



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

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**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)



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**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.

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



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.

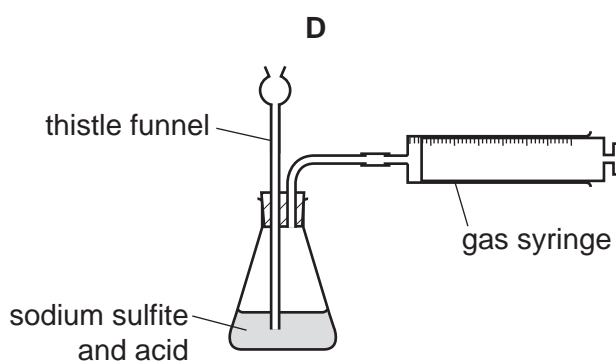
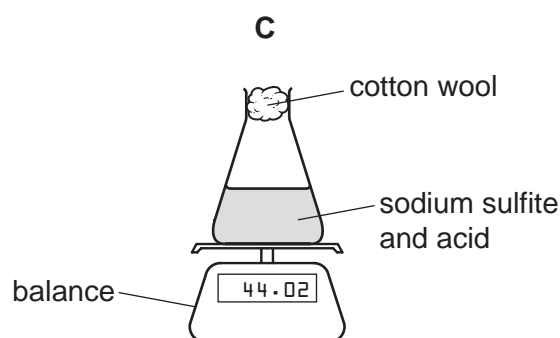
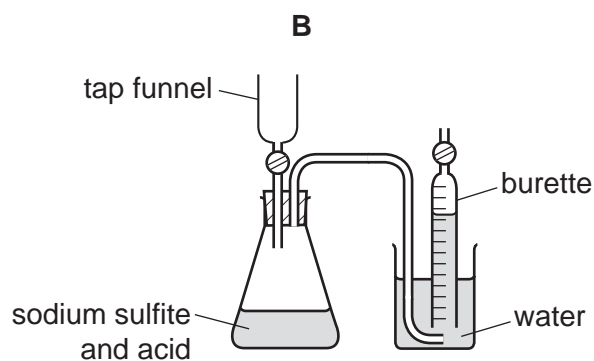
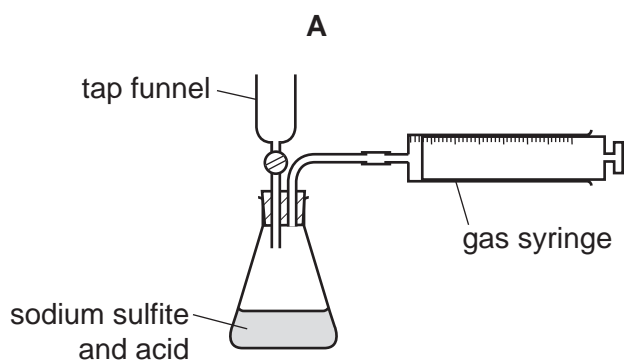
reagent added	few drops	an excess
aqueous sodium hydroxide	white precipitate	precipitate dissolves
aqueous ammonia	white precipitate	precipitate remains

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

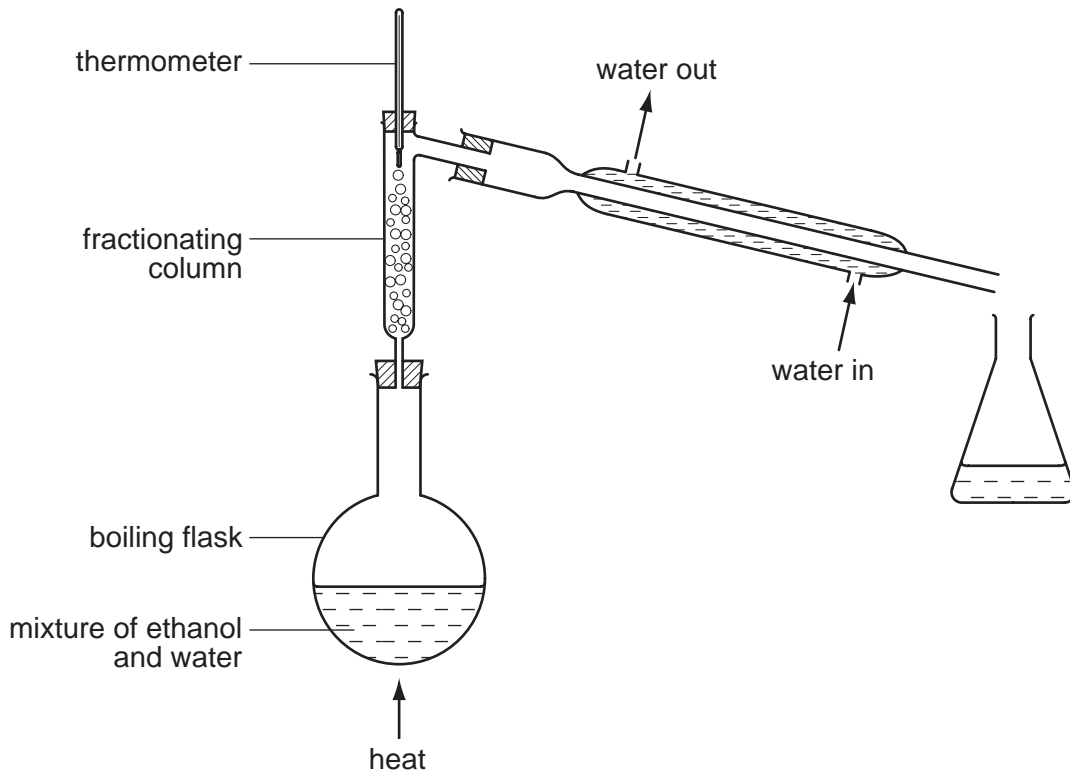
- A  $Al^{3+}$
- B  $Ca^{2+}$
- C  $Cu^{2+}$
- D  $Zn^{2+}$

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.

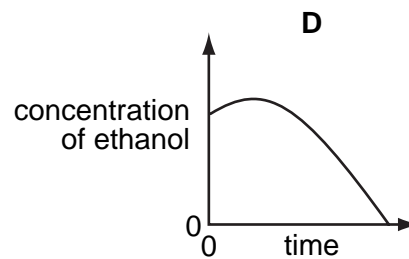
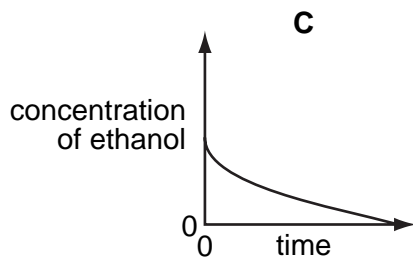
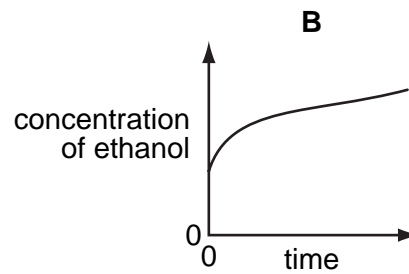
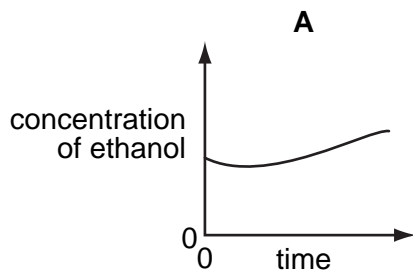
Which apparatus is **not** suitable?



- 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?



- 5 Aqueous silver nitrate is added to separate solutions of potassium chloride and sodium iodide.

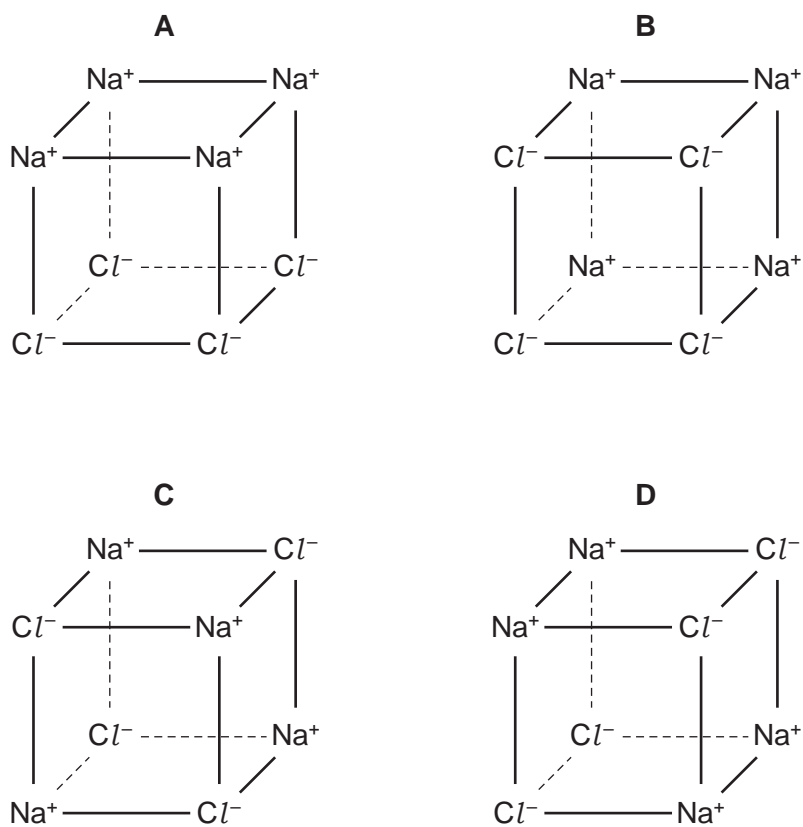
What are the colours of the precipitates formed?

	colour of precipitate formed with chloride	colour of precipitate formed with iodide
<b>A</b>	white	white
<b>B</b>	white	yellow
<b>C</b>	yellow	white
<b>D</b>	yellow	yellow

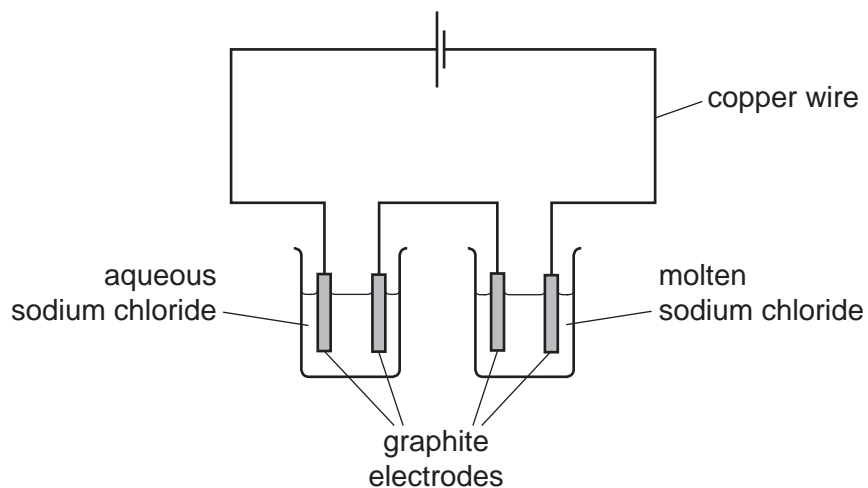
- 6 Which substance will **not** conduct electricity at room temperature and pressure?

- 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?



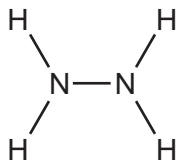
- 8 The diagram shows the electrolysis of aqueous sodium chloride and of molten sodium chloride.



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.

- 10 The diagram shows the structural formula of the covalent molecule hydrazine,  $\text{N}_2\text{H}_4$ .

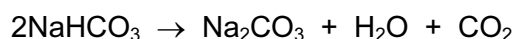


Consider **all** the electrons in a molecule of hydrazine.

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
<b>A</b>	5	4
<b>B</b>	5	8
<b>C</b>	10	4
<b>D</b>	10	8

- 11 Sodium hydrogencarbonate decomposes on heating.

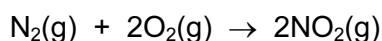


In an experiment, a 5.0 mol sample of sodium hydrogencarbonate is heated.

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

- A** 24 dm<sup>3</sup>      **B** 36 dm<sup>3</sup>      **C** 48 dm<sup>3</sup>      **D** 60 dm<sup>3</sup>

- 12 Nitrogen and oxygen react according to the equation.



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,  $\text{CO}_2$ , hydrogen,  $\text{H}_2$ , oxygen,  $\text{O}_2$  and ozone,  $\text{O}_3$  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.

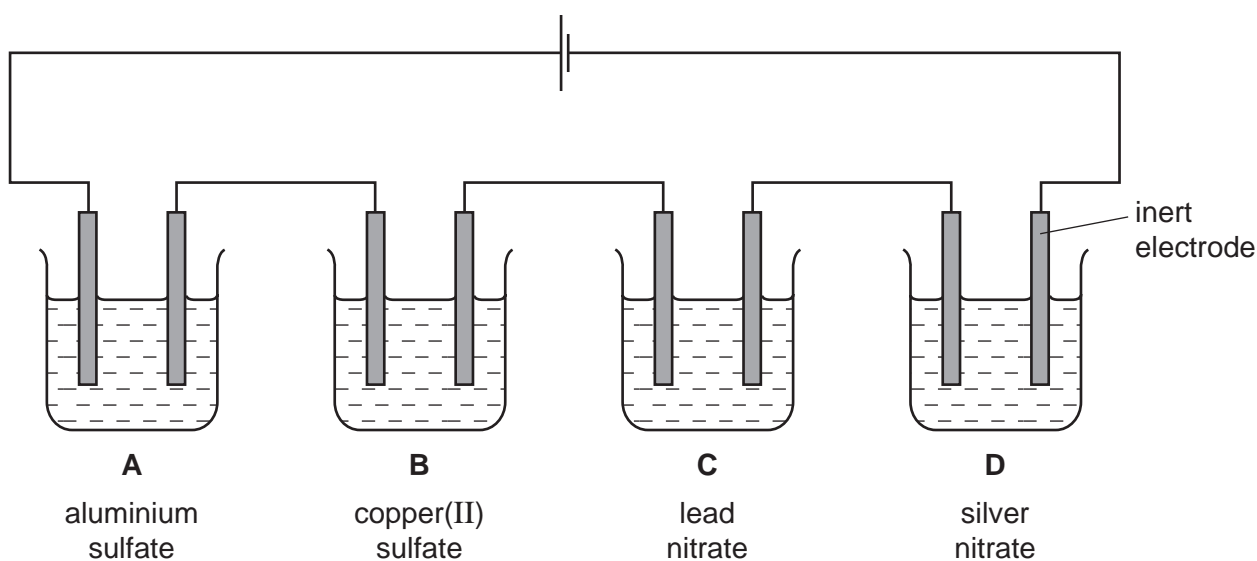
14 When dilute sulfuric acid is electrolysed between inert electrodes, which statements are correct?

- 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?

[ $A_r$ : Al, 27; Cu, 64; Pb, 207; Ag, 108]



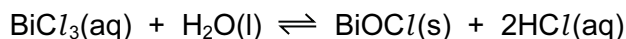
16 The formation of liquid water from hydrogen and oxygen is thought to occur in three stages.

- 1  $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 4\text{H}(\text{g}) + 2\text{O}(\text{g})$
- 2  $4\text{H}(\text{g}) + 2\text{O}(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g})$
- 3  $2\text{H}_2\text{O}(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l})$

Which stages would be exothermic?

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

- 17 When bismuth(III) chloride,  $\text{BiCl}_3$ , is added to water, a white precipitate of  $\text{BiOCl}$  is formed.



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

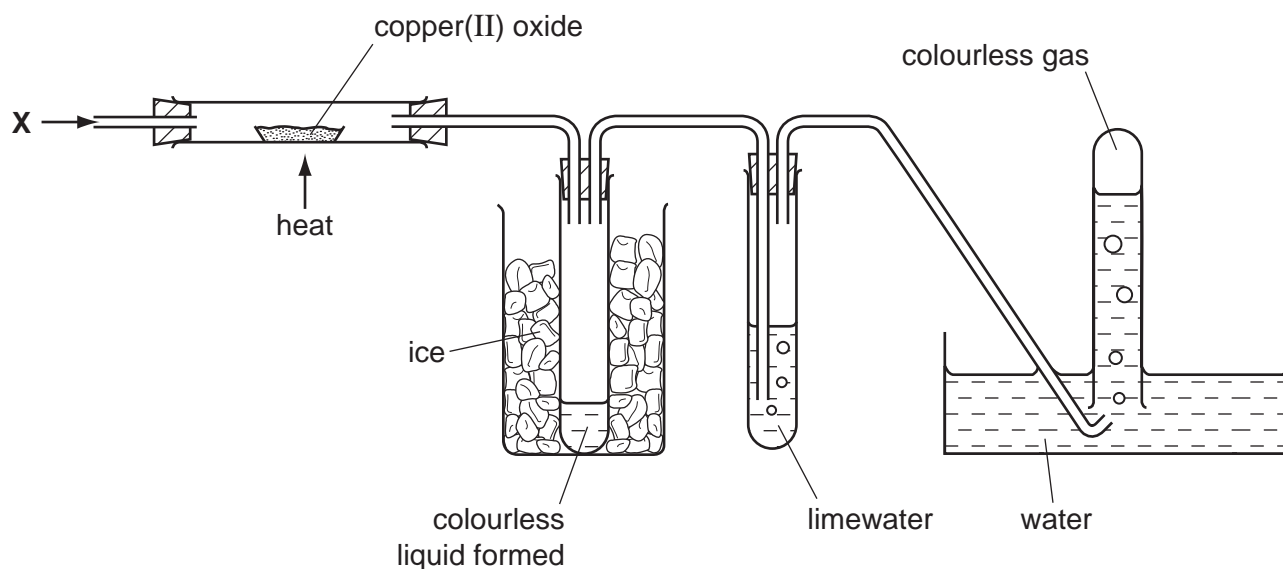
- A The position of equilibrium moves to the left and more white precipitate is formed.
  - B The position of equilibrium moves to the left and the white precipitate disappears.
  - C The position of equilibrium moves to the right and more white precipitate is formed.
  - D The position of equilibrium 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  $\text{Se}_2\text{O}$ ,  $\text{Na}_2\text{Se}$  and  $\text{NaSeO}_4$ .
  - B  $\text{SeO}_2$ ,  $\text{Na}_2\text{Se}$  and  $\text{NaSeO}_4$ .
  - C  $\text{SeO}_2$ ,  $\text{Na}_2\text{Se}$  and  $\text{Na}_2\text{SeO}_4$ .
  - D  $\text{SeO}_3$ ,  $\text{NaSe}$  and  $\text{NaSeO}_4$ .
- 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



- 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

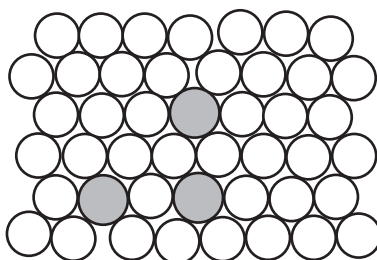
24 *W*, *X* and *Y* are elements in the same period of the Periodic Table.

- *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
<b>A</b>	$W \rightarrow Y \rightarrow X$
<b>B</b>	$X \rightarrow W \rightarrow Y$
<b>C</b>	$X \rightarrow Y \rightarrow W$
<b>D</b>	$Y \rightarrow W \rightarrow X$

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?

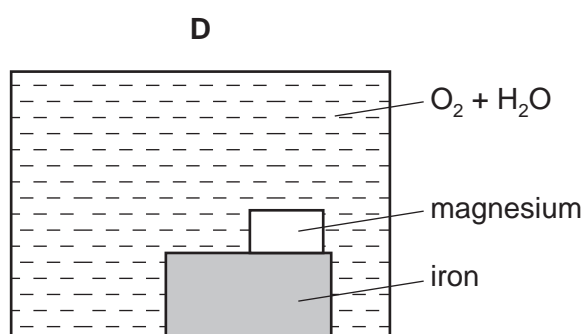
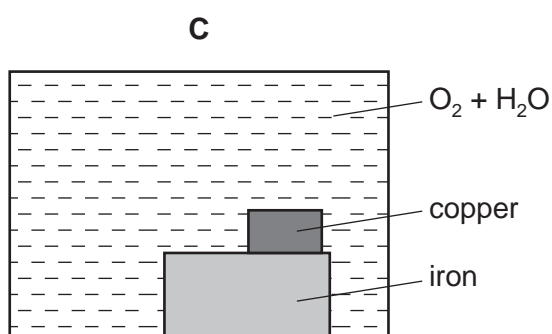
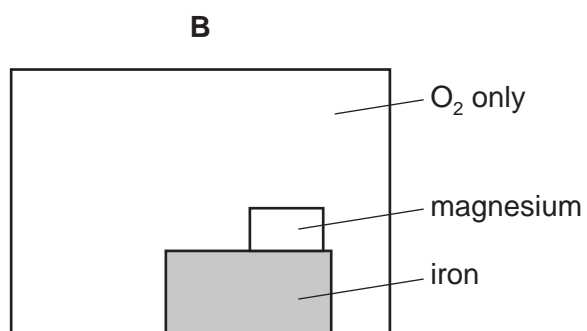
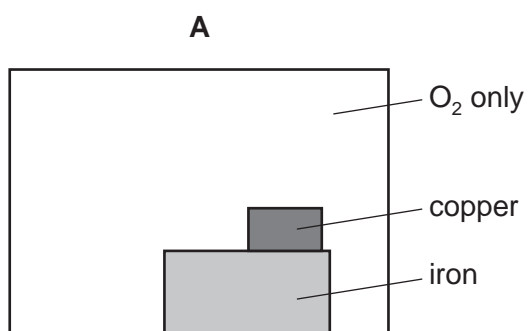
	oxides become more difficult to reduce →
<b>A</b>	iron → lead → zinc
<b>B</b>	iron → zinc → lead
<b>C</b>	lead → iron → zinc
<b>D</b>	zinc → iron → lead

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?



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

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 → 2 → 3 → 4
- B 1 → 2 → 4 → 3
- C 2 → 1 → 3 → 4
- D 2 → 1 → 4 → 3

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

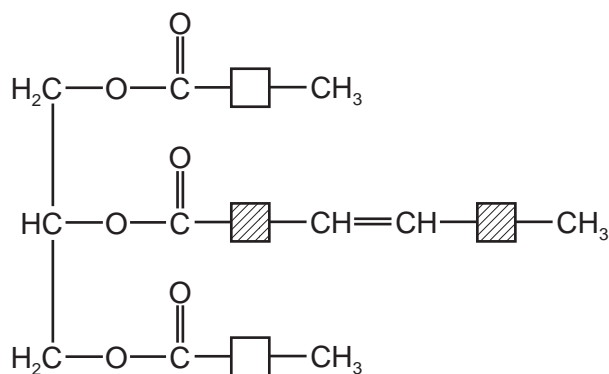
- A  $\text{CF}_2\text{Cl}_2$       B  $\text{CH}_4$       C  $\text{CO}_2$       D  $\text{SO}_2$

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

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	<i>Terylene</i>
<b>A</b>	✓	✓	✓
<b>B</b>	✓	✓	x
<b>C</b>	✓	x	✓
<b>D</b>	x	✓	✓

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?

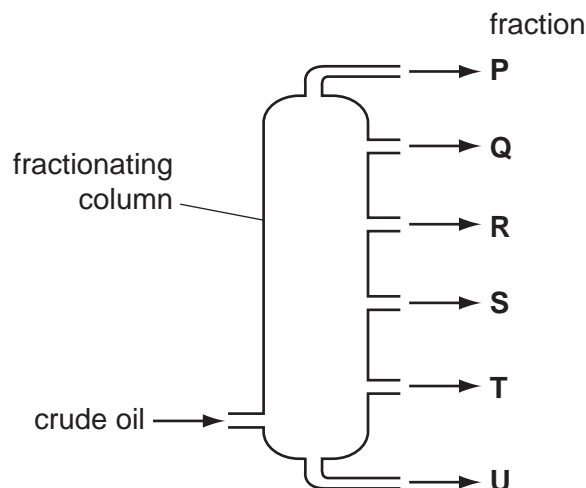
- A** butanoic acid
- B** ethanoic acid
- C** methanoic acid
- D** propanoic acid

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  $\text{C}_2\text{H}_4$ .
- D** Poly(ethene) is acted upon by bacteria so that it decomposes quickly when in a landfill site.

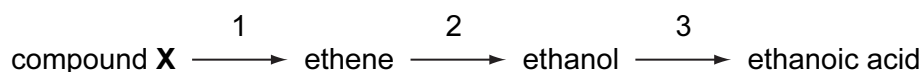
37 The diagram shows the fractionation of crude oil.



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

	boiling point of <b>R</b>	average molecular mass of <b>R</b>
<b>A</b>	higher than <b>S</b>	greater than <b>S</b>
<b>B</b>	higher than <b>S</b>	smaller than <b>S</b>
<b>C</b>	lower than <b>S</b>	greater than <b>S</b>
<b>D</b>	lower than <b>S</b>	smaller than <b>S</b>

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

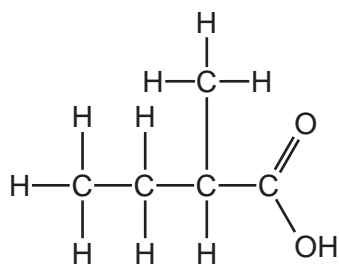


What are the three processes?

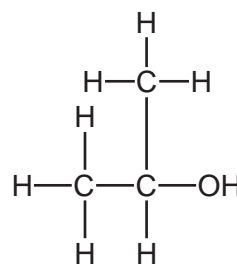
	1	2	3
<b>A</b>	cracking	hydration	oxidation
<b>B</b>	cracking	polymerisation	hydration
<b>C</b>	hydration	polymerisation	oxidation
<b>D</b>	polymerisation	oxidation	hydration

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

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

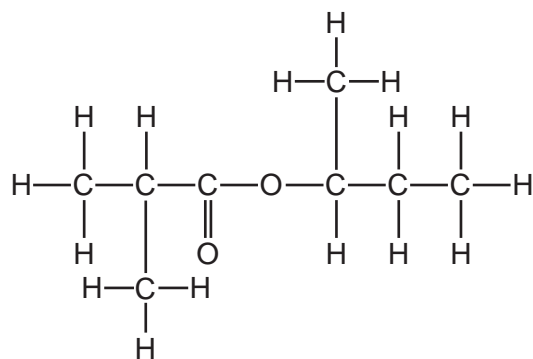


carboxylic acid

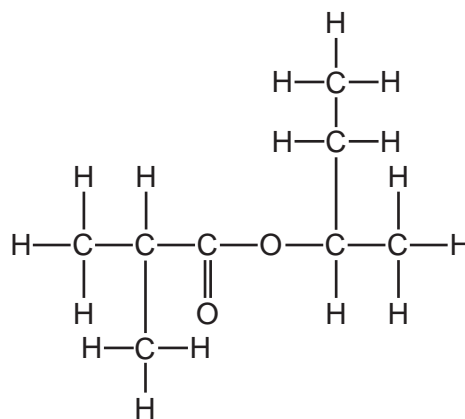


alcohol

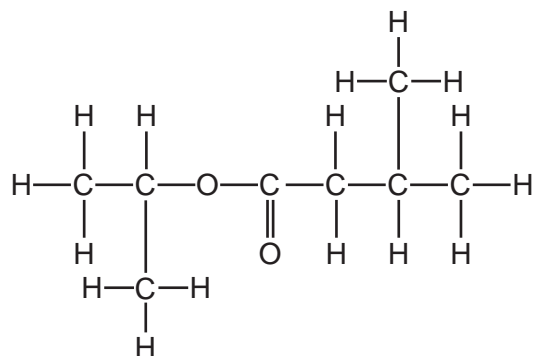
A



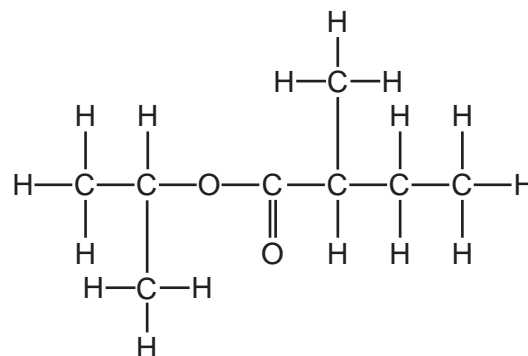
B



C



D



40 Which equation represents a combustion reaction?

- A  $\text{C}_2\text{H}_4 + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_5\text{OH}$
- B  $\text{C}_2\text{H}_5\text{OH} + \text{O}_2 \rightarrow \text{CH}_3\text{CO}_2\text{H} + \text{H}_2\text{O}$
- C  $\text{CH}_3\text{CO}_2\text{H} + 2\text{O}_2 \rightarrow 2\text{CO}_2 + 2\text{H}_2\text{O}$
- D  $\text{CH}_3\text{CO}_2\text{H} + \text{CH}_3\text{OH} \rightarrow \text{CH}_3\text{CO}_2\text{CH}_3 + \text{H}_2\text{O}$

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

		Group																				
I	II	III	IV	V	VI	VII	0															
		1 <b>H</b> Hydrogen 1					4 <b>He</b> Helium 2															
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4						20 <b>Ne</b> Neon 10															
23 <b>Na</b> Sodium 11	24 <b>Mg</b> Magnesium 12		12 <b>C</b> Carbon 6	14 <b>N</b> Nitrogen 7	16 <b>O</b> Oxygen 8	19 <b>F</b> Fluorine 9	35.5 <b>Cl</b> Chlorine 17															
39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	27 <b>Al</b> Aluminium 13	28 <b>Si</b> Silicon 14	31 <b>P</b> Phosphorus 15	32 <b>S</b> Sulfur 16	79 <b>Se</b> Selenium 34	84 <b>Kr</b> Krypton 36															
85 <b>Rb</b> Rubidium 37	88 <b>Sr</b> Strontium 38	70 <b>Ga</b> Gallium 31	73 <b>Ge</b> Germanium 32	75 <b>As</b> Arsenic 33	122 <b>Sb</b> Antimony 51	127 <b>I</b> Iodine 53	131 <b>Xe</b> Xenon 54															
133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	65 <b>Zn</b> Zinc 30	64 <b>Cu</b> Copper 29	66 <b>Ni</b> Nickel 28	106 <b>Pd</b> Palladium 46	195 <b>Pt</b> Platinum 78	201 <b>Hg</b> Mercury 80	207 <b>Pb</b> Lead 82	209 <b>Bi</b> Bismuth 83	84 <b>Po</b> Polonium 84	85 <b>At</b> Astatine 85	86 <b>Rn</b> Radon 86										
226 <b>Ra</b> Radium 88	227 <b>Ac</b> Actinium 89	59 <b>Co</b> Cobalt 27	56 <b>Fe</b> Iron 26	55 <b>Mn</b> Manganese 25	101 <b>Ru</b> Ruthenium 44	190 <b>Os</b> Osmium 76	186 <b>Re</b> Rhenium 75	184 <b>W</b> Tungsten 74	181 <b>Ta</b> Tantalum 73	178 <b>Hf</b> Hafnium 72	140 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	150 <b>Sm</b> Samarium 62	152 <b>Eu</b> Europium 63	157 <b>Gd</b> Gadolinium 64	162 <b>Dy</b> Dysprosium 66	165 <b>Ho</b> Holmium 67	167 <b>Er</b> Erbium 68	169 <b>Tm</b> Thulium 69	173 <b>Yb</b> Ytterbium 70	175 <b>Lu</b> Lutetium 71
232 <b>Th</b> Thorium 90	238 <b>U</b> Uranium 92	91 <b>Ti</b> Titanium 22	51 <b>V</b> Vanadium 23	96 <b>Cr</b> Chromium 24	93 <b>Nb</b> Niobium 41	181 <b>Ta</b> Tantalum 73	178 <b>Hf</b> Hafnium 72	139 <b>La</b> Lanthanum 57	89 <b>Y</b> Yttrium 39	91 <b>Zr</b> Zirconium 40	140 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	150 <b>Sm</b> Samarium 62	152 <b>Eu</b> Europium 63	157 <b>Gd</b> Gadolinium 64	162 <b>Dy</b> Dysprosium 66	165 <b>Ho</b> Holmium 67	167 <b>Er</b> Erbium 68	169 <b>Tm</b> Thulium 69	173 <b>Yb</b> Ytterbium 70	175 <b>Lu</b> Lutetium 71
232 <b>Th</b> Thorium 90	238 <b>U</b> Uranium 92	91 <b>Pa</b> Protactinium 91	93 <b>Np</b> Neptunium 93	94 <b>Pu</b> Plutonium 94	95 <b>Am</b> Americium 95	96 <b>Cm</b> Curium 96	97 <b>Bk</b> Berkelium 97	98 <b>Cf</b> Californium 98	100 <b>Fm</b> Fermium 100	101 <b>Md</b> Mendelevium 101	102 <b>No</b> Nobelium 102	103 <b>Lr</b> Lawrencium 103										

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

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

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).

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