Rewarding Learning

71	

Candidate Number

General Certificate of Secondary Education
2009

Science: Chemistry

Paper 2
Foundation Tier

[G1402]

G1402

WEDNESDAY 17 JUNE, MORNING

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all six** questions.

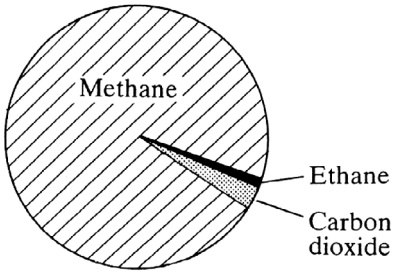
INFORMATION FOR CANDIDATES

The total mark for this paper is 120.
Quality of written communication will be assessed in question **6(a)(iv)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet which includes a Periodic Table of the Elements is provided.

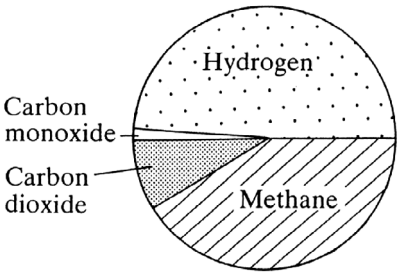
For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
6	
Total Marks	

Examiner Only	
Marks	Remark

1 Before large amounts of natural gas were discovered under the North Sea the main gas used in the UK was coal gas. The diagrams below show the composition of natural gas and coal gas.



Natural gas



Coal gas

(a) (i) Describe a chemical test that you could use to show that both gases contained carbon dioxide. State the result for a positive test.

_____

_____

_____ [3]

(ii) Name the substance in coal gas which is toxic.

_____ [1]

(iii) Name the substances formed when natural gas burns in a plentiful supply of air.

_____

_____ [2]

(iv) When both natural gas and coal gas burn, heat energy is given out. State the name used to describe a reaction which gives out heat.

_____ [1]

(v) Natural gas contains two **hydrocarbons**, ethane and methane. What is meant by the term hydrocarbon?

_____

_____ [2]

(vi) Coal gas contains hydrogen. Write a balanced symbol equation for hydrogen burning in oxygen.

_____ [3]

(b) The table shows the percentage of different energy sources used in the UK in 2004.

Energy Source	Percentage (%)
coal	26
crude oil	46
natural gas	18
nuclear power	3
hydroelectric power	6
others (wood, alcohol etc.)	0.5
solar power	0.5

(i) Name **two** energy sources from the table which are renewable.

_____

_____ [2]

(ii) Explain the difference between renewable and non-renewable sources of energy.

_____

_____

_____ [2]

(iii) One of the energy sources is also used to make many organic chemicals, for example, plastics. Name this energy source.

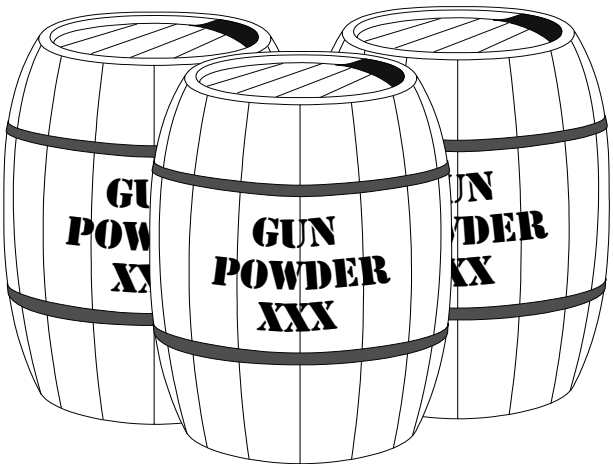
_____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

2 **(a)** Gunpowder is an explosive material which contains the salt potassium nitrate. In the 15th and 16th centuries potassium nitrate was obtained from urine. Nowadays potassium nitrate can be manufactured by neutralisation.



(i) What do you understand by the term **salt**?

_____

_____ [2]

(ii) Write the formula for potassium nitrate.

_____ [1]

(iii) Name **two compounds** which would react together to form potassium nitrate.

1. _____

2. _____ [2]

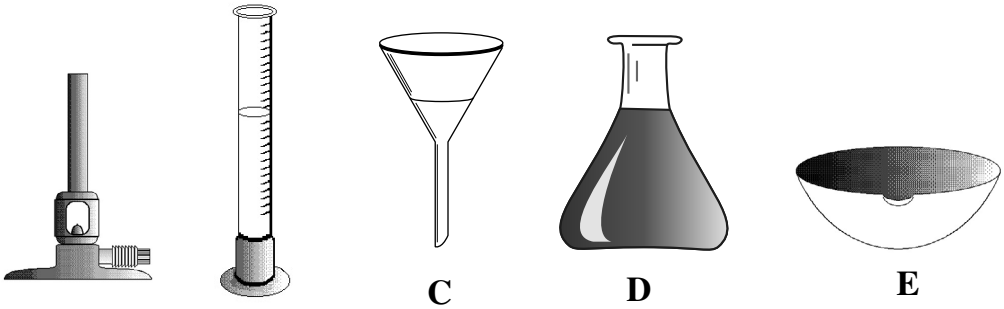
(b) Complete the following word equations for the reactions of acids.

(i) + → zinc sulphate + hydrogen [2]

(ii) + → potassium chloride + water [2]

Examiner Only	
Marks	Remark

(c) Sodium chloride is another salt and it may be prepared from the reaction between sodium hydroxide solution and hydrochloric acid. Some of the apparatus needed for this preparation is shown below.



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

(i) Name the pieces of apparatus labelled **A**, **B**, **C**, **D** and **E** in the diagrams above.

A _____

B _____

C _____

D _____

E _____ [5]

Using only the letters **A** to **E** answer the following questions.

(ii) Which piece of apparatus could be used to measure out 25 cm^3 of sodium hydroxide solution?

_____ [1]

(iii) In which piece of apparatus would you place the 25 cm^3 of sodium hydroxide solution before adding the acid?

_____ [1]

(iv) Which **two** pieces of apparatus would you need to evaporate some of the water from the salt solution?

_____ [2]

(d) Zinc chloride is a soluble salt which may be prepared by adding excess zinc carbonate to hydrochloric acid.

(i) State one way you would know that the zinc carbonate was in excess.

_____

_____ [1]

(ii) Write a balanced symbol equation for the reaction of zinc carbonate with hydrochloric acid.

_____ [3]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

3 Bordeaux mixture is a combination of copper(II) sulphate and calcium hydroxide invented in the vineyards of the Bordeaux region of France, and used mainly to control fungus on grapes, apples and peaches.

Source: http://www.organiccatalog.com/catalog/product_info.php?cPath=61_:181&products_id=517

(a) Bordeaux mixture is prepared by making a solution of copper(II) sulphate and a solution of calcium hydroxide, and the two solutions are then poured together through a strainer.

(i) What colour is copper(II) sulphate solution?

_____ [1]

(ii) What colour is calcium hydroxide solution?

_____ [1]

(iii) What is the common name for a solution of calcium hydroxide?

_____ [1]

(iv) Write the formula for calcium hydroxide.

_____ [1]

(v) What is meant by the term solution?

_____

_____ [2]

[Turn over

Examiner Only	
Marks	Remark

(b) To prepare a solution of copper(II) sulphate for use in Bordeaux mixture, 6.8 g of hydrated copper(II) sulphate crystals were crushed and added to 20 cm^3 of water in a boiling tube.

The mixture was stirred with a thermometer and heated very gently in a water bath. All the crystals dissolved and a **saturated solution** was obtained at 50 °C.

(i) State the **three** procedures in this experiment which helped to increase the speed of dissolving.

1. _____

2. _____

3. _____ [3]

(ii) Draw a **labelled diagram** of the assembled apparatus used to heat and dissolve the copper(II) sulphate crystals.

[4]

(iii) Explain what is meant by the term **saturated solution**.

_____

_____

_____ [2]

(c) Bordeaux mixture sometimes finds its way into lakes and rivers where it is dangerous for aquatic life.

State **two other** causes of pollution in water.

1. _____

2. _____ [2]

(d) Like Bordeaux mixture, sulphur dioxide gas is used to control fungus on grapes.

(i) How does the solubility of sulphur dioxide gas change as the temperature increases?

_____ [1]

(ii) State one other use for sulphur dioxide.

_____ [1]

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

(i) What is meant by the term anhydrous?

_____ [1]

(ii) What colour is anhydrous copper sulphate?

_____ [1]

(iii) Name one other chemical which could be used to test for water.

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 The Periodic Table contains all known elements. It evolved from the study of the trends and patterns in the physical and chemical properties of the elements.

(a) (i) Name the Russian chemist who devised a Periodic Table very similar to the modern Periodic Table used today.

_____ [1]

(ii) Fill in the blanks in the following passage.

The modern Periodic Table arranges the elements in order of increasing atomic _____ whereas early versions of the Periodic Table arranged them in order of increasing atomic _____. [2]

(iii) Name the English chemist who devised "a law of octaves" for the elements.

_____ [1]

(b) The Periodic Table groups together elements with similar properties.

(i) How many groups are there in the Periodic Table?

_____ [1]

(ii) In which group would you find the most reactive metals?

_____ [1]

(iii) Name the group which contains only non-metals which are unreactive.

_____ [1]

(iv) How does the reactivity of the elements in Group II change on descending the group?

_____ [1]

(c) There are many patterns and trends in the Periodic Table.

Examiner Only	
Marks	Remark

(i) What is the name given to the horizontal rows in the Periodic Table?

_____ [1]

(ii) What is the relationship between the position of an element in the Periodic Table and the number of electrons in the outer shell of an atom of the element?

_____

_____ [1]

(iii) Atoms of Group II elements form simple ions. What is the charge on these ions?

_____ [1]

(d) Samples of oxides of elements were tested for their solubility in water. The pH of any resulting solution was recorded. The reaction of the oxides with dilute hydrochloric acid was also noted. The results are summarised in the table below.

Unknown oxide	Soluble in water	pH of solution	Reaction with dilute hydrochloric acid
A	YES	14	YES
B	NO	—	YES
C	YES	2	NO

(i) Which letter, **A**, **B or C**, represents an oxide of a non-metal?

_____ [1]

(ii) Which letter, **A**, **B or C**, represents an oxide which is a base, but is not an alkali?

_____ [1]

(iii) Which letter, **A**, **B or C**, represents an alkali?

_____ [1]

(iv) Write a balanced symbol equation for the reaction of the base magnesium oxide with dilute hydrochloric acid.

_____ [3]

(e) Some **elements** form neutral oxides.

Name one **element** which forms a neutral oxide and write the formula of this oxide.

Element: _____

Formula of oxide: _____ [2]

Examiner Only

Marks	Remark

5 Metals show a variety of physical and chemical properties. Some metals react with cold water and others, which do not react with cold water, will react with steam.

Examiner Only

Marks	Remark

(a) Some of the physical properties of metals and their meanings are given in the table below. Complete the table.

Physical Property	Meaning
malleable	
	can be drawn out into wires
lustrous	

[3]

(b) Both potassium and calcium react with cold water. Complete both of the tables below stating the observations and writing a balanced symbol equation for each reaction.

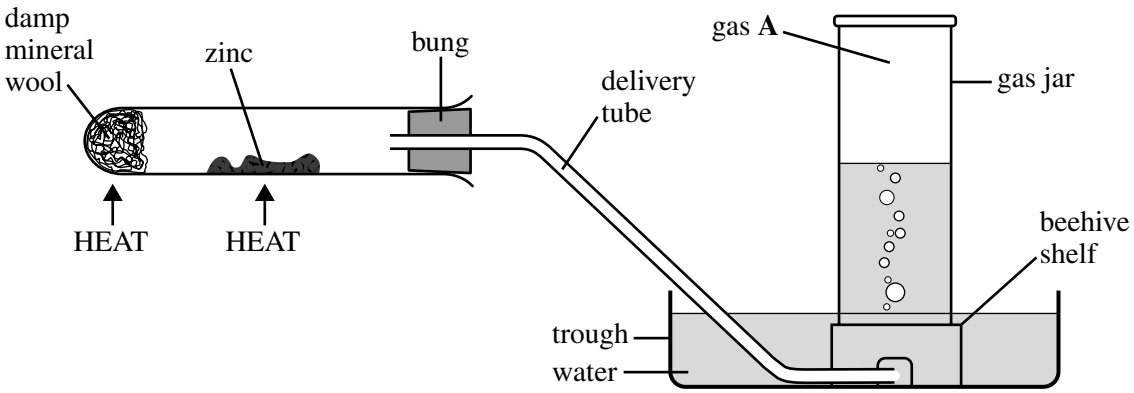
potassium and water	
observations	[4]
balanced symbol equation	[3]

calcium and water	
observations	[3]
balanced symbol equation	[3]

Examiner Only	
Marks	Remark

(c) Zinc does not react with cold water, but does react with steam.

The diagram below shows the apparatus used to react zinc with steam and to collect the gaseous product.



(i) Explain why the damp mineral wool is heated.

_____

_____ [1]

(ii) What is the name of gas **A**?

_____ [1]

(iii) Write a balanced symbol equation for the reaction of zinc with steam.

_____ [2]

(iv) Name **one other** metal which does not react with cold water but does react with steam.

_____ [1]

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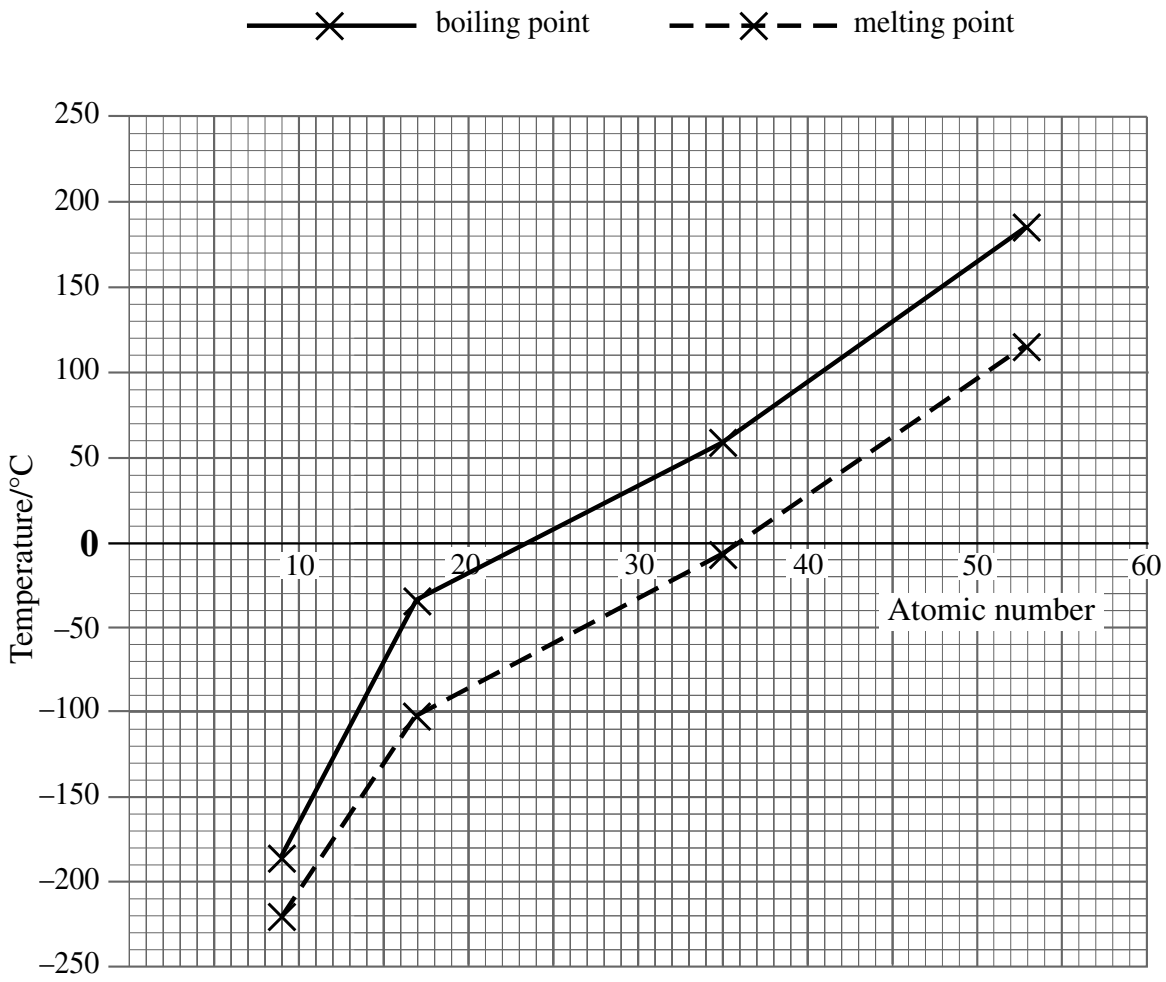
(Questions continue overleaf)

Examiner Only	
Marks	Remark

6 **(a)** The graph shows the melting points and the boiling points of the first four elements in the same group of the Periodic Table, against their atomic number.



(i) State the electronic configuration of the element with the **lowest** melting point.

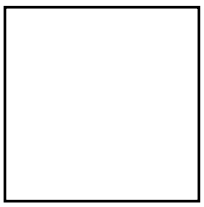
_____ [1]

(ii) Use the graph to find the melting point and boiling point of the elements with atomic number 17 and 35 and use this information to work out the states of these elements at room temperature and pressure (20 °C).

	Element with atomic number 17	**Element with atomic number 35**
Melting point (°C)		
Boiling point (°C)		
Physical state at room temperature		

[6]

(iii) Draw a diagram to show how the particles are arranged at 20 °C in the element with atomic number 17.



Element
(atomic number 17) [1]

(iv) The graph shows data for the first four elements in this group. The fifth element in this group is a solid at room temperature and pressure. Explain what happens, in terms of particles, when this solid is heated and changes to a liquid.

_____

_____

_____

_____

_____

_____ [3]

Quality of written communication [2]

(v) One of the elements in this group sublimes when heated. What is meant by the term sublimation?

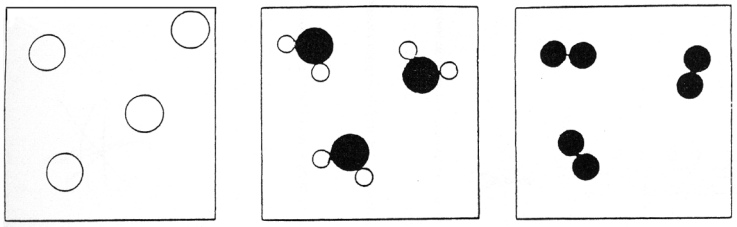
_____ [1]

Examiner Only

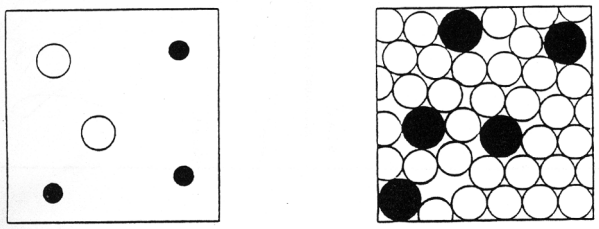
Marks	Remark

(b) The diagrams below represent elements, compounds and mixtures.

Examiner Only	
Marks	Remark



A **B** **C**



D **E**

Use the letters **A**, **B**, **C**, **D** or **E** to answer the questions below. Each letter may be used once, more than once, or not at all.

State which of the diagrams could represent:

(i) a gaseous mixture of argon and neon _____

(ii) a mixture of two solids _____

(iii) oxygen gas O_2 _____

(iv) a gas such as helium _____

(v) a compound which is a gas _____ [5]

THIS IS THE END OF THE QUESTION PAPER