Candidate Name	Centre Number	Candidate Number
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WJEC CBAC

GCSE

240/02

ADDITIONAL SCIENCE
HIGHER TIER
CHEMISTRY 2

A.M. MONDAY, 17 January 2011

45 minutes

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

0240
020001

ADDITIONAL MATERIALS

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

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

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 following table contains some information about elements **A**, **B**, **C**, **D**, **E** and **F**. These letters are **not** chemical symbols.
Element **F** has an error in its information.

Element	Mass number	Atomic number	Number of protons	Number of neutrons	Number of electrons
A	19	9	9	10	9
B	24	12	12	12	12
C	35	17	17	18	17
D	37	17	17	20	17
E	40	18	18	.....	18
F	40	20	20	20	21

Use the information in the table to answer parts (i) to (iv).

Each letter may be used once, more than once or not at all.

(i) I. Complete the table above by giving the number of neutrons in element **E**. [1]

II. Use the Periodic Table of Elements on the back cover of this examination paper to decide which of the elements, **A**, **B**, **C**, **D**, **E** or **F**, is argon. [1]

.....

(ii) One element appears **twice** in the above table. Give the **two** letters of that element and explain your choice. [2]

Letters ..... and .....

Explanation .....

.....

(iii) State the error in the information about element **F**. [1]

.....

(iv) A sodium atom can be represented in the following way:

$$^{23}_{11}\mathbf{Na}$$

Write the information for element **A** in the same form. [1]

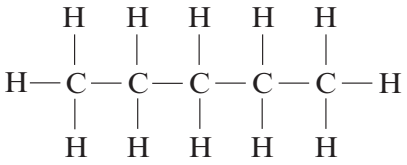
.....

$$\mathbf{A}$$

.....

Examiner only

2. *(a)* Complete the following table. [2]

Name	ethane	pentane
Formula	C_2H_6	
Structural formula		

(b) Polystyrene is an example of a polymer. Name **one** *other* polymer. [1]

.....

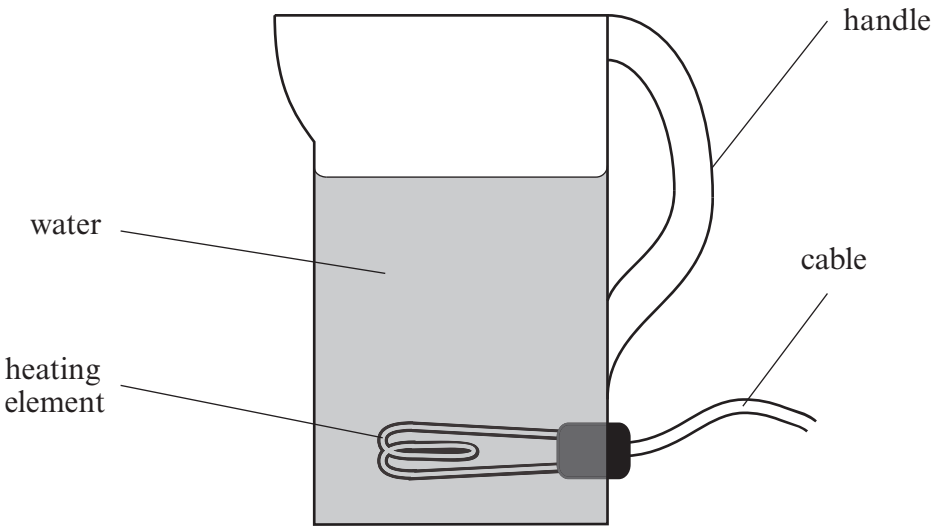
(c) Different substances have different properties that allow them to be used in different ways.
The following table contains information about five different substances labelled **A**, **B**, **C**, **D** and **E**.

Substance	Properties
A	gas at room temperature colourless does not conduct heat does not conduct electricity
B	solid at room temperature grey colour good conductor of electricity ductile
C	liquid at room temperature colourless does not conduct heat poor conductor of electricity
D	solid at room temperature white colour does not conduct electricity rigid does not melt easily on heating
E	solid at room temperature white colour does not conduct heat does not conduct electricity flexible

Use only the information in the table to answer parts (i), (ii) and (iii).

Each letter can be used once, more than once, or not at all.

The diagram below shows the main parts of a kettle.



State, giving **one** reason, which of the five substances, **A**, **B**, **C**, **D** or **E**, could be used to make the

(i) heating element, [2]

Substance .....

Reason .....

(ii) outer coating of the cable, [2]

Substance .....

Reason .....

(iii) handle. [2]

Substance .....

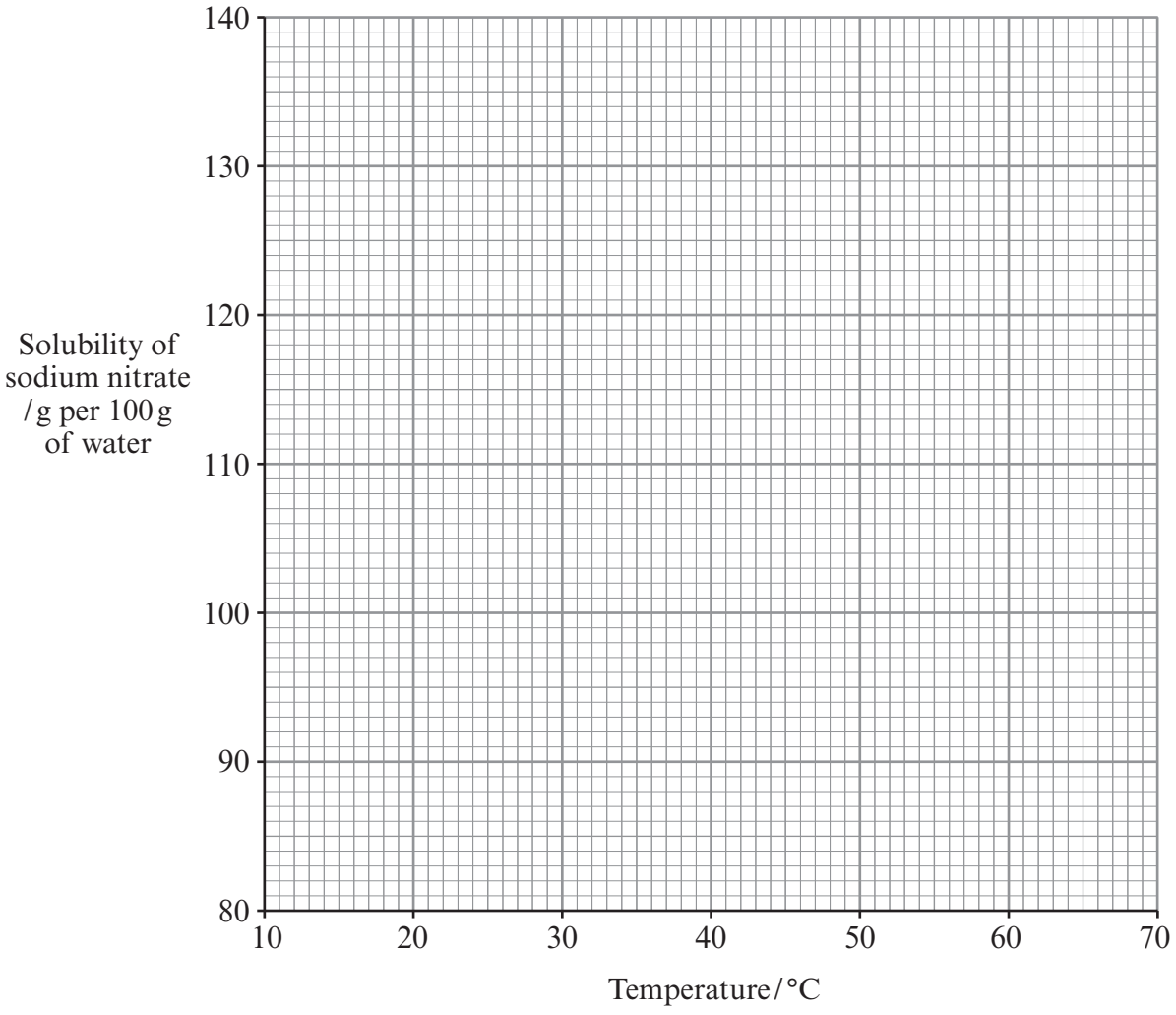
Reason .....

Examiner only

3. Sodium nitrate dissolves in water to form a solution.
The table below shows the solubility of sodium nitrate in 100 g of water at different temperatures. The maximum mass of solute that can dissolve in 100 g of solvent is called the solubility of a substance.

Temperature / °C	Solubility of sodium nitrate / g per 100 g of water
20	88
30	95
40	103
50	112
60	122
70	133

(i) Plot the points on the grid below and draw the solubility curve for sodium nitrate. [3]



(ii) Use the graph to predict the solubility of sodium nitrate at 10 °C. [1]

..... g per 100 g of water.

(iii) Use the graph to calculate the mass of sodium nitrate that would dissolve in **50 g** of water at 45 °C. [2]

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Examiner only

4. Smart materials are materials whose properties change with change in their surroundings. Polymer gels and shape memory polymers are two examples of smart materials.

(i) Describe the special properties of each of these smart materials. [2]

Polymer gels .....

.....

Shape memory polymers .....

.....

(ii) Give **one** use for each of these two types of smart materials. [2]

Use of polymer gels

.....

Use of shape memory polymers

.....

Examiner only

5. (i) Sodium reacts with oxygen to form sodium oxide.

Using the electronic structures below, show by means of a **diagram** the electronic changes that take place during the formation of sodium oxide. **Show the charges on the ions formed**. [3]

sodium = 2,8,1 oxygen = 2,6

(ii) Using the electronic structures below, show by means of a **diagram** the bonding in a water molecule. [2]

hydrogen = 1 oxygen = 2,6

Examiner only

6. *(a)* (i) Large saturated hydrocarbons can be broken down into smaller more useful hydrocarbon molecules.

Explain the term *saturated*. [1]

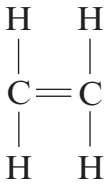
.....

(ii) When decane, $C_{10}H_{22}$, is passed over aluminium oxide catalyst at 500 °C, the following reaction takes place.

$$C_{10}H_{22} \longrightarrow C_8H_{18} + C_2H_4$$

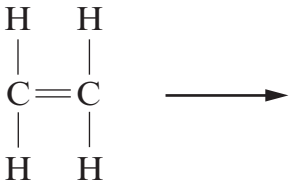
decane octane substance **A**

I. The structural formula of substance **A** is [1]



Name substance **A**. .....

II. When substance **A** is heated under high pressure with a different catalyst it undergoes polymerisation.
Complete and balance the **symbol equation** which represents the polymerisation of C_2H_4. [2]

..... 

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(b) Polystyrene is an example of a thermoplastic and bakelite is an example of a thermosetting plastic. Describe an experiment that could be carried out to distinguish polystyrene from bakelite, **giving the results you would expect for both**. [3]

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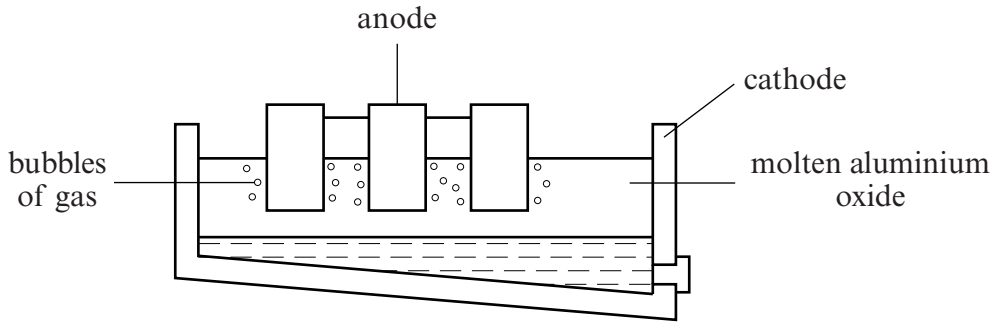
Examiner only

7. The following diagram shows the apparatus used for the electrolysis of molten aluminium oxide.



(i) Explain why the aluminium oxide needs to be **molten**. [1]

.....

.....

(ii) State what happens to the aluminium ions, Al^{3+}, during electrolysis. [1]

.....

.....

(iii) Complete and balance the electrode equation for the reaction that takes place at the anode. [2]

..... O^{2-} – ..... e^- ⟶ .....

Examiner only

8. *(a)* Excess chlorine reacted with 1.12 g of iron to produce 3.25 g of iron chloride.

(i) Calculate the mass of chlorine in 3.25 g of iron chloride. [1]

.....

(ii) Calculate the simplest formula of the iron chloride. [3]

Show your workings.

A_r(Fe) = 56; A_r(Cl) = 35.5

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(b) (i) Ammonium sulphate, $(NH_4)_2SO_4$, is made industrially by reacting ammonia, NH_3, with sulphuric acid, H_2SO_4.
The reaction that takes place is as follows.

$$2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$$

Use the above equation to calculate how many tonnes of ammonia would be needed to produce 66 tonnes of ammonium sulphate. [3]

A_r(H) = 1; A_r(N) = 14

The relative molecular mass, M_r, of ammonium sulphate, $(NH_4)_2SO_4$, is 132.

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(ii) A gas jar is thought to contain ammonia gas. Describe how you could show that the gas is ammonia, **giving the expected results**. [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^{+}		

PERIODIC TABLE OF ELEMENTS

1	2	Group										3	4	5	6	7	0
								$^{1}_{1}$H Hydrogen									$^{4}_{2}$He Helium
$^{7}_{3}$Li Lithium	$^{9}_{4}$Be Beryllium											$^{11}_{5}$B Boron	$^{12}_{6}$C Carbon	$^{14}_{7}$N Nitrogen	$^{16}_{8}$O Oxygen	$^{19}_{9}$F Fluorine	$^{20}_{10}$Ne Neon
$^{23}_{11}$Na Sodium	$^{24}_{12}$Mg Magnesium											$^{27}_{13}$Al Aluminium	$^{28}_{14}$Si Silicon	$^{31}_{15}$P Phosphorus	$^{32}_{16}$S Sulphur	$^{35}_{17}$Cl Chlorine	$^{40}_{18}$Ar Argon
$^{39}_{19}$K Potassium	$^{40}_{20}$Ca Calcium	$^{45}_{21}$Sc Scandium	$^{48}_{22}$Ti Titanium	$^{51}_{23}$V Vanadium	$^{52}_{24}$Cr Chromium	$^{55}_{25}$Mn Manganese	$^{56}_{26}$Fe Iron	$^{59}_{27}$Co Cobalt	$^{59}_{28}$Ni Nickel	$^{64}_{29}$Cu Copper	$^{65}_{30}$Zn Zinc	$^{70}_{31}$Ga Gallium	$^{73}_{32}$Ge Germanium	$^{75}_{33}$As Arsenic	$^{79}_{34}$Se Selenium	$^{80}_{35}$Br Bromine	$^{84}_{36}$Kr Krypton
$^{86}_{37}$Rb Rubidium	$^{88}_{38}$Sr Strontium	$^{89}_{39}$Y Yttrium	$^{91}_{40}$Zr Zirconium	$^{93}_{41}$Nb Niobium	$^{96}_{42}$Mo Molybdenum	$^{99}_{43}$Tc Technetium	$^{101}_{44}$Ru Ruthenium	$^{103}_{45}$Rh Rhodium	$^{106}_{46}$Pd Palladium	$^{108}_{47}$Ag Silver	$^{112}_{48}$Cd Cadmium	$^{115}_{49}$In Indium	$^{119}_{50}$Sn Tin	$^{122}_{51}$Sb Antimony	$^{128}_{52}$Te Tellurium	$^{127}_{53}$I Iodine	$^{131}_{54}$Xe Xenon
$^{133}_{55}$Cs Caesium	$^{137}_{56}$Ba Barium	$^{139}_{57}$La Lanthanum	$^{179}_{72}$Hf Hafnium	$^{181}_{73}$Ta Tantalum	$^{184}_{74}$W Tungsten	$^{186}_{75}$Re Rhenium	$^{190}_{76}$Os Osmium	$^{192}_{77}$Ir Iridium	$^{195}_{78}$Pt Platinum	$^{197}_{79}$Au Gold	$^{201}_{80}$Hg Mercury	$^{204}_{81}$Tl Thallium	$^{207}_{82}$Pb Lead	$^{209}_{83}$Bi Bismuth	$^{210}_{84}$Po Polonium	$^{210}_{85}$At Astatine	$^{222}_{86}$Rn Radon
$^{223}_{87}$Fr Francium	$^{226}_{88}$Ra Radium	$^{227}_{89}$Ac Actinium															

Key: