?

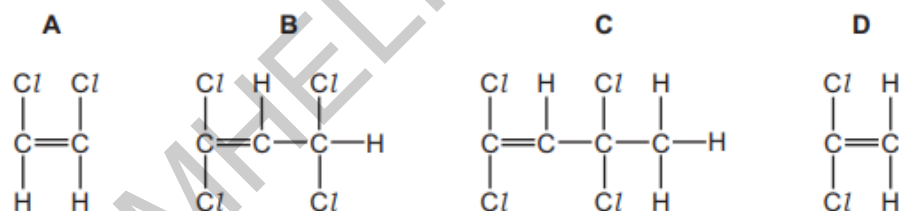
- A** Nylon contains the $\begin{array}{c} \text{O} \\ \parallel \\ \text{—C—N—} \\ | \\ \text{H} \end{array}$ linkage.
- B** Nylon is a polyester.
- C** Propane can be polymerised by addition polymerisation.
- D** The linkage in *Terylene* contains a carbon-carbon double bond.

w18-p23-q40

The structure of a polymer is shown.

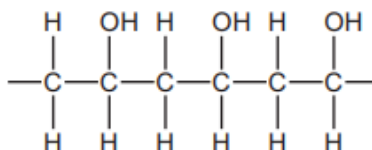


Which monomer is used to make this polymer?

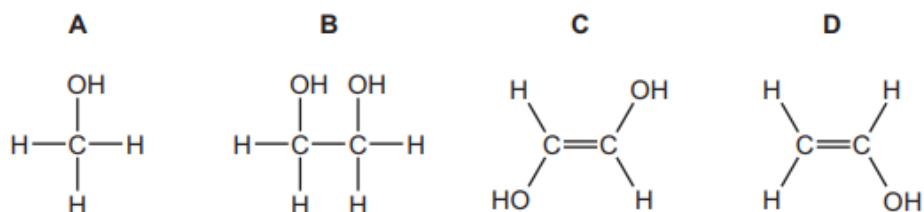


w18-p22-q40

The structure of an addition polymer is shown.

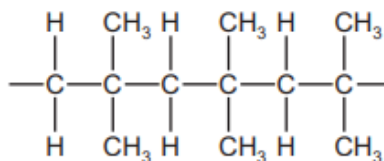


Which monomer is used to make this polymer?

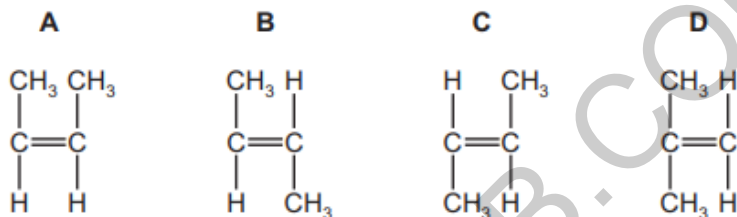


w18-p21-q40

The structure of a polymer is shown.



Which monomer is used to make this polymer?



s18-p23-q40

A polymer linkage contains carbon, hydrogen, nitrogen and oxygen atoms.

Which row about the polymer is correct?

	type of polymer	formed by
A	polyamide	addition polymerisation
B	polyamide	condensation polymerisation
C	polyester	addition polymerisation
D	polyester	condensation polymerisation

s18-p22-q40

Which two compounds react together to form a condensation polymer?

- A** $\text{HOCH}_2\text{CH}_2\text{OH}$ and CH_3COOH
- B** $\text{HOCH}_2\text{CH}_2\text{OH}$ and CH_3NH_2
- C** $\text{HOCH}_2\text{CH}_2\text{OH}$ and $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$
- D** $\text{HOCH}_2\text{CH}_2\text{OH}$ and $\text{HOOCCH}_2\text{CH}_2\text{COOH}$

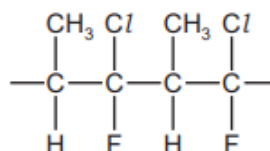
s18-p21-q40

Which row describes addition polymerisation and condensation polymerisation?

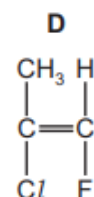
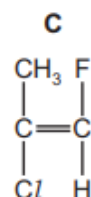
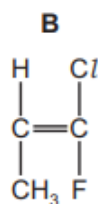
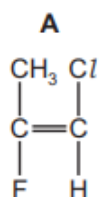
	addition polymerisation	condensation polymerisation
A	monomers have a C=C double bond and the polymer is the only product	monomers have a C=C double bond and the polymer is the only product
B	monomers have a C=C double bond and the polymer is the only product	the monomers react to form the polymer and a small molecule
C	the monomers react to form the polymer and a small molecule	monomers have a C=C double bond and the polymer is the only product
D	the monomers react to form the polymer and a small molecule	the monomers react to form the polymer and a small molecule

m18-p22-q40

The structure of a chlorofluorocarbon polymer is shown.



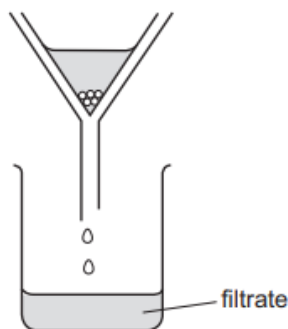
Which monomer is used to make this polymer?



	<u>12. Experimental Techniques and Chemical Analysis</u> 12.1 Experimental design
Content	<ol style="list-style-type: none"> Name appropriate apparatus for the measurement of time, temperature, mass and volume, including: <ol style="list-style-type: none"> stopwatches thermometers balances burettes volumetric pipettes measuring cylinders gas syringes Suggest advantages and disadvantages of experimental methods and apparatus Describe a: <ol style="list-style-type: none"> solvent as a substance that dissolves a solute solute as a substance that is dissolved in a solvent solution as a mixture of one or more solutes dissolved in a solvent saturated solution as a solution containing the maximum concentration of a solute dissolved in the solvent at a specified temperature residue as a substance that remains after evaporation, distillation, filtration or any similar process filtrate as a liquid or solution that has passed through a filter
m22-p2-q5	<p>Fermentation of sugar produces a mixture of ethanol solution and solid yeast.</p> <p>How is the solid yeast removed from the mixture?</p> <p>A crystallisation</p> <p>B distillation</p> <p>C filtration</p> <p>D fractional distillation</p>
w21-p23-q2 w21-p21-q2	<p>A student put exactly 25.00 cm³ of dilute hydrochloric acid into a conical flask.</p> <p>The student added 2.5g of solid sodium carbonate and measured the change in temperature of the mixture.</p> <p>Which apparatus does the student need to use?</p> <p>A balance, measuring cylinder, thermometer</p> <p>B balance, pipette, stopwatch</p> <p>C balance, pipette, thermometer</p> <p>D burette, pipette, thermometer</p>

w21-p23-q3
w21-p22-q3
w21-p21-q3

A student separates sugar from pieces of broken glass by dissolving the sugar in water and filtering off the broken glass.



What is the filtrate?

- A broken glass only
- B broken glass and sugar solution
- C pure water
- D sugar solution

w21-p22-q2

A student put exactly 25.00 cm^3 of dilute hydrochloric acid into a conical flask.

The student added 2.5 g of solid sodium carbonate and measured the change in temperature of the mixture.

Which apparatus does the student need to use?

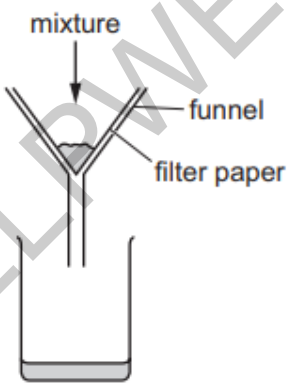
- A balance, measuring cylinder, thermometer
- B balance, pipette, stopwatch
- C balance, pipette, thermometer
- D burette, pipette, thermometer

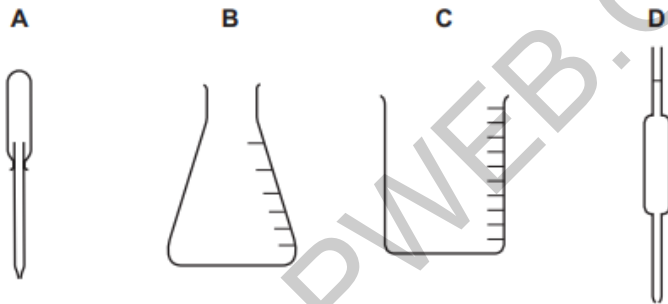
w21-p21-q19

Copper(II) chloride crystals are made by adding solid copper(II) carbonate to dilute hydrochloric acid until no more dissolves.

Which process is used to obtain pure copper(II) chloride crystals from the mixture?

- A distillation of the mixture
- B evaporation of the mixture
- C filtration followed by drying of the residue
- D filtration followed by evaporation of the filtrate

s21-p23-q19	<p>Aqueous solutions of sodium sulfate and barium chloride are mixed.</p> $\text{Na}_2\text{SO}_4(\text{aq}) + \text{BaCl}_2(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{NaCl}(\text{aq})$ <p>Which process is used to separate a sample of barium sulfate from the reaction mixture?</p> <p>A precipitation B filtration C evaporation D distillation</p>
s21-p21-q2	<p>A mixture is separated using the apparatus shown.</p>  <p>What is the mixture?</p> <p>A aqueous copper(II) sulfate and aqueous sodium chloride B aqueous copper(II) sulfate and copper C copper and sulfur D ethanol and ethanoic acid</p>
w20-p21-q3	<p>Which piece of apparatus can only measure a single fixed volume?</p> <p>A 250 cm³ beaker B 50 cm³ burette C 100 cm³ measuring cylinder D 25 cm³ pipette</p>

s20-p23-q2	<p>Which piece of apparatus is used to measure 13.7 cm^3 of dilute hydrochloric acid?</p> <p>A balance B burette C conical flask D pipette</p>
s20-p22-q2	<p>Which piece of apparatus is used to measure 25.0 cm^3 of aqueous sodium hydroxide?</p> <div style="text-align: center;">  <p>A B C D</p> </div>
s20-p21-q1	<p>Which piece of apparatus should be used to measure exactly 21.4 cm^3 of water?</p> <p>A 25 cm^3 beaker B 25 cm^3 pipette C 50 cm^3 burette D 50 cm^3 measuring cylinder</p>
m20-p22-q20	<p>The following substances can be reacted together to prepare salts.</p> <ol style="list-style-type: none"> 1 copper(II) oxide and excess hydrochloric acid 2 hydrochloric acid and excess sodium hydroxide 3 hydrochloric acid and excess zinc carbonate <p>In which reactions can the excess reactant be separated from the solution by filtration?</p> <p>A 1 and 2 B 1 and 3 C 2 and 3 D 3 only</p>

w19-p23-q2	<p>A student is asked to measure the time taken for 0.4 g of magnesium carbonate to react completely with 25.0 cm³ of dilute hydrochloric acid.</p> <p>Which pieces of apparatus does the student need?</p> <p>A balance, stop-clock, pipette</p> <p>B balance, stop-clock, thermometer</p> <p>C balance, pipette, thermometer</p> <p>D stop-clock, pipette, thermometer</p>															
w19-p23-q21 w19-p22-q21 w19-p21-q21	<p>A method used to make copper(II) sulfate crystals is shown.</p> <ol style="list-style-type: none">1 Place dilute sulfuric acid in a beaker.2 Warm the acid.3 Add copper(II) oxide until it is in excess.4 Filter the mixture.5 Evaporate the filtrate until crystals start to form.6 Leave the filtrate to cool. <p>What are the purposes of step 3 and step 4?</p> <table><tr><th></th><th>step 3</th><th>step 4</th></tr><tr><td>A</td><td>to ensure all of the acid has reacted</td><td>to obtain solid copper(II) sulfate</td></tr><tr><td>B</td><td>to ensure all of the acid has reacted</td><td>to remove the excess of copper(II) oxide</td></tr><tr><td>C</td><td>to speed up the reaction</td><td>to obtain solid copper(II) sulfate</td></tr><tr><td>D</td><td>to speed up the reaction</td><td>to remove the excess of copper(II) oxide</td></tr></table>		step 3	step 4	A	to ensure all of the acid has reacted	to obtain solid copper(II) sulfate	B	to ensure all of the acid has reacted	to remove the excess of copper(II) oxide	C	to speed up the reaction	to obtain solid copper(II) sulfate	D	to speed up the reaction	to remove the excess of copper(II) oxide
	step 3	step 4														
A	to ensure all of the acid has reacted	to obtain solid copper(II) sulfate														
B	to ensure all of the acid has reacted	to remove the excess of copper(II) oxide														
C	to speed up the reaction	to obtain solid copper(II) sulfate														
D	to speed up the reaction	to remove the excess of copper(II) oxide														
w19-p22-q2 w19-p21-q2	<p>A student is asked to measure the time taken for 0.4 g of magnesium carbonate to react completely with 25.0 cm³ of dilute hydrochloric acid.</p> <p>Which pieces of apparatus does the student need?</p> <p>A balance, stop-clock, pipette</p> <p>B balance, stop-clock, thermometer</p> <p>C balance, pipette, thermometer</p> <p>D stop-clock, pipette, thermometer</p>															

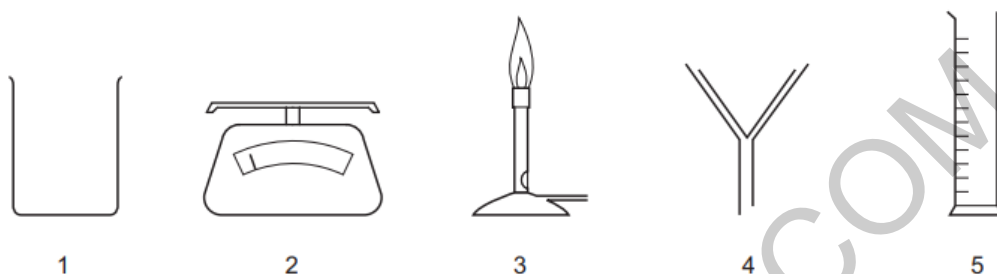
w19-p22-q2	<p>Lead(II) sulfate is an insoluble salt.</p> <p>Which reaction produces a mixture from which lead(II) sulfate is obtained by filtration?</p> <p>A adding solid lead(II) carbonate to dilute sulfuric acid</p> <p>B adding solid lead(II) hydroxide to dilute sulfuric acid</p> <p>C adding metallic lead to dilute sulfuric acid</p> <p>D adding aqueous lead(II) nitrate to dilute sulfuric acid</p>															
s19-p23-q2	<p>Which piece of apparatus is used to measure 24.8 cm³ of gas produced during a reaction?</p> <p>A beaker</p> <p>B conical flask</p> <p>C measuring cylinder</p> <p>D pipette</p>															
s19-p22-q2	<p>A student measures 25.00 cm³ of dilute hydrochloric acid accurately.</p> <p>Which apparatus is most suitable?</p> <p>A beaker</p> <p>B measuring cylinder</p> <p>C burette</p> <p>D dropping pipette</p>															
s19-p21-q2	<p>2.00 g of powdered calcium carbonate is added to 50.0 cm³ of hydrochloric acid.</p> <p>Which apparatus is used to measure the calcium carbonate and the hydrochloric acid?</p> <table><tr><td></td><td>calcium carbonate</td><td>hydrochloric acid</td></tr><tr><td>A</td><td>balance</td><td>burette</td></tr><tr><td>B</td><td>balance</td><td>thermometer</td></tr><tr><td>C</td><td>pipette</td><td>burette</td></tr><tr><td>D</td><td>pipette</td><td>thermometer</td></tr></table>		calcium carbonate	hydrochloric acid	A	balance	burette	B	balance	thermometer	C	pipette	burette	D	pipette	thermometer
	calcium carbonate	hydrochloric acid														
A	balance	burette														
B	balance	thermometer														
C	pipette	burette														
D	pipette	thermometer														

m19-p22-q3

Lead(II) iodide is insoluble in water.

Lead(II) iodide is made by adding aqueous lead(II) nitrate to aqueous potassium iodide.

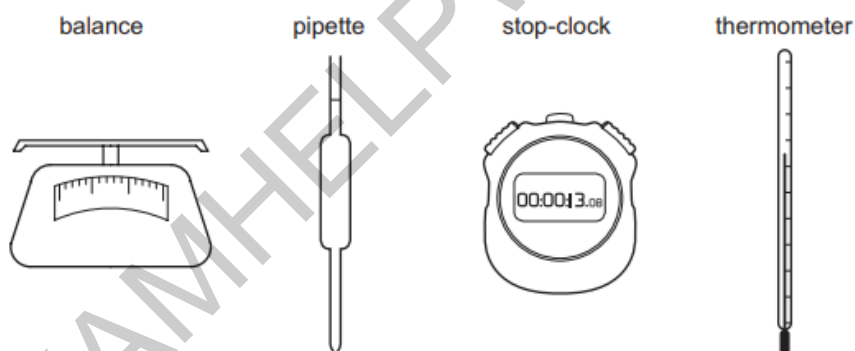
Which pieces of apparatus are needed to obtain solid lead(II) iodide from 20 cm³ of aqueous lead(II) nitrate?



- A** 1, 2 and 4 **B** 1, 3 and 5 **C** 1, 4 and 5 **D** 2, 4 and 5

w18-p23-q2
w18-p22-q2

The diagrams show four pieces of laboratory equipment.



Which equipment is essential to find out if dissolving a salt in water is an exothermic process?

	balance	pipette	stop-clock	thermometer
A	x	x	x	✓
B	✓	x	x	✓
C	x	✓	x	✓
D	✓	x	✓	x

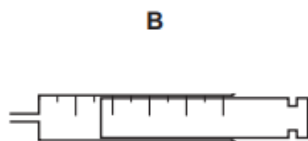
s18-p22-q3

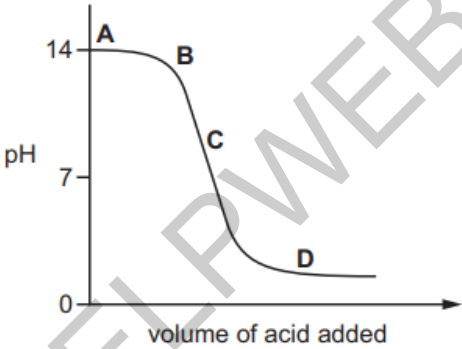
Which piece of apparatus **cannot** be used to collect and measure the volume of gas produced in an experiment?

- A** burette
B gas syringe
C measuring cylinder
D pipette

s18-p21-q3

Which piece of apparatus is used to measure exactly 26.3 cm^3 of a liquid?



Topic	<p align="center"><u>12. Experimental Techniques and Chemical Analysis</u></p> <p align="center">12.2 Acid-base titrations</p>
<p>Content</p>	<ol style="list-style-type: none"> Describe an acid–base titration to include the use of a: <ol style="list-style-type: none"> burette volumetric pipette suitable indicator Describe how to identify the end-point of a titration using an indicator
<p>s20-p23-q18 s20-p22-q18 s20-p21-q18</p>	<p>The graph shows how the pH of a solution changes as an acid is added to an alkali.</p> <p align="center">acid + alkali → salt + water</p> <p>Which letter represents the area of the graph where both acid and salt are present?</p> 

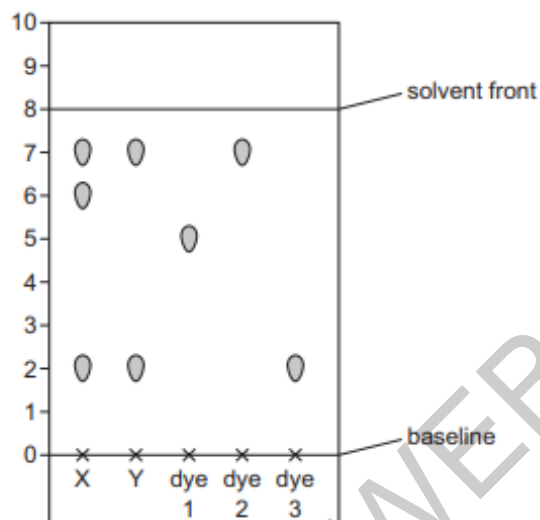
Topic	<p align="center"><u>12. Experimental Techniques and Chemical Analysis</u></p> <p align="center">12.3 Chromatography</p>
Content	<ol style="list-style-type: none"> Describe how paper chromatography is used to separate mixtures of soluble coloured substances, using a suitable solvent Interpret simple chromatograms to identify: <ol style="list-style-type: none"> unknown substances by comparison with known substances pure and impure substances Describe how paper chromatography is used to separate mixtures of soluble colourless substances, using a suitable solvent and a locating agent. Knowledge of specific locating agents is not required State and use the equation for R_f: $R_f = \frac{\text{distance travelled by substance}}{\text{distance travelled by solvent}}$
s21-p23-q3 s21-p22-q3 s21-p22-q3	<p>Which statement about paper chromatography is correct?</p> <p>A A solvent is needed to dissolve the paper.</p> <p>B Paper chromatography separates mixtures of solvents.</p> <p>C The solvent should cover the baseline.</p> <p>D The baseline should be drawn in pencil.</p>
s21-p22-q2	<p>A mixture of colourless compounds is separated using chromatography.</p> <p>Which type of reagent is used to detect these compounds after separation?</p> <p>A a dehydrating agent</p> <p>B a locating agent</p> <p>C an oxidising agent</p> <p>D a reducing agent</p>

m21-p22-q3

Two different food colourings, X and Y, are tested using chromatography.

Three pure dyes, 1, 2 and 3, are also tested.

The chromatogram is shown.



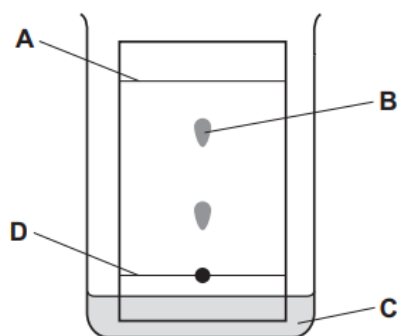
Which statements are correct?

- 1 X and Y both contain two or more dyes.
- 2 Dyes 2 and 3 are present in both X and Y.
- 3 The R_f of dye 1 is 0.625.

A 1 and 2 only **B** 1 and 3 only **C** 1, 2 and 3 **D** 2 and 3 only

w20-p23-q4
w20-p22-q4
w20-p21-q4

In the chromatography experiment shown, which label represents the solvent front?



w20-p22-q2

A chromatography experiment is carried out to analyse the pigments present in four different types of leaf. The student carrying out the experiment forgot to complete his table of results, which is shown.

plant leaf	number of pigments identified	colour of identified pigments	distance travelled by the solvent front (cm)	distance travelled from the origin by each pigment (cm)	R_f value
maple	F	green / yellow	3.7	green: 3.0 yellow: 3.1	green: 0.81 yellow: 0.83
laurel	2	green / yellow	G	green: 2.5 yellow: 2.5	green: 0.78 yellow: 0.78
lime	3	green / yellow / orange	3.5	green: 2.9 yellow: 3.0 orange: 2.7	green: 0.83 yellow: 0.86 orange: 0.77
ash	3	green / yellow / orange	3.5	green: 2.8 yellow: 3.0 orange: 2.7	green: 0.80 yellow: H orange: 0.77

Which row identifies the values of **F**, **G** and **H**?

	F	G	H
A	2	3.2	0.80
B	3	3.5	0.83
C	2	3.2	0.86
D	3	3.5	0.78

w20-p21-q2

A mixture of colourless amino acids is separated using chromatography.

The solvent used is propanol.

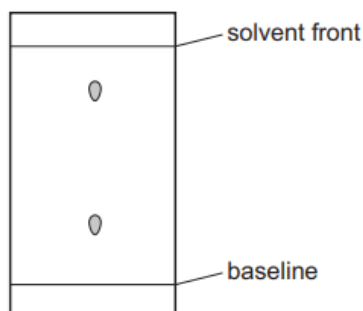
The chromatogram is sprayed with a locating agent.

Which row describes the purpose of the propanol and the locating agent?

	purpose of propanol	purpose of locating agent
A	to make the individual amino acids visible	to prevent the amino acids moving any further
B	to move the amino acids up the chromatography paper	to make the individual amino acids visible
C	to move the amino acids up the chromatography paper	to prevent the amino acids moving any further
D	to prevent the amino acids moving too far up the paper	to make the individual amino acids visible

s20-p23-q3

Chromatography is carried out on a mixture of three substances. The chromatogram is sprayed with a locating agent. The result is shown.



What are possible reasons why the chromatogram shows only two spots?

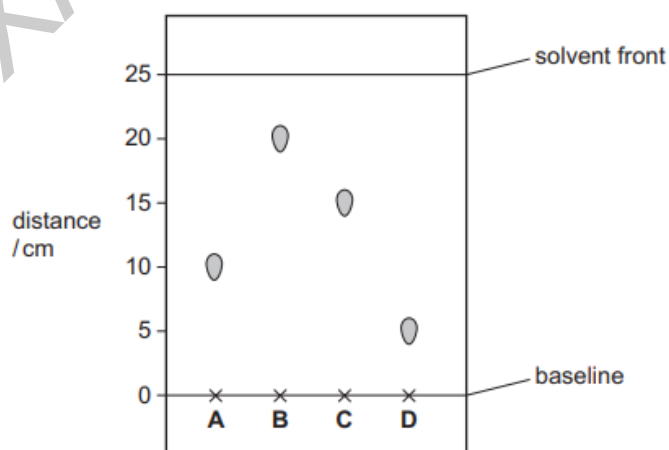
- 1 One of the substances in the mixture is insoluble in the solvent.
- 2 The locating agent did not react with one of the substances in the mixture.
- 3 Two of the substances in the mixture have the same R_f values.
- 4 The R_f value of one of the substances is too small.

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

s20-p22-q3

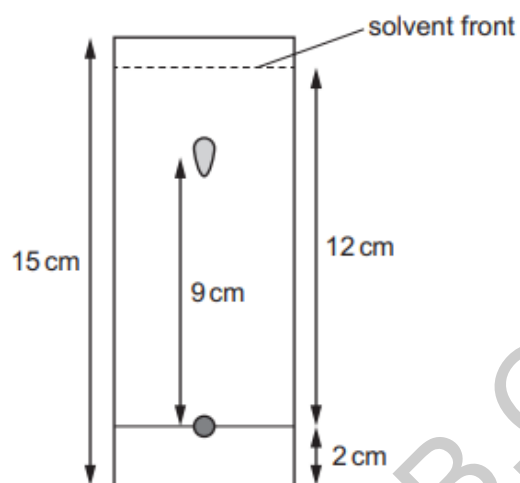
Paper chromatography is used to determine the R_f values for four different food colourings.

Which food colouring has an R_f value of 0.6?



s20-p21-q3

The chromatogram for an unknown dye is shown.



What is the R_f value of the dye?

- A** 0.60 **B** 0.64 **C** 0.75 **D** 0.82

m20-p22-q3

Chromatography is used to separate and identify the components in both coloured and colourless mixtures.

For colourless mixtures the chromatogram has to be treated with another chemical.

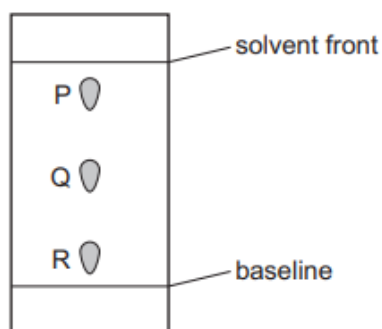
What is the name of this type of chemical?

- A** colouring agent
B display agent
C finding agent
D locating agent

w19-p23-q3

A substance is separated using chromatography.

The chromatogram is shown.



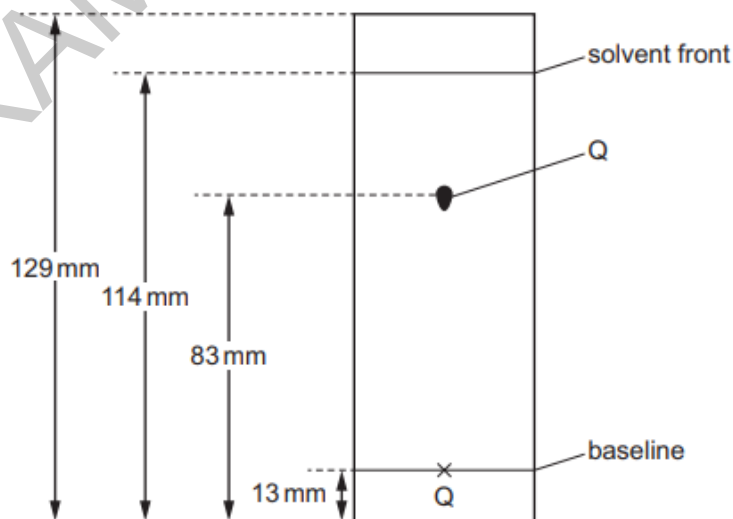
Which statement is **not** correct?

- A P has a higher R_f value than Q.
- B P, Q and R are all soluble in the solvent.
- C R is the most soluble substance.
- D The R_f value of P is less than 1.

w19-p22-q3

Substance Q was investigated using chromatography.

The chromatogram is shown. The diagram is not drawn to scale.



What is the R_f value of Q?

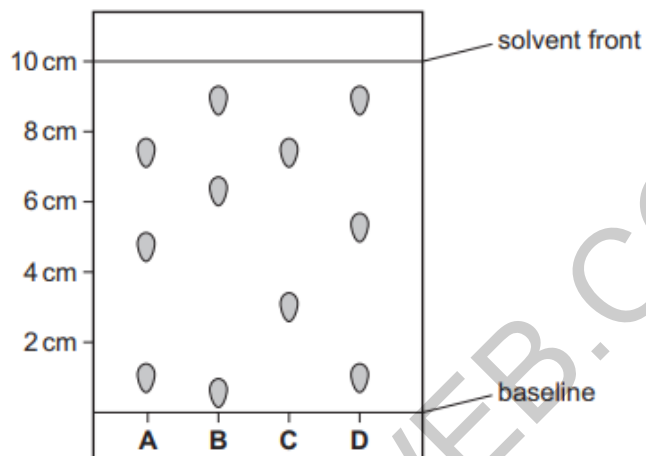
- A 0.60
- B 0.64
- C 0.69
- D 0.72

w19-p21-q3

Four different food colourings are analysed using chromatography.

The results are shown on the chromatogram. The diagram is not drawn to scale.

Which food colouring contains a component with an R_f value of 0.3?



s19-p23-q3

R_f values are used to identify unknown substances using paper chromatography.

Which statements about R_f values are correct?

- 1 R_f values are always less than 1.0.
- 2 R_f value = distance travelled by solvent \div distance travelled by unknown substance.
- 3 The higher the R_f value, the further the unknown substance travels.
- 4 R_f values are not affected by the solubility of the unknown substance.

A 1 and 2

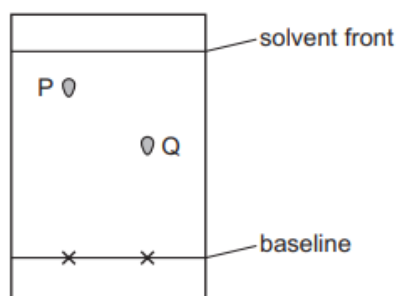
B 1 and 3

C 2 and 3

D 3 and 4

s19-p22-q3

The chromatogram of solutions of two metal ions, P and Q, is shown.



P is coloured. A locating agent is used to find the position of Q.

The R_f value of each solution is calculated.

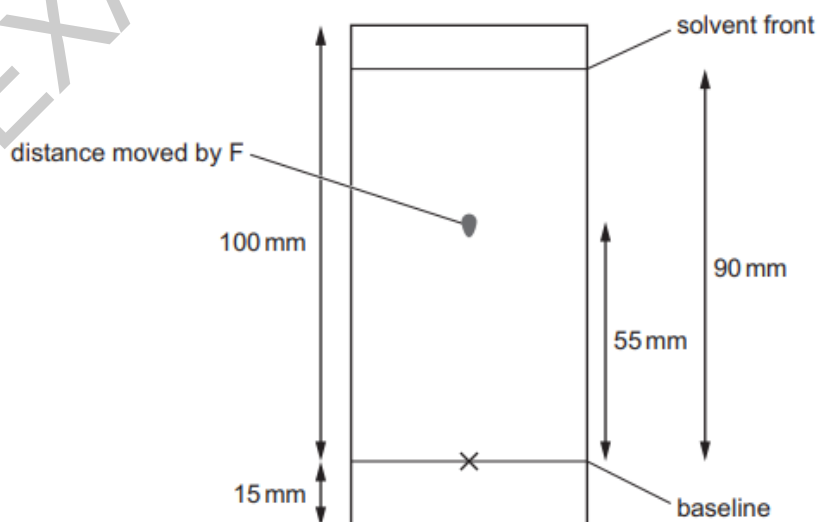
P is a1..... element and has an R_f value2..... than that of Q.

Which words complete gaps 1 and 2?

	1	2
A	non-transition	greater
B	non-transition	smaller
C	transition	greater
D	transition	smaller

s19-p21-q3

The measurements from a chromatography experiment using substance F are shown. The diagram is not drawn to scale.



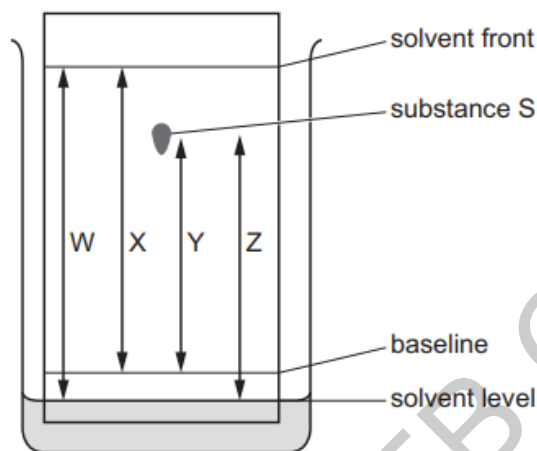
What is the R_f value of F?

- A** 0.55 **B** 0.61 **C** 0.90 **D** 1.64

m19-p22-q4

The chromatogram of substance S is shown.

Some distances, W, X, Y and Z, are labelled on the diagram.



How is the R_f value of substance S calculated?

A $\frac{X}{Y}$

B $\frac{W}{Z}$

C $\frac{Y}{X}$

D $\frac{Y}{W}$

s18-p23-q2

Paper chromatography is done in the same way with three different mixtures of dyes. Each mixture contains at least one of the dyes W, X, Y and Z.

The R_f values of the dyes in the three mixtures are shown.

dye	R_f values from mixture 1	R_f values from mixture 2	R_f values from mixture 3
W	0.15	0.15	0.15
X	0.00	0.00	0.00
Y	0.50	0.50	0.50
Z	0.00	0.91	0.91

Which conclusion is correct?

A Dye W is nearest the solvent front and is present only in mixture 1 and mixture 3.

B Dye X has travelled furthest up the chromatography paper.

C Dye Y is the only dye present in all three mixtures.

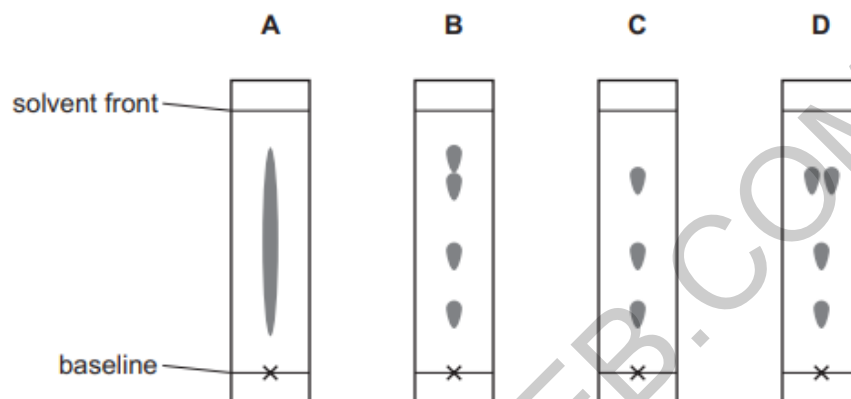
D Dye Z is nearest the solvent front and is found in only two of the mixtures.

s18-p22-q2

A chromatography experiment was done to separate a mixture of four substances.

The R_f values measured for these substances were 0.3, 0.5, 0.8 and 0.8.

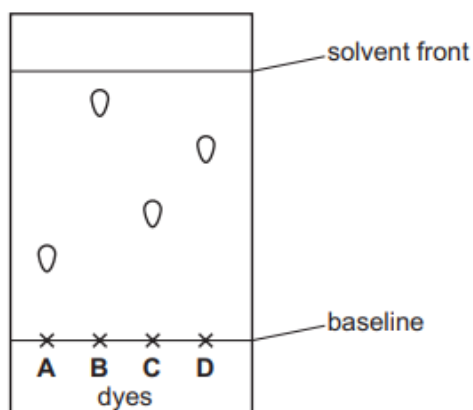
Which diagram shows the chromatogram obtained?



s18-p21-q2

Chromatography is a technique used to separate coloured dyes.

Which dye has an R_f value of 0.7?

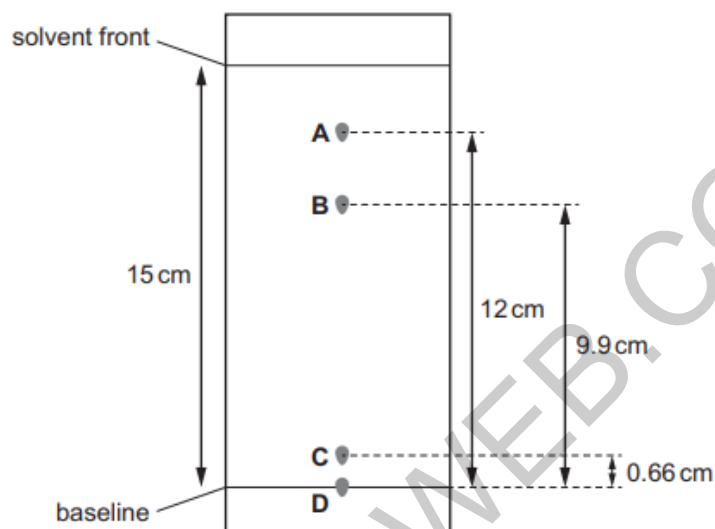


m18-p22-q3

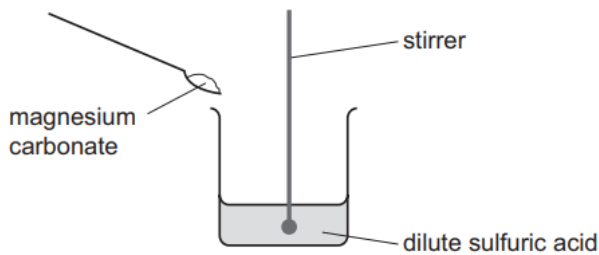
Chromatography is done on a mixture containing a drug. The drug has an R_f value of 0.66.

The diagram is **not** drawn to scale.

Which spot on the chromatogram represents the drug?



Topic	<u>12. Experimental Techniques and Chemical Analysis</u>																				
	12.4 Separation and purification																				
Content	<div>1. Describe and explain methods of separation and purification using: (a) a suitable solvent (b) filtration (c) crystallisation (d) simple distillation (e) fractional distillation</div> <div>2. Suggest suitable separation and purification techniques, given information about the substances involved</div> <div>3. Identify substances and assess their purity using melting point and boiling point information</div>																				
s21-p22-q38	<p>The flow chart shows how petroleum may be turned into a plastic.</p> <div><div>petroleum</div><div>process 1</div><div>saturated hydrocarbon</div><div>process 2</div><div>unsaturated hydrocarbon</div><div>process 3</div><div>plastic</div></div> <p>What are processes 1, 2 and 3?</p> <table><tr><td></td><td>process 1</td><td>process 2</td><td>process 3</td></tr><tr><td>A</td><td>cracking</td><td>fractional distillation</td><td>polymerisation</td></tr><tr><td>B</td><td>cracking</td><td>polymerisation</td><td>fractional distillation</td></tr><tr><td>C</td><td>fractional distillation</td><td>cracking</td><td>polymerisation</td></tr><tr><td>D</td><td>fractional distillation</td><td>polymerisation</td><td>cracking</td></tr></table>		process 1	process 2	process 3	A	cracking	fractional distillation	polymerisation	B	cracking	polymerisation	fractional distillation	C	fractional distillation	cracking	polymerisation	D	fractional distillation	polymerisation	cracking
	process 1	process 2	process 3																		
A	cracking	fractional distillation	polymerisation																		
B	cracking	polymerisation	fractional distillation																		
C	fractional distillation	cracking	polymerisation																		
D	fractional distillation	polymerisation	cracking																		
s21-P21-q19	<p>Copper(II) sulfate is prepared by adding excess copper(II) oxide to warm dilute sulfuric acid.</p> <p>Which purification methods are used to obtain pure solid copper(II) sulfate from the reaction mixture?</p> <div><div>1 crystallisation</div><div>2 filtration</div><div>3 chromatography</div><div>4 distillation</div></div> <div><div>A 1 and 4</div><div>B 1 and 2</div><div>C 2 and 3</div><div>D 3 and 4</div></div>																				

<p>w20-p23-q24 w20-p22-q24 w20-p22-q24</p>	<p>A student carries out an experiment to prepare pure magnesium sulfate crystals.</p> <p>The diagram shows the first stage of the preparation.</p>  <p>He adds magnesium carbonate until no more reacts.</p> <p>Which process should he use for the next stage?</p> <p>A crystallisation B evaporation C filtration D neutralisation</p>
<p>w20-p23-q30</p>	<p>Which process is used to separate oxygen from liquid air?</p> <p>A chromatography B distillation C filtration D fractional distillation</p>
<p>w20-p22-q5</p>	<p>Different methods of separation rely on substances having different properties.</p> <p>Which property does distillation make use of?</p> <p>A boiling point B colour C particle size D solubility in different solvents</p>

s20-p21-q29	<p>Element Y reacts with copper(II) oxide to form copper.</p> <p>Element Y will not react with zinc oxide. Copper has no reaction with zinc oxide.</p> <p>What is the order of reactivity of these three elements, most reactive first?</p> <p>A Cu → Y → Zn</p> <p>B Cu → Zn → Y</p> <p>C Zn → Cu → Y</p> <p>D Zn → Y → Cu</p>
w19-p23-q22	<p>Lead(II) iodide is formed as a precipitate in the reaction shown.</p> $\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{NaI}(\text{aq}) \rightarrow \text{PbI}_2(\text{s}) + 2\text{NaNO}_3(\text{aq})$ <p>Which method is used to separate the lead(II) iodide from the mixture?</p> <p>A crystallisation</p> <p>B distillation</p> <p>C evaporation</p> <p>D filtration</p>
w19-p23-q30	<p>River water contains soluble impurities, insoluble impurities and bacteria.</p> <p>River water is made safe to drink by filtration and chlorination.</p> <p>Which statement is correct?</p> <p>A Filtration removes bacteria and insoluble impurities, and chlorination removes soluble impurities.</p> <p>B Filtration removes insoluble impurities, and chlorination kills the bacteria.</p> <p>C Filtration removes soluble and insoluble impurities, and chlorination kills the bacteria.</p> <p>D Filtration removes soluble impurities and bacteria, and chlorination removes insoluble</p>
w19-p23-q31 w19-p22-q31	<p>How are oxygen and nitrogen separated from air?</p> <p>A chromatography</p> <p>B condensation and filtration</p> <p>C crystallisation</p> <p>D fractional distillation</p>

w19-p21-q31	<p>Which physical property is used to separate the nitrogen and oxygen from air?</p> <p>A boiling point</p> <p>B density</p> <p>C electrical conductivity</p> <p>D molecular mass</p>
m19-p22-q2	<p>Which method should be used to separate a mixture of two liquids?</p> <p>A crystallisation</p> <p>B electrolysis</p> <p>C filtration</p> <p>D fractional distillation</p>
m19-p22-q32	<p>What are the main substances produced by the fractional distillation of liquid air?</p> <p>A oxygen and carbon dioxide</p> <p>B oxygen and nitrogen</p> <p>C helium and nitrogen</p> <p>D hydrogen and oxygen</p>

Topic	<u>12. Experimental Techniques and Chemical Analysis</u> 12.5 Identification of ions and gases
Content	<ol style="list-style-type: none"> Describe tests to identify the anions: <ol style="list-style-type: none"> carbonate, CO_3^{2-}, by reaction with dilute acid and then testing for carbon dioxide gas chloride, Cl^-, bromide, Br^-, and iodide, I^-, by acidifying with dilute nitric acid then adding aqueous silver nitrate nitrate, NO_3^-, reduction with aluminium foil and aqueous sodium hydroxide and then testing for ammonia gas sulfate, SO_4^{2-}, by acidifying with dilute nitric acid and then adding aqueous barium nitrate sulfite, SO_3^{2-}, by reaction with acidified aqueous potassium manganate(VII) 2 Describe tests using aqueous sodium hydroxide and aqueous ammonia to identify the aqueous cations: <ol style="list-style-type: none"> aluminium, Al^{3+} ammonium, NH_4^+ calcium, Ca^{2+} chromium(III), Cr^{3+} copper(II), Cu^{2+} iron(II), Fe^{2+} iron(III), Fe^{3+} zinc, Zn^{2+} Describe tests to identify the gases: <ol style="list-style-type: none"> ammonia, NH_3, using damp red litmus paper carbon dioxide, CO_2, using limewater chlorine, Cl_2, using damp litmus paper hydrogen, H_2, using a lighted splint oxygen, O_2, using a glowing splint sulfur dioxide, SO_2, using acidified aqueous potassium manganate(VII) Describe the use of a flame test to identify the cations: <ol style="list-style-type: none"> lithium, Li^+ sodium, Na^+ potassium, K^+ calcium, Ca^{2+} barium, Ba^{2+} copper(II), Cu^{2+}
w21-p21-q28	<p>Which statements about the thermal decomposition of copper(II) nitrate are correct?</p> <ol style="list-style-type: none"> A brown gas is given off. A gas which relights a glowing splint is given off. The solid residue is an acidic oxide. <p>A 1 only B 1 and 2 C 1 and 3 D 2 and 3</p>

s21-p21-q20	<p>Some reactions of element M are shown.</p> <pre> graph LR A[element M] -- burn --> B[oxide of M] B -- add water --> C[solution] B -- "add to purple acidified potassium manganate(VII)" --> D[goes colourless] C -- "add blue litmus" --> E[goes red] </pre> <p>What is element M?</p> <p>A carbon B iron C magnesium D sulfur</p>
s21-p21-q32	<p>A white solid Z reacts with dilute hydrochloric acid to produce a gas.</p> <p>The same gas is produced when compound Z is heated strongly.</p> <p>What is Z?</p> <p>A calcium B calcium carbonate C calcium hydroxide D calcium oxide</p>
m21-p22-q20	<p>When aqueous sodium hydroxide is added to a solution of a metal ion, a grey-green precipitate forms, which dissolves in excess to form a dark green solution.</p> <p>What is the identity of the metal ion?</p> <p>A chromium(III) B iron(II) C iron(III) D copper(II)</p>

w20-p22-q32

The results of tests on solid S and its aqueous solution are shown.

tests on solid S	tests on aqueous solution of S	
effect of heat	effect of aqueous sodium hydroxide	effect of aqueous ammonia
brown gas given off, together with a gas which relights a glowing splint	white ppt., soluble in excess, giving a colourless solution	white ppt., soluble in excess, giving a colourless solution

What is S?

- A aluminium nitrate
- B aluminium sulfate
- C zinc sulfate
- D zinc nitrate

s20-p22-q8

Lead(II) nitrate, $\text{Pb}(\text{NO}_3)_2$, reacts with potassium iodide, KI, to form a yellow precipitate, PbI_2 , and a soluble salt, KNO_3 .

What is the equation for the reaction?

- A $\text{Pb}(\text{NO}_3)_2 + \text{KI} \rightarrow \text{PbI}_2 + \text{KNO}_3$
- B $\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \rightarrow \text{PbI}_2 + \text{KNO}_3$
- C $2\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \rightarrow \text{PbI}_2 + 2\text{KNO}_3$
- D $\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \rightarrow \text{PbI}_2 + 2\text{KNO}_3$

m20-p22-q21

Salt S is dissolved in water and three tests are carried out on the solution.

	test	result
1	aqueous sodium hydroxide is added	green precipitate formed, insoluble in excess sodium hydroxide
2	dilute nitric acid is added	no reaction
3	aqueous barium nitrate is added to the acidified solution from test 2	white precipitate formed

What is the identity of S?

- A copper(II) chloride
- B copper(II) sulfate
- C iron(II) chloride
- D iron(II) sulfate

s19-p21-q24	<p>Which statement about elements in Group VIII of the Periodic Table is correct?</p> <p>A They all have a full outer shell of electrons.</p> <p>B They all react with Group I elements to form ionic compounds.</p> <p>C They are all diatomic molecules.</p> <p>D They are all liquids at room temperature.</p>						
m19-p22-q22	<p>The results of two tests on an aqueous solution of X are shown.</p> <table border="1"> <thead> <tr> <th>test</th><th>observation</th></tr> </thead> <tbody> <tr> <td>aqueous sodium hydroxide added</td><td>green precipitate formed</td></tr> <tr> <td>acidified aqueous silver nitrate added</td><td>yellow precipitate formed</td></tr> </tbody> </table> <p>What is X?</p> <p>A copper(II) chloride</p> <p>B copper(II) iodide</p> <p>C iron(II) chloride</p> <p>D iron(II) iodide</p>	test	observation	aqueous sodium hydroxide added	green precipitate formed	acidified aqueous silver nitrate added	yellow precipitate formed
test	observation						
aqueous sodium hydroxide added	green precipitate formed						
acidified aqueous silver nitrate added	yellow precipitate formed						
m18-p23-q24	<p>Heating copper(II) carbonate produces copper(II) oxide and carbon dioxide.</p> <p>Heating the copper(II) oxide formed with carbon produces copper.</p> <p>Which colour changes are observed during these reactions?</p> <p>A green → black → brown</p> <p>B green → white → brown</p> <p>C blue → black → silver</p> <p>D blue → white → brown</p>						

m18-p21-q18	<p>Aqueous sodium hydroxide is added to solid Q in a test-tube.</p> <p>A gas is produced which turns damp red litmus blue.</p> <p>What is Q?</p> <p>A aluminium</p> <p>B ammonia</p> <p>C ammonium chloride</p> <p>D sodium nitrate</p>
m18-p22-q18	<p>A solution of compound Z gives a light blue precipitate with aqueous ammonia. The precipitate dissolves in an excess of ammonia.</p> <p>A flame test is done on compound Z.</p> <p>What is the colour of the flame?</p> <p>A blue-green</p> <p>B lilac</p> <p>C red</p> <p>D yellow</p>