WJEC GCSE CHEMISTRY

CHEMISTRY



EXAM QUESTION PACK

UNIT C2 FOUNDATION TIER 0240 PAPERS

STEMUP

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

0240/01

ADDITIONAL SCIENCE
FOUNDATION TIER
CHEMISTRY 2

A.M. TUESDAY, 29 January 2013

45 minutes

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

0240 010001

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.

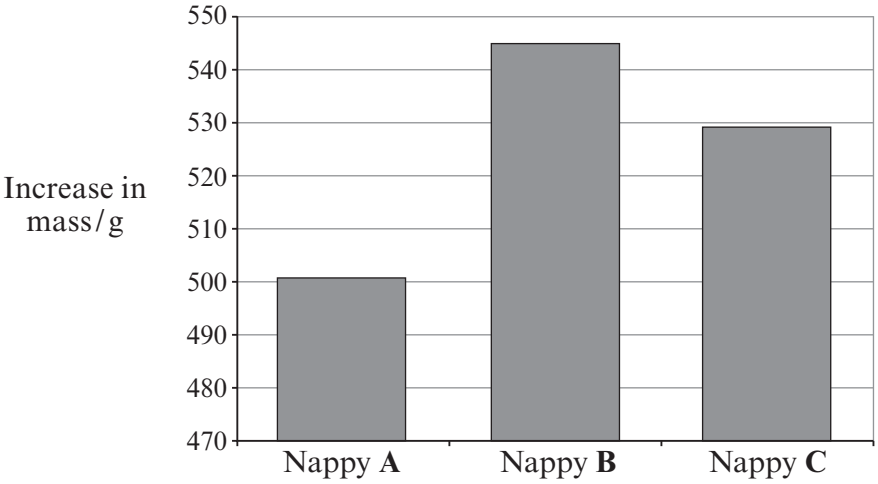
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Answer **all** *questions.*

1. *(a)* Three types of disposable nappy were soaked in water for 10 minutes. They were weighed and the increase in mass was recorded. The results are shown in the graph below.



(i) State which nappy, **A**, **B** or **C**, absorbed **least** water. ..... [1]

(ii) Hydrogels are the type of smart material used in making these nappies. Choose from the box below another use of hydrogels. [1]

artificial snow	**gumshields**	**lenses in sunglasses**

.....

(b) Thermochromic pigments change colour with changing temperature. Choose from the box below **one** use of thermochromic pigments. [1]

bottles	**sunglasses**	**television screens**	**forehead thermometers**

.....

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(c) The following box contains some information about carbon nanotubes.

> Carbon nanotubes are flat sheets of carbon atoms rolled up to form very thin, cylindrical tubes. One use of nanotubes is in computer chips where they are fixed in place and are not believed to be a health risk.
>
> However, free carbon nanotube particles have a structure similar to that of asbestos fibres. Asbestos fibres can cause lung problems when inhaled in large amounts over long periods.

Use the information above to help you answer the following questions.

(i) Name the element from which nanotubes are made. [1]

.....

(ii) State why the use of nanotubes in computer chips is not believed to pose a health risk. [1]

.....

.....

(iii) State why some people are concerned about the use of nanotubes as free particles. [1]

.....

.....

6

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2. The following table shows some information about three common metals.

Metal	Properties	Uses
aluminium	strong, low density, good conductor of heat and electricity, resistant to corrosion	overhead power cables, saucepans, cooking foil, drinks cans, aeroplanes, window frames
copper	attractive colour, good conductor of heat and electricity, malleable, ductile	ornaments, jewellery, electrical wires, water pipes, saucepan bases
titanium	hard, strong, high melting point, low density, resistant to corrosion	aircraft industry, medical applications, jewellery, golf clubs

(a) Use the information in the table to give the main reason for the choice of metal in each of the following uses.

(i) Aluminium for overhead power cables. [1]

.....

(ii) Copper for saucepan bases. [1]

.....

(b) Give **one** reason why titanium is used in the aircraft industry. [1]

.....

(c) Give **one** medical application of titanium. [1]

.....

4

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3. Many fertilisers are made from ammonia, NH_3.

(a) Complete the following **word** equation by giving the name of the compound formed when ammonia reacts with sulphuric acid. [1]

ammonia + sulphuric acid ⟶ .....

(b) Complete the following **word** equation by giving the name of the acid used to produce ammonium nitrate. [1]

ammonia + ... ⟶ ammonium nitrate

(c) Name the type of reaction taking place in *(a)* and *(b)*. [1]

.....

(d) The table below shows the nutrient content of three types of fertiliser.

	Percentage of nutrients present / %		
Fertiliser	Nitrogen	Potassium	Sulphur
A	34	0	0
B	21	0	24
C	0	52	12

(i) State which fertiliser, **A**, **B** or **C**, is not made from ammonia, NH_3. Give a reason for your answer. [2]

Fertiliser .....

Reason .....

(ii) One of the fertilisers is produced when ammonia reacts with sulphuric acid, H_2SO_4. State which one and give a reason for your answer. [2]

Fertiliser .....

Reason .....

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7

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4. Water can be either hard or soft.

(a) From the metal ions listed in the box below, choose **two** that cause hardness in water. [2]

calcium	**copper**	**iron**	**magnesium**	**sodium**

..... and .....

(b) You are provided with some soap solution and two different samples of water. Describe a simple experiment you could carry out to show which sample is the harder. Include details of how you would ensure a fair test. [5]

.....

.....

.....

.....

.....

.....

.....

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5. *(a)* The following table shows the observations made when some metals were added to solutions containing compounds of other metals.

Metal	Solution	Observations
copper	zinc sulphate	no reaction
magnesium	zinc sulphate	magnesium ribbon coated in dark solid
zinc	copper sulphate	brown deposit on the zinc, solution gradually loses its blue colour
zinc	magnesium sulphate	no reaction

(i) Use the information in the table to place the metals zinc, copper and magnesium in order of reactivity with the most reactive first. [1]

Most reactive .....

.....

Least reactive .....

(ii) Name the products formed when magnesium reacts with zinc sulphate solution. [2]

.....

(b) Iron is extracted from its ore, iron oxide, by heating with carbon. The process taking place is shown in the equation below.

iron oxide + carbon ⟶ iron + carbon dioxide

(i) State which of iron and carbon is the more reactive. Give a reason for your choice. [1]

More reactive .....

Reason .....

.....

(ii) I State why this method could not be used for the extraction of a reactive metal such as aluminium. [1]

.....

.....

II Name the process used to extract aluminium. [1]

.....

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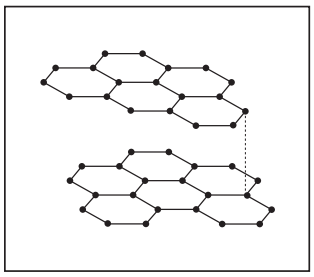
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Turn over.

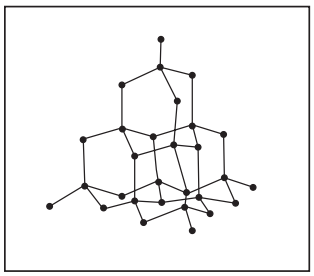
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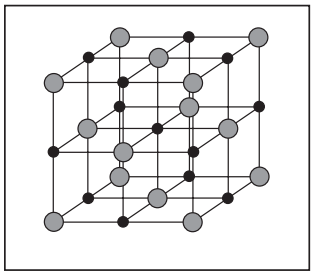
6. *(a)* The following diagrams show the structures of some substances. Draw a line from each structure to the correct name of the substance. [4]



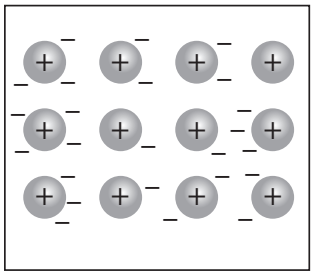
copper



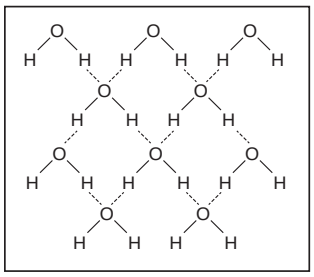
graphite



diamond



ice



sodium chloride

(b) Name the **two** substances that are good conductors of electricity. [1]

..... and .....

5

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7. *(a)* Complete the following table of information about the atoms of some elements. [5]

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

Element	Symbol	Number of protons	Number of neutrons	Number of electrons
sodium	$^{23}_{11}Na$	11	12	11
calcium	$^{40}_{20}Ca$	20	.....	.....
aluminium	.....	13	14	13
.....	$^{39}_{19}K$	19	.....	19

(b) Atoms of different elements each have a different mass, known as the relative atomic mass (A_r). The relative atomic mass compares the masses of different atoms on a scale which gives hydrogen a mass of 1. State why the actual mass of an atom is not used. [1]

.....

.....

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

$A_r(H) = 1$ $A_r(N) = 14$ $A_r(O) = 16$

$M_r(HNO_3)$ = ...

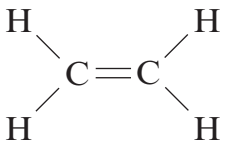
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8. *(a)* Complete the table below by giving the structural formulae for methane and ethane. [2]

Name	methane	ethane	ethene
Formula	CH_4	C_2H_6	C_2H_4
Structural formula			

(b) Ethene can be produced during a process known as cracking.

$$C_{12}H_{26} \longrightarrow C_{10}H_{22} + C_2H_4$$

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 the recycling of plastics such as polythene is important for the environment. [1]

.....

.....

7

END OF PAPER

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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^{+}		
Zinc	Zn^{2+}		

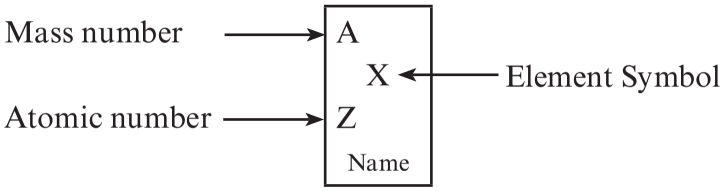
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PERIODIC TABLE OF ELEMENTS

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:



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(0240-01)

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GCSE MARKING SCHEME

CHEMISTRY (LEGACY)

JANUARY 2013

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2013 examination in GCSE CHEMISTRY (LEGACY). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

Unit	Page
C1 (LEGACY)	1
C2 (LEGACY)	17
C3 (LEGACY)	31

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GCSE CHEMISTRY (LEGACY)

C2 Mark Scheme - January 2013

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
1		(a)	(i)		1	**A**			
			(ii)		1	artificial snow			
		(b)			1	forehead thermometers			
		(c)	(i)		1	carbon	C		
			(ii)		1	they are fixed in place			
			(iii)		1	similar structure to asbestos / can be inhaled / may cause lung problems		dangerous	

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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
2		(a)	(i)		1	low density / good conductor **of electricity**		good conductor	
			(ii)		1	good conductor **of heat**		good conductor	
		(b)			1	hard / strong / low density			
		(c)			1	joint replacements / pins / plates	named joint		

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
3		(a)			1	ammonium sulphate	$(NH_4)_2SO_4$		
		(b)			1	nitric (acid)	HNO_3		
		(c)			1	neutralisation	exothermic		
		(d)	(i)		2	**C** (1) doesn't contain nitrogen / N (1)			
			(ii)		2	**B** (1) contains nitrogen **and** sulphur / N **and** S (1)			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
4		(a)			2	calcium (1) magnesium (1)	Ca Mg		
		(b)			5	**Method** : add soap solution to water sample (1), shake (1), measure height of froth / scum (1) **Fair test** : same volume of water / same amount of soap solution / shake for same amount of time or same number of times any two for (1) each	alternative suitable methods e.g add soap slowly from burette (1) shake (1) and record volume needed to form permanent lather (1)	same temperature	

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
5		(a)	(i)		1	magnesium zinc copper must be in correct order	Mg Zn Cu		
			(ii)		2	magnesium sulphate (1) zinc (1)	$MgSO_4$ Zn		
		(b)	(i)		1	carbon is able to reduce the iron oxide both needed	removes O from the iron oxide	displaces	
			(ii)	I	1	aluminium is more reactive than carbon	aluminium is too reactive	aluminium is reactive	
				II	1	electrolysis			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6		(a)			4	diagrams are in the following order graphite diamond sodium chloride copper ice all correct for (4) three correct for (3) two correct for (2) one correct for (1)			
		(b)			1	copper and graphite both needed			

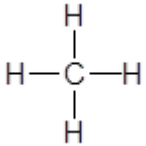
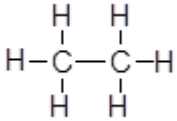
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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
7	1	(a)			5	20 20 $^{27}_{13}Al$ potassium 20			
		(b)			1	individual atoms are too small / light			
		(c)			2	1 + 14 + (16 × 3) (1) 63 (1) correct answer only (2)			

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Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	Sub-section							
8	2	(a)			2	 (1)  (1)			
		(b)			2	heat (1) catalyst (1)	high temperature / any temp >400 °C		
		(c)	(i)		1	polymerisation		addition	
			(ii)		1	packaging / household containers / electrical insulation / moisture barriers in construction industry			
			(iii)		1	don't decompose / less need for landfill sites / litter can pose problems to wildlife			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	3	(a)	(i)		1	hydrogel	polymer gel		
			(ii)		1	(strong cross links create an) open structure			
			(iii)		1	artificial muscles / robot actuators / absorbers of toxic chemicals / water retainers for plants / artificial snow	in compost	compost	
		(b)			1	regain shape (after being bent) / supereleastic / more difficult to break			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	4	(a)			1	electrical	electricity	heat	
		(b)	(i)		1	Al^{3+} and O^{2-} both needed			
			(ii)		1	opposite charges attract (each other)		Al is positive and cathode is negative	
		(c)			1	ions must be free to move			
		(d)			2	aluminium oxide (1) aluminium + oxygen (1)	 correct formulae		

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	5	(a)			1	50			
		(b)			1	38 ± 1			
		(c)			1	156			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	(a)			3	K atom loses 1 electron (1) Cl atom gains 1 electron (1) K^+ and Cl^- ions form (1) diagrams must show situation before and after bonding clearly - NO ambiguity e.g. electron on atom/ion at the same time or charges associated with atoms			
		(b)			2	pair of electrons shared between two chlorine atoms (1) full octet around both chlorine atoms (1)			
		(c)			2	layers are able to slide over each other (1) weak forces between layers (1)			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	7	(a)			2	H_2 (1) balancing 3 and 2 (1)			
		(b)	(i)		1	70 %			
			(ii)	I	1	faster reaction at 450 °C / too slow at 350 °C			
				II	1	equipment needed for high pressure expensive / too dangerous at high pressure		expensive	
		(c)	(i)		3	$M_r(NH_3) = 17$ **and** $M_r(NO) = 30$ (1) 255/17 = 15 (1) 15 × 30 = 450 (1) correct answer only (3)			
			(ii)		2	theoretical mass of product = 120 **and** total mass of reactants = 228 (1) 120 / 228 × 100 = 52.6 % (1) cao (2)			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	8	(a)			1	loss of oxygen			
		(b)	(i)		1	0.4 g			
			(ii)		3	mass / A_r 3.2 / 64 = 0.05 0.4 /16 = 0.025 either for (1) correct ratio = 2:1 (1) formula = Cu_2O (1)			

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Surname	Centre Number	Candidate Number
Other Names		0

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0240/01

ADDITIONAL SCIENCE
FOUNDATION TIER
CHEMISTRY 2

A.M. MONDAY, 21 May 2012

45 minutes

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

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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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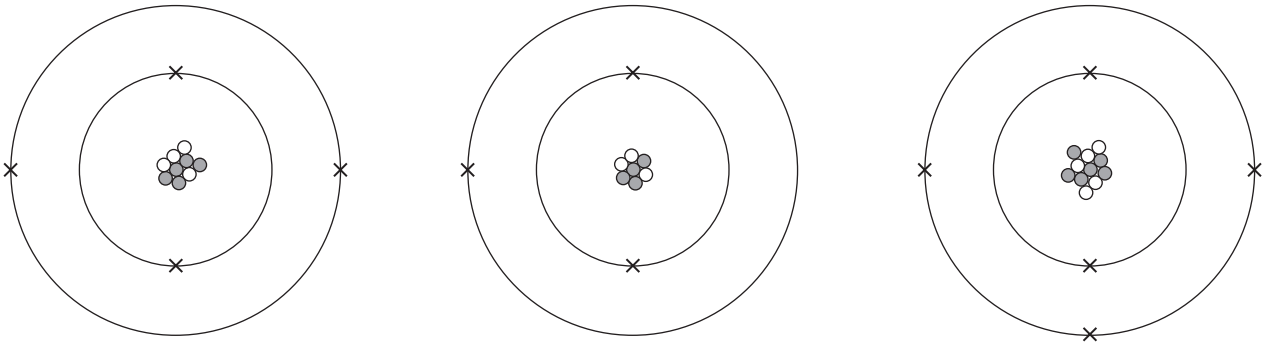
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Answer **all** *questions.*

1. *(a)* Atoms are made up of protons, neutrons and electrons.

A, **B** and **C** represent atoms of three different elements.



A **B** **C**

Give the **letter** of the atom which contains

(i) four protons, ... [1]

(ii) five electrons. ..... [1]

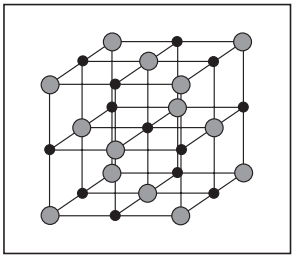
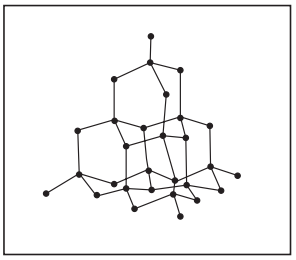
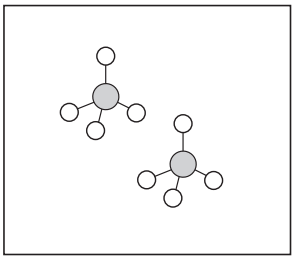
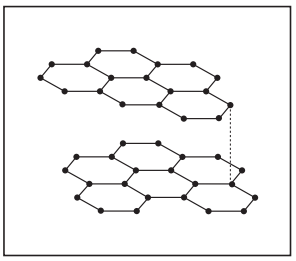
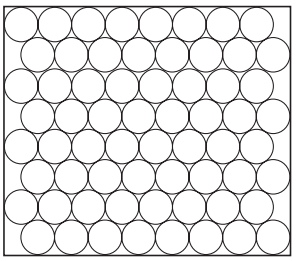
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(b) The following diagrams show the structures of some substances.

(i) Draw a line to connect **each** substance to its correct structure. [4]

Substance	Structure
aluminium	
methane	
diamond	
sodium chloride	
	

(ii) Give the name of the substance which contains positive and negative ions. [1]

.....

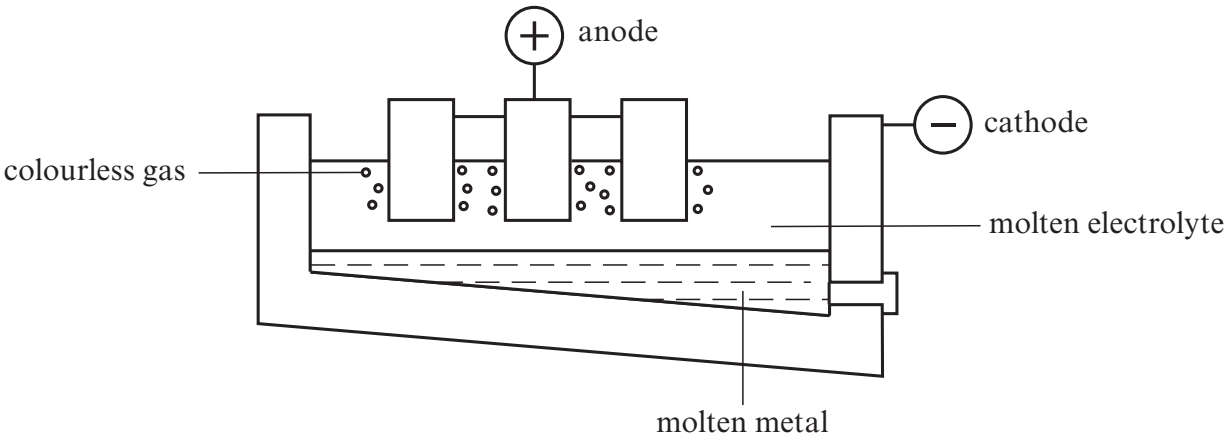
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2. *(a)* The diagram below shows the cell used in the industrial extraction of aluminium.



The molten electrolyte used in the process contains the ions Al^{3+} and O^{2-}.

(i) Give the chemical name for the molten electrolyte. ..... [1]

(ii) Name the electrode at which aluminium is formed. ..... [1]

(iii) Name the colourless gas formed during the process. ..... [1]

(b) The electrolyte is obtained from an ore called bauxite. Bauxite needs to be imported into the UK. The industrial extraction also needs a lot of electricity.

Choose from the box below the **two** factors that are **most** important when locating a new aluminium extraction plant in the UK. [2]

coastal position	**good transport system**	**nearby housing**
nearby limestone quarries	**nearby power station**	**nearby river for water**

Factor 1 .....

Factor 2 .....

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(c) Some properties and uses of aluminium are given below.
Draw a line from each pair of properties to the use which relies on **both** of these properties. [2]

Pair of properties	**Use**
heat conductor and malleable	drinks cans
electrical conductor and ductile	overhead power cables
malleable and non-toxic	cooking foil

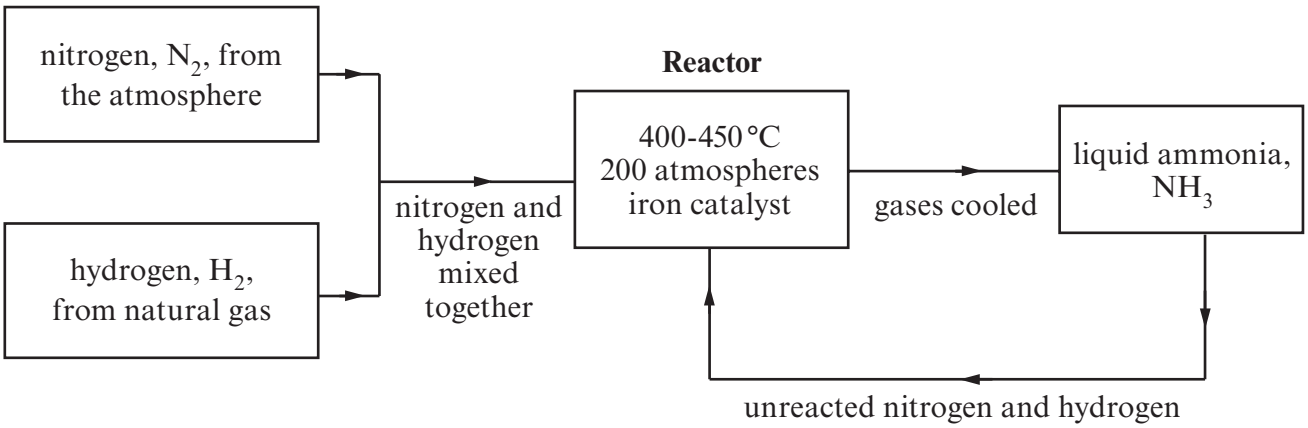
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3. The flow chart below shows the stages in the manufacture of ammonia.



Use only the information in the flow chart to answer parts *(a)*-*(c)*.

(a) Name the raw materials from which nitrogen and hydrogen are obtained. [1]

Nitrogen .....

Hydrogen .....

(b) The manufacture of ammonia is a reversible reaction.

Write a **word** equation for this reaction. [2]

..... + ... ⇌ .....

(c) The reaction mixture contains ammonia and unreacted nitrogen and hydrogen.

(i) Describe what happens to ammonia gas on cooling. [1]

.....

(ii) Only about 20% of the nitrogen and hydrogen react to form ammonia. State what happens to the unreacted gases. [1]

.....

5

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4. The box below shows some smart materials.

thermochromic pigment	**photochromic pigment**	**shape memory alloy**
hydrogel	**shape memory polymer**	

Choose from the box the type of smart material used in each of the following items.

(a) Battery test strips [1]

Pressing both ends of the battery completes a circuit, causing the strip to heat up and change colour, showing whether the battery is in good condition.

Smart material .....

(b) Water-absorbing granules [1]

Some garden centres sell water-absorbing granules which can be mixed with soil in plant pots. The granules absorb up to 100 times their weight in water and then release it slowly back to the soil.

Smart material .....

(c) Nitinol stents for veins [1]

A collapsed nitinol stent can be inserted into a vein. On warming the stent returns to its original expanded shape helping to improve blood flow.

Smart material .....

(d) Lenses for sunglasses [1]

Some lenses automatically darken when exposed to sunlight and return to a lighter shade when the light intensity decreases.

Smart material .....

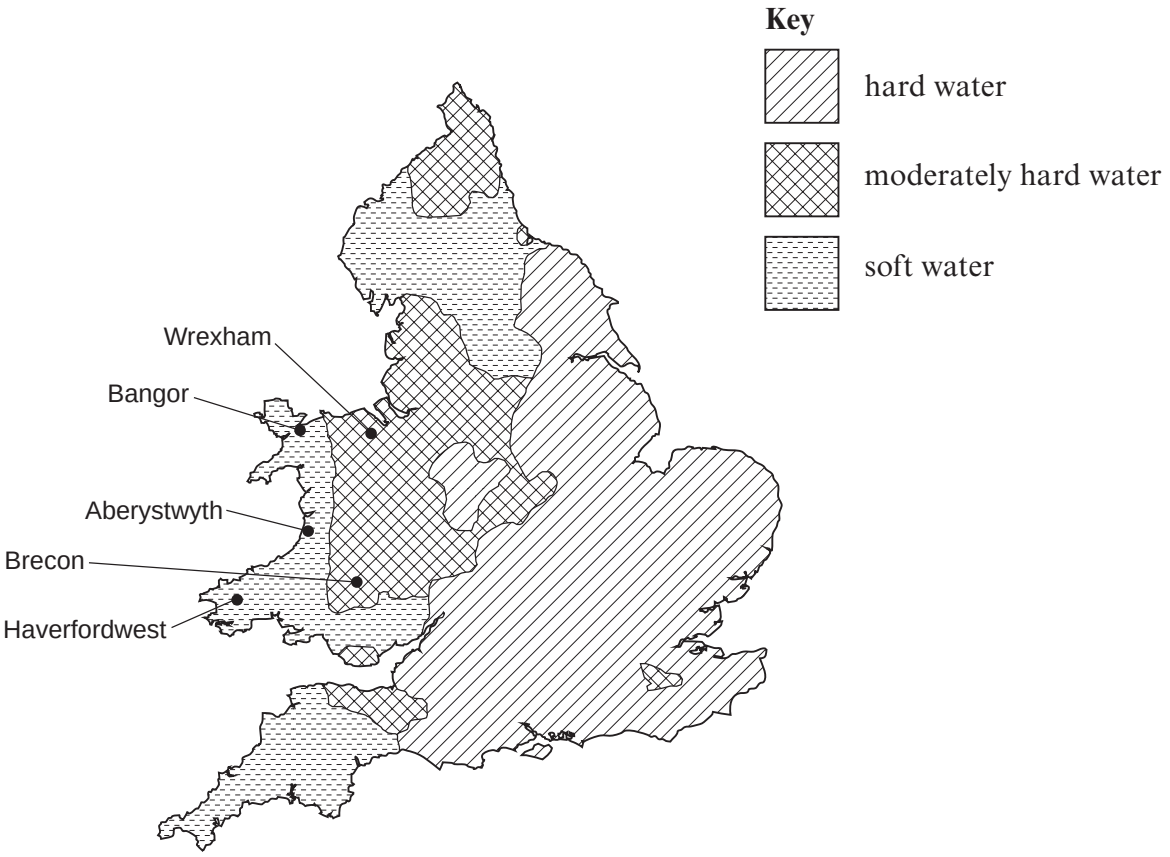
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5. The map below shows the hardness of water across the different regions of Wales and England.



(a) Water samples were collected at Bangor, Brecon and Wrexham.
1 cm^3 of soap solution was added to 10 cm^3 of each sample in separate test tubes.
Each tube was shaken for 10 seconds.

State, and explain, the difference you would expect in the appearance of the shaken solutions in each tube. [3]

.....

.....

.....

.....

(b) Give **one** way the procedure was made a fair test. [1]

.....

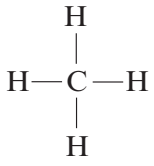
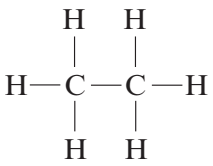
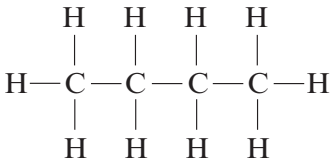
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6. *(a)* (i) Complete the following table to show the **structural** formula for propane. [1]

Structural formula				
Molecular formula	CH_4	C_2H_6	C_3H_8	C_4H_{10}
Name	methane	ethane	propane	butane

(ii) A molecule of pentane contains 5 carbon atoms. Give the number of hydrogen atoms found in a molecule of pentane. [1]

.....

(b) Use the relative atomic masses given below to calculate the relative molecular mass (M_r) of butane, C_4H_{10}. [2]

$A_r(H) = 1$ $A_r(C) = 12$

$M_r(C_4H_{10})$ = ...

(c) Plastics have replaced many traditional materials.

Apart from cost, give **two** general properties of a plastic which makes it a better material than

(i) paper for making carrier bags, [2]

Property 1 .....

Property 2 .....

(ii) iron for making guttering. [2]

Property 1 .....

Property 2 .....

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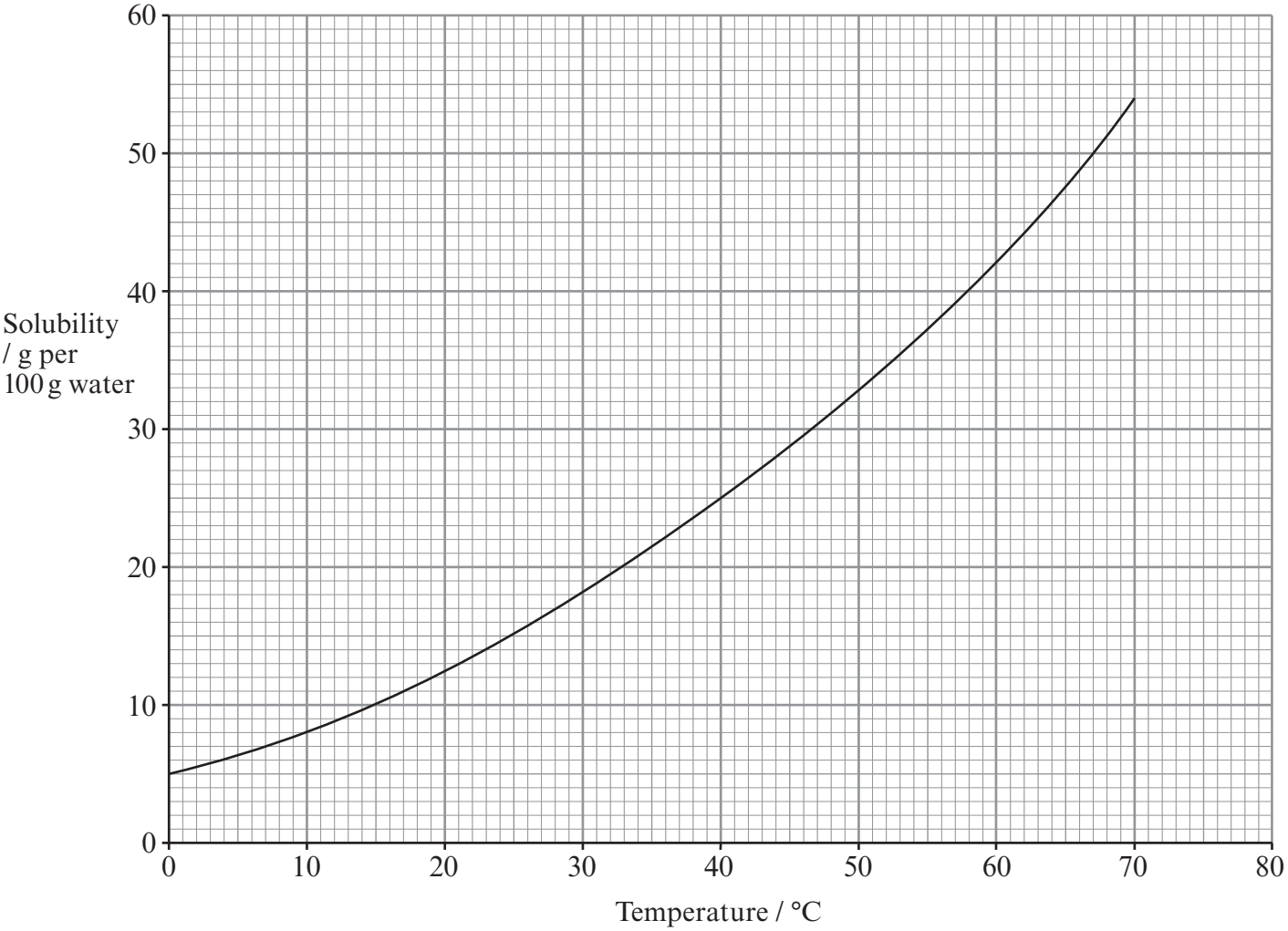
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Turn over.

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7. 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

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

Use the data and key on the Periodic Table of Elements shown on the **back page of this examination paper** to complete the table. [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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9. *(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 to 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]

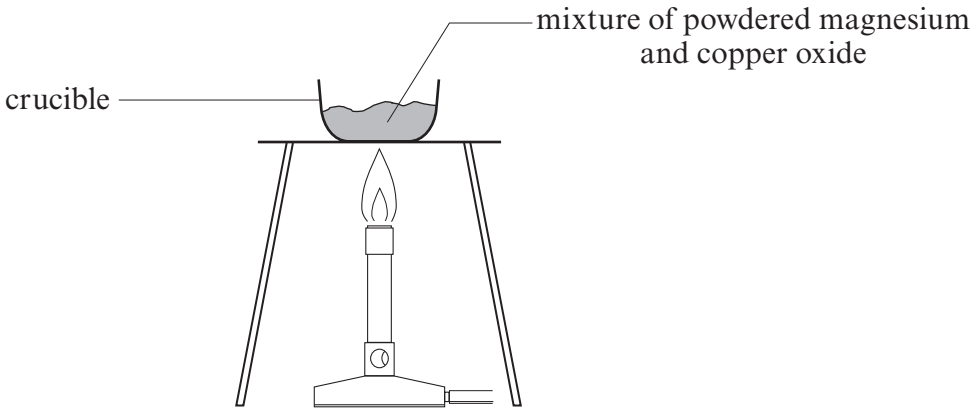
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(b) The apparatus in the diagram below can be used to show the violent reaction between magnesium and copper oxide. Both solids are in **powdered** form and well mixed together.



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

Explain, **using this reaction**, the terms oxidation and reduction. [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^{+}		

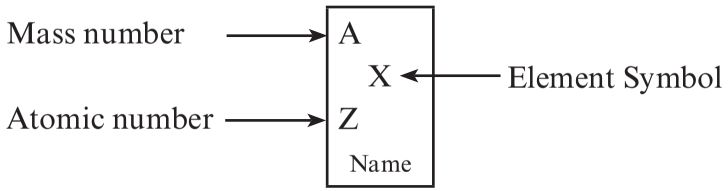
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PERIODIC TABLE OF ELEMENTS

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:



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GCSE MARKING SCHEME

SCIENCE - CHEMISTRY (LEGACY)

SUMMER 2012

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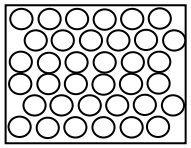
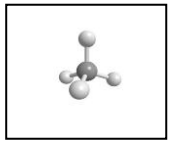
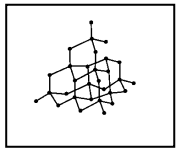
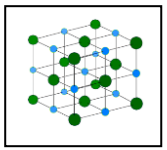
INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2012 examination in GCSE SCIENCE - CHEMISTRY (LEGACY). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

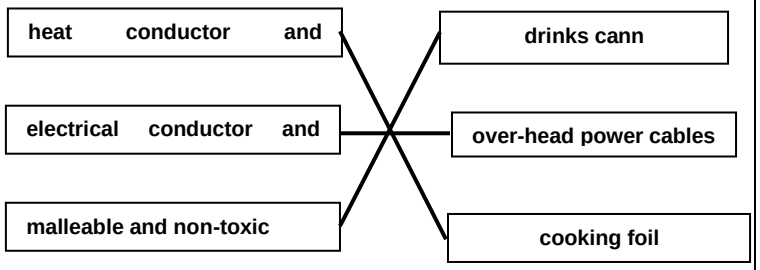
WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
1		(a)	(i)		1	**A**			
			(ii)		1	**C**			
		(b)	(i)		4	aluminium  (1) methane  (1) diamond  (1) sodium chloride  (1)			
			(ii)		1	sodium chloride	NaCl		

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Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	Sub-section							
2		(a)	(i)		1	aluminium oxide / alumina	Al_2O_3		cryolite bauxite
			(ii)		1	cathode / negative (electrode)	– (minus sign)		
			(iii)		1	oxygen	O_2 carbon dioxide / CO_2	O	
		(b)			2	nearby power station (1) coastal position (1)			
		(c)			2	 all correct (2) any one correct (1)			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
3		(a)			1	nitrogen: atmosphere hydrogen: natural gas - both needed	air		
		(b)			2	reactants : nitrogen + hydrogen (1) product: ammonia (1)	N_2 + H_2 NH_3 (ignore balancing)	reference to N and H	 *liquid* ammonia
		(c)	(i)		1	forms a liquid / condenses	liquefies		
			(ii)		1	put back into the reactor/ recycled / put back into the reaction / used again			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
4		(a)			1	thermochromic (materials)			
		(b)			1	hydrogels			
		(c)			1	shape memory alloys			
		(d)			1	photochromic (materials)			

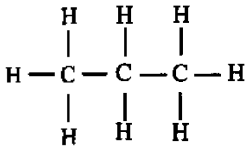
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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
5		(a)			3	Must imply • all three give a lather (1) • Bangor gives more lather than Wrexham & Brecon (1) the harder the water, the less lather is formed (1)	bubbles /foam / froth / suds = lather	reference to 'scum'	No lather
		(b)			1	• 1 cm^3 soap solution / same amount of soap solution / same volume of soap solution • 10 cm^3 water / same amount of water / same volume of water • shaken for 10s / shaken for the same time • same size test tube • same temperature - any one			

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Question Number								
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6									
		(a)	(i)		1				
			(ii)		1	12	C_5H_{12}		
		(b)			2	(4×12) + (10×1) (1) = 58 (1) ***award 2 marks if correct answer given without any working***			
		(c)	(i)		2	• stronger / doesn't rip easily (1) • waterproof / water resistant (1) • non-biodegradable / doesn't rot (1) a***ny two from three marking points***	strong / stretches	durable/ flexible/ tougher lasts longer	light /harder easily coloured can be re-used
			(ii)		2	• lighter / less dense (1) • does not corrode (1)	does not rust/ low maintenance/ doesn't have to be painted	tough / can be recycled easily coloured / easily shaped	

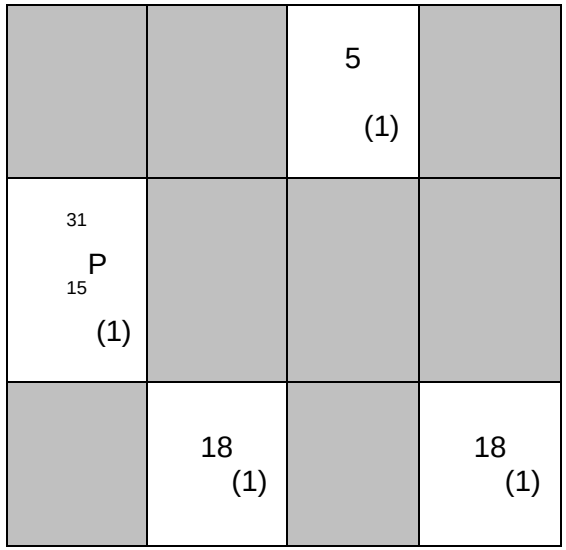
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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
7	1	(a)	(i)		3	all points plotted correctly (2) any 4 plotted correctly (1) tolerance ± ½ square line of 'best fit' (1) ***drawn with a ruler*** ***judgement by eye***			
		(b)	(i)		1	65 ±1 ***i.e. anywhere from 64-66 ^{o}C***			
			(ii)		1	19 ±1 ***i.e. anywhere from 18-20 g per 100g of water***			

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Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	Sub-section							
8	2				4				

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
9	3	(a)	(i)		2	most reactive: **magnesium** **zinc** **copper** least reactive: **silver** all correct (2) any 2 correct (1)	Mg Zn Cu Ag		metal nitrates
			(ii)		2	reactants: copper + silver nitrate (1) products: silver + copper nitrate (1)	Cu + $AgNO_3$ Ag + $Cu(NO_3)_2$		
		(b)			2	***magnesium gains oxygen*** to form magnesium oxide - ***oxidation*** (1) **copper oxide** ***loses oxygen*** to form copper - ***reduction*** (1) no reference to specific reaction e.g. gaining oxygen is oxidation and losing oxygen is reduction - 1 mark			

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Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	Sub-section							
	4	(a)			2	photochromic (1) darkens/changes colour (on exposure) to (sun)light (1)		Sun changes 'appearance'	
		(b)			2	thermochromic (1) changes colour with heat (1)		changes 'appearance'	

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Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	Sub-section							
	5	(a)			4	• (add) equal volume of soap solution *(or 'add soap solution 1cm^3 at a time until a permanent lather is formed)* (1) • (use) equal volume of water sample (1) • shake for an equal number of times/ equal time (1) [add soap, shake to give lather (1) if none of the first three marks credited] • **C** has most lather and **A** least lather (*or **C** needs least soap and **A** needs most)* **comparative answer needed** (1)	equal amounts equal amounts 'shake equally'		
		(b)	(i)		1	• strengthens bones • strengthens teeth • reduces heart disease • does not dissolve lead from lead pipes		• healthier • better for you • tastes better • *good for* bones • *good for* teeth	
			(ii)		1	• limescale / scale / boiler scale / fur blocks kettles • limescale/ scale/ boiler scale / fur blocks boilers	• cost of water softener	• wastes money • wastes energy • wastes electricity / gas	reference to 'scum' and 'wasting soap'

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	(a)	(i)		3	sodium atom loses 1 electron (1) fluorine atom gains 1 electron (1) *neutral atoms needed* *only one transferred electron allowed* Na^+ and F^- ions formed (1) *octet of electrons around F^- not needed* *discrete pair of ions needed for this mark*			
			(ii)		2	(four) **shared pair(s)** of electrons (1) **octet of electrons** around C atom (1)			
		(b)			2	bonding: covalent (1) structure: giant molecular (1)	giant covalent		'giant'

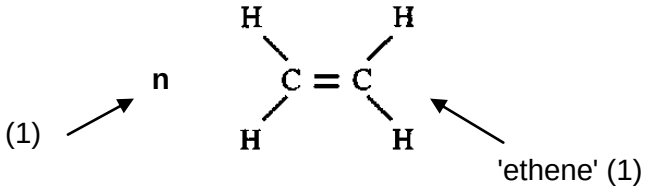
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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	7	(a)	(i)		1	20			
			(ii)	I	1	increases	goes up		
				II	1	decreases	goes down		
		(b)			2	(add warm) sodium hydroxide (solution) (1) damp (red) litmus paper turns blue or damp universal indicator turns blue / purple (1)			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	8	(a)	(i)		2	 ***ignore brackets around ethene***	C_2H_4		
			(ii)		1	addition			additional
			(iii)		1	• (it contains) a double bond / C=C bond • it is unsaturated		• it is an alkene	
		(b)			2	• softens on heating / loses its shape on heating (1) • no bonding between chains/ chains can slide over each other / weak forces between chains (1)	• diagram showing no links between chains	reference to melting / change of state tangled molecules chains	reference to layers

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	9	(a)			2	3e / $3e^-$ (1) $2O^{2-}$ (1)			
		(b)	(i)		3	$M_r(Al_2O_3)$ = 102 (1) 2(102) form 4(27) **or** 204 forms 108 (1) 10.2 forms 5.4 (1) ***award 3 marks for correct answer if no working shown***	10.4/102 = 0.1 0.1 : 0.2 0.2 (27) = 5.4		
			(ii)		2	4.3/5.4 × 100(1) = 79.62 % (1) *accept values from 79.6-80%* ***award 2 marks for correct answer if no working shown*** ***- mark consequentially***			

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

0240/01

ADDITIONAL SCIENCE
FOUNDATION TIER
CHEMISTRY 2

A.M. THURSDAY, 26 January 2012

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**5**	
3.	**3**	
4.	**7**	
5.	**5**	
6.	**4**	
7.	**5**	
8.	**6**	
9.	**3**	
10.	**6**	
Total	**50**	

0240 010001

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.

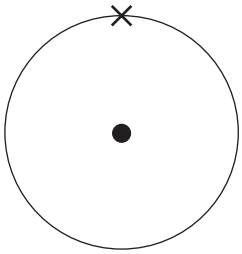
You are reminded of the necessity for good English and orderly presentation in your answers.

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.

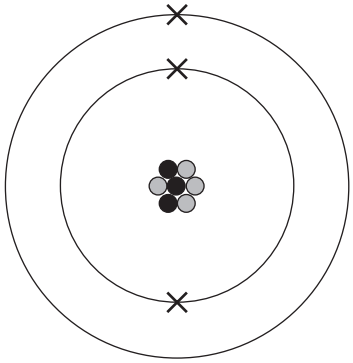
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Answer **all** *questions.*

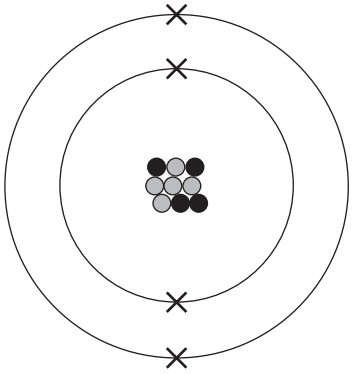
1. The following diagrams represent four different atoms, **A**, **B**, **C** and **D**.



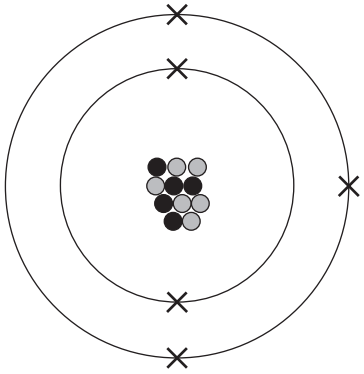
A



B



C



D

Key:

 proton

 neutron

 electron

(a) State which of the above diagrams, **A**, **B**, **C** or **D**,

(i) has five neutrons, ... [1]

(ii) has three electrons, ... [1]

(iii) represents an atom of hydrogen. ..... [1]

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(b) Give the

(i) atomic number of **D**, ... [1]

(ii) mass number of **B**. ..... [1]

(c) Give the name of the part of an atom where protons and neutrons are found. [1]

.....

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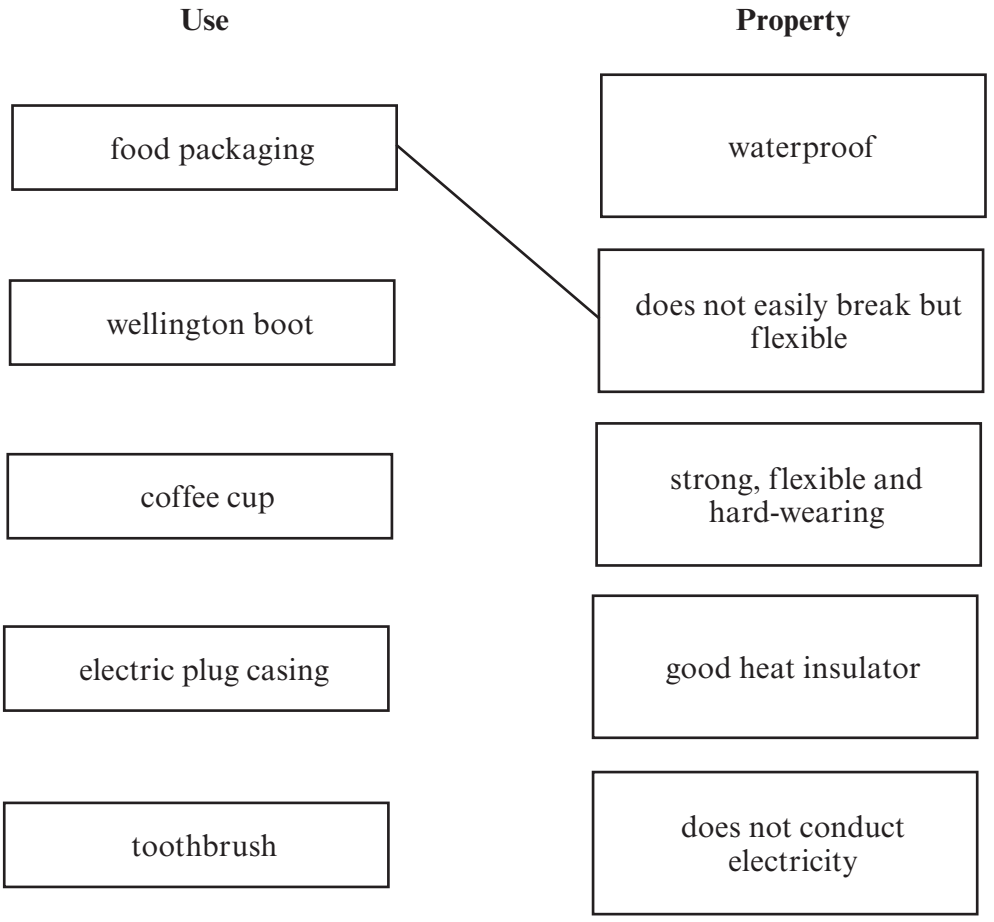
Examiner only

2. *(a)* Some uses and properties of plastics are listed below.

Draw a line to link each use to the property upon which that use relies.

One has already been done for you.

Each property should be used once only. [3]



(b) Polythene is an example of a plastic.

Give the name of **one** other plastic. ..... [1]

(c) Plastics are often used to make dustbins. Apart from cost, give **one** reason why dustbins are often made from plastic rather than from a metal such as iron. [1]

.....

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3. *(a)* Nitinol is an example of a shape memory alloy.

Place a tick (✓) in the boxes next to the **two** uses of shape memory alloys. [2]

absorb toxic chemicals	☐
superelastic spectacle frames	☐
artificial muscles	☐
nappies	☐
coffeepot thermostats	☐

(b) Some sunglasses have lenses that change colour in sunlight.

From the box below, choose the type of smart material that can be used in these lenses. [1]

photochromic pigment	**polymer gel**	**thermochromic pigment**

.....

0240 010005

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4. *(a)* A student carried out some experiments to investigate the reactivity of three different metals, **A**, **B** and **C**.

Metal	With cold water	With hot water	With steam
A	slow reaction	rapid reaction	very vigorous reaction
B	vigorous reaction	experiment not attempted	experiment not attempted
C	no reaction	no reaction	slow reaction

Arrange metals **A**, **B** and **C** in order of **decreasing** reactivity. [1]

Most reactive .....

.....

Least reactive .....

(b) The order of reactivity of some common metals is shown below.

Most reactive potassium
sodium
magnesium
aluminium
iron
copper
silver
Least reactive gold

(i) Complete the **word equation** for the reaction that takes place between magnesium and copper sulphate solution. [1]

magnesium + copper sulphate ⟶ ..... + ...

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(ii) Only **two** of the following pairs of substances react together.
Place a tick (✓) in the boxes next to **both**. [2]

aluminium and copper oxide	☐
copper and silver nitrate solution	☐
gold and magnesium oxide	☐
iron and aluminium oxide	☐
silver and copper sulphate solution	☐

(iii) Magnesium reacts very slowly with cold water. Predict how silver reacts with cold water, giving a reason for your answer. [2]

.....

.....

.....

(c) Aluminium is a reactive metal found near the top of the reactivity series.

Name the method used in its extraction. [1]

.....

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5. *(a)* The following table contains some information about five substances.

Substance	Symbol/ formula	Melting point/°C	Boiling point/°C	Density /g cm^{-3}	Solubility in water	Structure
methane	CH_4	–182	–162	0.0007	insoluble	simple molecular
graphite	C	4000	5100	2.1	insoluble	giant covalent
sodium chloride	NaCl	801	1413	2.17	soluble	giant ionic
aluminium	Al	660	2470	2.7	insoluble	metallic
potassium bromide	KBr	734	1435	2.75	soluble	.....

(i) Complete the table by giving the structure of potassium bromide. [1]

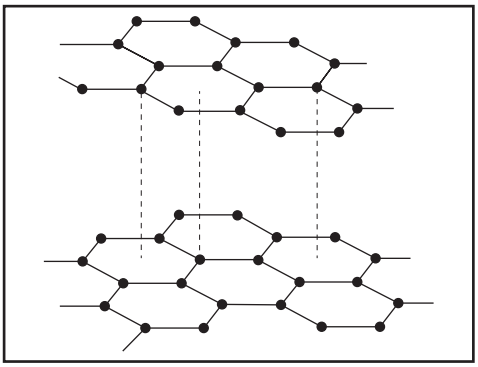
(ii) Calcium has a metallic structure.

From the values in the following box, choose the approximate melting point of calcium.

–200	**100**	**850**	**4500**

Approximate melting point of calcium is ..... °C [1]

(iii) Which of the five substances named in the above table is represented by the following diagram?



represents ..... [1]

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(b) The table below shows information about four substances, **A**, **B**, **C** and **D**.

Substance	Melting point / °C	Boiling point / °C	Density / g cm^{-3}
A	–101	–35	0.0032
B	1650	2230	2.6
C	–7	59	3.12
D	44	280	1.82

(i) State which substance could have a giant covalent structure. [1]

.....

(ii) The other three substances all have the same type of structure.

Name the type of structure. [1]

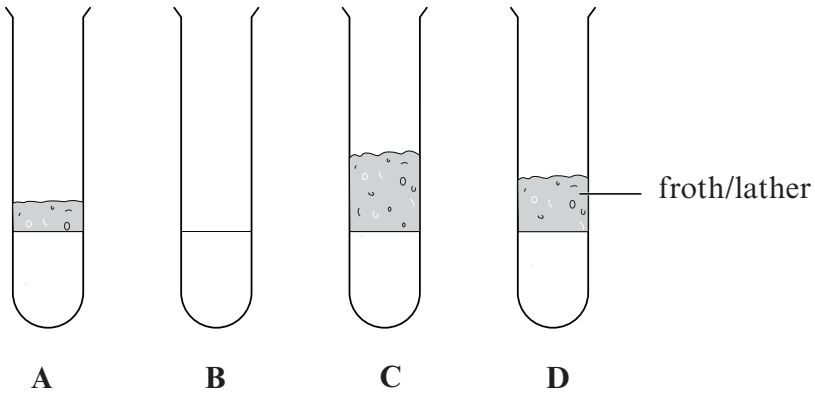
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6. 2 cm^3 of soap solution was shaken the same number of times with equal volumes of four different water samples, **A**, **B**, **C** and **D**.

The results are shown in the diagram below.



(a) State which water sample, **A**, **B**, **C** or **D**, is the softest and give a reason for your choice. [2]

Softest water .....

Reason .....

.....

(b) Describe what could be done to sample **B** to obtain a lather when using the same volume of soap solution. [1]

.....

.....

(c) Give **one** advantage of living in a hard water area. [1]

.....

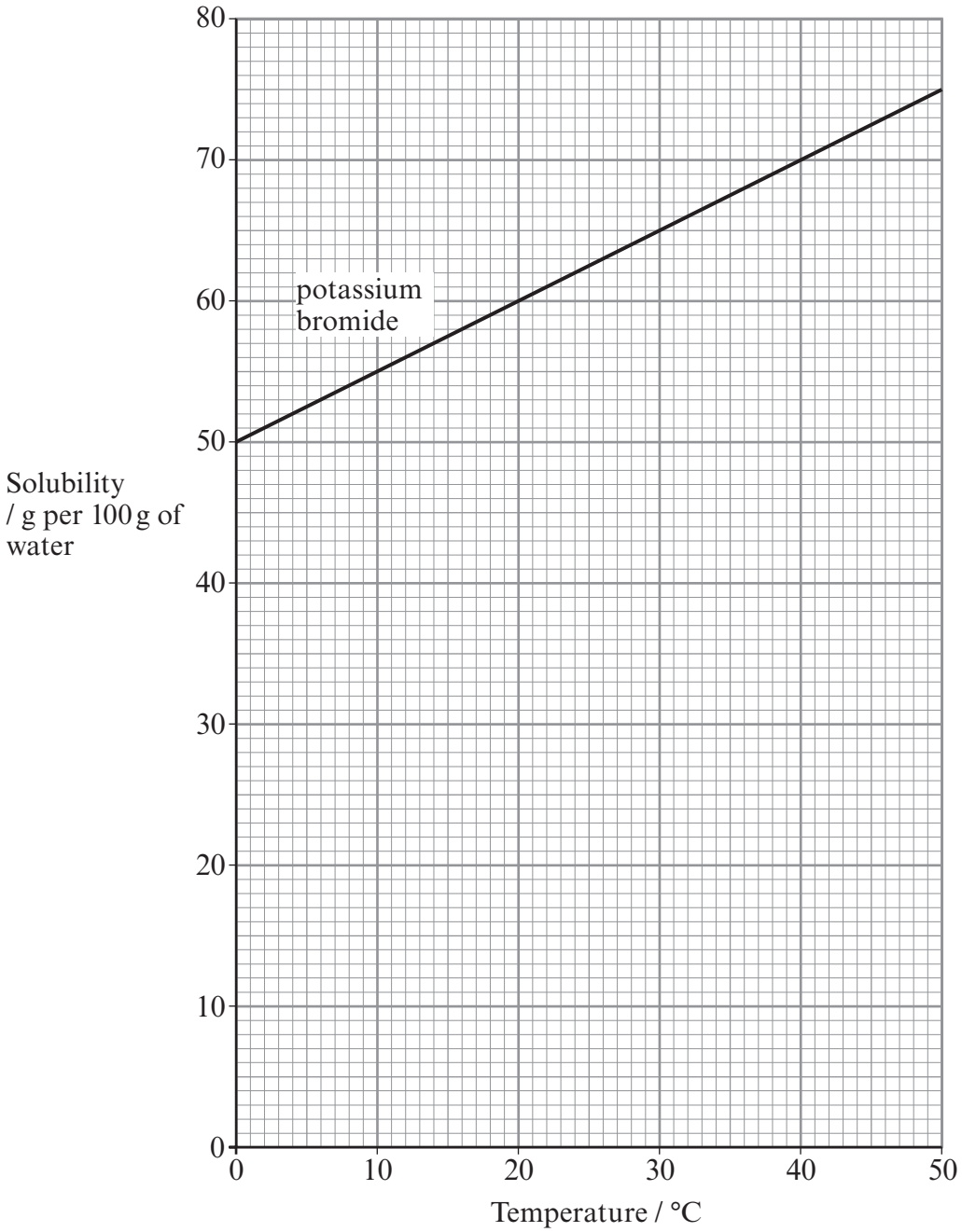
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7. The graph below shows the solubility of potassium bromide in water at different temperatures.



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The following table gives the solubility of potassium nitrate in water at different temperatures.

Temperature / °C	0	10	20	30	40	50
Solubility / g per 100 g of water	15	23	34	46	61	80

(a) Plot the results from the table on the grid opposite and then draw a **smooth curve** through the points. [3]

(b) Use the graph to find

(i) the solubility of potassium nitrate at 25 °C, [1]

..... g per 100 g of water

(ii) the temperature when the solubility of both substances is the same. [1]

..... °C

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Examiner only

8. *(a)* Complete the following table of information about some elements.

The Periodic Table of Elements shown on the **back cover of this examination paper** may help in answering this question. [4]

Element	Symbol	Number of protons	Number of neutrons	Number of electrons
carbon	$^{12}_{6}C$		6	6
magnesium	$^{24}_{12}Mg$	12	12	
phosphorus	$^{31}_{15}P$	15		15
argon		18	22	18

(b) Calculate the relative molecular mass (M_r) of sulphuric acid, H_2SO_4. [2]

$A_r(H) = 1$ $A_r(O) = 16$ $A_r(S) = 32$

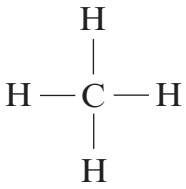
$M_r(H_2SO_4)$ = ...

6

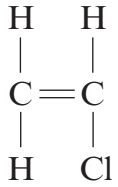
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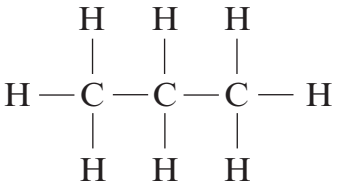
9. The following diagrams show the structural formulae of four substances, **A**, **B**, **C** and **D**.



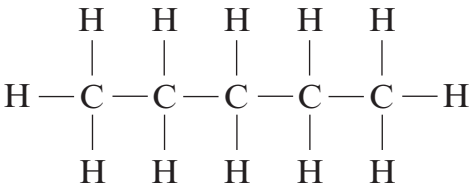
A



B



C



D

(a) The molecular formula of **A** is CH_4.

Give the molecular formula of **D**. ..... [1]

(b) Give the letter for the substance that is **not** a hydrocarbon. ..... [1]

(c) Butane contains four carbon atoms.

Draw the **structural** formula of butane. [1]

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10. *(a)* The following table contains the chemical names and formulae of some common fertilisers.

Name	Formula
sodium nitrate	$NaNO_3$
ammonium phosphate	$(NH_4)_3PO_4$
ammonium sulphate	$(NH_4)_2SO_4$
calcium nitrate	$Ca(NO_3)_2$

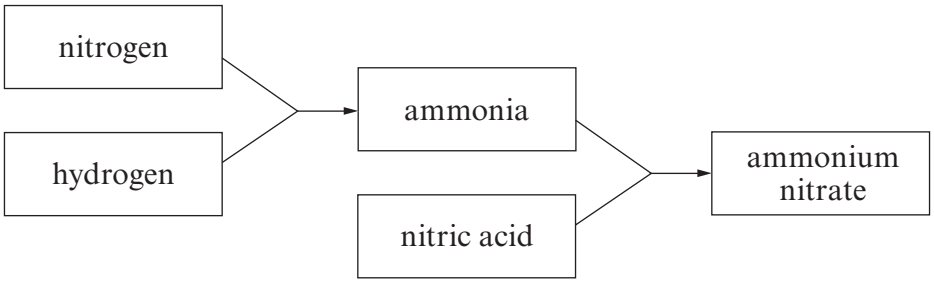
(i) **Name** the **two** elements that are found in all the above fertilisers. [1]

..... and .....

(ii) Name the acid used to neutralise ammonia in the production of ammonium sulphate. [1]

.....

(b) The following flow diagram shows how ammonium nitrate is manufactured from nitrogen, hydrogen and nitric acid.



(i) Which substance appearing in the flow diagram comes from the atmosphere? [1]

.....

(ii) Complete the **word equation** for the formation of ammonium nitrate. [1]

..... + ... ⟶ ammonium nitrate

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(c) When farmers use fertilisers, some fertiliser can be washed out of the soil into lakes. This can result in the overgrowth of algae. When algae die and decay, oxygen is removed from the lakes.

(i) State why farmers use fertilisers. [1]

.....

.....

(ii) Give **one** consequence of the removal of oxygen from lakes. [1]

.....

.....

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FORMULAE FOR SOME COMMON IONS

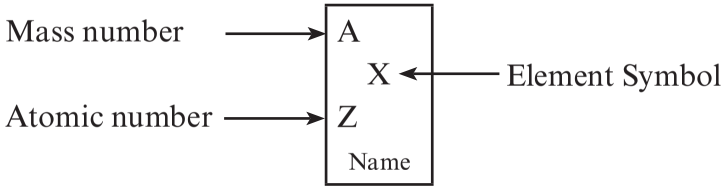
POSITIVE IONS		NEGATIVE IONS	
Name	**Formula**	**Name**	**Formula**
Aluminium	Al^{3+}	Bromide	Br^{-}
Ammonium	NH_4^{+}	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^{-}
Calcium	Ca^{2+}	Fluoride	F^{-}
Copper(II)	Cu^{2+}	Hydroxide	OH^{-}
Hydrogen	H^{+}	Iodide	I^{-}
Iron(II)	Fe^{2+}	Nitrate	NO_3^{-}
Iron(III)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

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PERIODIC TABLE OF ELEMENTS

1	2											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 Sulfur	$^{35}_{17}$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:



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GCSE MARKING SCHEME

SCIENCE – CHEMISTRY (LEGACY)

JANUARY 2012

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2012 examination in GCSE SCIENCE – CHEMISTRY (LEGACY). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

Unit	Page
C1 (Legacy)	1
C2 (Legacy)	17

UNIT C2 (LEGACY)

January 2012 Chemistry 2 Mark Scheme – Foundation Tier only questions

Q.1	Mark	Answer	Accept	Neutral answer	Do not accept
(a) (i)	1	**C**			
(ii)	1	**B**			
(iii)	1	**A**			
(b) (i)	1	5			
(ii)	1	7			
(c)	1	nucleus			

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Q.2	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	3	wellington boot ---------- waterproof coffee cup ---------- good heat insulator electric plug casing --------- does not conduct electricity tooth brush ---------- strong, flexible and hard wearing all four correct = 3 marks two correct = 2 marks one correct = 1 mark			
(b)	1	PVC, PTFE, polystyrene, nylon, polyester, acrylic, etc			
(c)	1	lighter / does not corrode or rust / easier to mould	can be coloured	waterproof	

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Q.3	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	2	to make superelastic spectacle frames (1) in coffeepot thermostat (1)			
(b)	1	photochromic pigment			

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Q.4	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	1	B A C			
(b) (i)	1	magnesium sulphate + copper	$MgSO_4$ + Cu		
(ii)	2	aluminium and copper oxide (1) copper and silver nitrate solution (1)			
(iii)	2	no reaction (1) silver is less reactive than magnesium/ magnesium is higher in the reactivity series (1)	 silver low in the series	more slowly than Mg	
(c)	1	electrolysis		reduction	

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Q.5	Mark	Answer	Accept	Neutral answer	Do not accept
(a) (i)	1	giant ionic			
(ii)	1	850			
(iii)	1	graphite		C	
(b) (i)	1	B			
(ii)	1	(simple) molecular			

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Q.6	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	2	C (1) most froth / lather formed (1)			
(b)	1	add sodium carbonate / distil / pass through ion-exchange resin	boil		
(c)	1	stronger teeth / stronger bones reduce heart illness better taste / good for making beer		strong teeth/bones	

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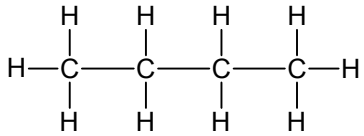
Q.7	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	3	6 points correct = 2 marks 5 points correct = 1 mark smooth curve going through all the points = 1 mark			
(b) (i) (ii)	1 1	40 ±1 47.5 ±1			

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Common questions

Q.8/1	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	4	6 (1) 12 (1) 16 (1) $^{40}_{18}$Ar (1)			
(b)	2	correct answer = 98 (2) M_r = 2 + 32 + (4x16) (1)			

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Q9/2	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	1	C_5H_{12}			
(b)	1	B			
(c)	1				

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Q.10/3	Mark	Answer	Accept	Neutral answer	Do not accept
(a) (i)	1	nitrogen and oxygen (1) both needed for the mark		N and O	
(ii)	1	sulphuric acid	H_2SO_4		
(b) (i)	1	nitrogen	N_2		N
(ii)	1	ammonia + nitric acid	$NH_3 + HNO_3$		
(c) (i)	1	increase growth / faster growth / bigger plants / healthy plants / improves soil / cheaper food / increase profit / releases land for other purposes			better plants/cheaper
(ii)	1	reduces the amount of fish		decrease in living organisms	

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Higher Tier only questions

Q.4	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	1	does not corrode		light/cost/malleable	
(b)	1	changes colour when exposed to sunlight / light			
(c)	1	has the ability to absorb a **lot** of liquids		absorbs water	
(d)	1	has the ability to regain its (original) shape when heated			

Q.5	Mark	Answer	Accept	Neutral answer	Do not accept
(a) (i) (ii)	1 1	carbon 3 → 2 3			
(b)	1	iron + aluminium oxide			
(c)	3	• place iron in the copper sulphate (solution) • the iron in copper sulphate experiment gives a (black/brown) solid / changes colour • (reaction has taken place therefore) iron more reactive than copper			

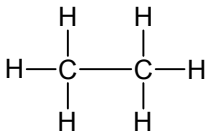
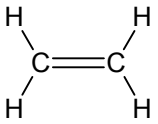
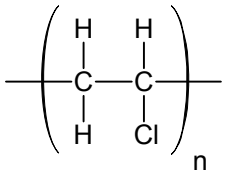
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Q.6	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	1	water that does not lather well / easily with soap water that contains calcium / magnesium ions / compounds	forms scum with soap	long <u>time</u> to lather	
(b) (i)	1	use the same amount of soap (solution) for both samples			
(ii)	1	A – requires more soap in experiment 2	A – less lather per cm^3 of soap (solution) /		
(iii)	1	volume of soap (solution) required to produce lather is less / the same for samples A and B – the ion exchange unit removes the hardness / softens the water / removes Ca^{2+}/replaces Ca^{2+} with Na^+	doubling volume of soap (solution) only produces small increase in lather (height) in experiment 1		

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Q.7	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	3	diagrammatic representation showing clearly **one** Ca atom losing 2 outer electrons (1) **two** Cl atoms gaining one electron each (1) Ca^{2+} and Cl^- (both needed) (1) there must be no ambiguity e.g. electrons cannot be on atoms and ions at the same time			
(b) (i)	2	shared pair of electrons between the N atom and the three H atoms (1) full octet around the N (1)			
(ii)	1	covalent			

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Q.8	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	2	 (1)  (1)			
(b) (i)	1	cracking			
(ii)	1	saturated – polythene has no double bonds / **only** contains single bonds		cannot add more hydrogen atoms contains single bonds	
(c) (i)	2				
(ii)	1	thermoplastic	thermosoftening plastics		

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Q.9	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	3	63.5 tonnes of Cu would come from 79.5 tonnes of CuO (1) 63.5 x 2 (127) tonnes of Cu would come from 2 x 79.5 tonnes of CuO (1) answer = 159 tonnes of CuO (1) [3 marks for correct answer]			
(b)	2	percentage yield = $\frac{101.6 \times 100}{127}$ (1) = 80 (1) [2 marks for correct answer]			$\frac{63.5}{79.5} \times 100 = 79.9\%$

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Q.10	Mark	Answer	Accept	Neutral answer	Do not accept
	3	(warm) with sodium hydroxide (1) **damp** (red) litmus (1) goes blue (1)	**damp** universal indicator paper goes blue / purple		

Surname	Centre Number	Candidate Number
Other Names		0

GCSE

240/01

ADDITIONAL SCIENCE
FOUNDATION TIER
CHEMISTRY 2

A.M. WEDNESDAY, 25 May 2011

45 minutes

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

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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.

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Examiner only

Answer **all** *questions.*

1. *(a)* Atoms are made up of particles called **electrons**, **neutrons** and **protons**.

(i) Complete the table below by writing the name of each particle alongside its correct mass and charge. [2]

Particle	Mass	Charge
	1	+1
	1	0
	very small	–1

(ii) Name the particles found in the shells (orbits) of atoms. [1]

.....

(iii) Name **one** particle found in the nucleus of an atom. [1]

.....

(b) Put a tick (✓) in the box next to the calculation used to find the relative molecular mass (M_r) of sulphuric acid, H_2SO_4. [1]

$A_r(H) = 1$ $A_r(O) = 16$ $A_r(S) = 32$

1 + 32 + 16 ☐

1 + 1 + 32 + 16 + 16 + 16 + 16 ☐

1 + 32 + 32 + 16 + 16 + 16 + 16 ☐

1 + 1 + 16 + 16 + 16 + 16 ☐

☐

5

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Examiner only

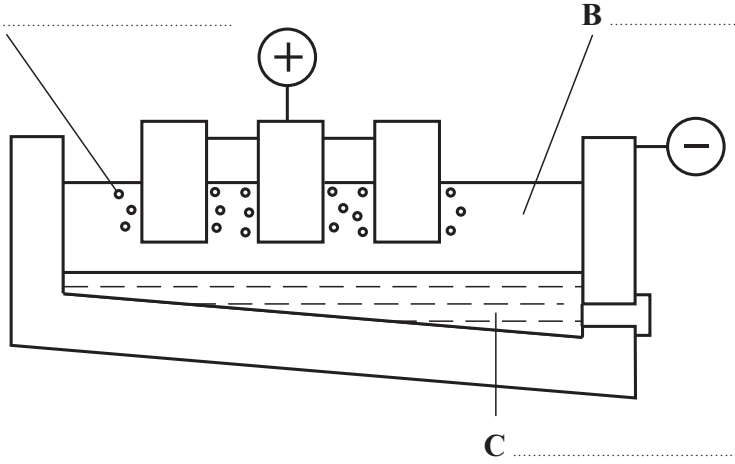
2. *(a)* Read the information about the extraction of aluminium given in the box below.

> The main ore of aluminium is bauxite. Bauxite is mainly aluminium oxide and the impurity iron oxide. Aluminium is extracted from molten aluminium oxide by the process of electrolysis. During the process, aluminium oxide is broken down into aluminium and oxygen using an electric current. Aluminium is formed at the negative cathode and oxygen at the positive anode. The process is expensive because a lot of electrical energy is needed.

Use only the information in the box to answer parts (i) and (ii).

(i) Name the substances labelled **A**, **B** and **C** in the following diagram. [3]

A .....



B .....

C .....

(ii) State why the process of electrolysis makes aluminium an expensive metal. [1]

.....

(b) Put a tick (✓) in the box next to **two** factors that affect the siting of an aluminium extraction plant in Britain. [2]

Aluminium extraction plants in Britain need to be close to

a power station ☐

the coast because aluminium ore is imported ☐

limestone quarries ☐

coal mines ☐

bauxite mines ☐

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3. *(a)* The table below shows the ions present in four different bottled mineral waters, **A-D**.

Ions present	Typical analysis / mg dm^{-3}			
	A	**B**	**C**	**D**
calcium	12	40.5	22.0	181
magnesium	1.6	11.6	11.5	53.5
potassium	0.7	0.9	1.0	2.5
sodium	3.9	9.4	22.0	36.1
hydrogencarbonate	45.0	190.0	116.0	239.0
chloride	5.0	8.1	14.0	57.5
sulphate	4.0	6.4	4.0	459.0
nitrate	1.0	2.4	0.1	2.2

Use the data in the table to answer parts (i) and (ii).

(i) State which water is the **hardest**. ..... [1]

(ii) Give **two** reasons for your choice in (i). [2]

1. .....

2. .....

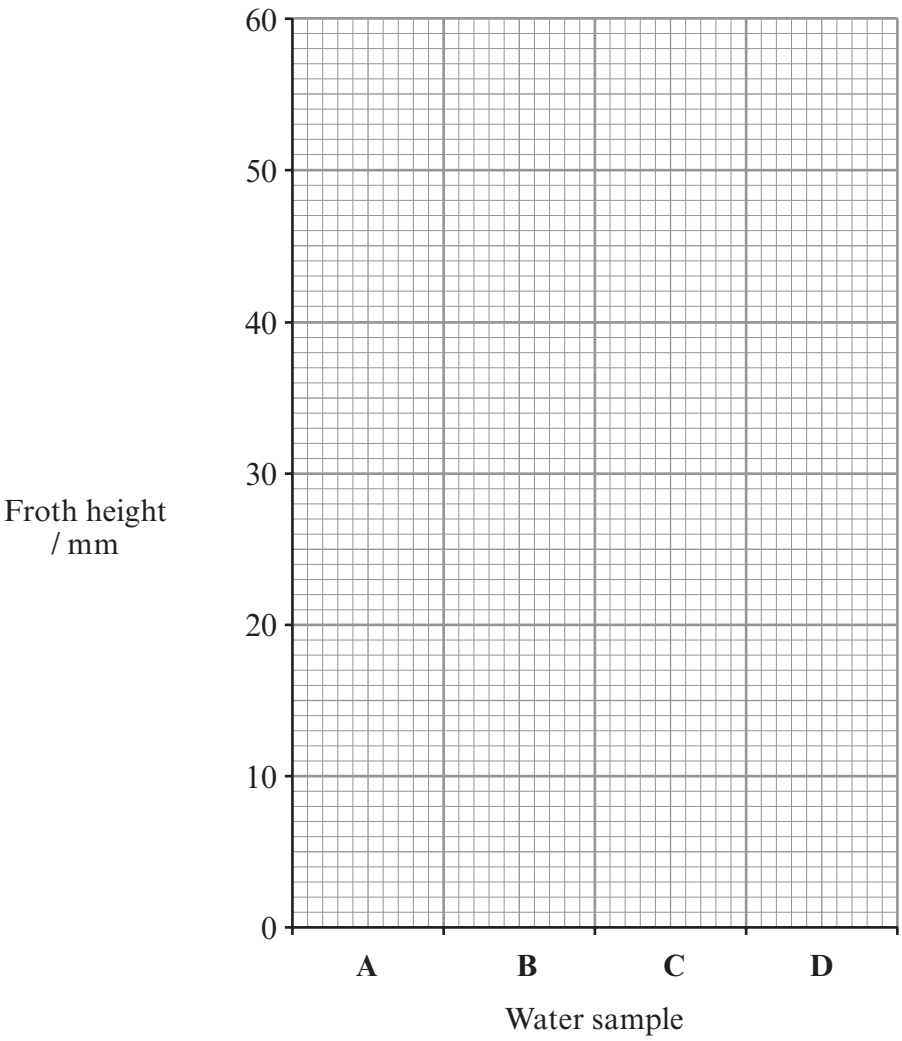
(b) 1 cm^3 of soap solution was shaken the same number of times, with equal volumes of each of the waters. The froth height was measured in each experiment.
Results are shown in the table below.

Mineral water	Froth height / mm
A	59
B	35
C	38
D	2

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(i) Complete the bar chart of the results on the grid below. [2]



(ii) Use the bar chart to place the mineral waters, **A-D**, in order of hardness. [1]

hardest .....

.....

.....

softest .....

(iii) Give **two** ways in which this experiment was made a fair test. [2]

1. .....

2. .....

(iv) State which part of the procedure could make the results unreliable. [1]

.....

Turn over.

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Examiner only

4. *(a)* Polythene is made from ethene and is an example of a polymer.

alkanes	**alkenes**	**cracking**	**monomers**	**polymerisation**	**polymers**

Choose words from the above box to complete the following sentences.

(i) Small molecules, like ethene, which can join together are called

..... [1]

(ii) Ethene belongs to the family of hydrocarbons called

..... [1]

(iii) The process of making polythene from ethene is called

..... [1]

(b) The table below shows some properties of four plastics, **A**, **B**, **C** and **D**.

Plastic	Effect of heat	Flexibility	Hardness	Lets light through?
A	melts	brittle	soft	no
B	melts	flexible	soft	no
C	melts	brittle	hard	yes
D	stable to heat	brittle	hard	no

Use only the information in the table to answer parts (i)-(iii) opposite.

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State which plastic, **A**, **B**, **C** or **D**, you would choose to make the following items, and give the **main** reason for your choice.

(i) Crash helmet ***visor***



Plastic .....

Main reason ..... [1]

(ii) Electric kettle



Plastic .....

Main reason ..... [1]

(iii) Carrier bag



Plastic .....

Main reason ..... [1]

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Examiner only

5. *(a)* **Use the word equation for the formation of ammonia to answer parts (i) and (ii).**

nitrogen + hydrogen $\rightleftharpoons$ ammonia

(i) Name the **reactant** which is found in the atmosphere. [1]

.....

(ii) Name the **product** of the reaction. [1]

.....

(iii) The above reaction can go in both directions. Give the chemical term used to describe this type of reaction. [1]

.....

(b) Ammonium sulphate, $(NH_4)_2SO_4$, and ammonium nitrate, NH_4NO_3, are examples of nitrogenous fertilisers made from ammonia.

(i) Name the **element** present in both fertilisers which is used by plants to help them grow. [1]

.....

(ii) Name the **acid** used to make ammonium sulphate, $(NH_4)_2SO_4$. [1]

.....

(c) State how nitrogenous fertilisers might get into our public water supplies. [1]

.....

6

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Examiner only

6. Smart materials are modern materials whose properties change with a change in their surroundings.

(a) Shape memory polymers are being developed to manufacture self-repairing car bodies. The diagram below shows a piece of twisted shape memory polymer.

State how the polymer can be made to regain its original shape. [1]



twisted shape memory polymer original shape

.....

(b) Thermochromic and photochromic pigments are examples of smart materials that have different colours under different conditions.

State the **type** of smart material used to make the following products, and the change in surroundings which causes the colour change in each case.

(i) Self-darkening sun glasses



Type of smart material .....

Change in surroundings which causes the colour change [1]

.....

(ii) Electric kettles



Type of smart material .....

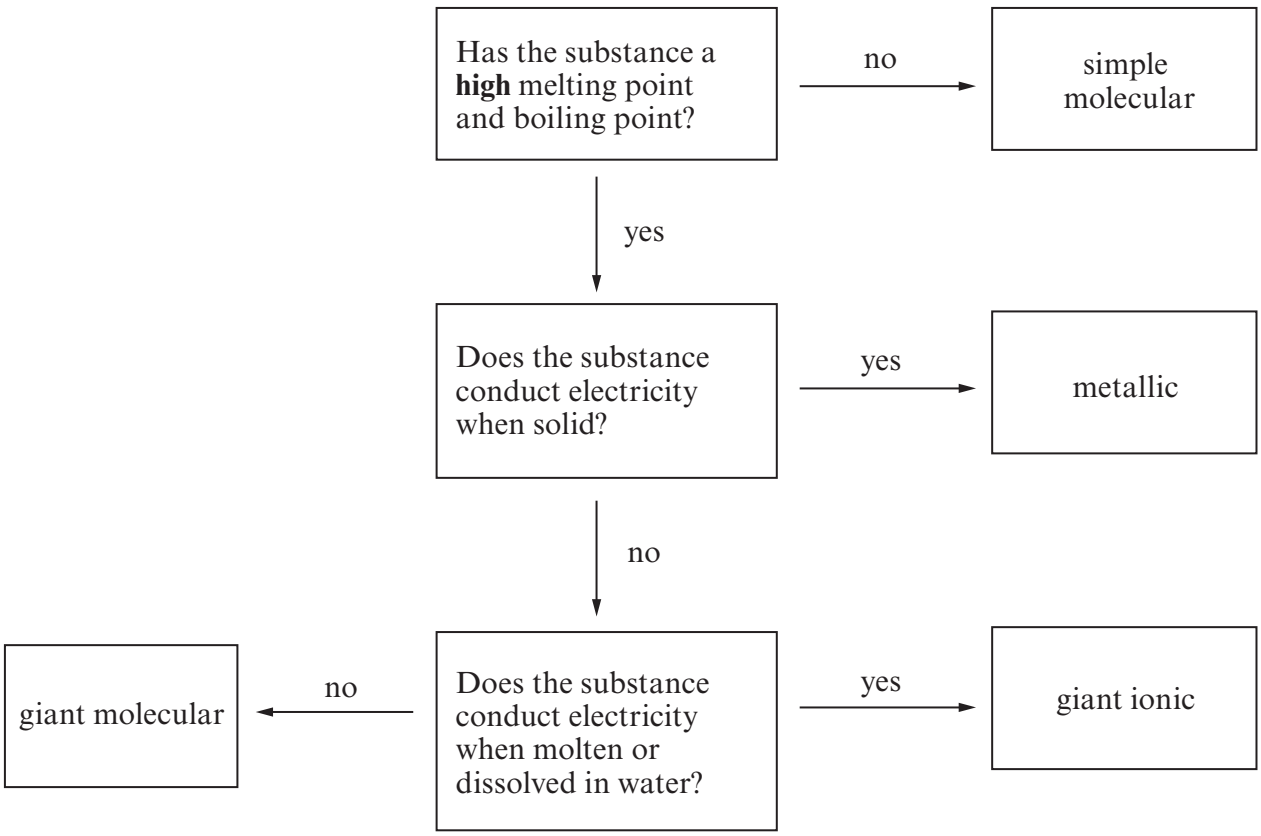
Change in surroundings which causes the colour change [1]

.....

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Examiner only

7. *(a)* The flow chart below can be used to identify the type of structure found in different substances.



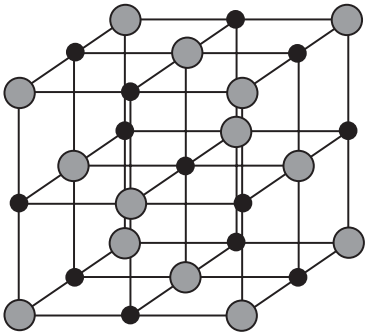
Complete the table below using the flow chart. [4]

Substance	Melting point / °C	Boiling point / °C	Electrical conductivity	Structure
aluminium oxide	2072	2980	conducts electricity only when molten	
ammonia	–77	–34	does not conduct electricity	
silicon dioxide	1610	2230	does not conduct electricity	
titanium	1667	3277	conducts electricity when solid	

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(b) The diagram below shows the structure of sodium chloride.



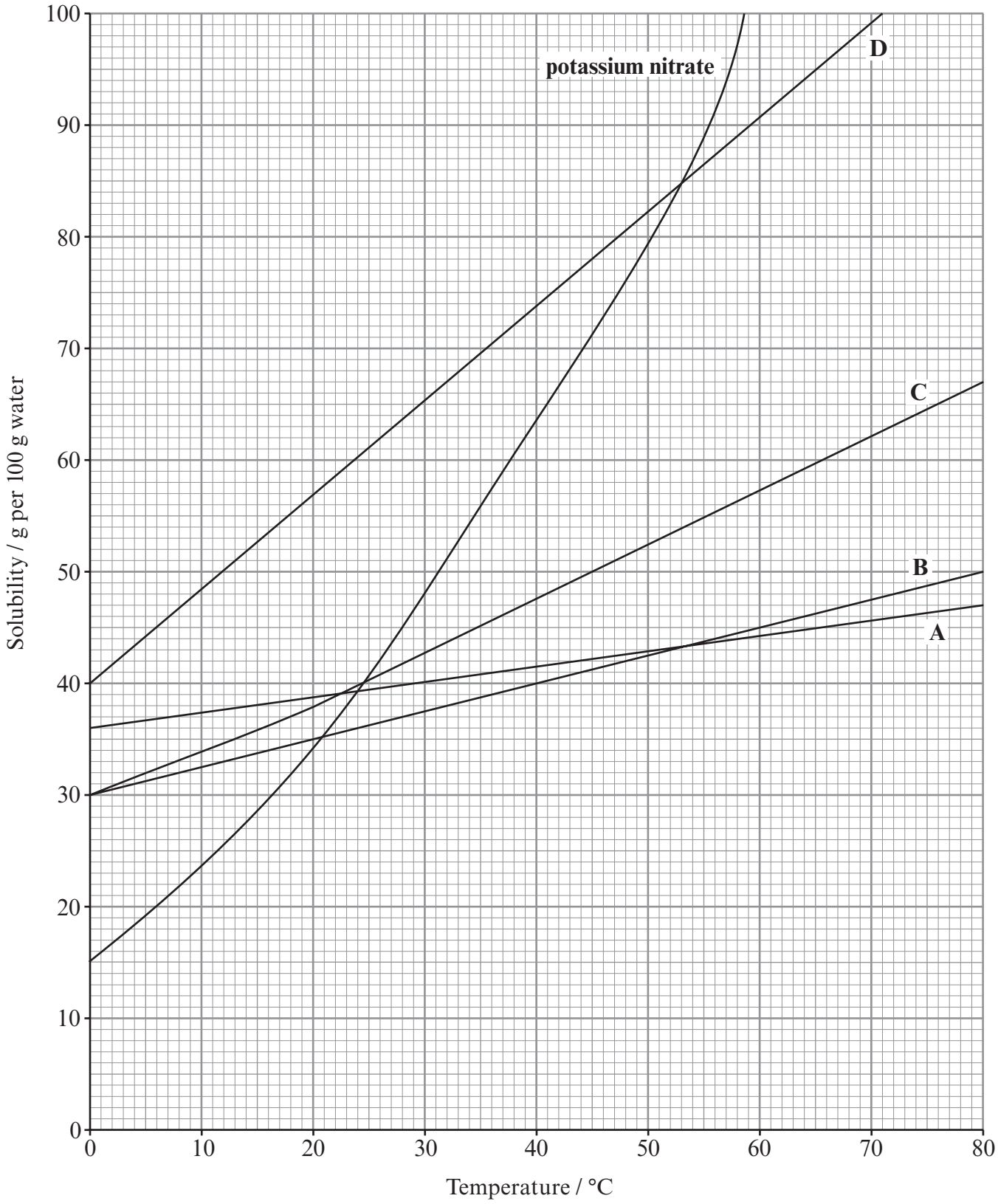
Describe the electrical conductivity of sodium chloride. [1]

.....

.....

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8. The graph below shows the solubility of potassium nitrate and four substances, **A**, **B**, **C** and **D**, in water at various temperatures.



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Use the graph to answer parts (a)-(e).

Give the letter of the substance which

(a) has the **lowest** solubility at 70 °C, [1]

.....

(b) has the **same** solubility as potassium nitrate at 53 °C, [1]

.....

(c) has the solubility that **changes** the **least** with temperature, [1]

.....

(d) forms 21 g of solid when a saturated solution in 100 g of water at 65 °C is cooled to 40 °C, [1]

.....

(e) forms the **smallest** mass of solid when a saturated solution in 100 g of water at 20 °C is cooled to 0 °C. [1]

.....

5

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9. The table below shows information about the atoms of four elements.

Use the data and key on the Periodic Table of Elements shown on the **back page of this examination paper** to complete the table. [5]

Element	Symbol and data	Number of protons	Number of neutrons	Number of electrons
lithium	$^{7}_{3}$Li	3	4	3
beryllium	$^{9}_{4}$Be			4
aluminium		13	14	
	$^{31}_{15}$P	15	16	15

5

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FORMULAE FOR SOME COMMON IONS

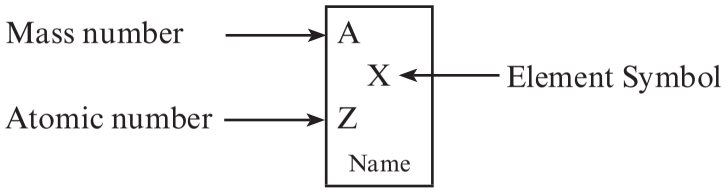
POSITIVE IONS		NEGATIVE IONS	
Name	**Formula**	**Name**	**Formula**
Aluminium	Al^{3+}	Bromide	Br^{-}
Ammonium	NH_4^{+}	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^{-}
Calcium	Ca^{2+}	Fluoride	F^{-}
Copper(II)	Cu^{2+}	Hydroxide	OH^{-}
Hydrogen	H^{+}	Iodide	I^{-}
Iron(II)	Fe^{2+}	Nitrate	NO_3^{-}
Iron(III)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

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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:



STEMUP.CO.UK (0240-01)

Candidate Name	Centre Number	Candidate Number
		0

WJEC CBAC

GCSE

240/01

ADDITIONAL SCIENCE
FOUNDATION TIER
CHEMISTRY 2

A.M. MONDAY, 17 January 2011

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**2**	
3.	**4**	
4.	**4**	
5.	**8**	
6.	**11**	
7.	**6**	
8.	**9**	
Total	**50**	

0240 010001

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.

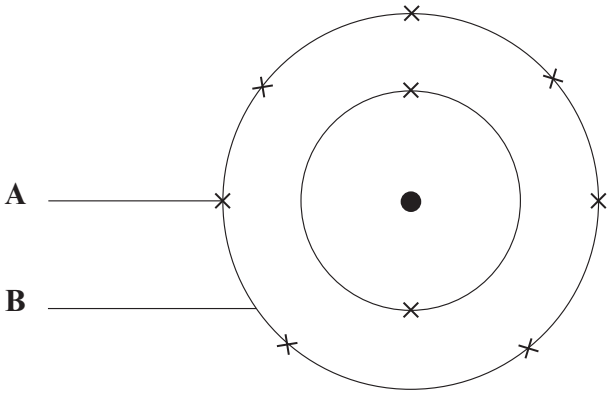
You are reminded of the necessity for good English and orderly presentation in your answers.

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.

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Answer **all** *questions.*

1. (i) The diagram below shows an atom of fluorine.



Use words from the box below to answer parts I and II.

electron	**neutron**	**nucleus**
orbit (shell)	**proton**	

I. Name the particle labelled **A**. ..... [1]

II. Name the part labelled **B**. ..... [1]

(ii) A beryllium atom can be represented by the following symbol:

$$^{9}_{4}\mathbf{Be}$$

Use the numbers in the box below to complete sentences I, II and III.

2	**3**	**4**	**5**	**9**	**13**

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

Complete the following sentences.

I. Beryllium has ..... electrons. [1]

II. The mass number of beryllium is ..... . [1]

III. Beryllium has ..... neutrons. [1]

(iii) Atoms have **equal numbers** of positive protons and negative electrons.
Give the overall charge of an atom. [1]

.....

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Examiner only

2. The calculation below shows how the relative molecular mass, M_r, of ammonia, NH_3, is found.

$$A_r(H) = 1; \quad A_r(N) = 14$$

$$M_r(NH_3) = 14 + 1 + 1 + 1 = 17$$

Tick (✓) the boxes next to the **two** substances which **both** have a relative molecular mass (M_r) of 28. [2]

$$A_r(H) = 1; \quad A_r(C) = 12; \quad A_r(N) = 14$$

$$A_r(O) = 16; \quad A_r(S) = 32.$$

carbon monoxide, CO ☐

hydrogen peroxide, H_2O_2 ☐

hydrogen sulphide, H_2S ☐

nitrogen, N_2 ☐

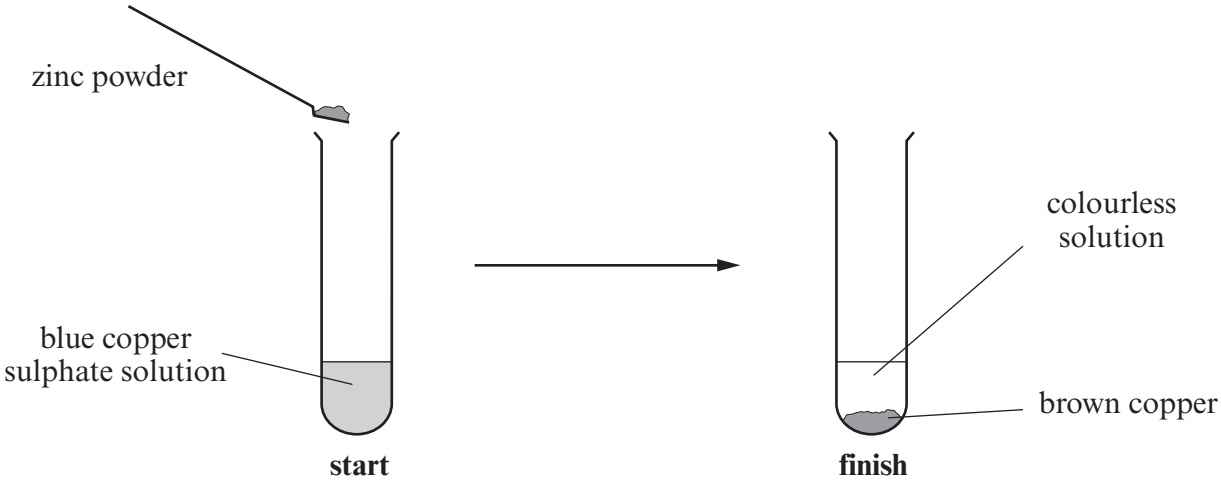
nitrogen oxide, NO ☐

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3. (i) A pupil carried out an experiment that involved adding excess zinc powder to blue copper sulphate solution. During the reaction, the blue solution became colourless and some brown copper was formed.



The reaction that took place can be shown by the following word equation.

zinc + copper sulphate ⟶ zinc sulphate + copper

I. The above experiment was then repeated using copper powder and silver nitrate solution.

During the reaction, a blue solution and a grey solid were formed. Complete the following **word equation**. [1]

copper + silver nitrate ⟶ ..... + ...

II. Use the results of the above two experiments to place copper, silver and zinc in order of **decreasing** reactivity. [1]

most reactive .....

.....

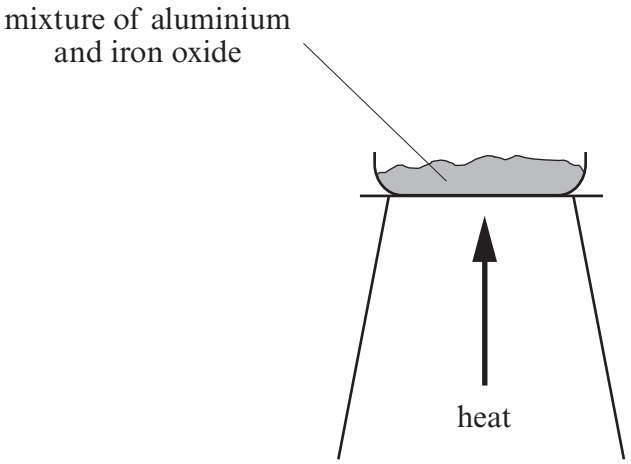
least reactive .....

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(ii) Aluminium is a more reactive metal than iron.

A mixture of aluminium powder and iron oxide was heated strongly using the equipment shown. A violent reaction took place with lots of heat being given out.



Give the **word equation** for the reaction that took place. [2]

..... + ... → ..... + ...

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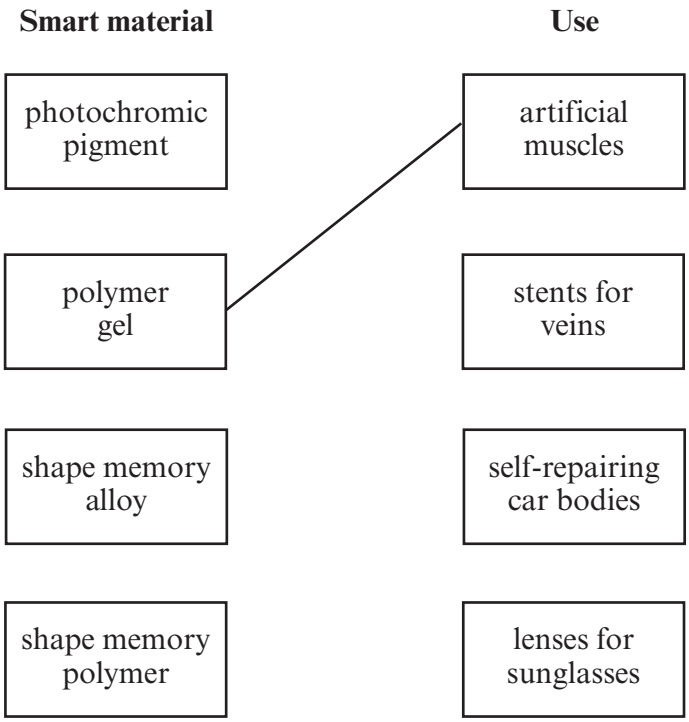
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4. (i) Photochromic pigments, polymer gels, shape memory alloys and shape memory polymers are all examples of smart materials.

Draw a line to connect **each** smart material to its correct use. [2]

One has already been done for you.

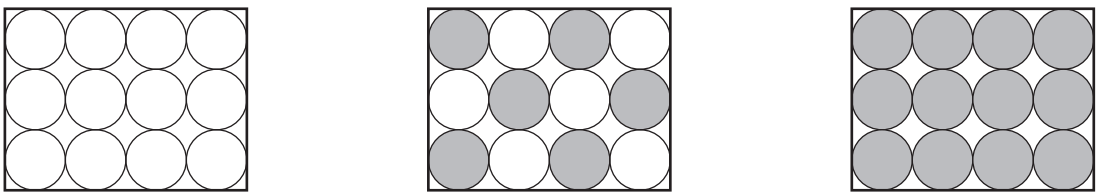


(ii) Nitinol (NiTi) is an example of a shape memory alloy.

I. State the **special** property of shape memory alloys. [1]

.....

II. State which of the following, **A**, **B** or **C**, best represents the structure of solid nitinol. [1]



A **B** **C**

The structure of nitinol is best represented by ..... .

4

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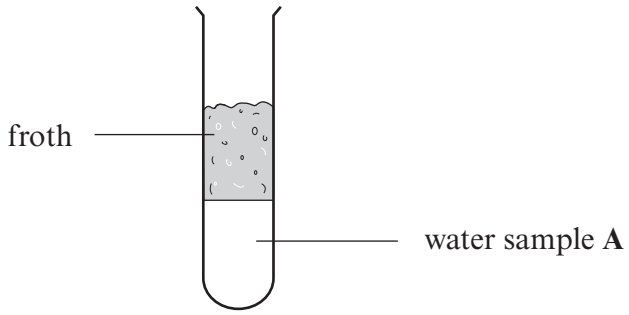
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5. 1 cm^3 of soap solution was shaken for 10 seconds with 10 cm^3 of water sample **A**. The height of the froth was measured.



The experiment was then repeated with water samples **B**, **C**, **D** and **E**.

(i) State **two** ways of making sure that the investigation was made a fair test. [2]

.....

.....

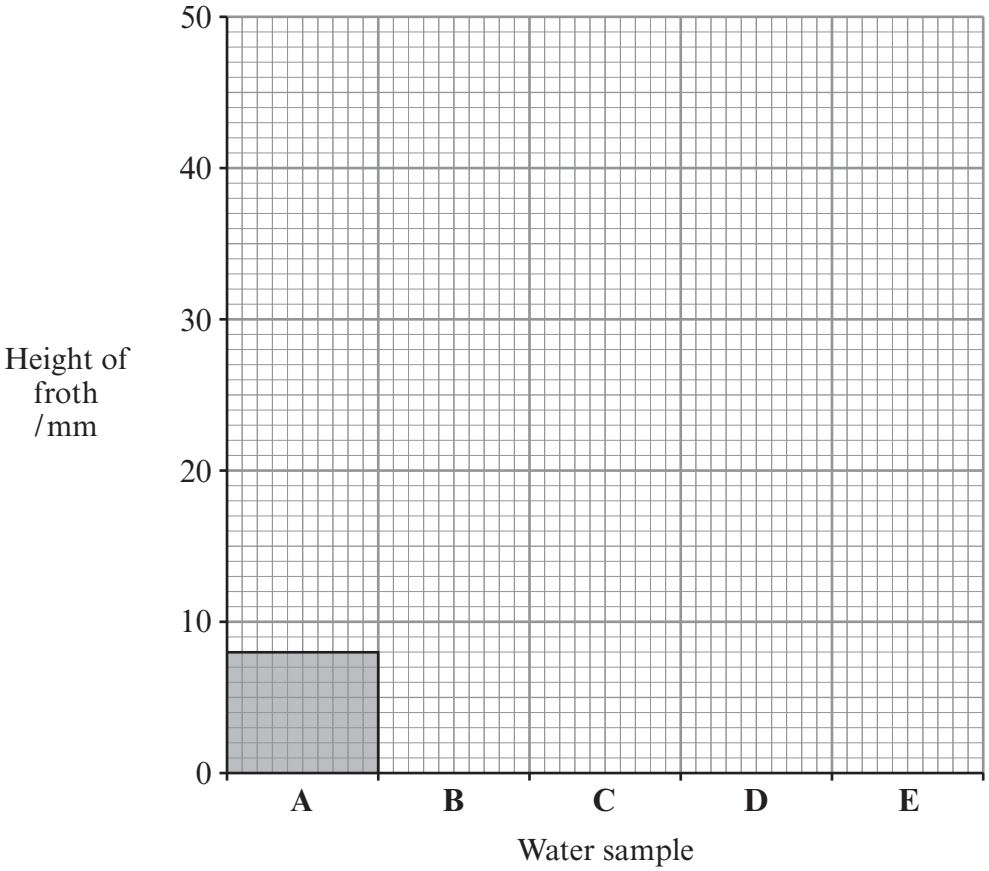
(ii) The results of the experiments are shown in the table below.

Water sample	Height of froth/mm
A	8
B	41
C	2
D	13
E	39

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Complete the bar chart of the results on the grid below.
The result for water sample A has already been done for you. [2]



(iii) State which sample was the hardest water and explain your answer. [2]

Sample .....

Explanation .....

.....

(iv) Tick (✓) **two** boxes to show two possible methods for softening hard water. [2]

adding sodium chloride ☐

adding calcium carbonate ☐

freezing ☐

adding sodium carbonate ☐

boiling ☐

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6. *(a)* The boxes below contain some information about nitrogen and ammonia.

Nitrogen, N_2	Ammonia, NH_3
colourless gas no smell slightly soluble in water neutral used in packaging crisps	colourless gas pungent smell very soluble in water alkaline used in making fertilisers

Use the information in the boxes to answer parts (i) and (ii).

(i) Give the **names** of the two elements present in ammonia. [1]

..... and .....

(ii) State **one similar property** and **one different property** of nitrogen and ammonia. [2]

Similar property

.....

Different property

.....

(iii)

giant covalent	**giant ionic**
simple molecular	**metallic**

Choose the structure from the box above to complete the following sentence. [1]

Nitrogen and ammonia are examples of substances which have a

..... structure.

(b) (i) Ammonia reacts with sulphuric acid to give a substance that can be used as a fertiliser.

Give the **word equation** for the reaction that takes place. [2]

..... + ... → .....

(ii) State the type of reaction that takes place between ammonia and sulphuric acid. [1]

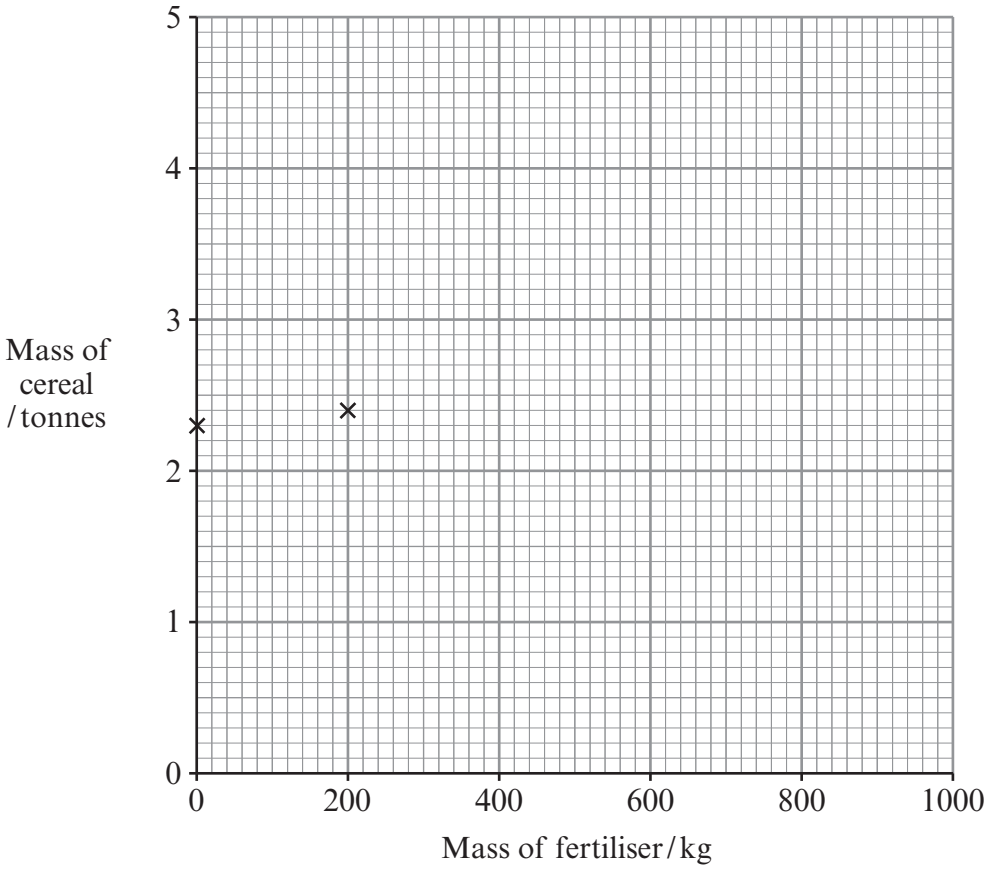
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(c) The table below shows the mass, in tonnes, of cereal produced from every hectare of land using different masses of fertilisers.

Mass of fertiliser / kg	Mass of cereal / tonnes
0	2.3
200	2.4
400	2.8
600	3.8
800	4.4
1000	4.6

(i) Plot the points on the grid below and draw a **smooth curve** through **all** the points. **Two points have been plotted for you**. [3]



(ii) Use the graph to find the mass of cereal you would expect to be produced using 700 kg of fertiliser. [1]

..... tonnes

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7. 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 .....

.....

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(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]

.....

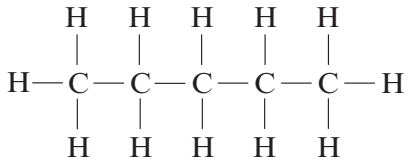
A

.....

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8. *(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**.

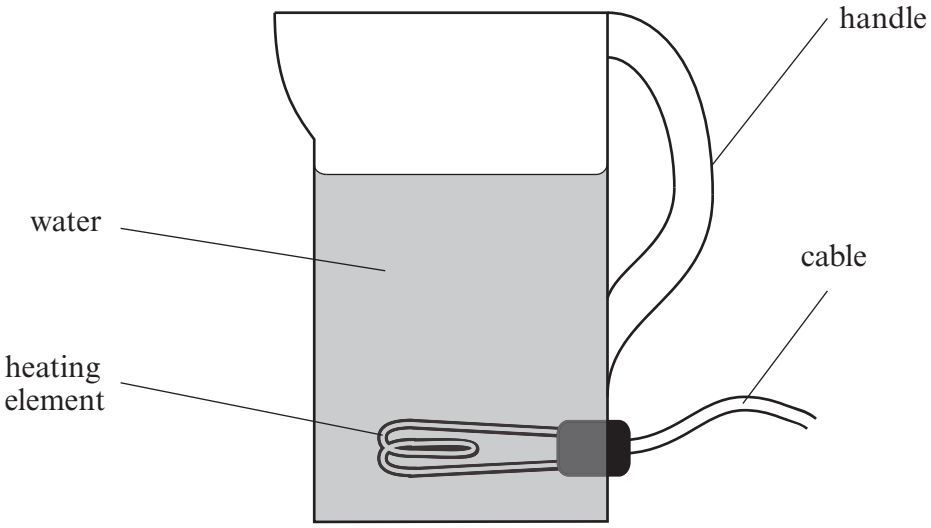
Substance	Properties
A	gas at room temperature colourless does not conduct heat does not conduct electricity
B	solid at room temperature grey colour good conductor of electricity ductile
C	liquid at room temperature colourless does not conduct heat poor conductor of electricity
D	solid at room temperature 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

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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 .....

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FORMULAE FOR SOME COMMON IONS

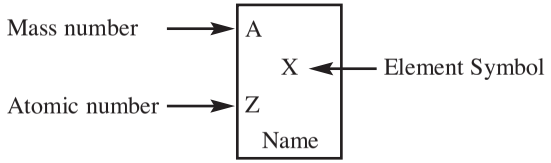
POSITIVE IONS		NEGATIVE IONS	
Name	**Formula**	**Name**	**Formula**
Aluminium	Al^{3+}	Bromide	Br^{-}
Ammonium	NH_4^{+}	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^{-}
Calcium	Ca^{2+}	Fluoride	F^{-}
Copper(II)	Cu^{2+}	Hydroxide	OH^{-}
Hydrogen	H^{+}	Iodide	I^{-}
Iron(II)	Fe^{2+}	Nitrate	NO_3^{-}
Iron(III)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

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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:



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