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)

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.

IB13 11_5070_11/5RP

UNIVERSITY of CAMBRIDGE
International Examinations

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

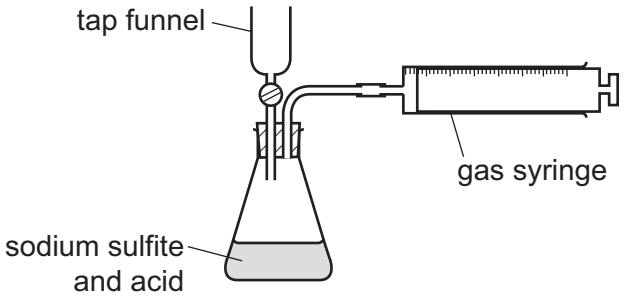
Which ion is present in solution **X**?

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



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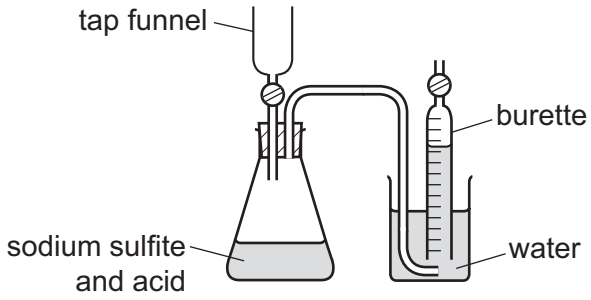

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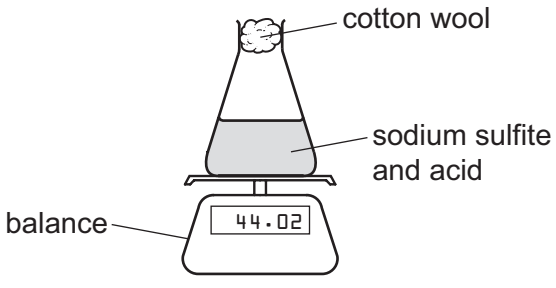
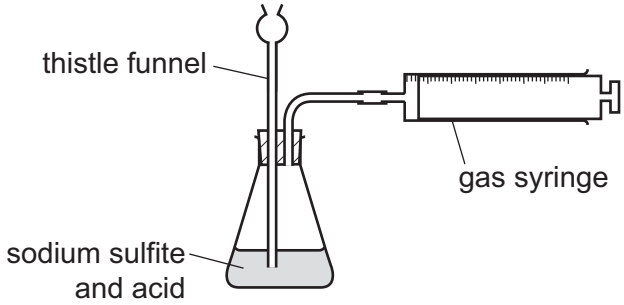
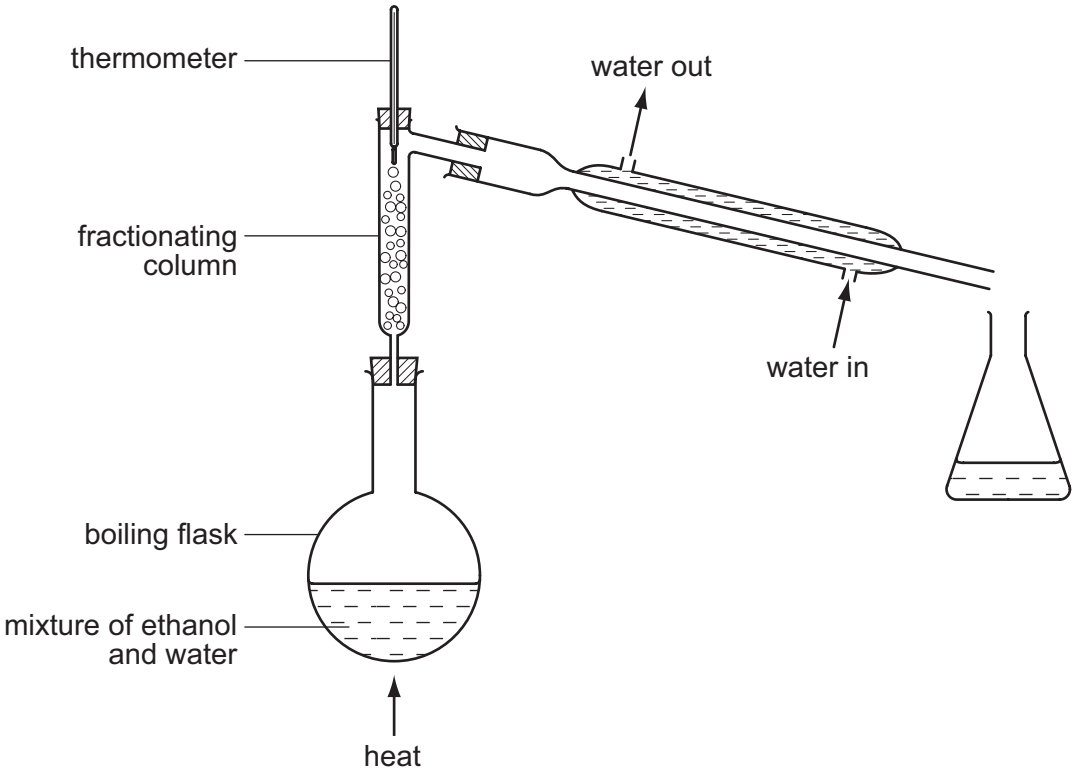


D

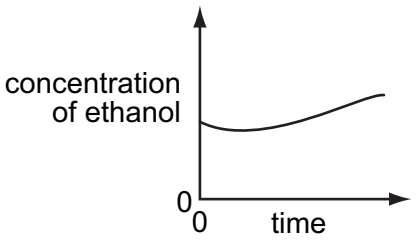


4 The apparatus shown is used to distil a dilute solution of ethanol in water.
[B.P.: ethanol, 78 °C; water 100 °C]

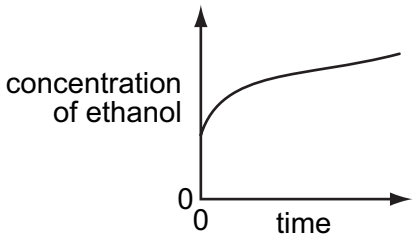


Which graph shows the change in concentration of the ethanol in the boiling flask as the distillation proceeds?

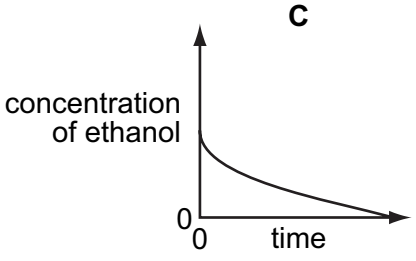
A



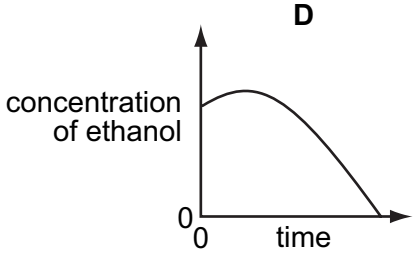
B



C



D



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

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

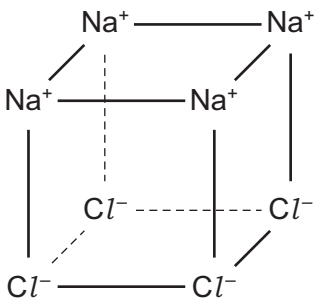
B graphite

C mercury

D sodium chloride

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

A



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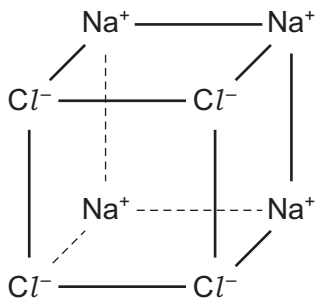
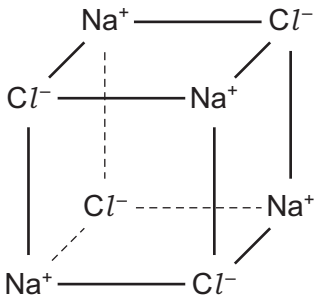
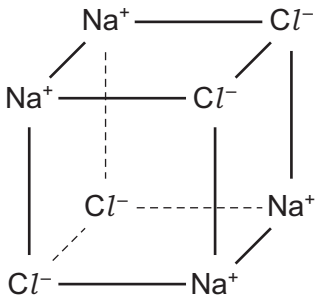


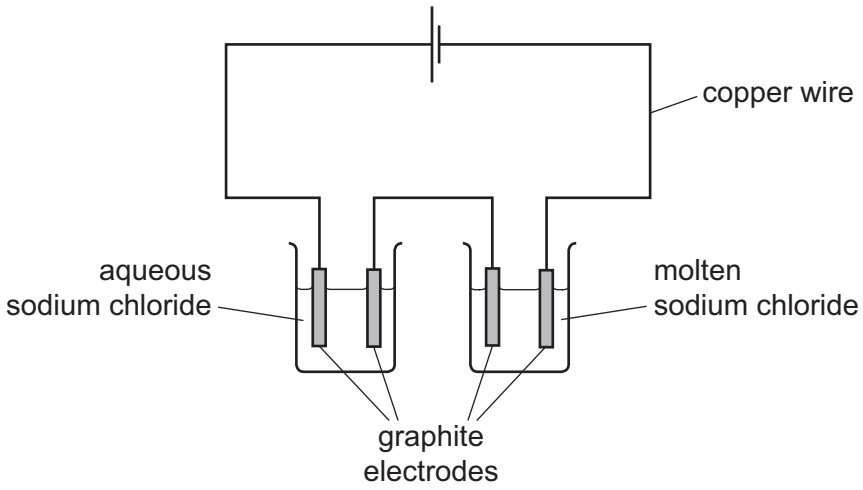
C



D



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



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?

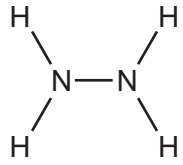
A The change is reduction, because there has been a gain of electrons.

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, 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.

14 When dilute sulfuric acid is electrolysed between inert electrodes, which statements a

1 Hydrogen is released at the negative electrode.

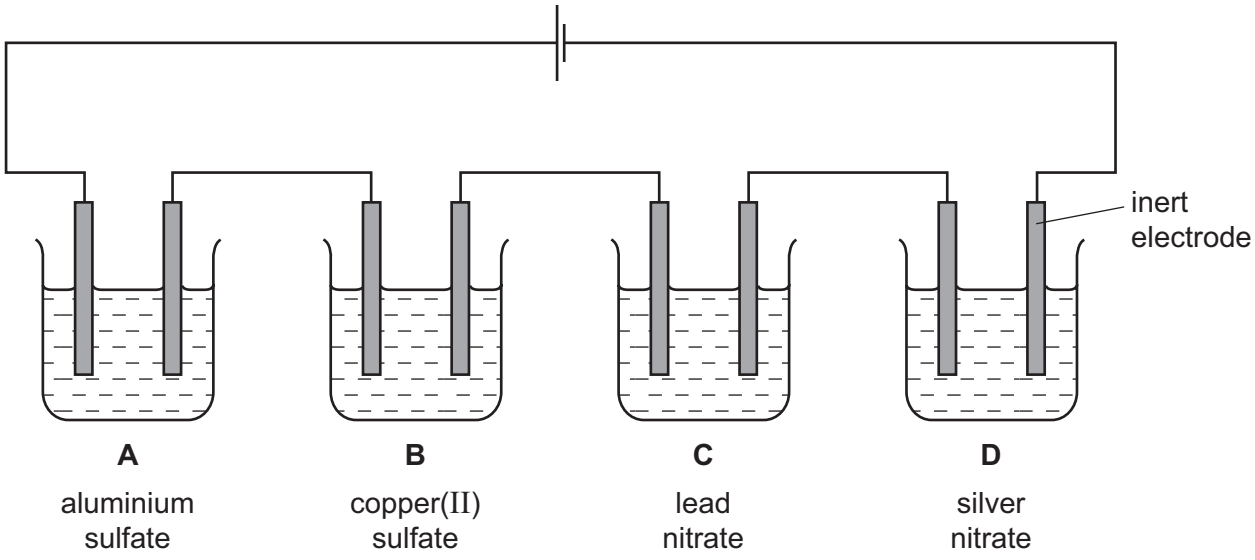
2 Oxygen is released at the positive electrode.

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

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

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

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?

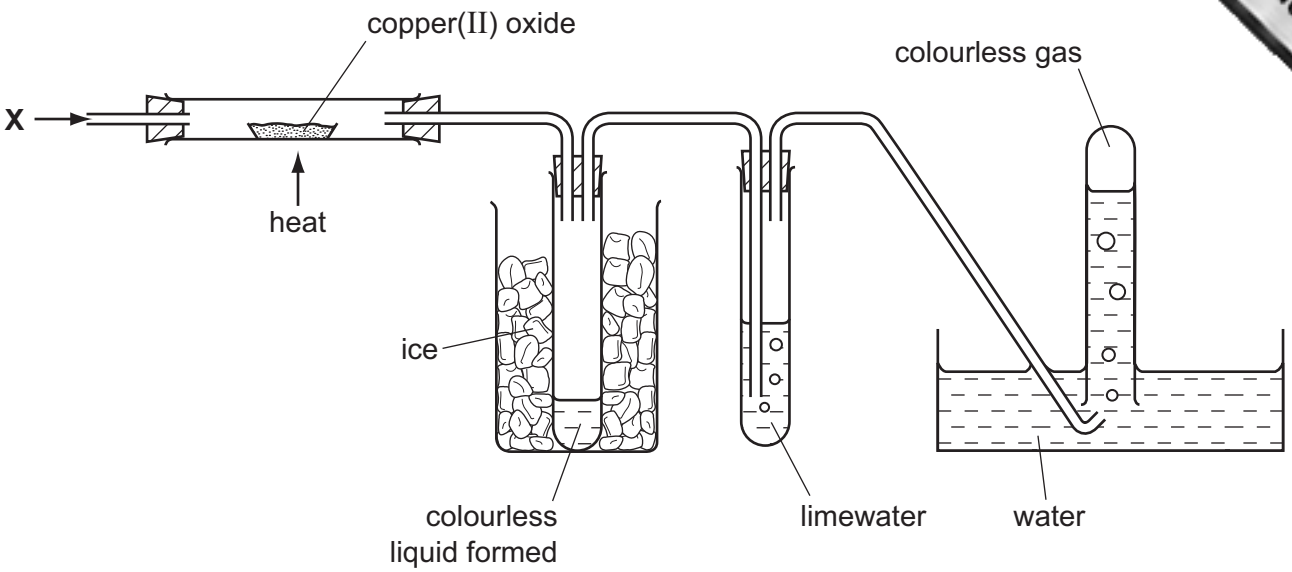
A hydrogen and chlorine

B hydrogen and nitrogen

C hydrogen and oxygen

D oxygen and carbon monoxide

21 When pure gas **X** was passed through the apparatus shown, the copper(II) oxide turned [illegible] 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

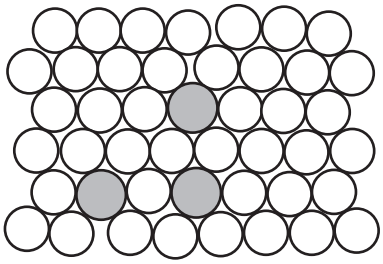
24 *W*, *X* and *Y* are elements in the same period of the Periodic Table.

- *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
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

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

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

A carbon dioxide

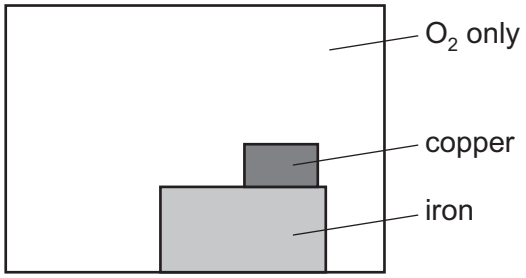
B carbon monoxide

C oxygen

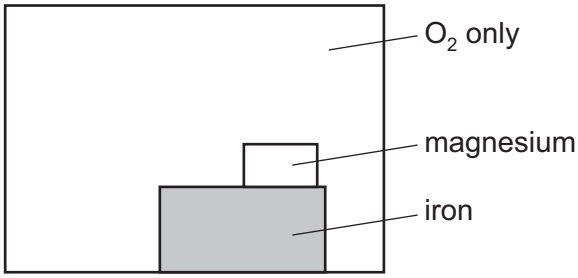
D sulfur dioxide

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?

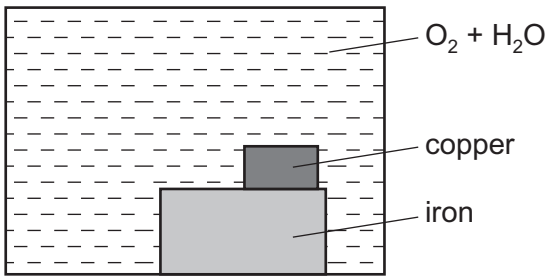
A



B



C



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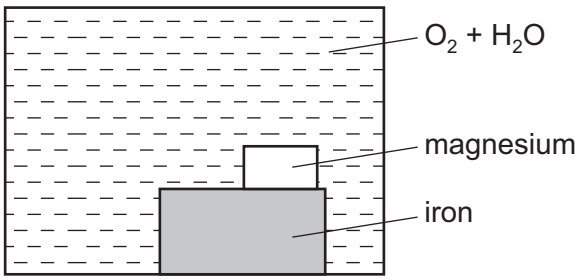


29 Metals usually occur in their ore combined with another element.

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 $1 \rightarrow 2 \rightarrow 3 \rightarrow 4$

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?

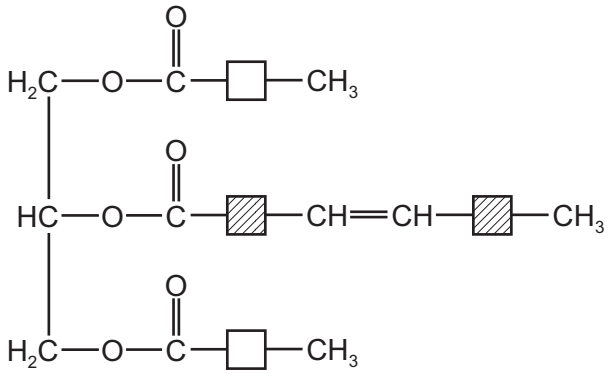
1 coke

2 cryolite

3 limestone

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

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?

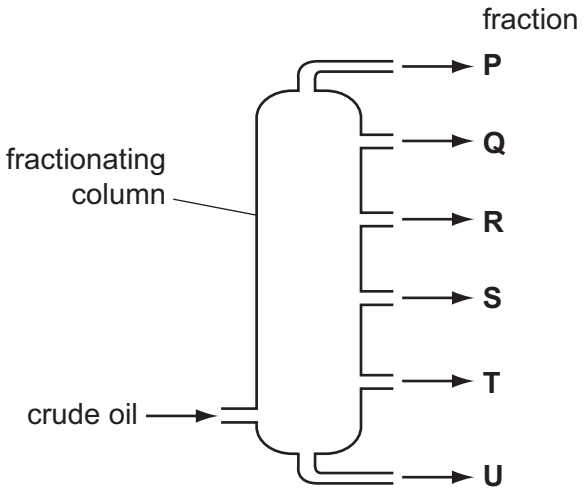
A Poly(ethene) can be disposed of by burning – this produces carbon dioxide and water.

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.

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.

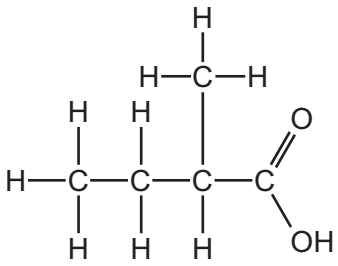
$$\text{compound } \mathbf{X} \xrightarrow{1} \text{ethene} \xrightarrow{2} \text{ethanol} \xrightarrow{3} \text{ethanoic acid}$$

What are the three processes?

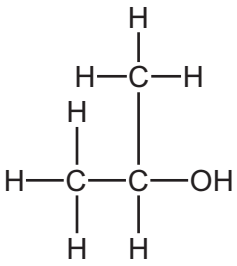
	1	2	3
A	cracking	hydration	oxidation
B	cracking	polymerisation	hydration
C	hydration	polymerisation	oxidation
D	polymerisation	oxidation	hydration

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

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

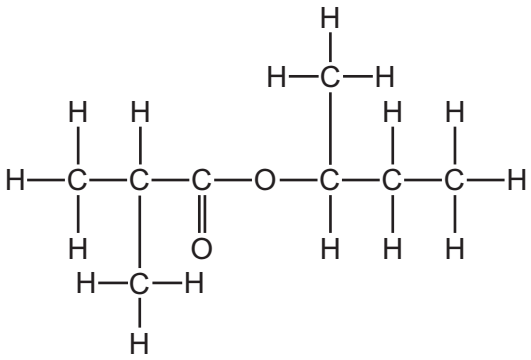


carboxylic acid



alcohol

A



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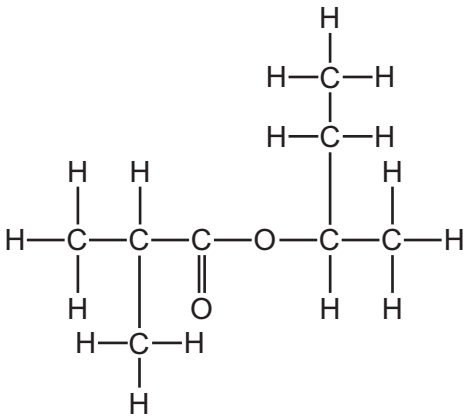

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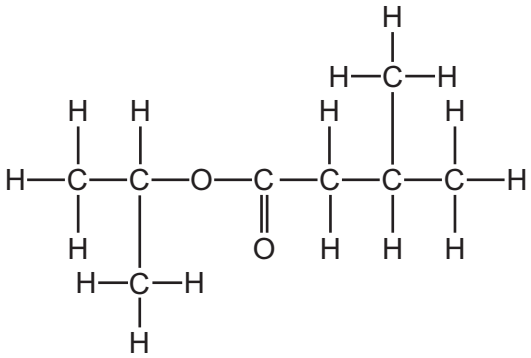
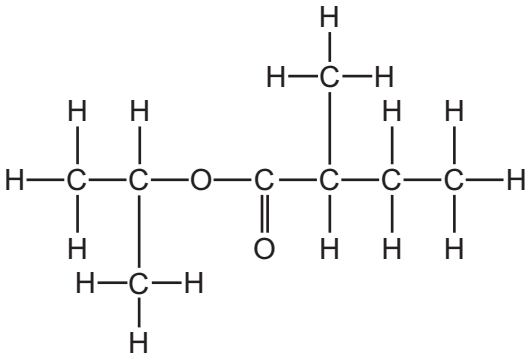


D



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 $CH_3CO_2H + CH_3OH \rightarrow CH_3CO_2CH_3 + H_2O$

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						12 **C** Carbon 6	14 **N** Nitrogen 7	16 **O** Oxygen 8	19 **F** Fluorine 9	20 **Ne** Neon 10
										11 **B** Boron 5	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
7 **Li** Lithium 3	9 **Be** Beryllium 4									27 **Al** Aluminium 13	70 **Ga** Gallium 31	73 **Ge** Germanium 32	75 **As** Arsenic 33	79 **Se** Selenium 34	80 **Br** Bromine 35	84 **Kr** Krypton 36
23 **Na** Sodium 11	24 **Mg** Magnesium 12									115 **In** Indium 49	119 **Sn** Tin 50	122 **Sb** Antimony 51	128 **Te** Tellurium 52	127 **I** Iodine 53	131 **Xe** Xenon 54	
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	112 **Cd** Cadmium 48	201 **Hg** Mercury 80	204 **Tl** Thallium 81	207 **Pb** Lead 82	209 **Bi** Bismuth 83	209 **Po** Polonium 84	209 **At** Astatine 85	209 **Rn** Radon 86
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	197 **Au** Gold 79								
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										
	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	a = relative atomic mass
X	**X** = atomic symbol
b	b = proton (atomic) number

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