CCEA GCSE SCIENCE: DOUBLE AWARD (MODULAR)

SCIENCE



EXAM QUESTION PACK

END OF MODULE TEST B HIGHER TIER GDB02 PAPERS

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Rewarding Learning

General Certificate of Secondary Education
2011–2012

Science: Double Award (Modular)

Using Materials and Understanding Reactions
End of Module Test
Higher Tier

[GDB02]

MONDAY 21 MAY 2012
9.15 am–10.00 am

MARK SCHEME

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	AVAILABLE MARKS

1

Element	Number of protons	Number of neutrons	Number of electrons	Electronic configuration
boron	5	6	**5**	2,3
sodium	11	**12**	11	2,8,1
phosphorous	15	16	15	**2,8,5**

[4] — 4

2 **(a)** diffusion [1]

(b) Idea of particles gaining energy **or** move faster [1]
idea that **more** particles have the energy to change from liquid to gas/leave the liquid and go into the air [1] — 3

3 **(a)** redox not r<u>a</u>dox [1]

(b) Hydrogen [1]

(c) $CuO + H_2 \longrightarrow Cu + H_2O$
[1] [1] [2] — 4

4 **(a)** Some substances can be broken down into simpler substances by using **electricity** [1]. This is called electrolysis and can happen when the substance **is molten** [1]/**or in solution** [1]. (any order) accept dissolved **or** aqueous [3]

(b) The **negative electrode** [1]

(c) Any suitable metal e.g. aluminium (i.e. zinc or above in electrochemical series) **not** copper [1] — 5

5 **(a)** Idea of the same volume of **water** sample used [1]

(b) Idea that the more soap solution needed to produce a permanent lather the harder the water or the less soap solution needed to form a permanent lather the softer the water **not** idea of time [1]

(c) Temporary [1]
produces scale when heated/wastes soap/may lead to blocked hot water pipes/idea that scale can form on heating elements of kettles reducing efficiency/or other suitable, e.g. formation of scum with soap [1] — 4

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			AVAILABLE MARKS
6	Candidate indicates by drawing, by use of electronic configurations or by statement the following points Calcium loses two electrons [1] Chlorine atoms each gain 1 electron [1] 2:1 ratio [1] Ionic bond/electrostatic attraction/attraction between oppositely charged ions [1]		4
7	**(a)** first two boxes ticked	[2]	
	(b) 2,7 arrangement/correct sharing [1] correct number of electrons [1]	[2]	4
8	**(a)** thermosoftening	[1]	
	(b) idea of bulb heating up [1] causing thermosoftening plastic to lose shape [1]	[2]	
	(c) diagram to correctly show crosslinks between strands	[1]	4
9	$.P_1V_1/T_1 = P_2V_2/T_2$ [1] $500 \times 2000/250 = 4000 \times V/400$ second method mark for correct computation correct 400 [3] cm^3 [1]	[4]	4
10	**(a)** neutralisation	[1]	
	(b) $H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O_{(l)}$ [1] [1] state symbols [1]	[3]	4
11	**(a)** It has free moving **electrons** [1] which carry the current [1]	[2]	
	(b) metal atoms/ions can slip into new positions **not** idea of layers sliding	[1]	
	(c) they are not strong	[1]	4

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			AVAILABLE MARKS
12	**(a)**	inert/does not react with the solution [1] conduct electricity [1]	[2]	
	(b)	oxygen	[1]	
	(c)	$2H^+ + 2e^- \longrightarrow H_2$ LHS [1] RHS [1]	[2]	
	(d)	SO_4^{2-}	[1]	6
			Total	**50**

Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2011–2012

Science: Double Award (Modular)

Using Materials and Understanding Reactions
End of Module Test
Higher Tier

B

[GDB02]

GDB02

TUESDAY 28 FEBRUARY 2012
11.00 am–11.45 am

TIME

45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all twelve** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 50.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet, which includes a Periodic Table of the elements, is provided for your use.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
Total Marks	

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Examiner Only	
Marks	Remark

1 You may find your Data Leaflet helpful when answering this question.

A list of chemical formulae is given below.

$NaHCO_3$ **$ZnCO_3$** **KNO_3** **FeS**

$IrSO_4$ **$NAHCO_3$** **$FeSO_4$** **$Na(HCO_3)_2$**

From the list choose the correct formula for:

(a) **(i)** Sodium hydrogen carbonate _____ [1]

(ii) Iron(II) sulphate _____ [1]

(b) How many atoms are there in the formula $CuSO_4$?

_____ [1]

(c) What is the name of the substance with the formula $ZnCO_3$?

_____ [1]

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2 Phosphorus is a chemical element with an atomic number of 15 and a mass number of 31.

(a) What is meant by the term **mass number**?

_____

_____ [2]

(b) Complete the table below to show the atomic structure of phosphorus.

Element	Atomic number	Mass number	Number of protons	Number of electrons	Number of neutrons
phosphorus	15	31			

[3]

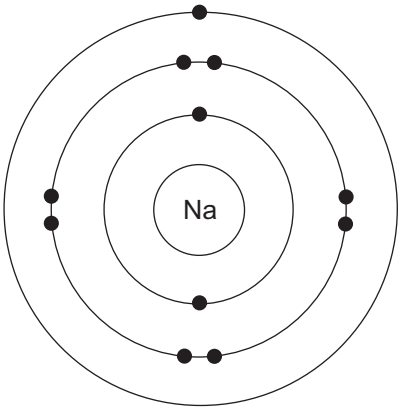
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Marks	Remark

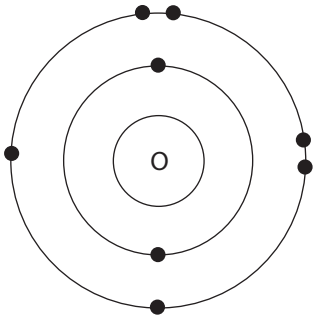
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Examiner Only	
Marks	Remark

3 The elements sodium and oxygen react to form a compound, sodium oxide. The electronic structures of a sodium atom and an oxygen atom are shown below.



sodium atom



oxygen atom

(a) In the spaces below, draw the electronic structures for the ions produced from each of these atoms.

sodium ion **oxide ion** [2]

(b) Give the chemical formula for sodium oxide.

_____ [1]

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4 **(a)** The table below gives some information about oxides **A**, **B** and **C**. Complete the table to show which oxides are metal and which are non-metal.

Oxide	Colour with Universal Indicator	Metal or non-metal oxide
A	purple	
B	green	non-metal oxide
C	red	

[2]

(b) Name a non-metal oxide which is neither acidic nor basic.

_____ [1]

(c) Some oxides are basic and can dissolve in water.

What term is used to describe a soluble base?

_____ [1]

Examiner Only

Marks	Remark

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5 The table below shows the solubility of different gases in water at different temperatures.

	Solubility g/100 g water		
Gas	**0 °C**	**20 °C**	**40 °C**
nitrogen	0.03	0.02	0.01
oxygen	0.07	0.04	0.03
carbon dioxide	0.34	0.17	0.10

(a) Which of these gases is the least soluble in water at 20 °C?

_____ [1]

(b) Use the information in the table to describe the trend in solubility.

_____

_____ [2]

(c) Salmon depend on the amount of oxygen dissolved in the water for survival. They cannot swim well when the water temperature rises above 15 °C.

Use the information in the table to explain why the salmon would have difficulty in swimming on hot summer days.

_____

_____ [1]

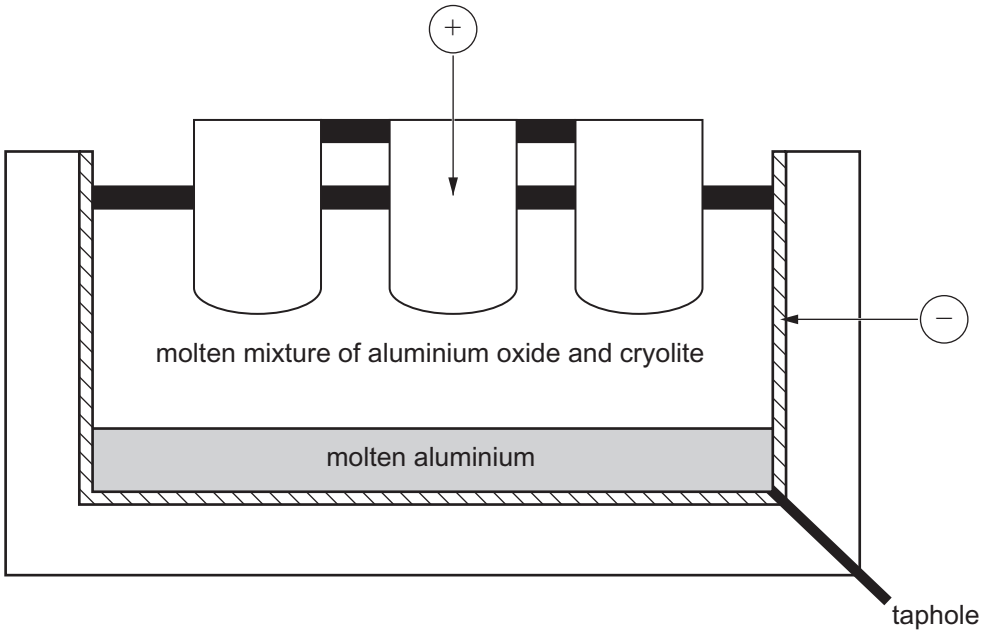
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Marks	Remark

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Examiner Only	
Marks	Remark

6 The diagram below shows the method used to extract aluminium from its ore.



(a) What name is given to the process of extraction of aluminium from its ore?

_____ [1]

(b) Name the electrode at which the aluminium is produced.

_____ [1]

(c) Complete the following sentence:

The positive electrode is made of blocks of carbon (graphite) which have to be replaced at regular intervals because the carbon reacts

with _____ to produce _____ [2]

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Examiner Only	
Marks	Remark

7 Water has the chemical formula H_2O.

(a) Draw a diagram to show how **all** the electrons are arranged in a molecule of water.

[2]

(b) Name the type of bonding in water.

_____ [1]

(c) Which of the following substances have the same kind of bonding as water?

Tick (✓) the **two** correct boxes.

sodium chloride ☐

chlorine gas ☐

magnesium chloride ☐

oxygen gas ☐

calcium oxide ☐ [2]

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8 Badminton racket frames were originally made from wood, then steel was used. Now racket frames are made from carbon fibre reinforced plastic, a composite material.

The table below gives some properties of widely used materials.

Material	Density g/cm^3	Relative strength	Relative stiffness
steel	7.8	10	105
polythene	0.96	0.2	0.3
glass fibre reinforced plastic	1.9	15	10
Kevlar	1.45	30	95
carbon fibre reinforced plastic	1.6	18	100

(a) Why is glass fibre reinforced plastic described as a composite material?

_____

_____

_____ [2]

(b) Use the information from the table to explain fully why carbon fibre reinforced plastic is a better material than steel for making badminton racket frames.

_____

_____

_____ [3]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

9 Two chemical reactions of the same type are represented by the equations below.

$$2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$$

$$KOH + HCl \longrightarrow KCl + H_2O$$

(a) What name is given to this **type** of chemical reaction?

_____ [1]

(b) Both of these reactions can be represented by the same **ionic equation**.

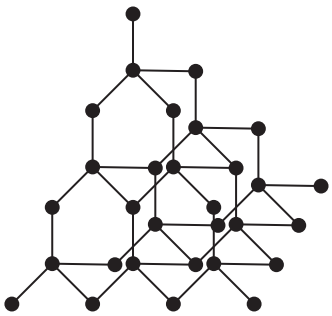
In the space below write this **ionic equation** and include state symbols.

_____ [3]

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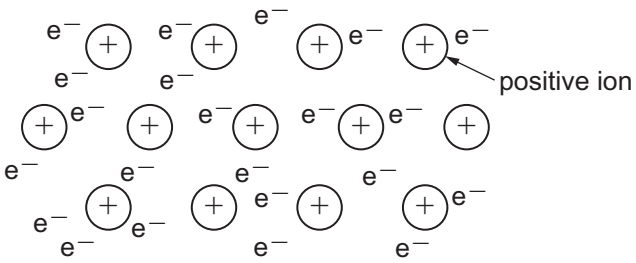
10 The giant structures of four substances **A**, **B**, **C** and **D** are shown below.

Examiner Only	
Marks	Remark



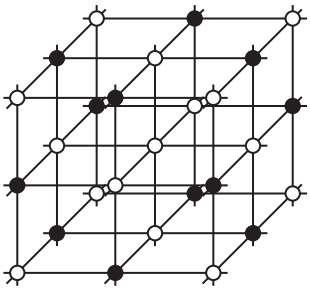
A

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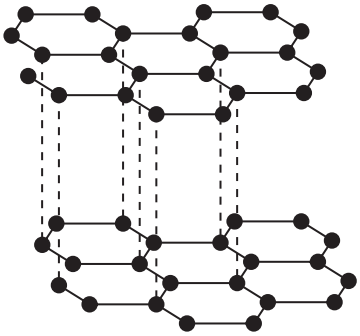
B

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C

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D

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(a) Which substance **A**, **B**, **C** or **D** only conducts electricity when it is molten or dissolved in water?

_____ [1]

(b) Which **two** substances **A**, **B**, **C** or **D** can conduct electricity in the solid state?

_____ and _____ [2]

(c) Which substance **A**, **B**, **C** or **D** is used to make pencil leads?

_____ [1]

(d) Give the name of a substance which has a structure like **A**.

_____ [1]

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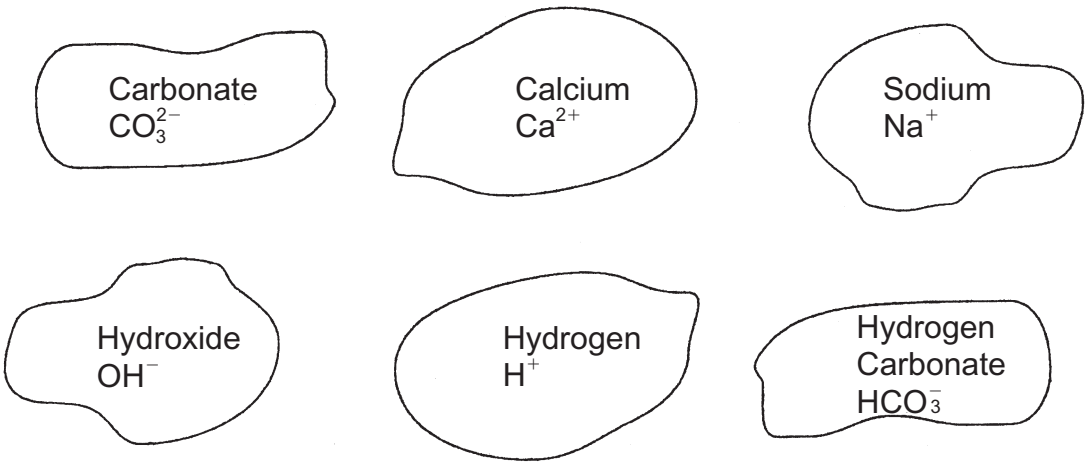
Examiner Only	
Marks	Remark

11 When rain water containing dissolved carbon dioxide falls on limestone rock, hard water is formed. This hard water contains calcium hydrogen carbonate.

(a) Complete the symbol equation for this reaction.

$CaCO_3 + H_2O + CO_2 \longrightarrow$ [1]

Below is a list of some ions that may be present in a water sample.



(b) Explain, in terms of ions, how hard water can be softened by ion exchange.

_____

_____

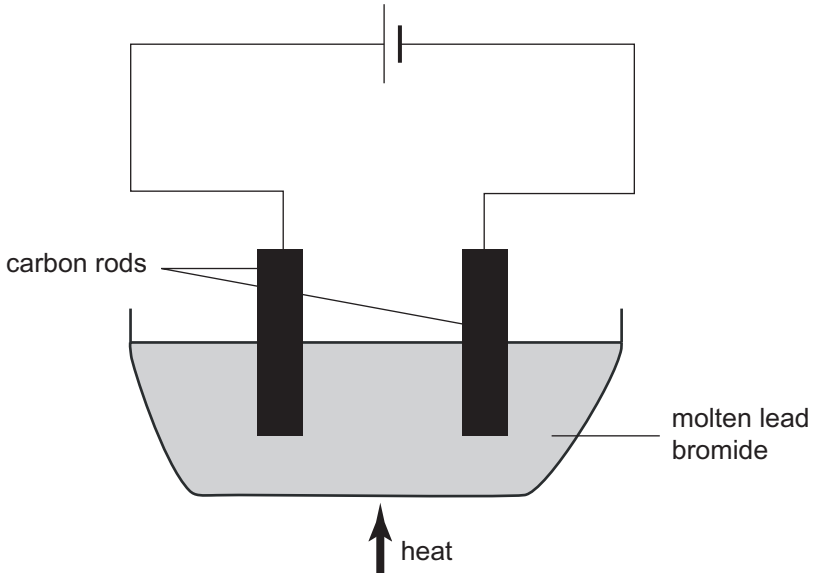
_____

_____ [2]

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Examiner Only	
Marks	Remark

12 Electrolysis of lead bromide can be carried out in the laboratory using the apparatus shown below.



(a) Why is it necessary to heat the lead bromide until it becomes molten?

_____ [1]

(b) What is the name of the gas which forms at the anode?

_____ [1]

(c) Write an **ionic equation** to show what happens at the cathode.

_____ [2]

THIS IS THE END OF THE QUESTION PAPER

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Rewarding Learning

General Certificate of Secondary Education
2011–2012

Science: Double Award (Modular)

Using Materials and Understanding Reactions
End of Module Test
Higher Tier

[GDB02]

TUESDAY 28 FEBRUARY 2012
11.00 am–11.45 am

MARK SCHEME

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			AVAILABLE MARKS
1	**(a)** **(i)** $NaHCO_3$ [1]		
	(ii) $FeSO_4$ [1]		
	(b) 6 [1]		
	(c) Zinc carbonate [1]		4
2	**(a)** Number of protons and neutrons [1] in (the nucleus of) an atom [1] or in the nucleus unless wrongly qualified [2]		
	(b) protons 15 [1] electrons 15 [1] neutrons 31 − 15 = 16 [1]		5
3	**(a)** 2,8 arrangement for sodium [1] 2,8 arrangement for oxygen [1]		
	(b) Na_2O [1]		3
4	**(a)** metal oxide, non-metal oxide [2]		
	(b) carbon monoxide/water/any suitable [1]		
	(c) alkali [1]		4
5	**(a)** nitrogen [1]		
	(b) as temp. increase solubility decreases [1] for (all) gases [1] [2]		
	(c) there is less oxygen (dissolved) in the water [1]		4
6	**(a)** electrolysis [1]		
	(b) cathode NOT negative [1]		
	(c) oxygen, carbon dioxide [2]		4

				AVAILABLE MARKS
7	**(a)**	correct sharing [1] correct number of electrons [1]	[2]	
	(b)	covalent	[1]	
	(c)	chlorine gas, oxygen gas	[2]	5
8	**(a)**	It combines the properties of more than one material [1] to produce a better material for a particular purpose.	[2]	
	(b)	1 correct property qualified [1] 2 correct properties unqualified [1] 3 correct properties unqualified [2] 2 correct properties 1 qualified [2] 2 correct properties 2 qualified [3] 3 correct properties 1 qualified [3]	[3]	5
9	**(a)**	neutralisation	[1]	
	(b)	$H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O_{(l)}$ LHS [1] RHS [1] state symbols [1]	[3]	4
10	**(a)**	C	[1]	
	(b)	B [1] D [1]	[2]	
	(c)	D	[1]	
	(d)	diamond/quartz	[1]	5
11	**(a)**	$Ca(HCO_3)_2$	[1]	
	(b)	Ca^{2+} ions [1] are replaced by Na^+ ions [1] if wrongly qualified max [1]	[2]	3
12	**(a)**	Ions must be free to move/idea of conducting electricity	[1]	
	(b)	bromine	[1]	
	(c)	$Pb^{2+} + 2e^- \longrightarrow Pb$ [1] [1]	[2]	4
			Total	**50**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2011–2012

Science: Double Award (Modular)

Using Materials and Understanding Reactions
End of Module Test

Higher Tier

B

[GDB02]

GDB02

WEDNESDAY 9 NOVEMBER 2011
9.15 am–10.00 am

TIME

45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all twelve** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 50.
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A Data Leaflet, which includes a Periodic Table of the elements, is provided for your use.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
Total Marks	

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Examiner Only	
Marks	Remark

1 Calcium hypochlorite, $Ca(ClO)_2$, is used to kill bacteria in swimming pools.

(a) How many different elements are present in calcium hypochlorite?

_____ [1]

(b) How many oxygen atoms are present in the formula for calcium hypochlorite?

_____ [1]

(c) What is the total number of atoms present in $Ca(ClO)_2$?

_____ [1]

The calcium ion has a charge of 2+ (Ca^{2+}).

(d) Use this information to suggest the charge of the hypochlorite ion in the compound calcium hypochlorite.

_____ [1]

(e) Calcium hypochlorite dissolves in water to form an acid.

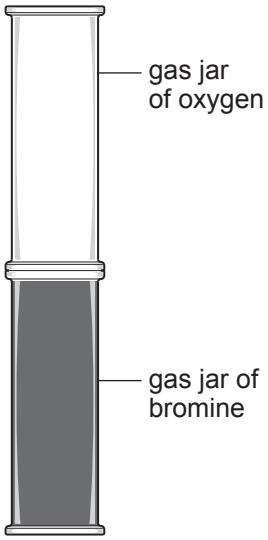
Name the ion which is present in the solution formed when an acid is dissolved in water.

_____ [1]

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Examiner Only	
Marks	Remark

2 Brown bromine vapour is more dense than oxygen. A gas jar of oxygen was placed on top of a gas jar of bromine and left for 15 minutes, as shown in the diagram below.



(a) What would you expect to see after 15 minutes?

_____

_____ [1]

(b) Which of the following statements best describes what happens during the 15 minutes?
Tick (✓) the box next to the correct answer.

bromine remains in the lower gas jar and oxygen stays in the top gas jar ☐

oxygen moves into the lower jar and the bromine remained in the lower jar ☐

some of the oxygen moves into the lower jar and some of the bromine moves into the top gas jar ☐

the oxygen reacts with the bromine ☐

[1]

(c) What is the name given to the process that happens in the gas jars?

_____ [1]

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3 Complete the table below which gives information about the particles in an atom.

Particle	Relative charge	Relative mass	Position in atom: shells/ nucleus
proton	+1		
electron		$\frac{1}{1840}$	shells
neutron	0		nucleus

[4]

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Marks	Remark

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4 Three samples of hard water, A, B and C, were tested to find out which was the hardest sample.

The volume of solution X needed to produce a lather which lasted 30 seconds was recorded in the table below.

Sample of hard water	Volume of solution X needed to produce a lather lasting 30 seconds	
	Untreated sample	**Boiled sample**
A	14 cm^3	14 cm^3
B	27 cm^3	14 cm^3
C	18 cm^3	2 cm^3

(a) Name solution X. _____ [1]

The results of the test show that sample B is the hardest sample.

(b) Explain why sample B is the hardest.

_____

_____ [1]

Use the information in the table to answer the following questions.

(c) Which sample of water, A, B or C, is permanent hard water only?

_____ [1]

(d) Which sample of water, A, B or C, would give the most problems with scale or fur in kettles?

_____ [1]

Examiner Only

Marks	Remark

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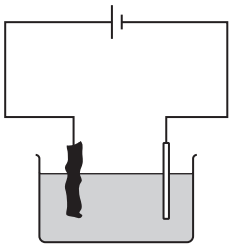
5 Lead is a mixture of three isotopes: $^{206}_{82}Pb$, $^{207}_{82}Pb$ and $^{208}_{82}Pb$. Complete the table below to show the similarities and differences between these isotopes.

Isotope	Mass number	Number of protons	Number of neutrons	Number of electrons
$^{206}_{82}Pb$	206			
$^{207}_{82}Pb$		82		
$^{208}_{82}Pb$			126	

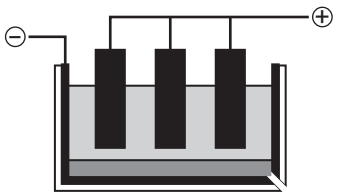
[4]

Examiner Only	
Marks	Remark

6 The diagrams below show two different electrolysis processes.



the purification of copper



production of aluminium from aluminium oxide

The sentences which follow are about the electrolysis processes shown in the diagrams above.

Read the sentences carefully. State if the sentence is true or false. The first one is done for you.

	Sentence	True or False
	The electrolytes in both processes are dissolved in water	False
a.	The electrodes in both of the processes are made from carbon	
b.	The anodes in both processes gradually disappear	
c.	The purification of copper happens at room temperature while the production of aluminium requires heat to begin the reaction	
d.	Pure copper and aluminium are both formed at the cathode	

[4]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

7 Many homes in Northern Ireland use natural gas for their central heating. Natural gas contains methane which has the chemical formula CH_4.

(a) In the space below draw a diagram to show the electronic arrangement of **all** the electrons in a methane molecule.

[2]

(b) One of the following statements about the bonding in methane is correct.
Tick (✓) the correct box.

Methane has a simple ionic structure ☐

The hydrogen atoms give their electrons to the carbon atom ☐

The electrons are shared between the carbon and hydrogen atoms ☐

[1]

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8 Problems involving a fixed mass of gas can be solved using the relationship:

$PV/T = \text{a constant}$.

A gas syringe holds 80 cm^3 of hydrogen at a pressure of 10 000 Pa and a temperature of 300 K.

What would the volume of gas be if the pressure was doubled to 20 000 Pa and the temperature increased from 300 K to 400 K?

Show all your working. State the units clearly.

Answer _____ [4]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

9 **(a)** The chemical formula for rust can be written as $Fe_2O_3.xH_2O$

What is the full chemical name for rust?

_____ [2]



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(b) The picture above shows a plant container that is made from iron coated with a layer of zinc.

What name is given to the process of coating a metal with zinc?

_____ [1]

(c) Zinc can be described as giving sacrificial protection to the iron.

What do you understand by the term sacrificial protection?

_____

_____

_____

_____ [2]

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10 The substances below may be classified as ionic, metallic, covalent, molecular or giant covalent in terms of their properties.

Substance	Melting point ºC	Boiling point ºC	Electrical conductivity when solid	Electrical conductivity when molten
A	119	445	poor	poor
B	975	1465	poor	good
C	−182	−161	poor	poor
D	3730	4830	poor	poor
E	1083	2600	good	good

(a) Which substance, A, B, C, D or E, has a simple molecular structure and is a solid at room temperature?

_____ [1]

(b) Which substance, A, B, C, D or E, is made up of positive and negative ions joined in a crystal lattice?

_____ [1]

(c) **(i)** Give the name of a substance which could be D.

_____ [1]

(ii) Explain why this substance is unable to conduct electricity.

_____

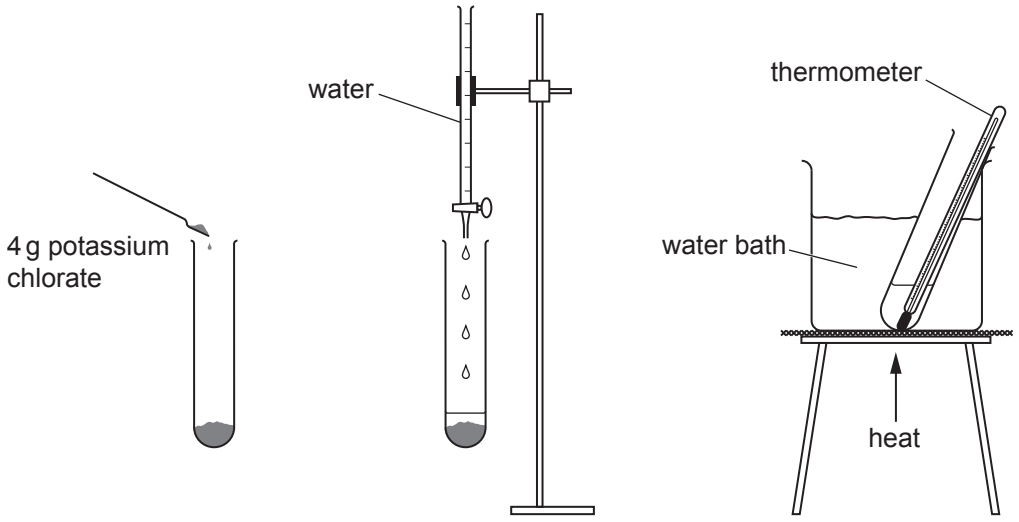
_____ [1]

Examiner Only

Marks	Remark

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11 A student wanted to obtain results to plot a solubility graph for potassium chlorate. She used the method shown below.



Stage 1: 4 g of potassium chlorate are placed in a boiling tube.

Stage 2: 10 cm^3 of water are added.

Stage 3: The boiling tube is placed in a beaker of hot water and heated until all the potassium chlorate has dissolved. Then the boiling tube is taken out of the water bath.

(a) What should the student be looking for after stage 3?

_____ [1]

(b) What measurement needs to be recorded?

_____ [1]

(c) More water, 2.5 cm^3, is added to the boiling tube. Describe the steps the student should then take to complete the experiment.

_____

_____

_____

_____ [3]

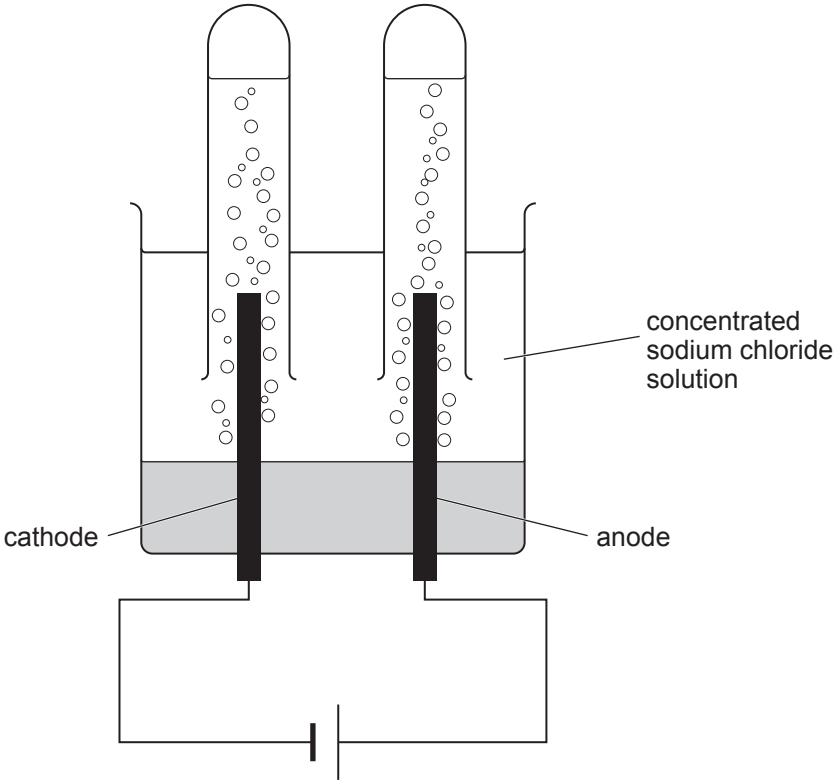
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

12 The electrolysis of concentrated sodium chloride solution is used widely in industry to manufacture two gases and other useful substances. The electrolysis can be carried out in the laboratory as shown in the diagram below.



(a) Name the gas produced at the cathode.

_____ [1]

(b) Write an **ionic** equation for the reaction which happens at the anode.

_____ [2]

(c) Two ions remain in solution and form an important chemical substance which is widely used in industry. Give the formulae of both of these ions.

_____ and _____ [2]

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111973

Rewarding Learning

General Certificate of Secondary Education
2011–2012

Science: Double Award (Modular)

Using Materials and Understanding Reactions
End of Module Test

Higher Tier

[GDB02]

WEDNESDAY 9 NOVEMBER 2011
9.15 am–10.00 am

MARK SCHEME

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			AVAILABLE MARKS
1	**(a)** 3 different elements	[1]	
	(b) 2 oxygen atoms	[1]	
	(c) 5	[1]	
	(d) 1^- or -1 (**not** negative or $-$)	[1]	
	(e) hydrogen ion allow H^+ (**not** H)	[1]	5
2	**(a)** Idea that the brown colour has spread throughout the gas jars	[1]	
	(b) (3rd option) some of the oxygen moved into the lower jar and some of the bromine moved into the top gas jar	[1]	
	(c) diffusion	[1]	3

3

Particle	Relative charge	Relative mass	Position in atom: shells/nucleus
proton	$+1$	1 [1]	nucleus [1]
electron	-1 [1]	$\frac{1}{1840}$	shells
neutron	0	1 [1]	nucleus

[4] 4

			AVAILABLE MARKS
4	**(a)** Soap (solution)	[1]	
	(b) Idea it takes most soap solution to produce a lather	[1]	
	(c) A	[1]	
	(d) C	[1]	4

5

Mass number	Number of protons	Number of neutrons	Number of electrons
206	82	124	82
207	82	125	82
208	82	126	82
[1]	[1]	[1]	[1]

[4] 4

				AVAILABLE MARKS
6	**(a)**	False	[1]	
	(b)	True	[1]	
	(c)	True	[1]	
	(d)	True	[1]	4
7	**(a)**	correct sharing [1] correct number of electrons [1] second mark dependent on first	[2]	
	(b)	third box – shared electrons	[1]	3
8		$P_1 V_1/T_1 = P_2 V_2/T_2$ $80 \times 10\,000/300 = 20\,000 \times V/400$ 53.3 [3] cm^3 [1] up to two method marks available – second method mark must involve a computation	[4]	4
9	**(a)**	hydrated [1] iron (III) oxide [1]	[2]	
	(b)	galvanising	[1]	
	(c)	zinc is more reactive than iron [1] It reacts in place of the iron or first [1] (**not** quicker)	[2]	5
10	**(a)**	A	[1]	
	(b)	B	[1]	
	(c)	**(i)** diamond [1]		
		(ii) no delocalised electrons/mobile electrons [1]	[2]	4
11	**(a)**	The formation of crystals/solid forming	[1]	
	(b)	Temperature at which crystals form not just temperature	[1]	
	(c)	Idea of repeating stage 3 [1] Subsequent Action – waiting for crystals to form/take temperature at which crystals form (to obtain more results) [1] Idea of continuing investigation [1]	[3]	5

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12 **(a)** hydrogen [1]

(b) $2Cl^- - 2e^- \longrightarrow Cl_2$ or $2Cl^- \longrightarrow Cl_2 + 2e^-$
[1] [1] [1] [1] [2]

(c) Na^+ OH^-
[1] [1] [2]

Total

AVAILABLE MARKS
5
50

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2011–2012

Science: Double Award (Modular)

Using Materials and Understanding Reactions
End of Module Test

Higher Tier

B

[GDB02]

GDB02

THURSDAY 19 MAY 2011, MORNING

TIME

45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all twelve** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 50.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet, which includes a Periodic Table of the elements, is provided for your use.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
Total Marks	

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Examiner Only	
Marks	Remark

1 The picture below shows some chips.



The smell from hot chips can quickly fill a room.

(a) Name the process which allows the smell to reach your nose.

_____ [1]

(b) Explain, with reference to the particles involved, why the smell from hot chips reaches your nose so quickly.

_____

_____ [2]

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2 This question is about chemical formulae.

You may find your Data Leaflet helpful.

(a) How many different **elements** are there in the compound Na_2CO_3?

_____ [1]

(b) Name the **compound** $KHCO_3$.

_____ [1]

(c) How many **atoms** are there in a $Cu(OH)_2$ molecule?

_____ [1]

(d) What is the correct formula for magnesium nitrate?

_____ [1]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

3 The table below has a list of oxides. Some of these react with acids to form salts.

(a) Complete the table by putting YES or NO in the appropriate boxes. The first one has been done for you.

name of oxide	**reacts with acids to form salts YES or NO**
zinc oxide	YES
nitrogen dioxide	
sodium oxide	
carbon dioxide	
calcium oxide	

[2]

(b) **(i)** What other compound, apart from a salt, is formed when an acid reacts with an oxide?

_____ [1]

(ii) What name is given to this **type** of chemical reaction?

_____ [1]

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4 The table below gives information about the atomic structure of five elements.

Use this information and your Data Leaflet to answer the questions which follow.

	number of electrons		
element	**1st shell**	**2nd shell**	**3rd shell**
A	2	1	
B	2	6	
C	2	4	
D	2	8	1
E	2	8	8

(a) Which element A, B, C, D or E has an atomic number of 6?

_____ [1]

(b) Which element A, B, C, D or E has a noble gas structure?

_____ [1]

(c) Which two of the elements A, B, C, D or E are **very** reactive?

_____ and _____ [1]

(d) Give the **name** of element D.

_____ [1]

Examiner Only

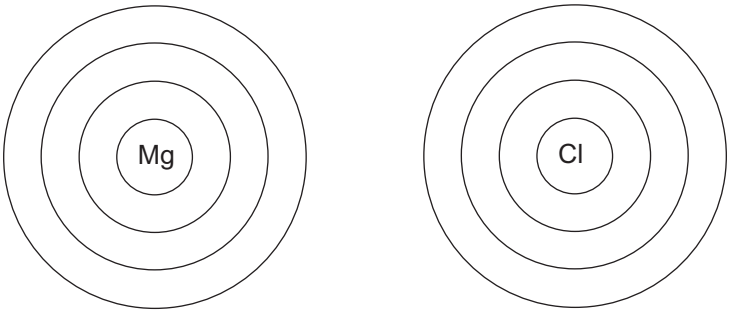
Marks	Remark

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Examiner Only	
Marks	Remark

5 When magnesium reacts with chlorine it forms a compound called magnesium chloride.

(a) On the diagrams below show how **all** the electrons are arranged in a magnesium atom and in a chlorine atom.



magnesium atom

chlorine atom

[2]

(b) Use words or a diagram to explain how the electrons are rearranged to form magnesium chloride.

_____

_____

_____

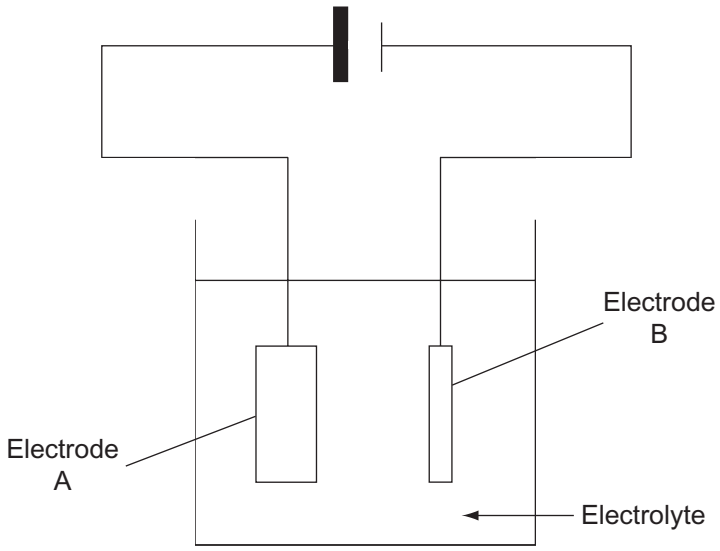
_____

_____ [3]

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Examiner Only	
Marks	Remark

6 Copper metal is purified by the process of electrolysis.



(a) Name a suitable electrolyte for the purification of copper.

_____ [1]

(b) What material is used to make electrode B?

_____ [1]

(c) What happens to the mass of electrode A during the electrolysis?

_____ [1]

Examiner Only	
Marks	Remark

7 **(a)** In the space below draw a diagram to show how the atoms of hydrogen and oxygen bond together to form water. You should show **all** the electrons.

[2]

(b) From the list below choose **two** substances which have the same type of bonding as water.

Tick **two** correct boxes.

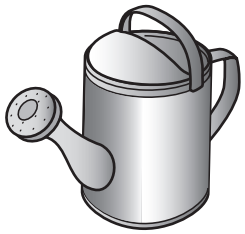
- Carbon dioxide ☐
- Sodium hydroxide ☐
- Aluminium oxide ☐
- Chlorine ☐
- Sodium chloride ☐

[2]

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Examiner Only	
Marks	Remark

8 The picture shows an iron watering can that has been coated with zinc to prevent rusting.



(a) What name is given to the process of coating iron with zinc?

_____ [1]

(b) Explain fully why this type of watering can will last longer than one made only of iron.

_____

_____

_____ [2]

(c) What is the full chemical name for rust?

_____ [2]

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Examiner Only	
Marks	Remark

9 The table below gives some examples of plastics, their properties and their uses.

plastic	properties	uses
nylon	flexible, light, tough	rope, gears, hinges
epoxy resins	brittle, chemically inert	adhesives
melamine	hard, heat resistant	adhesives, work surfaces
polycarbonate	rigid, strong, transparent	spectacle lenses
polythene	tough, flexible, soft	packaging, bags

(a) Choose a plastic from the table which is **thermosoftening** and explain, **with reference to its structure**, how its properties make it suitable for one of its uses.

Example: _____ [1]

Explanation: _____

_____

_____ [2]

(b) Spectacle lenses are made of polycarbonate. Suggest what **type** of plastic this is and say why polycarbonate is a suitable choice for this use.

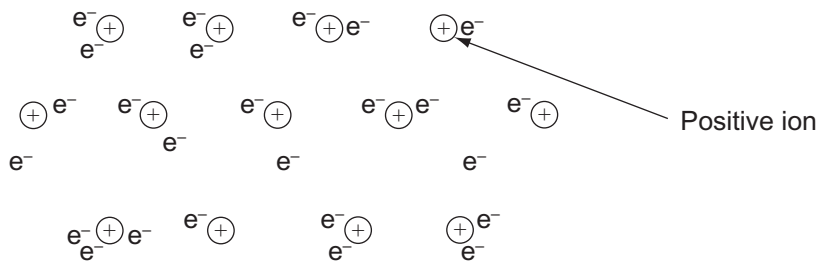
Type: _____ [1]

Reason: _____

_____ [1]

10 Aluminium is a metal that has many important uses. It can be hammered into very thin sheets, it is a good conductor of electricity, it has a low density and it has a reasonably high melting point.

The structure of aluminium can be represented by the diagram below.



Use your understanding of metallic bonding to answer the following questions.

(a) Why can metals such as aluminium be hammered into thin sheets?

_____

_____ [1]

(b) Explain why aluminium is a good conductor of electricity.

_____

_____

_____ [2]

(c) The melting point of aluminium is high enough for it to be used in cooking utensils.

What does this tell us about the bonds between the atoms in aluminium?

_____

_____ [1]

(d) Suggest why aluminium has a lower density than lead.

_____

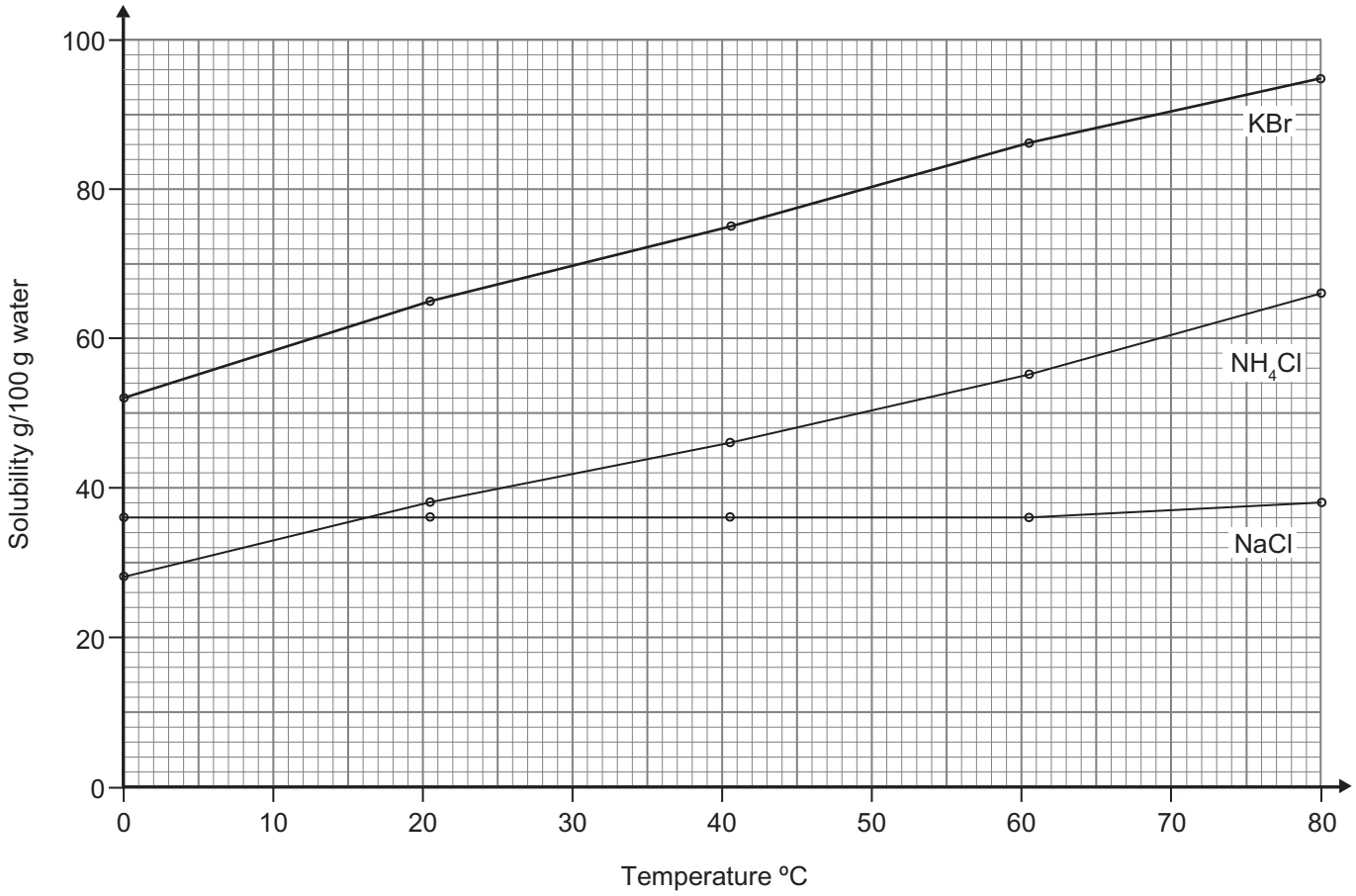
_____ [1]

Examiner Only

Marks	Remark

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11 The graph shows solubility curves for three substances, KBr, NH_4Cl and NaCl.



(a) At what temperature is the solubility of NH_4Cl equal to 50 g/100 g water?

_____ [1]

(b) If a saturated solution of KBr in 100 g of water is cooled from 65 ºC to 25 ºC how many grams of solid will be precipitated?

[2]

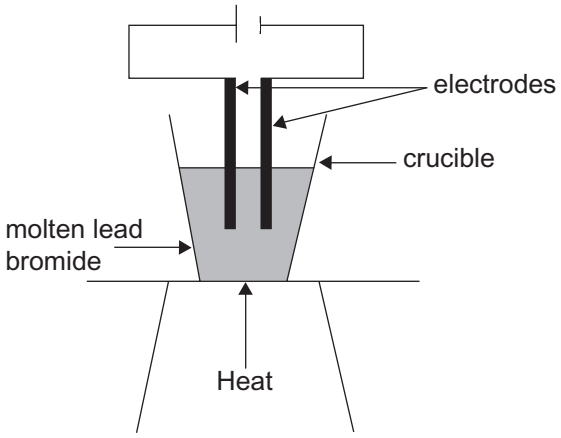
(c) Which of the saturated solutions shown would not easily form crystals if it was cooled from 60 ºC to 40 ºC?

_____ [1]

Examiner Only	
Marks	Remark

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12 The diagram shows the apparatus used in the electrolysis of lead bromide.



(a) The lead bromide has to be heated until it is molten. Explain why this is necessary.

_____

_____ [1]

(b) Write an **ionic** equation to show the chemical reaction which takes place at the **anode**.

_____ [2]

(c) Why should this experiment not be carried out in the open laboratory?

_____

_____ [1]

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Marks	Remark

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General Certificate of Secondary Education
2011–2012

Science: Double Award (Modular)

Using Materials and Understanding Reactions End of Module Test

Higher Tier

[GDB02]

THURSDAY 19 MAY 2011, MORNING

MARK SCHEME

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				AVAILABLE MARKS
1	**(a)**	Diffusion	[1]	
	(b)	Idea that particles have energy from the heat [1] Idea of fast particle movement [1]	[2]	3
2	**(a)**	3	[1]	
	(b)	potassium hydrogen carbonate	[1]	
	(c)	5	[1]	
	(d)	$Mg(NO_3)_2$	[1]	4
3	**(a)**	sodium oxide, calcium oxide YES nitrogen dioxide, carbon dioxide NO 4 correct = [2]; 2 or 3 correct = [1]	[2]	
	(b)	**(i)** water	[1]	
		(ii) neutralisation	[1]	4
4	**(a)**	C	[1]	
	(b)	E	[1]	
	(c)	Any 2 of A, B and D	[1]	
	(d)	sodium	[1]	4
5	**(a)**	magnesium 2, 8, 2 [1] chlorine 2, 8, 7 [1]	[2]	
	(b)	magnesium loses 2 electrons [1] chlorine gains 1 electron [1] Idea that 2 chlorine atoms are needed [1] Idea of sharing loses first two marking points	[3]	5
6	**(a)**	copper sulphate	[1]	
	(b)	**pure** copper	[1]	
	(c)	goes down	[1]	3

				AVAILABLE MARKS
7	**(a)**	correct sharing [1] correct numbers of electrons [1] second mark depends on first	[2]	
	(b)	carbon dioxide [1] chlorine [1]	[2]	4
8	**(a)**	galvanising	[1]	
	(b)	zinc is more reactive than iron [1] it corrodes first [1] (protecting the iron from rusting)	[2]	
	(c)	hydrated [1] iron (III) oxide [1]	[2]	5
9	**(a)**	nylon or polythene	[1]	
		thermosoftening plastics have no crosslinks [1] this makes them flexible [1] second mark dependent on first	[2]	
	(b)	thermosetting they are transparent	[1] [1]	5
10	**(a)**	atoms can easily slide/move into new positions	[1]	
	(b)	delocalised electrons [1] carry the current/charge [1]	[2]	
	(c)	bonds are strong	[1]	
	(d)	atoms in aluminium are spaced further apart than they are in lead [1] allow idea of aluminium having a lower relative atomic mass		5
11	**(a)**	48.5 − 49.5 °C	[1]	
	(b)	88 (+/− 0.5) − 67 (± 0.5) [1] correct difference i.e. 20 − 22 [1]	[2]	
	(c)	NaCl	[1]	4
12	**(a)**	ions cannot move in the solid state/does not conduct electricity when solid	[1]	
	(b)	$2Br^-$ [1] $\longrightarrow Br_2 + 2e^-$ [1]	[2]	
	(c)	bromine gas and/or lead fumes are toxic	[1]	4
		Total		**50**

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2010–2011

Science: Double Award (Modular)

Using Materials and Understanding Reactions
End of Module Test

Higher Tier

B

[GDB02]

GDB02

THURSDAY 24 FEBRUARY 2011, MORNING

TIME

45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all twelve** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 50.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet, which includes a Periodic Table of the elements, is provided for your use.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
Total Marks	

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Examiner Only	
Marks	Remark

1 The chemical formula for ammonium sulphate is:

$$(NH_4)_2\ SO_4$$

(a) How many **different** elements are there in this compound?

_____ [1]

(b) How many hydrogen atoms are there in one molecule of ammonium sulphate?

_____ [1]

(c) What is the total number of atoms in one molecule of ammonium sulphate?

_____ [1]

2 Oxygen is a mixture of ^{16}O and ^{18}O.

You may find your Data Leaflet helpful.

(a) Explain, in terms of particles, how the nucleus of ^{16}O is different from the nucleus of ^{18}O.

_____

_____

_____ [2]

(b) Complete the sentence below using a phrase from the list.

just as reactive as **more reactive than** **less reactive than**

Atoms of ^{16}O are _____ atoms of ^{18}O. [1]

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Examiner Only	
Marks	Remark

3 When sulphuric acid is added to copper carbonate a chemical reaction occurs.

(a) (i) Complete the symbol equation for the reaction of copper carbonate with dilute sulphuric acid.

$CuCO_3 + H_2SO_4 \longrightarrow$ _____ + _____ + CO_2 [2]

(ii) What colour change would you observe during this reaction?

_____ to _____ [2]

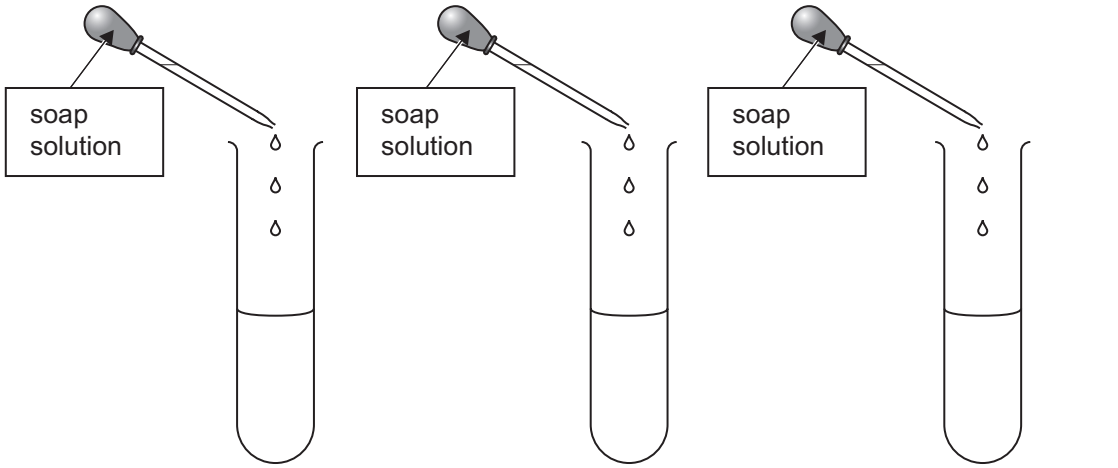
(b) If hydrochloric acid is added to copper carbonate, what gas would be produced?

_____ [1]

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Examiner Only	
Marks	Remark

4 An experiment was carried out to investigate the effect of soap and detergent on three different water samples **A**, **B** and **C**.



Each test tube was shaken after the three drops of soap solution were added. The experiment was then repeated with fresh water samples, using detergent instead of soap.

(a) Complete the results table below to show what would be observed for each water sample.

Water sample	Observation with soap	Observation with detergent
A temporary hard	no lather	
B soft		lather
C permanent hard		

[2]

(b) Explain what is meant by the term **temporary** hard water.

_____

_____ [1]

(c) Give one advantage and one disadvantage of hard water.

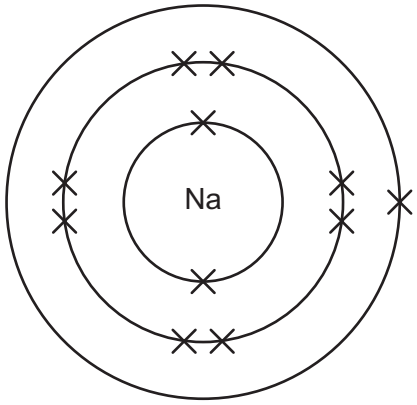
Advantage _____

Disadvantage _____ [2]

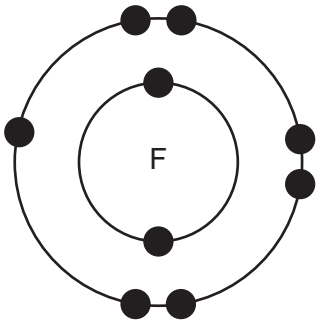
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Examiner Only	
Marks	Remark

5 When sodium reacts with fluorine it forms a compound called sodium fluoride. The electronic structures of a sodium atom and fluorine atom are shown below.



sodium atom



fluorine atom

(a) Draw the electronic structures for the **ions** produced from these atoms in the space below and include their charges.

sodium ion **fluoride ion** [2]

Charge on sodium ion _____ Charge on fluoride ion _____ [1]

(b) The force joining these ions together is described as:

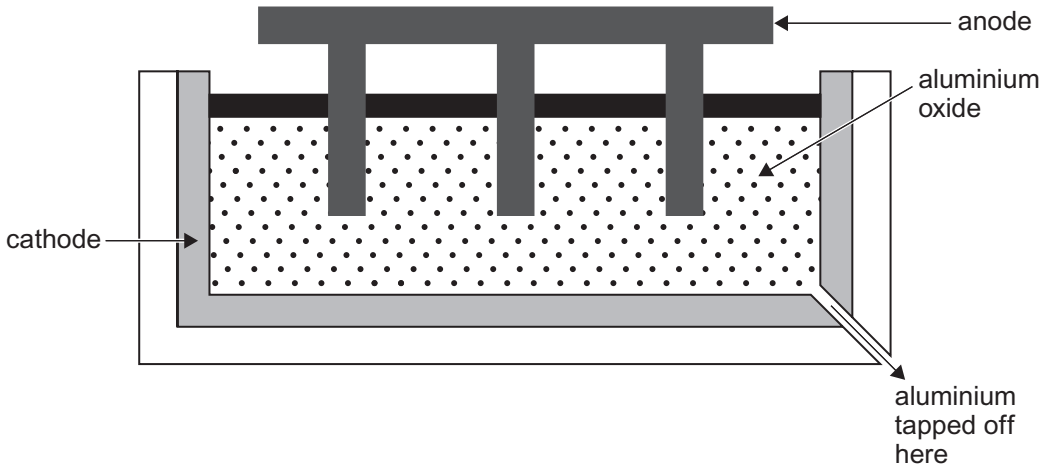
electrostatic **electronic** **magnetic**

Circle the correct answer. [1]

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Examiner Only	
Marks	Remark

6 Aluminium metal is produced by passing electricity through a cell containing molten aluminium oxide.



The aluminium is formed at the cathode.

(a) What is the meaning of the term **cathode**?

_____

_____ [1]

(b) Name the substance which is used to make the **anode**.

_____ [1]

(c) What substance is formed at the **anode** during this reaction?

_____ [1]

Examiner Only	
Marks	Remark

7 Methane is the chemical name for the natural gas which is piped into many homes in Northern Ireland. It has the chemical formula CH_4.

(a) Draw a diagram to show how **all** the electrons are arranged in a molecule of methane.

[2]

(b) Name the type of bonding in methane.

_____ [1]

(c) Which one of the following would you expect to have the same kind of bonding as methane? Tick the correct box.

sodium chloride ☐

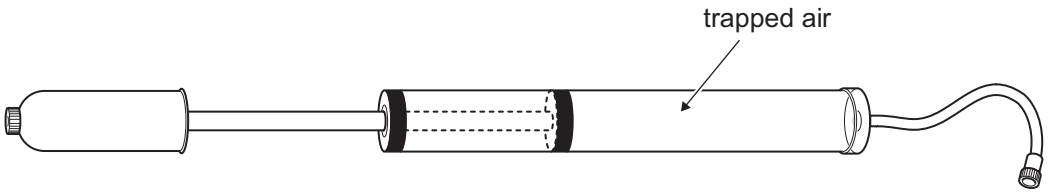
sulphur dioxide ☐

magnesium chloride ☐ [1]

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Examiner Only	
Marks	Remark

8 The diagram shows a bicycle pump containing 50 cm^3 of trapped air at a temperature of 280 K when a student pushed on the handle causing a pressure of 9240 Pa.



bicycle pump

What would the volume of air be if the pressure was increased to 16000 Pa at a temperature of 320 K?

$$\frac{PV}{T} = \text{a constant}$$

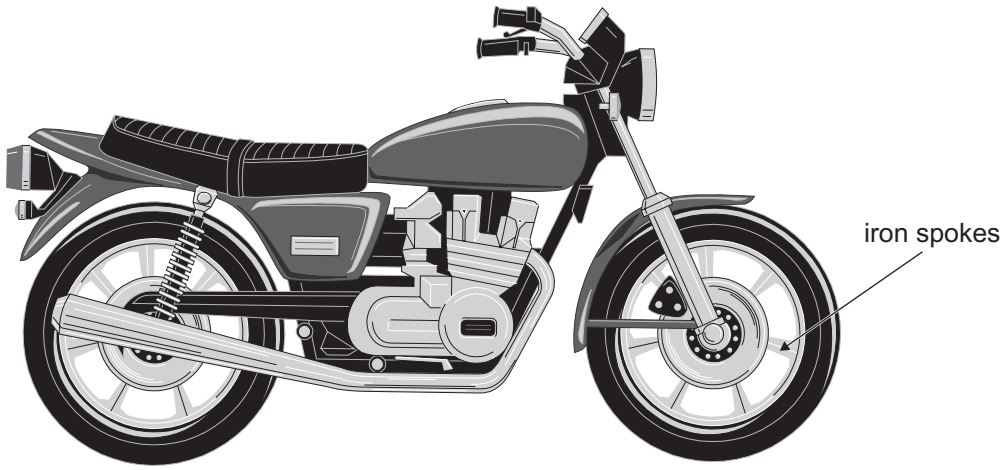
Show your working out and **give the units**.

Answer: _____ [4]

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Examiner Only	
Marks	Remark

9 Peter is very proud of his new motorbike. He is determined to protect it from rusting.



(a) What is the full chemical name for rust?

_____ [2]

The manufacturers have galvanised the iron spokes.

(b) (i) What is meant by the term **galvanised**?

_____

_____ [1]

(ii) How does galvanising protect the iron spokes from rusting?

_____

_____

_____ [2]

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10 The substances below may be classified as ionic, metallic, covalent, molecular or giant covalent in terms of their properties.

Substance	Melting point °C	Boiling point °C	Electrical conductivity	
			When solid	When molten
A	3730	4830	Poor	Poor
B	1083	2600	Good	Good
C	119	445	Poor	Poor
D	975	1465	Poor	Good
E	−182	−161	Poor	Poor

(a) Which substance, A, B, C, D or E could be made up of oppositely charged ions joined together?

_____ [1]

(b) Which substance A, B, C, D or E has a simple molecular structure and is a solid at room temperature?

_____ [1]

(c) Which substance A, B, C, D or E could be used as a conductor in an electrical circuit?

_____ [1]

(d) Give the name of a substance which could be A and explain your answer.

_____

_____ [2]

Examiner Only

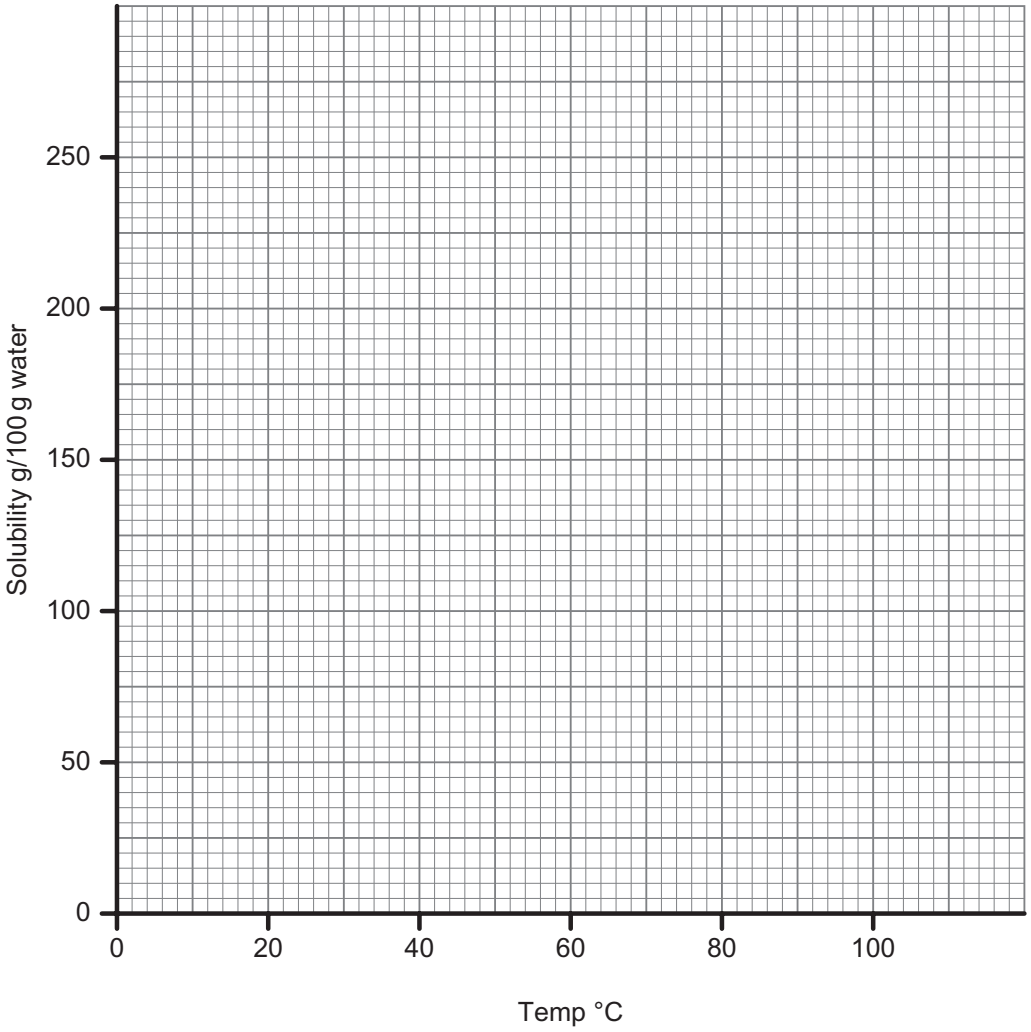
Marks	Remark

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Examiner Only	
Marks	Remark

11 **(a)** Use the data given to draw a solubility curve for potassium nitrate on the grid below.

Temperature °C	0	10	20	40	60	80	100
Solubility g/100 g water	13	20	30	67	110	170	245



[3]

(b) Use the graph to find the solubility of potassium nitrate at 90 °C.

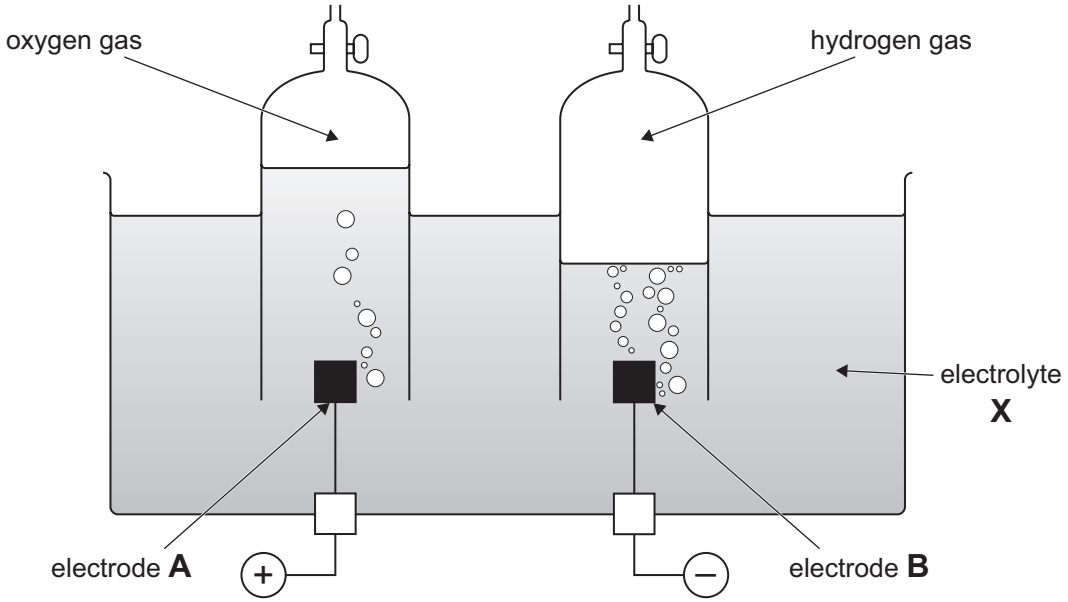
Solubility _____ g/100 g water [1]

(c) If a saturated solution is cooled in 100 g water from 90 °C to 30 °C, how much potassium nitrate would be precipitated?

Answer _____ g [2]

Examiner Only	
Marks	Remark

12 This diagram shows apparatus used to collect gases formed when electricity is passed through the electrolyte X.



(a) During this electrolysis, hydrogen gas and oxygen gas are produced. Sulphate ions (SO_4^{2-}) remain in the solution.

What is the name of electrolyte **X**?

_____ [1]

(b) Write an ionic equation to show how hydrogen is produced at electrode **B**.

_____ [2]

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Rewarding Learning

General Certificate of Secondary Education
2010–2011

Science: Double Award (Modular)

Using Materials and Understanding Reactions
End of Module Test

Higher Tier

[GDB02]

THURSDAY 24 FEBRUARY 2011, MORNING

MARK SCHEME

STEMUP.CO.UK

			AVAILABLE MARKS
1	**(a)** 4	[1]	
	(b) 8	[1]	
	(c) 15	[1]	3
2	**(a)** ^{18}O has 10 neutrons [1] ^{16}O has 8 neutrons [1] allow [1] for idea of different number of neutrons [1] for fact that one has 2 extra neutrons unless wrongly qualified	[2]	
	(b) just as reactive as	[1]	3
3	**(a)** **(i)** $CuSO_4$ [1] H_2O [1]	[2]	
	(ii) green [1] ⟶ blue [1]	[2]	
	(b) CO_2/carbon dioxide	[1]	5

4 **(a)**

Water sample	Observation with soap	Observation with detergent
A temporary hard		Lather
B soft	Lather	
C permanent hard	No lather	Lather

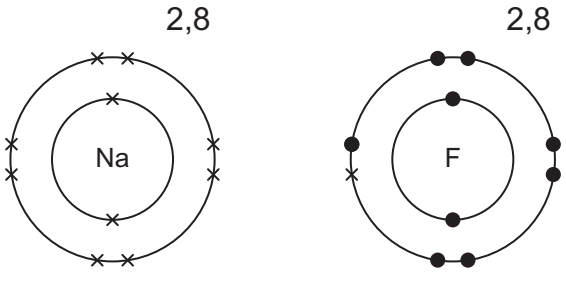
4 correct = [2] 2 or 3 correct = [1] 1 correct = [0] [2]

(b) water which has hardness which can be removed by boiling [1]

(c) good for teeth or bones/reduces risk of heart disease/tanning leather/brewing beer/idea of better taste [1]

scale in pipes or boilers/scum with soap/wastes soap/cost/allow idea of blocked pipes [1] 5

5 **(a)** correct ion structure [2]



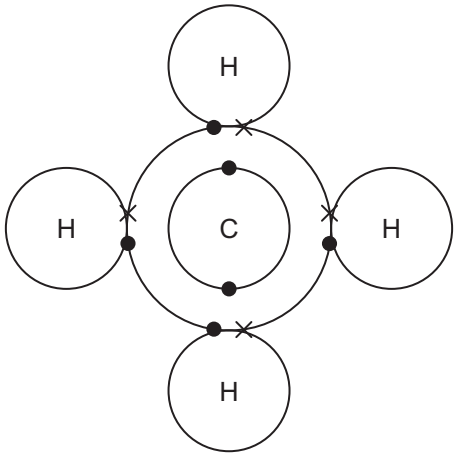
[1]

(b) electrostatic [1] 4

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				AVAILABLE MARKS
6	**(a)**	electrode connected to the negative terminal/negative electrode	[1]	
	(b)	carbon/graphite	[1]	
	(c)	oxygen	[1]	3

7 **(a)**



correct sharing [1]
correct total number of electrons [1] [2]
second mark depends on first

(b) covalent [1]

(c) sulphur dioxide [1] 4

8 $\frac{P_1\ V_1}{T_1} = \frac{P_2\ V_2}{T_2}$ [1]

$\frac{9240 \times 50}{280} = \frac{16000 \times V_2}{320}$

up to [2] method marks
[1] for formula substitution
[1] for computation

$V_2 = \frac{9240 \times 50 \times 320}{280 \times 16000}$ [1]

$= 33\,cm^3$
correct answer [3]
correct units [1] [4] 4

9 **(a)** hydrated [1] iron(III) oxide [1] [2]

(b) **(i)** idea of coated with zinc [1]

(ii) zinc corrodes first [1]
is more reactive than iron [1] [2] 5
not zinc rusting **not** zinc reacts quicker

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				AVAILABLE MARKS
10	**(a)**	D	[1]	
	(b)	C	[1]	
	(c)	B	[1]	
	(d)	diamond/quartz [1] high melting point no (electrical) conductivity [1] second mark dependent on first	[2]	5
11	**(a)**	all points correctly plotted [2] 5/6 correct points [1] curve joining points not drawn with ruler [1]	[3]	
	(b)	± 5 202 g/100 g water	[1]	
	(c)	45 ± 3 e.g. $205 - 45 = 160$ g all correct [2], 1 error [1] allow [1] for a correct method mark check graph	[2]	6
12	**(a)**	sulphuric acid	[1]	
	(b)	$2H^+ + 2e^- \longrightarrow H_2$ [1] [1]	[2]	3
			Total	**50**

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2010–2011

Science: Double Award (Modular)

Using Materials and Understanding Reactions
End of Module Test

Higher Tier

B

[GDB02]

GDB02

WEDNESDAY 10 NOVEMBER 2010, AFTERNOON

TIME

45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all thirteen** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 50.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet, which includes a Periodic Table of the elements, is provided for your use.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
Total Marks	

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Examiner Only	
Marks	Remark

1 This question is about chemical formulae.

You may find your Data Leaflet helpful.

(a) What is the chemical symbol for potassium?

_____ [1]

(b) Glucose has the formulae $C_6H_{12}O_6$.

How many atoms are present in a glucose molecule?

_____ [1]

(c) Ethanoic acid has the formula CH_3COOH.

How many **different** elements are present in an ethanoic acid molecule?

_____ [1]

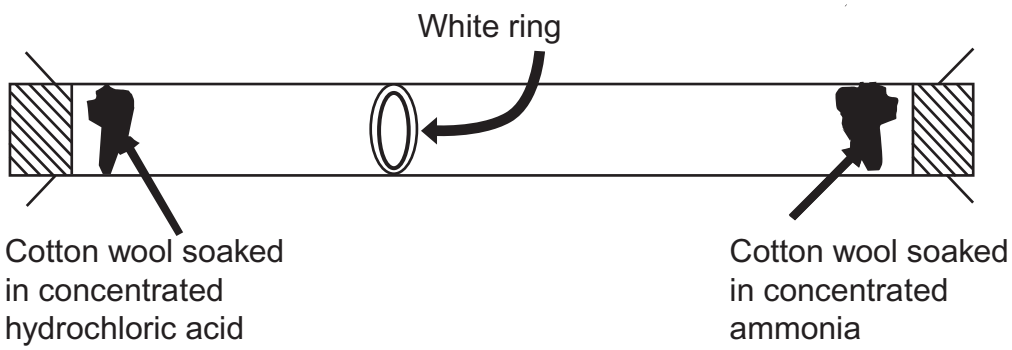
(d) Name the substance whose formula is $Ca(HCO_3)_2$.

_____ [1]

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Examiner Only	
Marks	Remark

2 The apparatus below is used in a warm room to investigate the movement of particles.



After about **5 minutes**, a white ring of ammonium chloride forms.

(a) What **word** is used to describe the movement of particles shown by using this apparatus?

_____ [1]

(b) If this experiment was repeated in a **colder** room what effect would this have on the formation of the white ring?

_____

_____ [1]

(c) Why is the white ring formed closer to the cotton wool soaked in concentrated hydrochloric acid?

_____

_____ [1]

(d) What is the formula of ammonium chloride? (You may find your Data Leaflet useful.)

_____ [1]

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Examiner Only	
Marks	Remark

3 The table below shows the atomic number, mass number and electronic arrangement (configuration) of four particles.

(a) Complete the table by filling in the blank spaces.
(You will need your Data Leaflet to find the missing mass numbers.)

Particle	Atomic Number	Mass Number	Electronic arrangement
A	6		2,4
B	1	2	1
C			2,3
D	1	3	

[4]

(b) **(i)** Which of the particles, A, B, C or D are isotopes?

_____ and _____ are isotopes [1]

(ii) Explain your answer to **(b)(i)**.

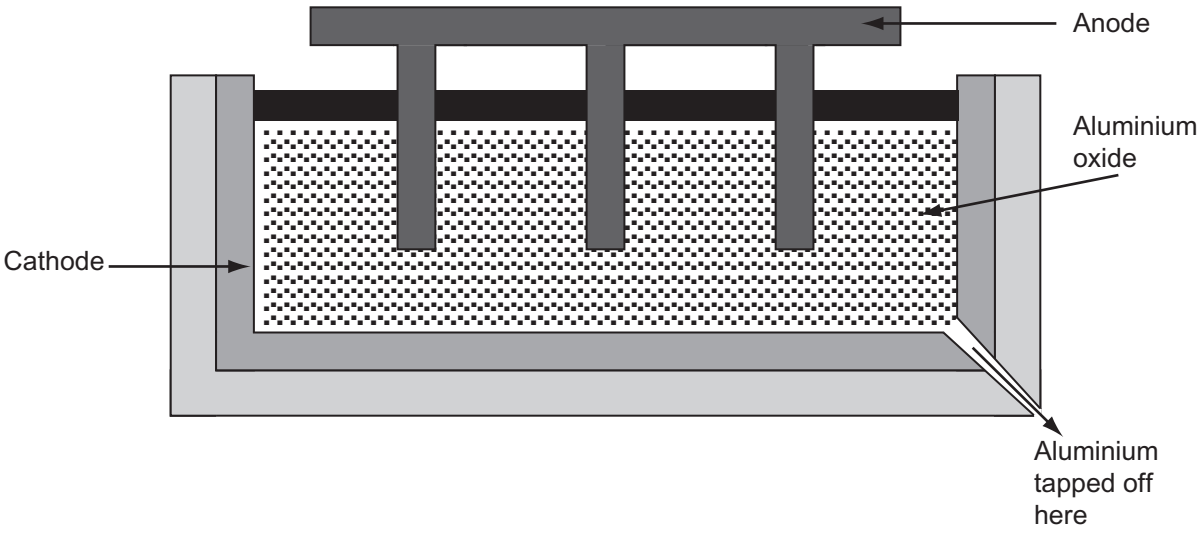
_____

_____ [1]

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Examiner Only	
Marks	Remark

4 Aluminium metal is produced by passing electricity through a cell containing molten aluminium oxide.



(a) At which electrode is aluminium formed.

_____ [1]

(b) Name the substance which is used to make the anode.

_____ [1]

(c) Give a **disadvantage** of using this method to produce aluminium.

_____ [1]

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Examiner Only	
Marks	Remark

5 **(a)** Copper sulphate is a blue salt which can be prepared by the reaction of an acid with a base.

Complete the word equation below by naming the acid, the base and any other substance formed.

\+ ⟶ copper sulphate +

[3]

(b) Copper sulphate can also be prepared by the reaction of an acid with a carbonate.

What gas is formed when an acid reacts with a carbonate?

_____ [1]

6 Magnesium fluoride is an ionic compound with the formula MgF_2.

Explain carefully, in terms of electron transfer, why two fluorine atoms are needed to bond with one atom of magnesium.

_____

_____

_____

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

7 Oxygen gas is made up of molecules which are represented by the formula O_2.

(a) Draw a diagram to show how **all** the electrons are arranged in a molecule of oxygen gas.

[2]

Oxygen combines with other elements to form oxides.

(b) Explain fully, in terms of the electrons, what happens when oxygen combines with hydrogen to form water.

_____

_____

_____ [2]

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Examiner Only	
Marks	Remark

8 Carbon fibre reinforced plastic is a composite material which is used in making aircraft structures.



© NASA http://www.nasa.gov/images/content/117378main_gulfstream_aircraft.jpg

(a) Explain fully why carbon fibre reinforced plastic can be described as a composite material.

_____

_____

_____

_____ [2]

(b) Explain why the use of carbon fibre reinforced plastic has reduced the cost of air travel.

_____

_____

_____ [2]

(c) What is the main disadvantage of using composite materials?

_____ [1]

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Examiner Only	
Marks	Remark

9 Farmers add lime to neutralise acid in the soil.



© N Herendeen

Write an **ionic** equation, including state symbols to show what happens to the ions involved in a neutralisation reaction.

_____ [3]

10 A gas syringe contained 100 cm^3 of air at a pressure of 20 kPa and a temperature of 300 K.

If the volume of air in the syringe was changed to 80 cm^3 and the pressure became 22 kPa calculate what the new temperature must have been.

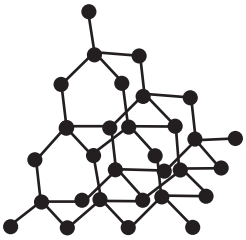
$$\frac{PV}{T} = \text{a constant}$$

Answer = _____ K [3]

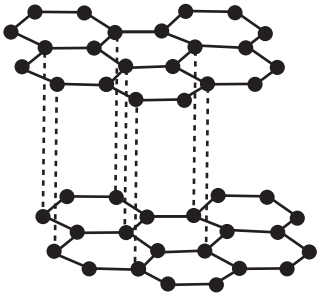
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Examiner Only	
Marks	Remark

11 Diamond and graphite are pure forms of the same element. Diamond is the hardest naturally occurring substance known and graphite is soft enough to leave grey marks on paper when it is used in pencils.



diamond





graphite

© Chemistry in Use by Roland Jackson published by Longman, ISBN 9780582013940. Reprinted by permission of Pearson Education Limited

(a) Explain, with reference to its structure, why diamond is such a hard substance.

_____

_____

_____ [2]

(b) Explain, with reference to its structure, why graphite is used to draw sketches.

_____

_____

_____ [2]

12 Water can be described as hard or soft depending on how it reacts with soap.



© Hemera/Thinkstock

Hard water can be softened by passing it through an ion exchange column.

Explain fully, with reference to the ions involved, how ion exchange works.

_____

_____

_____

_____

_____

_____

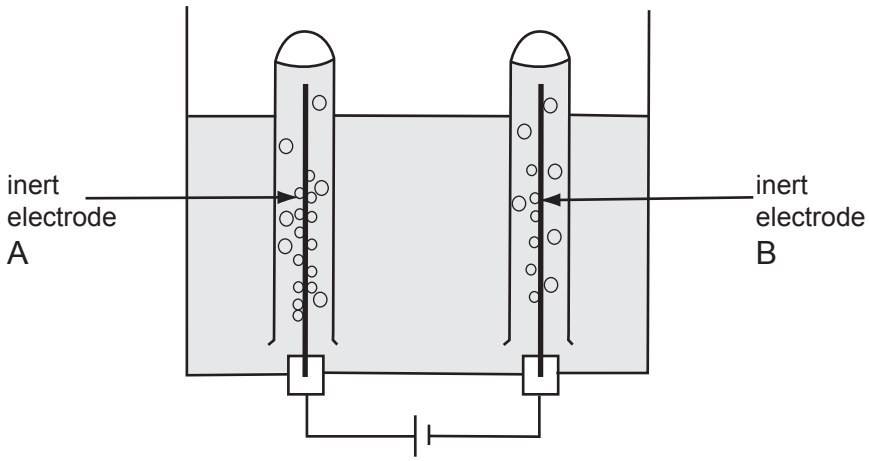
_____ [3]

Examiner Only

Marks	Remark

13 The diagram below shows the apparatus which can be used in the laboratory for the electrolysis of concentrated sodium chloride solution.

Examiner Only	
Marks	Remark



(a) Name the gas formed at the negative electrode, B.

_____ [1]

(b) Write an **ionic** equation for the formation of the gas at electrode A.

_____ [2]

(c) What is the name of the substance which remains in solution at the end of this electrolysis?

_____ [1]

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General Certificate of Secondary Education
2010–2011

Science: Double Award (Modular)

Using Materials and Understanding Reactions End of Module Test

Higher Tier

[GDB02]

WEDNESDAY 10 NOVEMBER 2010, AFTERNOON

MARK SCHEME

STEMUP.CO.UK

			AVAILABLE MARKS
1	**(a)** K	[1]	
	(b) 24	[1]	
	(c) 3	[1]	
	(d) Calcium hydrogen carbonate	[1]	4
2	**(a)** Diffusion	[1]	
	(b) Takes longer to form the white ring	[1]	
	(c) Idea that ammonia (particles) diffuses/moves faster/ hydrochloric acid (particles) diffuses/moves more slowly accept idea that ammonia is less dense/hydrochloric acid is more dense	[1]	
	(d) NH_4Cl	[1]	4

3 **(a)**

Particle	Atomic Number	Mass Number	Electronic arrangement
A	6	(12)	2,4
B	1	2	1
C	(5)	(11)	2,3
D	1	3	(1)

[4]

(b) **(i)** B and D [1]

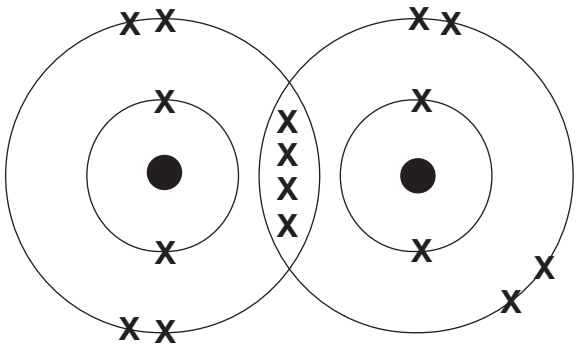
(ii) the particles have the same atomic number but different mass numbers [1] — 6

4 **(a)** cathode [1]

(b) graphite/carbon [1]

(c) high cost/idea of needing a lot of energy/anodes need to be replaced [1] — 3

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				AVAILABLE MARKS
5	**(a)**	Acid – sulphuric acid base – copper oxide/copper hydroxide product – water	[1] [1] [1]	
		If copper carbonate is used as the base it gains the mark for base but must state water and carbon dioxide for one mark for the product.		
	(b)	Carbon Dioxide	[1]	4
6		idea of Mg atom losing 2 electrons idea of F atom gaining 1 electron idea of 2 F atoms needed to allow Mg to lose 2 electrons (third mark dependent on first two)	[1] [1] [1]	3
7	**(a)**			
		Correct sharing Correct number of electrons (second mark dependent on first)	[1] [1]	
	(b)	Idea of sharing electrons/covalent bonding Idea of correct 2:1 ratio	[1] [1]	4
8	**(a)**	It combines the properties of two or more materials to form a better more useful material	[1] [1]	
	(b)	carbon fibre reinforced plastic is less dense/lighter than steel/aluminium it will need less fuel or idea of greater efficiency	[1] [1]	
	(c)	Idea of (initial) cost.	[1]	5
9		$H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O_{(l)}$		
		[1] for left hand side [1] for right hand side [1] for state symbols	[3]	3

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				AVAILABLE MARKS
10	$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$		[1]	
	$\frac{20 \times 100}{300} = \frac{22 \times 80}{T_2}$		[1]	
	$T_2 = \frac{22 \times 80 \times 300}{20 \times 100}$			
	$T_2 = 264\,K$		[1]	3
	For correct answer award [3] up to [2] available for method			
11	**(a)**	it has a giant structure	[1]	
		The bonds between the atoms are very strong/Difficult to break	[1]	
	(b)	graphite has a layer structure	[1]	
		this allows the atoms to slide over each other	[1]	4
12	Hard water contains calcium ions		[1]	
	which are replaced by sodium ions/hydrogen ions		[1]	
	which do not cause hardness		[1]	3
13	**(a)**	hydrogen gas	[1]	
	(b)	$2\,Cl^- - 2e^- \longrightarrow Cl_2$ or $2Cl^- \longrightarrow Cl_2 + 2e$ [1] [1]	[2]	
	(c)	sodium hydroxide	[1]	4
			Total	**50**

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GCSE

Science: Double Award (Modular)

End of Module Tests

May 2010

Mark Schemes

Issued: October 2010

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General Certificate of Secondary Education
2009–2010

Science: Double Award (Modular)

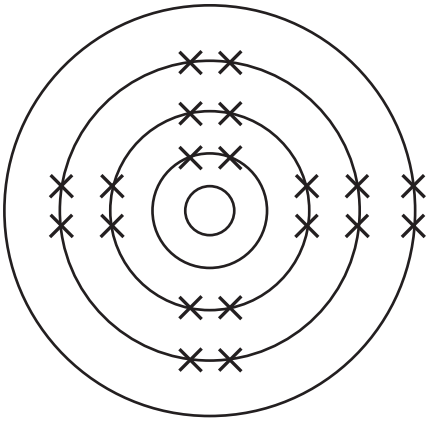
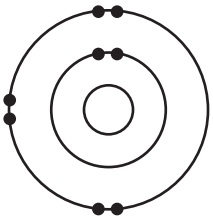
Using Materials and Understanding Reactions
End of Module Test
Higher Tier

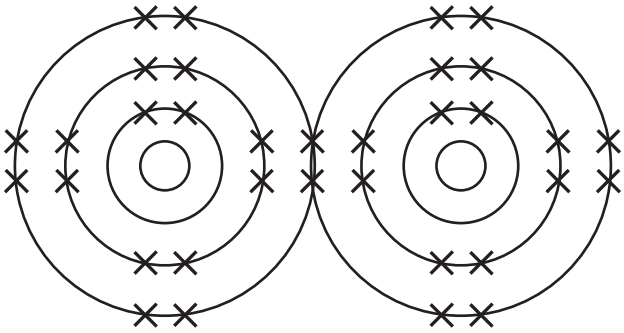
[GDB02]

THURSDAY 20 MAY 2010, MORNING

MARK SCHEME

STEMUP.CO.UK

				AVAILABLE MARKS
1	**(a)**	protons 13 [1] neutrons 14 [1] electrons 13 [1]	[3]	
	(b)	2, 8, 3 Apply cm	[1]	4
2	**(a)**	hydrogen oxide (water) neutral [1] carbon dioxide acidic [1] magnesium oxide basic [1]	[3]	
	(b)	alkalis **Accept** alkaline	[1]	4
3	**(a)**	4	[1]	
	(b)	8	[1]	
	(c)	+1/1+ Allow + **not** positive	[1]	
	(d)	$(NH_4)_2 CO_3$	[1]	4
4	**(a)**		[1]	
	(b)		[1]	
	(c)	Idea of electron transfer from calcium to oxygen [1] two [1] electrons transferred Second mark follows from first Idea of sharing gains **no** credit	[2]	
	(d)	Ionic (bond)/electrostatic force/electrostatic attraction	[1]	5

				AVAILABLE MARKS
5	**(a)**	Nitrogen	[1]	
	(b)	Decreases	[1]	
	(c)	In the fridge	[1]	3
6	**(a)**	pure copper	[1]	
	(b)	copper sulphate	[1]	
	(c)	at the cathode	[1]	3
7	**(a)**	 correct sharing [1] correct total number of electrons [1] second mark dependent on first	[2]	
	(b)	weaker than	[1]	
	(c)	Any correct covalent formula	[1]	4

8 $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$\frac{1800 \times 40}{300} = \frac{3600 \times V_2}{400}$

} [1] for method $\frac{PV}{T} = 240$ gets first method mark

$V_2 = \frac{1800 \times 40 \times 400}{300 \times 3600}$ [1] for computation

$V_2 = 26.67$ (or 26.7) cm^3 [1] **accept** 27 cm^3 [1]
correct numerical answer gains [3]
units gain [1] [4] 4

up to 2 method marks available for incorrect answer

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				AVAILABLE MARKS
9	**(a)**	hydrated [1] iron(III) oxide [1]	[2]	
	(b)	**(i)** idea of being coated/covered with zinc	[1]	
		(ii) clear idea that zinc is more reactive than iron [1] idea that (if bucket gets scratched) zinc reacts and iron does not/ **or** idea that zinc reacts first [1] apply cm **not** idea that zinc reacts faster **not** just zinc reacts	[2]	5
10	**(a)**	C	[1]	
	(b)	E [1] the second answer depends on first it conducts when liquid but not when solid [1] (both needed)	[2]	
	(c)	D [1] the second answer depends on first it has a high melting point and does not conduct electricity [1] (both needed)	[2]	5
11	**(a)**	any correct e.g. good for teeth and bones/tastes nice/may help prevent heart disease/used to make beer/for tanning leather **not** good for you, **not** contains Ca (or Ca^{2+}) **not** answers about lathering	[1]	
	(b)	calcium **ions**/Ca^{2+} react/combine [1] with carbonate **ions**/CO_3^{2-}/to form calcium carbonate/$CaCO_3$ an insoluble substance/a precipitate [1] **not** idea of exchange	[3]	4
12	**(a)**	graphite **allow** carbon	[1]	
	(b)	oxygen	[1]	
	(c)	sulphate/SO_4^{2-}	[1]	
	(d)	$2H^+ + 2e^- \rightarrow H_2$ [1] [1]	[2]	5
		or $H^+ + e^- \rightarrow H$ $H + H \rightarrow H_2$		
			Total	**50**

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2009–2010

Science: Double Award (Modular)

Using Materials and Understanding Reactions
End of Module Test
Higher Tier

B

[GDB02]

GDB02

WEDNESDAY 24 FEBRUARY 2010, MORNING

TIME

45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all twelve** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 50.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet, which includes a Periodic Table of the elements, is provided for your use.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
Total Marks	

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Examiner Only	
Marks	Remark

1 Sodium hydrogen carbonate, $NaHCO_3$, is known as baking soda.

(a) (i) How many **elements** are present in sodium hydrogen carbonate?

_____ [1]

(ii) How many **oxygen atoms** are present in the formula for sodium hydrogen carbonate?

_____ [1]

(b) Sodium hydrogen carbonate decomposes when heated to form sodium carbonate, carbon dioxide and water.

Write the formula of sodium carbonate. You may find your Data Leaflet helpful.

_____ [1]

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2 The names of five different types of chemical reaction are given below.

Examiner Only	
Marks	Remark

combustion **electrolysis** **neutralisation**

reduction **oxidation**

A, **B**, **C**, **D** and **E** below are statements or equations describing chemical reactions. Using the names given above state the type of reaction described by **A**, **B**, **C**, **D** and **E**. The first one is done for you.

	Chemical Reaction	**Type of reaction**
A	Fuel is burned to give out energy, water and carbon dioxide.	combustion
B	$NaOH + HCl \rightarrow NaCl + H_2O$	_____
C	Molten aluminium oxide is decomposed into its elements by the passage of electricity.	_____
D	$CuO + H_2 \rightarrow Cu + H_2O$	_____
E	Iron reacts with oxygen in the air to form hydrated iron oxide.	_____

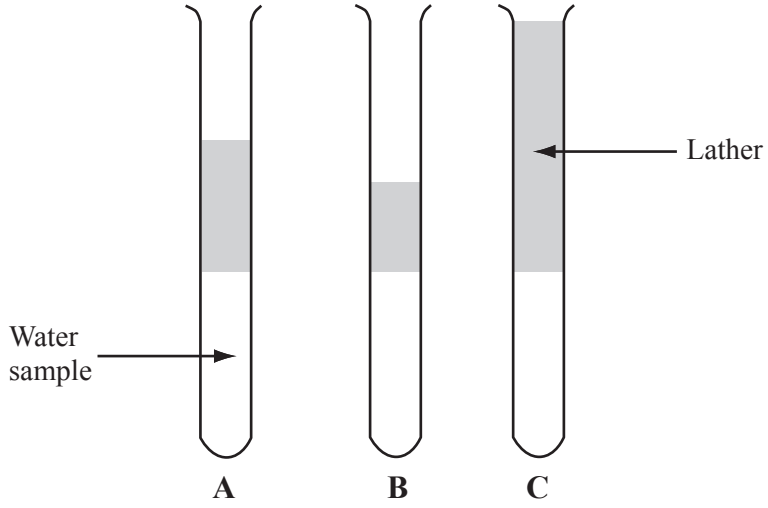
[4]

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Marks	Remark

3 Samples of water from three different towns, **A**, **B** and **C** were tested for hardness.

Soap solution (5 cm^3) was added to 10 cm^3 of each water sample and shaken. The height of the lather formed was noted. The diagram below represents the results.



(a) What is meant by hard water?

_____

_____ [1]

(b) Which town, **A**, **B** or **C** had the hardest water supply?

_____ [1]

(c) State **one** disadvantage of hard water.

_____ [1]

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4 Acids react with alkalis to form salts.

(a) Complete the table by filling in the missing chemicals.

Acid	Alkali	Salt
sulphuric acid	potassium hydroxide	
	potassium hydroxide	potassium chloride
nitric acid		sodium nitrate

[3]

(b) Apart from a salt, what other substance is formed when an acid reacts with an alkali?

_____ [1]

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Marks	Remark

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5 There are three particles in an atom, the proton, the electron and the neutron. Complete the table below to give the relative mass, the charge and the position of each particle in the atom.

Name of particle	Charge	Relative mass	Position of particle in the atom
proton		1	
electron	–1		outside the nucleus
neutron		1	in the nucleus

[4]

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Marks	Remark

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Examiner Only	
Marks	Remark

6 This question is about the element chlorine.

(a) Chlorine exists as two isotopes. What is an isotope?

_____

_____

_____

_____ [2]

(b) Chlorine can form compounds with both metals and non-metals.

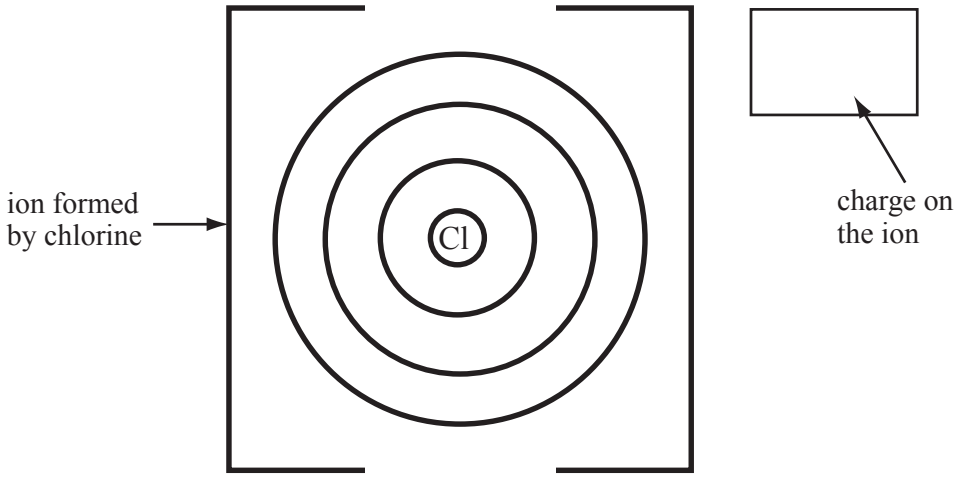
When it forms a compound with a non-metal such as hydrogen, the chlorine and the hydrogen share one electron each on their outer shells.

What is this type of bond called?

_____ [1]

(c) When chlorine forms a compound with a metal such as sodium, the chlorine and the sodium form ions.

(i) Complete the labelled diagram below to show the arrangement of all the electrons in the **ion** formed by chlorine and give the charge on the ion.



[2]

(ii) What is the **name** of the **ion** formed by chlorine?

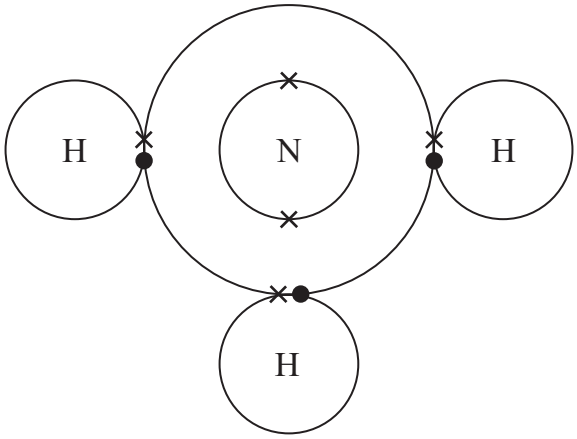
_____ [1]

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Examiner Only	
Marks	Remark

7 The diagram below shows the electronic structure of the compound ammonia, NH_3.

Two electrons are missing from the diagram.



(a) Complete the diagram by adding the missing **two** electrons. You may find your Data Leaflet helpful.

_____ [1]

(b) Ammonia is colourless, has a distinctive smell and is soluble in water. Give **one other physical** property you would expect ammonia to have.

_____ [1]

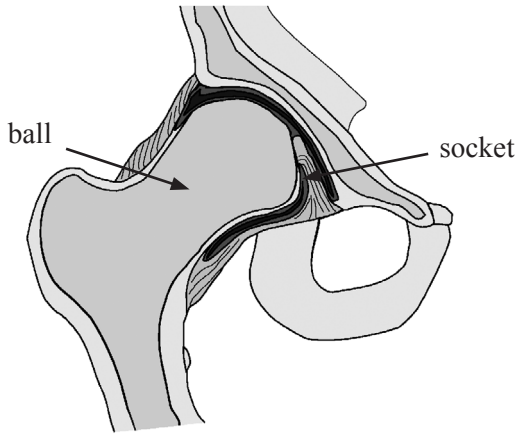
(c) Draw a diagram, in the space below, to show how hydrogen bonds with oxygen to form water. You should show **all** the electrons for both hydrogen and oxygen.

[2]

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8 Bone is a natural composite material.

Below is a diagram of a hip joint.



(a) Explain why bone is described as a composite material.

_____

_____

_____

_____ [2]

(b) The ball of an artificial hip joint is made of a ceramic material.

What property of a ceramic material, other than strength, makes it suitable for use in an artificial hip joint?

Give a reason for your choice.

Property: _____

Reason: _____

_____

_____

_____ [2]

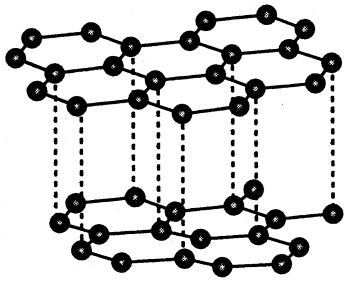
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Marks	Remark

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Examiner Only	
Marks	Remark

9 The diagram below shows the structure of graphite.



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(a) Explain, with reference to its structure, why graphite is used as a lubricant.

_____

_____

_____ [2]

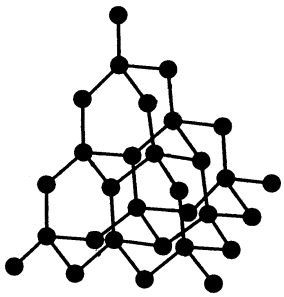
(b) Graphite is a non-metal which is able to conduct electricity. Explain, with reference to its structure, how graphite is able to conduct electricity.

_____

_____

_____ [2]

(c) Diamond has a giant structure also made up of carbon atoms.



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Why can diamond **not** be used either as a lubricant or an electrical conductor?

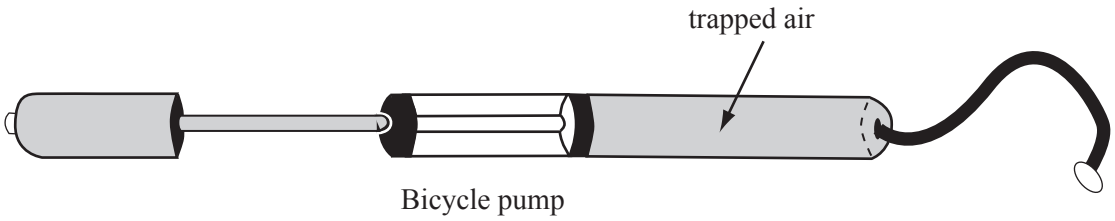
_____

_____

_____ [2]

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10 The diagram below shows a bicycle pump containing 66 cm^3 of trapped air at 280 K and a pressure of 7000 Pa.



Bicycle pump

The student increased the pressure to 9000 Pa and the temperature to 300 K.

Use the formula $\frac{PV}{T}$ = a constant to calculate the new volume of air in the pump.

Show your working. Give the **units**.

Answer: _____ [4]

Examiner Only	
Marks	Remark

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Marks	Remark

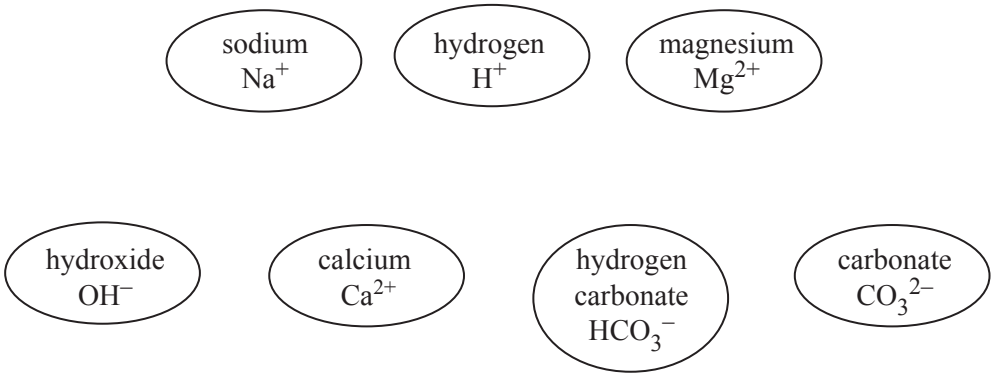
11 Hard water is formed when rain water containing dissolved carbon dioxide falls on limestone rock (calcium carbonate). This type of hard water contains calcium hydrogen carbonate.

(a) Complete the chemical equation for the formation of hard water from calcium carbonate.

$CaCO_3$ + + →

[2]

(b) Below is a list of ions.



(i) Select **two** ions from the list which cause the water to be hard.

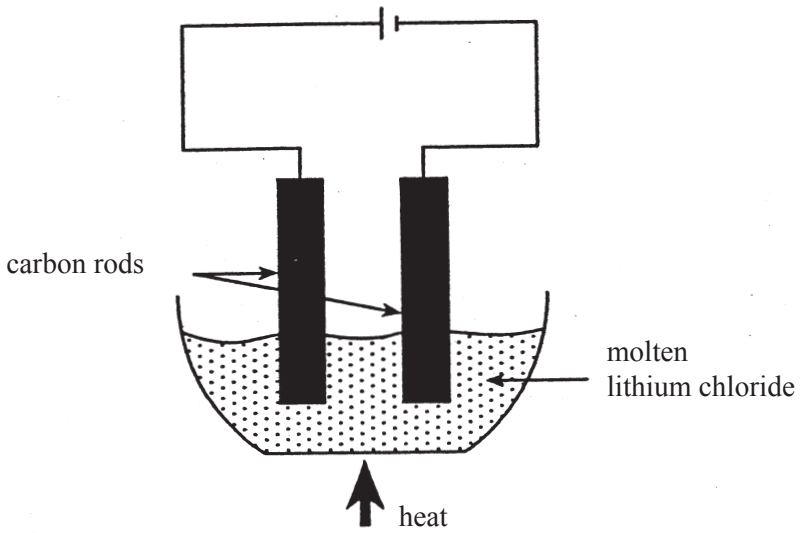
_____ [1]

(ii) Select **one** ion which could be used in an ion exchange resin to soften hard water.

_____ [1]

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12 Electrolysis of lithium chloride is carried out using the following apparatus.



(a) Give **two** reasons why carbon rods are used as electrodes in this electrolysis.

1. _____

2. _____ [2]

(b) Write an ionic equation for the reaction which takes place at the **cathode**.

_____ [2]

Examiner Only

Marks	Remark

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THIS IS THE END OF THE QUESTION PAPER

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GCSE

Science: Double Award (Modular)

End of Module Tests

March 2010

Mark Schemes

Issued: May 2010

Rewarding Learning

General Certificate of Secondary Education
2009 – 2010

Science: Double Award (Modular)

Using Materials and Understanding Reactions
End of Module Test
Higher Tier

[GDB02]

WEDNESDAY 24 FEBRUARY 2010, MORNING

MARK SCHEME

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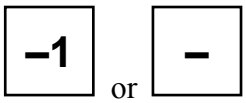
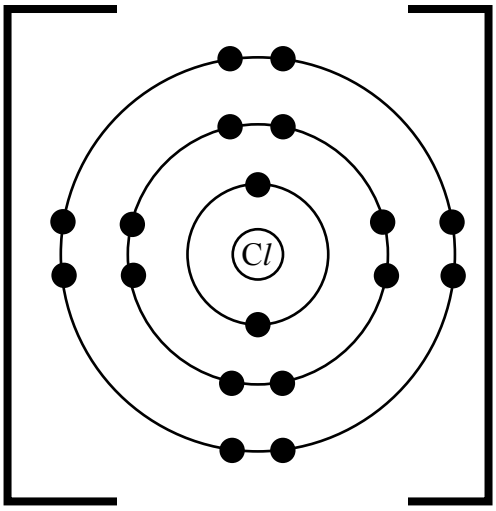
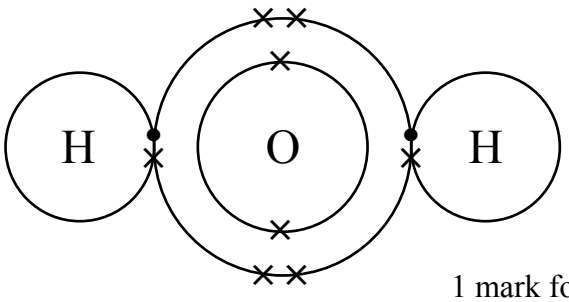
			AVAILABLE MARKS
1	**(a)** **(i)** 4	[1]	
	(ii) 3	[1]	
	(b) Na_2CO_3	[1]	3
2	B. Neutralisation	[1]	
	C. Electrolysis	[1]	
	D. Reduction	[1]	
	E. Oxidation	[1]	4
3	**(a)** Hard water is water which will not (easily) form a lather **with soap**	[1]	
	(b) B	[1]	
	(c) Leaves scale (on kettles)/wastes soap/forms scum **with soap**/ clogs up (hot) water pipes/qualified economic reason or any suitable disadvantage	[1]	3
4	**(a)** potassium sulphate [1] hydrochloric acid [1] sodium hydroxide **or** sodium oxide **or** sodium carbonate **or** sodium hydrogencarbonate [1]	[3]	
	(b) Water	[1]	4

5

Name of particle	**Charge**	**Relative mass**	**Position of particle in the atom**
Proton	**+1**	1	**nucleus**
Electron	–1	**Almost zero**	outside the nucleus
Neutron	**0**	1	in the nucleus

[1] each [4] 4

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		AVAILABLE MARKS
6	**(a)** Isotopes are atoms of the same element/have same atomic number [1] Which have a different number of neutrons/have a different mass number [1] [2]	
	(b) Covalent [1]	
	(c) **(i)**  [1]	
	 [1]	
	(ii) chlor**ide** [1]	6
7	**(a)** **Two** electrons on nitrogen outer shell [1]	
	(b) low melting pt / low boiling point gas (at room temp.) / low density [1]	
	(c)  1 mark for sharing 1 for correct total electrons 2nd mark dependent on first [2]	4

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				AVAILABLE MARKS
8	**(a)**	Bone combines the properties of two or more materials [1] to make a better material / more useful material [1] Any **two**	[2]	
	(b)	Property [1] reason [1] Smooth – easy movement Unreactive – does not affect body fluids / or other Durable – it will last a long time Rigid/hard – correct idea **Not** Density answer or other correct	[2]	4
9	**(a)**	Weak bonds between **layers** [1] allowing it to **slide/slip** [1]	[2]	
	(b)	Delocalised electrons (between the layers) [1] carry charge/current [1]	[2]	
	(c)	All the bonds are strong no layer structure [1] Diamond does not have delocalised electrons / free mobile electrons [1]	[2]	6
10	$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$ [1] or $\frac{66 \times 7000}{280} = \frac{V_2 \times 9000}{300}$ $V_2 = \frac{66 \times 7000 \times 300}{280 \times 9000}$ [1]		Up to **two** method marks Correct numerical answer gains [3] Units needed for [4] $V_2 = 55$ [3] cm^3 [1]	[4]	4
11	**(a)**	$CaCO_3 + H_2O + CO_2 \rightarrow Ca(HCO_3)_2$ LHS [1] RHS [1] (or H_2CO_3)		[2]	
	(b)	**(i)** Ca^{2+} Mg^{2+}	both needed for mark correct names are OK	[1]	
		(ii) Na^+ or H^+		[1]	4

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			AVAILABLE MARKS
12	**(a)**	Any **two** of: Conduct electricity high melting point inert (2 × [1]) [2]	
	(b)	$Li^+ + e^- \rightarrow Li$ [1] [1] [2]	4
		Total	**50**

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