UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

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

Paper 1 Multiple Choice **October/November 2013**

**1 hour**

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

*9876489879*

**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN 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.
Electronic calculators may be used.

This document consists of **15** printed pages and **1** blank page.


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**1** When drops of bromine are placed on a table-top at one side of a room, the smell of bromine can eventually be detected at the other side of the room.

What is **not** part of the explanation of this?

After evaporation, the bromine particles

**A** collide with air particles.

**B** move in a random way.

**C** spread out to occupy the total available space.

**D** vibrate from side to side.

**2** Which elements exist as diatomic molecules at room temperature?

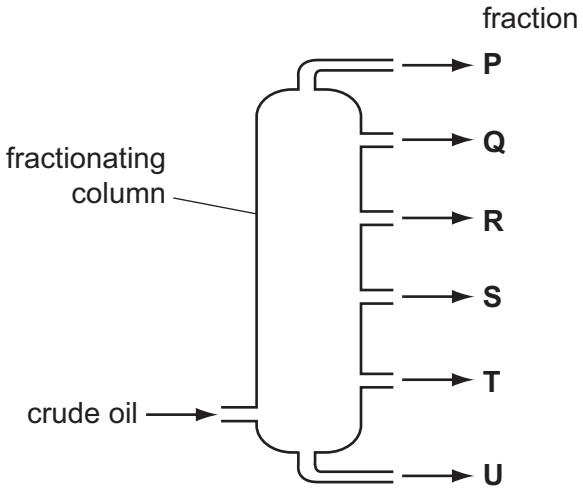
**A** hydrogen, oxygen, helium

**B** nitrogen, chlorine, neon

**C** nitrogen, oxygen, fluorine

**D** oxygen, chlorine, helium

**3** The diagram shows the fractionation of crude oil.




Which statement is correct?

**A** Each fraction consists of a single compound.

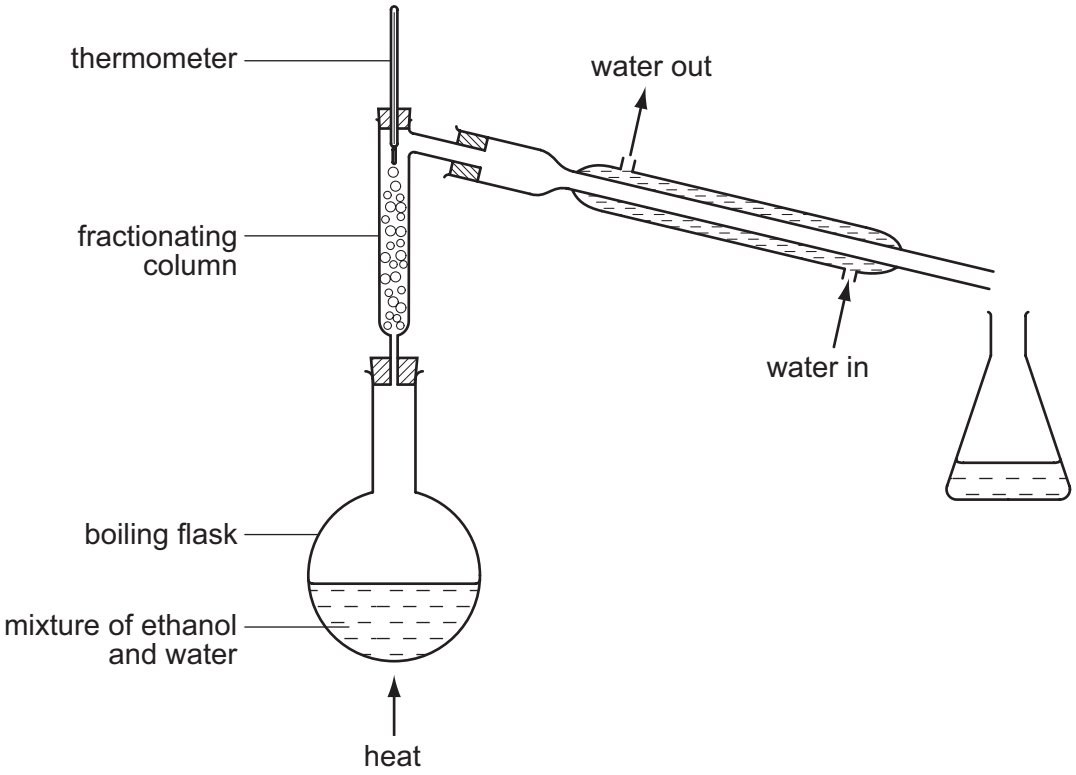
**B** Fraction **P** has the highest boiling point.

**C** The highest temperature is at the top of the column.

**D** The naphtha fraction is used as feedstock for the chemical industry.

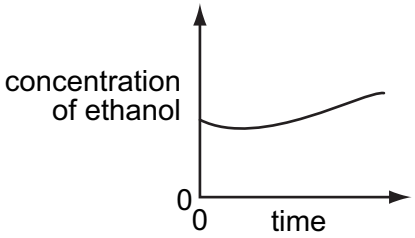
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**4** The apparatus shown is used to distil a dilute solution of ethanol in water.
[B.P.: ethanol, 78 °C; water 100 °C]

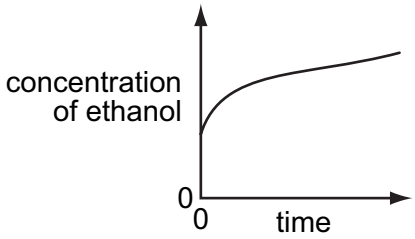



Which graph shows the change in concentration of the ethanol in the boiling flask as the distillation proceeds?

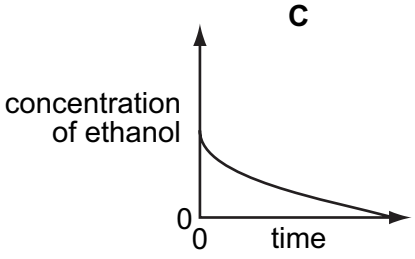
**A**



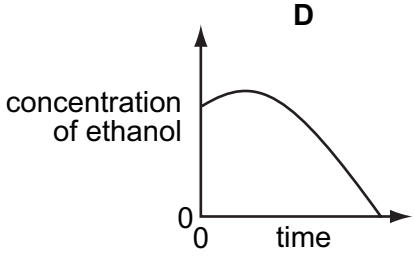

**B**



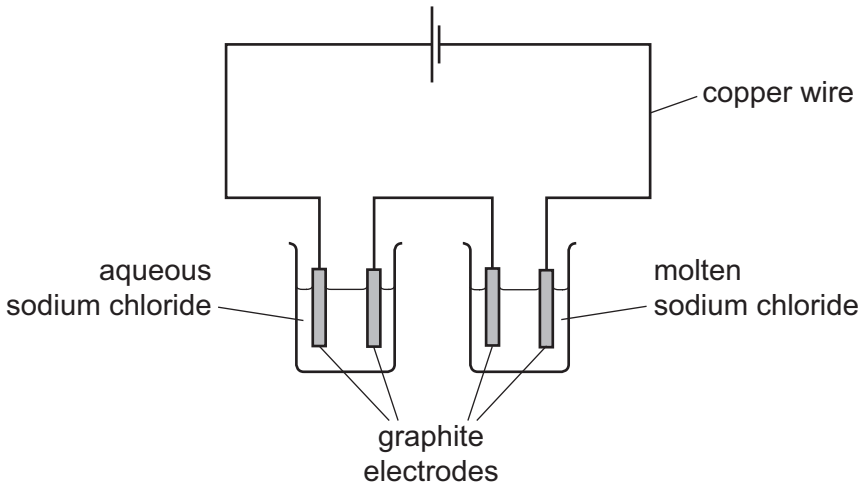

**C**




**D**



**5** The diagram shows the electrolysis of aqueous sodium chloride and of molten sodium chloride.




Which substance in the diagram has both positive ions and mobile electrons?

**A** aqueous sodium chloride

**B** copper wire

**C** graphite electrodes

**D** molten sodium chloride

**6** Substance X has a simple molecular structure and substance Y has a giant molecular structure.

Which row is correct?

| | X could be | Y could be |
|---|---|---|
| **A** | an element only | an element only |
| **B** | an element only | an element or a compound |
| **C** | an element or a compound | an element only |
| **D** | an element or a compound | an element or a compound |

**7** The table gives some of the properties of four substances.

Which substance could be hydrogen chloride?

| | melting point / °C | boiling point / °C | ability to conduct electricity | |
|---|---|---|---|---|
| | | | when liquid | in aqueous solution |
| **A** | –114 | –85 | none | good |
| **B** | –114 | 78 | none | none |
| **C** | 180 | 218 | none | (insoluble) |
| **D** | 808 | 1465 | good | good |

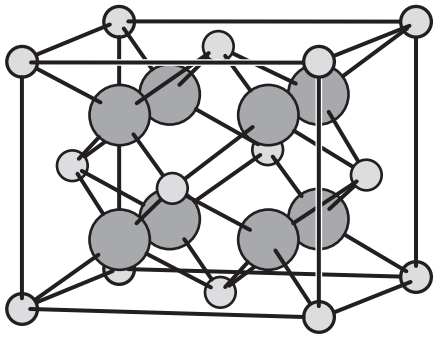
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**8** Aqueous silver nitrate is added to separate solutions of potassium chloride and sodium iodide.

What are the colours of the precipitates formed?

| | colour of precipitate formed with chloride | colour of precipitate formed with iodide |
|---|---|---|
| **A** | white | white |
| **B** | white | yellow |
| **C** | yellow | white |
| **D** | yellow | yellow |

**9** The diagram shows the structure of an ionic compound.



What is a possible formula for this compound?

**A** $CaF_2$ **B** $NaCl$ **C** $SO_2$ **D** MgO

**10** 18 g of water contains the same number of molecules as

**A** 18 g of ammonia gas.

**B** 2 g of hydrogen gas.

**C** 14 g of nitrogen gas.

**D** 16 g of oxygen gas.

**11** The complete combustion of 20 $cm^3$ of a gaseous alkane, **X**, requires 130 $cm^3$ of oxygen. Both volumes were measured at r.t.p..

What could be the identity of **X**?

**A** butane

**B** ethane

**C** methane

**D** propane

**12** Which process will separate an ionic compound *PQ* into its elements *P* and *Q*?

**A** distillation

**B** electrolysis

**C** filtration

**D** precipitation

**13** Which statement describes the conversion of magnesium atoms to magnesium ions?

**A** The change is reduction, because there has been a gain of electrons.

**B** The change is oxidation, because there has been a loss of electrons.

**C** The change is reduction, because there has been a loss of electrons.

**D** The change is oxidation, because there has been a gain of electrons.

**14** Which arrangement would be 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** | aqueous sulfuric acid | piece of pure copper | steel key |
| **D** | aqueous sulfuric acid | steel key | piece of pure copper |

**15** Sodium hydrogencarbonate decomposes on heating.

$$2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$$

In an experiment, a 5.0 mol sample of sodium hydrogencarbonate is heated.

Which volume of carbon dioxide, measured at room temperature and pressure, is evolved?

**A** $24\,dm^3$ **B** $36\,dm^3$ **C** $48\,dm^3$ **D** $60\,dm^3$

**16** It has been suggested that the cars of the future could be powered by fuel cells. One type of fuel cell uses the chemical reaction between oxygen and hydrogen to produce electricity.

What would be a disadvantage of using this type of fuel cell to power a car?

**A** A car cannot be powered by electricity.

**B** The hydrogen tank might split in an accident, leading to an explosion.

**C** The product of the reaction between oxygen and hydrogen is toxic.

**D** The oxygen would need to be obtained from air.

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**17** Sulfur and selenium, Se, are in the same group of the Periodic Table.

From this, we would expect selenium to form compounds having the formulae

**A** $Se_2O$, $Na_2Se$ and $NaSeO_4$.

**B** $SeO_2$, $Na_2Se$ and $NaSeO_4$.

**C** $SeO_2$, $Na_2Se$ and $Na_2SeO_4$.

**D** $SeO_3$, NaSe and $NaSeO_4$.

**18** When the product of a reaction between two gases is added to water, a solution of pH7 is formed.

Which could be these gases?

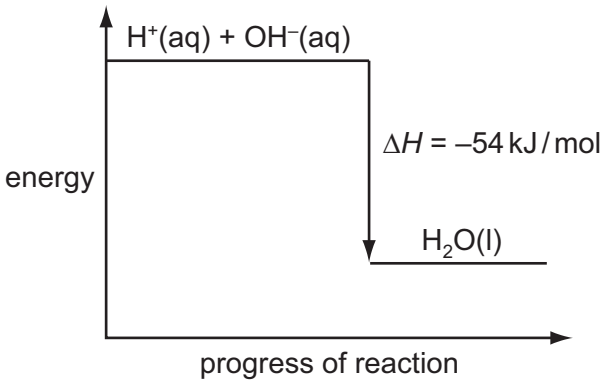
**A** hydrogen and chlorine

**B** hydrogen and nitrogen

**C** hydrogen and oxygen

**D** oxygen and carbon monoxide

**19** The energy diagram for the reaction between aqueous sodium hydroxide and dilute hydrochloric acid is shown.




What can be deduced from the diagram?

**A** The energy change when one mole of water is formed from its elements, hydrogen and oxygen, is 54 kJ / mol.

**B** The $OH^-$ ions have more energy than the $H^+$ ions.

**C** The products contain less energy than the reactants.

**D** The reaction is endothermic.

**20** Which change will **not** increase the rate of a chemical reaction?

**A** an increase in concentration of aqueous reactants

**B** an increase in pressure of gaseous reactants

**C** an increase in temperature of a reaction system

**D** an increase in the particle size of solid reactants

**21** The metals iron, lead and zinc can be manufactured by the reduction of their oxides with coke.

What is the correct order of the ease of reduction of the metal oxides?

| | oxides become more difficult to reduce ⟶ |
|---|---|
| **A** | iron → lead → zinc |
| **B** | iron → zinc → lead |
| **C** | lead → iron → zinc |
| **D** | zinc → iron → lead |

**22** The following stages happen during eutrophication.

1 increase in growth of algae

2 increase in nitrate concentration

3 death of aquatic plants

4 decrease in dissolved oxygen

In which order do these stages occur?

**A** 1 → 2 → 3 → 4

**B** 1 → 2 → 4 → 3

**C** 2 → 1 → 3 → 4

**D** 2 → 1 → 4 → 3

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**23** The equation shows that mixtures of hydrogen gas and iodine vapour can reach dynamic equilibrium.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

Two students, X and Y, make statements about the equilibrium mixture.

X Hydrogen iodide is continually being formed and decomposed.

Y If more hydrogen is injected into the equilibrium mixture the equilibrium concentration of HI increases.

Which statements are correct?

**A** both X and Y

**B** X only

**C** Y only

**D** neither X nor Y

**24** Aluminium is manufactured by the electrolysis of molten aluminium oxide.

Which gas is **not** formed during this process?

**A** carbon dioxide

**B** carbon monoxide

**C** oxygen

**D** sulfur dioxide

**25** Which equation represents a redox reaction?

**A** $4CuO + CH_4 \rightarrow 4Cu + 2H_2O + CO_2$

**B** $CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$

**C** $CuCO_3 \rightarrow CuO + CO_2$

**D** $CuSO_4 + 2NaOH \rightarrow Cu(OH)_2 + Na_2SO_4$

**26** What is the percentage, by mass, of nitrogen in the fertiliser $(NH_4)_3PO_4$?
[$A_r$: H, 1; N, 14; O, 16; P, 31]

**A** 9.4% **B** 18.8% **C** 28.2% **D** 37.6%

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**27** In the Contact process for the manufacture of sulfuric acid, the most important reaction occurs in the catalyst chamber.

Which set of reactants and catalyst for this reaction is correct?

| | reactants | catalyst |
|---|---|---|
| **A** | sulfur and oxygen | vanadium(V) oxide |
| **B** | sulfur dioxide and air | vanadium(V) oxide |
| **C** | sulfur dioxide and steam | iron |
| **D** | sulfur trioxide and water | platinum |

**28** Which compound is formed by a method involving precipitation?

**A** NaC$l$

**B** $K_2SO_4$

**C** $Ca(NO_3)_2$

**D** $PbSO_4$

**29** Ionic compounds have high melting points because of the strong attraction between oppositely charged ions.

Which compound has the lowest melting point?

**A** $(Al^{3+})_2(O^{2-})_3$

**B** $Mg^{2+}O^{2-}$

**C** $Na^{+}Cl^{-}$

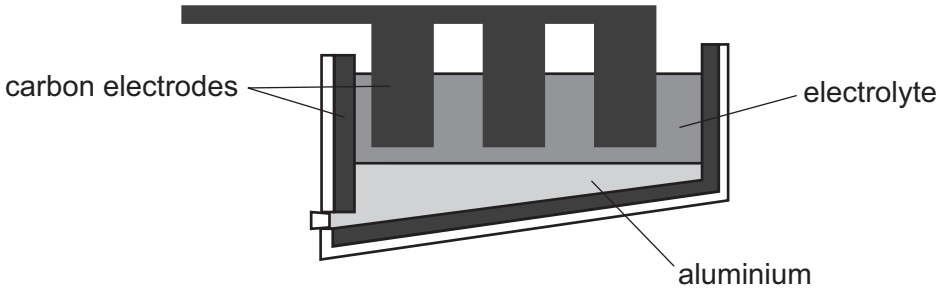
**D** $(Fe^{3+})_2(O^{2-})_3$

**30** In which row are the elements placed in the correct order of their chemical reactivity, starting with the most reactive element?

| | most reactive ⟶ | | least reactive |
|---|---|---|---|
| **A** | calcium | magnesium | silver |
| **B** | magnesium | calcium | silver |
| **C** | silver | calcium | magnesium |
| **D** | silver | magnesium | calcium |

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**31** The diagram shows the apparatus needed to extract aluminium from aluminium oxide.




Which statement about this process is correct?

**A** The electrolyte is a solid mixture of aluminium oxide and cryolite.

**B** The electrolyte is aluminium oxide dissolved in water.

**C** The equation for the reaction at the positive electrode is $Al^{3+} + 3e^- \rightarrow Al$.

**D** The positive carbon electrodes lose mass during the process and need regular replacement.

**32** Graphite shares some properties with metals.

Which property of graphite is **not** one of the general properties of metals?

**A** Graphite forms a gaseous oxide.

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

**C** Graphite is a conductor of electricity.

**D** Graphite is a solid.

**33** Which metallic element, represented by *X*, has the following characteristics?

- It can be prevented from corroding by attaching a piece of magnesium to it.
- Two of its oxides have the formulae *X*O and $X_2O_3$.
- It has the highest percentage by mass of all the metals present in stainless steel.

**A** Fe **B** Na **C** Pb **D** Zn

**34** Which pair of gases are both non-acidic?

**A** ammonia and methane

**B** carbon dioxide and ammonia

**C** methane and nitrogen dioxide

**D** nitrogen dioxide and carbon dioxide

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**35** Both nylon and the proteins found in egg yolk are polymers.

Which statement about nylon and these proteins is correct?

**A** They are both naturally occurring macromolecules.

**B** They are both polyamides.

**C** They both possess the  linkage.

**D** They can both be hydrolysed to form amino acids.

**36** An organic compound has an empirical formula $C_2H_4O$.

What could the compound be?

**A** butanoic acid

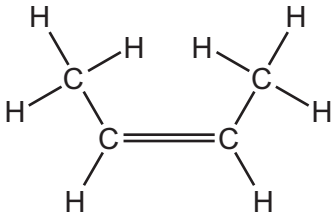
**B** butanol

**C** ethanoic acid

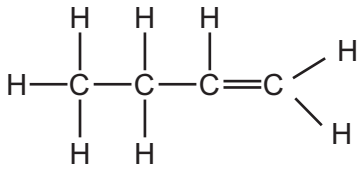
**D** ethanol

**37** Which diagram shows the structure of the monomer of poly(propene)?

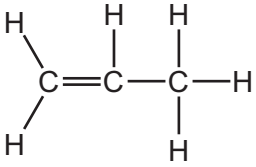
**A**



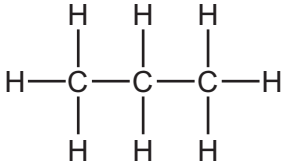
**B**



**C**



**D**

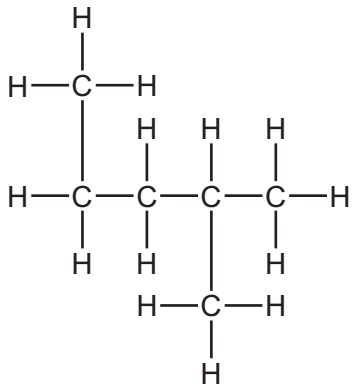


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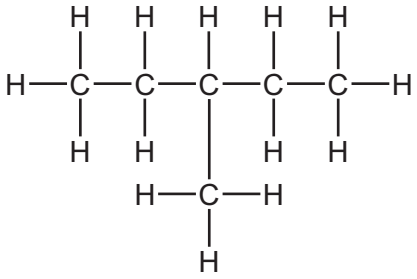
**38** Alkanes are saturated compounds containing carbon and hydrogen only.

Structures 1, 2, 3 and 4 are saturated hydrocarbons.

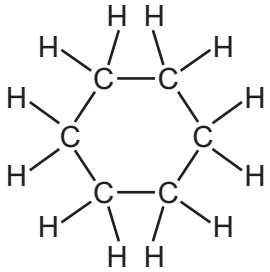
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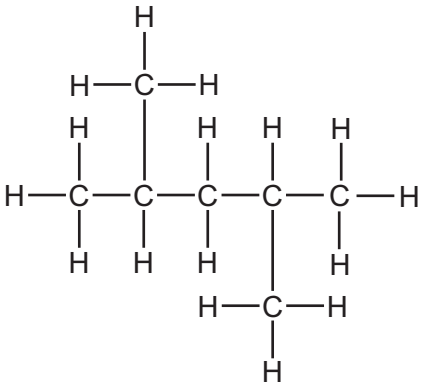
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3



4



Which pair of structures are isomers?

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

**39** Which pair of compounds are both esters and are isomers of each other?

**A** $HCO_2CH_3$ and $CH_3CO_2H$

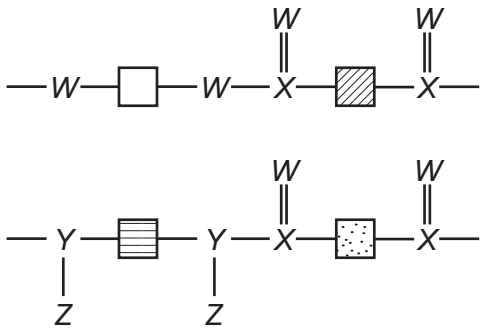
**B** $CH_3CO_2CH_3$ and $C_2H_5CO_2H$

**C** $CH_3CO_2C_2H_5$ and $C_2H_5CO_2CH_3$

**D** $C_3H_7CO_2CH_3$ and $CH_3CO_2C_2H_5$

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**40** The diagram shows the partial structures of two different polymers.




Which chemical symbols should replace *W*, *X*, *Y* and *Z*?

| | *W* | *X* | *Y* | *Z* |
|---|---|---|---|---|
| **A** | C | N | H | O |
| **B** | O | C | H | N |
| **C** | O | C | N | H |
| **D** | N | H | O | C |

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**DATA SHEET**
**The Periodic Table of the Elements**

| Group | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | II | | | | | | | | | III | IV | V | VI | VII | 0 | | |
| | | | | | | | | | | | | | | | 4 He Helium 2 | | |
| | | | | | 1 H Hydrogen 1 | | | | | | | | | | | | |
| 7 Li Lithium 3 | 9 Be Beryllium 4 | | | | | | | | | 11 B Boron 5 | 12 C Carbon 6 | 14 N Nitrogen 7 | 16 O Oxygen 8 | 19 F Fluorine 9 | 20 Ne Neon 10 | | |
| 23 Na Sodium 11 | 24 Mg Magnesium 12 | | | | | | | | | 27 Al Aluminium 13 | 28 Si Silicon 14 | 31 P Phosphorus 15 | 32 S Sulfur 16 | 35.5 Cl Chlorine 17 | 40 Ar Argon 18 | | |
| 39 K Potassium 19 | 40 Ca Calcium 20 | 45 Sc Scandium 21 | 48 Ti Titanium 22 | 51 V Vanadium 23 | 52 Cr Chromium 24 | 55 Mn Manganese 25 | 56 Fe Iron 26 | 59 Co Cobalt 27 | 59 Ni Nickel 28 | 64 Cu Copper 29 | 65 Zn Zinc 30 | 70 Ga Gallium 31 | 73 Ge Germanium 32 | 75 As Arsenic 33 | 79 Se Selenium 34 | 80 Br Bromine 35 | 84 Kr Krypton 36 |
| 85 Rb Rubidium 37 | 88 Sr Strontium 38 | 89 Y Yttrium 39 | 91 Zr Zirconium 40 | 93 Nb Niobium 41 | 96 Mo Molybdenum 42 | Tc Technetium 43 | 101 Ru Ruthenium 44 | 103 Rh Rhodium 45 | 106 Pd Palladium 46 | 108 Ag Silver 47 | 112 Cd Cadmium 48 | 115 In Indium 49 | 119 Sn Tin 50 | 122 Sb Antimony 51 | 128 Te Tellurium 52 | 127 I Iodine 53 | 131 Xe Xenon 54 |
| 133 Cs Caesium 55 | 137 Ba Barium 56 | 139 La Lanthanum 57 * | 178 Hf Hafnium 72 | 181 Ta Tantalum 73 | 184 W Tungsten 74 | 186 Re Rhenium 75 | 190 Os Osmium 76 | 192 Ir Iridium 77 | 195 Pt Platinum 78 | 197 Au Gold 79 | 201 Hg Mercury 80 | 204 Tl Thallium 81 | 207 Pb Lead 82 | 209 Bi Bismuth 83 | Po Polonium 84 | At Astatine 85 | Rn Radon 86 |
| Fr Francium 87 | 226 Ra Radium 88 | 227 Ac Actinium 89 † | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * | 140 Ce Cerium 58 | 141 Pr Praseodymium 59 | 144 Nd Neodymium 60 | Pm Promethium 61 | 150 Sm Samarium 62 | 152 Eu Europium 63 | 157 Gd Gadolinium 64 | 159 Tb Terbium 65 | 162 Dy Dysprosium 66 | 165 Ho Holmium 67 | 167 Er Erbium 68 | 169 Tm Thulium 69 | 173 Yb Ytterbium 70 | 175 Lu Lutetium 71 |
| † | 232 Th Thorium 90 | Pa Protactinium 91 | 238 U Uranium 92 | Np Neptunium 93 | Pu Plutonium 94 | Am Americium 95 | Cm Curium 96 | Bk Berkelium 97 | Cf Californium 98 | Es Einsteinium 99 | Fm Fermium 100 | Md Mendelevium 101 | No Nobelium 102 | Lr Lawrencium 103 |

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 $dm^3$ at room temperature and pressure (r.t.p.).

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