

Candidate Name	Centre Number	Candidate Number
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GCSE

240/02

ADDITIONAL SCIENCE

HIGHER TIER

CHEMISTRY 2

P.M. THURSDAY, 15 January 2009

45 minutes

For Examiner's use only	
Total Mark	

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

Answer **all** questions.

1. (a) Complete the following table that shows information about the atoms of some elements. [5]

The Periodic Table of Elements shown on the **back cover of this examination paper** may be of help in answering this question.

<i>Element</i>	<i>Symbol</i>	<i>Number of protons</i>	<i>Number of neutrons</i>	<i>Number of electrons</i>
sodium	${}_{11}^{23}\text{Na}$	11	12	11
neon	${}_{10}^{20}\text{Ne}$	.....	10	.....
calcium	.....	20	20	20
.....	${}_{15}^{31}\text{P}$	15	.....	15

- (b) (i) State what is meant by the relative atomic mass (A_r) of an element. [1]

.....

- (ii) Calculate the relative molecular mass (M_r) of nitric acid, HNO_3 . [2]

$$A_r(\text{H}) = 1; \quad A_r(\text{N}) = 14; \quad A_r(\text{O}) = 16$$

.....

$$M_r(\text{HNO}_3) = \dots\dots\dots$$

2. (a) Complete the table below to show the structural formulae for the hydrocarbons given. [2]

<i>Name</i>	<i>methane</i>	<i>ethane</i>	<i>ethene</i>
<i>Formula</i>	CH ₄	C ₂ H ₆	C ₂ H ₄
<i>Structural formula</i>	.....	.....	$ \begin{array}{c} \text{H} & & \text{H} \\ & \diagdown & / \\ & \text{C} = \text{C} & \\ & / & \diagdown \\ \text{H} & & \text{H} \end{array} $

- (b) Ethene can be produced during a process known as cracking. For example:



State **two** conditions necessary for cracking to take place. [2]

..... and

- (c) Polythene is produced from ethene.

(i) Name the process taking place when polythene is produced from ethene. [1]

.....

(ii) Give **one** use of polythene. [1]

.....

(iii) Give **one** reason why recycling of plastics, such as polythene, is important for the environment. [1]

.....

.....

3. (i) Disposable nappies contain a type of smart material that is capable of absorbing several times its own weight of water. Name the type of smart material used in these nappies. [1]

.....

- (ii) In terms of structure, state how this smart material is able to absorb such a large amount of water. [1]

.....

.....

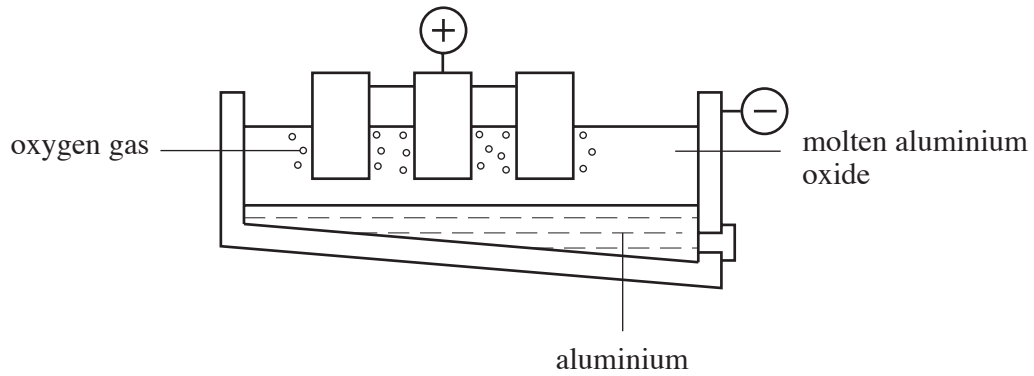
- (iii) Apart from nappies, give **one** other use for this type of smart material. [1]

.....

- (iv) Shape memory alloys are another type of smart material. State the property of shape memory alloys that makes them more suitable for making spectacle frames than traditional materials. [1]

.....

4. The process of electrolysis can be used to extract reactive metals, such as aluminium, from their ores.



- (i) State what is meant by the term *electrolysis*. [2]

.....

.....

- (ii) Give **one** reason for this process being expensive. [1]

.....

.....

- (iii) Give **two** ways in which the cost of **this process** is reduced. [2]

.....

.....

- (iv) Give **one** way in which **this process** causes harm to the environment. [1]

.....

5. (a) The table below shows some physical properties of magnesium chloride.

<i>Melting point / °C</i>	<i>Boiling point / °C</i>	<i>Solubility in water</i>
714	1412	Soluble

- (i) Using the information given in the table above, state the type of **structure** found in magnesium chloride. [1]

.....

- (ii) State why the bonding in magnesium chloride produces a solid with a high melting point. [1]

.....

- (iii) State and explain **one** other property of this type of compound. [2]

.....

.....

- (b) Chlorine gas, Cl₂, consists of molecules.

- (i) By means of a diagram, show the bonding in a chlorine molecule. [2]

- (ii) Name this type of bonding. [1]

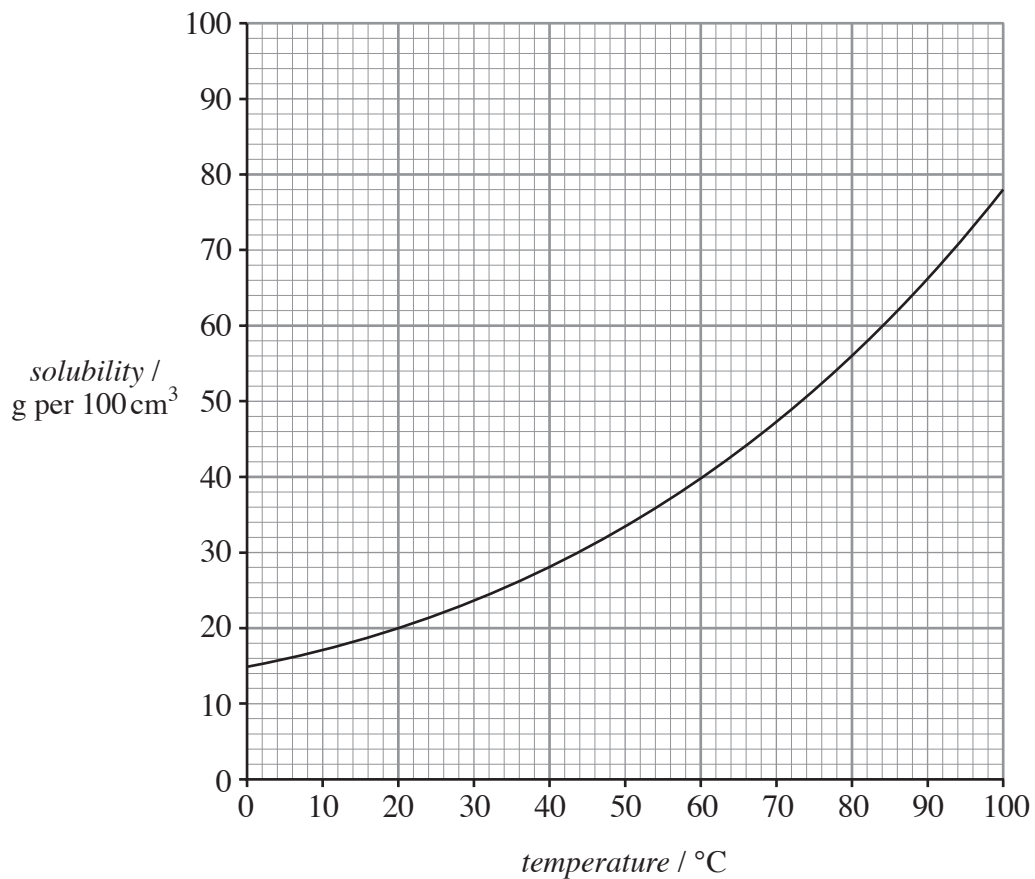
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- (iii) Explain in terms of bonding why chlorine has such a low boiling point that it is a gas at room temperature. [2]

.....

.....

6. The following graph shows how the solubility of copper sulphate varies with temperature.



Use the graph above to answer parts (i) and (ii).

- (i) Give the solubility of copper sulphate at 80°C.

[1]

.....

- (ii) If a saturated solution in 100 cm³ of water at 80°C is cooled to 30°C, calculate the mass of crystals that will form.

[2]

.....

.....

7. Ammonia is made industrially from nitrogen and hydrogen by the Haber process.

- (i) Write the balanced **symbol** equation for the formation of ammonia from nitrogen and hydrogen in the Haber process. [3]



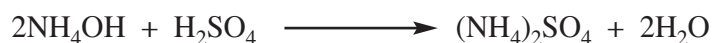
- (ii) Describe how a scientist could carry out a test to identify ammonia gas. Name any reagents used and give the result you would expect. [2]

.....

.....

.....

- (iii) One use of ammonia is in the production of fertilisers such as ammonium sulphate. The reaction involves neutralising a solution of ammonia (ammonium hydroxide) with sulphuric acid. The equation for the reaction is given below.



Use the equation to calculate the maximum mass of ammonium sulphate that can be produced from 70 g of ammonium hydroxide. [3]

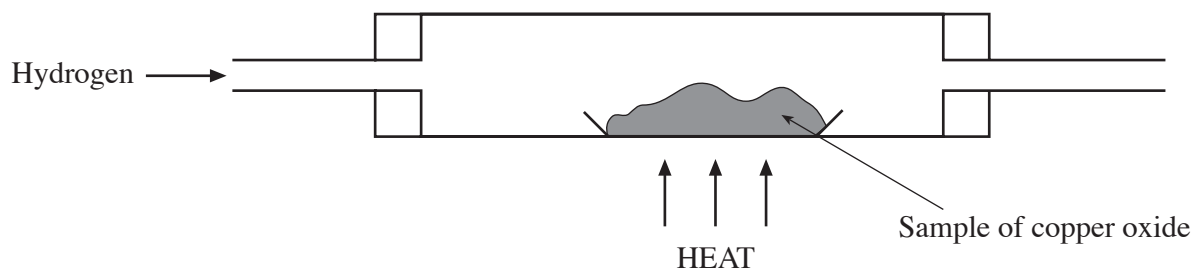
$$A_r(\text{H}) = 1; \quad A_r(\text{N}) = 14; \quad A_r(\text{O}) = 16; \quad A_r(\text{S}) = 32$$

.....

.....

.....

8. A sample of 7.2 g of copper oxide is reduced by heating in a stream of hydrogen using the apparatus shown below. After heating, 6.4 g of copper was produced.



- (i) Give the meaning of the term *reduction*. [1]

- (ii) Use the figures given above to calculate

- I. the mass of oxygen in 7.2 g of the oxide, [1]

- II. the empirical formula for this oxide of copper. [3]

Show your workings

$$A_r(\text{O}) = 16; \quad A_r(\text{Cu}) = 64$$

Empirical formula

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FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	Formula	Name	Formula
Aluminium	Al^{3+}	Bromide	Br^-
Ammonium	NH_4^+	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^-
Calcium	Ca^{2+}	Fluoride	F^-
Copper(II)	Cu^{2+}	Hydroxide	OH^-
Hydrogen	H^+	Iodide	I^-
Iron(II)	Fe^{2+}	Nitrate	NO_3^-
Iron(III)	Fe^{3+}	Oxide	O^{2-}
Lithium	Li^+	Sulphate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^+		
Silver	Ag^+		
Sodium	Na^+		

