



# Cambridge O Level

**CHEMISTRY**

**5070/01**

Paper 1 Multiple Choice

**For examination from 2023**

SPECIMEN PAPER

**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.

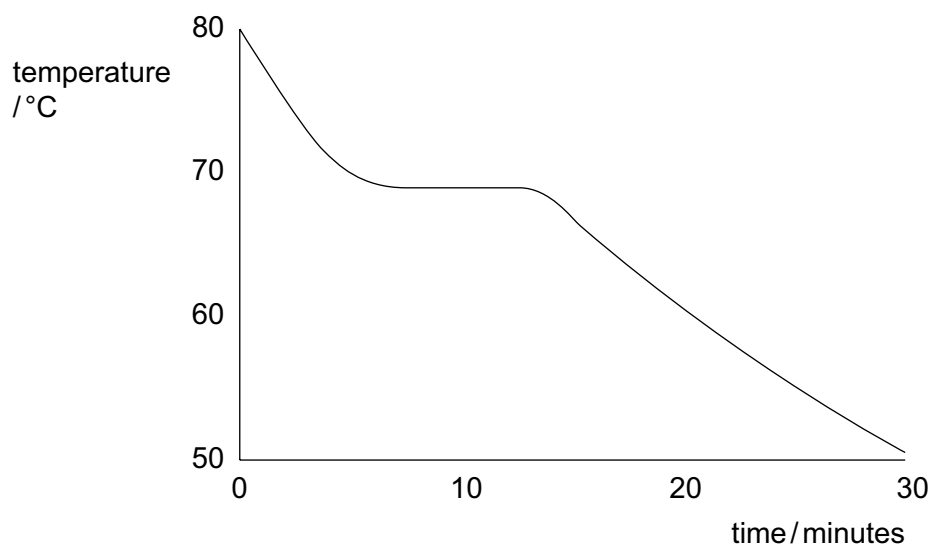
## INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **18** pages. Any blank pages are indicated.

- 1 Stearic acid has a melting point of  $69^{\circ}\text{C}$ .

A heated sample of pure stearic acid is cooled and the temperature is recorded every minute for 30 minutes. A graph of the results is shown.



Which process occurs between 8 and 12 minutes?

- A** boiling  
**B** condensing  
**C** freezing  
**D** melting
- 2 Which statements are correct?
- 1 The volume of a gas at constant pressure increases as the temperature increases.
  - 2 When the pressure of a gas is increased the particles move closer together.
  - 3 The pressure of a gas at constant volume decreases as the temperature increases.
- A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only
- 3 Which substance would diffuse most quickly?
- A** carbon dioxide at  $0^{\circ}\text{C}$   
**B** carbon dioxide at  $25^{\circ}\text{C}$   
**C** neon at  $0^{\circ}\text{C}$   
**D** neon at  $25^{\circ}\text{C}$

- 4 Which diagram shows the arrangement of particles inside a balloon containing a mixture of the gases nitrogen and oxygen?

**A**                      **B**                      **C**                      **D**

key  
● nitrogen atom  
○ oxygen atom

- 5 The ion  $Q^{2+}$  has three complete shells of electrons.

What is Q?

- A** calcium  
**B** magnesium  
**C** oxygen  
**D** sulfur

- 6 The symbols for two ions are shown.



Which statement is correct?

- A** The fluoride ion contains more electrons than the sodium ion.  
**B** The sodium ion contains more neutrons than the fluoride ion.  
**C** The two ions contain the same number of electrons as each other.  
**D** The two ions contain the same number of protons as each other.
- 7 Two isotopes of chlorine are  ${}^{35}\text{Cl}$  and  ${}^{37}\text{Cl}$ .

Using these isotopes, how many different relative molecular masses are possible for the compound with molecular formula  $\text{C}_2\text{H}_3\text{Cl}_3$ ?

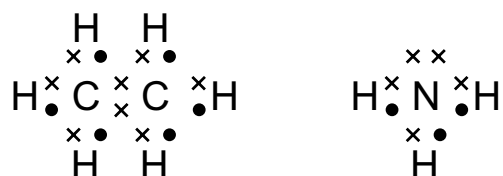
- A** 2                      **B** 3                      **C** 4                      **D** 5

8 What happens to an atom of a Group II element when it forms a compound with oxygen?

- A It bonds with two atoms of oxygen.
- B It receives two electrons from an atom of oxygen.
- C It shares two electrons with an atom of oxygen.
- D It transfers two electrons to an atom of oxygen.

9 Ethane,  $C_2H_6$ , and ammonia,  $NH_3$ , are covalent compounds.

The dot-and-cross diagrams of these compounds are shown.



Which statements are correct?

- 1 A molecule of ethane contains twice as many hydrogen atoms as a molecule of ammonia.
- 2 An unreacted nitrogen atom has five outer electrons.
- 3 In a molecule of ethane, the bond between the carbon atoms is formed by sharing two electrons, one from each carbon atom.

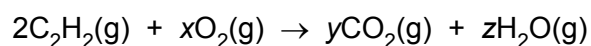
A 1, 2 and 3      B 1 and 2 only      C 1 and 3 only      D 2 and 3 only

10 A compound contains 70% by mass of iron and 30% by mass of oxygen.

What is its empirical formula? [ $A_r$ : O, 16; Fe, 56]

A FeO      B  $Fe_2O_3$       C  $Fe_3O_2$       D  $Fe_3O_4$

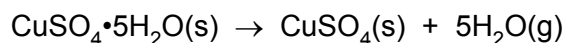
11 The equation for the reaction between ethyne,  $C_2H_2$ , and oxygen is shown.



When the equation is balanced, what is  $x$ ?

A 2      B 3      C 4      D 5

- 12 25.0 g of hydrated copper(II) sulfate crystals are heated to produce anhydrous copper(II) sulfate and water.



What is the mass of anhydrous copper(II) sulfate formed?

[ $M_r$ :  $\text{CuSO}_4$ , 160;  $\text{H}_2\text{O}$ , 18]

- A 9.0g            B 16.0g            C 22.5g            D 25.0g
- 13 The relative formula masses of four compounds are given.  
A student has a 1.0 g sample of each compound.

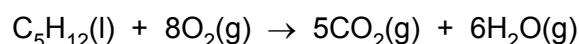
Which sample contains the highest number of moles of oxygen atoms?

	compound	relative formula mass
<b>A</b>	$\text{Al}_2\text{O}_3$	102
<b>B</b>	$\text{CuO}$	80
<b>C</b>	$\text{H}_2\text{SO}_4$	98
<b>D</b>	$\text{HNO}_3$	63

- 14  $50.0\text{cm}^3$  of  $0.10\text{mol/dm}^3$  silver nitrate,  $\text{AgNO}_3$ , is added to  $150.0\text{cm}^3$  of  $0.05\text{mol/dm}^3$  sodium iodide,  $\text{NaI}$ , in a beaker.

After the reaction, solid silver iodide is present in the beaker.  
What else is present?

- A aqueous silver nitrate and aqueous sodium nitrate  
B aqueous sodium iodide and aqueous sodium nitrate  
C aqueous sodium iodide only  
D aqueous sodium nitrate only
- 15 When 0.1 mol of the hydrocarbon,  $\text{C}_5\text{H}_{12}$ , is completely combusted it produces carbon dioxide,  $\text{CO}_2$ , and water,  $\text{H}_2\text{O}$ .



What is the volume of carbon dioxide produced when measured at room temperature and pressure?

- A  $0.5\text{dm}^3$             B  $2.4\text{dm}^3$             C  $5.0\text{dm}^3$             D  $12\text{dm}^3$

16 Carbon electrodes are used to electrolyse aqueous copper(II) sulfate.

Which observations are made?

	at the anode	electrolyte	at the cathode
<b>A</b>	colourless gas forms	blue colour fades	pink solid forms
<b>B</b>	colourless gas forms	blue colour fades	colourless gas forms
<b>C</b>	electrode increases in mass	blue colour fades	pink solid forms
<b>D</b>	electrode increases in mass	no change	pink solid forms

17 Electrolysis is used to plate a metal coin with silver.

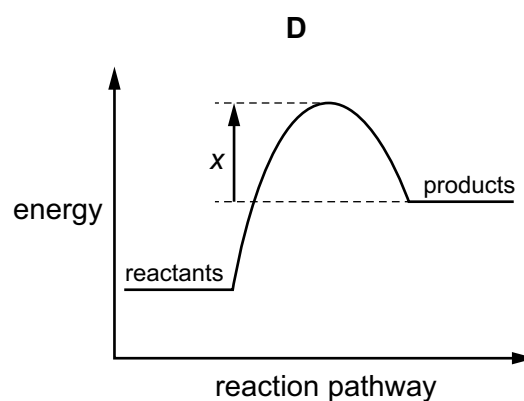
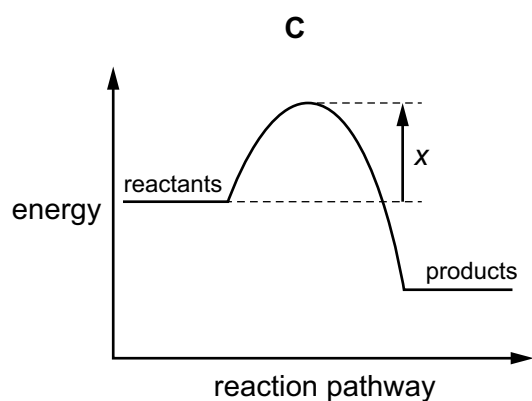
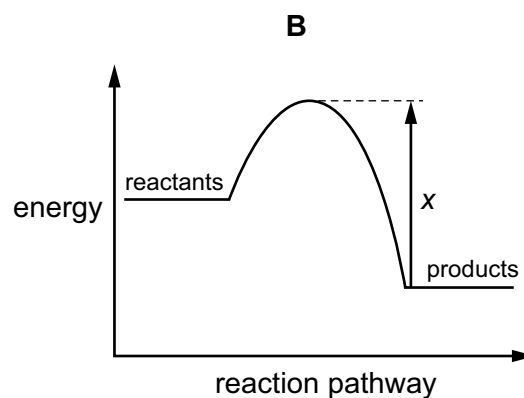
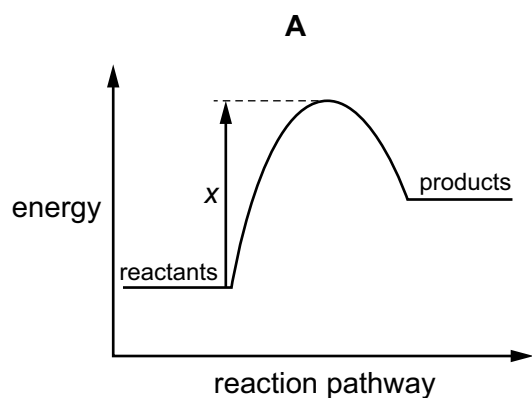
The coin is used as an electrode in a suitable electrolyte.

Which row is correct?

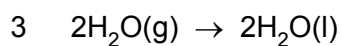
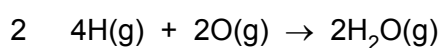
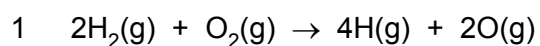
	coin	electrolyte
<b>A</b>	anode	AgCl(aq)
<b>B</b>	anode	AgNO <sub>3</sub> (aq)
<b>C</b>	cathode	AgCl(aq)
<b>D</b>	cathode	AgNO <sub>3</sub> (aq)

18 An endothermic reaction has an activation energy of  $x$ .

Which reaction pathway diagram is correct for this reaction?



19 The formation of liquid water from hydrogen and oxygen may occur in three stages.



Which stages are endothermic?

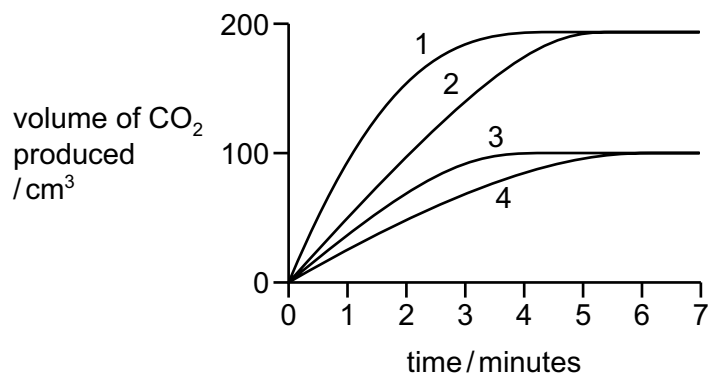
- A** 1, 2 and 3    **B** 1 only    **C** 1 and 3    **D** 2 only

- 20 In four separate experiments, 1, 2, 3 and 4, nitric acid is added to an **excess** of marble pieces and the volume of carbon dioxide gas formed is measured.

In all four experiments the same volume of nitric acid is used.

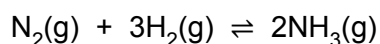
The concentration, or temperature, or both concentration and temperature of the nitric acid, are changed.

The results of the experiments are shown on the graph.



Which statement is correct?

- A A lower concentration of acid is used in experiment 3 than in experiment 1.
  - B Experiment 4 is faster than experiment 3.
  - C The acid used in experiment 2 is of a lower concentration than in experiment 1.
  - D The temperature of the acid is the same in experiments 1 and 2.
- 21 The equation shows the reaction for the manufacture of ammonia.

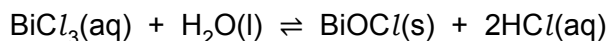


Which change will decrease the activation energy of the reaction?

- A adding a catalyst
- B decreasing the temperature
- C increasing the concentration
- D increasing the pressure



22 A reversible reaction is shown.

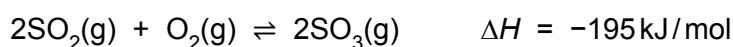


Which changes increase the mass of the precipitate formed?

- 1 adding more water
- 2 adding aqueous sodium hydroxide
- 3 adding dilute hydrochloric acid

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

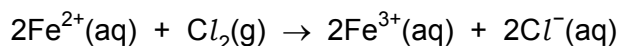
23 Sulfur trioxide is produced by the reversible reaction shown.



Which change in conditions will produce a greater amount of  $\text{SO}_3$  at equilibrium?

- A** adding a catalyst
- B** increasing the pressure
- C** increasing the temperature
- D** removing some  $\text{SO}_2$  and  $\text{O}_2$

24 Iron(II) ions react with chlorine.



Which statement about this reaction is correct?

- A** Chlorine is reduced by iron(II) ions.
- B** Chlorine is the reducing agent.
- C** Iron(II) ions are reduced by chlorine.
- D** Iron(II) ions are the oxidising agent.

25 Which reactions involve oxidation and reduction?

- 1 chlorine gas reacting with aqueous potassium iodide
- 2 dilute sulfuric acid reacting with magnesium
- 3 dilute hydrochloric acid reacting with aqueous sodium hydroxide

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

- 26 Which statement about weak acids is correct?
- A They are partially dissociated in aqueous solution.
  - B They do not react with alkalis.
  - C They do not react with metals.
  - D They form solutions with pH values in the range 0 to 2.
- 27 A colourless aqueous solution of pH 13 is tested separately with methyl orange indicator and thymolphthalein indicator.

Which row is correct?

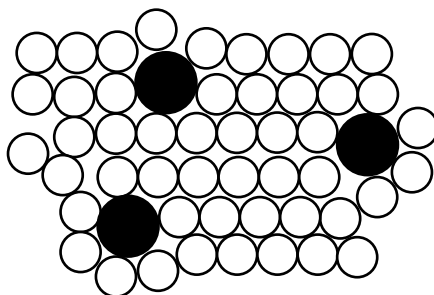
	colour with methyl orange	colour with thymolphthalein
<b>A</b>	red	blue
<b>B</b>	red	colourless
<b>C</b>	yellow	blue
<b>D</b>	yellow	colourless

- 28 Which pair of reagents is suitable for preparing a pure sample of copper(II) chloride crystals?
- A aqueous copper(II) nitrate and aqueous sodium chloride
  - B copper and aqueous sodium chloride
  - C copper and dilute hydrochloric acid
  - D copper(II) oxide and dilute hydrochloric acid
- 29 Element X forms an oxide of formula  $X_2O_5$ .

In which group of the Periodic Table is X likely to be found?

- A Group II
- B Group III
- C Group V
- D Group VIII

30 The diagram shows the structure of an alloy.

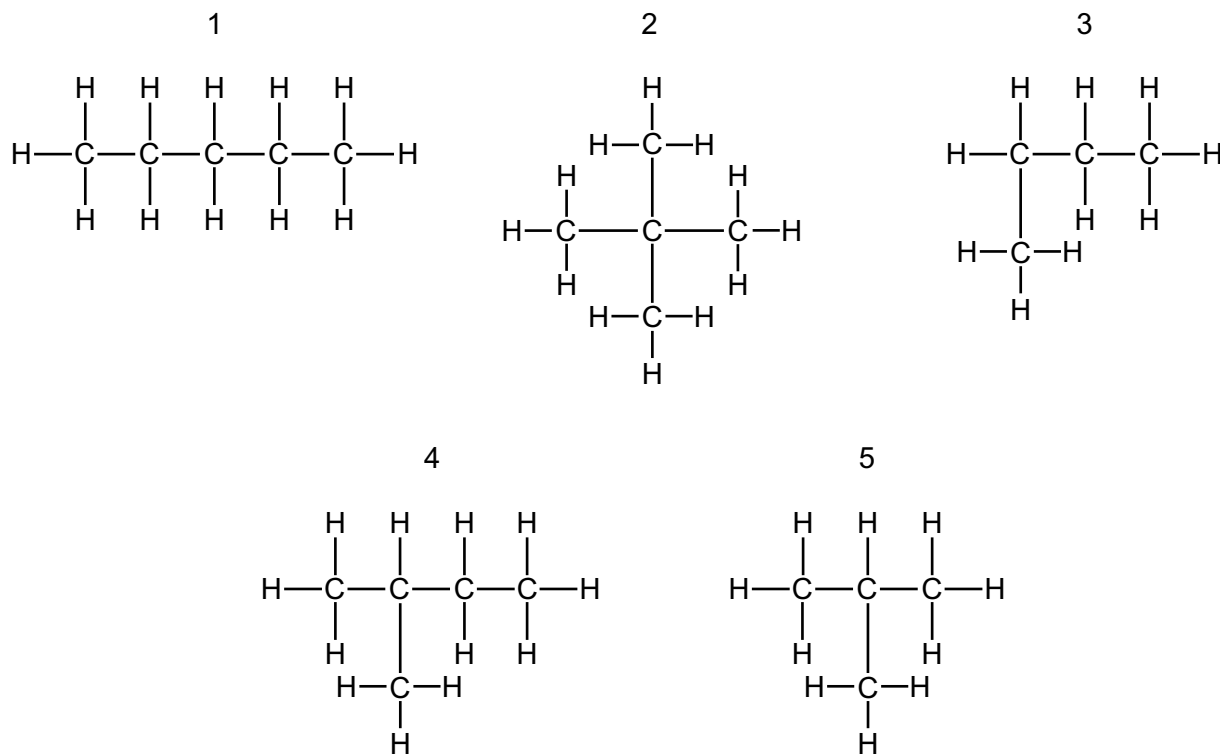


Which statement about alloys is correct?

- A Alloys can only be formed by mixing copper or iron with other metals.
  - B Carbon and iron are the only two elements in stainless steel.
  - C In an alloy there is attraction between positive ions and a 'sea' of delocalised electrons.
  - D The alloy brass has a chemical formula.
- 31 Which compound has the lowest percentage by mass of nitrogen?

- A  $(\text{NH}_2)_2\text{CO}$  [ $M_r$ : 60]
- B  $(\text{NH}_4)_2\text{SO}_4$  [ $M_r$ : 132]
- C  $(\text{NH}_4)_3\text{PO}_4$  [ $M_r$ : 149]
- D  $\text{NH}_4\text{NO}_3$  [ $M_r$ : 80]

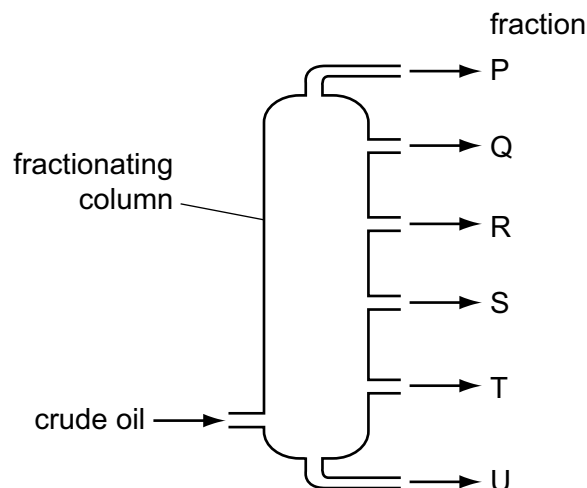
32 The diagrams show the structures of five hydrocarbons.



Which three hydrocarbons are isomers of each other?

- A** 1, 2 and 4    **B** 2, 3 and 5    **C** 2, 3 and 4    **D** 3, 4 and 5

33 The diagram shows a fractionating column used in the separation of petroleum.



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

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

34 Which compound is an alkane?

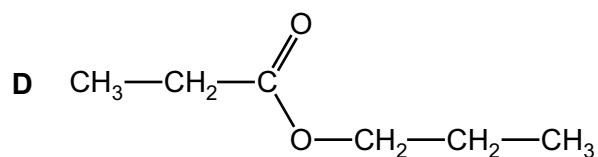
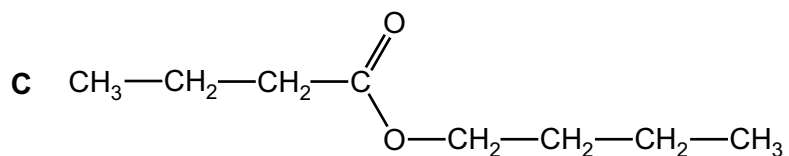
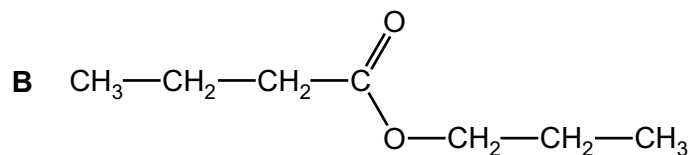
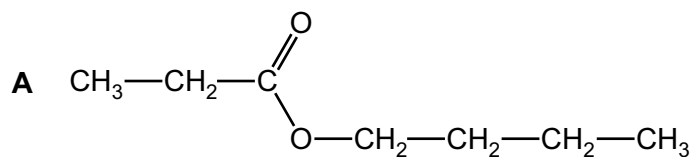
- A**  $C_{31}H_{33}$       **B**  $C_{31}H_{60}$       **C**  $C_{31}H_{62}$       **D**  $C_{31}H_{64}$

35 Which row correctly describes alkenes?

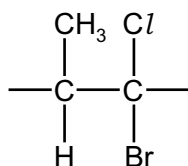
	saturated or unsaturated	result when shaken with aqueous bromine
<b>A</b>	saturated	no change
<b>B</b>	saturated	the aqueous bromine is decolourised
<b>C</b>	unsaturated	no change
<b>D</b>	unsaturated	the aqueous bromine is decolourised

- 36 A carboxylic acid with molecular formula  $C_4H_8O_2$  reacts with an alcohol with molecular formula  $C_3H_8O$  to form an ester.

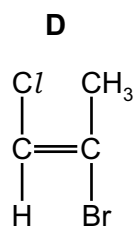
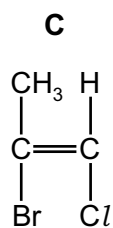
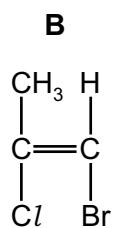
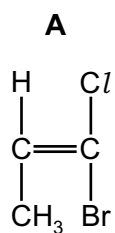
What is the formula of the ester formed?



- 37 The repeat unit of a polymer is shown.

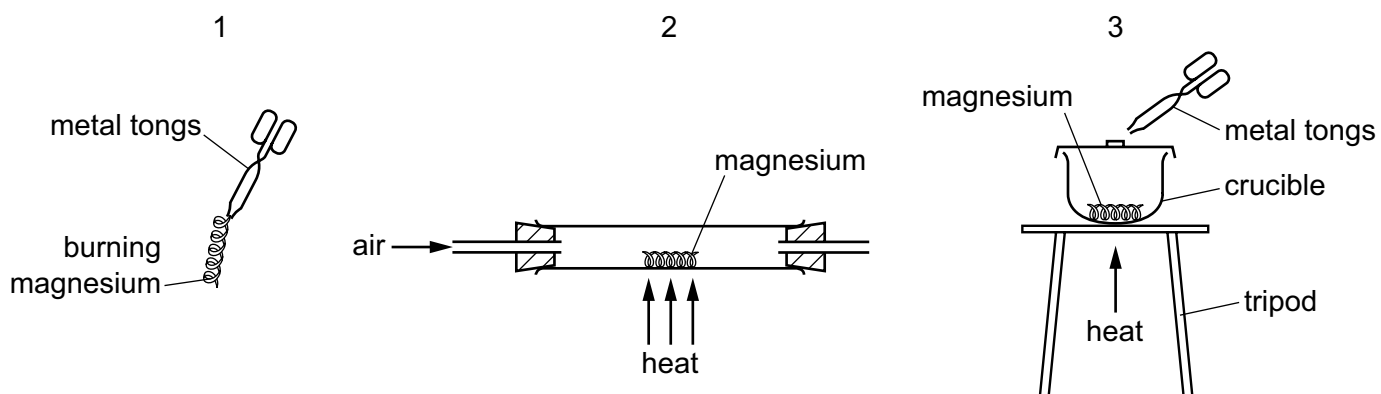


Which monomer would produce this polymer?



38 When heated, magnesium reacts with oxygen in the air to form magnesium oxide, a white powder.

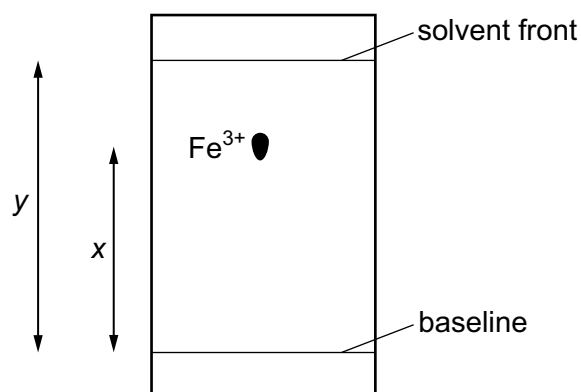
A student investigates the change in mass that occurs during this reaction. The student is given a balance and the three sets of apparatus shown.



Which sets of apparatus are suitable for this investigation?

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

39 A student uses paper chromatography to find an  $R_f$  value for  $\text{Fe}^{3+}(\text{aq})$ . The result is shown.



To make the spot containing  $\text{Fe}^{3+}(\text{aq})$  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  $R_f$  value of  $\text{Fe}^{3+}(\text{aq})$  is given by .....1..... and the colour of the precipitate is .....2.....

Which row correctly completes gaps 1 and 2?

	gap 1	gap 2
<b>A</b>	$\frac{x}{y}$	green
<b>B</b>	$\frac{x}{y}$	red-brown
<b>C</b>	$\frac{y}{x}$	green
<b>D</b>	$\frac{y}{x}$	red-brown

40 Tests on an aqueous solution of an unknown compound P are shown in the table.

test	observation
aqueous sodium hydroxide added	green precipitate, soluble in excess giving a green solution
dilute nitric acid added then aqueous barium nitrate	white precipitate
dilute nitric acid added then aqueous silver nitrate	no precipitate

Which ions are present in P?

- A  $\text{Cr}^{3+}$  and  $\text{Cl}^-$
- B  $\text{Cr}^{3+}$  and  $\text{SO}_4^{2-}$
- C  $\text{Fe}^{2+}$  and  $\text{Cl}^-$
- D  $\text{Fe}^{2+}$  and  $\text{SO}_4^{2-}$



## The Periodic Table of Elements

Group																																																																																						
I	II	III										IV	V	VI	VII	VIII																																																																						
3 <b>Li</b> lithium 7	4 <b>Be</b> beryllium 9	<b>Key</b> atomic number atomic symbol name relative atomic mass																2 <b>He</b> helium 4																																																																				
11 <b>Na</b> sodium 23	12 <b>Mg</b> magnesium 24																	1 <b>H</b> hydrogen 1	5 <b>B</b> boron 11	6 <b>C</b> carbon 12	7 <b>N</b> nitrogen 14	8 <b>O</b> oxygen 16	9 <b>F</b> fluorine 19	10 <b>Ne</b> neon 20	13 <b>Al</b> aluminium 27	14 <b>Si</b> silicon 28	15 <b>P</b> phosphorus 31	16 <b>S</b> sulfur 32	17 <b>Cl</b> chlorine 35.5	18 <b>Ar</b> argon 40	19 <b>K</b> potassium 39	20 <b>Ca</b> calcium 40	21 <b>Sc</b> scandium 45	22 <b>Ti</b> titanium 48	23 <b>V</b> vanadium 51	24 <b>Cr</b> chromium 52	25 <b>Mn</b> manganese 55	26 <b>Fe</b> iron 56	27 <b>Co</b> cobalt 59	28 <b>Ni</b> nickel 59	29 <b>Cu</b> copper 64	30 <b>Zn</b> zinc 65	31 <b>Ga</b> gallium 70	32 <b>Ge</b> germanium 73	33 <b>As</b> arsenic 75	34 <b>Se</b> selenium 79	35 <b>Br</b> bromine 80	36 <b>Kr</b> krypton 84	37 <b>Rb</b> rubidium 85	38 <b>Sr</b> strontium 88	39 <b>Y</b> yttrium 89	40 <b>Zr</b> zirconium 91	41 <b>Nb</b> niobium 93	42 <b>Mo</b> molybdenum 96	43 <b>Tc</b> technetium —	44 <b>Ru</b> ruthenium 101	45 <b>Rh</b> rhodium 103	46 <b>Pd</b> palladium 106	47 <b>Ag</b> silver 108	48 <b>Cd</b> cadmium 112	49 <b>In</b> indium 115	50 <b>Sn</b> tin 119	51 <b>Sb</b> antimony 122	52 <b>Te</b> tellurium 128	53 <b>I</b> iodine 127	54 <b>Xe</b> xenon 131	55 <b>Cs</b> caesium 133	56 <b>Ba</b> barium 137	57–71 lanthanoids	72 <b>Hf</b> hafnium 178	73 <b>Ta</b> tantalum 181	74 <b>W</b> tungsten 184	75 <b>Re</b> rhenium 186	76 <b>Os</b> osmium 190	77 <b>Ir</b> iridium 192	78 <b>Pt</b> platinum 195	79 <b>Au</b> gold 197	80 <b>Hg</b> mercury 201	81 <b>Tl</b> thallium 204	82 <b>Pb</b> lead 207	83 <b>Bi</b> bismuth 209	84 <b>Po</b> polonium —	85 <b>At</b> astatine —	86 <b>Rn</b> radon —	87 <b>Fr</b> francium —	88 <b>Ra</b> radium —

lanthanoids

57 <b>La</b> lanthanum 139	58 <b>Ce</b> cerium 140	59 <b>Pr</b> praseodymium 141	60 <b>Nd</b> neodymium 144	61 <b>Pm</b> promethium —	62 <b>Sm</b> samarium 150	63 <b>Eu</b> europium 152	64 <b>Gd</b> gadolinium 157	65 <b>Tb</b> terbium 159	66 <b>Dy</b> dysprosium 163	67 <b>Ho</b> holmium 165	68 <b>Er</b> erbium 167	69 <b>Tm</b> thulium 169	70 <b>Yb</b> ytterbium 173	71 <b>Lu</b> lutetium 175
89 <b>Ac</b> actinium —	90 <b>Th</b> thorium 232	91 <b>Pa</b> protactinium 231	92 <b>U</b> uranium 238	93 <b>Np</b> neptunium —	94 <b>Pu</b> plutonium —	95 <b>Am</b> americium —	96 <b>Cm</b> curium —	97 <b>Bk</b> berkelium —	98 <b>Cf</b> californium —	99 <b>Es</b> einsteinium —	100 <b>Fm</b> fermium —	101 <b>Md</b> mendelevium —	102 <b>No</b> nobelium —	103 <b>Lr</b> lawrencium —

actinoids

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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