





**Answer ALL questions**

1. Use the Periodic Table on page 2 to help you answer this question.

(a) State the symbol of the element that has the atomic number of 12.

.....  
(1)

(b) State the symbol of the element that has a relative atomic mass of 12.

.....  
(1)

(c) State the number of the group that contains the noble gases.

.....  
(1)

(d) Which group contains elements whose atoms form ions with a 2+ charge?

.....  
(1)

(e) Which group contains elements whose atoms form ions with a 1- charge?

.....  
(1)

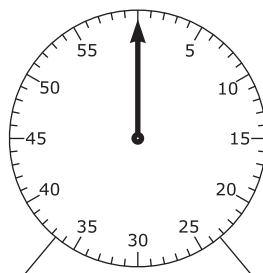
**(Total 5 marks)**

Q1

2. The diagrams show some pieces of apparatus you can find in a chemistry laboratory.



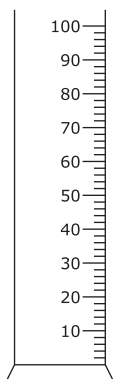
**A**



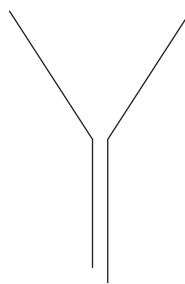
**B**



**C**



**D**



**E**

(a) Name the pieces of apparatus, **B** and **E**. Use only names from the box.

funnel	measuring cylinder	thermometer
pipette	stop clock	

**B** .....

**E** .....

(2)

(b) **Two** of the pieces shown can be used to measure the volume of a liquid. State the letters of these two pieces.

..... and .....

(2)

(c) **One** of the pieces shown cannot be used to make a measurement. State the letter of this piece.

.....

(1)

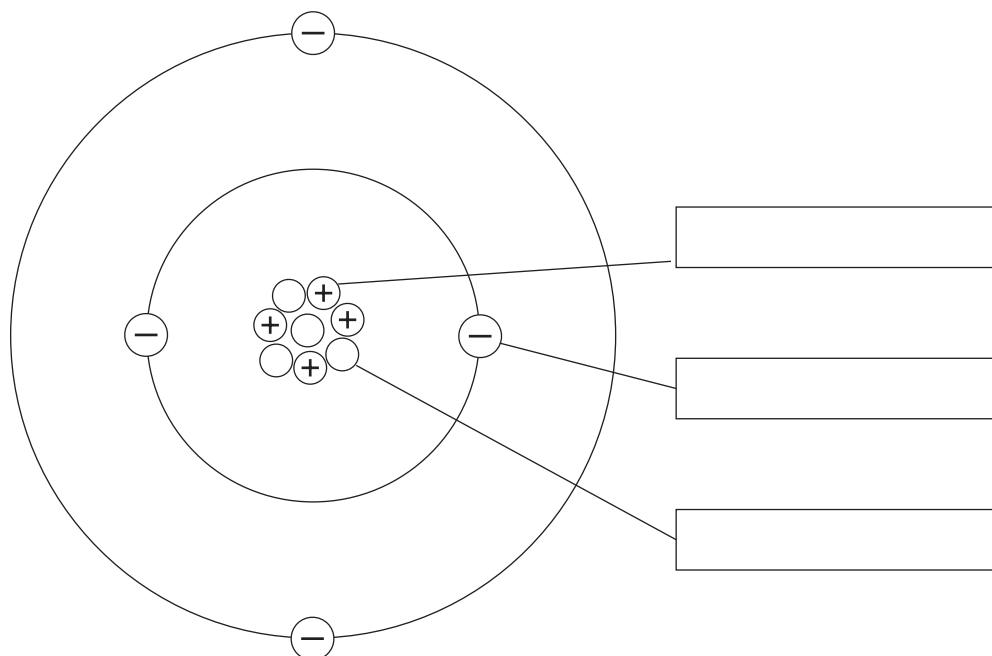
(Total 5 marks)

Q2

3. This question is about atoms.

(a) (i) Choose words from the box to label the diagram of an atom.

electron	ion
neutron	proton



(3)

(ii) State the mass number of this atom.

..... (1)

(iii) The diagram above represents the atom of an element. State the name of the element. Use the Periodic Table on page 2 to help you.

..... (1)

(b) Chlorine has two isotopes. State one way in which atoms of the two isotopes are

the same .....

.....

different .....

.....

(2)

(Total 7 marks)

Q3

4. A piece of iron is left in damp air for some time.  
A brown layer forms on the iron.

(a) Name the **two** substances in damp air that are needed for the iron to react.

1 .....

2 .....

**(2)**

(b) Name the substance in the brown layer.

.....

**(1)**

(c) The reaction between iron and damp air can be prevented by covering the iron with another material. Name **two** materials that can be used.

1 .....

2 .....

**(2)**

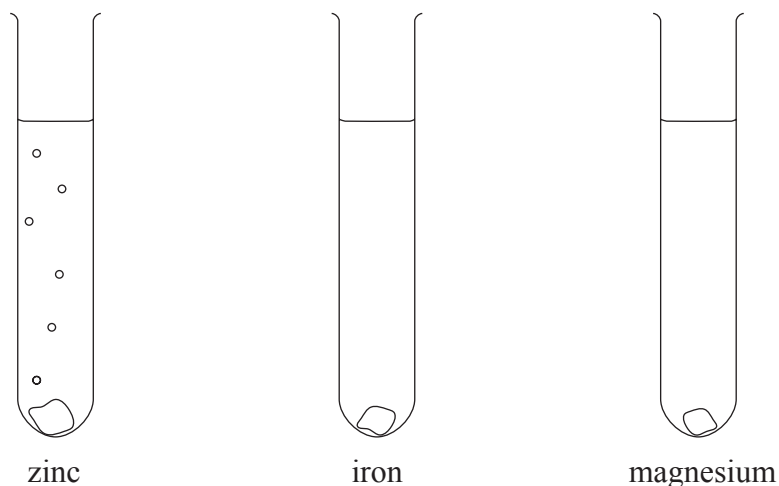
**(Total 5 marks)**

**Q4**

5. The reactivity of metals can be compared by comparing their reactions with dilute hydrochloric acid.  
 Three different metals of identical size are added to separate test tubes containing this acid.

The diagram already shows bubbles of hydrogen gas forming when a piece of zinc is added to dilute hydrochloric acid.

- (a) Complete the diagram to show the bubbles forming in the other two test tubes.



(2)

- (b) Write a word equation to show the reaction between zinc and dilute hydrochloric acid.

..... (1)

- (c) Name **one** metal that does not react when it is added to dilute hydrochloric acid.

..... (1)

- (d) Suggest **two** substances, other than acids, that can be used in reactions to compare the reactivity of metals.

1 .....

2 .....

(2)

(Total 6 marks)

Q5

6. (a) A molecule of hydrogen contains a covalent bond.

(i) What is a covalent bond?

..... (1)

(ii) Draw a dot and cross diagram to show the covalent bond in a hydrogen molecule.

(1)

(b) State a test for hydrogen gas and the result.

Test .....

Result .....

(2)

(c) State **one** industrial use of hydrogen.

..... (1)

(d) The only product of the combustion of hydrogen is water. Write a word equation for the combustion of hydrogen.

..... (1)



(e) Anhydrous copper(II) sulphate can be used to test for water.

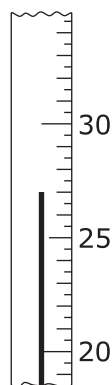
(i) Use words from the box to complete the sentence.

<b>blue</b>	<b>brown</b>	<b>colourless</b>
<b>green</b>	<b>pink</b>	<b>white</b>

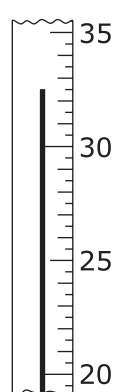
Water is a ..... liquid which changes the colour of the copper(II) sulphate from ..... to .....  
**(3)**

(ii) The diagrams show the thermometer readings of some water before and after the addition of anhydrous copper(II) sulfate. Write the temperature shown on each thermometer in the space below each diagram.

Before



After



Temperature before ..... °C      Temperature after ..... °C  
**(2)**

(iii) Calculate the temperature change that occurred.

**(1)**

Leave  
blank

(iv) What type of reaction occurs in this test? Put a cross (☒) in the correct box.

- A endothermic
- B exothermic
- C neutralisation

(1)

Q6

(Total 13 marks)

--	--

7. The equation below shows the decomposition of ammonium chloride. It is a reversible reaction.

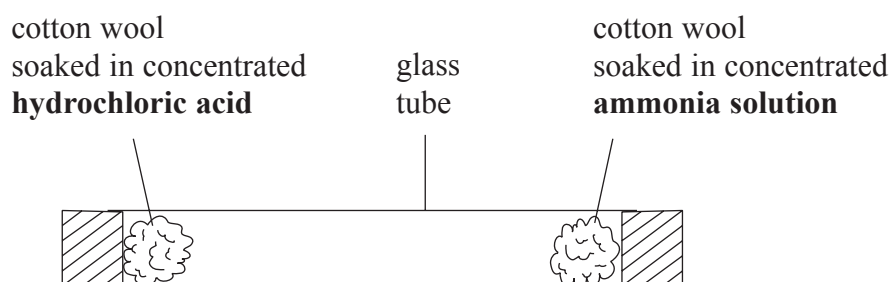


- (a) How is this reaction made to go in the **forward** direction?

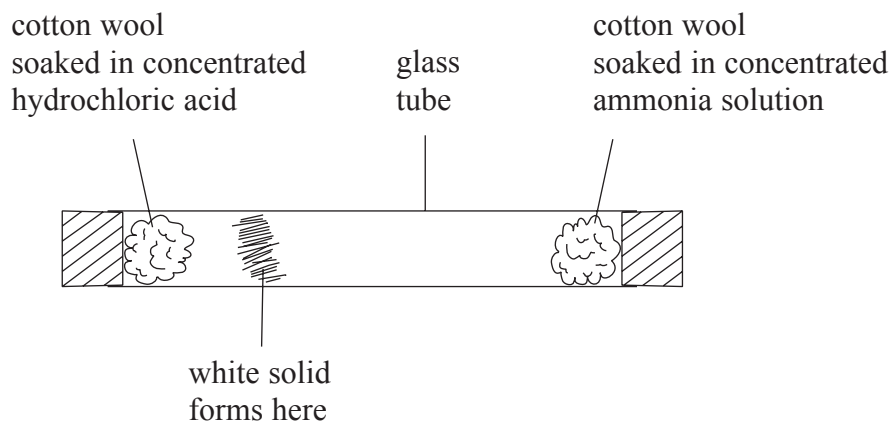
..... (1)

- (b) Concentrated hydrochloric acid gives off hydrogen chloride gas.  
Concentrated ammonia solution gives off ammonia gas.

An experiment is set up.



After a few minutes a white solid forms inside the tube. The solid forms when ammonia gas reacts with hydrogen chloride gas.



- (i) Name the process by which the ammonia and hydrogen chloride particles move inside the tube.

..... (1)

- (ii) Name the white solid that forms inside the tube.

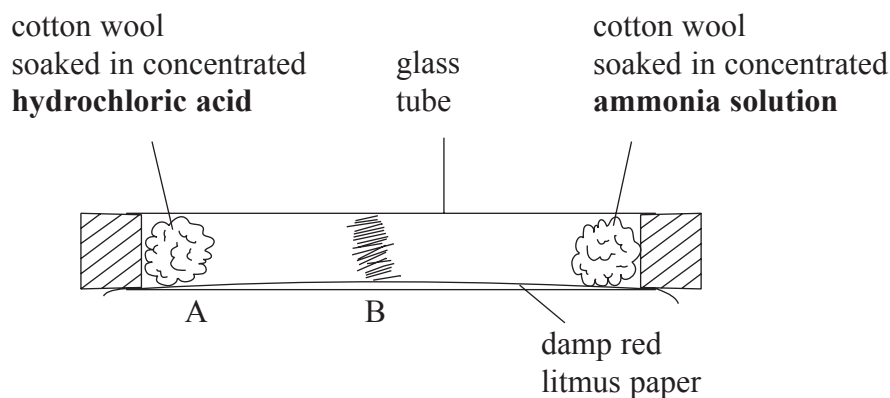
..... (1)

(iii) Suggest what the position of the white solid tells you about the relative speeds at which the ammonia and hydrogen chloride particles move.

.....  
 .....

(1)

(iv) The experiment is repeated with a strip of damp red litmus paper placed along the inside of the tube.



State the colour of the litmus paper at A and B when the white solid forms.

A .....

B .....

(2)

(Total 6 marks)

Q7

8. The alkenes are a **homologous series** of **unsaturated** hydrocarbons.

(a) (i) Place a cross (☒) in the **two** boxes that indicate which statements about members of a homologous series are correct.

A They have similar chemical properties ☒

B They have the same displayed formula ☒

C They have the same general formula ☒

D They have the same physical properties ☒

E They have the same relative formula masses ☒

(2)

(ii) State the meaning of the term **unsaturated**.

.....  
 .....

(1)

(b) Alkenes react with bromine water. Ethene is the simplest alkene.

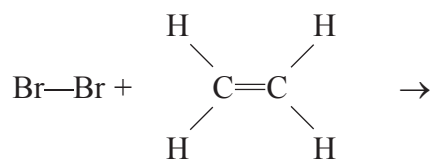
(i) Bromine water is added to ethene. State the colours of the reaction mixture at the start and the finish.

Colour at start .....

Colour at finish .....

(2)

(ii) Complete the equation by drawing the displayed formula of the product.



(1)

- (c) Isomers are compounds that have the same molecular formula but different displayed formulae.

Draw the displayed formulae of **two** isomers that have the molecular formula  $C_4H_8$ .

(2)

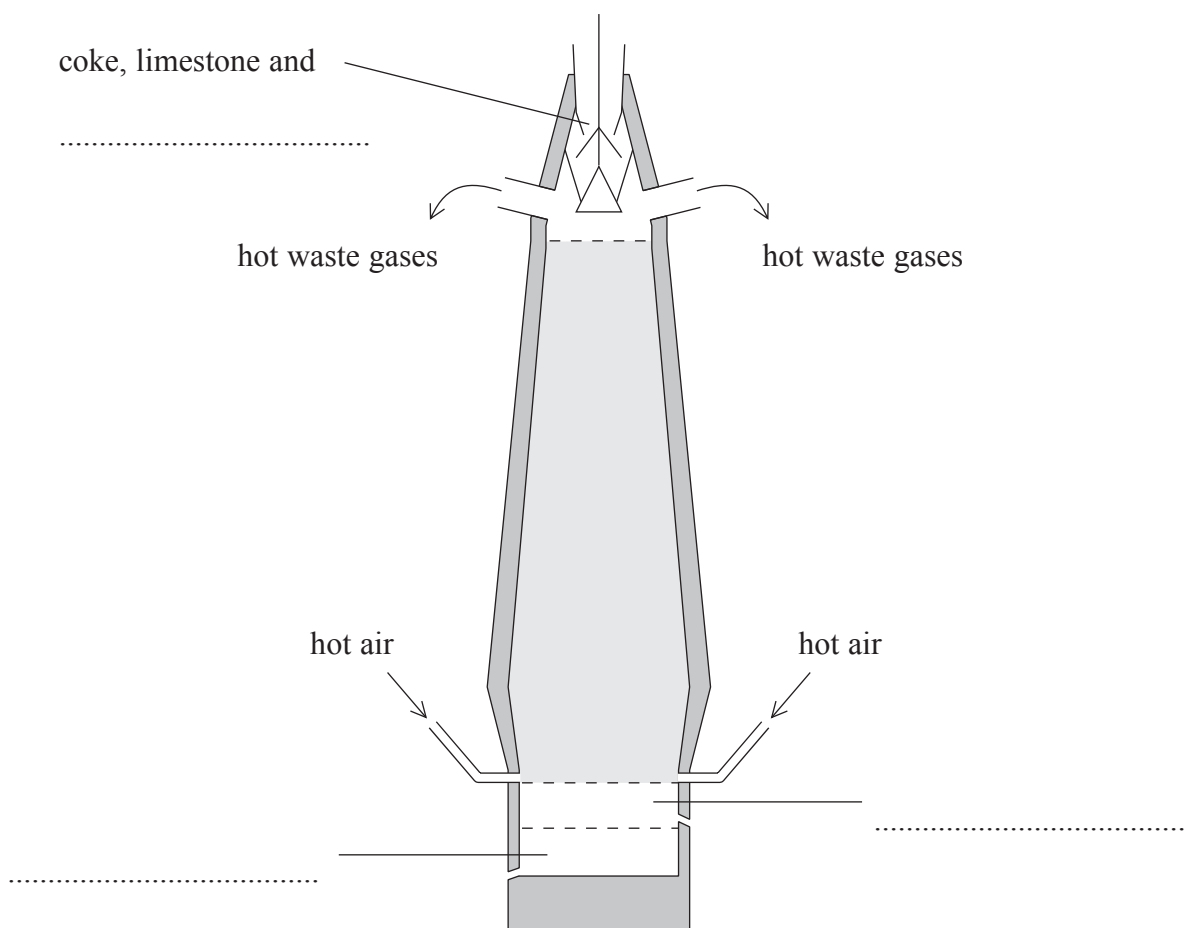
Q8

(Total 8 marks)

9. Iron is extracted from iron ore in a blast furnace.

(a) Label the diagram of the blast furnace. Use only words from the box. Each word may be used once, more than once or not at all.

<b>bauxite</b>	<b>cryolite</b>	<b>haematite</b>
<b>molten iron</b>	<b>sand</b>	<b>slag</b>



(3)

(b) Coke is composed mainly of carbon. Coke burns in the oxygen in the hot air.

(i) Write a chemical equation for the reaction which occurs when carbon burns completely in oxygen.

.....  
(1)

(ii) State why this reaction is important in the blast furnace.

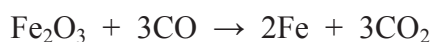
.....  
.....  
(1)

- (c) Limestone is mainly calcium carbonate. In the blast furnace limestone decomposes to give carbon dioxide and calcium oxide.

Write a chemical equation for this reaction.

.....  
(1)

- (d) Iron is produced by the reduction of iron(III) oxide. An equation for the reaction is



Suggest why this reaction is described as the reduction of iron(III) oxide.

.....  
(1)

- (e) Aluminium is another important metal.

- (i) Unlike iron, aluminium cannot be extracted from its ore using a blast furnace. Explain why.

.....  
(1)

- (ii) State **one** large-scale use of aluminium, and a property of aluminium on which this use depends.

Use .....

Property .....

(2)

Q9

(Total 10 marks)

--	--



**10.** Sodium is a very reactive metal. When a small piece of sodium is added to a trough of water it floats and reacts rapidly, giving off hydrogen gas.

A small piece of sodium is placed in a trough of water. A reaction takes place and hydrogen gas is given off.

(a) (i) State **two** observations, other than the sodium floating, that you could make during the reaction.

1 .....

2 .....

**(2)**

(ii) Write a word equation for the reaction.

.....

**(1)**

(b) A piece of platinum wire is dipped into the solution in the trough and then held in a roaring Bunsen flame. The Bunsen flame becomes coloured.

(i) State the colour that the flame becomes.

.....

**(1)**

(ii) Name the method of identification.

.....

**(1)**

(c) After the reaction with sodium, universal indicator is added to the solution remaining in the trough. State what colour it turns and explain why.

Colour .....

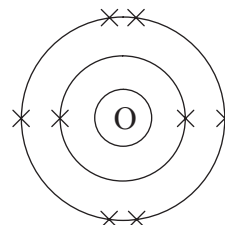
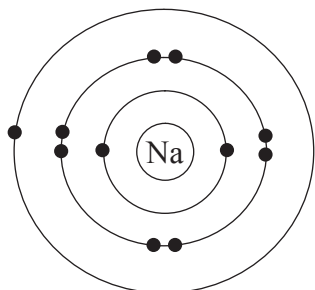
Explanation .....

.....

**(2)**

- (d) A piece of sodium is heated in a Bunsen flame. The sodium catches fire and reacts with the oxygen in the air. The product is sodium oxide.

The diagrams show the electron arrangement in an atom of sodium and an atom of oxygen.



Sodium oxide contains ionic bonds. Describe what happens, in terms of electrons, when sodium reacts with oxygen.

.....

.....

.....

.....

.....

.....

(3)

Q10

(Total 10 marks)

--	--

**BLANK PAGE**

11. Dilute hydrochloric acid reacts with solid calcium carbonate. The equation below shows this equation.



Some students investigate the effect on the rate of the reaction of changing the temperature of the hydrochloric acid. The method is:

- use a measuring cylinder to pour 50 cm<sup>3</sup> of dilute hydrochloric acid into a conical flask
- heat the acid to the required temperature
- place the flask on a balance
- add 10 g (an excess) of calcium carbonate chips to the flask
- time how long it takes for the mass to decrease by 1.00 g
- the experiment is repeated at different temperatures.

The table shows the students' results.

Temperature of acid (°C)	Time to lose 1.00 g (s)
22	93
35	68
46	65
57	40
65	33
78	26

(a) (i) On the grid opposite, draw a graph of these results. The axes and scales have been provided for you.

**(3)**

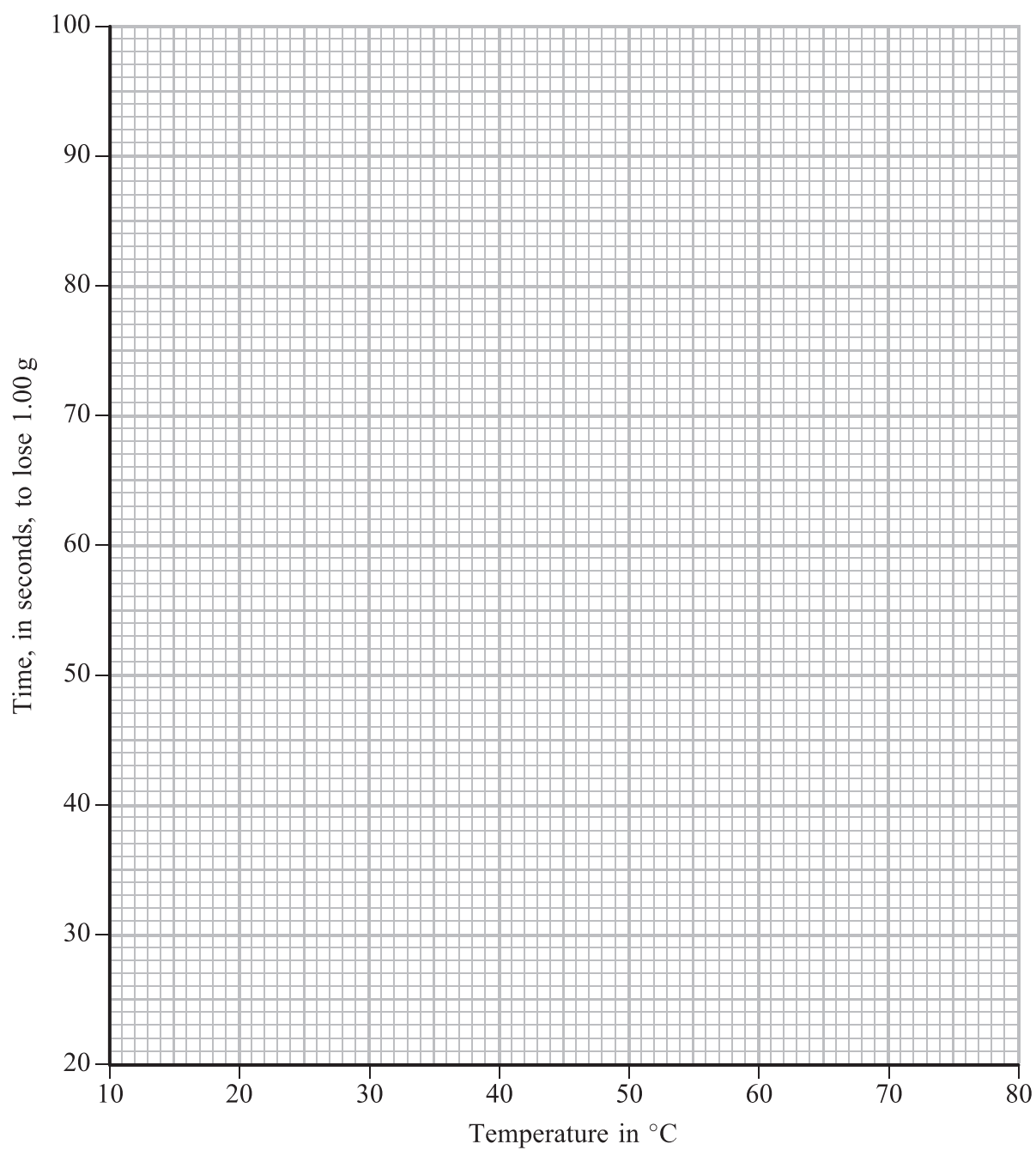
(ii) One of the points is anomalous. Circle this point on your graph.

**(1)**

(iii) The students did not make an error in reading the stopwatch. Suggest a possible cause of this anomalous result.

.....  
 .....

**(1)**



**QUESTION 11 CONTINUES OVERLEAF**

(b) (i) Use your graph to find the time taken to lose 1.00 g at 30 °C and at 52 °C.

Time at 30 °C ..... s

Time at 52 °C ..... s

(2)

(ii) The rate of the reaction can be found using the equation:

$$\text{rate of reaction} = \frac{\text{mass lost}}{\text{time taken to lose this mass}}$$

Use this equation and your results from (b)(i) to calculate the rate of reaction at 30 °C and at 52 °C.

Rate at 30 °C ..... g/s

Rate at 52 °C ..... g/s

(2)

(iii) State how the rate of reaction changes when the temperature increases.

.....  
 .....

(1)

(iv) Explain, in terms of particles and collisions, why the rate of reaction changes.

.....  
 .....  
 .....  
 .....  
 .....

(3)

(c) The students did **not** obtain any results at temperatures below room temperature, 22 °C. Describe how the method could be changed to obtain results below room temperature.

.....  
 .....  
 .....

(1)

Q11

(Total 14 marks)

--	--

12. Many useful substances are produced by the fractional distillation of crude oil.

- (a) Bitumen, fuel oil and gasoline are three fractions obtained from crude oil. There are several differences between these fractions.

Name the fraction that has the following property.

the highest boiling point range .....

molecules with the fewest carbon atoms .....

the darkest colour .....

**(3)**

- (b) Some long-chain hydrocarbons are converted into more useful products by a chemical process. Name this process and describe how it is carried out.

.....  
 .....  
 .....  
 .....  
 .....

**(3)**

- (c) Some hydrocarbons, such as methane, are used as fuels. When methane undergoes incomplete combustion, carbon monoxide is formed.

- (i) Write a balanced chemical equation for this reaction.

.....

**(2)**

- (ii) Explain why it is dangerous to breathe air containing carbon monoxide.

.....  
 .....  
 .....  
 .....

**(2)**

**(Total 10 marks)**

**Q12**

13. Three of the elements in Group 7 of the Periodic Table are chlorine, bromine and iodine.

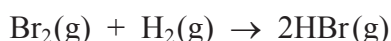
(a) State the electronic configuration of chlorine.

..... (1)

(b) State the number of electrons present in the outer shell of an atom of iodine.

..... (1)

(c) Bromine reacts with hydrogen to form hydrogen bromide. The chemical equation for the reaction is



Describe the colour change occurring during the reaction.

Colour change ..... (2)

(d) Hydrogen bromide and hydrogen chloride have similar chemical properties.

(i) A sample of hydrogen bromide is dissolved in water.

A piece of blue litmus paper is placed in the solution. State, with a reason, the final colour of the litmus paper.

Colour .....

Reason .....

..... (2)

(ii) A sample of hydrogen bromide is dissolved in methylbenzene.

A piece of blue litmus paper is placed in the solution. State, with a reason, the final colour of the litmus paper.

Colour .....

Reason .....

..... (2)

(Total 8 marks)

Q13



14. (a) A solution was made by dissolving 1.62 g of hydrogen bromide, HBr, in 250 cm<sup>3</sup> of water.

(i) Calculate the relative formula mass of hydrogen bromide. Use data from the Periodic Table on page 2.

.....  
 .....  
 (1)

(ii) Calculate the amount, in moles, of hydrogen bromide in a 1.62 g sample.

.....  
 .....  
 .....  
 .....  
 (2)

(iii) Calculate the concentration, in mol dm<sup>-3</sup>, of the hydrogen bromide solution.

.....  
 .....  
 .....  
 .....  
 (2)

(iv) Calculate the concentration, in g dm<sup>-3</sup>, of the hydrogen bromide solution.

.....  
 .....  
 .....  
 .....  
 (2)

(b) Hydrogen bromide solution can be neutralised by adding sodium hydroxide solution.

(i) Write a chemical equation for this neutralisation reaction.

.....  
**(1)**

(ii) Explain, with reference to ions, why this reaction is described as a neutralisation reaction.

.....  
 .....  
 .....  
 .....  
**(1)**

(c) A 20.0 cm<sup>3</sup> sample of a solution of hydrogen bromide had a concentration of 0.200 mol dm<sup>-3</sup>.

(i) Calculate the amount, in moles, of hydrogen bromide in 20.0 cm<sup>3</sup> of 0.200 mol dm<sup>-3</sup> solution.

.....  
 .....  
**(2)**

(ii) Calculate the volume of 0.100 mol dm<sup>-3</sup> sodium hydroxide solution needed to neutralise this sample of hydrogen bromide solution.

.....  
 .....  
**(2)**

**Q14**

**(Total 13 marks)**

**TOTAL FOR PAPER: 120 MARKS**

**END**