MINISTRY OF EDUCATION, SINGAPORE
in collaboration with
CAMBRIDGE ASSESSMENT INTERNATIONAL EDUCATION
General Certificate of Education Ordinary Level

CHEMISTRY 6092/01

Paper 1 Multiple Choice

For examination from 2024

SPECIMEN PAPER

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and index number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE ON ANY BARCODES.

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 separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 16.
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **16** printed pages.

Singapore Examinations and Assessment Board

Cambridge Assessment International Education

[Turn over

1 Aqueous sodium hydroxide is neutralised by dilute hydrochloric acid in a titration.

$25.0\,cm^3$ of aqueous sodium hydroxide is measured into a conical flask using a ...1... and a few drops of methyl orange indicator is added to the solution.

The dilute hydrochloric acid is added to the conical flask using a ...2... .
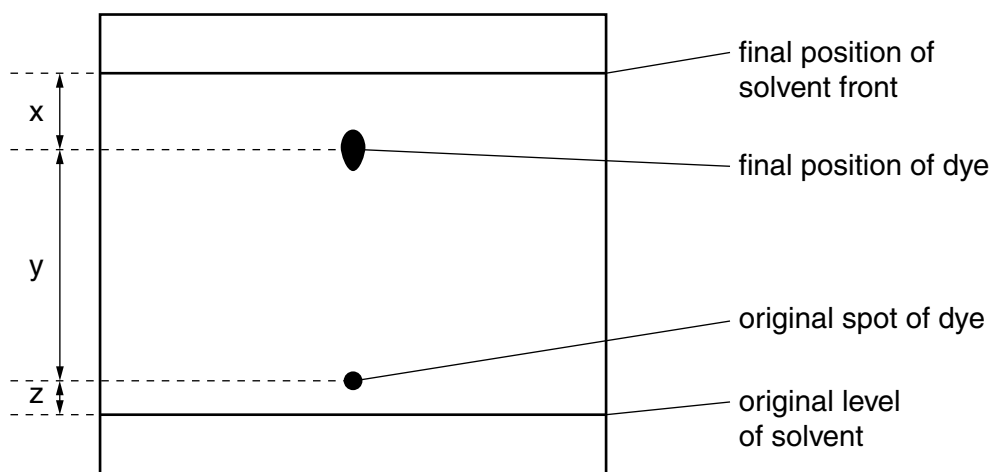
The end-point is reached when the methyl orange indicator turns ...3... .

Which row completes gaps 1, 2 and 3?

	1	2	3
A	burette	pipette	red
B	burette	pipette	orange
C	pipette	burette	orange
D	pipette	burette	red

2 The diagram shows the chromatogram obtained by analysis of a single dye.

Three measurements are shown.

How is the R_f value of the dye calculated?

**A** $\dfrac{x}{x+y}$ **B** $\dfrac{y}{x+y}$ **C** $\dfrac{x}{x+y+z}$ **D** $\dfrac{y}{x+y+z}$

3 Hexane and water are immiscible liquids.

Which method could be used to separate a mixture of hexane and water and how is the purity of the separated hexane checked?

	method of separation	purity check
A	filtration	find the boiling point
B	filtration	by sublimation
C	use a separating funnel	find the boiling point
D	use a separating funnel	by sublimation

4 Nitrogen dioxide is a dark brown gas and is more dense than air.

A gas jar containing nitrogen dioxide is sealed with a glass plate and is then inverted on top of a gas jar containing air.
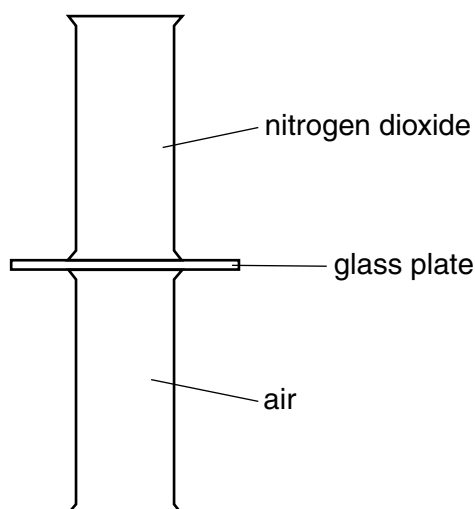
The glass plate is removed.

Which row correctly describes the colours inside the gas jars after a long period of time? The gases are at room temperature and pressure.

	upper gas jar	lower gas jar
A	brown	brown
B	colourless	dark brown
C	dark brown	light brown
D	light brown	dark brown

5 The compound $C_2H_3Br_3$ contains only the ^{12}C isotope of carbon and the ^1H isotope of hydrogen.

The two stable isotopes of bromine are ^{79}Br and ^{81}Br.

Using these two isotopes of bromine, how many different relative molecular masses are possible for $C_2H_3Br_3$?

A 2 **B** 3 **C** 4 **D** 5

6 Which statement explains why sodium chloride, $NaCl$, has a lower melting point than magnesium oxide, MgO?

A Sodium chloride is covalent but magnesium oxide is ionic.

B Sodium is more reactive than magnesium.

C The attraction between Na^+ and Cl^- is weaker than that between Mg^{2+} and O^{2-}.

D The melting point of sodium is lower than that of magnesium.

7 The outer shell electrons in a molecule, YZ_2, are shown.
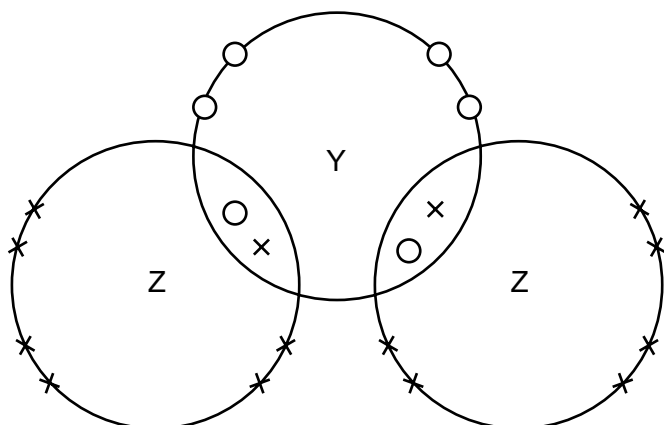
key
O electrons of atom Y
× electrons of atom Z

Using the Periodic Table, how many protons are in atom Y?

A 6 **B** 8 **C** 12 **D** 18

8 Substance J conducts electricity when in the solid state.

J reacts with hydrochloric acid.

Which substance could J be?

A copper

B copper(II) oxide

C sodium chloride

D zinc

9 Element X is a metal. Using only this information, what can be deduced about element X?

    A   It has a low melting point.

    B   It is a conductor of heat.

    C   It is less dense than water.

    D   It is very reactive.

10 The diagram shows the structure of silicon carbide, SiC.

    ● carbon atom
    ○ silicon atom
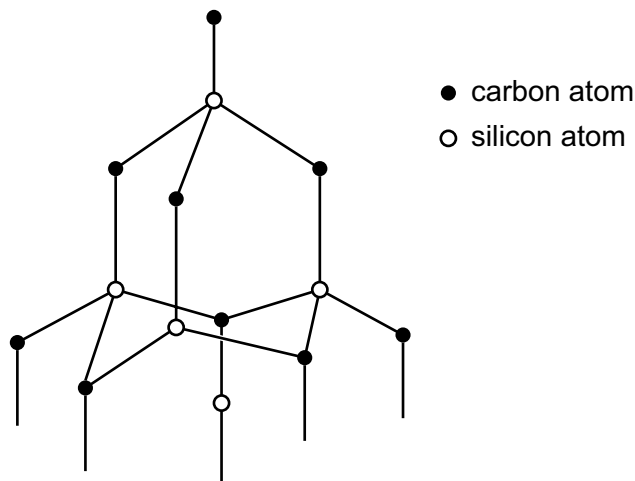
Which set of properties does silicon carbide have?

	physical state	when strongly heated in oxygen
A	soft solid	combusts, giving a solid residue only
B	soft solid	combusts, leaving no solid residue
C	hard solid	combusts, giving a solid residue and a colourless gas
D	hard solid	combusts, giving a solid residue only

11 Which statement about graphite is correct?

    A   It conducts electricity because graphite has ions which are free to move.

    B   It has an ionic lattice.

    C   It has the same structure as diamond.

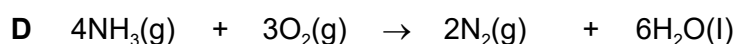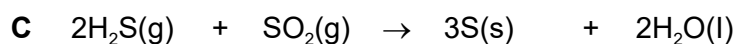   **D**   Its structure contains hexagonal rings of carbon atoms.

12 What is the relative molecular mass of propanoic acid?

    A 58   **B** 60   **C** 74   **D** 88

**13** Which compound contains the highest percentage mass of oxygen?

	compound	relative formula mass
A	Al_2O_3	102
B	Co_3O_4	241
C	CuO	80
D	$KMnO_4$	158

14 In which reaction does the smallest percentage change in volume occur?

A $CH_4(g)$ + $2O_2(g)$ → $CO_2(g)$ + $2H_2O(l)$

B $C_3H_8(g)$ + $5O_2(g)$ → $3CO_2(g)$ + $4H_2O(l)$

C $2H_2S(g)$ + $SO_2(g)$ → $3S(s)$ + $2H_2O(l)$

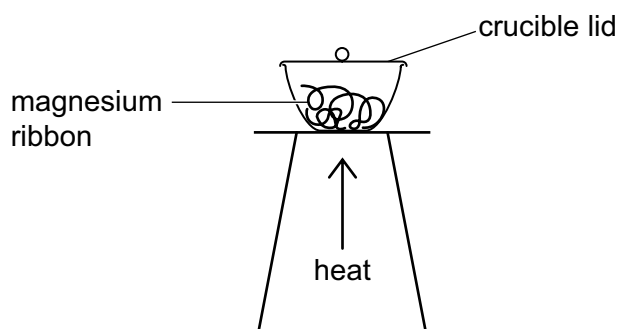**D** $4NH_3(g)$ + $3O_2(g)$ → $2N_2(g)$ + $6H_2O(l)$

15 In a titration, $25.0\,cm^3$ of aqueous potassium hydroxide, KOH, is neutralised by $21.50\,cm^3$ of $0.100\,mol/dm^3$ sulfuric acid, H_2SO_4.

What is the concentration of the aqueous potassium hydroxide?

A $0.002\,mol/dm^3$

B $0.004\,mol/dm^3$

C $0.086\,mol/dm^3$

D $0.172\,mol/dm^3$
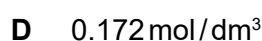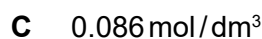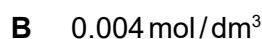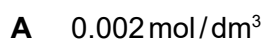
16 When 4.8 g of magnesium is heated in a crucible, 5.9 g of magnesium oxide is formed.

What is the percentage yield of magnesium oxide?

A 53%　　　**B** 74%　　　**C** 80%　　　**D** 81%
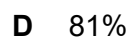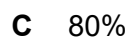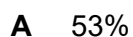
17 Which ionic equation correctly represents the neutralisation of aqueous sodium hydroxide with dilute nitric acid?

A H^+ + OH^- $\rightarrow$ H_2O

B Na^+ + NO_3^- $\rightarrow$ $NaNO_3$

C Na^+ + HNO_3 $\rightarrow$ $NaNO_3$ + H^+

D $NaOH$ + H^+ $\rightarrow$ Na^+ + H_2O

18 Which pair of aqueous solutions produce a precipitate when they are mixed?

A barium nitrate and silver nitrate

B sodium chloride and barium nitrate

C sodium nitrate and barium chloride

D sodium sulfate and barium chloride

19 Which equation shows the most suitable reaction for making lead(II) sulfate?

A Pb + H_2SO_4 $\rightarrow$ $PbSO_4$ + H_2

B $PbCO_3$ + H_2SO_4 $\rightarrow$ $PbSO_4$ + CO_2 + H_2O

C $Pb(NO_3)_2$ + H_2SO_4 $\rightarrow$ $PbSO_4$ + $2HNO_3$

D $PbCl_2$ + H_2SO_4 $\rightarrow$ $PbSO_4$ + $2HCl$

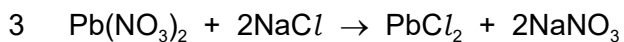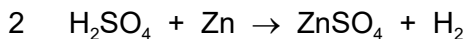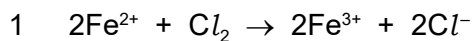**20** The table shows the results of tests carried out on compound X.

test	result
dilute hydrochloric acid added	gas given off which gave a white precipitate with limewater
warm with aqueous sodium hydroxide	gas given off which turned damp red litmus blue

What is compound X?

A ammonium carbonate

B ammonium nitrate

C calcium carbonate

D calcium nitrate

21 Which are redox reactions?

     1    $2Fe^{2+} + Cl_2 \rightarrow 2Fe^{3+} + 2Cl^-$

     2    $H_2SO_4 + Zn \rightarrow ZnSO_4 + H_2$

     3    $Pb(NO_3)_2 + 2NaCl \rightarrow PbCl_2 + 2NaNO_3$

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

22 Which statement about the electrolysis of concentrated aqueous sodium chloride using inert electrodes is correct?

A   Chlorine is released at the cathode.

B   Oxygen is released at the cathode.

C   Sodium is released at the cathode.

**D**   The pH of the electrolyte increases.

23 In which electrolysis experiment would there be no change in the concentration of the solution?

	electrolyte	electrodes
A	aqueous copper(II) sulfate	carbon
B	aqueous copper(II) sulfate	copper
C	concentrated aqueous potassium chloride	carbon
D	dilute sulfuric acid	platinum

24 In an experiment, rods of copper and zinc are dipped into dilute sulfuric acid. The top of each rod is touching.

Hydrogen bubbles collect around the copper rod.
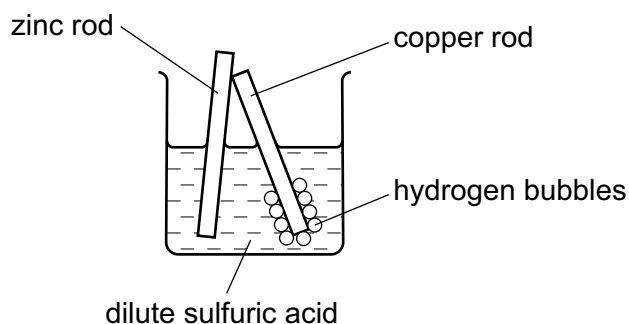
Which statement about the experiment is correct?

A Copper reacts with the acid.

B Electrons flow from zinc to copper.

C The zinc becomes coated with copper.

D The zinc is less reactive than copper.

25 The element with proton number 12 has similar chemical properties to the element with which proton number?

A 2   **B** 11   **C** 20   **D** 24

26 Element Z has the following properties.

- It has a high melting point.

- Its presence can lower the activation energy of a reaction.

What type of element is Z?

A a halogen

B an alkali metal

C a noble gas

D a transition metal

27 Chromium is between zinc and iron in the reactivity series.

Which element reduces the oxide of chromium?

A carbon

B copper

C iron

D lead

28 Dry hydrogen gas is passed over a heated powdered solid and then through a cooled U-tube before the excess of hydrogen is burned in air.
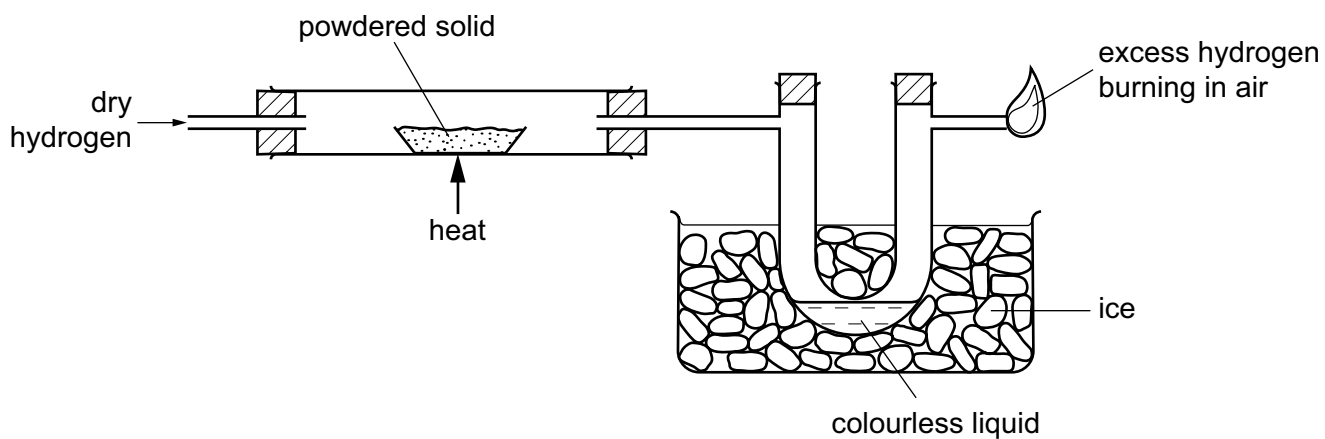
A colourless liquid collects in the U-tube.

What could the powdered solid be?

A calcium oxide

B copper(II) oxide

C magnesium

D zinc oxide

29 The formation of hydrogen iodide from hydrogen and iodine is an endothermic reaction.

$$H–H + I–I \rightarrow H–I + H–I$$

What may be deduced from this information?

A The number of bonds broken is greater than the number of bonds formed.

B The formation of H–I bonds absorbs energy.

C The products possess less energy than the reactants.
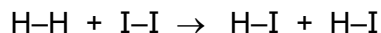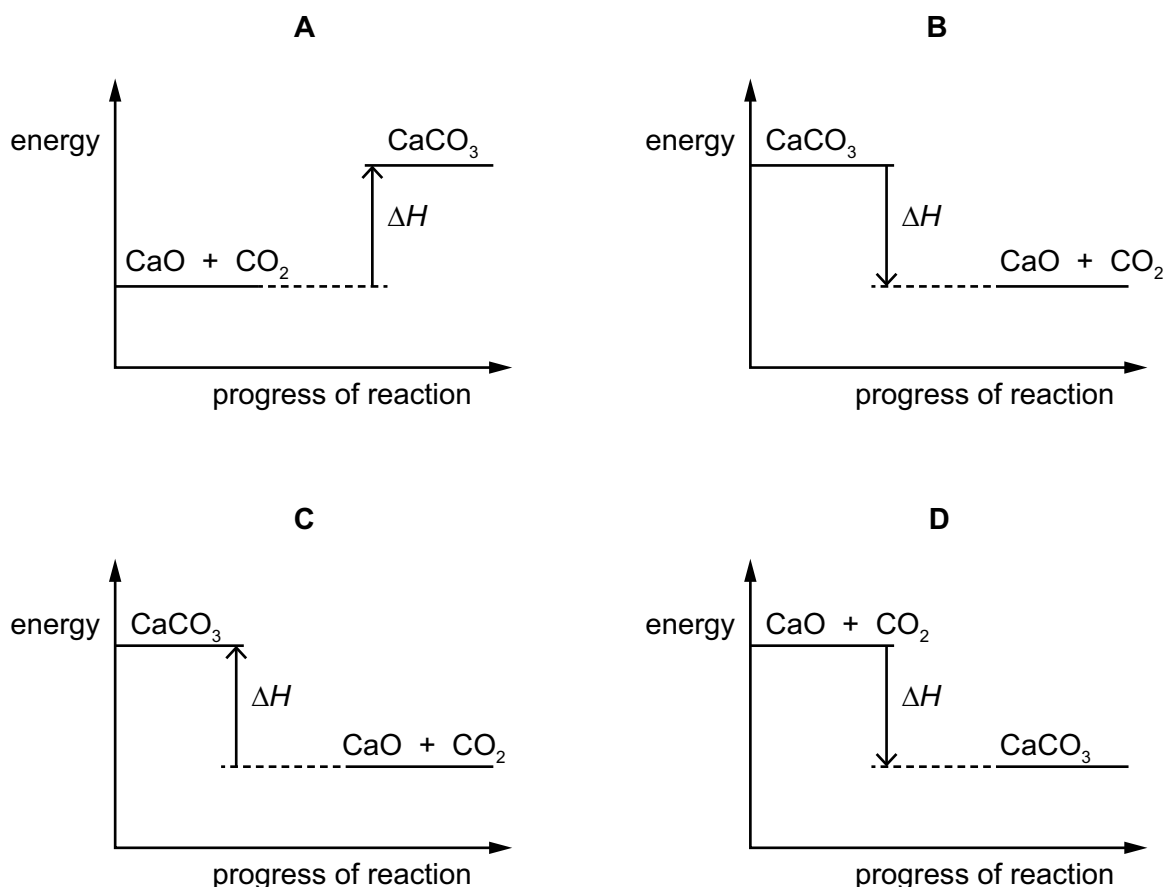
D The total energy change in bond formation is less than that in bond breaking.

30 Calcium carbonate decomposes endothermically into calcium oxide and carbon dioxide.

Which energy profile diagram correctly shows the reaction of calcium oxide and carbon dioxide to form calcium carbonate?

A

energy / progress of reaction. $CaCO_3$ higher, ΔH, $CaO + CO_2$ lower.

B

energy / progress of reaction. $CaCO_3$ higher, ΔH, $CaO + CO_2$ lower.

C

energy / progress of reaction. $CaCO_3$ higher, ΔH, $CaO + CO_2$ lower.

D

energy / progress of reaction. $CaO + CO_2$ higher, ΔH, $CaCO_3$ lower.

31 In which reaction is pressure **least** likely to affect the rate of reaction?

A $C(s) + CO_2(g) \rightarrow 2CO(g)$

B $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

C $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$

D $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$

32 Aqueous hydrogen peroxide is catalytically decomposed by manganese(IV) oxide.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$
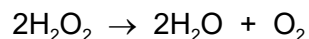
To study the effect of the concentration of the solution on the rate of reaction, the total volume of oxygen evolved is recorded against time. Three experiments are performed using a fixed mass of catalyst but with the following volumes and concentrations of hydrogen peroxide solution:

    solution 1 $50\,cm^3$ of $2.0\,mol/dm^3$ hydrogen peroxide

    solution 2 $100\,cm^3$ of $1.0\,mol/dm^3$ hydrogen peroxide

    solution 3 $100\,cm^3$ of $2.0\,mol/dm^3$ hydrogen peroxide
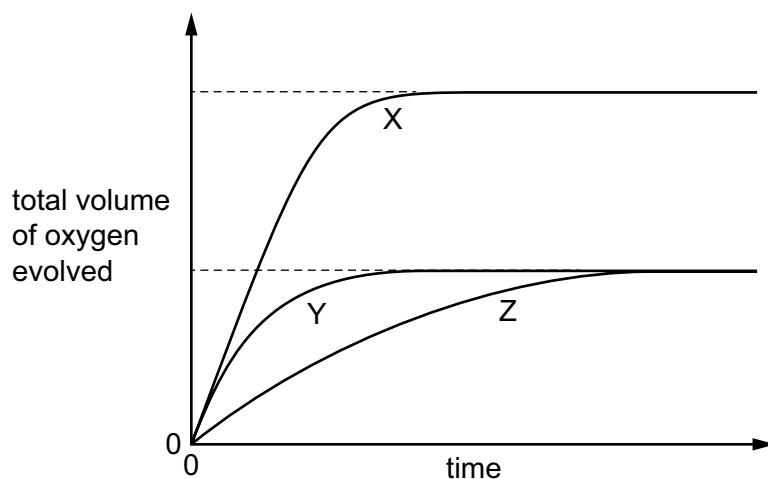
On the graph above, which of the curves X, Y and Z relate to the solutions 1, 2 and 3?

	1	2	3
A	X	Y	Z
B	X	Z	Y
C	Z	X	Y
D	Y	Z	X

33 Octane is a hydrocarbon found in petrol.

Which statement about octane is correct?

A   It can be polymerised.

B   It decolourises aqueous bromine.

C   It has a lower boiling point than methane.

D   It reacts with chlorine by substitution.

34 Which compound is an isomer of propanol?

A

$$H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-C\overset{O}{\underset{H}{\diagdown}}$$

B

$$\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}=\underset{}{\overset{\overset{H}{|}}{C}}-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-O-H$$

C

$$H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-O-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-H$$

D

$$H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-C\overset{O}{\underset{O-H}{\diagup}}$$
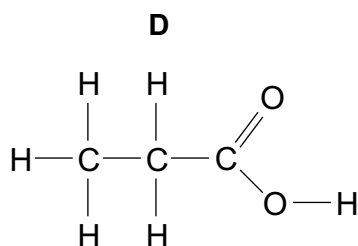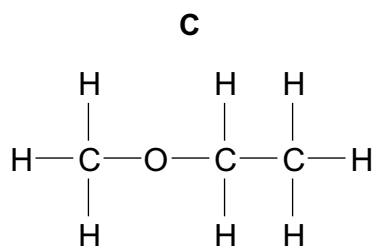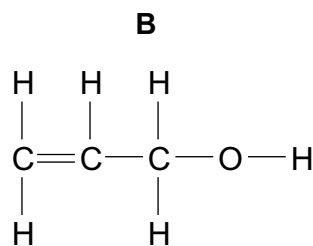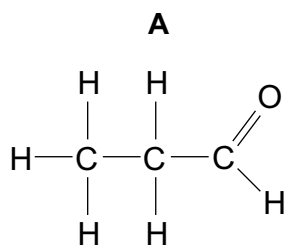
35 Which compound reacts with sodium carbonate to produce carbon dioxide?

A

$$H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-O-H$$

B

$$H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-C\overset{O}{\underset{O-H}{\diagup}}$$

C

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

D

$$H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-C\overset{O}{\diagup}\underset{O-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-H}{}$$
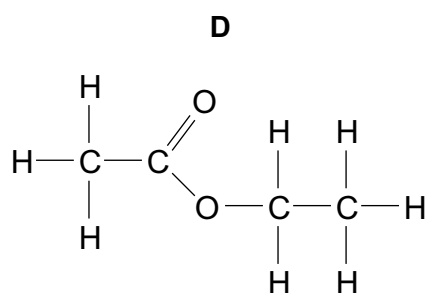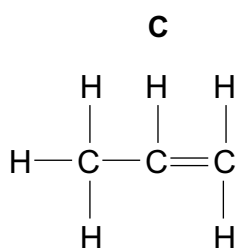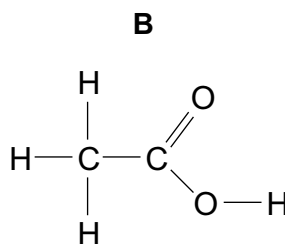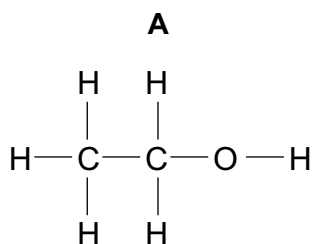
36 Which acid and alcohol react together to form the compound shown?

$$CH_3CH_2 - C \begin{matrix} O \\ \\ OCH_3 \end{matrix}$$
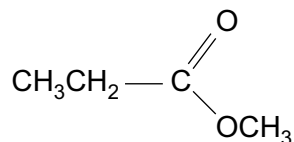
A ethanoic acid and ethanol

B ethanoic acid and methanol

C propanoic acid and ethanol

D propanoic acid and methanol

37 The diagram shows the partial structure of a polymer.

$$\left(CH_2 - \underset{\underset{O}{\overset{C=O}{|}}}{\overset{CH_3}{|}} CH - CH_2 - \underset{\underset{O}{\overset{C=O}{|}}}{\overset{CH_3}{|}} CH \right)_n$$
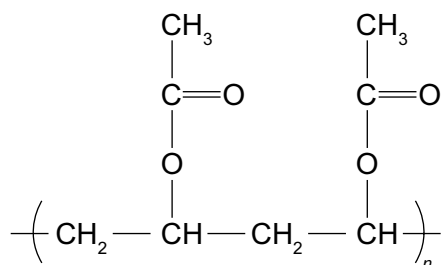
Which of the following could be used to make this polymer?

A $CH_3CO_2CH{=}CH_2$

B CH_3CO_2H and $HOCH_2CH_2OH$

C $CH_3COCH{=}CH_2$

D $CH_3CO_2CH_3$ and $HOCH_2CH_2OH$

38 The equation for one method of recycling a polymer is shown.

$$\left[\overset{O}{\overset{||}{C}} \square \overset{O}{\overset{||}{C}} - O - \blacksquare - O \right]_n + 2n\,H_2O \overset{H^+}{\rightarrow} n\,H - O - \overset{O}{\overset{||}{C}} \square \overset{O}{\overset{||}{C}} - O - H + n\,H - O - \blacksquare - O - H$$
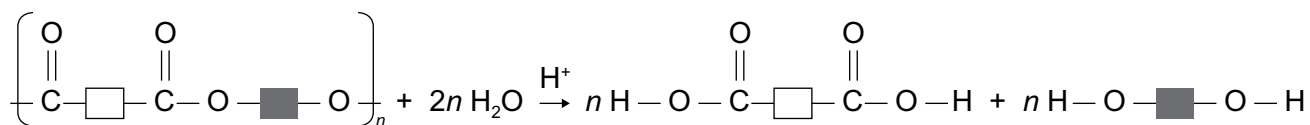
Which statements are correct?

1 The polymer could be nylon.

2 The reaction is catalysed hydrolysis.

3 If $\blacksquare$ is CH_2CH_2, the alcohol product has $M_r = 62$.

A 1, 2 and 3

B 1 and 3 only

C 2 and 3 only

D 1 and 2 only

39 Which diagram represents the structure of *Terylene*?

A

$$\text{—C—}\blacksquare\text{—C—N—}\square\text{—N—C—}\blacksquare\text{—C—N—}\square\text{—N —}$$

with O double-bonded to each C, and H below each N.
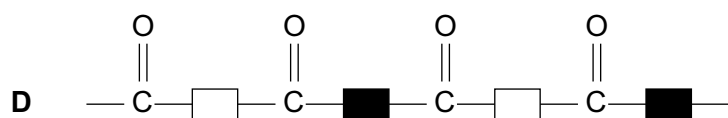
B

$$\text{—C—}\blacksquare\text{—C—O—}\square\text{—O—C—}\blacksquare\text{—C—O—}\square\text{—O —}$$

with O double-bonded to each C.

C

$$\text{—C—}\blacksquare\text{—C—C—}\square\text{—C—C—}\blacksquare\text{—C—C—}\square\text{—C —}$$

with H above and below each C.

D

$$\text{—C—}\square\text{—C—}\blacksquare\text{—C—}\square\text{—C—}\blacksquare\text{—}$$

with O double-bonded to each C.
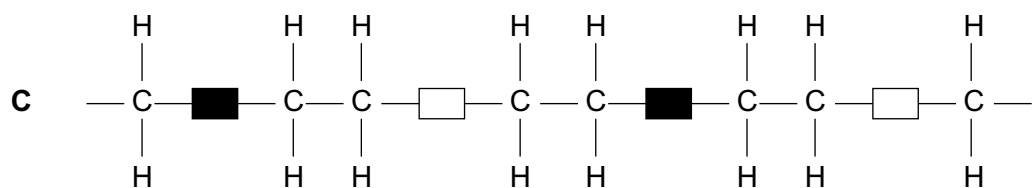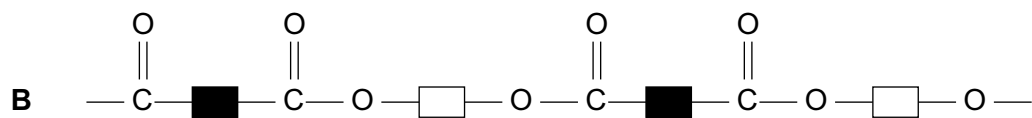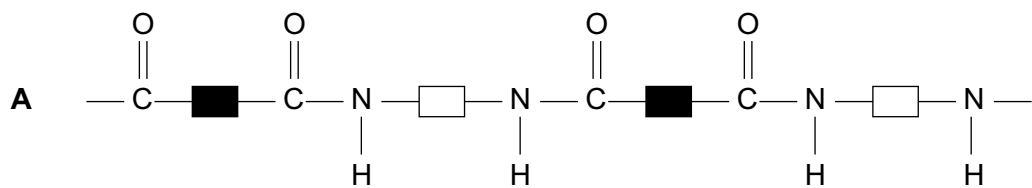
40 Which compound is used in flue gas desulfurisation?

A calcium carbonate

B carbon monoxide

C copper(II) oxide

D potassium manganate(VII)

The Periodic Table of Elements

Group

1	2											13	14	15	16	17	18
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24	3	4	5	6	7	8	9	10	11	12	13 A*l* aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 C*l* chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 T*l* thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –	113 Nh nihonium –	114 F*l* flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

Key

proton (atomic) number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is $24\,dm^3$ at room temperature and pressure (r.t.p.).
The Avogadro constant, $L = 6.02 \times 10^{23}\,mol^{-1}$.