Surname	Centre Number	Candidate Number
Other Names		0

GCSE

0240/02

ADDITIONAL SCIENCE
HIGHER TIER
CHEMISTRY 2

A.M. MONDAY, 21 May 2012

45 minutes

Suitable for Modified Language Candidates

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

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020001

ADDITIONAL MATERIALS

In addition to this paper you will need 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.

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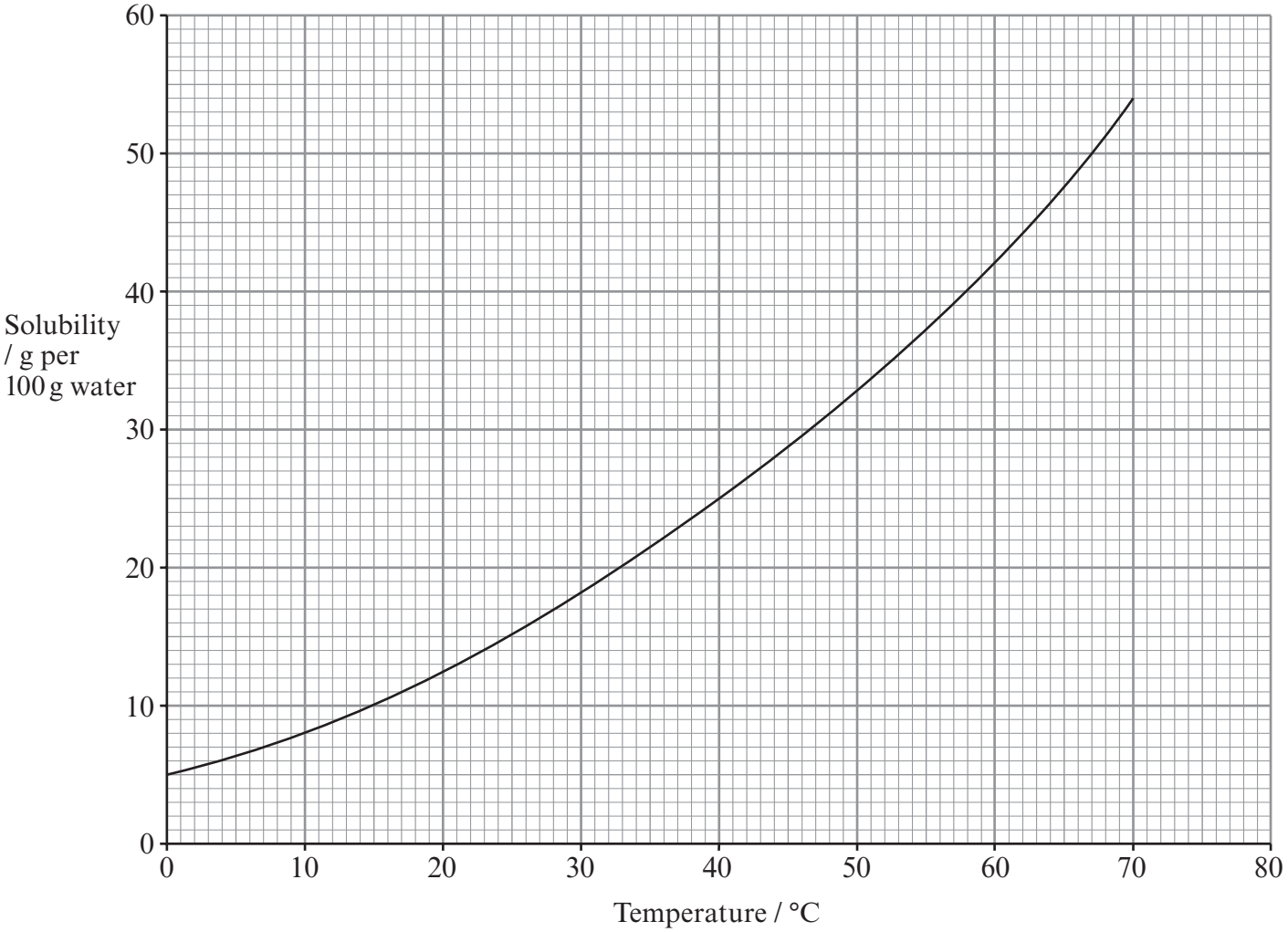
Answer **all** *questions.*

1. The graph below shows the solubility of potassium dichromate in water at different temperatures.



The table below shows the solubility of potassium chloride in water at different temperatures.

Temperature / °C	0	20	40	60	80
Solubility / g per 100 g water	28	34	40	46	52

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(a) Plot the graph of the solubility of potassium chloride on the grid on the opposite page. [3]

(b) Using the graphs give

(i) the temperature at which the solubility is the **same** for both potassium chloride and potassium dichromate, [1]

Temperature = ... °C

(ii) the **difference** between the solubilities of potassium chloride and potassium dichromate at 30 °C. [1]

Difference = ... g per 100 g of water

5

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2. The table below shows information about the atoms of three elements.

Complete the table.

Use the data and key on the Periodic Table of Elements shown on the **back page of this examination paper**. [4]

Element	Symbol	Number of protons	Number of neutrons	Number of electrons
beryllium	$^{9}_{4}Be$	4		4
phosphorus		15	16	15
argon	$^{40}_{18}Ar$		22	

4

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3. *(a)* Copper, magnesium, silver and zinc were added separately to solutions containing copper nitrate, magnesium nitrate, silver nitrate and zinc nitrate.

The table shows the results obtained from the series of experiments.

Metal	Metal nitrate solution			
	copper nitrate	magnesium nitrate	silver nitrate	zinc nitrate
copper	no reaction	no reaction	silvery-grey crystals form on copper foil	no reaction
magnesium	brown solid forms and blue solution turns colourless	no reaction	silvery-grey solid forms	silvery-grey solid forms
silver	no reaction	no reaction	no reaction	no reaction
zinc	brown solid forms and blue solution turns colourless	no reaction	silvery-grey solid forms	no reaction

(i) Use the information in the table above. Place the metals copper, magnesium, silver and zinc in order of reactivity. [2]

Most reactive .....

.....

.....

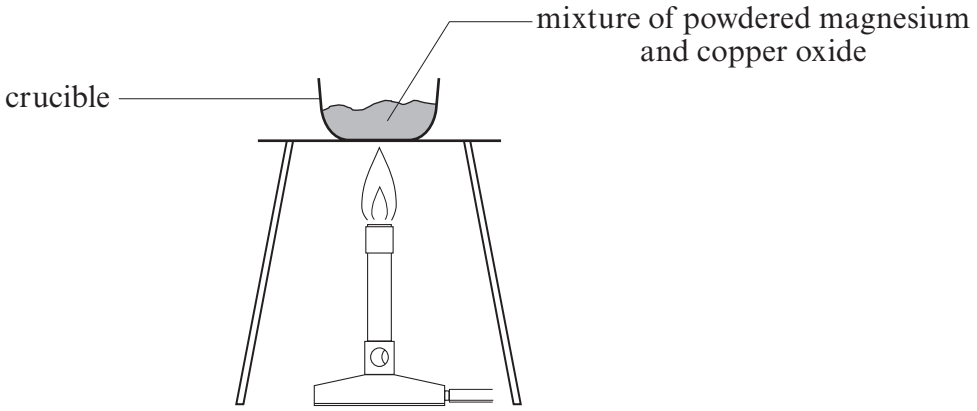
Least reactive .....

(ii) Write a **word** equation for the reaction between copper and silver nitrate. [2]

..... + ... ⟶ ..... + ...

Examiner only

(b) The apparatus in the diagram below can be used to show the violent reaction between magnesium and copper oxide. Both solids are in **powdered** form and well mixed together.



After a few minutes of heating a violent reaction occurs. Tiny brown specks and a white powdery substance remain.

Use **this reaction** to explain the terms oxidation and reduction. [2]

.....

.....

.....

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Turn over.

Examiner only

4. Scientists have developed a range of new materials known as smart materials. Smart materials have unusual properties and are now being used to make everyday items.

Name the **type** of smart material being used for each of the following items. Describe the **unusual property** that makes it a smart material.

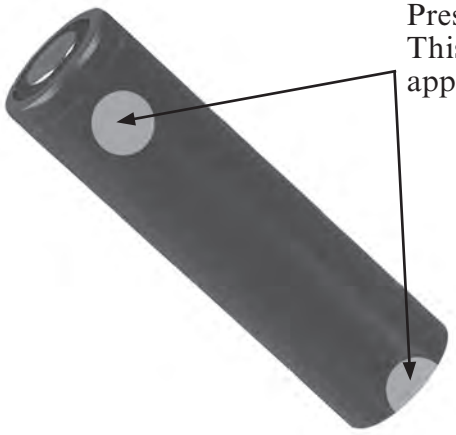
(a) Lenses for sunglasses

Type ..... [2]

Unusual property .....

.....

(b) Battery test strips



Type ..... [2]

Unusual property .....

.....

4

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5. *(a)* Three samples of tap water, **A**, **B** and **C**, are to be tested for hardness using soap solution.

It is suspected that sample **A** is the most hard and sample **C** the least hard.

Describe an experiment you would carry out to show that the above statement is true. Include your expected observations. [4]

.....

.....

.....

.....

.....

(b) State why hard water is thought to be

(i) good for our health, [1]

.....

(ii) a problem in kettles and boilers. [1]

.....

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6. *(a)* The table below shows the electronic structures of four elements.

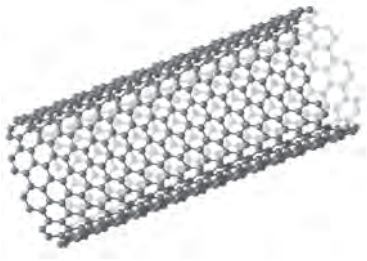
Element	Electronic structure
hydrogen	1
carbon	2,4
fluorine	2,7
sodium	2,8,1

(i) Draw a diagram to show the electronic changes that take place during the formation of sodium fluoride from sodium and fluorine. [3]

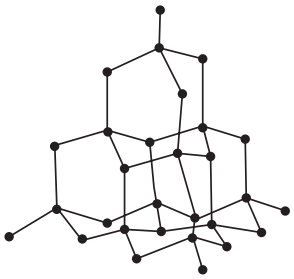
(ii) Draw a diagram to show the bonding in a methane molecule, CH_4. [2]

Examiner only

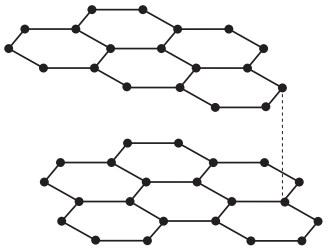
(b) The diagrams below show three different forms of the element carbon.



carbon nanotube



diamond



graphite

What type of bonding and structure is common to each of the three forms of carbon? [2]

Bonding .....

Structure .....

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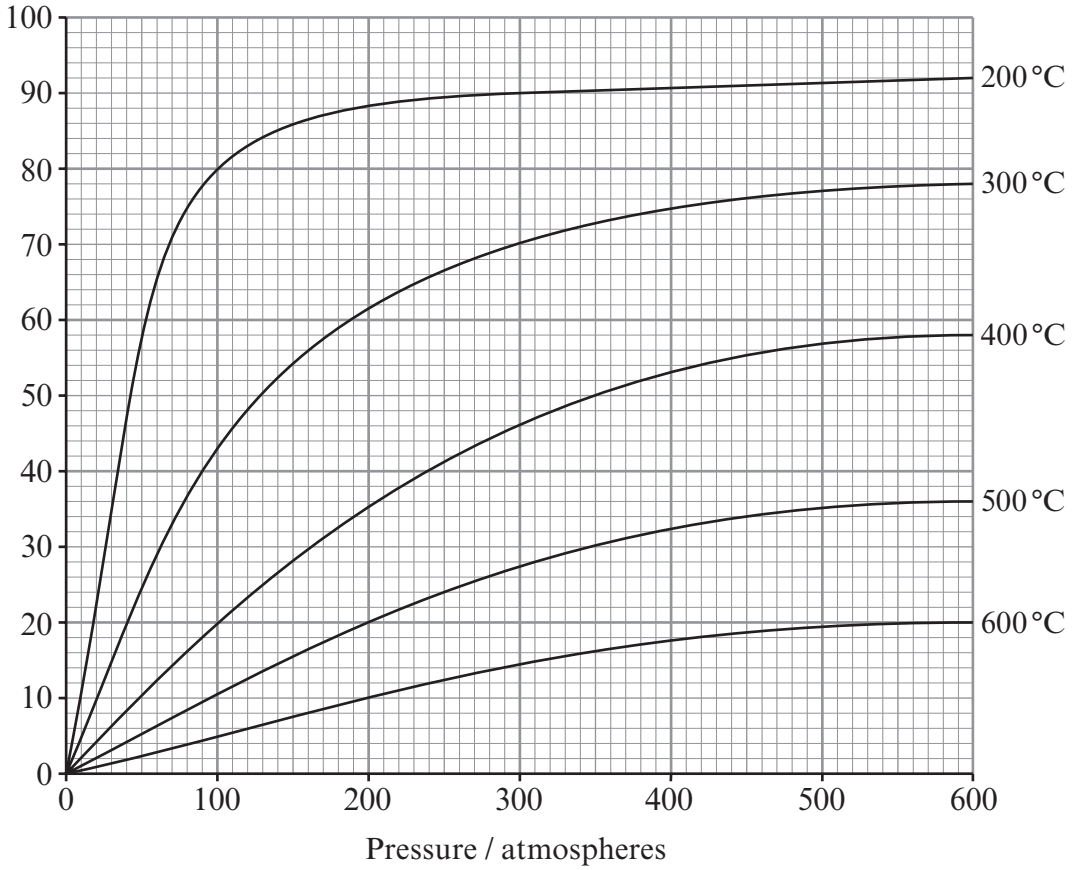
7. *(a)* The graphs below show how the yield of ammonia depends on the temperature and pressure used in its production.



(i) Use the appropriate graph to find the percentage yield of ammonia at a pressure of 200 atmospheres and a temperature of 500 °C. [1]

..... %

(ii) State the effect on the yield of ammonia of

I. increasing the pressure, [1]

.....

II. increasing the temperature. [1]

.....

(b) Farmers use nitrogenous fertilisers, containing ammonium compounds, to increase crop yields.

Describe a chemical test you would carry out on a sample of fertiliser to show that it contained ammonium ions. Include the results expected for a positive identification of the gas formed. [2]

.....

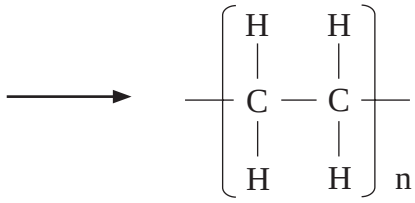
.....

5

Examiner only

8. *(a)* Ethene is used to make the polymer polythene.

(i) Complete and balance the **symbol** equation below for the production of polythene from ethene. [2]



(ii) Give the name for the type of polymerisation taking place in the production of polythene from ethene. [1]

.....

(iii) Give the reason why ethene can undergo this type of polymerisation. [1]

.....

(b) Polythene is a thermoplastic. Why is a thermoplastic unsuitable for making cups to hold boiling water? Explain your answer in terms of **structure**. [2]

.....

.....

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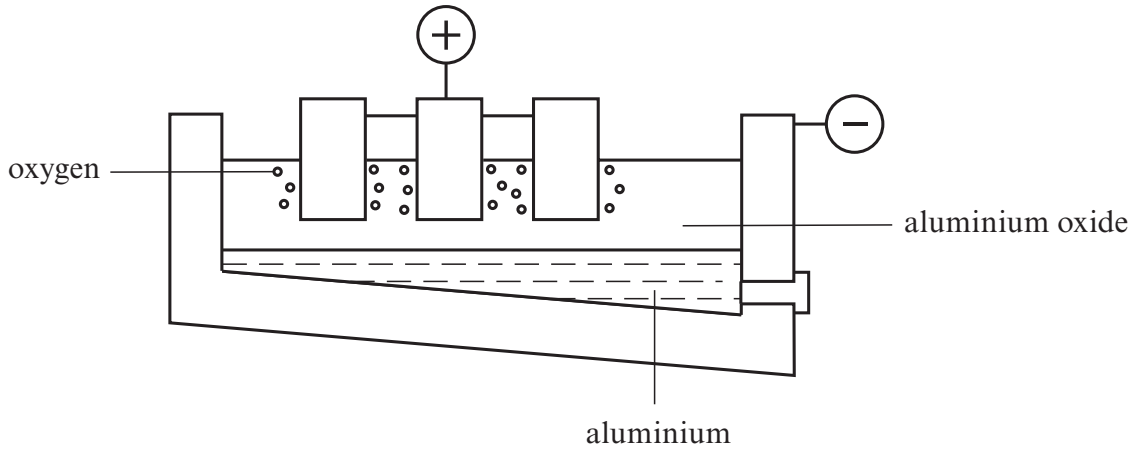
Examiner only

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



(a) Complete and balance the following electrode equations. [2]

At the cathode Al^{3+} + ... ⟶ Al

At the anode ..... – $4e^-$ ⟶ O_2

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

$$2Al_2O_3 \longrightarrow 4Al + 3O_2$$

$A_r(O) = 16$ $A_r(Al) = 27$

(i) Calculate the mass of aluminium you would expect to extract from 10.2 tonnes of aluminium oxide. [3]

.....

.....

.....

.....

(ii) During an actual process 4.3 tonnes of aluminium was formed from 10.2 tonnes of aluminium oxide. Calculate the percentage yield for this reaction. [2]

.....

.....

.....

7

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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^{+}		

Turn over.

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: