# Cambridge O Level

**CHEMISTRY** **5070/12**

Paper 1 Multiple Choice **May/June 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)



**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.
- The Periodic Table is printed in the question paper.

This document has **20** pages. Blank pages are indicated.




**[Turn over**

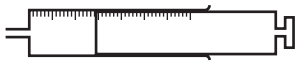
**1** The diagram shows four pieces of apparatus that are used to measure the volume of a gas or liquid.

Which piece of apparatus should always be filled to the same level?

**A**

burette

**B**



gas syringe

**C**

measuring cylinder

**D**

pipette

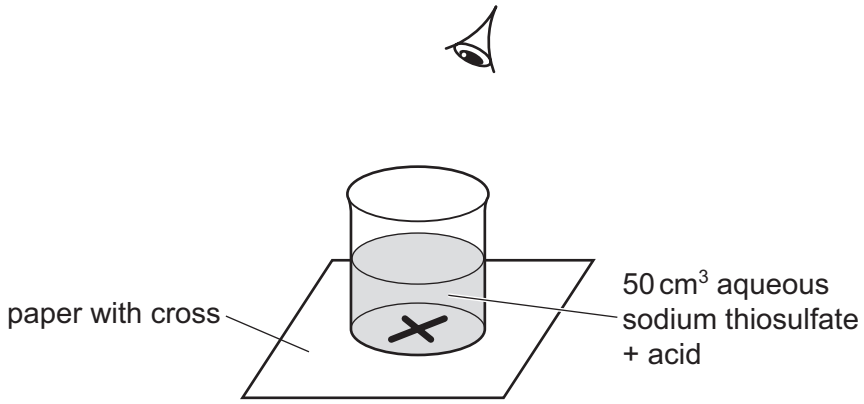
**2** Aqueous sodium thiosulfate reacts with acid to make a precipitate of sulfur.

$$Na_2S_2O_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + SO_2(g) + S(s)$$

A student investigates the effect of temperature on the rate of this reaction.

The student:

- places a piece of paper with a cross on it below the reaction mixture as shown in the diagram
- measures the time taken for the cross to no longer be seen
- repeats the reaction at different temperatures.




Which apparatus is needed for this investigation?

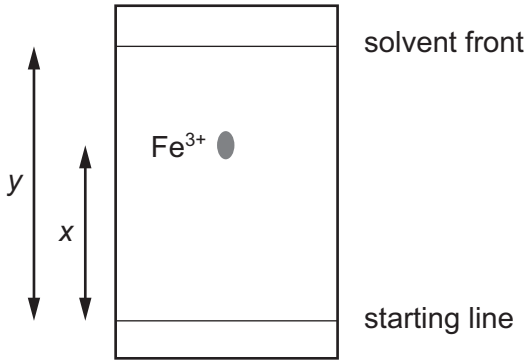
**A** balance, pipette, stop-clock

**B** balance, stop-clock, thermometer

**C** burette, gas syringe, thermometer

**D** measuring cylinder, stop-clock, thermometer

**3** A paper chromatography experiment is carried out to find an $R_f$ value for $Fe^{3+}(aq)$. The result is shown.



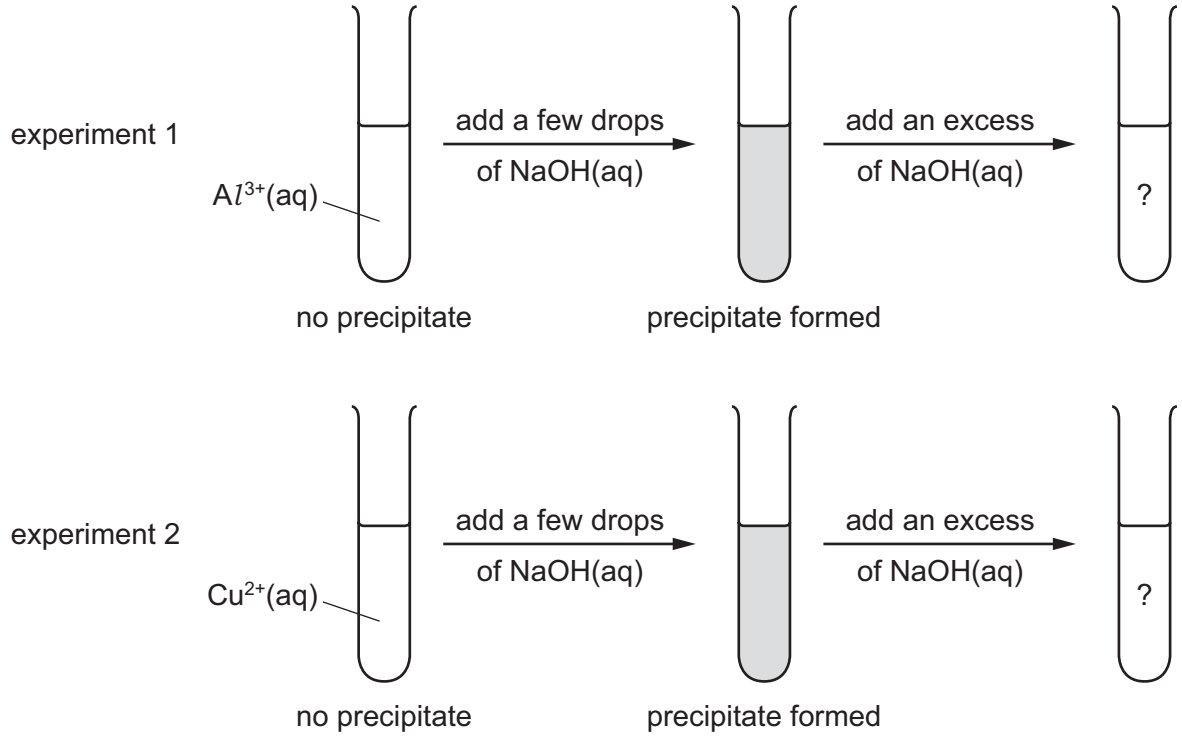

To make the spot containing $Fe^{3+}(aq)$ more visible, the paper is sprayed with aqueous sodium hydroxide so that a precipitate of iron(III) hydroxide forms.

Under the conditions of the experiment, the $R_f$ of $Fe^{3+}(aq)$ is given by .....1..... and the colour of the precipitate is .....2..... .

Which row correctly completes gaps 1 and 2?

| | gap 1 | gap 2 |
|---|---|---|
| **A** | $\frac{x}{y}$ | red-brown |
| **B** | $\frac{x}{y}$ | green |
| **C** | $\frac{y}{x}$ | red-brown |
| **D** | $\frac{y}{x}$ | green |

**4** The diagram shows two experiments.




What are the results of adding an excess of NaOH(aq) in each experiment?

| | experiment 1 | experiment 2 |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

key
✓ = precipitate remains
✗ = precipitate dissolves

**5** Which methods of separation require a change of state from liquid to gas?

1 paper chromatography
2 crystallisation
3 distillation
4 filtration

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

**6** Hydrogen sulfide, $H_2S$, and hydrogen chloride, $HCl$, are both gases at temperatures above –50 °C.

Which gas will diffuse most rapidly at the temperature given?

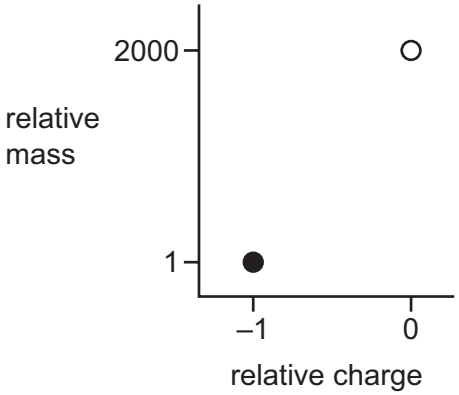
**A** hydrogen chloride at –40 °C

**B** hydrogen chloride at –20 °C

**C** hydrogen sulfide at –40 °C

**D** hydrogen sulfide at –20 °C

**7** The diagram shows the relative mass and the relative charge of two particles, ○ and ●, present in atoms and ions.




Which of these particles are present in a hydrogen atom and in a hydrogen ion?

| | H | $H^+$ |
|---|---|---|
| **A** | both ○ and ● | both ○ and ● |
| **B** | both ○ and ● | ○ but not ● |
| **C** | ● but not ○ | neither ○ nor ● |
| **D** | ○ but not ● | ● but not ○ |

**8** Which ion has the most shells that contain electrons?

**A** $Al^{3+}$ **B** $Be^{2+}$ **C** $N^{3-}$ **D** $S^{2-}$

**9** Which substance conducts electricity both when solid and when molten?

**A** an alloy

**B** a hydrocarbon

**C** a metal oxide

**D** a salt

**10** When they react together, which pair of elements form an ionic compound?

**A** carbon and hydrogen

**B** hydrogen and chlorine

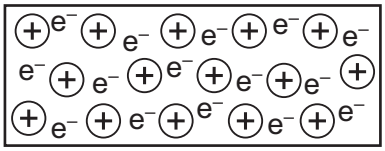
**C** lithium and oxygen

**D** sulfur and oxygen

**11** How many shared electrons are in one carbon dioxide molecule?

**A** 2 **B** 4 **C** 8 **D** 12

**12** Element X has a lattice of positive ions and a 'sea of electrons'.



Which property will X have?

**A** It conducts electricity by the movement of ions and electrons.

**B** It has a high melting point.

**C** It is decomposed by an electric current.

**D** It is not malleable.

**13** Which row shows the correct state symbols for the reaction between calcium carbonate and dilute hydrochloric acid? (The conditions are room temperature and pressure.)

| | $CaCO_3$ + | $2HCl \rightarrow CaCl_2$ + | $H_2O$ + | $CO_2$ |
|---|---|---|---|---|
| **A** | s | aq | aq | aq | g |
| **B** | s | l | aq | l | g |
| **C** | s | l | l | aq | g |
| **D** | s | aq | aq | l | g |

**14** The expression shown for the value of $A_r$ for fluorine is incomplete.

$$A_r \text{ (fluorine)} = \frac{\text{average mass of one .....1..... of fluorine}}{\text{.....2..... of the mass of one atom of } {}^{12}_{6}\text{C}}$$

How should the gaps in the expression be correctly completed?

| | gap 1 | gap 2 |
|---|---|---|
| **A** | atom | $\frac{1}{6}$ |
| **B** | atom | $\frac{1}{12}$ |
| **C** | molecule | $\frac{1}{6}$ |
| **D** | molecule | $\frac{1}{12}$ |

**15** A mixture of 5 $cm^3$ of $CH_4$ and 100 $cm^3$ of air is exploded. Assume air is 80% $N_2$ by volume and 20% $O_2$ by volume. The resulting mixture is cooled. All volumes are measured at room temperature and pressure.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$$

What is the composition of the resulting gas?

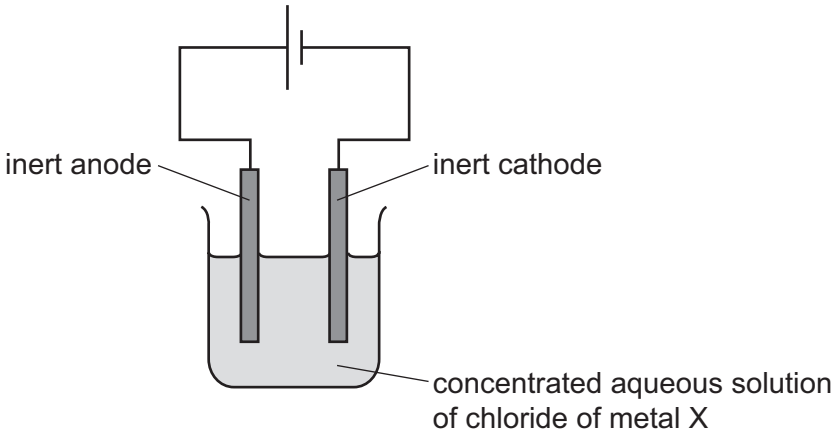
| | 5 $cm^3$ of $CO_2$ | 10 $cm^3$ of $O_2$ | 80 $cm^3$ of $N_2$ | 10 $cm^3$ of steam |
|---|---|---|---|---|
| **A** | ✓ | ✓ | ✓ | ✓ |
| **B** | ✓ | ✓ | ✓ | ✗ |
| **C** | ✓ | ✗ | ✓ | ✓ |
| **D** | ✓ | ✗ | ✓ | ✗ |

**16** Which arrangement is used to electroplate copper onto a steel key?

| | electrolyte | anode (positive electrode) | cathode (negative electrode) |
|---|---|---|---|
| **A** | aqueous copper(II) sulfate | piece of pure copper | steel key |
| **B** | aqueous copper(II) sulfate | steel key | piece of pure copper |
| **C** | dilute sulfuric acid | piece of pure copper | steel key |
| **D** | dilute sulfuric acid | steel key | piece of pure copper |

**17** The chloride of metal X is dissolved in water.

A concentrated solution of this chloride is electrolysed using inert electrodes.




X is above sodium in the reactivity series.

In addition to chlorine, which gas is liberated and at which electrode?

| | gas | liberated at electrode |
|---|---|---|
| **A** | hydrogen | anode |
| **B** | hydrogen | cathode |
| **C** | oxygen | anode |
| **D** | oxygen | cathode |

**18** Which change in conditions, for the reaction between zinc and dilute sulfuric acid, increases the rate of reaction by lowering the activation energy?

**A** adding a catalyst

**B** increasing the concentration of the acid

**C** increasing the surface area of the zinc

**D** increasing the temperature

**19** Many reactions can be classified as redox reactions.

Which equations show redox reactions?

1 $Mg + 2HCl \rightarrow MgCl_2 + H_2$

2 $2FeCl_2 + Cl_2 \rightarrow 2FeCl_3$

3 $2Na + Br_2 \rightarrow 2NaBr$

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

**20** Which row correctly shows whether the hydrogen ion concentration and the pH of ethanoic acid are higher or lower than those of hydrochloric acid of the same concentration?

| | hydrogen ion concentration | pH |
|---|---|---|
| **A** | higher | higher |
| **B** | higher | lower |
| **C** | lower | higher |
| **D** | lower | lower |

**21** Which aqueous reagent liberates ammonia from ammonium nitrate on warming?

**A** calcium nitrate

**B** potassium hydroxide

**C** sodium chloride

**D** sulfuric acid

**22** Two fertilisers are made by mixing chemical compounds.

Fertiliser X contains 500 g of $NH_4NO_3$ and 500 g of $(NH_4)_2SO_4$ per kilogram.

Fertiliser Y contains 700 g of $NH_4NO_3$ and 300 g of $CaSO_4$ per kilogram.

Which fertiliser contains the higher percentage of nitrogen by mass and which contains the higher percentage of sulfur by mass?

[$M_r$: $NH_4NO_3$, 80; $(NH_4)_2SO_4$, 132; $CaSO_4$, 136]

| | fertiliser with higher percentage N | fertiliser with higher percentage S |
|---|---|---|
| **A** | X | X |
| **B** | X | Y |
| **C** | Y | X |
| **D** | Y | Y |

**23** Which processes occur in the manufacture of sulfuric acid?

1 burning sulfur in air

2 dissolving sulfur dioxide in sulfuric acid

3 dissolving sulfur dioxide in water

4 reacting sulfur dioxide with air

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

**24** A lump of element X can be cut by a knife.

During its reaction with water, X floats and melts.

What is X?

**A** calcium

**B** copper

**C** magnesium

**D** potassium

**25** Chlorine is passed into separate samples of aqueous potassium iodide and aqueous potassium bromide.

In which solutions is there a colour change?

| | KI(aq) | KBr(aq) |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

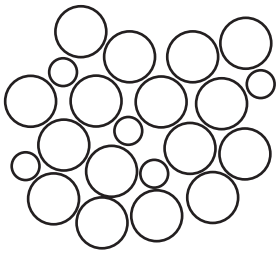
key

✓ = yes

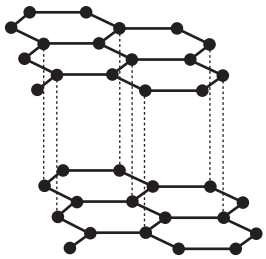
✗ = no

**26** Which diagram shows the structure of an alloy?

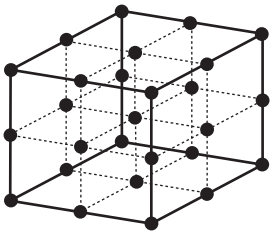
**A**



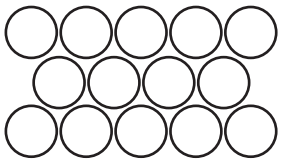
**B**



**C**



**D**



**27** Which element can only be extracted from its ore using electrolysis?

**A** calcium

**B** copper

**C** lead

**D** silver

**28** Which equation shows a thermal decomposition that occurs in the blast furnace?

**A** $C + O_2 \rightarrow CO_2$

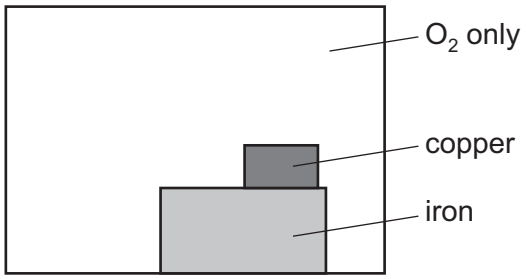
**B** $CO_2 + C \rightarrow 2CO$

**C** $CaCO_3 \rightarrow CaO + CO_2$

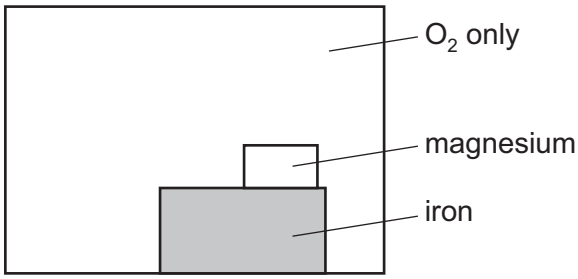
**D** $CaO + SiO_2 \rightarrow CaSiO_3$

**29** Which diagram correctly shows the conditions necessary for the rusting of iron and also the metal that can be used to prevent rusting by sacrificial protection?

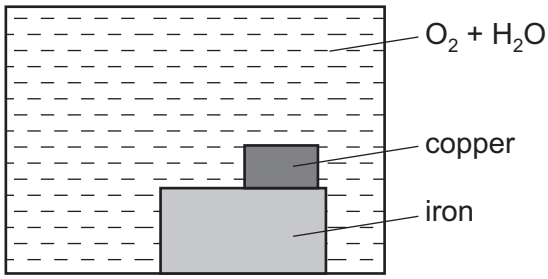
**A**



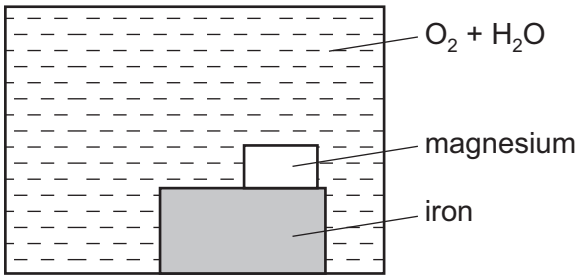

**B**




**C**




**D**




**30** Aluminium is produced by the electrolysis of pure aluminium oxide. One of the electrodes in the process has to be replaced often.

Which statement is correct?

**A** The product at the anode reacts with the anode.

**B** The product at the anode reacts with the cathode.

**C** The product at the cathode reacts with the anode.

**D** The product at the cathode reacts with the cathode.

**31** Which row correctly compares carbon dioxide and methane?

| | both contain carbon | both are described as a greenhouse gas | both lower the pH of water when they dissolve in it |
|---|---|---|---|
| **A** | ✓ | ✗ | ✓ |
| **B** | ✓ | ✓ | ✗ |
| **C** | ✗ | ✓ | ✓ |
| **D** | ✗ | ✓ | ✗ |

**32** Sea water has to be purified in order to obtain drinking water from it.

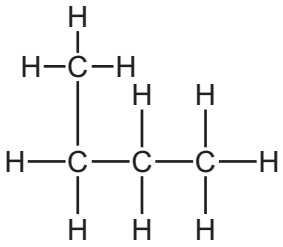
Which processes are used to purify the sea water?

| | fractional distillation | desalination |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

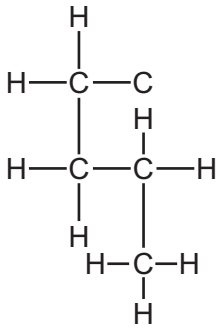
key
✓ = used
✗ = not used

**33** Which structure represents an isomer of butane?

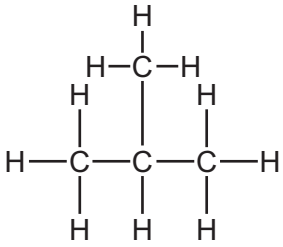
**A**



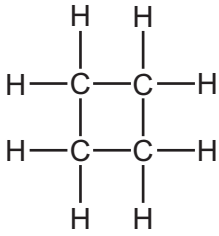
**B**



**C**



**D**



**34** Which statement about the organic compounds $CH_4$, $C_2H_4$, $C_2H_6$ and $C_3H_8$ is correct?

**A** Only $C_2H_4$ and $C_2H_6$ decolourise bromine water.

**B** They are all saturated compounds.

**C** They are all unsaturated compounds.

**D** They are all hydrocarbons.

**35** The alkenes are a homologous series.

Which statement about alkenes is correct?

**A** An alkene molecule contains four fewer hydrogen atoms than an alkane molecule with the same number of carbon atoms.

**B** If a food is described as *polyunsaturated* it means that it contains polymers.

**C** Propene reacts with steam to form propanol.

**D** The general formula for the alkenes is $C_nH_{2n+2}$.

**36** Which organic compound is used as a solvent, a renewable fuel and in the production of vinegar?

**A** ethanoic acid

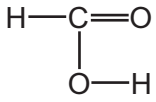
**B** ethanol

**C** propanoic acid

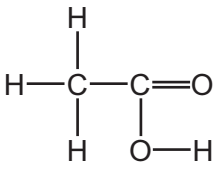
**D** propanol

**37** Which structure shows the carboxylic acid with the lowest relative molecular mass?

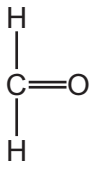
**A**



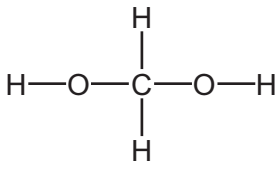
**B**



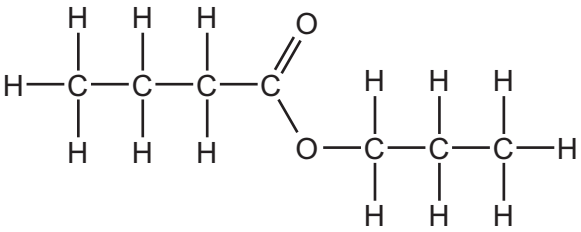
**C**



**D**



**38** What is the name of the ester shown?



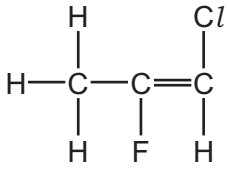
**A** butyl propanoate

**B** propyl butanoate

**C** propyl ethanoate

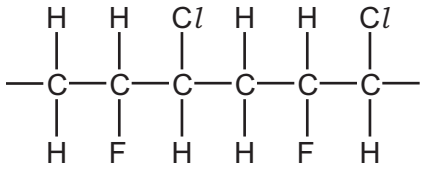
**D** propyl propanoate

**39** The diagram shows the structure of a monomer.

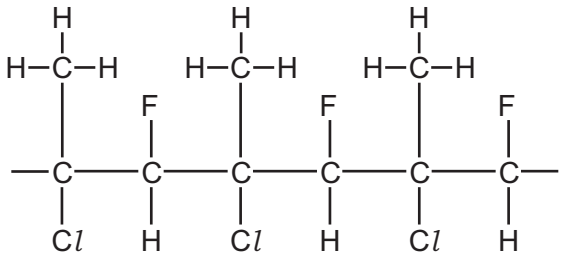


Which diagram shows the partial structure of its polymer?

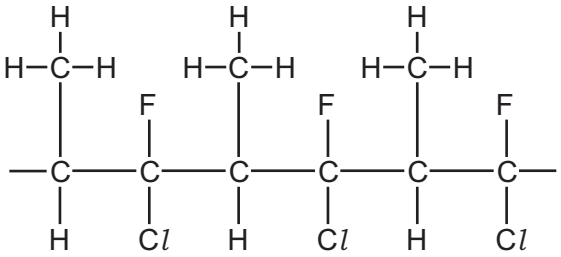
**A**



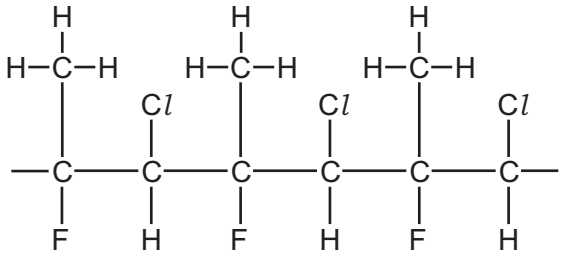
**B**



**C**



**D**



**40** Which statement about polymers is correct?

**A** Nylon and *Terylene* are produced by addition polymerisation.

**B** Nylon and *Terylene* both contain amide linkages.

**C** Simple sugars are produced by hydrolysing proteins.

**D** Starch contains the elements carbon, hydrogen and oxygen.

**BLANK PAGE**

**BLANK PAGE**

**BLANK PAGE**

## The Periodic Table of Elements

| Group | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | II | | | | | | | | | | | III | IV | V | VI | VII | VIII |
| | | | | | | | 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 | | | | | | | | | | | 13 Al aluminium 27 | 14 Si silicon 28 | 15 P phosphorus 31 | 16 S sulfur 32 | 17 Cl 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 Tl 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 – | | 114 Fl flerovium – | | 116 Lv livermorium – | | |

**Key**

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.).