

Candidate Name	Centre Number	Candidate Number
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GCSE

240/02

**ADDITIONAL SCIENCE
HIGHER TIER
CHEMISTRY 2**

A.M. THURSDAY, 4 June 2009

45 minutes

For Examiner's use only		
Question	Maximum Mark	Mark awarded
1.	5	
2.	6	
3.	4	
4.	5	
5.	5	
6.	5	
7.	6	
8.	7	
9.	7	
Total	50	

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

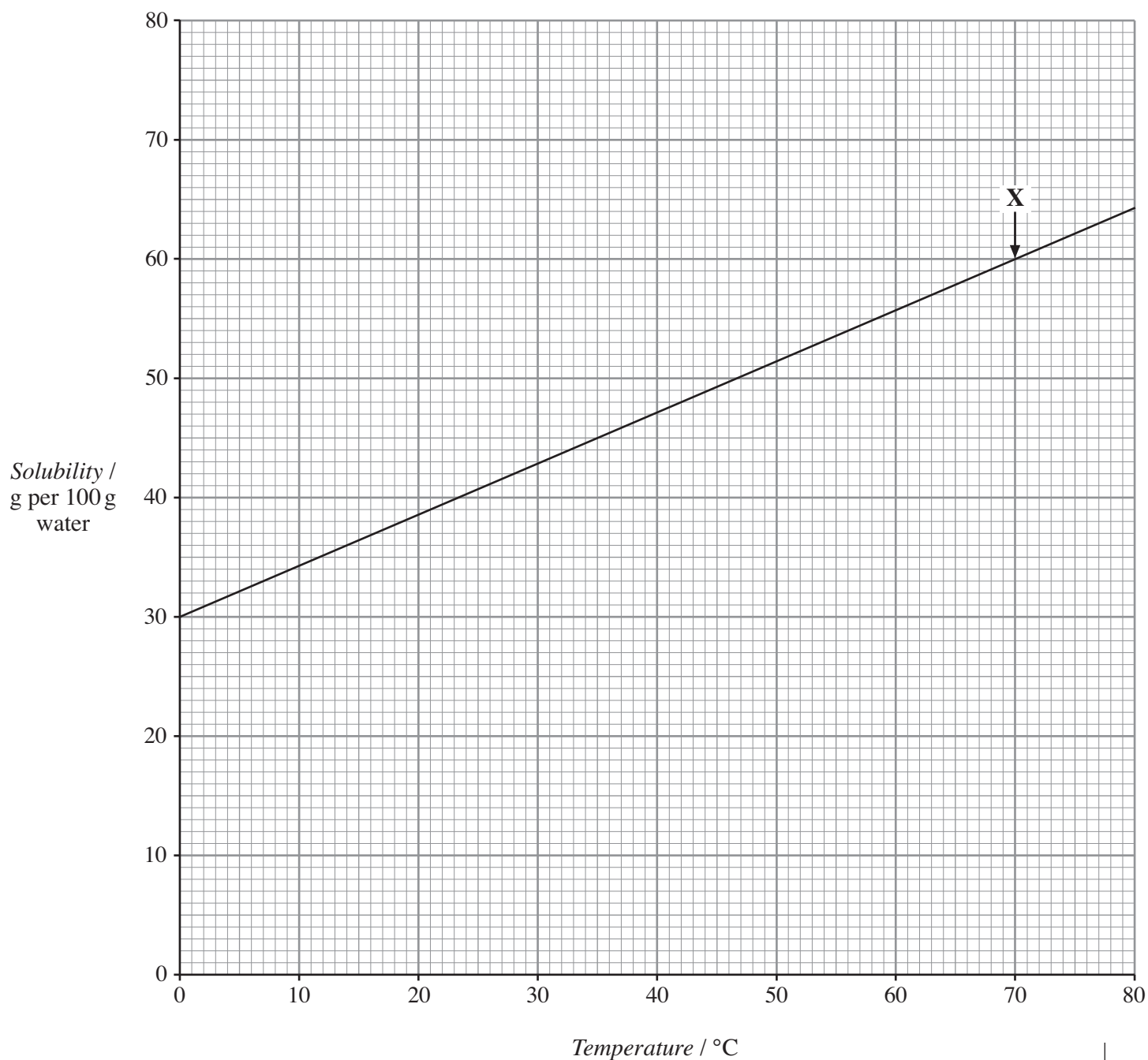
The number of marks is given in brackets at the end of each question or part-question.

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. The graph below shows the solubility of ammonium chloride in water at various temperatures.



Use the graph to answer parts (i) to (iii).

(i) Give the

I. solubility of ammonium chloride at 40 °C,

..... g per 100 g water. [1]

II. lowest temperature at which 100 g of water can dissolve 45 g of ammonium chloride.

..... °C [1]

(ii) State, **in full**, the information that can be obtained from the point marked **X** on the graph. [1]

.....
.....

(iii) Calculate the mass of ammonium chloride solid that would form when a saturated solution in 100 g of water at 30 °C cools to 5 °C. [2]

.....

2. (a) (i) The following metals are listed in order of their reactivity.

Most reactive: magnesium
zinc
iron
Least reactive: copper

When a mixture of powdered magnesium and copper oxide is heated, a violent reaction takes place. In the reaction, the magnesium is *oxidised* to magnesium oxide.

- I. Complete the **word** equation below for the reaction between magnesium and copper oxide.

magnesium + copper oxide \longrightarrow + [1]

- II. Explain the meaning of the term *oxidised*. [1]

.....

- (ii) Tin does not react with iron oxide but it *reduces* lead oxide.

- I. Explain the meaning of the term *reduce*. [1]

.....

- II. Arrange tin, iron and lead in order of decreasing reactivity. [1]

Most reactive:

.....

Least reactive:

- (b) A pupil had four metals **A**, **B**, **C** and **D**. She placed each metal in turn into separate solutions of the nitrate of the other three. The results were:

A displaced **D**
B displaced **A**
B displaced **D**
C displaced **A**, **B** and **D**

Place the metals in order of reactivity. [2]

Most reactive:

.....

.....

Least reactive:

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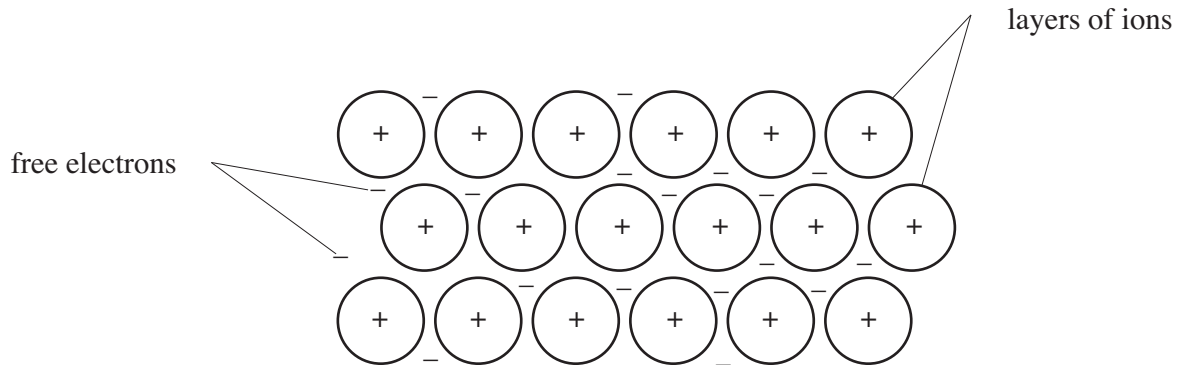
3. (i) The following table shows some properties of three different types of structures.

<i>Structure</i>	<i>Particle model</i>	<i>Melting points and boiling points</i>	<i>Electrical conductivity</i>
giant ionic	consists of charged ions	high	only when molten or in solution
giant covalent	single molecules consisting of very many atoms	high	poor
simple covalent	small molecules, each consisting of a few atoms	low	poor

Use the information above to complete the following table by stating the type of structure found in each of the substances, **A**, **B** and **C**. [2]

<i>Substance</i>	<i>Melting point / °C</i>	<i>Boiling point / °C</i>	<i>Electrical conductivity</i>	<i>Type of structure</i>
A	-182	-161	poor
B	3550	4827	poor
C	801	1413	good when dissolved

(ii) The diagram below shows a model of the structure of a metal.



State the physical property of metals which can be explained by

I. the presence of free electrons,

.....

[1]

II. layers of ions being able to slide over each other.

.....

[1]

4. (i) Four samples of water, **A**, **B**, **C**, and **D**, from different parts of Britain were tested in a laboratory. The volume of soap solution needed to obtain a lather was measured. Each sample was then boiled for two minutes. After boiling the water, the volume of soap solution needed to form a lather was measured again. The results are shown in the table below.

<i>Water sample</i>	<i>Volume of soap solution needed for a lather / cm³</i>	
	<i>Before boiling</i>	<i>After boiling</i>
A	1	1
B	3	1
C	21	21
D	24	1

Give the **letter** of a sample which is

- I. permanent hard water, [1]
- II. temporary hard water, [1]
- III. the softest water. [1]
- (ii) State **one** other method, *apart from boiling*, of softening water. [1]
.....
- (iii) Give **one** disadvantage, *apart from wasting soap*, of living in a hard water area. [1]
.....

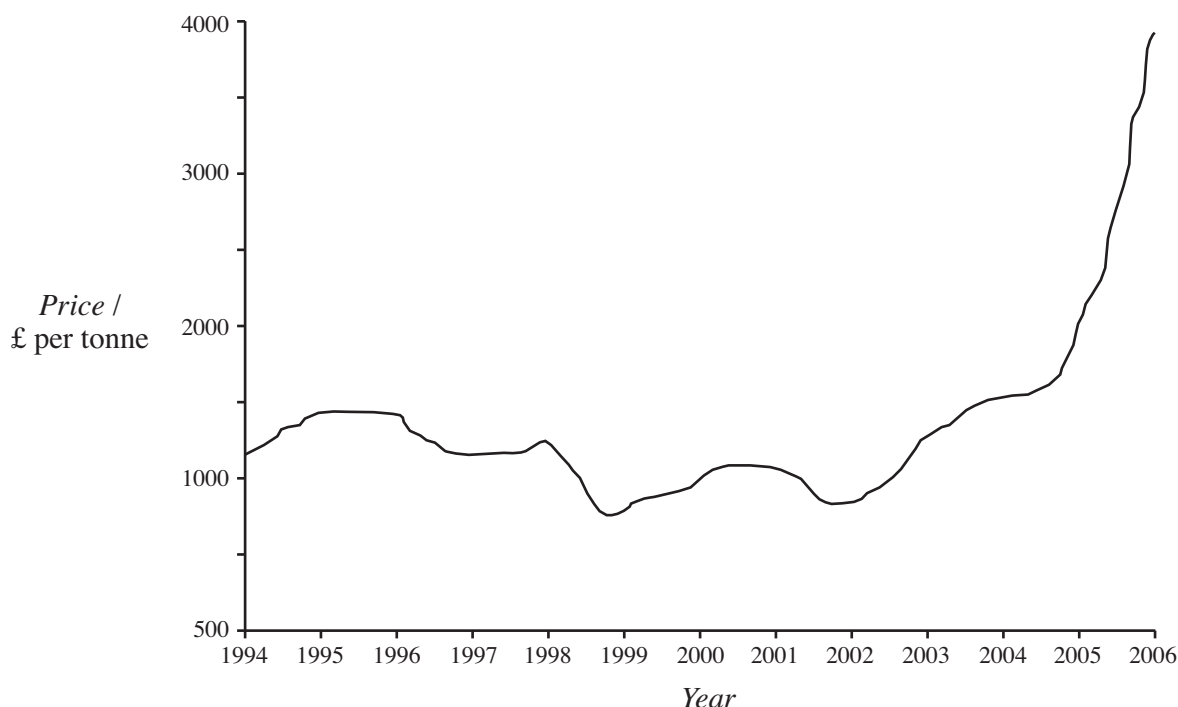
5.



Copper coins once contained 97% copper. Coins made today are made from steel with a thin copper coating. One tonne of old copper coins would have a face value of about £3000 and yet would be worth approximately £4000 for the copper content alone.

- (i) State why the Royal Mint now uses steel rather than copper to make coins. [1]

- (ii) The graph below shows the price of copper between 1994 and 2006.



Use the graph to explain why, **from 2005**, old copper coins (containing no steel) became worth more if melted down. [1]

- (iii) Suggest **one** reason for the increasing demand for copper in modern society. [1]

- (iv) Most copper, 88%, is obtained from ore mined directly from the ground. State how the need to mine copper ore can be reduced. [1]

- (v) State **one** property that makes copper a suitable material for making water pipes. [1]

6. The table below shows the electronic structures of four elements.

<i>Element</i>	<i>Electronic structure</i>
hydrogen	1
nitrogen	2,5
oxygen	2,6
calcium	2,8,8,2

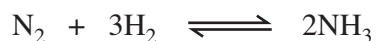
Show, by means of diagrams or otherwise, the electronic changes that take place during the formation of

(i) calcium oxide from calcium and oxygen (include charges on the diagram of the ions), [3]

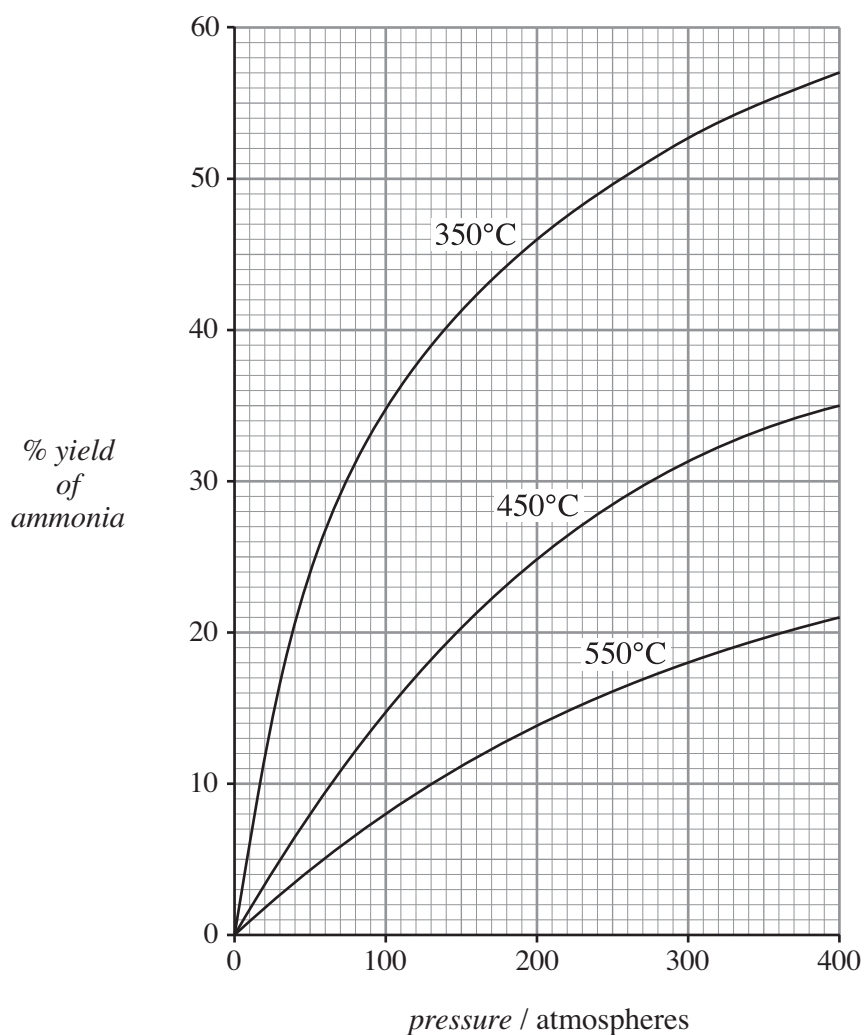
(ii) ammonia, NH_3 , from nitrogen and hydrogen. [2]

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7. Ammonia is manufactured by the Haber process.



The graphs below show the yield of ammonia at different pressure and temperature conditions.



(i) Use the appropriate graph to answer parts I and II.

Find the

I. temperature needed to obtain 25% yield of ammonia at a pressure of 200 atmospheres,

..... °C

[1]

II. percentage yield of ammonia at a pressure of 350 atmospheres and a temperature of 350°C.

..... %

[1]

- (ii) Ammonia is used to make the nitrogenous fertiliser ammonium sulphate, $(\text{NH}_4)_2\text{SO}_4$. Calculate the relative formula mass (M_r) of ammonium sulphate. [2]

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

.....

.....

- (iii) One advantage of the use of nitrogenous fertilisers is the increase in crop yield. One disadvantage is that nitrogenous fertilisers pollute our drinking water.

I. Apart from increasing crop yield, give **one** other advantage of using nitrogenous fertilisers. [1]

.....

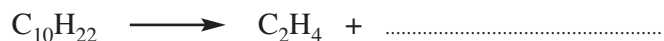
II. Apart from the pollution of our drinking water, give **one** other disadvantage of the use of nitrogenous fertilisers. [1]

.....

8. Cracking is the process that oil companies carry out on large hydrocarbons to form smaller, more useful hydrocarbon molecules.

(i) Ethene is one of the products of the cracking of decane, $C_{10}H_{22}$.

I. Complete the **symbol** equation below for the cracking of decane. [1]

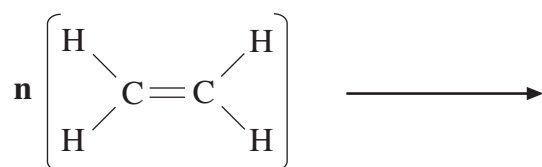


II. Give one of the conditions necessary for cracking to take place. [1]

.....

(ii) Ethene undergoes addition polymerisation to form polythene.

I. Complete and balance the **symbol** equation below to show the addition polymerisation of ethene. [2]



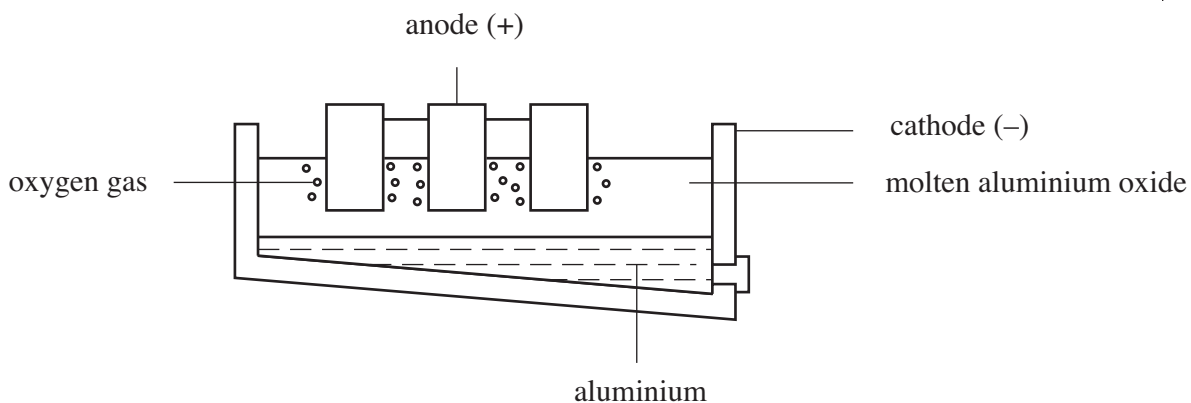
II. Give the reason why ethene can undergo addition polymerisation. [1]

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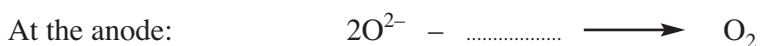
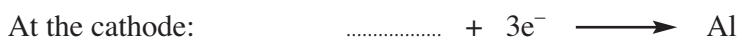
(iii) Polythene is an example of a thermoplastic polymer and is the plastic used to replace glass in making milk bottles. Glass bottles are sterilised using super-heated steam before being re-used. State and explain, **in terms of structure**, why this method is unsuitable for bottles made from polythene. [2]

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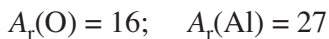
9. Aluminium is extracted from molten aluminium oxide by electrolysis.



(i) Complete the following **electrode** equations [2]



(ii) The overall equation for the extraction of aluminium is shown below.



Use the above equation to

I. calculate how many tonnes of aluminium could be obtained from 2040 tonnes of aluminium oxide, [3]

.....

.....

.....

II. calculate the atom economy of the reaction for the production of aluminium. [2]

.....

.....

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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^+		

