UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

**CHEMISTRY** **5070/11**

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)

*9258778076*

**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 **16** printed pages.


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**1** Which process provides the best evidence for the particle theory of matter?

**A** dehydration

**B** diffusion

**C** filtration

**D** neutralisation

**2** The results of two tests on a solution **X** are shown.

| reagent added | few drops | an excess |
|---|---|---|
| aqueous sodium hydroxide | white precipitate | precipitate dissolves |
| aqueous ammonia | white precipitate | precipitate remains |

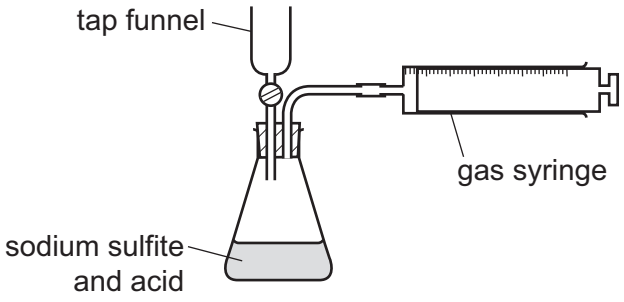
Which ion is present in solution **X**?

**A** $Al^{3+}$ **B** $Ca^{2+}$ **C** $Cu^{2+}$ **D** $Zn^{2+}$

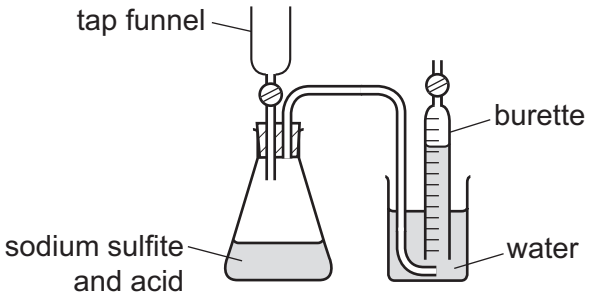
**3** A student wanted to follow how the rate of the reaction of sodium sulfite with acid varies with time. The reaction produces gaseous sulfur dioxide.

Which apparatus is **not** suitable?

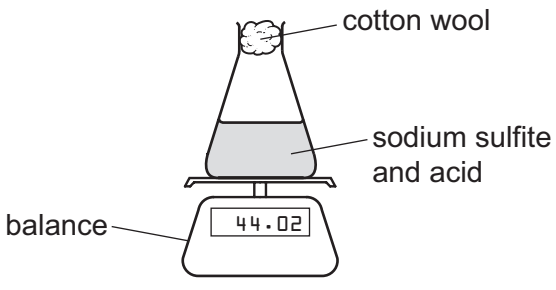
**A**



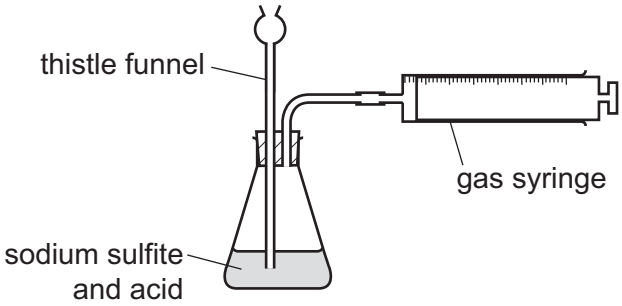

**B**




**C**

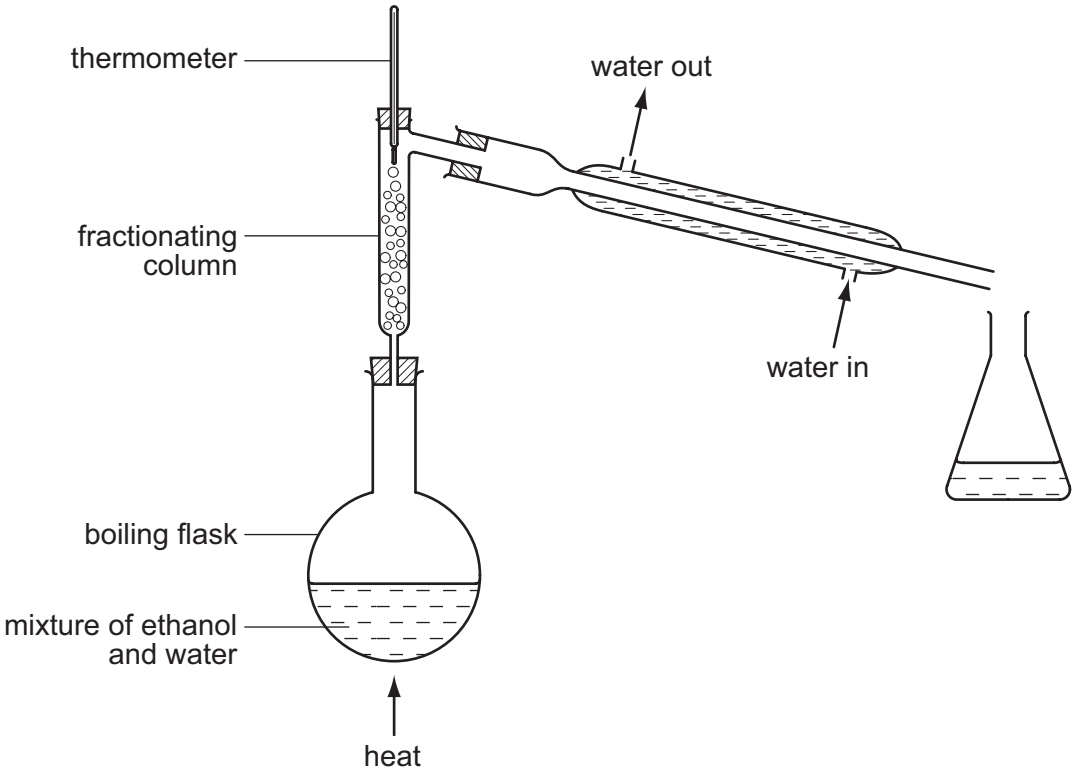



**D**



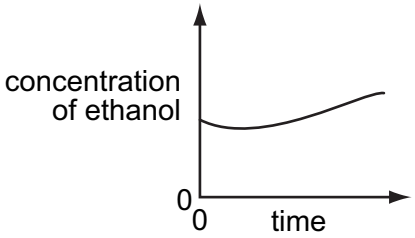

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**4** The apparatus shown is used to distil a dilute solution of ethanol in water.
[B.P.: ethanol, 78 °C; water 100 °C]

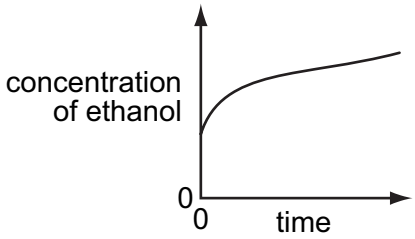



Which graph shows the change in concentration of the ethanol in the boiling flask as the distillation proceeds?

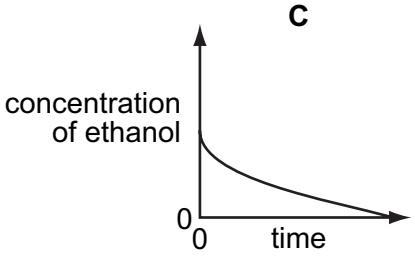
**A**



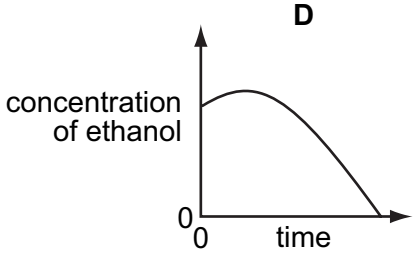

**B**




**C**




**D**




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[Turn over

**5** 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 |

**6** Which substance will **not** conduct electricity at room temperature and pressure?

**A** dilute nitric acid

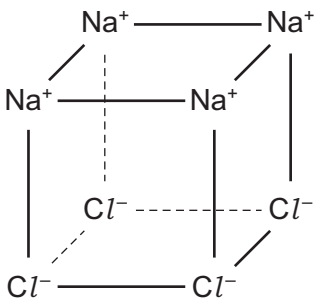
**B** graphite

**C** mercury

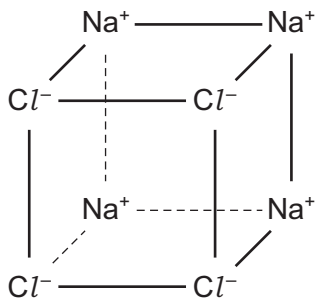
**D** sodium chloride

**7** Which diagram correctly shows the arrangement of the ions in solid sodium chloride?

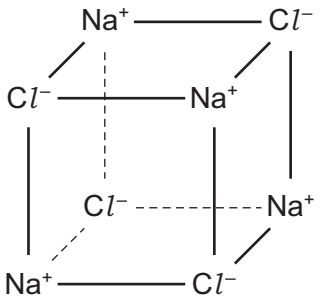
**A**



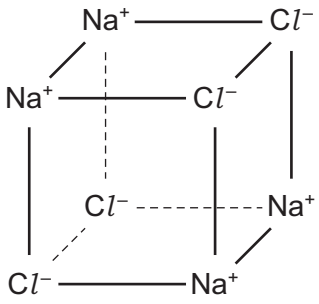

**B**




**C**

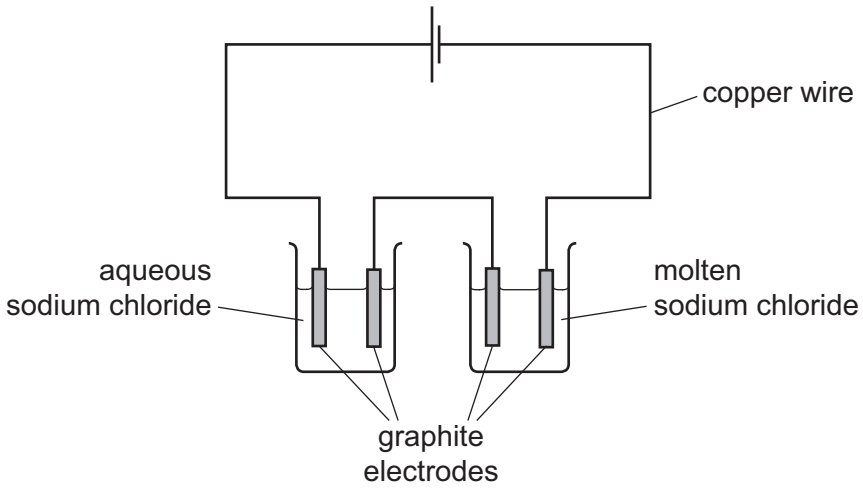



**D**




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**8** 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

**9** 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.

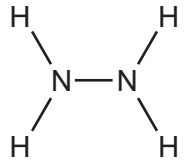
**C** The change is reduction, because there has been a loss of electrons.

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

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**[Turn over**

**10** The diagram shows the structural formula of the covalent molecule hydrazine, $N_2H_4$.




Consider **all** the electrons in a molecule of hydrazine.

Which description fits the arrangement of these electrons in the molecule?

| | total number of electrons involved in bonding | total number of electrons not involved in bonding |
|---|---|---|
| **A** | 5 | 4 |
| **B** | 5 | 8 |
| **C** | 10 | 4 |
| **D** | 10 | 8 |

**11** 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 $dm^3$

**12** Nitrogen and oxygen react according to the equation.

$$N_2(g) + 2O_2(g) \rightarrow 2NO_2(g)$$

The enthalpy change for the reaction shown is +66 kJ.

If two moles of nitrogen and two moles of oxygen are used, what will be the enthalpy change?

**A** +16.5 kJ **B** +33 kJ **C** +66 kJ **D** +132 kJ

**13** Which statement about the four gases carbon dioxide, $CO_2$, hydrogen, $H_2$, oxygen, $O_2$ and ozone, $O_3$ is correct?

**A** One mole of each gas occupies the same volume at a given temperature and pressure.

**B** Ozone has the fastest rate of diffusion at a given temperature and pressure.

**C** They are all denser than air.

**D** They are all elements.

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**14** When dilute sulfuric acid is electrolysed between inert electrodes, which statements are correct?

1 Hydrogen is released at the negative electrode.

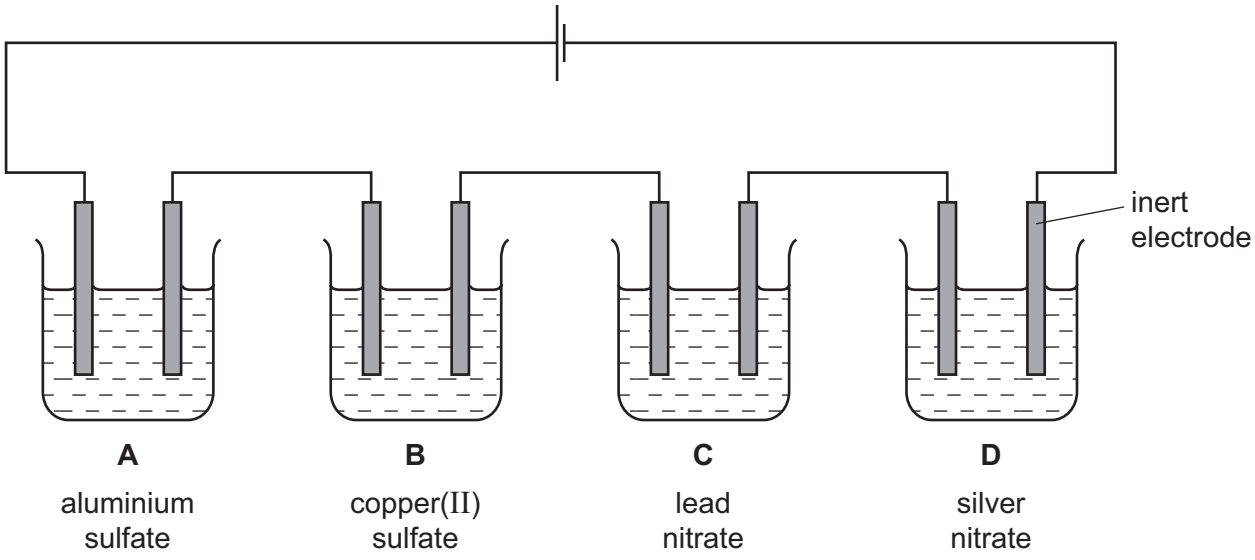
2 Oxygen is released at the positive electrode.

3 Sulfur dioxide is released at the positive electrode.

4 The acid becomes more concentrated.

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

**15** When electrolysed using inert electrodes, which dilute solution would produce the greatest increase in mass of the cathode?
[$A_r$: A*l*, 27; Cu, 64; Pb, 207; Ag, 108]




**16** The formation of liquid water from hydrogen and oxygen is thought to occur in three stages.

1 $2H_2(g) + O_2(g) \rightarrow 4H(g) + 2O(g)$

2 $4H(g) + 2O(g) \rightarrow 2H_2O(g)$

3 $2H_2O(g) \rightarrow 2H_2O(l)$

Which stages would be exothermic?

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

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**17** When bismuth(III) chloride, $BiCl_3$, is added to water, a white precipitate of $BiOCl$ is formed.

$$BiCl_3(aq) + H_2O(l) \rightleftharpoons BiOCl(s) + 2HCl(aq)$$

If this reversible reaction is at equilibrium and hydrochloric acid is added, what will happen?

**A** The position of equilibrium moves to the left and more white precipitate is formed.

**B** The position of equilibrium moves to the left and the white precipitate disappears.

**C** The position of equilibrium moves to the right and more white precipitate is formed.

**D** The position of equilibrium moves to the right and the white precipitate disappears.

**18** Which colour change occurs when ethanol is added to a small quantity of warm, acidified potassium dichromate(VI)?

**A** orange to colourless

**B** orange to green

**C** purple to colourless

**D** purple to green

**19** 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 $NaSeO_4$.

**20** 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

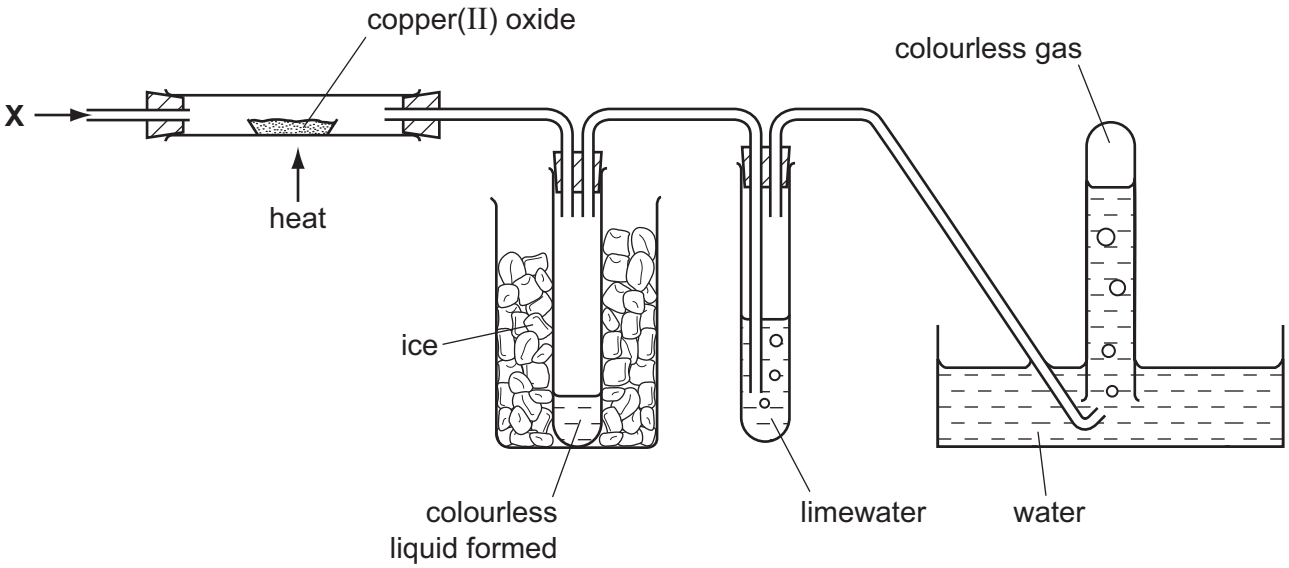
**B** hydrogen and nitrogen

**C** hydrogen and oxygen

**D** oxygen and carbon monoxide

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**21** When pure gas **X** was passed through the apparatus shown, the copper(II) oxide turned pink and the limewater stayed colourless.




What is gas **X**?

**A** carbon dioxide

**B** carbon monoxide

**C** hydrogen

**D** nitrogen

**22** Which reagent is added to aqueous potassium chloride to prepare lead chloride?

**A** aqueous lead nitrate

**B** lead

**C** lead carbonate

**D** lead sulfate

**23** Which change in the properties of the halogens is **not** correct?

| | chlorine → bromine → iodine |
|---|---|
| **A** | darker in colour |
| **B** | decrease in melting point |
| **C** | decrease in rate of diffusion |
| **D** | increase in density |

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**[Turn over**

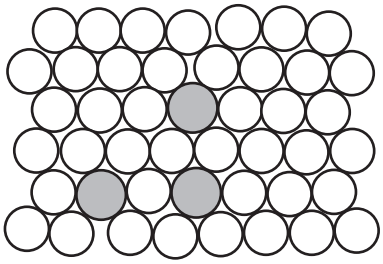
**24** *W*, *X* and *Y* are elements in the same period of the Periodic Table.

- *X* forms compounds of formulae $XCl_2$ and $XCl_3$.
- *Y* forms a solution of pH12 when it reacts with water.
- The reaction of *W* with water is similar to the reaction of *Y* with water but is less vigorous.

In which order are the elements in the Periodic Table?

| | left to right along a period |
|---|---|
| **A** | $W \rightarrow Y \rightarrow X$ |
| **B** | $X \rightarrow W \rightarrow Y$ |
| **C** | $X \rightarrow Y \rightarrow W$ |
| **D** | $Y \rightarrow W \rightarrow X$ |

**25** The diagram shows the structure of an alloy.



Which statement about alloys is correct?

**A** Alloys can only be formed by mixing copper or iron with other metals.

**B** High carbon steel alloys are soft and easily shaped.

**C** In an alloy there is attraction between positive ions and delocalised electrons.

**D** The alloy brass has a chemical formula.

**26** 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 |

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

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

**A** carbon dioxide

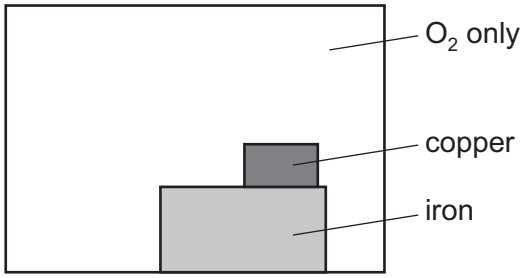
**B** carbon monoxide

**C** oxygen

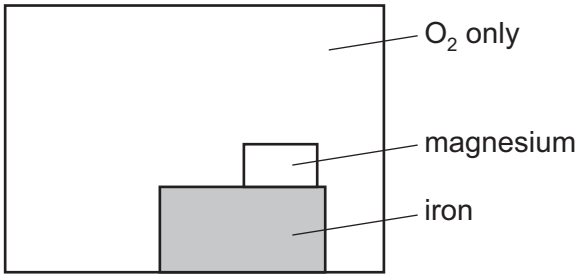
**D** sulfur dioxide

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

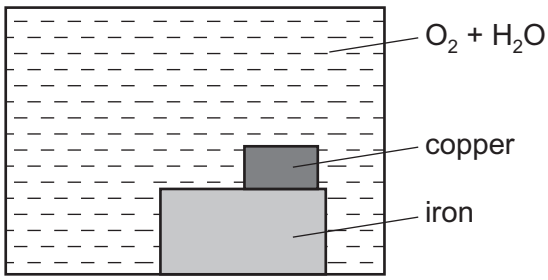
**A**



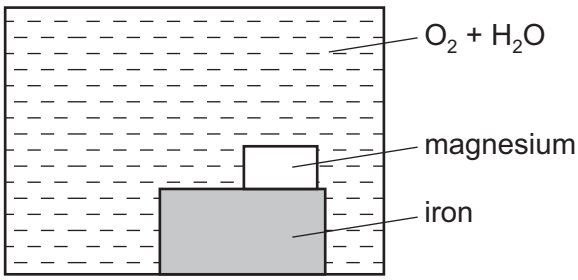

**B**




**C**




**D**




**29** Metals usually occur in their ore combined with another element.

Which metal is least likely to occur combined with another element?

**A** aluminium

**B** calcium

**C** magnesium

**D** silver

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**[Turn over**

**30** The noble gases, argon, helium, krypton and xenon, are present in air.

Which noble gas is present in the largest proportion?

**A** argon

**B** helium

**C** krypton

**D** xenon

**31** 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** $1 \rightarrow 2 \rightarrow 3 \rightarrow 4$

**B** $1 \rightarrow 2 \rightarrow 4 \rightarrow 3$

**C** $2 \rightarrow 1 \rightarrow 3 \rightarrow 4$

**D** $2 \rightarrow 1 \rightarrow 4 \rightarrow 3$

**32** Which gas will react with ozone in the upper atmosphere of the Earth?

**A** $CF_2Cl_2$ **B** $CH_4$ **C** $CO_2$ **D** $SO_2$

**33** Iron is extracted from iron ore in a blast furnace.

Which solid substances are fed into the top of the blast furnace?

1 coke

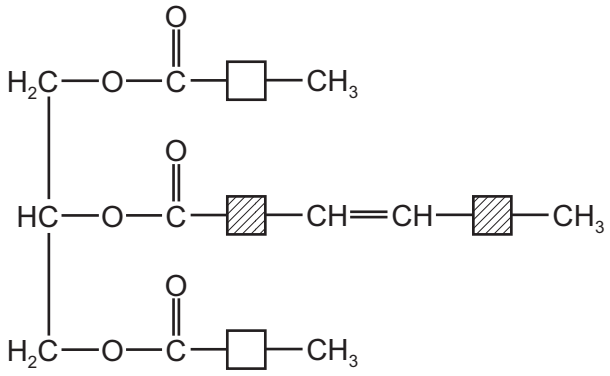
2 cryolite

3 limestone

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

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**34** The diagram shows a simplified structure of a fat.



Which compounds in the table have linkages that can be found in this fat? (Do **not** consider C–H or C-C bonds as linkages.)

| | ethene | nylon | *Terylene* |
|---|---|---|---|
| **A** | ✓ | ✓ | ✓ |
| **B** | ✓ | ✓ | ✗ |
| **C** | ✓ | ✗ | ✓ |
| **D** | ✗ | ✓ | ✓ |

**35** The solubility of the carboxylic acids in water decreases as the size of the carboxylic acid molecules increases.

Which carboxylic acid is the least soluble in water?

**A** butanoic acid

**B** ethanoic acid

**C** methanoic acid

**D** propanoic acid

**36** Poly(ethene) is the addition polymer formed from the monomer ethene.

Which statement is correct?

**A** Poly(ethene) can be disposed of by burning – this produces carbon dioxide and water.

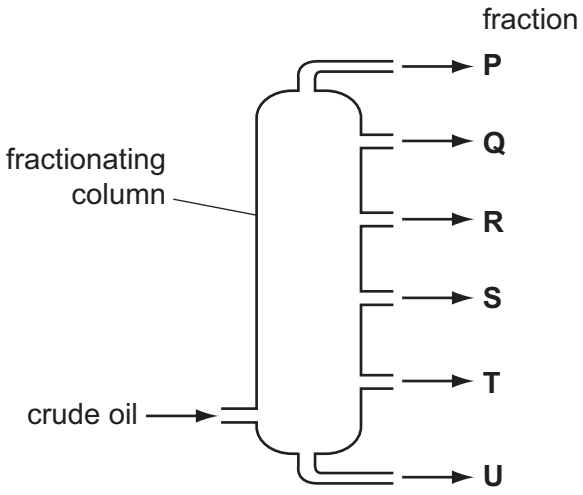
**B** Poly(ethene) decolourises bromine water.

**C** Poly(ethene) has the empirical formula $C_2H_4$.

**D** Poly(ethene) is acted upon by bacteria so that it decomposes quickly when in a landfill site.

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




Which row explains why fraction **R** is collected above fraction **S**?

| | boiling point of **R** | average molecular mass of **R** |
|---|---|---|
| **A** | higher than **S** | greater than **S** |
| **B** | higher than **S** | smaller than **S** |
| **C** | lower than **S** | greater than **S** |
| **D** | lower than **S** | smaller than **S** |

**38** In the manufacture of ethanoic acid, the chemical industry uses the following sequence of reactions.

$$\text{compound } \mathbf{X} \xrightarrow{1} \text{ethene} \xrightarrow{2} \text{ethanol} \xrightarrow{3} \text{ethanoic acid}$$

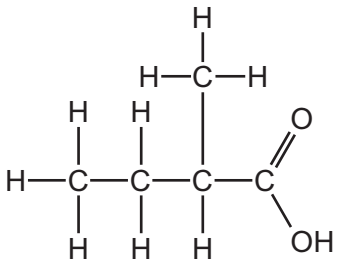
What are the three processes?

| | 1 | 2 | 3 |
|---|---|---|---|
| **A** | cracking | hydration | oxidation |
| **B** | cracking | polymerisation | hydration |
| **C** | hydration | polymerisation | oxidation |
| **D** | polymerisation | oxidation | hydration |

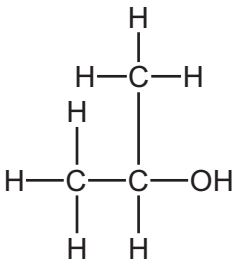
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**39** Esters are formed when an alcohol reacts with a carboxylic acid.

Which ester would be formed using the carboxylic acid and alcohol shown?

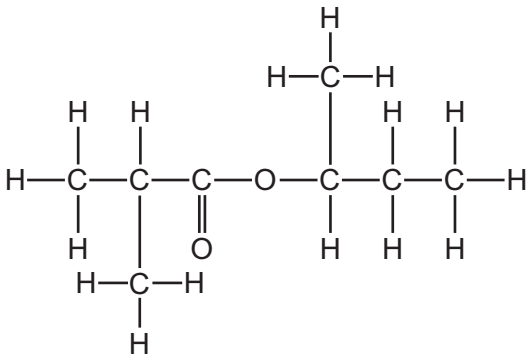


carboxylic acid

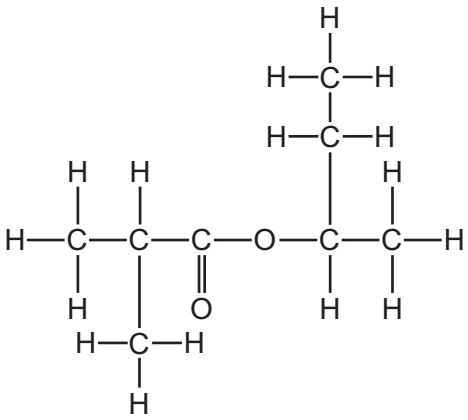


alcohol

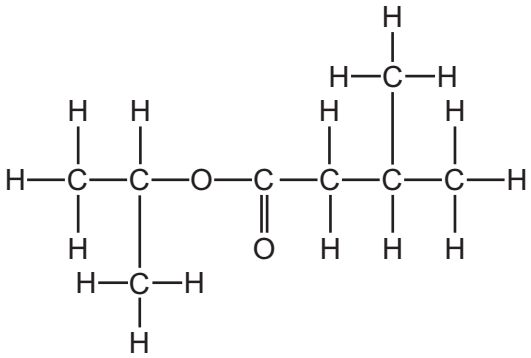
**A**



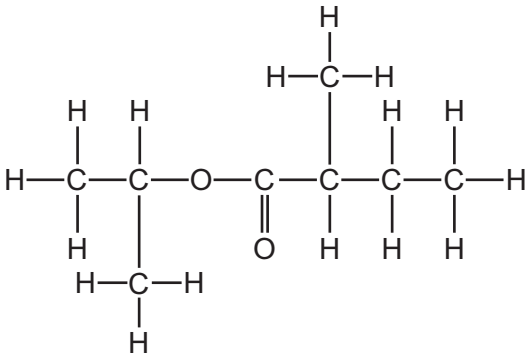
**B**



**C**



**D**



**40** Which equation represents a combustion reaction?

**A** $C_2H_4 + H_2O \rightarrow C_2H_5OH$

**B** $C_2H_5OH + O_2 \rightarrow CH_3CO_2H + H_2O$

**C** $CH_3CO_2H + 2O_2 \rightarrow 2CO_2 + 2H_2O$

**D** $CH_3CO_2H + CH_3OH \rightarrow CH_3CO_2CH_3 + H_2O$

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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 † | | | | | | | | | | | | | | | |

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

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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