CCEA GCSE SCIENCE: SINGLE AWARD (MODULAR)

SCIENCE



EXAM QUESTION PACK

MODULE 3 HIGHER TIER GSC32 PAPERS

STEMUP

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2011–2012

Science: Single Award (Modular)

Chemical Patterns and our Environment Module 3

Higher Tier

[GSC32]

GSC32

MONDAY 21 MAY 2012, 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 six** questions.

INFORMATION FOR CANDIDATES

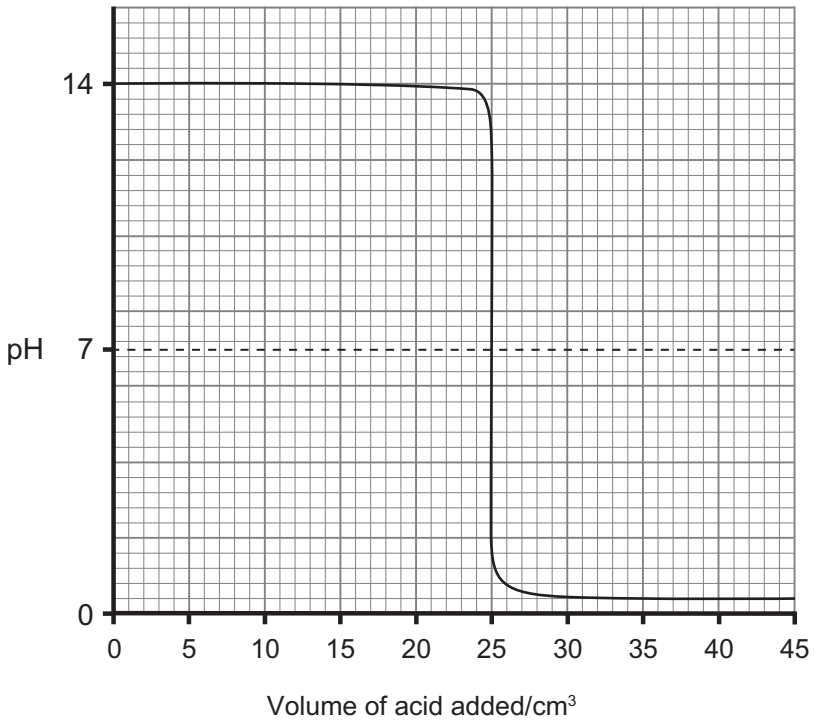
The total mark for this paper is 45.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet is provided for use with this paper.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
Total Marks	

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Examiner Only	
Marks	Remark

1 Jane measured the pH changes during a reaction using a pH probe. The following graph was produced.



She measured 25cm^3 of sodium hydroxide into a conical flask and then slowly added hydrochloric acid.

(a) Name a piece of apparatus that she could have used to add the hydrochloric acid.

_____ [1]

(b) What was the pH value of the liquid in the flask at the start of the experiment?

_____ [1]

(c) What volume of acid was needed to cause a sharp fall in the pH value?

_____ cm^3 [1]

(d) What name is given to reactions in which acids react with alkalis?

_____ [1]

(e) Complete the word equation for this reaction.

sodium hydroxide	+	hydrochloric acid	→		+	

[2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

2 Tartrazine is a yellow colouring which is added to some foods. In Europe all food additives have to be tested many times before they can be used. Some scientists have linked tartrazine to hyperactivity in children. It has also been linked to allergies, migraines and even cancer.

The British Nutrition Foundation (BNF) believes that more research is needed before any link is proved between additives and allergies.

One scientist said, "The public should not be worried because the additives have been tested before they were added to food." Another scientist said, "Many additives should be avoided on health grounds".

(a) Why is tartrazine added to food?

_____ [1]

(b) Give **two** health problems which have been linked to tartrazine.

1. _____

2. _____ [2]

(c) Explain fully why the public may be confused about the safety of food additives.

_____

_____

_____

_____

_____ [3]

(d) Many parents are worried about particular food additives. Explain fully what action they can take when shopping.

_____

_____

_____ [2]

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Examiner Only	
Marks	Remark

3 **(a)** Fluorine is an element with nine electrons. Draw the electronic structure of fluorine in the box below.

[1]

(b) Complete the table below about the particles in an atom.

Particle	Mass	Charge
proton		+1
electron	1/1840	
neutron		

[4]

(c) Use your Data Leaflet to write formulae for the following compounds.

(i) calcium oxide _____

(ii) magnesium carbonate _____

(iii) potassium sulphate _____ [3]

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Examiner Only	
Marks	Remark

4 **(a)** There are different theories on the age of the Earth. One of these theories is based on the Book of Genesis in the Bible. It involves counting the generations of ancestors.

(i) Name the person who is known to have based his theory on the Book of Genesis.

_____ [1]

(ii) What is the age of the Earth calculated from this method?

_____ [1]

(b) Scientists measure the age of the Earth using radiometric dating. Describe how radiometric dating is used to find the age of the Earth.

_____

_____

_____

_____

_____ [3]

(c) The image below shows a rock containing a fossil.



© Junior Geo Ltd

Explain how fossils helped Alfred Wegener to form his theory of continental drift.

_____

_____

_____ [2]

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Examiner Only	
Marks	Remark

5 **(a)** Indigestion tablets usually contain one of the following chemicals.

Magnesium hydroxide	$Mg(OH)_2$
Aluminium oxide	Al_2O_3
Calcium carbonate	$CaCO_3$

(i) Name the element which is present in all these compounds.

_____ [1]

(ii) Explain fully why aluminium oxide is described as a compound.

_____

_____

_____ [2]

(b) Milk of Magnesia is a well known product that can be used to cure excess acid in the stomach.

Complete and balance the symbol equation for the chemical reaction which takes place in the stomach after taking this medicine.

$Mg(OH)_2 \quad + \quad HCl \quad \rightarrow \qquad\qquad\qquad + \qquad\qquad$

[3]

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Examiner Only	
Marks	Remark

6 Baking soda is a most useful substance to have in the home. It can be used to make sweets, cakes and can also be used to cure indigestion.

Sherbet is a mixture of baking soda, citric acid and sugar. When it is moistened in the mouth it produces a pleasant fizzing sensation.



© Tangerine Confectionery Ltd

(a) Name the gas which causes the fizzing sensation.

_____ [1]

(b) Complete the word equation.

sodium hydrogencarbonate	+	citric acid	→		+		+	

[3]

Examiner Only	
Marks	Remark

(c) When baking soda is mixed with tartaric acid it forms baking powder.

(i) Explain fully how these chemicals react to make cakes rise.

_____

_____

_____ [2]

(ii) During this reaction a salt is formed. What is the name of this salt?

_____ [1]

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(d) When baking soda is used to cure indigestion it reacts with hydrochloric acid in the stomach. Complete the symbol equation below for this reaction.



[3]

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Marks	Remark

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Rewarding Learning

General Certificate of Secondary Education
2011–2012

Science: Single Award (Modular)

Chemical Patterns and our Environment
Module 3
Higher Tier

[GSC32]

MONDAY 21 MAY 2012
9.15 am–10.00 am

MARK SCHEME

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				AVAILABLE MARKS
1	**(a)**	burette, pipette (not teat) syringe	[1]	
	(b)	14	[1]	
	(c)	25 (cm^3)	[1]	
	(d)	neutralisation	[1]	
	(e)	sodium chloride, water (either order)	[2]	6
2	**(a)**	to improve appearance/more attractive/appealing	[1]	
	(b)	hyperactivity, allergies, migraines, cancer *any two*	[2]	
	(c)	difference of opinion one for use one for avoiding	[1] [1] [1]	
	(d)	read the labels on the food packets do not buy foods containing additives	[2]	8
3	**(a)**	2, 7 arrangement	[1]	
	(b)	proton: mass 1 electron: charge −1 neutron: mass 1, charge 0	[4]	
	(c)	**(i)** CaO		
		(ii) $MgCO_3$		
		(iii) K_2SO_4	[3]	8
4	**(a)**	**(i)** Bishop Ussher	[1]	
		(ii) 6000 years	[1]	
	(b)	use rocks, radioactivity, isotopes – uranium, potassium measure half-life, idea of daughter nuclei *any three*	[3]	
	(c)	rocks containing fossils were present in both Africa and South America/ idea of same fossils in each	[2]	7

				AVAILABLE MARKS
5	**(a)**	**(i)** oxygen	[1]	
		(ii) two elements, (chemically) joined	[2]	
	(b)	2 HCl, $\underbrace{MgCl_2 \quad H_2O}_{\text{either order}}$	[3]	6
6	**(a)**	carbon dioxide	[1]	
	(b)	sodium citrate, water, carbon dioxide (any order)	[3]	
	(c)	**(i)** react to form carbon dioxide bubbles of gas cause mixture to rise	[2]	
		(ii) sodium tartrate	[1]	
	(d)	$NaHCO_3 \quad \underbrace{NaCl \quad CO_2}_{\text{either order}}$	[3]	10
			Total	**45**

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2011–2012

Science: Single Award (Modular)

Chemical Patterns and our Environment
Module 3
Higher Tier

[GSC32]

GSC32

TUESDAY 28 FEBRUARY 2012
11.00 am–11.45 am

TIME

45 minutes.

INSTRUCTIONS TO CANDIDATES

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Total Marks	

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Examiner Only	
Marks	Remark

1 **(a)** Complete the sentence below.

The number of _____ plus the number of _____

in an atom is called the **mass number** of that element. [2]

(b) An oxygen atom has eight electrons.

In the space below, draw a diagram to show how these eight electrons are arranged in an atom of oxygen.

[2]

(c) Magnesium metal burns in air to produce the compound magnesium oxide.

The formula for magnesium oxide is MgO.

Calculate the **total number** of particles in magnesium oxide.

You may find your Data Leaflet helpful.

protons _____

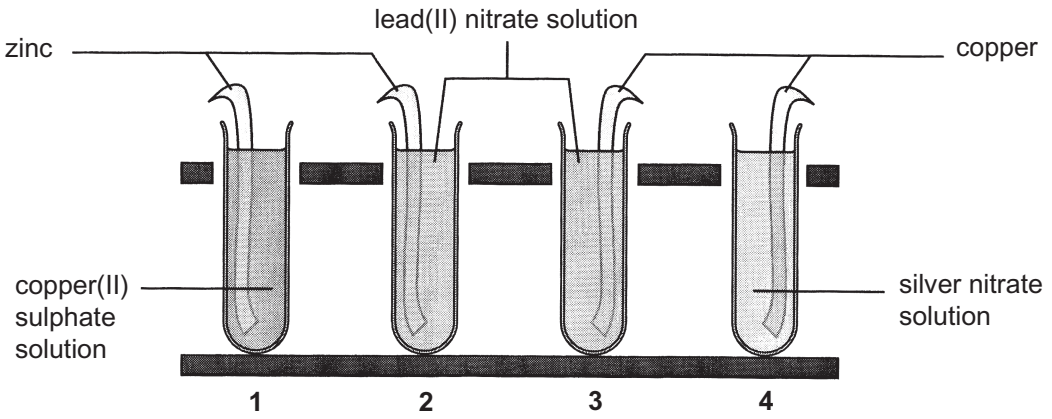
electrons _____

neutrons _____ [3]

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Examiner Only	
Marks	Remark

2 David did an experiment to investigate which metals are the most reactive. He set up the apparatus as shown in the diagram below.



He recorded his results in a table as follows:

Test tube	Appearance of solution at start	Appearance of metal at start	Appearance of solution after 2 hours	Appearance of metal after 2 hours
1	blue	silvery colour	colourless	reddish brown deposit
2	colourless	silvery colour	colourless	greyish white deposit
3	colourless	reddish brown colour	colourless	silvery colour no deposit
4	colourless	reddish brown colour	blue	greyish deposit

Use this information to answer the following questions.

(a) What name is given to a reaction in which one metal takes the place of another metal?

_____ [1]

(b) In which test tube, 1, 2, 3, or 4, was there no chemical reaction?

_____ [1]

(c) Name the reddish brown deposit on the zinc metal in test tube 1.

_____ [1]

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(d) The solution in test tube 1 lost its blue colour. Explain how this happened.

_____ [1]

(e) Which of the metals involved is the most reactive?

Circle the correct answer.

copper **silver** **zinc** **lead** [1]

(f) Explain fully what has happened in test tube 4.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

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3 Honeycomb toffee can be made using the following ingredients:

- granulated sugar crystals – 5 tablespoons
- golden syrup – 2 tablespoons
- baking soda – 1 teaspoon



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(a) Use this information and your knowledge to describe how you could make honeycomb.

_____

_____

_____

_____

_____ [3]

(b) One of the reactions which takes place during the formation of honeycomb is described as thermal decomposition.

Write a word equation to show how baking soda is thermally decomposed.

_____ [3]

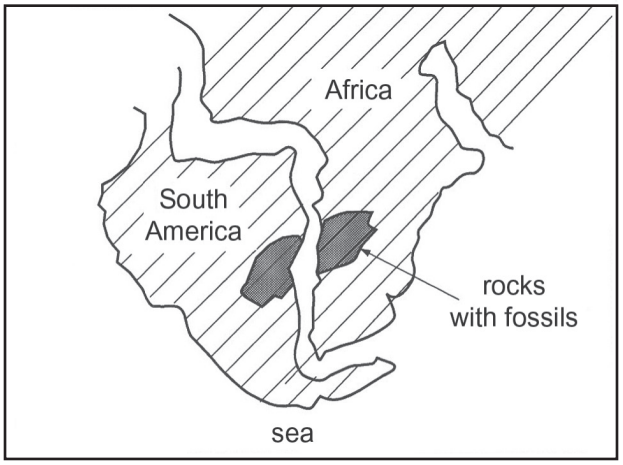
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Marks	Remark

Examiner Only	
Marks	Remark

4 Alfred Wegener put forward his theory on the formation of the continents in 1915. Ideas on this subject had been debated since 1597 but it was not until 1960 that scientists accepted his theory as being correct.

Below is a map showing the relative positions of South America and Africa millions of years ago.



(a) Describe Wegener's theory including one piece of evidence that he gave to support it.

_____

_____

_____

_____

_____ [3]

(b) Before 1960 some scientists rejected Wegener's theory. Give one reason why it was rejected.

_____

_____ [1]

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Examiner Only	
Marks	Remark

5 Food additives can be divided into groups.

(a) Complete the table below.

Food Additive	Function
Flavouring	
	Stops fats from going rancid (off)
Emulsifiers	
	Keeps the food at the right pH

[4]

(b) E142 is a green colouring which is added to some vegetables.

Give **two** disadvantages of adding colouring to food.

1. _____

2. _____ [2]

(c) Describe the advantages and disadvantages of testing food additives on animals.

_____

_____

_____

_____ [3]

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Examiner Only	
Marks	Remark

6 **(a)** Rubidium is in Group 1 of the Periodic Table.

(i) Using your knowledge of other Group 1 elements, describe how you would expect rubidium to react with water.

_____

_____

_____

_____

_____ [3]

(ii) How many electrons would you expect rubidium to have in its outer shell?

_____ [1]

(iii) When storing rubidium in the laboratory it must be kept away from water. Suggest how it should be stored.

_____ [1]

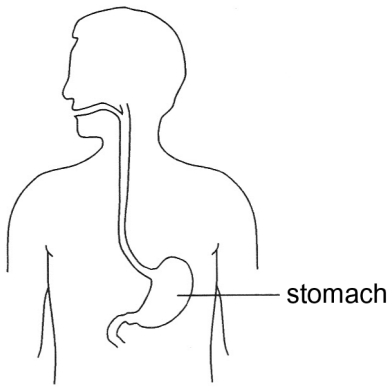
(b) Complete the balanced symbol equation to show what happens when sodium reacts with water.

$2Na + 2H_2O \longrightarrow$ _____ + _____ [2]

Examiner Only	
Marks	Remark

7 Acid indigestion is caused by excess hydrochloric acid in the stomach.

Calcium carbonate is present in many antacid tablets.



(a) What name is given to the type of chemical reaction which takes place in the stomach after swallowing an antacid tablet?

_____ [1]

(b) Give the name of another chemical substance which could be used as an alternative to calcium carbonate.

_____ [1]

(c) Complete and balance the symbol equation below to show the reaction between calcium carbonate and hydrochloric acid.

$CaCO_3$ + _____ ⟶ $CaCl_2 + H_2O$ + _____ [3]

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Rewarding Learning

General Certificate of Secondary Education
2011– 2012

Science: Single Award (Modular)

Chemical Patterns and our Environment
Module 3
Higher Tier

[GSC32]

TUESDAY 28 FEBRUARY 2012
11.00 am–11.45 am

MARK SCHEME

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				AVAILABLE MARKS
1	**(a)**	protons/neutrons	[2]	
	(b)	2, 6 arrangement – 1 mark for each correct shell	[2]	
	(c)	20 protons, 20 electrons, 20 neutrons	[3]	7
2	**(a)**	displacement	[1]	
	(b)	3/none	[1]	
	(c)	copper metal	[1]	
	(d)	copper came out of the solution	[1]	
	(e)	zinc	[1]	
	(f)	copper displaced the silver the silver was deposited on the strip	[2]	7
3	**(a)**	heat the sugar and syrup until the sugar has dissolved add the baking soda and stir allow the mixture to rise pour onto a cooling tray/allow to cool any 3	[3]	
	(b)	sodium hydrogencarbonate $\longrightarrow$ sodium carbonate + water + carbon dioxide (1 mark awarded for each product)	[3]	6
4	**(a)**	theory of continental drift continents moving apart [2] shapes of continents fit like a jigsaw/ same rocks with fossils appear on both continents } [1]	[3]	
	(b)	some scientists did not believe it was possible	[1]	4
5	**(a)**	flavouring – improves taste anti-oxidants – stops fats – rancid/off emulsifiers – stabilises oil/water mixtures acidity regulators – keeps correct pH	[4]	
	(b)	may cause allergies/migraines/hyperactivity	[2]	
	(c)	animals are similar to humans may avoid harm to humans may cause suffering to animals animals have no say animals may react differently any 3	[3]	9

					AVAILABLE MARKS
6	(a)	(i)	violent reaction/explosive catch fire/burn disappear/dissolve completely accept float – stay on surface give off a gas/hydrogen any 3 correct	[3]	
		(ii)	1	[1]	
		(iii)	storing under oil	[1]	
	(b)		$2NaOH + H_2$	[2]	7
7	(a)		neutralisation	[1]	
	(b)		sodium hydrogen carbonate/magnesium hydroxide	[1]	
	(c)		2HCl CO_2 1 mark for each formula 1 mark for balancing	[3]	5
				Total	**45**

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2011–2012

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Chemical Patterns and our Environment
Module 3
Higher Tier

[GSC32]

GSC32

WEDNESDAY 9 NOVEMBER 2011
9.15 am–10.00 am

TIME

45 minutes.

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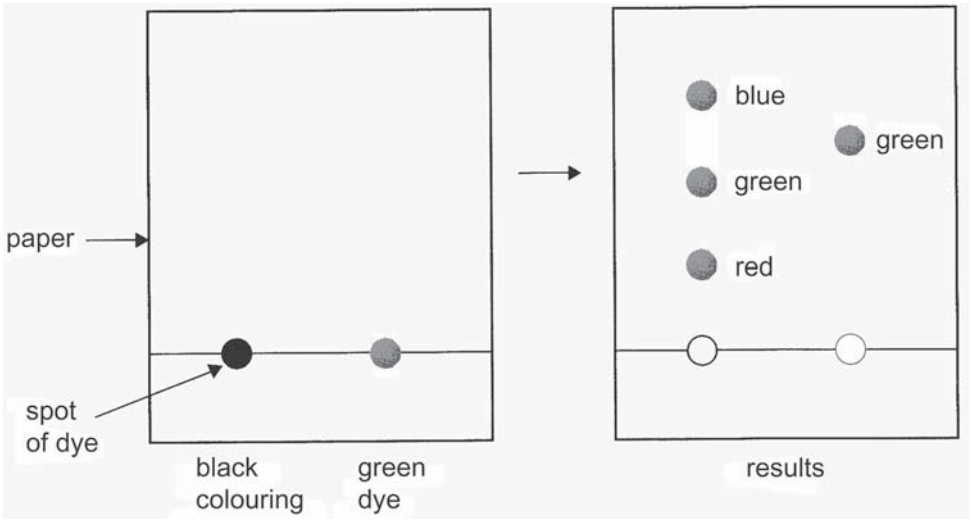
Total Marks	

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1 Emma investigated if a green dye was used in making a certain black colouring which is used in baking.

She carried out an experiment and obtained the following results.



(a) What name is given to this type of experiment?

_____ [1]

(b) Which dye from the black colouring was the most soluble in this experiment?

_____ [1]

(c) Explain fully what Emma has found out from her results.

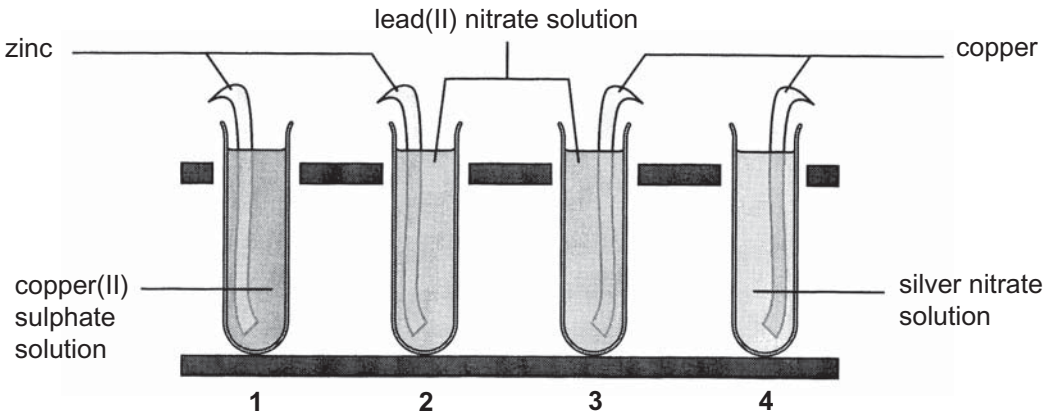
_____

_____

_____ [2]

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2 The diagram below shows four solutions into which strips of metal were placed.



After several hours the following results were obtained.

Test tube 1: solution lost its blue colour and a reddish brown deposit was seen on the metal strip.

Test tube 2: solution remained colourless and a greyish white deposit was seen on the metal strip.

Test tube 3: solution remained colourless and the metal strip remained shiny with no deposit.

Test tube 4: solution turned blue and a deposit was seen on the metal strip.

Use this information to answer the following questions.

(a) Why are reactions like these described as displacement reactions?

_____ [1]

(b) Name the reddish brown deposit formed on the zinc in test tube 1.

_____ [1]

(c) Why did the solution lose its blue colour in test tube 1?

_____ [1]

Examiner Only
Marks Remark

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(d) Explain fully the result for test tube 3.

_____

_____ [2]

(e) Two products were formed in test tube 4. Name these two products.

_____ and_____ [2]

(f) Which of the metals involved is the least reactive?

Circle the correct answer.

copper **zinc** **lead** **silver** [1]

(g) Explain fully why sodium would not be a suitable metal for this experiment.

_____

_____ [2]

Examiner Only
Marks Remark

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3 (a) Aluminium is an element which has 13 electrons.

In the space below draw a diagram to show how all these electrons are arranged in an atom of aluminium.

[2]

(b) Complete the table below about the particles in an atom.

Particle	Mass	Charge
electron	1/1840	
neutron		0
	1	+1

[3]

(c) Use your Data Leaflet to name the formulae given below .

(i) $CaCO_3$ _____

(ii) KOH _____

(iii) Na_2SO_4 _____ [3]

Examiner Only
Marks Remark

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4 Sherbet is a kind of sweet which can be made using baking soda.



© Tangerine Confectionery Ltd

(a) Give the chemical name and formula for baking soda.

Name _____

Formula _____ [2]

(b) Sherbet is made from a mixture of baking soda and citric acid which react together in the mouth to produce a cooling sensation.

Write a complete word equation for this reaction.

_____ [4]

(c) Baking soda is also used to make honeycomb. In this reaction the baking soda is added to a mixture of golden syrup and sugar which has been allowed to come to the boil in a saucepan.

Describe fully the chemical reaction which takes place in the saucepan.

_____

_____

_____ [3]

(d) Why would adding vinegar to the honeycomb mixture improve the height of the honeycomb?

_____

_____ [2]

Examiner Only	
Marks	Remark

5 **(a)** There are different ideas about the age of the Earth.

One is based on the Book of Genesis in the Bible and involves counting the generations of ancestors.

(i) Name the person who is known to have based his ideas on the Book of Genesis.

_____ [1]

(ii) What is the age of the Earth calculated from this method?

_____ [1]

Another theory is based on radiometric dating.

(b) Describe how radiometric dating is used to find the age of the Earth.

_____

_____

_____

_____

_____ [3]

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Examiner Only
Marks Remark

6 Indigestion is caused when there is too much acid in the stomach.

One of the substances used to treat indigestion is called Milk of Magnesia.

(a) The chemical name for this product is magnesium hydroxide, $Mg(OH)_2$.

How many different elements are present in this compound?

_____ [1]

(b) When used to treat indigestion, name the type of chemical reaction that takes place in the stomach.

_____ [1]

(c) Complete and balance the symbol equation for this reaction.

$Mg(OH)_2 + HCl \longrightarrow \quad + \quad$ [3]

(d) Tablets containing calcium carbonate can also be used to relieve indigestion. Complete the symbol equation below.

$CaCO_3 + 2HCl \longrightarrow CaCl_2 + \quad + \quad$ [2]

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2011–2012

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Chemical Patterns and our Environment
Module 3
Higher Tier

[GSC32]

WEDNESDAY 9 NOVEMBER 2011
9.15 am–10.00 am

MARK SCHEME

STEMUP.CO.UK

				AVAILABLE MARKS
1	**(a)**	chromatography	[1]	
	(b)	blue	[1]	
	(c)	black colouring is made of 3 dyes [1] The green dye in black colouring is not the same as the green dye tested [1]	[2]	4
2	**(a)**	because one metal has replaced another metal from a solution	[1]	
	(b)	copper	[1]	
	(c)	all the copper had left the solution	[1]	
	(d)	No chemical reaction took place because copper is less reactive or unable to displace the lead	[2]	
	(e)	copper nitrate and silver	[2]	
	(f)	silver	[1]	
	(g)	Sodium is too reactive [1] It would react violently with the water [1]	[2]	10
3	**(a)**	2, 8, 3 arrangement [1] for 3 shells [1] for correct electron arrangement	[2]	
	(b)	Electron charge –1 [1] Neutron mass 1 [1] Proton [1]	[3]	
	(c)	**(i)** Calcium carbonate [1]		
		(ii) Potassium hydroxide [1]		
		(iii) Sodium sulphate [1]	[3]	8

				AVAILABLE MARKS
4	**(a)**	Sodium hydrogen carbonate $NaHCO_3$	[2]	
	(b)	Sodium hydrogen carbonate [1] + Citric acid ⟶ Sodium citrate [1] + water [1] + carbon dioxide [1]	[4]	
	(c)	Baking soda decomposes or breaks down [1] in the heat [1] to produce CO_2 [1]	[3]	
	(d)	Any **two** from: vinegar is an acid [1], it reacts with the baking soda [1] to produce more CO_2 [1]	[2]	11
5	**(a)**	**(i)** Archbishop Ussher	[1]	
		(ii) 4000 ⟶ 6000 years	[1]	
	(b)	Any **three** from: Radioactive isotopes/uses radio isotopes: Uranium/Potassium: Half life/daughter elements/rocks	[3]	5
6	**(a)**	3	[1]	
	(b)	neutralisation	[1]	
	(c)	$Mg(OH)_2 + 2HCl \longrightarrow MgCl_2 + 2H_2O$ [1] for each product [1] for balancing	[3]	
		$CaCO_3 + 2HCl \longrightarrow CaCl_2 + H_2O + CO_2$ [1] for each product	[2]	7
				45

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2010–2011

Science: Single Award (Modular)

Chemical Patterns and our Environment
Module 3

Higher Tier

[GSC32]

GSC32

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 six** questions.

INFORMATION FOR CANDIDATES

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For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
Total Marks	

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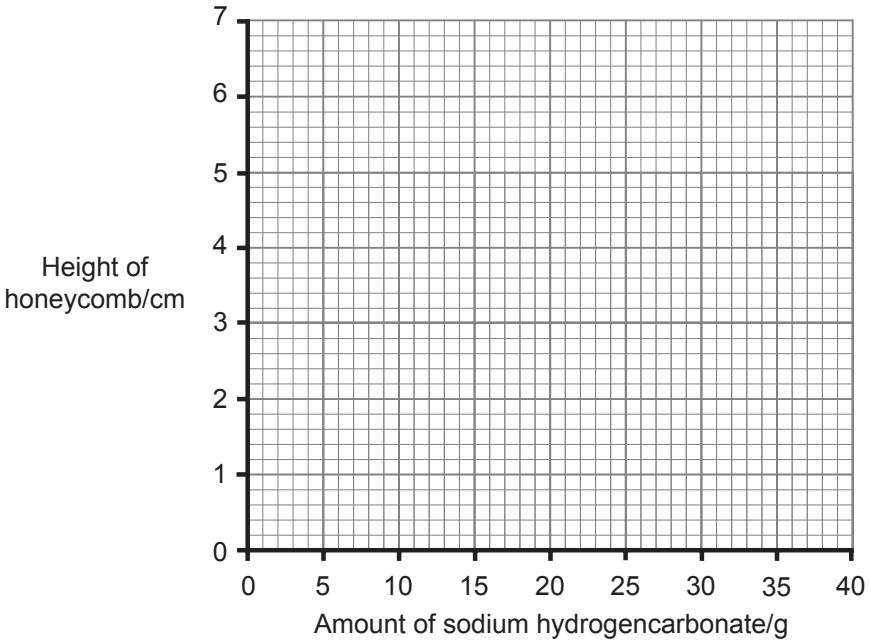
Examiner Only	
Marks	Remark

1 John investigated how the amount of sodium hydrogencarbonate affects the height of honeycomb toffee. His results are shown below.
One of his results is **not** correct.

Amount of sodium hydrogencarbonate/g	4	8	12	16	20	24	28	32	36
Height of honeycomb/ cm	2.0	3.0	4.0	4.2	6.0	6.4	6.6	6.6	6.6

(a) (i) Plot the points and draw a line graph on the grid below.

NB: When drawing the line take into account that **one** result is not correct.



[3]

(ii) From the graph, predict what is the correct height for the anomalous result.

_____ cm [1]

(b) From the results describe how the amount of sodium hydrogencarbonate affects the height of the honeycomb.

_____

_____ [2]

(c) The teacher decided to make more honeycomb. What is the least amount of sodium hydrogencarbonate she should use to get the maximum height?

_____ g [1]

(d) John asked if he could add a few drops of vinegar to the mixture to try and get an even greater height. Explain fully why adding vinegar could make a difference.

_____

_____ [2]

(e) Complete the word equation for the reaction of vinegar with sodium hydrogencarbonate.

sodium hydrogencarbonate + ⟶ sodium ethanoate + carbon dioxide +

[2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

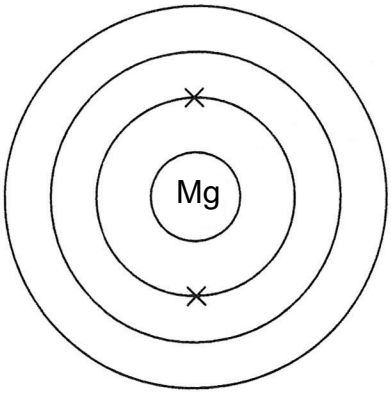
2 Magnesium is a chemical element with an atomic number of 12 and a mass number of 24.

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

_____

_____ [1]

(b) Complete the diagram to show how all the electrons are arranged in an atom of magnesium.



[1]

(c) What is the meaning of the term compound?

_____

_____ [2]

(d) Complete the sentences about magnesium and oxygen.

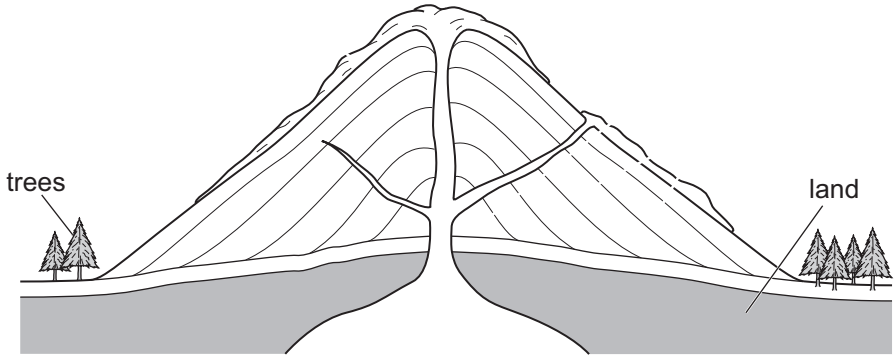
Magnesium is in Group _____ of the Periodic Table. Oxygen is in Period _____ of the Periodic Table.

When magnesium is burned in oxygen a new substance is formed.

This substance is called _____. [3]

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3 The diagram below shows a cross section through a volcano.



(a) With reference to the diagram describe what happens when a volcano erupts.

_____

_____

_____ [3]

(b) In May 2010 an active volcano in Iceland erupted. The volcano was covered in snow and ice.

Suggest one effect the snow and ice had on the lava.

_____

_____ [1]

(c) Explain fully what causes earthquakes.

_____

_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

4 The Periodic Table was developed over a period of time. Three scientists in particular are noted for their contribution: Mendeleev, Aristotle (a Greek scientist) and Newlands.

(a) List these scientists in the order that they made their contribution starting with the earliest.

_____ _____ _____ [1]

(b) Use the information below and your knowledge to describe the contribution made by each scientist.

Gaps were left for undiscovered elements.

There were four elements, earth, fire, air and water.

Elements were found to have a repeating pattern every 8th element.

Atomic mass was used to put elements in order.

John Newlands: _____

_____

Aristotle: _____

_____

Dmitri Mendeleev: _____

_____

[4]

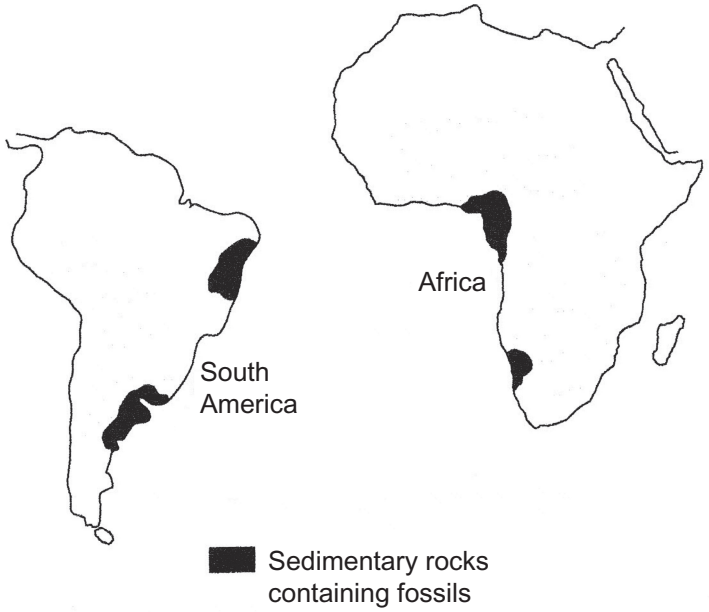
(c) Describe how the modern Periodic Table differs from earlier versions.

_____

_____

_____ [2]

5 In 1915 a German scientist called Alfred Wegener put forward a theory that the continents were once joined together.



(a) Use the diagram and your knowledge to suggest **two** reasons why he thought the continents had once been joined together.

_____

_____

_____ [2]

(b) What was the name of Wegener's theory?

_____ [1]

(c) Why was Wegener's theory originally rejected in 1915?

_____

_____ [1]

Examiner Only

Marks	Remark

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6 The table below lists some physical properties of the alkali metals.

Element	Melting point/°C	Boiling point/°C	Density/g/cm^3
Lithium	180	1 347	0.53
Sodium	98	883	0.97
Potassium	64	774	0.86
Rubidium	39	688	1.53
Caesium	28	678	1.88

(a) (i) Name the alkali metal that is a liquid at 34 °C.

_____ [1]

(ii) Suggest the name of an alkali metal which would sink when placed in water.

_____ [1]

(iii) Give a trend in the boiling points of the alkali metals.

_____

_____ [1]

(b) (i) Using your knowledge of the Group 1 metals, describe in detail how you would expect rubidium to react with water.

_____

_____

_____

_____ [3]

(ii) How many electrons would you expect rubidium to have in its outer shell?

_____ [1]

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Marks	Remark

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(c) Complete and **balance** the equation for the reaction of sodium with water.

$Na + H_2O \longrightarrow$ _____ + _____ [3]

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Marks	Remark

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2010–2011

Science: Single Award (Modular)

Chemical Patterns and our Environment
Module 3

Higher Tier

[GSC32]

THURSDAY 19 MAY 2011, MORNING

MARK SCHEME

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				AVAILABLE MARKS
1	**(a)**	**(i)**	8, 9 points correctly plotted [2] 7, 6 points [1] less than 6 [0] [2] joined correctly [1]	
		(ii)	5 cm ± 0.1 Must agree with graph [1]	
	(b)		the greater the amount, the higher the honeycomb [1] it stops at 28 g [1] [2]	
	(c)		28 g [1]	
	(d)		vinegar is an acid/reacts with baking soda [1] it will react to produce (more) CO_2 [1] [2]	
	(e)		ethanoic acid/water [2]	11
2	**(a)**		number of protons + neutrons (in nucleus) [1]	
	(b)		2, 8, 2 arrangement [1]	
	(c)		two or more elements [1] combined/chemically joined [1] [2]	
	(d)		magnesium – group 2 oxygen – period 2 magnesium oxide [3]	7
3	**(a)**		molten rock/magma from [1] moves up to the surface [1] gases + molten rock come out of the crater [1] rock flows down the side as lava [1] Any three [3]	
	(b)		it would have speeded up cooling [1] it could cause it to form solid faster [1] it turned some of the molten rock into fine hard particles [1] Any one [1]	
	(c)		plates [1] rub against each other [1] [2]	6

				AVAILABLE MARKS
4	**(a)**	Aristotle, Newlands, Mendeleev	[1]	
	(b)	John Newlands – noticed pattern of 8 called this the law of octaves [1]	[1]	
		Aristotle – 4 elements – earth, fire, air, water	[1]	
		Mendeleev – left gaps atomic mass order	[2]	
	(c)	– atomic number order more elements	[2]	7
5	**(a)**	rocks on both continents match – same fossils in each [1] shapes fit together like a jig-saw [1]	[2]	
	(b)	continental drift	[1]	
	(c)	people didn't believe that continents could move	[1]	4
6	**(a)**	**(i)** caesium	[1]	
		(ii) rubidium or caesium	[1]	
		(iii) decrease as you move down the group	[1]	
	(b)	**(i)** violent reaction/flame gives off gas disappears	[3]	
		(ii) one	[1]	
	(c)	$2Na + 2H_2O \longrightarrow 2NaOH + H_2$ (one mark for each correct formula/one for balancing)	[3]	10
			Total	**45**

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2010–2011

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Chemical Patterns and our Environment Module 3

Higher Tier

[GSC32]

GSC32

WEDNESDAY 23 FEBRUARY 2011, MORNING

TIME

45 minutes.

INSTRUCTIONS TO CANDIDATES

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Answer **all six** questions.

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Total Marks	

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Marks	Remark

1 Paul set up an experiment to investigate the reactions of metals with solutions of their salts.

In beaker A he put zinc into a solution of copper sulphate.

In beaker B he put iron into a solution of zinc sulphate.

He left the beakers to stand for 30 minutes.

Beaker	Colour at start	Colour after 30 minutes.
A	Solution – blue Metal – grey	Solution – _____ Metal – _____
B	Solution – colourless Metal – grey	Solution – _____ Metal – _____

(a) Complete the table above to show the colours Paul observed after 30 minutes. [4]

(b) Explain fully the results for beaker B.

_____

_____ [2]

(c) What is the name given to this type of reaction?

_____ [1]

(d) Name the solution formed in beaker A after 30 minutes.

_____ [1]

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Examiner Only	
Marks	Remark

2 Mary carried out an experiment to find out how much magnesium oxide could be produced by heating 8.4 g of magnesium carbonate.

She heated the magnesium carbonate in a test tube with a Bunsen burner.

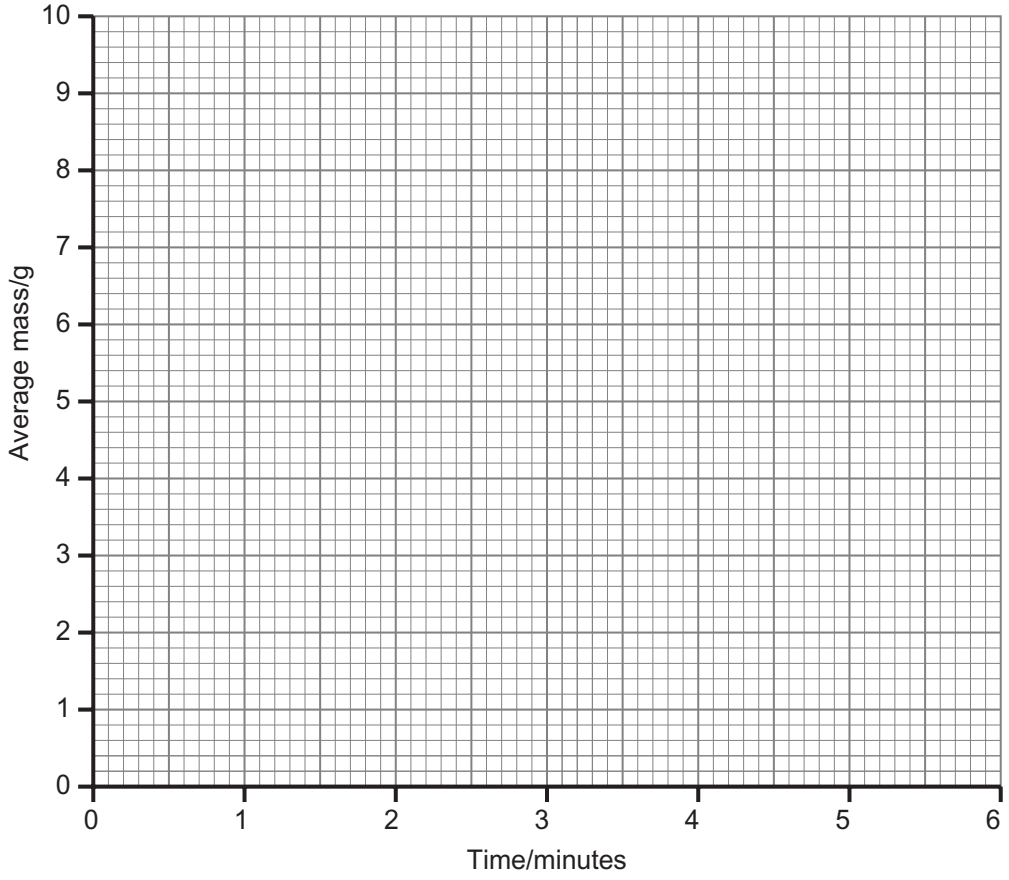
Mary then recorded the mass of the solid remaining in the test tube every minute.

She repeated the experiment with another 8.4 g of magnesium carbonate.

Her results are shown in the table below.

Time/ minutes	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Mass/g (test 1)	8.4	7.1	6.3	5.3	4.3	3.9	3.9
Mass/g (test 2)	8.4	6.9	5.9	4.7	4.1	4.1	4.1
Average mass/g	8.4	7.0	6.1	5.0	4.2	4.0	4.0

(a) On the grid below plot and draw a line graph of average mass against time.



[3]

(b) Why did Mary do the experiment twice and calculate an average?

_____ [1]

(c) Give **one** safety precaution Mary would have taken.

_____ [1]

(d) Complete the symbol equation for heating magnesium carbonate.

$MgCO_3 \longrightarrow$ + [2]

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

_____ [2]

(ii) When 8.4 g of magnesium carbonate is heated, 4.0 g of magnesium oxide is left.

Calculate how much carbon dioxide has been given off.

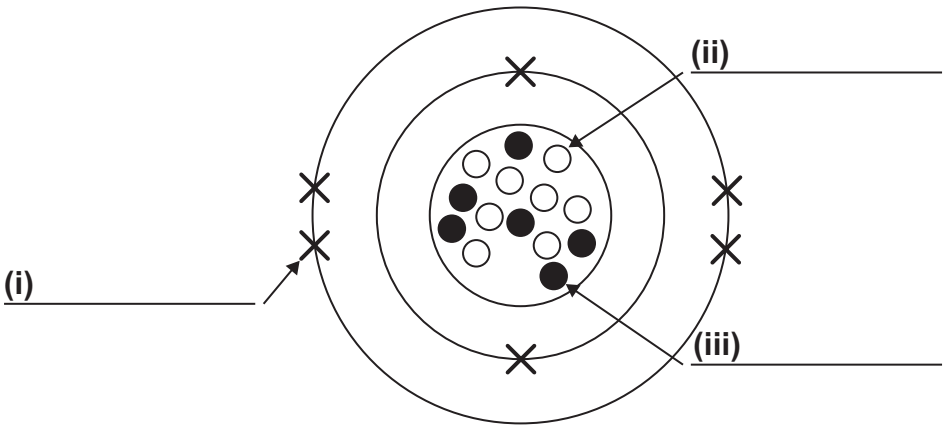
Answer _____ g [1]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

3 **(a)** Complete the labels on the diagram below.



[3]

(b) Name the element shown above.
You may find your Data Leaflet helpful.

_____ [1]

(c) Complete the table below.

Particle	Relative charge	Relative mass
Proton	+1	
Neutron		1
Electron		$\frac{1}{1840}$

[3]

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Examiner Only	
Marks	Remark

4 Emulsifiers are added to foods, e.g. salad cream, to stop the different substances in the food from separating.

(a) For the additives below give **one** reason why they are added to food.

(i) Anti-oxidants.

_____

_____ [1]

(ii) Acid base regulators.

_____

_____ [1]

(iii) Colourings.

_____

_____ [1]

(b) Give **two** reasons why some people are concerned about the use of food additives.

_____

_____ [2]

(c) Discuss the advantages and disadvantages of testing food additives on animals.

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

5 **(a)** Radiometric dating is a scientific method of estimating the age of the Earth using rocks.

Describe how this method is used.

_____

_____

_____

_____ [3]

(b) Another theory on the age of the Earth is based on the book of Genesis in the Bible.

(i) What is the name of the person who based his theory on the book of Genesis?

_____ [1]

(ii) What is the age of the Earth calculated from this method?

_____ [1]

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Examiner Only	
Marks	Remark

6 **(a)** Aluminium sulphate has the chemical formula $Al_2(SO_4)_3$.

(i) Complete the table below, to show the number of atoms of each element in the formula for aluminium sulphate.

Element	Numbers of atoms in the formula $Al_2(SO_4)_3$
Aluminium, Al	_____
Sulphur, S	_____
Oxygen, O	_____

[3]

(ii) How many different elements are contained in the formula $Ca(HCO_3)_2$?

_____ [1]

(b) Magnesium hydroxide $Mg(OH)_2$ is used to relieve excess acidity in the stomach.

Complete and balance the symbol equation below.

$Mg(OH)_2 + 2HCl \longrightarrow$ +

[3]

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Chemical Patterns and our Environment Module 3

Higher Tier

[GSC32]

WEDNESDAY 23 FEBRUARY 2011, MORNING

MARK SCHEME

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				AVAILABLE MARKS
1	**(a)**	A: colour of solution – colourless/pale blue [1] metal – reddish brown [1] B: colour of solution – colourless [1] metal – grey [1]	[4]	
	(b)	iron is less reactive than zinc [1] it is unable to displace it/no reaction [1]	[2]	
	(c)	displacement	[1]	
	(d)	zinc sulphate	[1]	8
2	**(a)**	all points plotted correctly [2] 5, 6 correct [1] line joining points [1]	[3]	
	(b)	to get more reliable results	[1]	
	(c)	safety glasses	[1]	
	(d)	$MgCO_3 \longrightarrow MgO + CO_2$ [1] [1]	[2]	
	(e)	**(i)** thermal [1] decomposition [1]	[2]	
		(ii) 4.4 g	[1]	10
3	**(a)**	**(i)** electron	[1]	
		(ii) neutron	[1]	
		(iii) proton	[1]	
	(b)	carbon	[1]	
	(c)	proton mass 1 neutron charge 0 electron charge –1	[3]	7

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					AVAILABLE MARKS
4	**(a)**	**(i)**	to stop fats from going rancid or off	[1]	
		(ii)	to keep the pH at the right level	[1]	
		(iii)	to make food more attractive	[1]	
	(b)		migraines, hyperactivity, cancer, allergies (not just health) any **two**	[2]	
	(c)		Advantages: safer than testing on humans may warn of harm to humans Disadvantages: animals may suffer animals cannot say no animals may react differently to humans Must give at least one advantage and one disadvantage	[3]	8
5	**(a)**		rocks [1] contain elements which are radioactive [1] the half life of these elements can be measured [1] uranium and potassium isotopes can be used [1] presence of daughter nuclei [1] any **three**	[3]	
	(b)	**(i)**	Archbishop Ussher	[1]	
		(ii)	6 000 years	[1]	5
6	**(a)**	**(i)**	Al 2 [1] S 3 [1] O 12 [1]	[3]	
		(ii)	4	[1]	
	(b)		$Mg(OH)_2 + 2HCl \rightarrow MgCl_2 + 2H_2O$ [1] for $MgCl_2$, [1] for H_2O, [1] for correct balancing	[3]	7
				Total	**45**

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Centre Number

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Candidate Number

General Certificate of Secondary Education
2010–2011

Science: Single Award (Modular)

Chemical Patterns and our Environment
Module 3

Higher Tier

[GSC32]

GSC32

TUESDAY 9 NOVEMBER 2010, AFTERNOON

TIME

45 minutes.

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Marks	Remark

1 **(a)** In February 2008 there was a small earthquake in the south of England. It happened at one o'clock in the morning.

Suggest **two** reasons why it could injure more people so early in the morning.

_____

_____

_____ [2]

(b) The table below shows the effects of different strengths of earthquakes.

Number on Richter Scale	Effect of earthquake
2	Trees sway, ponds ripple, doors swing slowly. People cannot tell that it is an earthquake.
4	Buildings shake, dishes rattle, windows rattle.
6	Furniture moves, plaster can fall, walls may crack.
8	Buildings fall down, bridges collapse, lives are lost.

Earthquakes are quite common in the UK, but most are less than 2 on the Richter Scale.
Suggest one reason why most are not reported and explain your answer.

_____

_____

_____ [2]

(c) Given below are some comments from BBC reporters just after the 2008 earthquake.

"Everything started wobbling. The windows were rattling and the blinds were moving."

"I went outside in my dressing gown to see if the roof had collapsed."

"Cracks appeared in the ceiling and some plaster fell. All the cupboard doors flew open."

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Using this information and the table opposite suggest what number on the Richter Scale best describes the 2008 earthquake.

Circle the correct answer.

1 **3** **5** **7** **9** [1]

(d) In January 2010 there was a major earthquake in Haiti which measured 7 on the Richter Scale. Describe what causes an earthquake, and explain why it is not possible to warn people.

_____

_____

_____

_____ [3]

(e) Give **one** reason why it would be important to be able to warn people that an earthquake is about to happen.

_____

_____ [1]

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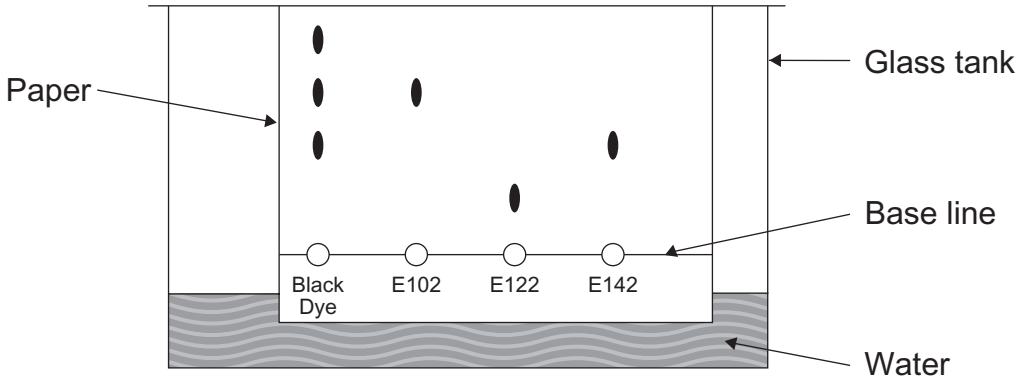
Marks	Remark

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Examiner Only	
Marks	Remark

2 A student set up an experiment to investigate the dyes in a black food colouring.

He wanted to compare the dyes with the permitted colours E102, E122 and E142 and to find out if any other dyes were present.
His results are shown below.



(a) Name this method of separation.

_____ [1]

(b) Describe fully what the student discovered as a result of this experiment.

_____

_____

_____

_____ [3]

(c) Food colourings are tested on animals.

Give one advantage and one disadvantage of animal testing.

_____

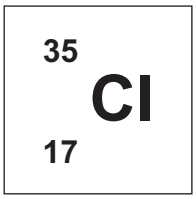
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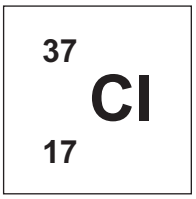
_____ [2]

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3 Chlorine has two different types of atoms (A and B).



A



B

(a) (i) Give the atomic number of chlorine.
You may find your Data Leaflet helpful.

_____ [1]

(ii) What is meant by the term atomic mass?

_____

_____ [1]

(b) Name the particle in an atom which has the smallest mass.

_____ [1]

(c) How many neutrons are present in each of the chlorine atoms (A and B) represented above?

A _____ **B** _____ [2]

(d) Draw a diagram to show how all the electrons are arranged in an atom of chlorine.

[2]

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Marks	Remark

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Marks	Remark

4 Yellow Man can be made by adding baking soda to a hot mixture of sugar and golden syrup.



© Ruth Wilson - Scotproof

(a) (i) What is the chemical formula for baking soda?

_____ [1]

(ii) Describe fully the chemical reaction which takes place when baking soda is added to the mixture of sugar and golden syrup.

_____

_____

_____ [3]

(b) Some recipes include the addition of vinegar.
Why would this help to produce more bubbles in the Yellow Man?

_____

_____ [2]

(c) Give the name of another type of sweet that can be made using baking soda, sugar and citric acid.

_____ [1]

(d) Complete the word equation for this reaction.

Sodium hydrogen carbonate + citric acid ⟶ + +

[3]

Examiner Only	
Marks	Remark

5 **(a)** Indigestion tablets usually contain one of the following chemicals.

Magnesium hydroxide	$Mg(OH)_2$
Calcium carbonate	$CaCO_3$
Aluminium oxide	Al_2O_3

(i) Name the element which is present in all of these compounds.

_____ [1]

(ii) Explain fully why calcium carbonate is described as a compound.

_____

_____ [2]



(b) When Milk of Magnesia is added to stomach acid a chemical reaction takes place.

(i) What name is given to this type of reaction?

_____ [1]

(ii) Complete and balance the symbol equation for this reaction.

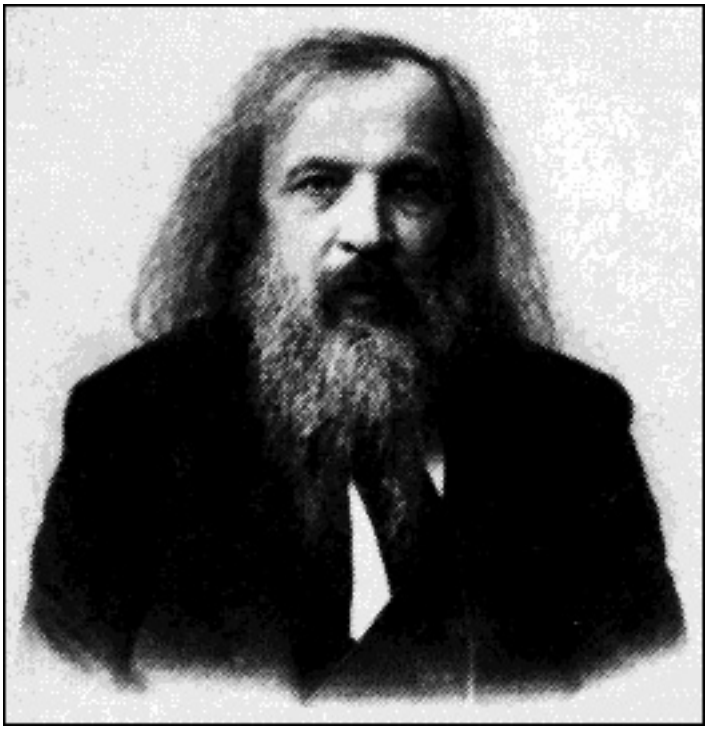
$Mg(OH)_2$ + HCl ⟶ +

[3]

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Examiner Only	
Marks	Remark

6 Mendeleev was one of the chemists who helped to develop the Periodic Table.



The first attempt to classify elements was by the Greeks, who had just four elements.
John Newlands attempted to put the chemical elements into a table. He had noticed a repeating pattern.
Mendeleev arranged the elements in order of increasing atomic weight. He tried to put elements with similar properties in the same group. Sometimes he left spaces and he did not always follow the order of increasing atomic weight.

Use the information given and your knowledge to answer the following questions.

You may find your Data Leaflet useful.

(a) Name the four 'elements' described by the Greeks.

_____ [1]

(b) What was the repeating pattern noticed by John Newlands?

_____

_____ [1]

(c) Why did Mendeleev leave gaps in his table?

_____ [1]

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(d) Suggest why Mendeleev put tellurium (atomic weight 128) before iodine (atomic weight 127).

_____

_____ [1]

(e) Much more is now known about the atomic structure of atoms.

Explain how the modern Periodic Table takes account of this.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

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Rewarding Learning

General Certificate of Secondary Education
2010–2011

Science: Single Award (Modular)

Chemical Patterns and our Environment Module 3

Higher Tier

[GSC32]

TUESDAY 9 NOVEMBER 2010, AFTERNOON

MARK SCHEME

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				AVAILABLE MARKS
1	**(a)**	More people indoors [1] **or** implied People asleep/slow to react [1] Any **two**	[2]	
	(b)	Effects are too weak [1] Small, not much damage [1] Not recognised as an earthquake [1] Any **two**	[2]	
	(c)	5	[1]	
	(d)	Earth is made up of plates which move [1] When they rub past each other (they cause friction) [1] It happens below the ground/no advanced warning/ cannot detect stresses set up [1]	[3]	
	(e)	It could save lives **or** implied	[1]	9
2	**(a)**	Chromatography	[1]	
	(b)	The black dye contains E102 and E142 [1] It does not contain E122 [1] It does contain an illegal dye [1] Black dye contains 3 dyes [1] Any **three**	[3]	
	(c)	Animals may suffer Animals cannot say no It avoids harming humans It helps to find out if the dye is safe Any **two** Answer must include at least one advantage and one disadvantage	[2]	6
3	**(a)**	**(i)** 17	[1]	
		(ii) Number of protons + neutrons in an atom	[1]	
	(b)	Electron	[1]	
	(c)	A 35 – 17 = 18 [1] B 37 – 17 = 20 [1]	[2]	
	(d)	3 shells [1] 2, 8, 7 [1]	[2]	7

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					AVAILABLE MARKS
4	**(a)**	**(i)**	$NaHCO_3$	[1]	
		(ii)	Baking soda breaks down [1] in the heat [1] to produce CO_2 [1] **Accept** equation	[3]	
	(b)		Vinegar is an acid [1] it reacts with the baking soda/neutralises to produce more carbon dioxide [1]	[2]	
	(c)		Sherbet	[1]	
	(d)		$\longrightarrow$ sodium citrate + water + carbon dioxide [1] [1] [1]	[3]	10
5	**(a)**	**(i)**	Oxygen	[1]	
		(ii)	It contains two or more different elements [1] chemically joined [1]	[2]	
	(b)	**(i)**	Neutralisation	[1]	
		(ii)	$Mg(OH)_2 + 2\ HCl \longrightarrow MgCl_2 + 2\ H_2O$ [2] for correct products [1] for balancing	[3]	7
6	**(a)**		Earth, fire, wind, water	[1]	
	(b)		Law of octaves/the eighth element was a repetition of the first	[1]	
	(c)		For undiscovered elements	[1]	
	(d)		Because iodine properties fitted better in this other position	[1]	
	(e)		It is arranged in atomic number order [1] which is the number of protons in an atom [1] The number of electrons in the outer shell is the same as the group number [1] Any **two**	[2]	6
				Total	**45**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2009–2010

Science: Single Award (Modular)

Chemical Patterns and our Environment
Module 3

Higher Tier

[GSC32]

THURSDAY 20 MAY 2010, MORNING

GSC32

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 six** questions.

INFORMATION FOR CANDIDATES

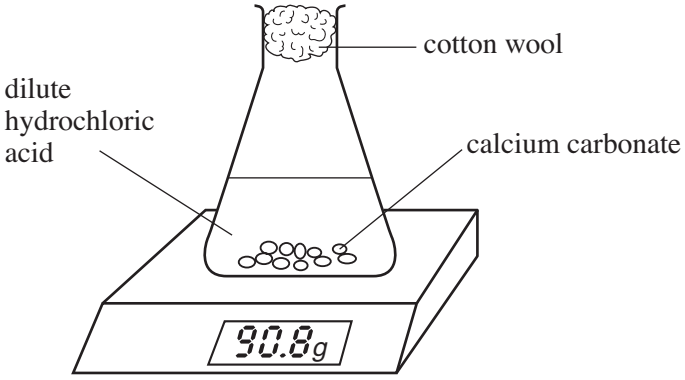
The total mark for this paper is 45.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet is provided for use with this paper.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
Total Marks	

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Examiner Only	
Marks	Remark

1 Mary investigated the reaction between hydrochloric acid and excess calcium carbonate.

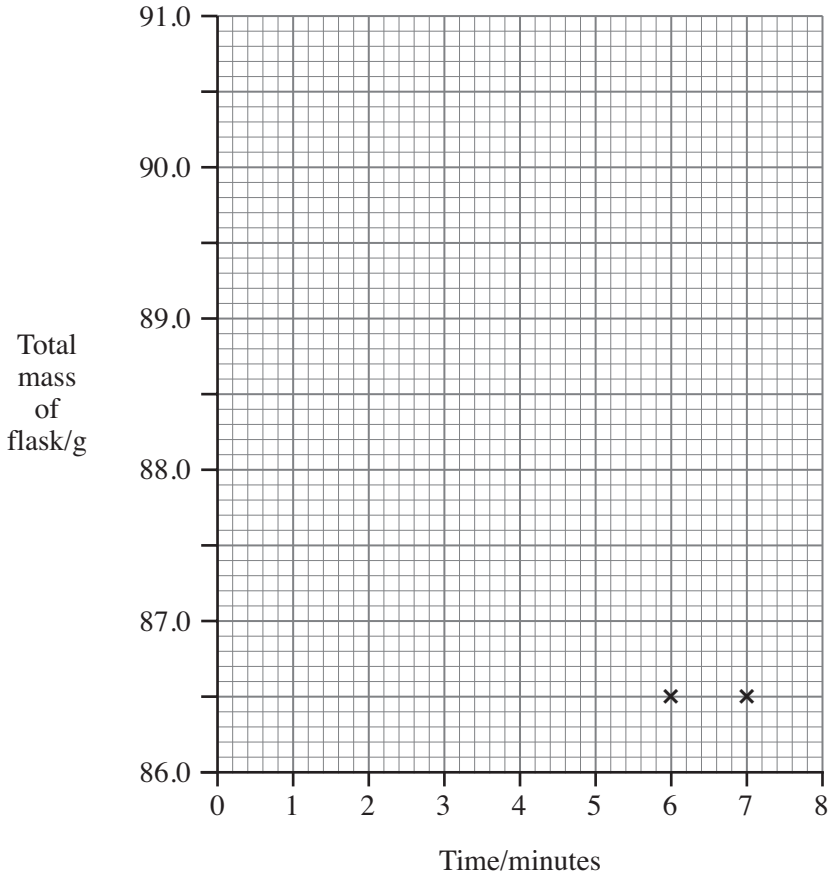


She measured the mass of the flask and its contents every minute.

(a) Complete the graph by plotting the remaining points and draw a line of best fit.

Time/ minutes	0	1	2	3	4	5	6	7
Total mass of flask/g	90.8	88.9	87.5	87.0	86.7	86.6	86.5	86.5

[3]



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(b) What is the trend shown by these results?

_____

_____ [2]

(c) Which reactant was completely used up during the reaction?

_____ [1]

(d) The equation for this reaction is shown below.

$$\text{Calcium Carbonate} + \text{Hydrochloric Acid} \longrightarrow \text{Calcium Chloride} + \text{Water} + \text{Carbon Dioxide}$$

Use the equation to fully explain why there was a decrease in the mass of the flask and its contents.

_____

_____ [2]

(e) Give two reasons why cotton wool was used to plug the flask instead of using a rubber bung.

1. _____

2. _____ [2]

(f) How could Mary ensure that her results were reliable?

_____ [1]

Examiner Only	
Marks	Remark

2 The table below gives information about the numbers of electrons in an atom of each of the elements A, B, C, D and E.

Element	No. of electrons in 1st shell	No. of electrons in 2nd shell	No. of electrons in 3rd shell
A	2	1	
B	2	4	
C	2	8	
D	2	8	1
E	2	6	

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

(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 is a Noble gas?

_____ [1]

(c) Which two elements A, B, C, D or E are in the same Group of the Periodic Table?

_____ and _____ [1]

(d) Give the name of element D.

_____ [1]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

3 **(a)** There are different theories on the age of the Earth.
One of these is based on radiometric dating.
Another theory was written by a local man from Armagh who based his theory on information in the Book of Genesis.

(i) Name the person who is known to have based his theory on the information in the Book of Genesis.

_____ [1]

(ii) What information in the Book of Genesis did he use to calculate the age of the Earth?

_____

_____ [1]

(iii) What is the age of the Earth calculated by this theory?

_____ [1]

(b) Scientists use the method of radiometric dating to find the age of the Earth. Describe the method of radiometric dating.

_____

_____

_____

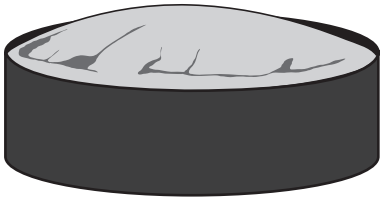
_____

_____ [3]

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Examiner Only	
Marks	Remark

4 Baking soda is used to make cakes rise.





(a) What is the chemical name for baking soda?

_____ [1]

(b) Baking soda undergoes a chemical reaction when it is put into an oven at 200ºC.
What name is given to this type of chemical reaction?

_____ [2]

(c) Explain fully what causes the cake to rise.

_____

_____ [2]

(d) Complete and balance the **symbol** equation below for this reaction.

_____ ⟶ Na_2CO_3 + _____ + _____ [3]

5 The table below gives information about four solutions into which strips of metal were placed.
After several hours the following observations were made.

Test tube	Metal	Solution	Observation
1	zinc	copper sulphate	Solution turned colourless, reddish brown deposit appeared
2	zinc	lead nitrate	Solution remained colourless, grey solid appeared
3	copper	lead nitrate	Solution remained colourless, copper strip remained shiny No deposit
4	copper	silver nitrate	Solution turned blue, shiny deposit appeared

Use this information and your knowledge to answer the following questions.

(a) In which test tubes (1, 2, 3 or 4) did a displacement reaction occur?

_____ [1]

(b) Why did the solution lose its colour in test tube 1?

_____ [1]

(c) Explain fully the results for test tube 3.

_____

_____ [2]

(d) Which of the metals involved is the most reactive?
Circle the correct answer.

lead **copper** **zinc** **silver** [1]

(e) Complete the symbol equation:

$CuSO_4 + Zn \longrightarrow$ _____ + _____ [2]

Examiner Only
Marks | Remark

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(f) Describe and explain how the observations would change if sodium nitrate solution was used instead of lead nitrate in test tubes 2 and 3.

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

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6 The Periodic Table has been developed through the years by many scientists. Describe the role of each of the following in the development of the Periodic Table.

Examiner Only	
Marks	Remark

John Newlands

_____

_____

_____ [2]

Dimitri Mendeleev

_____

_____

_____ [2]

Modern Scientists

_____

_____

_____ [2]

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GCSE

Science: Single Award (Modular)

End of Module Tests

May 2010

Mark Schemes

Issued: October 2010

Rewarding Learning

General Certificate of Secondary Education
2009–2010

Science: Single Award (Modular)

Chemical Patterns and our Environment
Module 3

Higher Tier

[GSC32]

THURSDAY 20 MAY 2010, MORNING

MARK SCHEME

STEMUP.CO.UK

			AVAILABLE MARKS
1	**(a)** All 6 points correct [2] 5/4 points correct [1] < 4 points [0] line of best fit [1]	[3]	
	(b) decreases [1] then levels off [1]	[2]	
	(c) hydrochloric acid	[1]	
	(d) gas given off/escapes	[2]	
	(e) CO_2 produced to stop acid spray escaping, soak up liquid to let gas escape/prevent explosion, idea of free movement of gas	[1] [1]	
	(f) repeat the experiment/take more readings	[1]	11
2	**(a)** B accept carbon	[1]	
	(b) C accept neon	[1]	
	(c) A, D	[1]	
	(d) Sodium	[1]	4
3	**(a)** **(i)** Archbishop Ussher	[1]	
	(ii) He counted up the different generations	[1]	
	(iii) 6 000 years	[1]	
	(b) Used to find age of rocks [1] uses radioactivity [1] radio isotopes U238, K40 idea of daughter elements Pb 206 } [1]	[3]	6

				AVAILABLE MARKS
4	**(a)**	Sodium hydrogen carbonate	[1]	
	(b)	thermal [1] decomposition [1]	[2]	
	(c)	CO_2 given off/bubbles rising and trapping in cake	[2]	
	(d)	$2NaHCO_3 \longrightarrow Na_2CO_3 + H_2O + CO_2$ [1] [1] + [1] for balancing	[3]	8
5	**(a)**	1, 2 and 4 must have all three	[1]	
	(b)	copper was displaced from solution	[1]	
	(c)	copper is less reactive than lead [1] no reaction [1]	[2]	
	(d)	zinc	[1]	
	(e)	$ZnSO_4 + Cu$	[2]	
	(f)	zinc is less reactive than sodium [1] test tube 2 would have no change [1] test tube 3 would remain unchanged [1]	[3]	10
6	**(a)**	**(i)** ordered in a table	[1]	
		(ii) Law of octaves	[1]	
	(b)	left gaps	[1]	
		ordered in atomic	[1]	
	(c)	atomic number	[1]	
		more elements	[1]	6
			Total	**45**

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2009–2010

Science: Single Award (Modular)

Chemical Patterns and our Environment
Module 3

Higher Tier

[GSC32]

GSC32

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 seven** questions.

INFORMATION FOR CANDIDATES

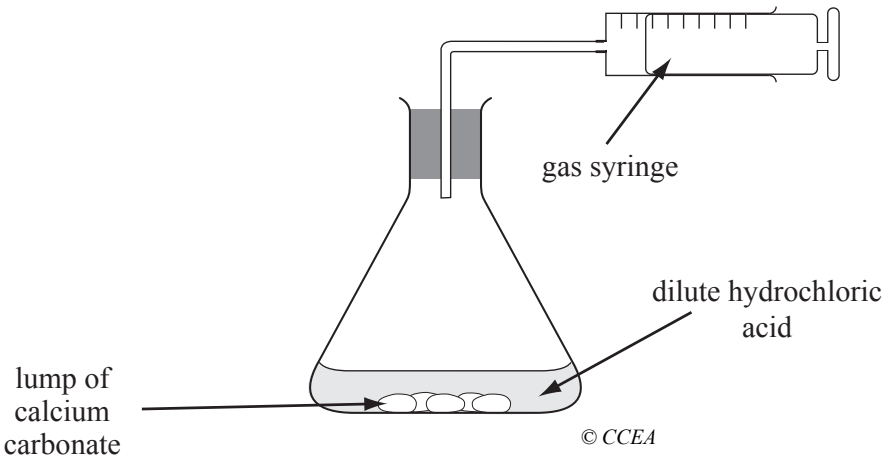
The total mark for this paper is 45.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet is provided for use with this paper.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
Total Marks	

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Examiner Only	
Marks	Remark

1 The diagram shows the apparatus used to investigate the reaction between a piece of calcium carbonate and dilute hydrochloric acid.



John recorded the total volume of carbon dioxide collected at intervals over 15 minutes.

At the end of the reaction there was some calcium carbonate left in the flask.

John obtained the following results:

Time/minutes	0	1	2	3	5	7	9	11	13	15
Carbon dioxide/cm^3 collected	0	20	38	46	62	72	78	82	82	82

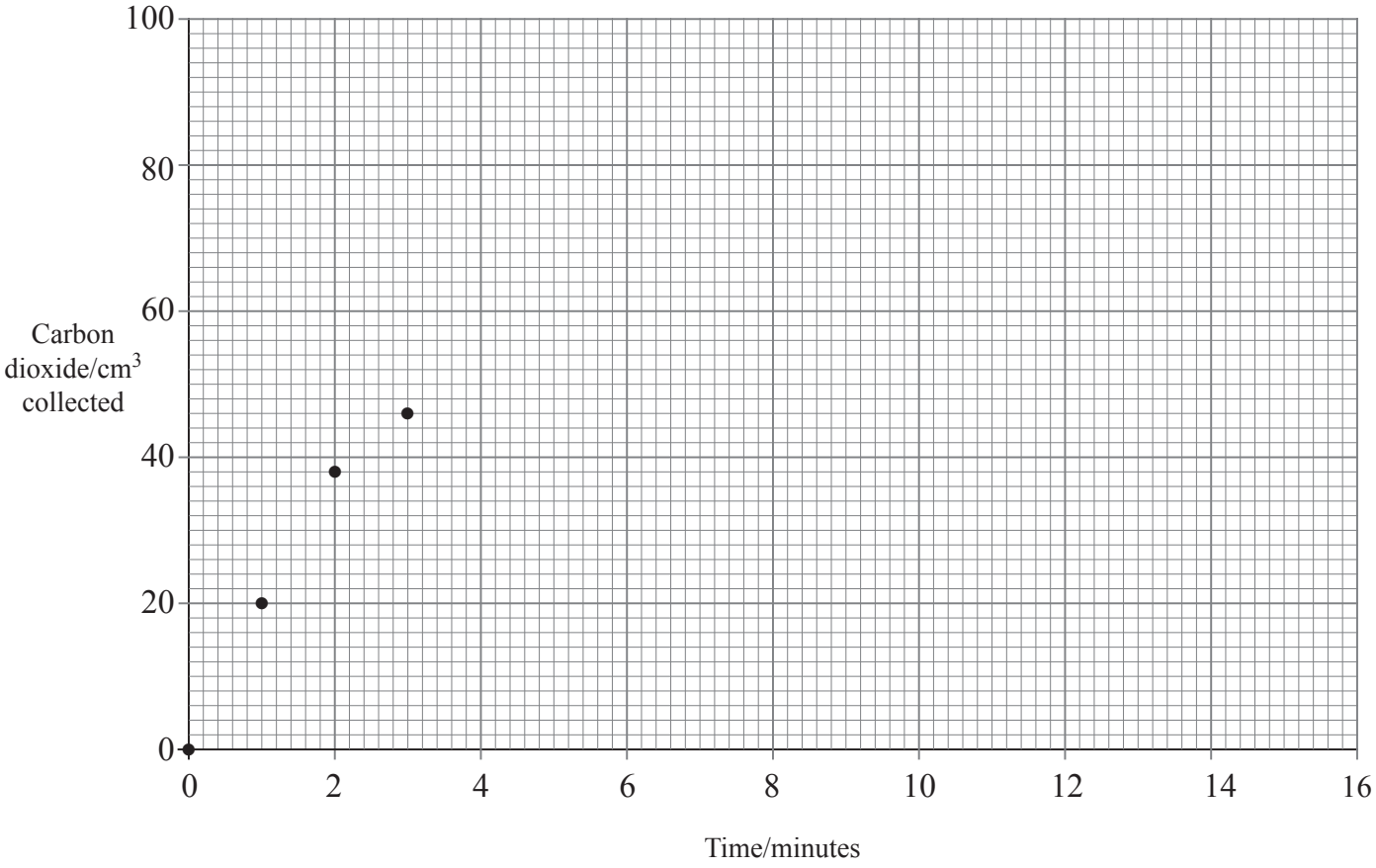
(a) Complete the graph on the page opposite by plotting the remaining points and join these points to form a smooth curve. [3]

(b) Describe and explain the shape of the graph over the first two minutes.

_____

_____ [2]

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Examiner Only

Marks	Remark

(c) **(i)** At what time did the reaction finish?

_____ [1]

(ii) How do you know that calcium carbonate was in excess?

_____ [1]

(d) Which one of the following would give a more accurate result? Tick the correct box.

Use a digital clock ☐

Use more acid ☐

Measure the volume of gas every 30 seconds ☐ [1]

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(e) To improve the reliability of the results John should do which of the following?
Tick the correct box.

Do the experiment for a longer period ☐

Use stronger acid ☐

Repeat the experiment at least once ☐ [1]

(f) Complete the word equation for this reaction.

calcium carbonate + hydrochloric acid → ☐ + ☐ + carbon dioxide

[2]

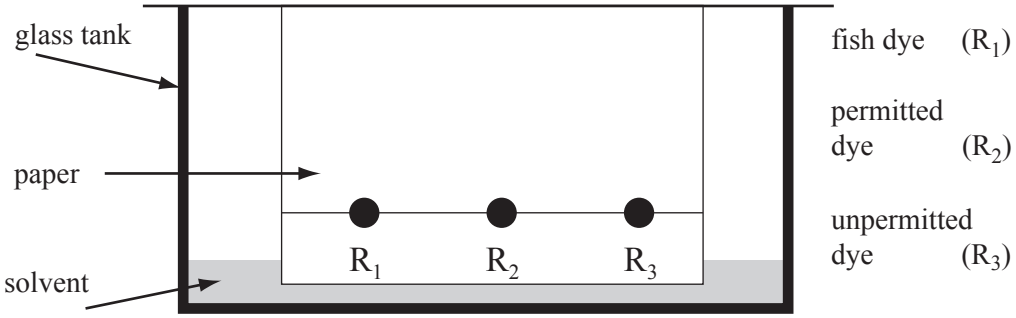
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

2 Farmed salmon have a red dye added to their food to improve their appearance. Paul was asked to investigate this dye to make sure it was permitted. He was given two other red dyes for comparison and the apparatus below.



(a) What name is given to this type of separation?

_____ [1]

(b) Describe the steps Paul would take to carry out this separation.

_____

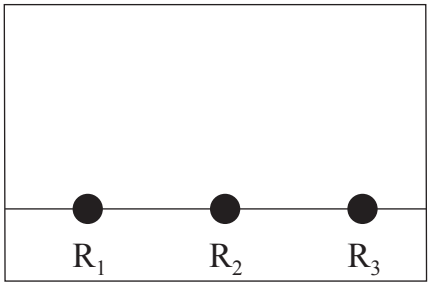
_____

_____

_____

_____ [4]

(c) Paul found that the fish dye (R_1) was the same as the unpermitted dye (R_3). R_2 was found to be the least soluble dye and each dye was found to be a single colour. Complete the diagram below to show the relative positions of all three dyes after the experiment.



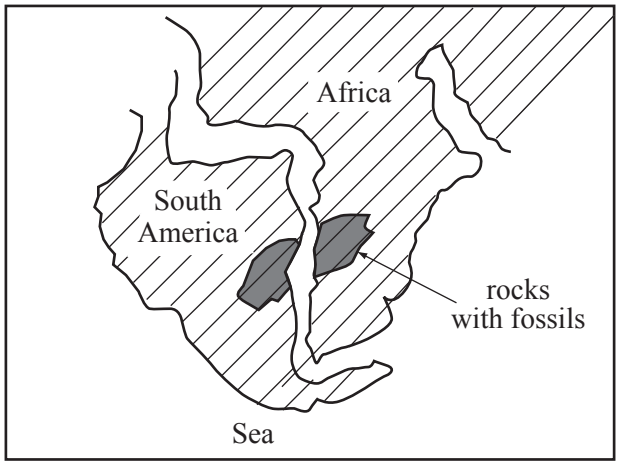
[1]

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Examiner Only	
Marks	Remark

3 Ideas on the formation of the continents have been debated since 1597 but a full explanation wasn't developed until 1915 when Alfred Wegener put forward his theory. However, it wasn't until 1960 that scientists accepted his theory as being correct.

Map showing the relative positions of South America and Africa millions of years ago.



(a) Describe Wegener's theory including one piece of evidence that he gave to support it.

_____

_____

_____

_____

_____ [3]

(b) Some other scientists rejected Wegener's theory. Give **one** reason why it was rejected.

_____ [1]

Examiner Only	
Marks	Remark

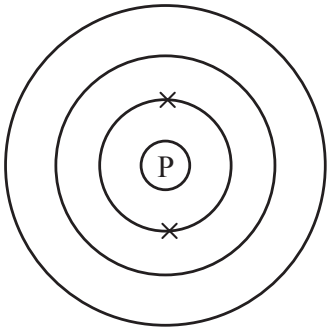
4 Phosphorus is a chemical element with an atomic number of 15 and a mass number of 31.

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

_____

_____ [1]

(b) Complete the diagram to show how all the electrons are arranged in an atom of phosphorus.



[1]

(c) Explain fully the meaning of the term **compound**.

_____

_____ [2]

(d) Complete the sentences below about the Periodic Table.

Phosphorus is in Group _____ of the Periodic Table.

It reacts with chlorine which is in Period _____ of the

Periodic Table to form a compound called _____ .

[3]

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5 Sherbet is a mixture of citric acid, sugar and baking soda. When it is eaten it causes a fizzing sensation.

Examiner Only	
Marks	Remark



(a) (i) Name the gas which causes the fizzing sensation.

_____ [1]

(ii) Complete the word equation.

sodium hydrogen carbonate	+		→	sodium citrate	+		+	

[3]

(b) Baking soda undergoes thermal decomposition when it is put into the oven.

Explain fully what thermal decomposition means and suggest one advantage of this process when baking cakes.

_____

_____

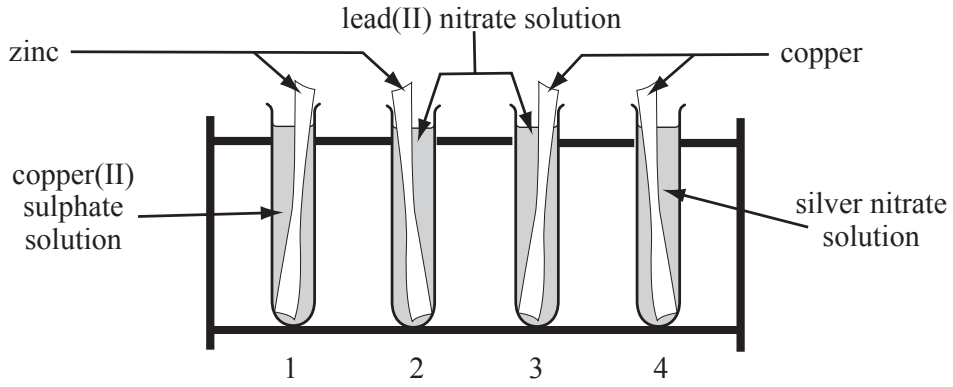
_____

_____ [3]

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Examiner Only	
Marks	Remark

6 The diagram below shows four solutions into which strips of metal were placed.



After several hours the following results were obtained.

Test tube 1: solution lost its blue colour and a reddish brown deposit was seen on the metal strip.

Test tube 2: solution remained colourless and a greyish white deposit was seen on the metal strip.

Test tube 3: solution remained colourless and the metal strip remained shiny with no deposit.

Test tube 4: solution turned blue and a deposit was seen on the metal strip.

Use this information and your knowledge to answer the following questions.

(a) In which test tube (1, 2, 3 or 4) was there no chemical reaction?

_____ [1]

(b) Name the blue solution produced in test tube 4.

_____ [1]

(c) Name the greyish white deposit that was seen in test tube 2.

_____ [1]

(d) Which of the metals is the most reactive? Circle the correct answer.

copper **lead** **zinc** **silver** [1]

(e) Complete the symbol equation for the reaction in test tube 1.

$Zn + CuSO_4 \rightarrow$ _____ + _____ [2]

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Examiner Only	
Marks	Remark

7 Use your knowledge and the Data Leaflet to answer the following questions.

(a) What name is given to the compound which has the chemical formula Na_2SO_4?

_____ [1]

(b) How many different elements are present in the substance which has the chemical formula NH_4NO_3?

_____ [1]

(c) How many atoms are present in $Al_2(SO_4)_3$?

_____ [1]

(d) What is the chemical formula for calcium hydrogen carbonate?

_____ [1]

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110806

GCSE

Science: Single Award (Modular)

March 2010

Mark Schemes

Issued: May 2010

Rewarding Learning

General Certificate of Secondary Education
2009–2010

Science: Single Award (Modular)

Chemical Patterns & Environment
Module 3

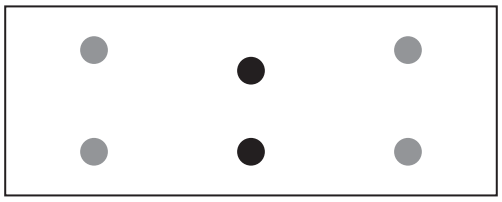
Higher Tier

[GSC32]

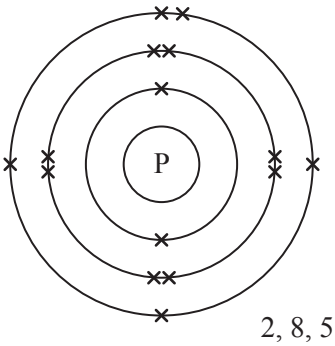
WEDNESDAY 24 FEBRUARY 2010, MORNING

MARK SCHEME

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			AVAILABLE MARKS
1	**(a)** All 6 points correct [2] 4, 5 correct [1] <4 [0] Joining points correctly [1]	[2]	
	(b) Increases/goes up/CO_2 given off goes up [1] Idea of speed/faster/quicker/vigorous reaction [1]	[2]	
	(c) **(i)** 10/11 minutes [1]		
	(ii) Some calcium carbonate left [1]	[2]	
	(d) Measure volume every 30 s.	[1]	
	(e) Repeat information	[1]	
	(f) Calcium + Water Chloride [1] [1]	[2]	11
2	**(a)** Chromatography	[1]	
	(b) Draw base pencil line on paper/put small spot of dye on line/ label in pencil/place paper in tank/allow to travel up paper/ remove and measure distance travelled by each dye. *(any 4)*	[4]	
	(c)  R_3 should be level with R_1 and R_2 slightly lower	[1]	6
3	**(a)** Wegener's theory was that the continents were once all joined together [1] and they drifted apart [1]. They fitted together like a jigsaw [1] Fossil records from America & Africa matched [1]/rock types [1] *(any 3)*	[3]	
	(b) Other scientists did not believe they could drift/one large mass/ fixed positions	[1]	4

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				AVAILABLE MARKS
4	**(a)**	Number of protons + neutrons in an atom	[1]	
	(b)	 2, 8, 5	[1]	
	(c)	Two or more different elements [1] joined together [1]	[2]	
	(d)	Phosphorus is in group 5	[1]	
		Chlorine is in period 3	[1]	
		Phosphorus Chloride	[1]	7
5	**(a)**	**(i)** Carbon dioxide	[1]	
		Citric acid $\longrightarrow$ water + carbon dioxide	[3]	
	(b)	Using heat [1] to break down [1]		
		Bubbles of gas released by reaction cause cake to rise or CO_2 produced causes cake to rise [1]	[3]	7
6	**(a)**	Test tube 3	[1]	
	(b)	Copper nitrate	[1]	
	(c)	Lead	[1]	
	(d)	Zinc	[1]	
	(e)	$ZnSO_4 + Cu$	[2]	6
7	**(a)**	Sodium sulphate	[1]	
	(b)	3	[1]	
	(c)	17	[1]	
	(d)	$Ca(HCO_3)_2$	[1]	4
			Total	45

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