Cambridge International AS & A Level

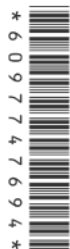|	
CHEMISTRY	**9701/13**
Paper 1 Multiple Choice	**October/November 2020**
	1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)
Data booklet

INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.

This document has **16** pages. Blank pages are indicated.

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Section A

For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider to be correct.

Use of the Data Booklet may be appropriate for some questions.

1   Which statement is correct?

   A Cl has a relative isotopic mass of 35.5. *35 or 37*

   B Cl_2 has a relative molecular mass of 70. *35.5×2*

   C ICl has a relative molecular mass of 162.4.

   D $NaCl$ has a relative molecular mass of 58.5.

2   Strontium metal can be extracted from strontium oxide, SrO, by reduction with aluminium. One of the possible reactions is shown.

$$6SrO + 2Al \rightarrow 3Sr + Sr_3Al_2O_6$$

$\frac{100}{103.6} = 0.965$ moles $\longrightarrow \frac{0.965}{2} = mass/87.6$
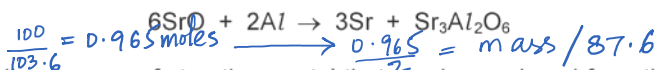
   What is the maximum mass of strontium metal that can be produced from the reduction of 100 g of strontium oxide using this reaction?

   A   41.3 g   **B**   42.3 g   **C**   84.6 g   **D**   169.2 g

3   A single ^{32}P nucleus can be produced when a single ^{32}S nucleus joins with particle X. In the process a proton is emitted.

   What is particle X? $^{1}_{0}X + {}^{32}_{16}S \longrightarrow {}^{32}_{15}P + {}^{1}_{1}P$

   A   a deuteron, $^{2}_{1}H^{+}$

   B   an electron

   C   a neutron

   D   a proton

4   In which of the following, when in liquid form, are there only intermolecular forces based on temporary dipoles between the particles?

   A   bromine

   B   ethanol *hydrogen bonding*

   C   hydrogen chloride *ionic*

   D   water *hydrogen bonding*

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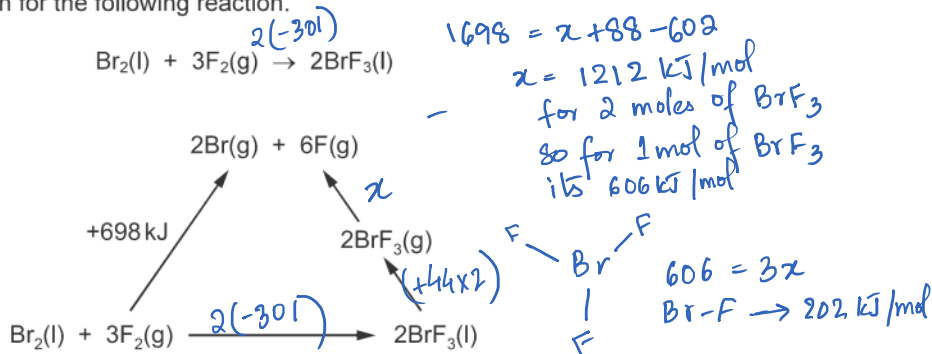
metallic bonding

5   Copper has a high melting point.

What is the reason for the high melting point of copper?

A   strong attractive forces between copper atoms only

B   strong attractive forces between copper ions and delocalised electrons   *Cu²⁺*

C   strong attractive forces between copper ions only

D   strong attractive forces between copper atoms and delocalised electrons

(B is circled)

6   Which pair of standard enthalpy changes are numerically equal?

A   atomisation of $CH_4(g)$ and formation of $CH_4(g)$ *(crossed out) not possible*

B   combustion of $CH_3OH(l)$ and combustion of graphite + 2(combustion of $H_2(g)$))

$$CH_3OH + O_2 \rightarrow CO_2 + H_2O$$
$$C + 2H_2 + O_2 \rightarrow CO_2 + H_2O$$

C   combustion of graphite and formation of $CO_2(g)$ $C + O_2 \rightarrow CO_2$ & $C + O_2 \rightarrow CO_2$

D   neutralisation of $HCl(aq)$ with $NaOH(aq)$ and formation of $H_2O(l)$

$$HCl + NaOH \rightarrow NaCl + H_2O \quad \& \quad H_2 + \tfrac{1}{2}O_2 \rightarrow H_2O$$

(C is circled)

7   An energy cycle is drawn for the following reaction.

$$Br_2(l) + 3F_2(g) \rightarrow 2BrF_3(l) \quad 2(-301)$$

2Br(g) + 6F(g)

+698 kJ ↗   ↘ *x*

2BrF₃(g)

(+44×2)   F—Br—F *(structure)*

Br₂(l) + 3F₂(g) — *2(-301)* → *2BrF₃(l)*

Handwritten calculations:
$$1698 = x + 88 - 602$$
$$x = 1212 \text{ kJ/mol}$$
for 2 moles of BrF₃
so for 1 mol of BrF₃
its 606 kJ/mol

$$606 = 3x$$
$$Br-F \rightarrow 202 \text{ kJ/mol}$$

The standard enthalpy of formation of $BrF_3(l)$ = -301 kJ mol^{-1} *for formation of 1 mole of BrF₃(l)*

The enthalpy change of $BrF_3(l)$ to $BrF_3(g)$ is $+44\text{ kJ mol}^{-1}$.   *for 1 mole of BrF₃*

What is the average bond energy of the Br–F bond in BrF_3?

A 152 kJ mol^{-1} B 202 kJ mol^{-1} C 304 kJ mol^{-1} D 404 kJ mol^{-1}

(B is circled)

8   In which reaction does the greatest change in the oxidation number of sulfur occur?

A $S(s) + O_2(g) \rightarrow SO_2(g)$ *(0, +4)*

B $SO_2(g) + \tfrac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$ *(+4, +6)*

C $SO_3(g) + H_2SO_4(l) \rightarrow H_2S_2O_7(l)$ *(+6, +6, +6)*

D $H_2S_2O_7(l) + H_2O(l) \rightarrow 2H_2SO_4(l)$ *(+6, +6)*

(A is circled)

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4

9 The first stage in the chloride process for the manufacture of titanium consists of the following reaction.

$$\overset{+4}{2TiO_2} + \overset{0}{4Cl_2} + \overset{0}{3C} \rightarrow \overset{+4 \; -1}{2TiCl_4} + \overset{+2}{2CO} + \overset{+4}{CO_2}$$

oxidation no. ↓   −1
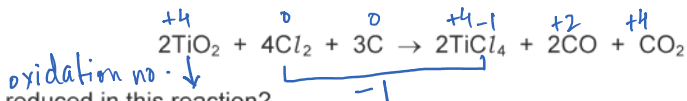
What is reduced in this reaction?

A   carbon

(B) chlorine

C   oxygen

D   titanium

10 In aqueous solution, sulfuric acid dissociates as shown.

$$\overset{2 \rightarrow}{H_2SO_4} \rightarrow \overset{2}{HSO_4^-} + \overset{+ \; 2}{H^+}$$ This reaction goes to completion.

$$HSO_4^- \rightleftharpoons SO_4^{2-} + H^+$$ This reaction reaches equilibrium with constant K_c.

Analysis of a $2.00\,mol\,dm^{-3}$ solution of H_2SO_4 found the HSO_4^- concentration to be $1.988\,mol\,dm^{-3}$.

What is K_c?

	$HSO_4^- \rightleftharpoons$	$SO_4^{2-} +$	H^+
Initial	2	0	2
Change	−0.012	+0.012	+0.012
Eq.	1.988	0.012	2.012

$$K_c = \frac{[SO_4^{2-}][H^+]}{[HSO_4^-]}$$

$$= \frac{0.012 \times 2.012}{1.988}$$

A $1.381 \times 10^5\,dm^3\,mol^{-1}$

B $82.34\,dm^3\,mol^{-1}$

(C) $1.214 \times 10^{-2}\,mol\,dm^{-3}$

D $7.244 \times 10^{-5}\,mol\,dm^{-3}$

11 An autocatalytic reaction is a reaction in which one of the products catalyses the reaction.

Which curve would be obtained if the rate of an autocatalytic reaction is plotted against time?

A   B   (C)   D
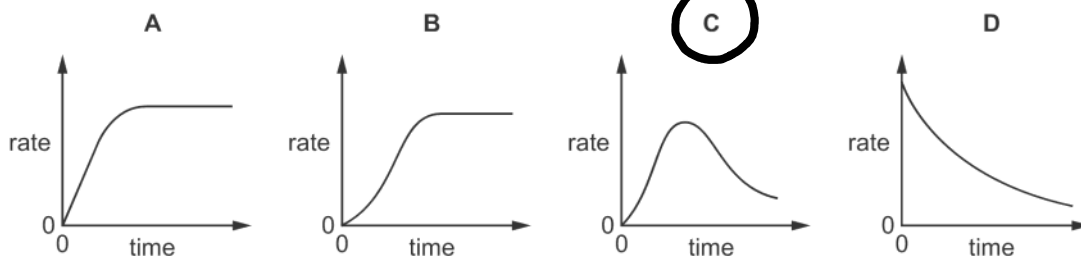
For autocatalytic reactions, rate initially increases then decrease with time.

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5

Handwritten: Na, Mg, Al, Si, P, S, Cl

12 X and Y are two elements in Period 3 of the Periodic Table. They combine to form compound Z.

Handwritten: Si, P, S

X forms a soluble acidic oxide. The oxidation number of X in this oxide is +4. *Handwritten: SiO_2 or SO_2*

Y forms an amphoteric oxide. *Handwritten: Al_2O_3*

What is the formula of compound Z?

A AlP   **B** Al_2S_3 **C** Si_2P_5 **D** SiS_2

13 This question is about two elements in Group 2, Q and R.

Three of the statements shown are correct for metal Q.

The one remaining statement is correct for metal R.

Which statement applies to R?

A A saturated solution of the hydroxide of this metal has the higher pH value. *Handwritten: more soluble so its Sr, Ba, Ra*

B This metal has a carbonate that is used in agriculture to reduce the acidity of soil. *Handwritten: Ca*

C This metal has the greater atomic radius. *Handwritten: Sr, Ba, Ra*

D This metal reacts more quickly with cold water. *Handwritten: Sr, Ba, Ra*

14 The electronic arrangement for atoms of four elements is given.

Which element is the strongest oxidising agent? *Handwritten: easily gains electrons thus its the one that has less shielding*

A $1s^2 2s^2 2p^5$

B $1s^2 2s^2 2p^6 3s^2$

C $1s^2 2s^2 2p^6 3s^2 3p^5$

D $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

15 A student mixes pairs of chemicals together in separate test-tubes.

- excess calcium (s) + water (l) *Handwritten: $Ca + H_2O \rightarrow Ca(OH)_2 (s) + H_2$*
- barium chloride (aq) + strontium hydroxide (aq) *Handwritten: $BaCl_2 + Sr(OH)_2 \rightarrow Ba(OH)_2 + SrCl_2$*
- calcium carbonate (s) + excess hydrochloric acid (aq) *Handwritten: $CaCO_3 + HCl \rightarrow CaCl_2 + H_2O + CO_2$*
- magnesium sulfate (aq) + barium nitrate (aq) *Handwritten: $MgSO_4 + Ba(NO_3)_2 \rightarrow BaSO_4 (s) + Mg(NO_3)_2$*

How many of the mixtures produce a white, solid product?

A 0   **B** 1   **C** 2   **D** 3

6

16 With which compound does concentrated sulfuric acid react **both** as a strong acid **and** as an oxidising agent?

can oxidise Br^- & I^-

$$H_2SO_4 + NaB\overset{-1}{r} \longrightarrow \overset{0}{Br_2} + SO_2 + H_2O$$

oxidised
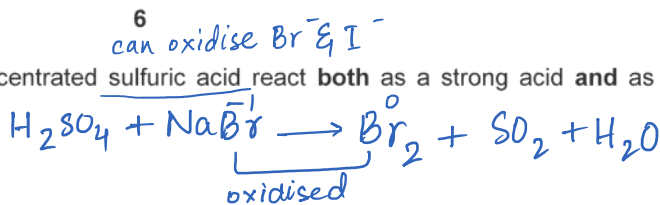
   A   magnesium carbonate

   B   potassium chloride

   (C) sodium bromide

   D   sulfur trioxide

$$NH_3 + HCl \longrightarrow NH_4Cl$$

17 Ammonia can undergo an acid–base reaction with hydrogen chloride to form ammonium chloride.

Which statement is correct?

   A   The ammonium ion is basic. $NH_4^+ \longrightarrow NH_3$

   B   The hydrogen atom from HC*l* donates a lone pair of electrons to the nitrogen atom.

   C   The H–N–H bond angle in ammonia is the same as the H–N–H bond angle in the ammonium ion. *107° 109.5°*

   (D) The H–N–H bond angle in the ammonium ion is the same as the H–C–H bond angle in methane. *109.5° 109.5°*

18 What are the trends in the stated properties as Group 2 is descended from magnesium to barium?

	decomposition temperature of the carbonate	first ionisation energy
A	decreases	increases
B	decreases	decreases
C	increases	increases
(D)	increases	decreases

Decomposition temp ↑ bcz metal carbonates are more stable down the group
I.e ↓ down the group bcz of increased shielding

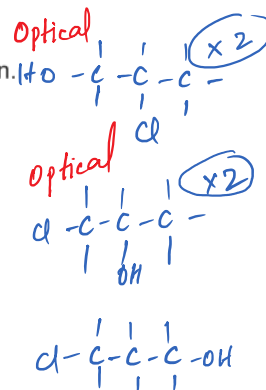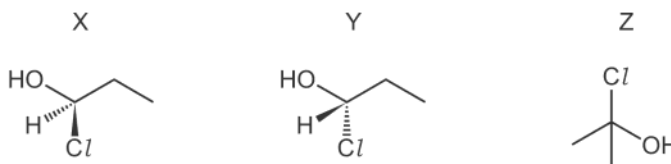19 Sulfur dioxide, SO_2, reacts with calcium hydroxide in aqueous solution.

acid   base

$$SO_2 + Ca(OH)_2 \longrightarrow CaSO_3 + H_2O$$
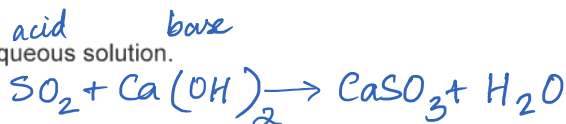
What is the main product that is first formed?

   A $Ca(HSO_4)_2$ B   CaS   (C) $CaSO_3$ D $CaSO_4$

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chain/position/functional   cis-trans/optical

20 Structural and stereoisomerism should be considered when answering this question.

Optical
$H_2O - \overset{|}{\underset{|}{C}} - \overset{|}{\underset{|}{C}} - \overset{|}{\underset{Cl}{C}} -$ ⊗2

Compounds X, Y and Z are shown.

| X | Y | Z |

$Cl - \overset{|}{\underset{|}{C}} - \overset{|}{\underset{OH}{C}} - \overset{|}{\underset{|}{C}} -$ *optical* ×2

How many other isomers of C_3H_7ClO are there that are alcohols?

A 2   B 3   C 4   (D) 5

$Cl - \overset{|}{\underset{|}{C}} - \overset{|}{\underset{|}{C}} - \overset{|}{\underset{|}{C}} - OH$

21 Two students each make a statement about 2-methylbut-1-ene.

$\overset{CH_3}{\underset{|}{C}} = \overset{|}{\underset{|}{C}} - \overset{|}{\underset{|}{C}} - \overset{|}{\underset{|}{C}} -$

Student 1 states that 2-methylbut-1-ene has geometrical isomers. *NO bcz of 2 H atoms on same C*

Student 2 states that 2-methylbut-1-ene reacts with HBr in an addition reaction to give 1-bromo-2-methylbutane as the main product. *NO bcz main product would be the most stable. Br can either attach to 1st or 2nd C so to produce the more stable or main product, it must attach itself to 2nd C atom & form 2 bromo 2 methyl butane*

Which students are correct?

A   both 1 and 2

B   1 only

C   2 only

(D)   neither 1 nor 2

addition polymer

22 Which statement is correct when referring to the complete combustion of PVC?

(A) A gas is made which contributes to global warming.

B   Carbon dioxide and water are the only products.

C   If water is used to clean the exhaust gases, the water becomes alkaline.

~~D~~   There is no need to treat the exhaust gases as the products are non-hazardous.

gives yellow ppt.

23 Iodoethane, CH_3CH_2I, reacts with aqueous silver nitrate at 50 °C. A precipitate forms during this reaction.

Which row of the table is correct about this reaction?

|	type of organic reaction	colour of precipitate
~~A~~	electrophilic substitution	cream Br^-
B	electrophilic substitution ✗	yellow I^-
~~C~~	nucleophilic substitution	cream Br^-
(D)	nucleophilic substitution	yellow I^-

8

24 A student converts 1-iodopropane, C_3H_7I, into butanoic acid, $C_3H_7CO_2H$, by a two-stage chemical synthesis.

halogenoalkane $\longrightarrow$ nitrile $\longrightarrow$ acid
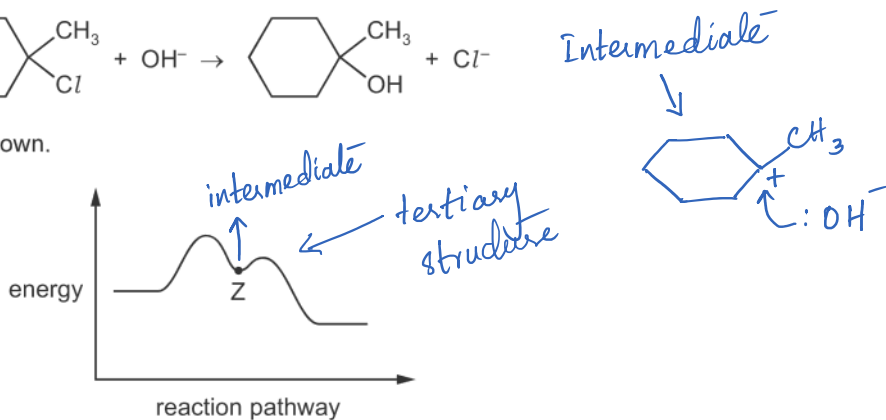*KCN (ethanolic)   HCl (aq)*
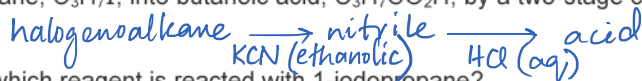
In the **first** of the two stages, which reagent is reacted with 1-iodopropane?

A   aqueous sodium hydroxide

B   ethanolic ammonia

Ⓒ   ethanolic potassium cyanide

D   ethanolic sodium hydroxide

25 1-chloro-1-methylcyclohexane is hydrolysed by heating with NaOH(aq).

Intermediate
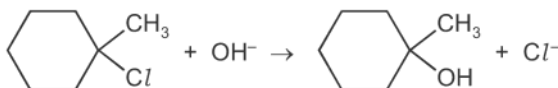
The reaction pathway is shown.

intermediate
tertiary structure

$:OH^-$

One carbon atom in 1-chloro-1-methylcyclohexane is bonded to three other carbon atoms.

What is the charge on this carbon atom at point Z?

A   1−   B $\delta-$ C $\delta+$ Ⓓ   1+

26 An alcohol with the molecular formula $C_5H_{12}O$ decolourises warm acidified potassium manganate(VII). The alcohol also gives a yellow precipitate with alkaline aqueous iodine.
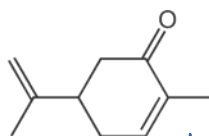
secondary alcohol with methyl group

What could be the identity of the alcohol?

X̶A̶   2-methylbutan-2-ol   *methyl*

Ⓑ   3-methylbutan-2-ol   *OH CH₃*   *–C–C–C–C–*

X̶C̶   pentan-1-ol

X̶D̶   pentan-3-ol   *OH*   *–C–C–C–C–C ← NOT methyl secondary alcohol*

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9

27 Which pair of test results would prove that a substance, X, is a ketone?

confirms NOT aldehyde

A X has no reaction with Tollens' reagent. X reacts with alkaline aqueous iodine. *confirms that it's either methyl ketone, ethanal or methyl secondary alcohol*

ketone or acid or ethanal   is ethanal

B X is reduced by lithium aluminium hydride. X is oxidised by acidified dichromate(VI).

carbonyl group

C X reacts with 2,4-DNPH reagent. X has no reaction with Fehling's reagent. *confirms that X is ketone*

D X reacts with hydrogen cyanide. X is reduced by lithium aluminium hydride.

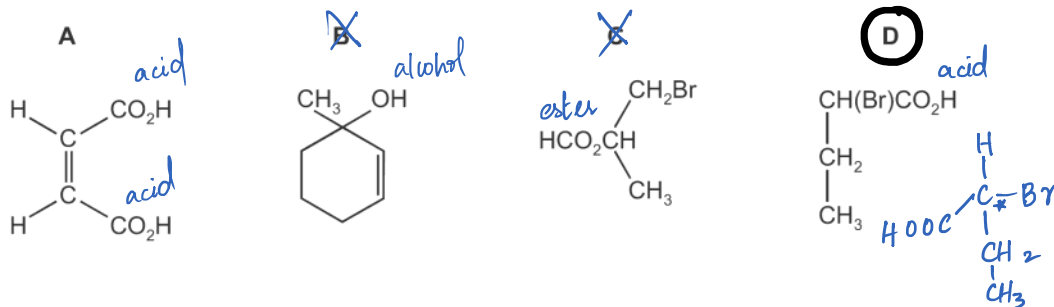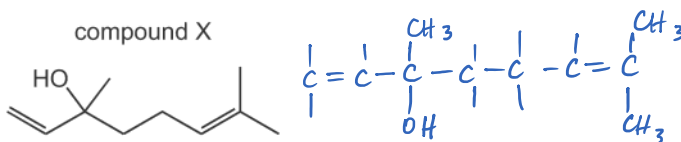**28** Carvone is found in spearmint oil.

carvone

Which product is formed when carvone is reacted with NaBH₄? *only reduces ketone to secondary alcohol group*
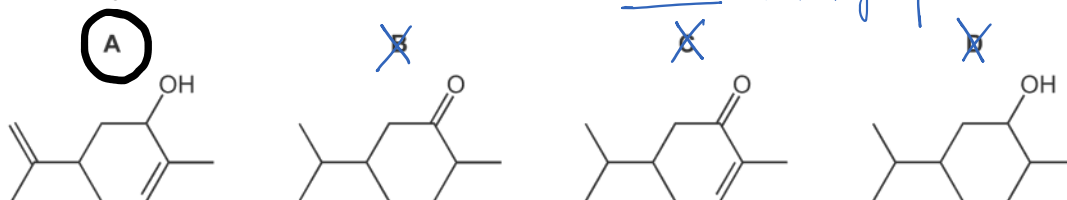
29 Which compound is chiral and reacts with Na_2CO_3 to give CO_2? *acid*

A — *acid* H–C(CO₂H)=C(CO₂H)–H *acid*

B — CH₃, OH *alcohol*

C — CH₂Br, HCO₂CH, CH₃ *ester*

D — CH(Br)CO₂H, CH₂, CH₃ *acid*   HOOC–C*≠Br–CH₂–CH₃ with H

30 The skeletal formula of compound X is shown.

compound X

C=C–C(CH₃)(OH)–C–C–C=C(CH₃)(CH₃)

What is the molecular formula of compound X?

A $C_{10}H_{18}O$ **B** $C_{10}H_{20}O$ **C** $C_{11}H_{22}O$ **D** $C_{11}H_{24}O$

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10

Section B

For each of the questions in this section, one or more of the three numbered statements **1** to **3** may be correct.

Decide whether each of the statements is or is not correct (you may find it helpful to put a tick against the statements that you consider to be correct).

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, 2 and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

No other combination of statements is used as a correct response.
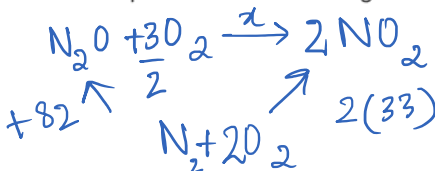
Use of the Data Booklet may be appropriate for some questions.

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31 Nitrogen forms a number of oxides. Their enthalpies of formation are given.

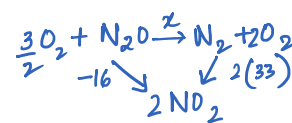$\Delta H_f^\ominus[\text{NO(g)}] = +90\,\text{kJ mol}^{-1}$

$\Delta H_f^\ominus[\text{N}_2\text{O(g)}] = +82\,\text{kJ mol}^{-1}$

$\Delta H_f^\ominus[\text{NO}_2\text{(g)}] = +33\,\text{kJ mol}^{-1}$

[handwritten] $N_2O + \frac{3O_2}{2} \xrightarrow{x} 2NO_2 \quad x + 82 = 66$ $x = -16\,kJ/mol$

$N_2 + 2O_2 \quad 2(33)$

$+82\uparrow$

$\frac{3O_2}{2} + N_2O \xrightarrow{x} N_2 + 2O_2$ $-16 \searrow \swarrow 2(33)$ $2NO_2$

$-16 = 66 + x$ so $x = -82$

Which statements are correct? *[handwritten] A*

✓ 1   If $\text{N}_2\text{O(g)}$ is oxidised by $\text{O}_2\text{(g)}$ to $\text{NO}_2\text{(g)}$, 16 kJ is released per mole of N_2O.

✓ 2   The decomposition of $\text{N}_2\text{O(g)}$ to $\text{N}_2\text{(g)}$ and $\text{O}_2\text{(g)}$ is exothermic.

✓ 3   The reaction between NO and oxygen is exothermic.

[handwritten] $NO + O_2 \rightarrow NO_2$

---

32 Which statements are correct? *[handwritten] D*

[handwritten] $H_2 + O_2 \xrightarrow{\Delta H_{comb}^\ominus} H_2O$ & $H_2 + O_2 \xrightarrow{\Delta H_{form}^\ominus} H_2O$

✓ 1   enthalpy of combustion of H_2 = enthalpy of formation of H_2O

✗ 2   enthalpy of formation of H_2 = −(enthalpy of atomisation of H_2) *[handwritten]* positive 0 & $-\left(\frac{1}{2}H_2(g) \rightarrow 1H(g)\right)$

3   enthalpy of solution of $\text{HC}l$ = enthalpy of hydration of H^+ + enthalpy of hydration of $\text{C}l^-$

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33 The units of K_c for an equilibrium reaction are $\text{mol}^{-1}\text{dm}^3$.

What could be the equation for the equilibrium? *[handwritten] A*

✓ 1 $\text{A(aq)} + \text{B(aq)} \rightleftharpoons \text{C(s)} + \text{D(aq)}$ *[handwritten]* $K_c = \dfrac{D}{AB} = \text{mol dm}^{-3} \times \text{mol}^{-2}\text{dm}^{+6}$

✓ 2 $\text{P(aq)} + \text{Q(aq)} \rightleftharpoons \text{R(aq)}$ *[handwritten]* $\dfrac{R}{PQ} = \text{mol dm}^{-3} \times \text{mol}^{-2}\text{dm}^{+6}$

✓ 3 $\text{W(aq)} + 2\text{X(aq)} \rightleftharpoons \text{Y(aq)} + \text{Z(aq)}$ *[handwritten]* $\dfrac{YZ}{X^2W} = \text{mol}^2\text{dm}^{-6} \times \text{mol}^{-3}\text{dm}^9$

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34 Methanol, CH_3OH, can be produced industrially by reacting CO with H_2.

$$CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g) \qquad \Delta H = -91\,kJ\,mol^{-1}$$

The process can be carried out at $4 \times 10^3\,kPa$ and $1150\,K$.

Which statements about this reaction are correct? *D*

1 Increasing the temperature will increase the rate of reaction because more effective collisions will occur.

2 Lowering the temperature will ~~reduce the rate of reaction~~ *increase yield of CH_3OH* because the forward reaction is exothermic.

3 Increasing the pressure will reduce the rate of reaction because there are a larger number of moles on the left-hand side of the equation.

35 Which rows correctly show the relative electrical conductivities of the sets of three Period 3 elements? *B*

	greatest conductivity	⟶	least conductivity
1	*ionic* sodium	*covalent* silicon	*covalent* chlorine
2	*+3 covalent* aluminium	*+2 covalent* magnesium	*covalent* phosphorus
3	*covalent* sulfur	silicon	phosphorus

36 Three test-tubes, X, Y and Z, each contain water.

- A small amount of NaCl is added to test-tube X. *$NaCl + H_2O \longrightarrow Na^+ + Cl^-$ pH remains 7*
- A small amount of $SiCl_4$ is added to test-tube Y. *$SiCl_4 + H_2O \longrightarrow SiO_2 + HCl$ low pH*
- A small amount of $AlCl_3$ is added to test-tube Z. *$AlCl_3 + H_2O \longrightarrow$ hydrolyse low pH*

After a short time, two drops of universal indicator solution are added to each test-tube.

Which statements can be correct? *A*

1 The pH in test-tube X is 7.

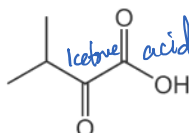2 The pH in test-tube Y is 2.

3 The pH in test-tube Z is 2.

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The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, 2 and 3 are correct	**1 and 2** only are correct	**2 and 3** only are correct	**1 only** is correct

No other combination of statements is used as a correct response.

37 The structure of compound R is shown.

compound R

*Icetone acid*

B

Which statements about compound R are correct?

✓ **1** It has an M_r of 116. $C_5H_8O_3$

✓ **2** It contains two groups that show strong absorptions between 1640 and 1740 cm^{-1} in its infrared spectrum. $C=O$

✗ **3** Its only infrared absorption between 2500 and 3000 cm^{-1} is sharp and strong.

38 During the bromination of methane, the free radical $CH_3\bullet$ is generated. A possible termination step of this reaction is the formation of C_2H_6 by the combination of two free radicals.

What could be produced in a termination step during the bromination of **propane**?   *C*

1 $CH_3CH_2CH(CH_3)CH_2CH_3$

✗ **2** $CH_3CH(CH_3)CH(CH_3)_2$

✓ **3** $CH_3CH_2CH_2CH(CH_3)_2$

$CH_3\bullet + CH_3\bullet \longrightarrow C_2H_6$
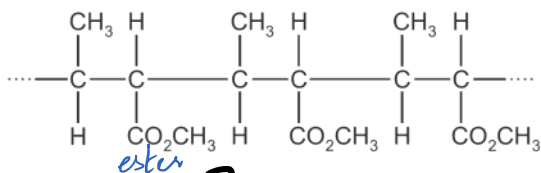
so same radicals must react

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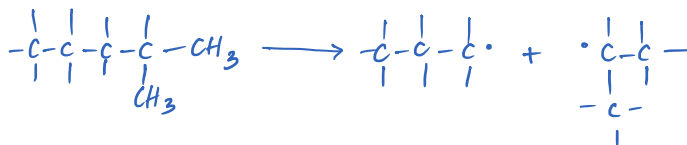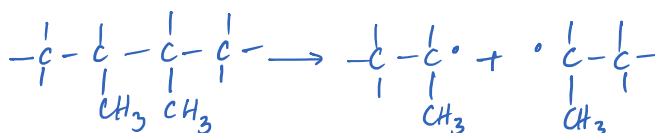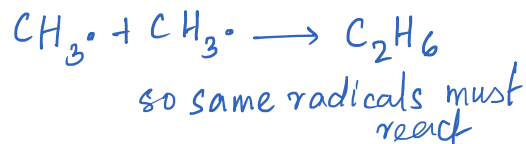
39 Three reactions of primary alcohols are listed.

Which reactions give water as one of the products? **A**

  1 reaction with ethanoic acid CH_3COOH + primary alcohol ⟶ $-\overset{|}{C}-\overset{\overset{O}{\|}}{C}-O-$ + H_2O

  2 reaction with concentrated HBr $-\overset{|}{\underset{|}{C}}-OH$ + HBr ⟶ $\overset{|}{\underset{|}{C}}-Br$ + H_2O

  3 passing the alcohol vapour over heated Al_2O_3 $-\overset{|}{\underset{|}{C}}-\overset{|}{\underset{|}{C}}-OH$ ⟶ H_2O + $\overset{|}{C}=\overset{|}{C}$

40 The diagram shows part of the structure of polymer X.

$$
\cdots -\underset{\underset{H}{|}}{\overset{\overset{CH_3}{|}}{C}} - \underset{\underset{CO_2CH_3}{|}}{\overset{\overset{H}{|}}{C}} - \underset{\underset{H}{|}}{\overset{\overset{CH_3}{|}}{C}} - \underset{\underset{CO_2CH_3}{|}}{\overset{\overset{H}{|}}{C}} - \underset{\underset{H}{|}}{\overset{\overset{CH_3}{|}}{C}} - \underset{\underset{CO_2CH_3}{|}}{\overset{\overset{H}{|}}{C}} - \cdots
$$

ester

Which reagents react with polymer X? **B**

  1 aqueous sulfuric acid   *ester hydrolisis*

  2 aqueous sodium hydroxide   *salt + alcohol*

  3 sodium