CCEA GCSE SCIENCE: SINGLE AWARD

SCIENCE



EXAM QUESTION PACK

UNIT 2 (CHEMISTRY) HIGHER TIER GSS22 PAPERS

STEMUP

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2016–2017

Science: Single Award

Unit 2 (Chemistry)
Higher Tier

GSS22

[GSS22]

THURSDAY 10 NOVEMBER 2016, MORNING

TIME

1 hour 15 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 ten** questions.

INFORMATION FOR CANDIDATES

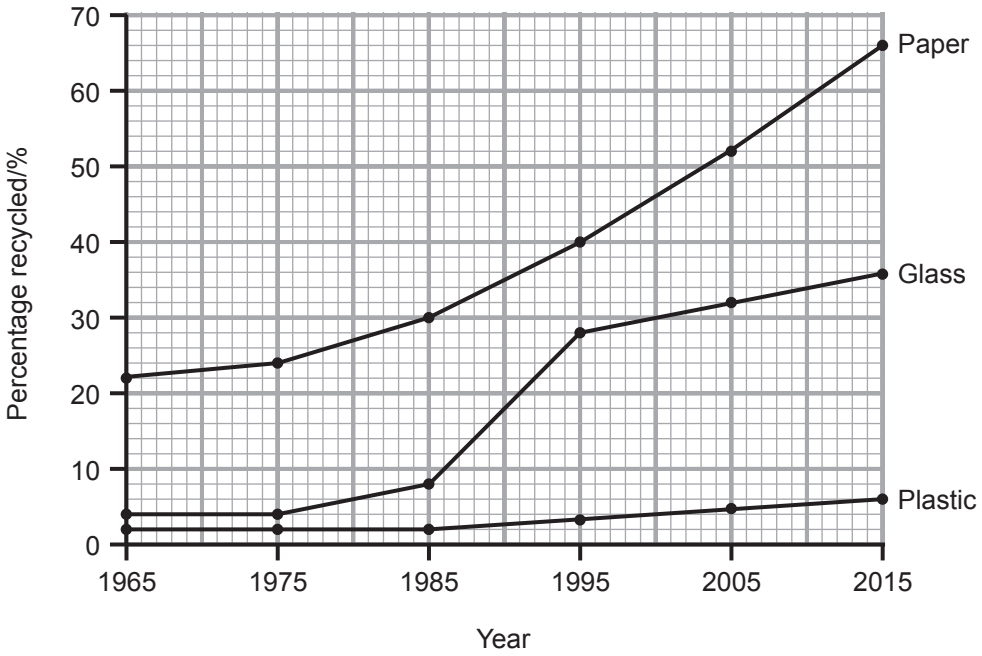
The total mark for this paper is 75.
Quality of written communication will be assessed in Questions **2** and **9**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet, which includes a Periodic Table of the Elements, is included for your use.

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

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Examiner Only	
Marks	Remark

1 **(a)** The graph below shows the percentage of plastic, glass and paper recycled in a country between the years 1965 to 2015.



Source: Principal Examiner

(i) Which material shows the biggest percentage increase between the years **1985** to **1995**?

_____ [1]

(ii) Calculate the percentage increase for paper recycling from **1965** to **2015**.

(Show your working out.)

_____ % [2]

(iii) Describe the steps in recycling glass after it has been delivered to a factory.

_____

_____

_____

_____

_____

_____ [3]

(b) Waste that does not get recycled often ends up in landfill sites.



© Ashley Cooper / Science Photo Library

Waste items found in landfill include: aluminium cans, food waste, glass bottles, newspapers and plastic bags. Many items will remain in landfill sites for hundreds of years. Some of the waste gives off polluting gases and can produce foul-smelling liquids that leak into water supplies. A recent survey suggests that many new landfill sites need to be found each year due to the large volume of waste being produced.

Use **only** the information provided to answer parts **(i)** and **(ii)** below.

(i) Apart from food waste, suggest **one** other material which is biodegradable.

_____ [1]

(ii) Suggest **two** disadvantages of living near a landfill site.

1. _____

2. _____ [2]

(c) Some materials are non-biodegradable. Explain fully the term 'non-biodegradable'.

_____

_____ [2]

(d) Suggest **one** way local authorities can encourage people to recycle more waste.

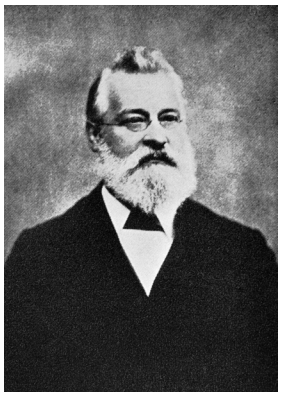
_____ [1]

Examiner Only	
Marks	Remark

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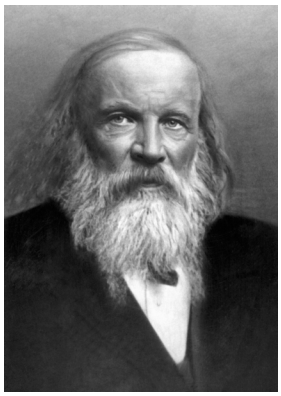
Examiner Only	
Marks	Remark

2 Early work on the Periodic Table began in the 19th century. In 1864 John Newlands placed the 62 known elements into his periodic table. This was further developed in 1869 by Dmitri Mendeleev.



John Newlands

© Science Photo Library



Dmitri Mendeleev

© Sputnik / Science Photo Library

Describe the work of these two scientists in the development of the Periodic Table.

Your answer should include:

- Newlands' ideas
- Mendeleev's improvements
- the name of the Group of unreactive elements not included in Mendeleev's table.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only	
Marks	Remark

3 **(a)** Some tap water contains dissolved metal ions which can make it hard.

(i) Give the name of **one** metal ion that causes tap water to be hard.

_____ [1]

(ii) Give **one** advantage and **one** disadvantage of hard water.

Advantage _____

_____

Disadvantage _____

_____ [2]

(b) The hardness of three samples of water **X**, **Y** and **Z** was measured using soap solution. New samples were boiled and the experiment repeated.
The results are shown below.

Sample of water	Volume of soap solution needed to form a permanent lather/cm^3	
	Before boiling	After boiling
X	2	2
Y	17	17
Z	13	2

State the type of water in samples **Y** and **Z**. Explain your answers.

(i) Sample **Y** _____

_____

_____ [2]

(ii) Sample **Z** _____

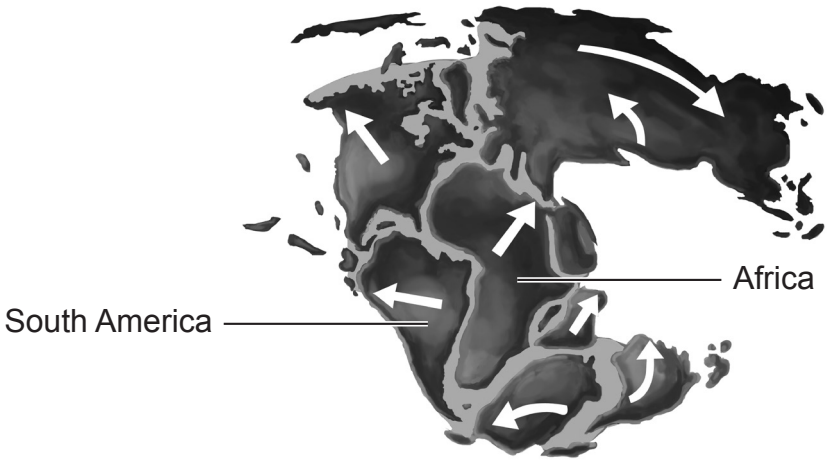
_____

_____ [2]

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Examiner Only	
Marks	Remark

4 In 1912 the German scientist Alfred Wegener suggested that the continents were once joined as one super-continent as shown in the diagram below. Wegener proposed that this super-continent then broke up and drifted apart. He called this the theory of continental drift.



© Spencer Sutton / Science Photo Library

(a) One piece of evidence to support his theory was that similar fossils were found in South America and Africa.

(i) What is a 'fossil'?

_____

_____

_____ [2]

(ii) Give two **other** pieces of evidence that suggested that continents were once closely joined.

1. _____

_____

2. _____

_____ [2]

(b) Give **one** reason why Wegener's theory of continental drift was rejected in 1912.

_____

_____ [1]

5 The table below gives information about the colours of three indicators in different chemicals.

Indicator / Chemical	Colour		
	red litmus	**Universal Indicator**	**beetroot juice**
citric acid	red	orange	red
water	red	green	purple
sodium hydroxide	blue	purple	yellow
hydrochloric acid	red	red	red
sodium hydrogencarbonate	blue	blue	green

(a) Use this information and your knowledge to answer the questions below.

(i) From the table name the strong acid.

_____ [1]

(ii) Which indicator would be most useful to give a full range of pH values? Explain your answer.

_____

_____

_____ [2]

(iii) Name the indicator which would **not** show that water is neutral. Explain your answer.

_____

_____

_____ [2]

(b) State the chemical formulae for hydrochloric acid and sodium hydrogencarbonate.

Hydrochloric acid _____

Sodium hydrogencarbonate _____ [2]

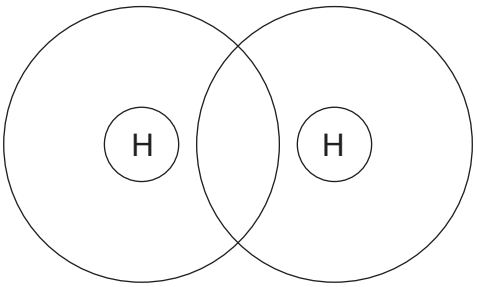
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

6 **(a)** Below is a diagram showing a molecule of hydrogen.



(i) On the diagram show how the electrons are arranged in this molecule. [1]

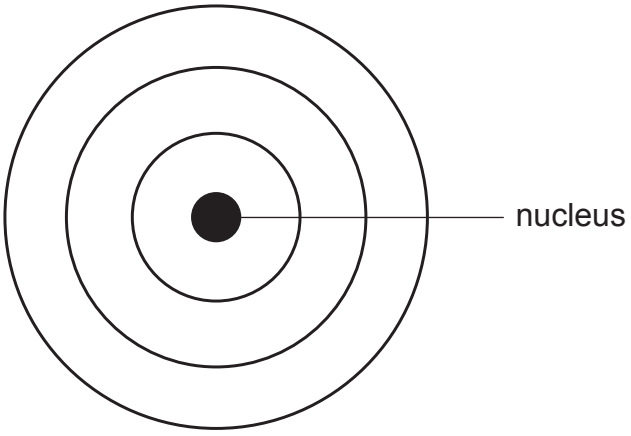
(ii) Name **one** other molecule that forms bonds in a similar way to hydrogen.

_____ [1]

(b) The table below shows information about five elements found in Period 3 of the Periodic Table.

Element	Sodium	Magnesium	Aluminium	Silicon	Phosphorus
Symbol	Na	Mg	Al	Si	P
Atomic number	11	12	13	14	15
Melting point/°C	98	639	660	1410	44
Metallic character	metal	metal	metal	semi-metal	non-metal

(i) Complete the diagram below to show how the electrons are arranged in phosphorus.



Source: Chief Examiner

[1]

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(ii) Describe how the metallic character changes across Period 3 of the Periodic Table.

_____

_____ [1]

(iii) Describe the trend in melting points for the **metal** elements shown in the table.

_____

_____ [1]

(c) Magnesium oxide is a compound. What is meant by the term 'compound'?

_____

_____

_____ [2]

(d) Shown below is the word equation for a reaction involving magnesium.

magnesium + copper sulfate → copper + magnesium sulfate

Name the **type** of reaction shown and explain why this reaction happens.

_____

_____

_____ [2]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

7 **(a)** Composite materials are widely used in the manufacture of aircraft.

(i) Explain fully the term 'composite material'.

_____

_____

_____ [2]

Below is information about the materials used to manufacture two aircraft **A** and **B**.

Aircraft **A**	Aircraft **B**
Steel – 14% Titanium – 15% Aluminium – 50% Composite – 12% Other – 9%	Steel – 9% Titanium – 14% Aluminium – 21% Composite – 50% Other – 6%
Cost to manufacture £462 million	Cost to manufacture £1646 million

(ii) Using the information above, suggest **one** reason why aircraft **B** is much more expensive to manufacture than aircraft **A**.

_____

_____ [1]

(b) Give **one** example of:

(i) a naturally occurring composite.

_____ [1]

(ii) a man-made composite.

_____ [1]

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(Questions continue overleaf)

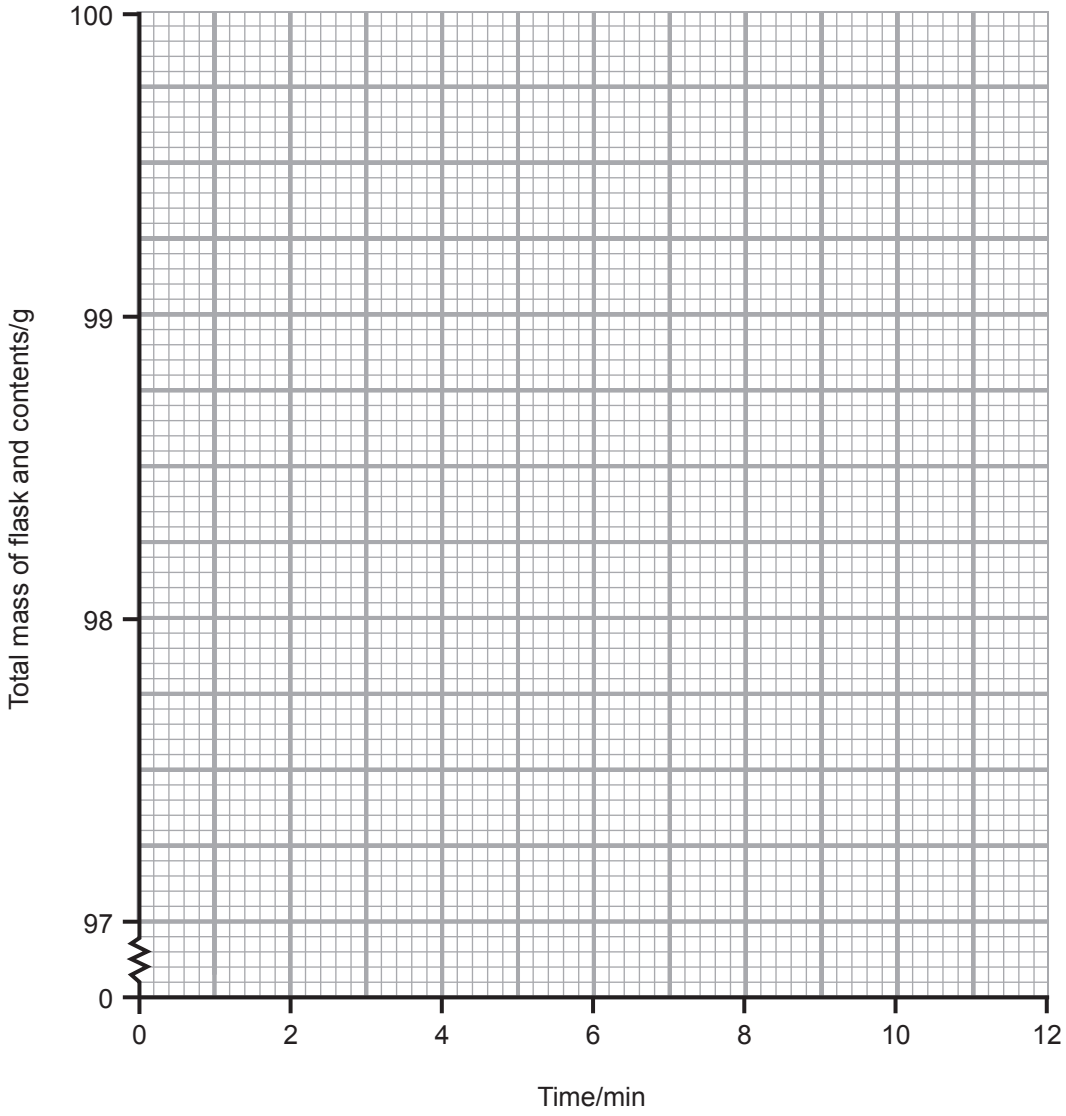
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Examiner Only	
Marks	Remark

8 **(a)** A student investigated the reaction between magnesium carbonate and excess hydrochloric acid. She carried out the reaction in a flask placed on a balance and measured the mass every two minutes. Her results are shown below.

Time/min	0	2	4	6	8	10	12
Total mass of flask and contents/g	100	99.1	98.5	98.0	97.7	97.5	97.5

(i) On the grid below plot and draw a line graph of these results.



[3]

(ii) Describe the trend shown by these results.

_____

_____ [1]

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(iii) Why does the mass change in this reaction?

_____

_____ [1]

Examiner Only	
Marks	Remark

(b) At what time had all the magnesium carbonate reacted?

_____ min [1]

(c) Complete the word equation for this reaction.

magnesium carbonate + hydrochloric acid → [ ] + [ ] + [ ]

[2]

(d) The student repeated the experiment using ethanoic acid which is weaker than hydrochloric acid.

Describe **one** similarity and **one** difference that would be observed during the reactions of each of these acids with magnesium carbonate.

Similarity _____

_____

Difference _____

_____ [2]

9 In the 17th Century Archbishop Ussher used the Bible to suggest the age of the Earth. A more recent scientific method involving the dating of rocks has suggested a different age.

Describe how each method is used to calculate the age of the Earth. Include in your answer the age estimated by each method.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

10 (a) The following compounds are hydrocarbons.

butane **methane** **ethene** **propane** **ethane**

(i) Which of these compounds is **not** an alkane?

_____ [1]

(ii) Butane has the chemical formula C_4H_{10}.

In the space below draw the **structural** formula for butane.

[1]

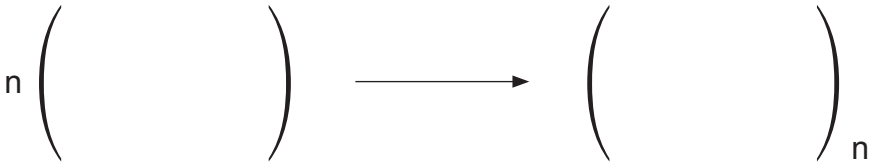
(iii) Give the chemical formula for methane.

_____ [1]

(iv) Write a balanced symbol equation for the combustion of propane **(C_3H_8)**.

_____ [3]

(b) Polythene is a plastic that is made by a process involving ethene molecules. Complete the symbol equation to show how polythene is made from ethene.



[2]

THIS IS THE END OF THE QUESTION PAPER

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SYMBOLS OF SELECTED IONS

Positive ions

Name	Symbol
Ammonium	NH_4^+
Chromium(III)	Cr^{3+}
Copper(II)	Cu^{2+}
Iron(II)	Fe^{2+}
Iron(III)	Fe^{3+}
Lead(II)	Pb^{2+}
Silver	Ag^+
Zinc	Zn^{2+}

Negative ions

Name	Symbol
Carbonate	CO_3^{2-}
Dichromate	$Cr_2O_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogen carbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	$HCOO^-$
Nitrate	NO_3^-
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

SOLUBILITY IN COLD WATER OF COMMON SALTS, HYDROXIDES AND OXIDES

Soluble
All sodium, potassium and ammonium salts
All nitrates
Most chlorides, bromides and iodides EXCEPT silver and lead chlorides, bromides and iodides
Most sulfates EXCEPT lead and barium sulfates Calcium sulfate is slightly soluble

Insoluble
Most carbonates EXCEPT sodium, potassium and ammonium carbonates
Most hydroxides EXCEPT sodium, potassium and ammonium hydroxides
Most oxides EXCEPT sodium, potassium and calcium oxides which react with water

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DATA LEAFLET

For the use of candidates taking
Science: Chemistry,
Science: Double Award
or Science: Single Award

Copies must be free from notes or additions of any kind. No other type of data booklet or information sheet is authorised for use in the examinations.

Contents **Page**

Periodic Table of the Elements 2–3
Symbols of Selected Ions 4
Solubility of Common Salts 4

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THE PERIODIC TABLE OF ELEMENTS

Group

1	2											3	4	5	6	7	0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La* Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
223 Fr Francium 87	226 Ra Radium 88	227 Ac† Actinium 89	261 Rf Rutherfordium 104	262 Db Dubnium 105	263 Sg Seaborgium 106	262 Bh Bohrium 107	265 Hs Hassium 108	266 Mt Meitnerium 109	269 Ds Darmstadtium 110	272 Rg Roentgenium 111	285 Cn Copernicium 112						

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	147 Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	231 Pa Protactinium 91	238 U Uranium 92	237 Np Neptunium 93	242 Pu Plutonium 94	243 Am Americium 95	247 Cm Curium 96	245 Bk Berkelium 97	251 Cf Californium 98	254 Es Einsteinium 99	253 Fm Fermium 100	256 Md Mendelevium 101	254 No Nobelium 102	257 Lr Lawrencium 103

* 58 – 71 Lanthanum series
† 90 – 103 Actinium series

a
b x

a = relative atomic mass (approx)
x = atomic symbol
b = atomic number

Rewarding Learning

General Certificate of Secondary Education
2016–2017

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

THURSDAY 10 NOVEMBER 2016, MORNING

MARK SCHEME

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General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

1 **(a)** **(i)** Glass [1]

(ii) 66 – 22 [1]
44% [1] [2]

(iii) Reprocessing of cullet/broken into pieces/crushed [1]
use furnace/melt [1]
remould/reshape/reformed [1] [3]

(b) **(i)** Newspaper [1]

(ii) Any **two** from:
- (waste) giving off polluting gases
- foul smelling liquid
- liquid can leak into water supplies
- eyesore [2]

(c) Cannot be broken down [1] by microbes [1] [2]

(d) Provide **special** bins/advertising in newspapers, magazines and on television/education in schools/fines or rewards or other suitable [1]

AVAILABLE MARKS

12

2 **Indicative Content:**
- Newlands developed the law of octaves
- Each eighth element was similar
- Newlands put two elements in one box
- Newlands/Mendeleev ordered the elements according to mass number/ atomic mass
- Mendeleev ordered the elements into groups and periods
- Mendeleev separated metals and non metals
- Mendeleev left gaps for undiscovered elements
- Mendeleev predicted properties of elements yet to be discovered/ Mendeleev more elements
- Noble gases not discovered in 1869

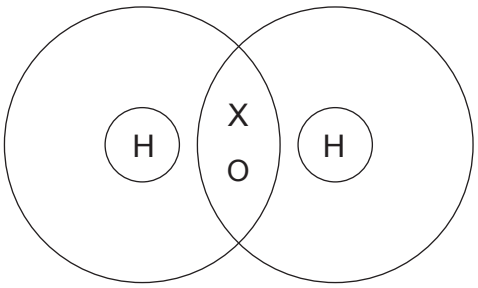
Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe the work of Newlands and Mendeleev using **5–8** of the points above, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe **3 or 4** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe the work of Newlands and Mendeleev using **1 or 2** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Not worthy of credit.	[0]

[6]

6

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				AVAILABLE MARKS
3	**(a)**	**(i)**	Calcium/magnesium [1]	
		(ii)	Advantages: better taste/stronger teeth or bones/reduces risk of heart disease [1] Disadvantages: causes 'fur' on kettles/limescale in pipes/stains clothing/ block pipes/cost qualified (e.g. replace kettles/more energy) [1] [2]	
	(b)	**(i)**	Water Y is permanent hard water [1] there was still **a lot** of soap solution needed to form a lather after boiling [1] [2]	
		(ii)	Water Z is temporary hard water [1] the **volume of soap** required to form a lather decreased after boiling [1] [2]	7
4	**(a)**	**(i)**	Remains of plants/animals [1] **preserved** in rock [1] [2]	
		(ii)	Any **two** from: • shape of continents fit together • similar species of animals still living in continents • similar rock types in continents once joined [2]	
	(b)		Scientists believed that continents could not drift/no evidence at that time/fixed position [1]	5
5	**(a)**	**(i)**	Hydrochloric acid [1]	
		(ii)	Universal indicator [1] provides a full range of colours/5 different individual colours [1] [2]	
		(iii)	(Red) litmus paper [1] it is the same colour in acid and water [1] [2]	
	(b)		HCl [1] $NaHCO_3$ [1] [2]	7

					AVAILABLE MARKS
6	(a)	(i)	 [1]		
		(ii)	Water/H_2O or other correct	[1]	
	(b)	(i)	2:8:5	[1]	
		(ii)	Metallic character decreases (from left to right)	[1]	
		(iii)	Melting point increases from sodium to aluminium/as atomic number increases/as you move from left to right	[1]	
	(c)		Two (or more) elements [1] (**chemically** combined/joined) [1]/bonded [1]	[2]	
	(d)		Displacement [1] magnesium is more reactive than copper/magnesium is higher in the reactivity series [1]	[2]	9
7	(a)	(i)	Two (or more) materials combined/joined [1] to make a new material for a particular purpose/with specific properties [1]	[2]	
		(ii)	Aircraft B contains **more** composite material/comparison	[1]	
	(b)	(i)	Bone/teeth or other suitable	[1]	
		(ii)	Glass fibre/reinforced glass/reinforced concrete/ glass reinforced plastic or other suitable	[1]	5
8	(a)	(i)	Seven points plotted correctly award [2] six points plotted correctly award [1] smooth curve through the points [1]	[3]	
		(ii)	As the **time** increases, total **mass** decreases	[1]	
		(iii)	Carbon dioxide/gas is escaping	[1]	
	(b)		10	[1]	
	(c)		Magnesium chloride [1] carbon dioxide and water [1] (any order)	[2]	
	(d)		Bubbles observed/loss in mass/magnesium carbonate disappears [1] slower/less vigorous reaction than with hydrochloric acid [1]	[2]	10

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AVAILABLE MARKS

9 Indicative Content:

Archbishop Ussher
- Book of Genesis
- involved counting generations of ancestors
- put the age of the Earth at 6000 years old

Scientific theory
- uses radiometric dating
- radioactive isotopes/uranium or potassium (found in rocks)
- have a half-life
- proportion of daughter nuclei/isotopes left allow age to be worked out
- Earth 4500 million/4.5 billion years old

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout using **six to eight** of the points above, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms using **three to five** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates use **one or two** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Not worthy of credit.	[0]

[6] 6

10 (a) (i) Ethene [1]

(ii) Correct structure for butane [1]

(iii) CH_4 [1]

(iv) $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$
LHS [1] RHS [1] Correct balancing if both sides are correct [1] [3]

(b) Correct ethene monomer on LHS [1] correct single bond structure on RHS [1] [2] 8

Total **75**

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015–2016

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

GSS22

THURSDAY 19 MAY 2016, MORNING

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in blue or black ink only. **Do not write with a gel pen.**
Answer **all ten** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Quality of written communication will be assessed in Questions **1** and **9**.
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 included in this question paper.

10660

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1 Describe why and how earthquakes occur.

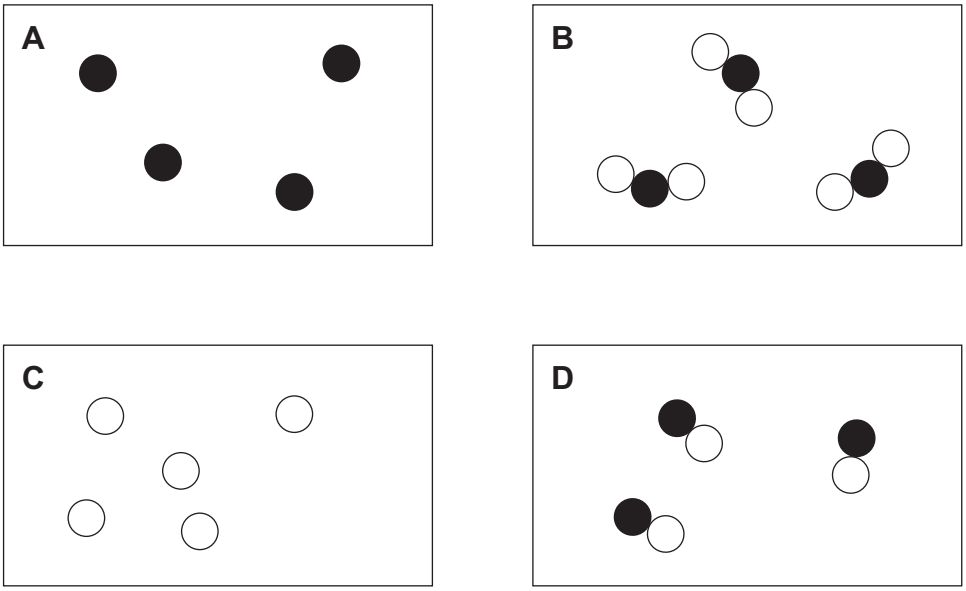
Your answer should include:

- an explanation of the process;
- the name of the scale used to measure earthquakes and what the readings tell us about earthquakes.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

2 Below are some particle diagrams. They represent elements or compounds.



(a) Which of the diagram(s) (**A**, **B**, **C** or **D**) show elements? Explain your answer.

Diagram(s) _____

_____

_____ [2]

(b) Suggest which diagram (**A**, **B**, **C** or **D**) could represent the compound carbon monoxide (CO).

_____ [1]

[Turn over

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3 **(a)** The table below gives information about five hydrocarbon molecules.

Molecule	Number of carbon atoms	Melting point/°C	Boiling point/°C	Energy released per gram when burned/kJ
methane	1	– 182	– 162	56
ethane	2	– 183	– 89	52
propane	3	– 188	– 42	51
butane	4	– 138	0	50
pentane	5	– 130	36	49

(i) Calculate the energy released when 100 grams of propane is burned.

_____ kJ [1]

(ii) Calculate the difference between the melting points of the molecules with the most and least carbon atoms.

_____ °C [1]

(iii) Describe the trend between the number of carbon atoms and a molecule's boiling point.

_____

_____ [1]

(b) Complete the word equation below for the burning of propane.

propane + [ ] → carbon dioxide + water [1]

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DO NOT WRITE ON THIS PAGE

(Questions continue overleaf)

[Turn over

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4 The table below gives information about three different indicators and their colours at different pH values.

Indicator \ pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
methyl purple	P	P	P	P	G	G	G	G	G	G	G	G	G	G
thymol blue	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B	B
indigo carmine	B	B	B	B	B	B	B	B	B	B	B	Y	Y	Y

Key: B = blue G = green P = purple Y = yellow

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

(a) What colour is:

1. methyl purple indicator in a strong acid? _____

2. indigo carmine indicator in sodium hydroxide? _____ [2]

(b) A scientist is going to add an acid to an alkali. He needs to stop adding the acid when the pH value is 7.

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

_____ [1]

(ii) Explain fully why the scientist would **not** find any of the indicators in the table useful for his experiment.

_____

_____

_____ [2]

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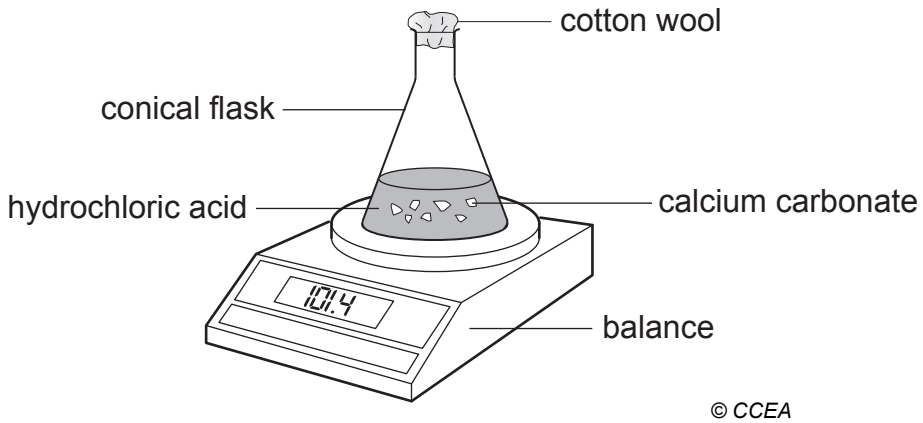
(c) Most indicators are made from plants. Describe how you would obtain an indicator from red cabbage.

[3]

[Turn over

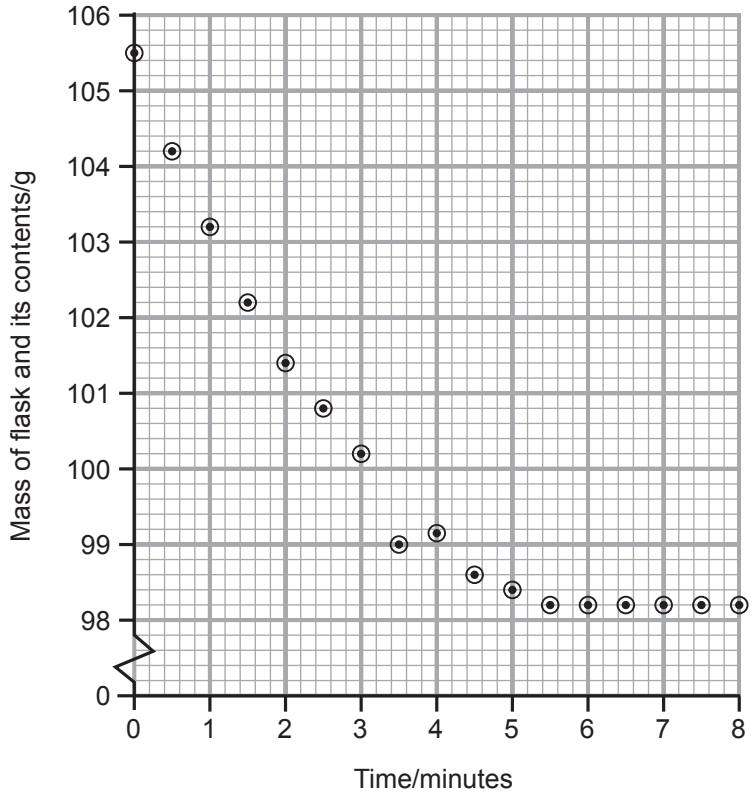
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5 A student investigated the amount of carbon dioxide released during the reaction between hydrochloric acid and calcium carbonate. He used the apparatus shown below.



© CCEA

The student measured the mass of the flask and its contents for 8 minutes. The results are shown in the graph below.



(a) Complete the graph opposite by adding a curve of best fit ignoring any anomalous results. [1]

(b) Describe fully the trend shown in the graph.

_____

_____

_____ [2]

(c) Complete the word equation for this reaction.

hydrochloric acid + calcium carbonate → [ ] + [ ] + carbon dioxide

[2]

(d) **(i)** Name the chemical used to test for carbon dioxide.

_____ [1]

(ii) Describe the colour change during this test for carbon dioxide.

_____

_____ [2]

[Turn over

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6 **(a)** Aluminium is extracted from its ore by the process of electrolysis.

(i) Define the term electrolysis.

_____

_____ [2]

(ii) Complete the following sentences about the extraction of aluminium.

The chemical name for the ore of aluminium is aluminium _____.

During electrolysis the aluminium ions move to the negative electrode which is called the _____. Here they gain three _____ to become aluminium atoms. [3]

(b) Another compound of aluminium is aluminium hydroxide; its formula is $Al(OH)_3$.

(i) Name the **three** elements present in aluminium hydroxide.

_____ _____ _____ [1]

(ii) How many atoms in total are represented by the formula $Al(OH)_3$?

_____ [1]

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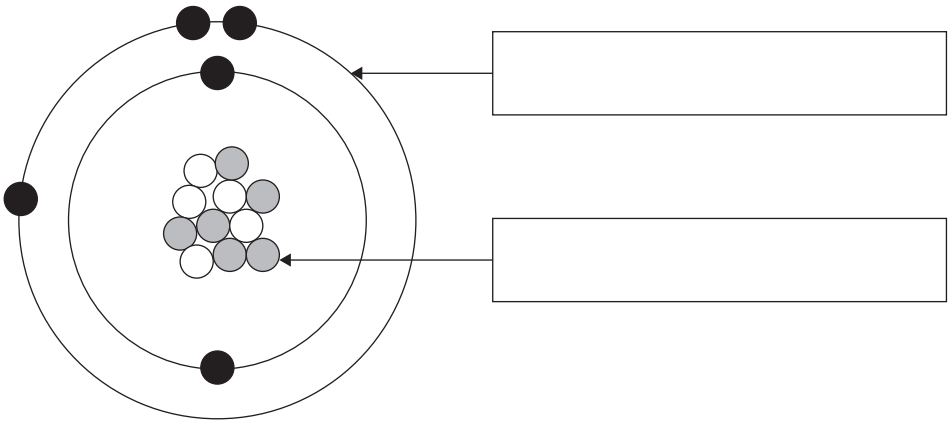
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(Questions continue overleaf)

[Turn over

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7 **(a)** Label the diagram of the atom shown below.



[2]

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

_____ [1]

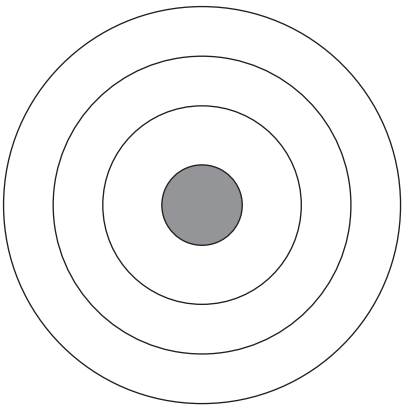
(c) Complete the table below about the particles in an atom.

Particle	Relative charge	Relative mass
proton		
electron		
neutron		

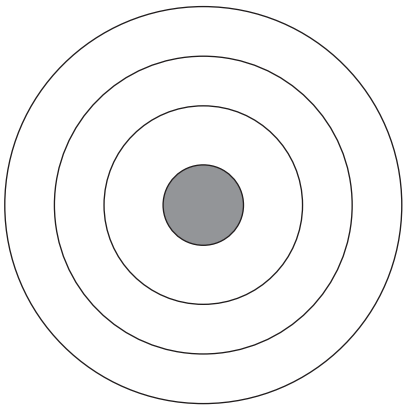
[3]

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(d) (i) Complete the diagrams below to show the electronic structures of sodium and chlorine. You may find your Data Leaflet helpful.



sodium



chlorine

[2]

(ii) Give **one** similarity and **one** difference between the electronic structures of sodium and chlorine.

Similarity _____

_____

Difference _____

_____ [2]

(iii) Describe, in terms of electrons, how sodium and chlorine form the compound sodium chloride.

_____

_____

_____ [3]

(iv) Write the balanced symbol equation for the reaction between sodium and chlorine.

_____ [3]

[Turn over

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8 **(a)** What is meant by the term hard water?

_____

_____ [1]

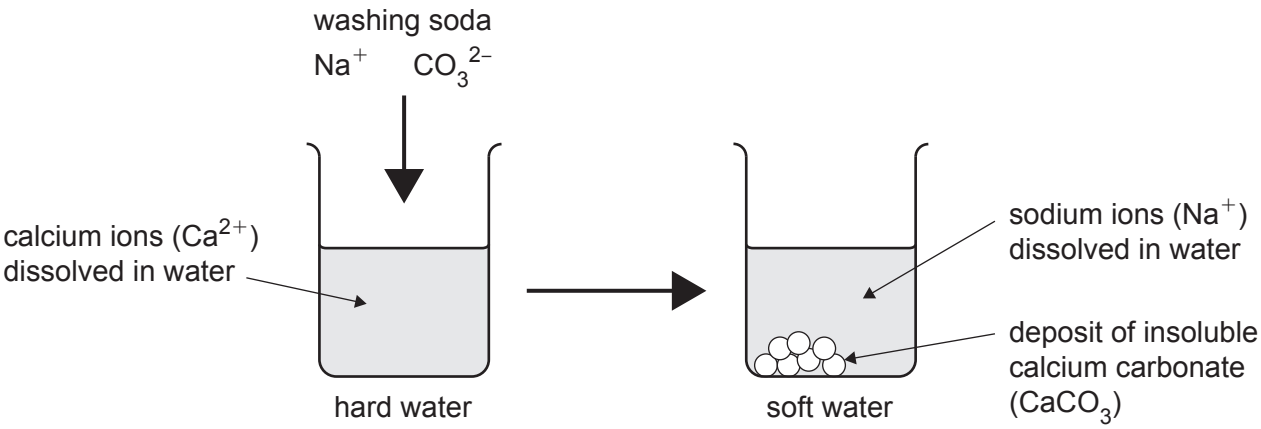
(b) Hard water can be described as either temporary or permanent.

(i) Temporary hard water can be removed by boiling. Complete the balanced symbol equation below for this reaction.

$Ca(HCO_3)_2 \rightarrow$ [ ] + [ ] + [ ]

[2]

(ii) Permanent hard water can be softened using washing soda (sodium ions and carbonate ions).



Using the diagram above explain how washing soda removes hardness from water.

_____

_____

_____

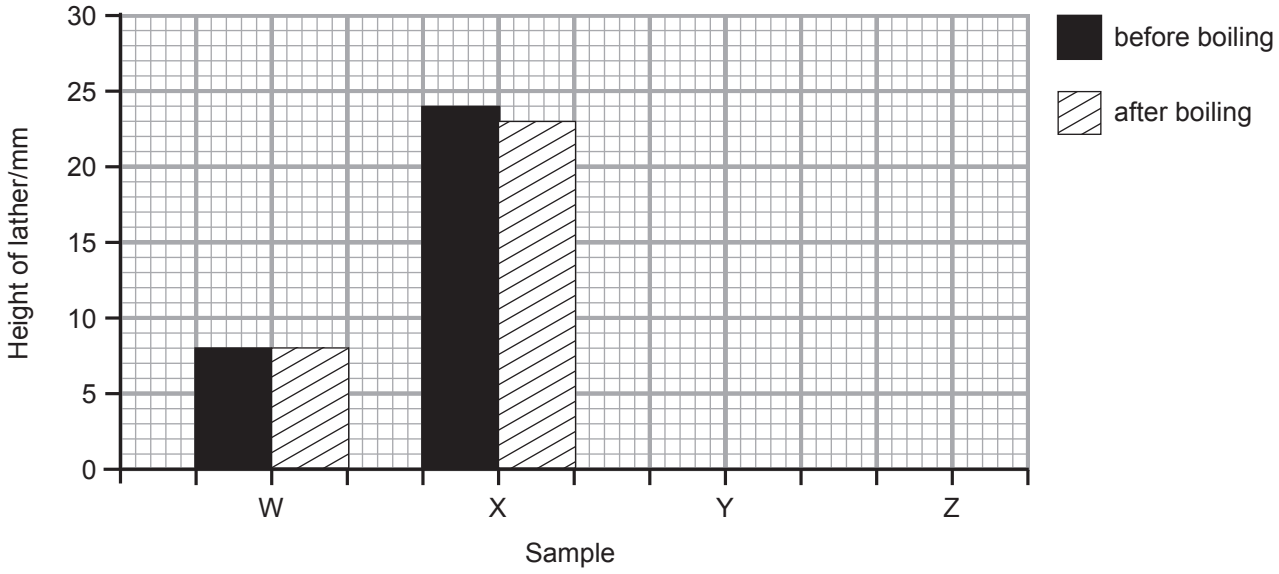
_____ [3]

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(c) A scientist conducted an investigation into the hardness of different samples of water. He put 25 cm^3 of four different samples (W, X, Y, Z) into separate flasks. He added soap solution to each flask and shook until a lather was formed. He repeated the experiment with boiled samples. The results are shown below.

Sample	Height of lather before boiling/mm	Height of lather after boiling/mm
W	8	8
X	24	23
Y	20	23
Z	6	21

(i) Complete the bar chart below.



[2]

(ii) What can be concluded about the type of water in sample Z? Explain your answer.

_____

_____

_____ [2]

[Turn over

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9 Smart materials are used in many everyday objects such as sunglasses, forehead thermometers and baby feeding spoons.

Define the following three terms:
smart material, thermochromic and photochromic.
Suggest how thermochromic and/or photochromic materials are useful in any two of the objects named above.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

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(Questions continue overleaf)

10 Crude oil produces many useful hydrocarbons.

(a) Define the term hydrocarbon.

_____

_____ [1]

(b) Propane is one example of a hydrocarbon.

(i) In the space below, draw the structural formula for propane.

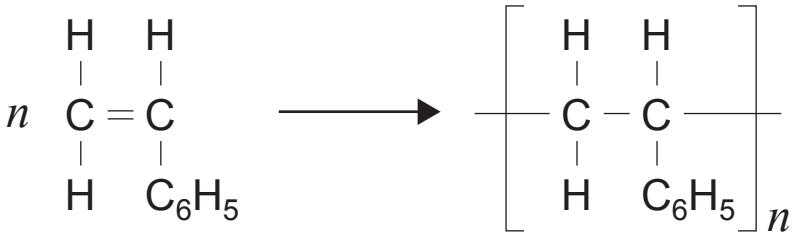
[1]

(ii) Name the family of hydrocarbons that propane belongs to.

_____ [1]

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(c) Polystyrene is a plastic that can be made from reacting styrene molecules together as shown below.



styrene polystyrene

(i) What name is given to this process?

_____ [1]

(ii) Using the diagram and your knowledge, describe how styrene molecules react together to form polystyrene.

_____

_____

_____

_____

_____ [3]

THIS IS THE END OF THE QUESTION PAPER

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

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
2015–2016

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

THURSDAY 19 MAY 2016, MORNING

MARK SCHEME

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General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

AVAILABLE MARKS

1 Indicative content:

- **tectonic** plate (theory)
- earthquakes happen at plate **boundaries**
- earthquakes are caused by a **build-up** of pressure
- earthquakes are caused by **sudden** movement of plates
- earthquakes can happen as plates move past each other/collide
- the **Richter scale** (measures the size of earthquakes)
- the larger the Richter scale value the more intense the earthquake is

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe earthquakes using **six or seven** of the points above, in a logical sequence including the term plate tectonics. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe earthquakes using **four or five** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe earthquakes using **one to three** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6] 6

2 (a) A and C [1]
they only contain one **type of atom** [1] [2]

(b) D [1] 3

3 (a) (i) 5100 [1]

(ii) 52 [1]

(iii) As the number of carbon atoms increases the boiling point increases [1]

(b) Oxygen [1] 4

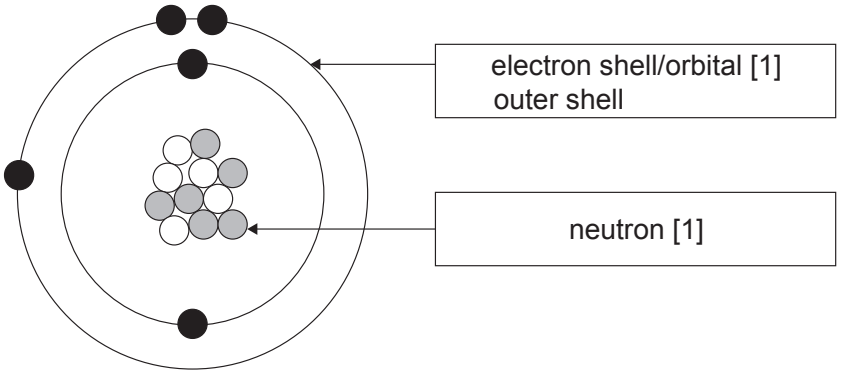
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					AVAILABLE MARKS
4	**(a)**		Purple [1] yellow [1]	[2]	
	(b)	**(i)**	Neutralisation	[1]	
		(ii)	None of the indicators **change colour at pH7**/point of neutralisation [1] they remain the same colour in **pH8 and pH7** [1]	[2]	
	(c)		(Cut up the cabbage) and **add water** [1] **boil/heat** until (water changes colour) [1] (filter/decant) the coloured **solution** to use **as the indicator** [1]	[3]	8
5	**(a)**		Smooth curve drawn, ignoring anomalous point	[1]	
	(b)		At the start the mass of the flask and contents decreased with time [1] from 5.5 minutes the mass of the flask and contents remained constant [1]	[2]	
	(c)		Calcium chloride [1] water [1] (either order)	[2]	
	(d)	**(i)**	Limewater	[1]	
		(ii)	Turns from **colourless** [1] to **cloudy/milky** [1]	[2]	8
6	**(a)**	**(i)**	Using electricity [1] to break down a substance [1]	[2]	
		(ii)	Oxide [1] cathode [1] electrons [1]	[3]	
	(b)	**(i)**	Aluminium, oxygen and hydrogen (any order)	[1]	
		(ii)	7	[1]	7

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AVAILABLE MARKS

7 **(a)**



[2]

(b) Boron [1]

(c)

Particle	Relative charge	Relative mass
proton	+1	1
electron	–1	$\frac{1}{1840}$ /0
neutron	0	1

(half mark each, round down) [3]

(d) **(i)** Correct electron arrangement drawn for sodium 2.8.1 [1]
correct electron arrangement drawn for chlorine 2.8.7 [1] [2]

(ii) Similarity: same number of shells/both have two **inner** shells filled [1]
difference: different number of **electrons** in the **outer shell** [1] [2]

(iii) Sodium loses **one** electron [1]
chlorine gains one electron [1]
correct direction of transfer [1] [3]

(iv) $2Na + Cl_2 \rightarrow 2NaCl$
LHS [1] RHS [1] Correct balancing [1] [3]

16

8 **(a)** Hard water is water that is difficult to get a lather **with soap** [1]

(b) **(i)** $CaCO_3$ [1]
$H_2O + CO_2$ [1] [2]
(Any order)

(ii) **Calcium** ions react with **carbonate** ions (from the washing soda) [1]
(this forms) insoluble calcium carbonate [1]
removes calcium **ions** from the water/only sodium **ions** left in the
(water therefore the water is no longer hard) [1] [3]

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(c) (i) All bars correct [2]
(3 bars correct [1])
Incorrect/no shading [–1]

(ii) **Temporary hard** water [1]
more lather produced after boiling than before [1] [2]

AVAILABLE MARKS

10

9 **Indicative content:**

- a smart material changes its **properties**
- because of a change in its surroundings
- thermochromic materials change **colour** due to a change in temperature
- photochromic materials change **colour** due to a change in **light**

Any **two** from:

- sunglass lenses are a photochromic material and **darken** when exposed to sunlight
- forehead thermometers are thermochromic; they **change colour** depending on the **person's temperature**
- baby feeding spoons are thermochromic they **change colour** if the food is too hot

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe smart materials using **at least five** of the points above, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe smart materials using **three or four** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe smart materials using **one or two** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6]

6

10 **(a)** A compound that contains carbon and hydrogen **only** [1]

(b) **(i)** Correct structure drawn for propane, C_3H_8 [1]

(ii) Alkanes [1]

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				AVAILABLE MARKS
(c)	**(i)**	Polymerisation	[1]	
	(ii)	Double bond breaks [1] forming a single bond and allowing [1] **many** monomers/styrene molecules to join together [1]	[3]	7
			Total	**75**

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015–2016

Science: Single Award

Unit 2 (Chemistry)
Higher Tier

GSS22

[GSS22]

THURSDAY 25 FEBRUARY 2016, MORNING

TIME

1 hour 15 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 eleven** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Quality of written communication will be assessed in Questions **3** and **10**.
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 included for your use.

For Examiner's use only	
Question Number	Marks
1	
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Total Marks	

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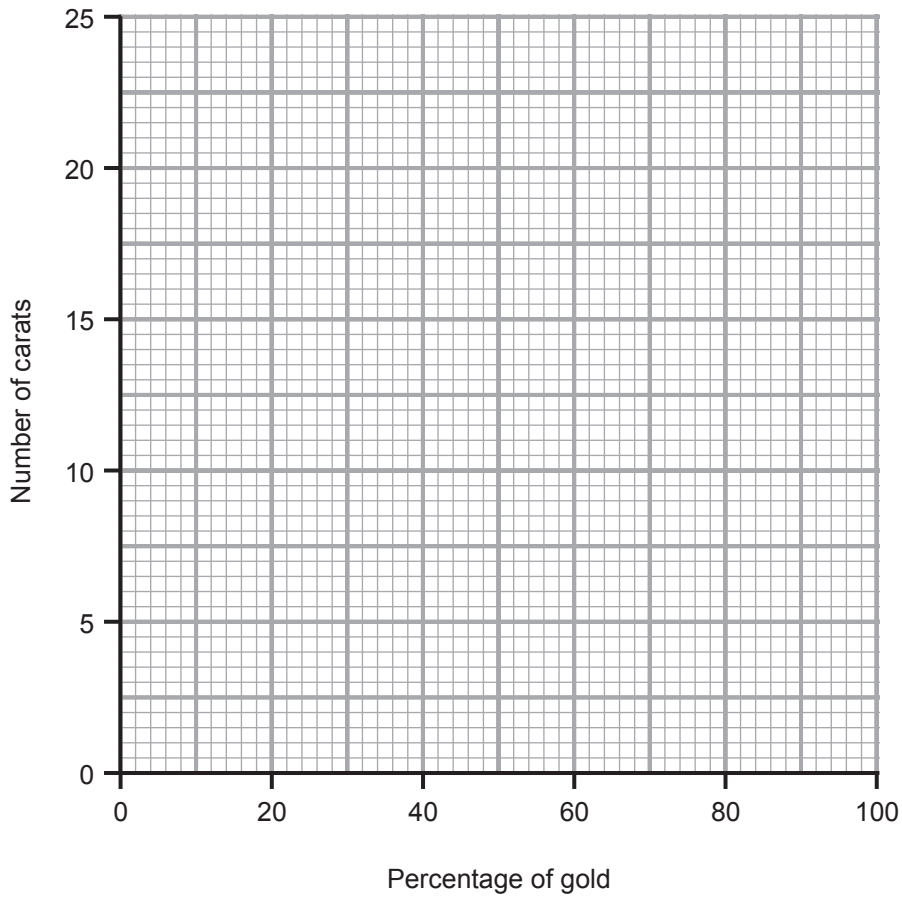
Examiner Only	
Marks	Remark

1 **(a)** Gold is a metal element used in jewellery. The purity of gold is often measured in carats.

The table below shows how the number of carats is related to the percentage of gold.

Percentage of gold	Number of carats
100	24
92	22
75	18
38	9

(i) On the grid below plot and draw a line graph for this information.



[2]

(ii) State the trend shown by this information.

_____

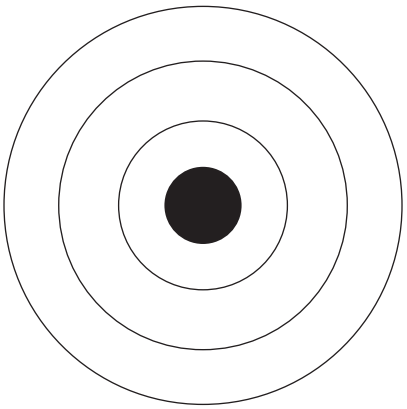
_____ [1]

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(iii) Use the graph to find the percentage of gold in a 14 carat gold ring.

_____ % [1]

(b) Aluminium is often added to gold in jewellery. An atom of aluminium has 13 electrons. Complete the diagram below to show how all these electrons are arranged.



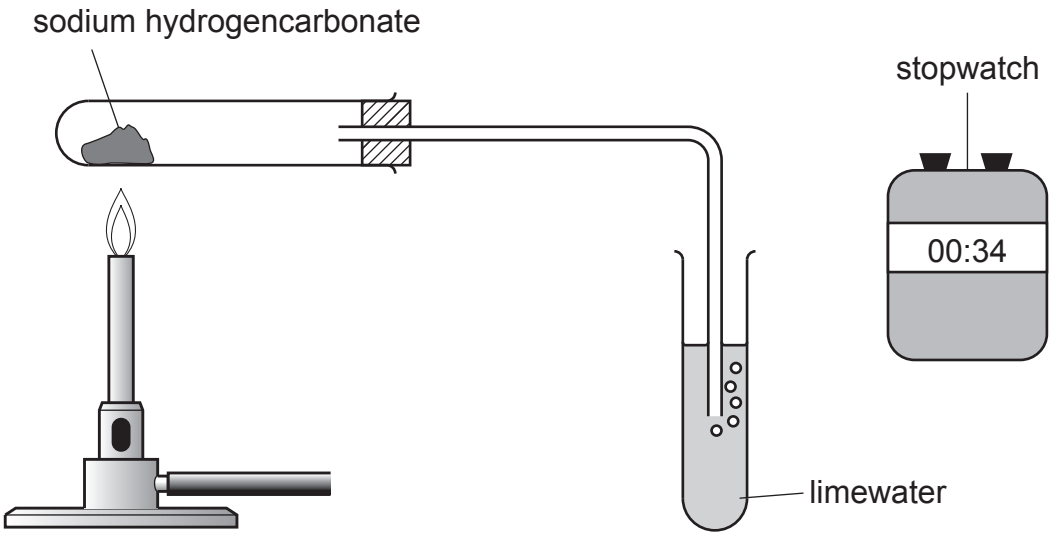
[1]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

2 Sarah investigated the effect of heating a **small** amount of sodium hydrogencarbonate using the apparatus shown below.



Sarah's observations are shown in the table below.

Time interval/ seconds	Observations
0 to 30	Small number of gas bubbles observed in limewater. The limewater remained colourless
31 to 60	A large number of gas bubbles. The limewater turned cloudy
61 to 90	No bubbles

(a) In this investigation:

(i) name the gas produced.

_____ [1]

(ii) name the type of reaction that produced this gas.

_____ [1]

(b) Suggest **one** reason for Sarah's observations between 0 and 30 seconds.

_____

_____ [1]

(c) Explain fully Sarah's observation between 61 and 90 seconds.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

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3 The fingerprint shown below was found on the door of a stolen black car.



© Science Source / Science Photo Library

Describe how the fingerprint can be taken from the black car and kept as evidence.

Your answer should include:

- the type of fingerprint shown above,
- why the fingerprint may be useful in helping solve the crime.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 The reactivity of three metals, copper, zinc and magnesium, was investigated by adding a small amount of each to sulfate solutions of the other metals.

Some results are shown below.

If there was a reaction a tick (✓) was used; for no reaction a cross (✗) was used.

Solution / Metal	Copper sulfate	Zinc sulfate	Magnesium sulfate
Copper		✗	
Zinc			
Magnesium		✓	

(a) Use your knowledge of the reactivity series to complete the table above. [2]

(b) Complete the word equation for the reaction between magnesium and zinc sulfate.

magnesium + zinc sulfate → _____ + _____

[2]

(c) Name this type of reaction.

_____ [1]

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5 The table shows some chemicals that can be separated from **one** barrel of crude oil.

Chemicals	Amount in one barrel/gallons
petrol	2.2
jet fuel	4.8
fuel oil	2.8
diesel	8.0
others	7.4

(a) Name the process used to separate crude oil into these different chemicals.

_____ [1]

(b) Name **one** other chemical that can be separated from crude oil.

_____ [1]

(c) A plane needs 4800 gallons of **jet fuel** for one journey. Calculate how many barrels of crude oil are needed for this journey.

(Show your working out.)

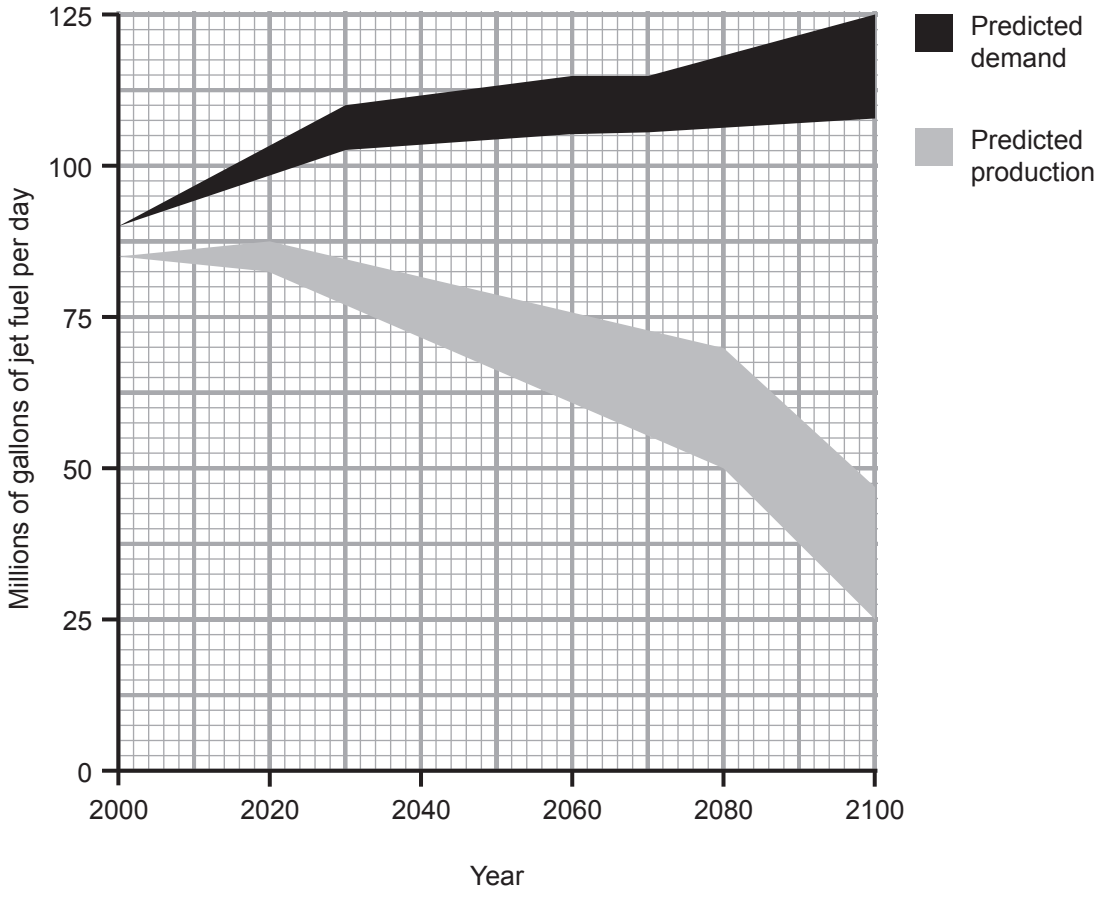
_____ [2]

Examiner Only

Marks	Remark

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The graph below shows the predicted demand for jet fuel. It also shows the predicted production of jet fuel from crude oil.



(d) Use the graph to explain why airline companies are investing large amounts of money to find alternative sources of fuel for their aircraft.

_____

_____

_____ [2]

(e) Suggest **two** reasons why these predictions may not be accurate.

1. _____

2. _____ [2]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

6 The Bank of England plans to change its paper bank notes to a plastic polymer material. It is thought that plastic rather than paper will help reduce counterfeiting.

(a) Define fully the term polymer.

_____

_____ [2]

Shown below is a copy of a paper £10 note.



© Louise Murray / Science Photo Library

(b) Give **one** way that a shop owner can test for counterfeit bank notes.

_____ [1]

(c) Paper and some modern plastics are biodegradable. Explain fully the term 'biodegradable'.

_____

_____

_____ [2]

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(Questions continue overleaf)

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Examiner Only	
Marks	Remark

7 **(a)** The table below gives the properties of five materials.

Material	Density/ kg/m^3	Relative strength	Relative stiffness	Cost
Nylon	1100	0.08	3	medium
Steel	7800	1	210	low
Polythene	960	0.02	0.6	low
Kevlar	1250	3	190	high
Carbon fibre-reinforced plastic	1600	1.8	200	high

Using **only** the information in the table answer parts **(i)** and **(ii)** below.

(i) Give **one** disadvantage of using steel for car bodies.

_____ [1]

(ii) Bulletproof vests are worn like a coat and are designed to stop a bullet hitting a person's body. Name the material that would be most suitable to make a bulletproof vest. Explain your answer.

_____

_____

_____ [2]

(b) Carbon fibre-reinforced plastic can be described as a composite material.

(i) Using carbon fibre-reinforced plastic as an example, explain what is meant by a composite material.

_____

_____

_____ [2]

(ii) Name **one** other composite material.

_____ [1]

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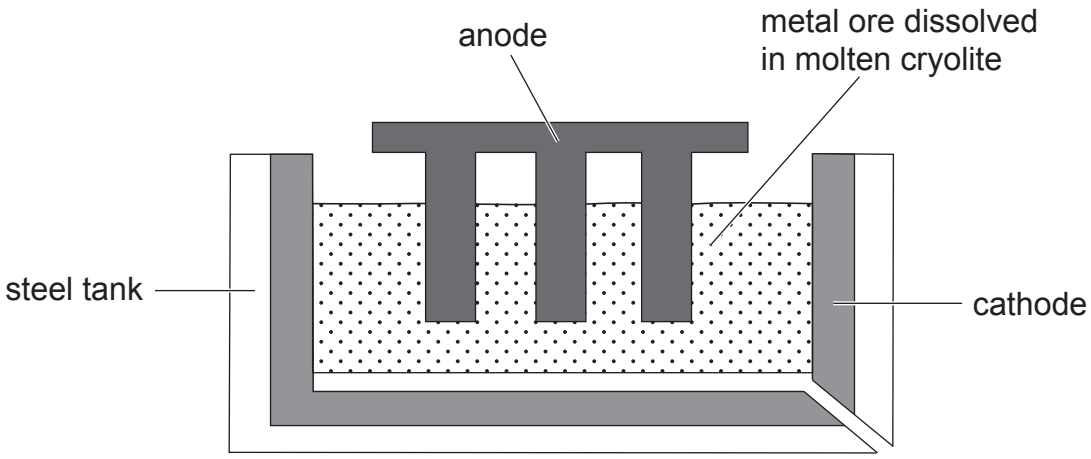
Examiner Only	
Marks	Remark

(c) Electrolysis plays an important part in extracting some metals from their ores.

(i) Name **one** metal that is obtained from its ore by electrolysis.

_____ [1]

The apparatus shown below is used for electrolysis.



Source: CCEA

(ii) Name **one** material often used to make the anode and the cathode. Explain your choice.

_____

_____

_____ [2]

(iii) Complete the following sentence.

In this extraction process the cathode is

the _____ charged electrode. [1]

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Examiner Only	
Marks	Remark

8 **(a)** The element magnesium reacts with oxygen to form the compound magnesium oxide.

(i) Balance the symbol equation for this reaction.

$$Mg \quad + \quad O_2 \quad \rightarrow \quad MgO$$ [1]

(ii) Explain in terms of electrons how magnesium forms bonds with oxygen in magnesium oxide.

_____

_____

_____

_____ [3]

(iii) Choose **one** chemical compound that has the same type of bonding as magnesium oxide.

Circle the correct answer.

H_2O **NaCl** **C_3H_8**

[1]

(b) Magnesium hydrogencarbonate has the chemical formula $Mg(HCO_3)_2$.

(i) How many different elements does magnesium hydrogencarbonate contain?

_____ [1]

(ii) How many carbon atoms are represented by the formula $Mg(HCO_3)_2$?

_____ [1]

(iii) What is the total number of atoms represented by the formula $Mg(HCO_3)_2$?

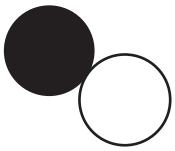
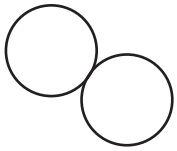
_____ [1]

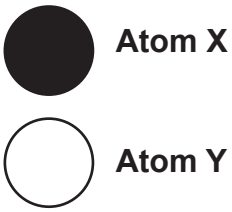
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During a lesson on elements and compounds a student made the following statement.

"Since all compounds are molecules, then all molecules must be compounds."

(c) Explain with reference to **both** molecules **A** and **B** shown below why this statement is incorrect.

	
Molecule A	**Molecule B**



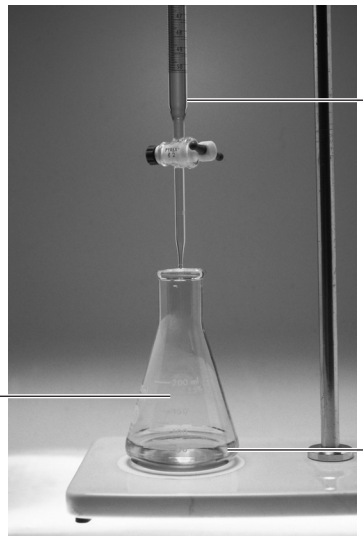
[3]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

9 **(a)** Some students investigated the hardness of water using the apparatus below.



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(i) Name a piece of apparatus that could be used to **accurately** measure 25 cm^3 of hard water.

_____ [1]

(ii) Explain why it is better to use a conical flask rather than a beaker.

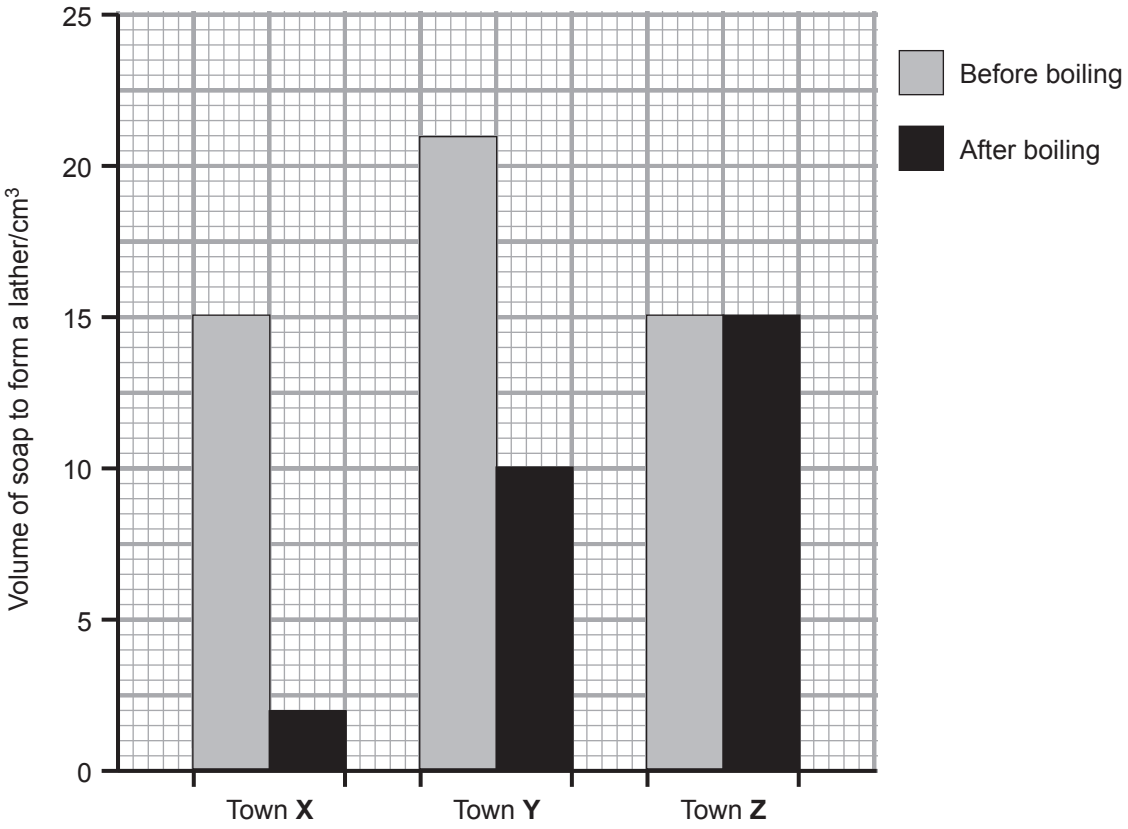
_____ [1]

(iii) What is meant by the term hard water?

_____

_____ [1]

The students used the same apparatus to compare the hardness of water in three towns (**X**, **Y** and **Z**) before and after boiling. The results are shown below.



(b) From the results which town (**X**, **Y** or **Z**) has both temporary and permanent hard water? Explain your answer fully.

_____

_____

_____

_____

_____

_____ [3]

(c) Name a compound which causes permanent hardness in water.

_____ [1]

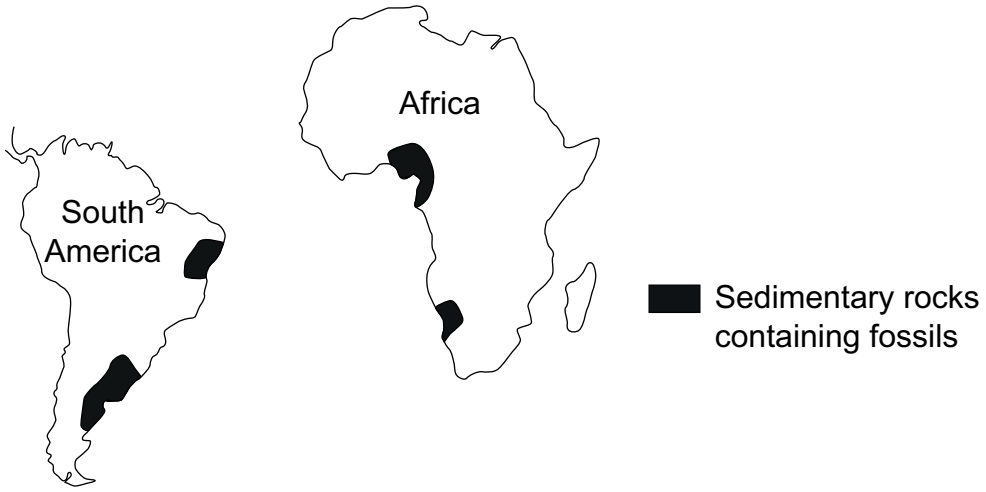
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

10 In 1912 Alfred Wegener proposed a theory to explain the formation of the continents. However, other scientists at the time did not agree that his theory was the correct explanation.



Referring to the diagram above, describe Wegener's theory, including evidence that supports it and reasons why scientists at the time thought he was wrong.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only	
Marks	Remark

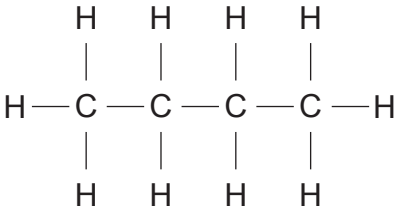
11 **(a)** The following chemical compounds are all hydrocarbons.

ethane **propane** **ethene** **butane**

(i) Which of the above compounds is **not** an alkane?

_____ [1]

(ii) Complete the table below about two hydrocarbons.

Name of hydrocarbon	Molecular formula	Structural formula
methane	CH_4	
butane		

[2]

Polypropene is made by a process involving propene molecules.

(b) Name the process used to make polypropene.

_____ [1]

The word equation for the combustion of propane is given below.

propane + oxygen → carbon dioxide + water

(c) Write the **balanced symbol** equation for the combustion of propane.

_____ [3]

THIS IS THE END OF THE QUESTION PAPER

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113159

Rewarding Learning

General Certificate of Secondary Education
2015–2016

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

THURSDAY 25 FEBRUARY 2016, MORNING

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

				AVAILABLE MARKS
1	(a)	(i)	All points plotted correctly [1] correct line of best fit [1] (not back to point 0,0) [2] (mark line of best fit independently)	
		(ii)	As the percentage of gold increases the number of carats increases **or** opposite, not **they** both increase. [1]	
		(iii)	58–59% or correct from graph [1]	
	(b)		2.8.3 [1]	5
2	(a)	(i)	Carbon dioxide/CO_2 [1]	
		(ii)	Thermal decomposition [1]	
	(b)		Reaction had not started/temperature was not high enough/ not enough carbon dioxide produced [1]	
	(c)		Any **two** from: The reaction was finished [1] all the sodium hydrogencarbonate had reacted/only a small amount of sodium hydrogencarbonate was used [1] no more carbon dioxide/gas produced [1] [2]	5

3 Indicative Content:

- add aluminium powder/talc
- sprinkle powder over print/dust/brush
- brush off any **excess** powder
- lift print with (clear) tape/cellotape
- place onto card/glass/any colour of card
- whorl print shown above/labelled on diagram
- fingerprints are unique/everyone has their own
- place criminal at crime scene/use a database

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout using **7 or 8** of the points above, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms using **4, 5 or 6** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe the lifting of a fingerprint method using **1, 2 or 3** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Not worthy of credit.	[0]

6

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				AVAILABLE MARKS
4	**(a)**			

Metal \ Solution	Copper sulfate	Zinc sulfate	Magnesium sulfate
Copper		✗	✗
Zinc	✓		✗
Magnesium	✓	✓	

half mark for each correct answer, rounded down [2]

(b) Magnesium sulfate [1]
zinc [1] (either order) [2]

(c) Displacement [1] 5

5 **(a)** **Fractional** distillation [1]

(b) Refinery gas/naphtha/lubricating oil/tar (bitumen) [1]

(c) 4800/4.8 [1] 1000 [1] [2]

(d) Demand for jet fuel is increasing [1]
production of jet fuel is decreasing [1] [2]

(e) Any **two** from:
- the current values are estimates/guesses
- difficult to predict what will happen in the future/may be fewer planes
- more oil discovered
- other alternative answer, e.g. alternative fuels used/new fuel [2] 8

6 **(a)** Chain of small molecules/monomers [1]
joined/bonded together [1] [2]

(b) Ultraviolet light/watermark/metal strip/hologram [1]

(c) Can be broken down [1]
by microbes [1] [2] 5

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					AVAILABLE MARKS
7	(a)	(i)	Steel has a **high** density/is heavy	[1]	
		(ii)	Kevlar [1] kevlar is very strong **and** light [1]	[2]	
	(b)	(i)	Carbon (fibre) and plastic [1] combined to make a more useful material [1]	[2]	
		(ii)	Glass fibre/reinforced glass/(reinforced) concrete/bone/steel or other suitable	[1]	
	(c)	(i)	Aluminium/Magnesium	[1]	
		(ii)	Carbon/graphite [1] conducts electricity/inert [1]	[2]	
		(iii)	Negatively/negative	[1]	10
8	(a)	(i)	$2Mg + O_2 \rightarrow 2MgO$	[1]	
		(ii)	Magnesium loses electrons [1] two electrons [1] oxygen gains electrons [1]	[3]	
		(iii)	NaCl	[1]	
	(b)	(i)	4 (Magnesium, hydrogen, carbon, oxygen)	[1]	
		(ii)	2	[1]	
		(iii)	11	[1]	
	(c)		Any **three** from: Molecule B is an element/not a compound [1] as it contains **one type of atom** [1] molecule A has **two different types** of atom [1] molecule A is a compound [1]	[3]	11
9	(a)	(i)	Burette/pipette/**25 cm^3** measuring cylinder	[1]	
		(ii)	No spillage/easier to shake	[1]	
		(iii)	Water that is hard to lather with soap	[1]	
	(b)		Town Y [1] after boiling the volume did decrease removing the temporary hardness [1] did not go down enough representing also permanent hardness [1]	[3]	
	(c)		Calcium chloride/magnesium chloride/calcium sulfate/magnesium sulfate	[1]	7

10 Indicative Content

Theory
- originally one continent/'Pangaea'
- it broke up and formed other continents/continental drift
- over millions of years

Evidence
- continents fitted together (like a jigsaw)
- rock (features) in one continent extended into another continent
- fossils found in different continents match up across the joint

Rejection
- geologists believed that continents could not drift/no evidence at that time/couldn't see this happen

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout using **six or seven** of the points above, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms using **four to five** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates use **one to three** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Not worthy of credit.	[0]

AVAILABLE MARKS

6

11 (a) (i) Ethene [1]

(ii) Correct structure for methane [1]
C_4H_{10} [1] [2]

(b) Polymerisation [1]

(c) $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$
LHS [1] RHS [1] Correct balancing if both sides are correct [1] [3]

7

Total **75**

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015–2016

Science: Single Award

Unit 2 (Chemistry)
Higher Tier

GSS22

[GSS22]

THURSDAY 12 NOVEMBER 2015, MORNING

TIME

1 hour 15 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 nine** questions.

INFORMATION FOR CANDIDATES

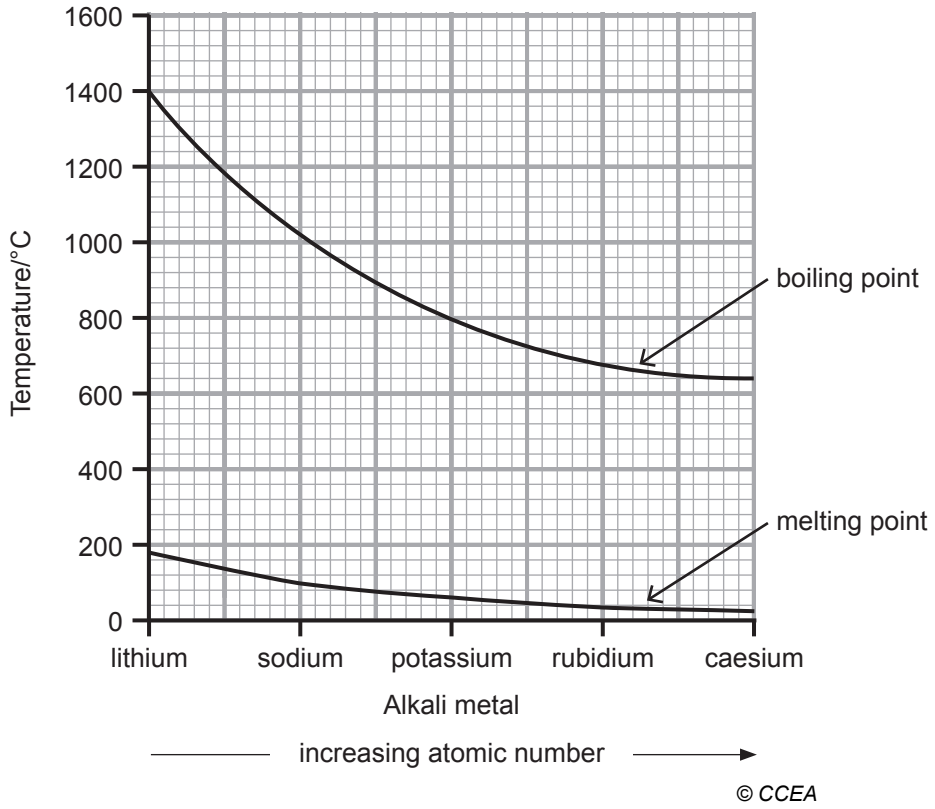
The total mark for this paper is 75.
Quality of written communication will be assessed in Questions **2** and **9(a)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet, which includes a Periodic Table of the Elements, is included for your use.

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

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Examiner Only	
Marks	Remark

1 Information about the melting and boiling points of some Group 1 (alkali) metals is shown below.



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

(a) Complete the following sentence to describe the trend in boiling points of the alkali metals.

As the atomic number of the alkali metals _____

_____ [1]

(b) Francium is below caesium in Group 1 of the Periodic Table. Predict the boiling point of francium.

_____ °C [1]

(c) Choose the metal with the biggest difference between its melting point and its boiling point. Calculate the temperature difference between its melting point and its boiling point.

(Show your working out.)

_____ °C [2]

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(d) Name the gas formed when the alkali metals react with water.

_____ [1]

(e) Potassium reacts vigorously with water. Describe how you would expect lithium to react with water compared to potassium.

_____

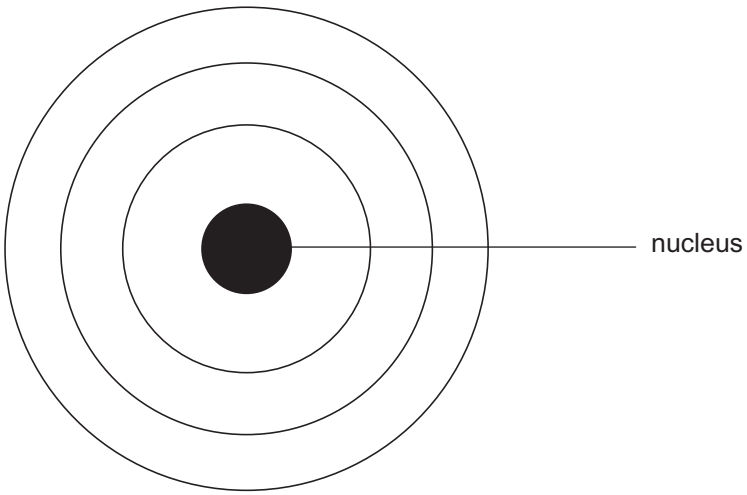
_____ [1]

(f) Apart from wearing safety goggles, state **two** safety precautions needed when adding potassium to water.

1. _____

2. _____ [2]

(g) **(i)** A sodium atom has 11 electrons. Complete the diagram below to show how the electrons are arranged in a sodium atom.



[1]

(ii) In terms of the arrangement of electrons, state why sodium and other alkali metals are placed in Group 1 of the Periodic Table.

_____

_____ [1]

Examiner Only

Marks	Remark

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2 Describe the process of a volcanic eruption.

Your answer should include:

- why volcanoes occur
- the effect on surrounding areas
- the type of rock produced after an eruption.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only	
Marks	Remark

3 The table below gives information about some plastics.

Plastic	Properties	Colours available	Cost
PVC	hard, keeps its shape, weather resistant	wide range of colours	medium
nylon	hard, long lasting	white or cream	high
polythene	soft, flexible, good electrical insulator	wide range of colours but they fade easily	medium
plasticised PVC	soft, flexible, good electrical insulator	wide range of colours	medium
polystyrene	does not keep its shape, good heat insulator	white	low
acrylic	stiff, weather resistant, good electrical insulator	wide range of colours	high

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

Examiner Only	
Marks	Remark

(a) Which **two** plastics could be best used for covering electrical cables?

_____ and _____ [1]

(b) A manufacturer is going to produce cheap, green buckets to sell at large DIY stores.



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Which plastic should the manufacturer choose? Give **two** reasons for your choice.

_____

_____

_____ [3]

(c) Give **one** reason why polystyrene is **not** used to make garden chairs. Explain your answer.

_____

_____

_____ [2]

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Examiner Only	
Marks	Remark

4 Given below is information about the reactions of some metals with their metal salt solutions.

	Tin sulfate	**Zinc sulfate**	**Copper sulfate**	**Magnesium sulfate**
Tin		no reaction	reaction	no reaction
Zinc	reaction		reaction	no reaction
Copper	no reaction	no reaction		no reaction
Magnesium	reaction	reaction	reaction	

(a) Use the information to put the metals in order of decreasing reactivity.

_____ most reactive

_____

_____

_____ least reactive [2]

(b) (i) Complete the word equation for the reaction between tin and copper sulfate.

copper sulfate	+	tin	→		+	

[2]

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

_____ [1]

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(c) Using lines, match each metal reaction with **one** expected observation.

Metal reaction	Expected observation
zinc + copper sulfate	bubbles of gas
	blue solution fades
magnesium + acid	silver coloured solid forms
	solution turns milky

[2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

5 **(a)** The table below gives information about the structure of four elements **A**, **B**, **C** and **D**.

Element	Number of protons	Number of electrons	Number of neutrons
A	4	4	5
B	9	9	10
C	15	15	16
D	12	12	12

You may find your Data Leaflet helpful.

(i) Name the element labelled **C** above.

_____ [1]

(ii) Which element (**A**, **B**, **C** or **D**) has 7 electrons in its outer shell?

_____ [1]

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

_____ and _____ [1]

(iv) Calculate the mass number of element **A**.

_____ [1]

(v) Which element (**A**, **B**, **C** or **D**) is a halogen?

_____ [1]

(b) The Greeks were the first to recognise the idea of elements. Name **two** elements the Greeks used.

_____ and _____ [2]

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(Questions continue overleaf)

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6 Shown below are parts of labels from two mineral water bottles, **A** and **B**.

Examiner Only	
Marks	Remark

Ions present	Composition/ mg/dm^3
calcium	78.0
magnesium	24.0
potassium	1.0
sodium	5.0
chloride	4.5
hydrogencarbonate	329.0
nitrate	2.8
sulfate	8.0
pH = 7.2	

Water A

Ions present	Composition/ mg/dm^3
calcium	24.5
magnesium	8.5
potassium	0.4
sodium	5.7
chloride	9.0
hydrogencarbonate	260.0
nitrate	3.5
sulfate	9.0
pH = 7.8	

Water B

(a) How many different metal ions are present in mineral water **A**?

_____ [1]

(b) A student carried out an investigation using soap solution to see if the mineral waters were hard water.

(i) How would the student know from this investigation if the water was hard?

_____

_____ [1]

(ii) His teacher suggested that he also tested pure distilled water for hardness. Suggest why the student's teacher thought this was important.

_____

_____ [1]

(iii) Which mineral water (**A** or **B**) would you expect to be the hardest? Explain your choice.

_____

_____ [1]

(iv) How could the student accurately check the pH of the water?

_____ [1]

(c) Apart from taste, give **one** advantage of drinking hard water.

_____ [1]

(d) One disadvantage of living in a hard water area is the build-up of 'fur' on the inside of kettles. What is the chemical name for kettle 'fur'?

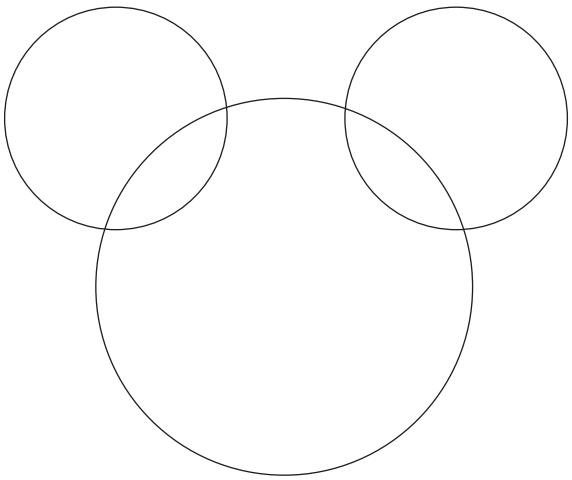
_____ [1]

(e) Give **two** methods of softening permanent hard water.

1. _____

2. _____ [2]

(f) Water has the formula H_2O. Complete the diagram for the bonding in water, showing only the outer electrons.
Label the oxygen and hydrogen atoms.



[3]

Examiner Only

Marks	Remark

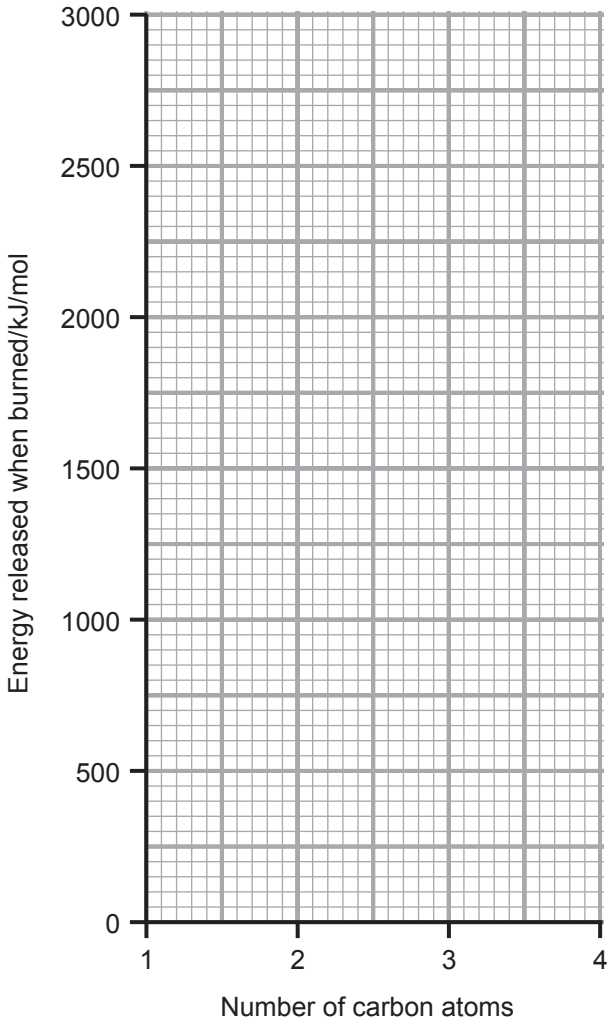
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Examiner Only	
Marks	Remark

7 **(a)** The table below shows information about the energy released when some alkanes burn.

Alkane	Number of carbon atoms	Energy released when burned/kJ/mol
methane	1	900
ethane	2	1550
propane	3	2200
butane	4	2850

(i) On the grid below draw a line graph to show this information.



[3]

(ii) Pentane is an alkane with five carbon atoms. Predict the energy released when pentane is burned.

_____ kJ/mol [1]

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(b) In the space below draw the structural formula for ethane (C_2H_6).

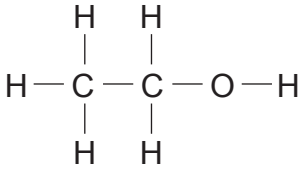
[1]

(c) Complete the balanced symbol equation for the burning of methane.

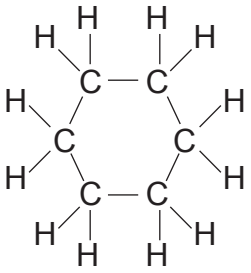
$$CH_4 \quad + \quad O_2 \quad \rightarrow$$

[3]

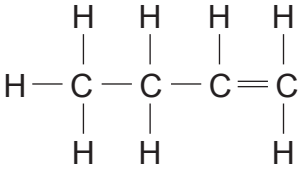
(d) Below are the structures of some organic compounds.



A



B



C

(i) Which compound (**A**, **B** or **C**) has the formula C_4H_8?

_____ [1]

(ii) Which compound (**A**, **B** or **C**) is **not** a hydrocarbon? Explain your answer fully.

_____

_____

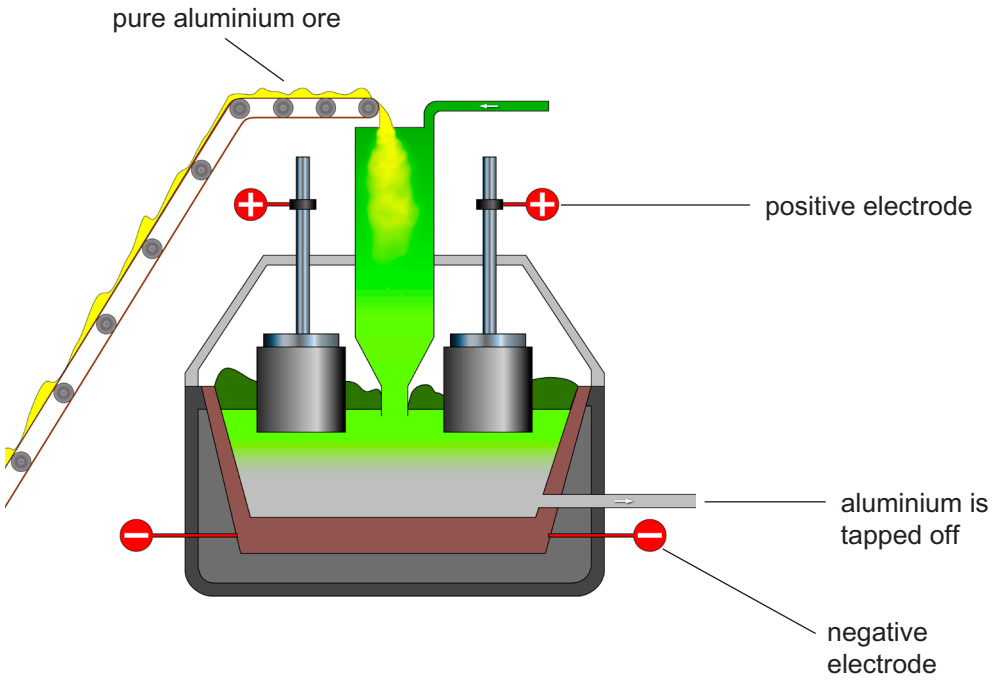
_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

8 Electrolysis can be used to extract aluminium from its ore on a large scale using the process shown below.



© Science Photo Library

(a) What is meant by the term 'electrolysis'?

_____

_____ [2]

(b) What is the chemical name for pure aluminium ore?

_____ [1]

(c) **(i)** What name is given to the negative electrode?

_____ [1]

(ii) Explain in terms of ions and electrons how aluminium is formed at the negative electrode.

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

9 **(a)** Explain the cause of indigestion and describe how sodium hydrogencarbonate can cure it.

Your answer should also include the names of the products formed in this process.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

(b) Write a balanced symbol equation for the thermal decomposition of sodium hydrogencarbonate.

[3]

THIS IS THE END OF THE QUESTION PAPER

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Rewarding Learning

General Certificate of Secondary Education
2015–2016

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

THURSDAY 12 NOVEMBER 2015, MORNING

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

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The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

		AVAILABLE MARKS
1	**(a)** As the atomic number of the alkali metal increases the boiling point decreases [1]	
	(b) 600–640 °C (any value in the range) [1]	
	(c) 1400 – 180 [1] 1220 [1] [2]	
	(d) Hydrogen [1]	
	(e) Lithium will react less vigorously [1]	
	(f) Any **two** from: use a safety screen/fume cupboard use tongs use a small amount of potassium/large amount of water [2]	
	(g) **(i)** 2.8.1 drawn correctly [1]	
	(ii) They all have the same number of electrons/1 electron in their outer shell [1]	10

2 **Indicative Content:**

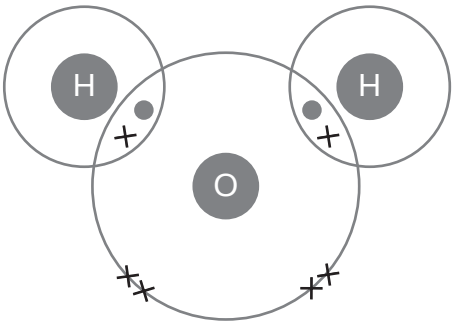
- idea of plate tectonics
- volcanoes occur when tectonic plates are pulled apart/pushed together
- pressure builds up (in the magma chamber)
- magma is pushed to the surface
- lava flows out of cracks/down sides of volcano
- produces dust/gas/ash clouds
- lava cools to form igneous rocks
- kills plants and animals in the surrounding areas

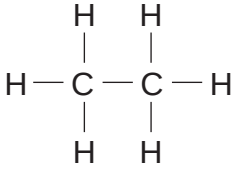
Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe the process of a volcanic eruption using **six** to **eight** of the points above, in a logical sequence including the term plate tectonics. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe the process of a volcanic eruption using **four** or **five** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe the process of a volcanic eruption using **one, two** or **three** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Not worthy of credit.	[0]

[6] 6

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				AVAILABLE MARKS
3	**(a)**	Plasticised PVC and polythene	[1]	
	(b)	PVC [1] can be coloured [1] hard/keeps its shape/weather resistant/qualified cost [1]	[3]	
	(c)	Does not keep its shape [1] would not support the weight of a person [1]	[2]	6
4	**(a)**	Magnesium, zinc, tin, copper (any 2 in correct order [1])	[2]	
	(b)	**(i)** Tin sulfate [1] + copper [1] (either order)	[2]	
		(ii) Displacement	[1]	
	(c)	Zinc + copper sulfate – blue solution fades [1] magnesium + acid – bubbles of gas [1]	[2]	7
5	**(a)**	**(i)** Phosphorus	[1]	
		(ii) B	[1]	
		(iii) A and D	[1]	
		(iv) 9	[1]	
		(v) B	[1]	
	(b)	Any **two** from: fire, earth, air, water	[2]	7

			AVAILABLE MARKS
6	**(a)**	4 [1]	
	(b)	**(i)** Very little lather/no lather/scum/lots of soap needed for lather [1]	
		(ii) Used as a control/to compare results [1]	
		(iii) A as it contains the most calcium **and** magnesium ions [1]	
		(iv) Use a pH meter/probe [1]	
	(c)	Strong teeth and bones/prevents heart disease [1]	
	(d)	Calcium carbonate [1]	
	(e)	Any **two** from: precipitation/adding washing soda distillation ion exchange [2]	
	(f)	 Correct sharing [1] correct oxygen electrons [1] labelled H and O [1] [3]	12

					AVAILABLE MARKS
7	**(a)**	**(i)**	All points correct [2] (three points correct [1]) line of best fit [1]	[3]	
		(ii)	3500	[1]	
	(b)			[1]	
	(c)		$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ [1] [1]		
			correct balancing [1]	[3]	
	(d)	**(i)**	C	[1]	
		(ii)	A [1] it contains oxygen as well as carbon and hydrogen [1]	[2]	11
8	**(a)**		Using electricity [1] to break down a substance [1]	[2]	
	(b)		Aluminium oxide	[1]	
	(c)	**(i)**	Cathode	[1]	
		(ii)	Aluminium **ions** [1] gain three [1] electrons [1]	[3]	7

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AVAILABLE MARKS

9 (a) Indicative Content:

- neutralisation
- sodium hydrogencarbonate is an alkali (base)
- the stomach contains excess acid
- stomach acid is hydrochloric acid
- products are:
  - sodium chloride
  - water and
  - carbon dioxide

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe the neutralisation reaction of sodium hydrogencarbonate using **six or seven** of the points above, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe the theories about the neutralisation reaction of sodium hydrogencarbonate using **four or five** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe the theories about the neutralisation reaction of sodium hydrogencarbonate using **one, two or three** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Not worthy of credit.	[0]

[6]

(b) $2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$

LHS[1] RHS[1] Correct balancing [1] [3]

9

Total **75**

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Rewarding Learning

General Certificate of Secondary Education
2014–2015

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

THURSDAY 14 MAY 2015, MORNING

MARK SCHEME

STEMUP.CO.UK

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				AVAILABLE MARKS
1	**(a)**	Strong [1] cheap [1] penalise: m.p./density	[2]	
	(b)	Gold is very dense/heavy[1] wires may break/too heavy for pylons [1] independent marks	[2]	
	(c)	Aluminium [1] low density [1] penalise reference to other reasons (ignore cost)	[2]	6
2	**(a)**	X placed in correct position (Group 7)	[1]	
	(b)	**(i)** D/argon	[1]	
		(ii) A	[1]	
	(c)	18	[1]	
	(d)	Octaves [1] Mendeleev [1]	[2]	6
3	**(a)**	**(i)** Copper [1] water [1] (either order)	[2]	
		(ii) Reduction (accept REDOX)	[1]	
	(b)	Y [1] the diagram shows two of the **same** type of atom joined together [1]	[2]	
	(c)	6	[1]	6
4	**(a)**	Bone **combines** two or more materials [1] reference to properties/reference to hard & flexible [1] more useful/better material/for a particular property/purpose [1]	[3]	
	(b)	**(i)**	[2]	

Element	Number of protons	Number of neutrons
Phosphorus	**15** [1]	16
Oxygen	8	**8** [1]

(ii) zero/ $\frac{1}{1840}$ [1] or range $\frac{1}{1800} \rightarrow \frac{1}{2000}$

–1 [1] [2] 7

5 Indicative Content:

AVAILABLE MARKS

Method

- use a **flame test** rod/nichrome wire
- dip into (concentrated) acid
- dip into the metal salt
- place into **blue** Bunsen flame
- clean the rod/use new rod

or

- use a spray bottle
- make a solution of the salt/add water
- spray into flame
- use blue Bunsen flame
- clean bottle/use a new bottle

Results

- copper – blue-green
- lithium – red [6]

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe carrying out a flame test using **five to seven** of the points above, in a logical sequence including at least one result. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe carrying out a flame test using **three or four** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe carrying out a flame test using **one or two** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Not worthy of credit.	[0]

6

				AVAILABLE MARKS
6	**(a)**	Thermal decomposition	[1]	
	(b)	**(i)** The gas/CO_2 can escape [1] There should be a bung/cork in the clamped test tube [1] the glass tube must extend into the limewater [1]	[2]	
		(ii) Turns milky/cloudy	[1]	
		(iii) Mass will decrease [1] CO_2/gas is escaping/releasing/producing/losing [1]	[2]	
		(iv) No more bubbles/no further change in mass/no more CO_2 released	[1]	
		(v) Sodium carbonate[1] + Water [1] symbols OK	[2]	
	(c)	Tartaric acid	[1]	10
7	**(a)**	Hard water does not lather easily with soap/more soap is required to form a lather with hard water/forms a scum with soap	[1]	
	(b)	**(i)** The water is temporary hard water	[1]	
		(ii) Calcium carbonate	[1]	
	(c)	Calcium **ions**/Ca^{2+} from hard water [1] are replaced by sodium ions [1] sodium ions do not cause hardness/removing calcium ions means the water is no longer hard/contains no calcium ions/contains only sodium ions [1]	[3]	6
8	**(a)**	All plotted correctly [2] 4 plotted correctly [1] correct curve [1]	[3]	
	(b)	**(i)** 0.43–0.44 (correct value from graph)	[1]	
		(ii) 6 (correct value from graph)	[1]	
	(c)	magnesium (accept calcium or aluminium)	[1]	6

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				AVAILABLE MARKS
9	**(a)**	Continental drift	[1]	
	(b)	Earthquakes/(fold) mountains	[1]	
	(c)	Igneous	[1]	
	(d)	98.75%	[1]	
	(e)	• radioactive isotopes/radio isotopes/elements [1] • found in uranium/potassium [1] • used the half life/ratio/proportions of decayed/undecayed or parent/daughter [1]	[3]	7
10	**(a)**	More vigorous reaction/explode **instantly** [1] further down group 1 [1]	[2]	
	(b)	**(i)** Sodium has one electron in its outer shell/same number of electrons as potassium and rubidium	[1]	
		(ii) $2Na + 2H_2O$ [1] $\rightarrow 2NaOH + H_2$ [1] correctly balanced [1]	[3]	
	(c)	One electron [1] transferred [1] from sodium to chlorine [1] gives [1]	[3]	9

11 Indicative Content:

AVAILABLE MARKS

- small molecules are called monomers
- the name of the process is polymerisation
- double bond breaks
- breaks/forms single bonds
- monomers join together/combined/connect
- named examples of polymers: polythene/polypropene/poly vinyl chloride/ nylon (PVC) [max 2]

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe the process using **five to seven** of the points above, in a logical sequence including at least one named example of a polymer. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe the process using **three or four** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe the process using **one or two** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Not worthy of credit.	[0]

6

Total **75**

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2014–2015

Science: Single Award

Unit 2 (Chemistry)
Higher Tier

GSS22

[GSS22]

WEDNESDAY 25 FEBRUARY 2015, MORNING

TIME

1 hour 15 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 ten** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Quality of written communication will be assessed in Questions **4** and **10(a)**.
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 included for your use.

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

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1 **(a)** Stomach ache can be caused by too much hydrochloric acid in the stomach. Indigestion tablets can be used to reduce the amount of acid in the stomach as they contain calcium carbonate.



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(i) Complete the word equation for this reaction.

calcium carbonate	+	hydrochloric acid	→		+		+	carbon dioxide

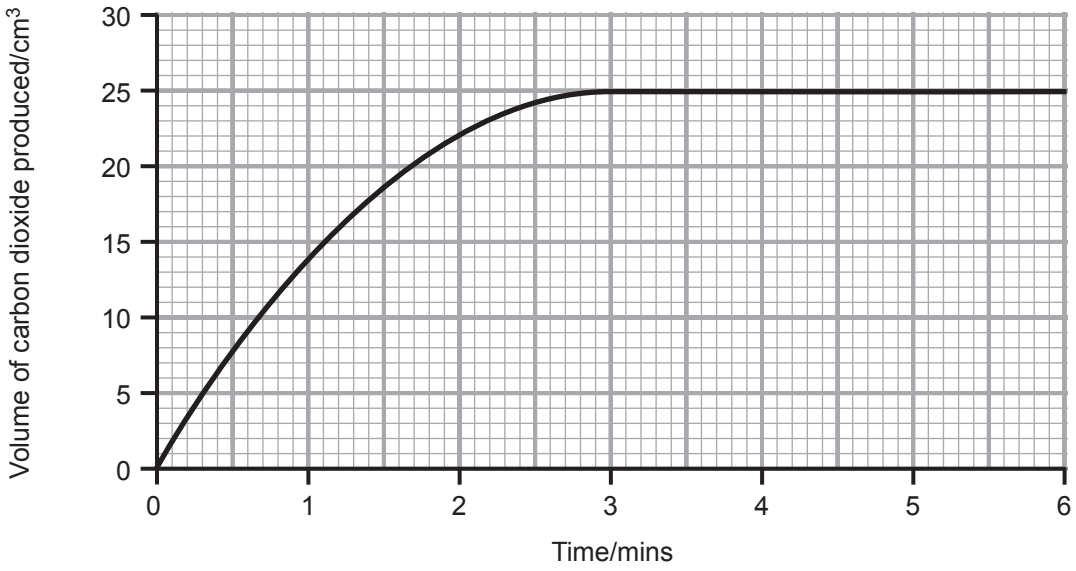
[2]

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

_____ [1]

Examiner Only	
Marks	Remark

Some hydrochloric acid is added to excess calcium carbonate.
The graph below shows how the volume of carbon dioxide produced changes with time.



(b) Describe fully the trend shown by these results.

_____

_____

_____ [2]

(c) Describe the test for carbon dioxide.

_____

_____

_____ [2]

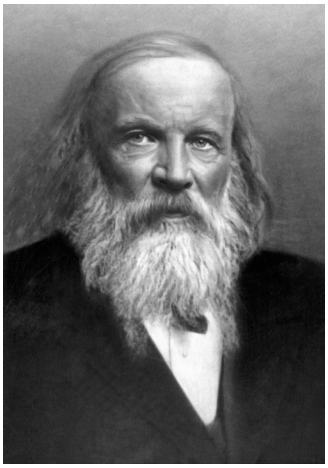
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

2 In 1869 the scientist pictured below put the sixty known elements into a Periodic Table.



© Ria Novosti / Science Photo Library

(a) Name the scientist pictured above.

_____ [1]

(b) Name the unreactive **group** of elements not included in his table because they had not been discovered by 1869.

_____ [1]

(c) Sodium is in Group 1 of the modern Periodic Table.

(i) Complete the table below to show the number of each different particle in a sodium atom.

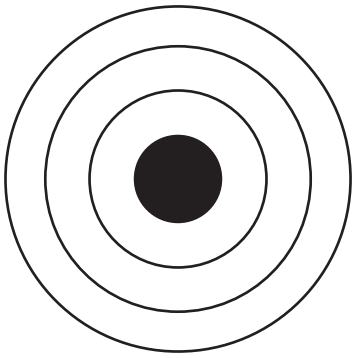
You may find your Data Leaflet helpful.

	Number of protons	**Number of neutrons**	**Number of electrons**
sodium (Na)			

[3]

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(ii) Complete the diagram below to show the electronic structure of a sodium atom.



sodium atom

[1]

(d) When sodium is added to water there is a violent reaction during which it moves on the water surface.

(i) Give **two** other observations during this reaction.

1. _____

2. _____ [2]

(ii) Name the alkaline solution formed during this reaction.

_____ [1]

(e) Potassium and sodium are both in Group 1 of the Periodic Table. Give **two** reasons why these metals are in the same Group.

1. _____

2. _____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

3 **(a)** Some students investigated the hardness of water in four towns (**W**, **X**, **Y** and **Z**). The following method was used for each town.

1. Measure 25 cm^3 of water and add to a conical flask.

2. Add 1 cm^3 of soap solution and shake well.

3. Repeat step 2 until a permanent lather forms.

4. Record the volume of soap solution used.

5. Boil another 25 cm^3 of water and repeat steps 1 to 4.

The results are shown below.

	Volume of soap solution/cm^3	
Town	**before boiling**	**after boiling**
W	26	1
X	6	6
Y	24	17
Z	1	1

(i) Name a piece of apparatus the students could have used to measure 1 cm^3 of soap solution.

_____ [1]

(ii) Suggest **one** way in which the reliability of the results could have been improved.

_____ [1]

(b) What can you conclude about the hardness of the water from Town **Y**? Explain your answer.

_____

_____

_____

_____ [2]

(c) Apart from using more soap, give **one** disadvantage of using hard water.

_____ [1]

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4 A student adds a piece of magnesium metal to a solution of copper sulfate. Describe the reaction between magnesium and copper sulfate solution.

Your answer should include:

- the name of this type of reaction
- an explanation of why this reaction happened
- three observations that could be made during this reaction

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

5 Steel is a common building material made from iron and carbon. Other metals can be added to make alloys of steel.

The table shows some information about iron and steel.

Material	What it contains	Properties	Relative cost
pure iron	iron	soft and weak, rusts easily	low
steel (low carbon)	iron and 0.1% carbon	harder and stronger than iron and easily shaped, rusts easily	low
steel (high carbon)	iron and 1% carbon	harder but more brittle than low carbon steel, rusts easily	low
stainless steel	iron and 18% chromium and 10% nickel	hard and very resistant to rusting	high
titanium steel	iron and 2% titanium	hard and able to withstand very high temperatures	very high
manganese steel	iron and 14% manganese	extremely hard	very high

Use the information in the table to answer the questions that follow.

(a) Name the alloy of steel that contains the lowest percentage of iron.

_____ [1]

(b) Titanium steel is used to make parts of a car engine. Give **one** reason why it is suitable for this use.

_____ [1]

(c) Paper clips are often used to hold sheets of paper together.



© minddream / iStock / Thinkstock

Name the material from the table that would be best for making paper clips. Explain your answer.

_____

_____

_____ [2]

(d) Some cutlery is shown below.



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Name the material from the table that would be best for making cutlery. Explain your answer.

_____

_____

_____ [2]

(e) Using the information in the table opposite, explain fully why low carbon steel is described as a composite material but iron is not.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

6 During the twentieth century many scientists proposed ideas about the Earth's crust and the cause of earthquakes.

In 1912 Alfred Wegener proposed his theory of '*continental drift* '.

In 1930 Arthur Holmes suggested his theory of '*mantle dynamics*'. His theory was based on the idea that the Earth's mantle was made of molten rock and was slowly moving due to the heat from the core of the Earth.

(a) Describe Wegener's theory of continental drift.

_____

_____

_____ [2]

(b) Explain how Arthur Holmes's idea supported Wegener's theory.

_____

_____ [1]

(c) A fault is the boundary where two tectonic plates meet. Explain fully how earthquakes happen at a fault line.

_____

_____

_____

_____

_____ [3]

(d) Name the scale that measures the size of an earthquake.

_____ [1]

(e) Give **two** other natural events that happen at fault lines.

1. _____

2. _____ [2]

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Examiner Only	
Marks	Remark

7 Baking soda contains sodium hydrogencarbonate. When it is used in baking cakes, the sodium hydrogencarbonate thermally decomposes.



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(a) Complete the balanced symbol equation for this reaction.

$NaHCO_3 \longrightarrow Na_2CO_3 +$ ☐ $+$ ☐

[3]

(b) Explain fully why this reaction is important in baking cakes.

_____

_____

_____ [2]

8 **(a)** The table below gives information about the colours of four indicators made from plants.

pH / Indicator	1	2	3	4	5	6	7	8	9	10	11	12
Blueberry	R	R	V	V	G	G	G	G	G	G	G	G
Red Cabbage	P	P	P	V	V	B	B	B	G	G	Y	Y
Grape Juice	R	R	R	R	R	R	G	G	G	G	G	G
Litmus Solution	R	R	R	R	R	R	V	B	B	B	B	B

Key

P	Pink
R	Red
Y	Yellow
G	Green
B	Blue
V	Violet

(i) What colour would the blueberry indicator be in hydrochloric acid?

_____ [1]

(ii) Name the indicator which would allow you to distinguish between magnesium hydroxide and sodium hydroxide.

_____ [1]

(b) A student wants to add an acid to an alkali and stop at pH7. Name the indicator that they should use. Explain your answer.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

(c) Litmus indicator, universal indicator and pH sensors can all be used to follow a neutralisation reaction.

(i) Put these methods in order of accuracy, the most accurate first.

_____ (most accurate)

_____

_____ [1]

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

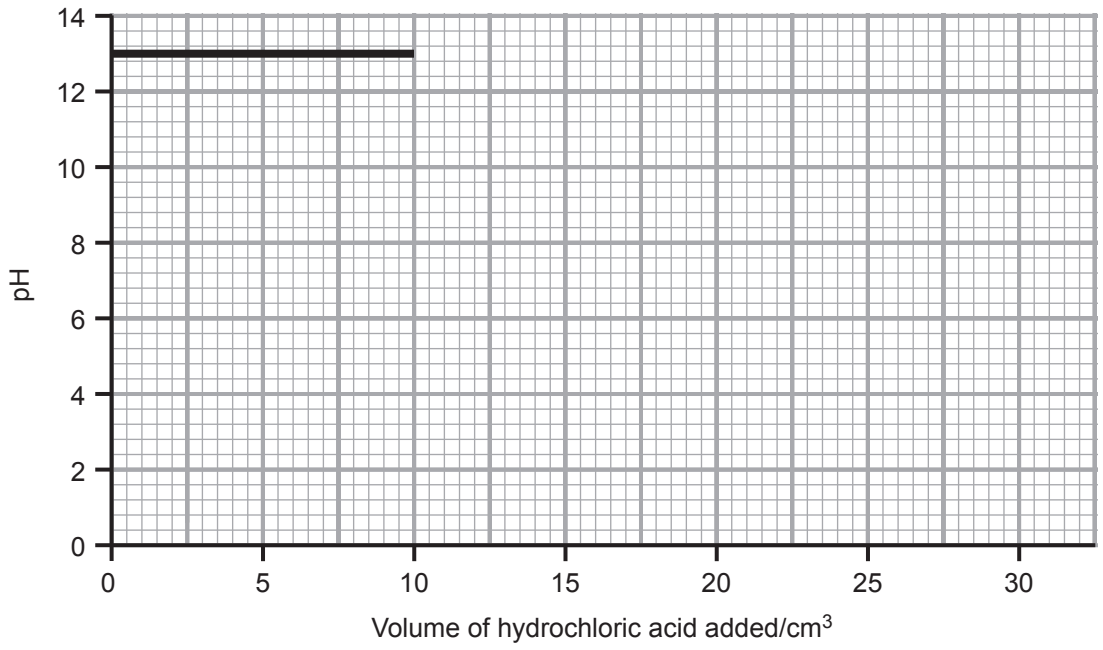
_____

_____

_____

_____ [3]

(d) Complete the graph below to show how the pH changes when hydrochloric acid is added to 20 cm^3 of sodium hydroxide.
The acid and alkali are of **equal strength**.

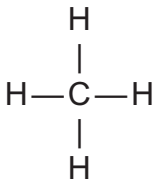
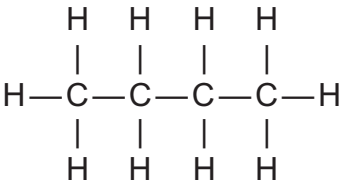


[2]

Examiner Only	
Marks	Remark

9 Some alkanes are hydrocarbon fuels.

(a) Complete the table below.

Name of alkane	Molecular formula	Structural formula
	CH_4	
propane	C_3H_8	
butane		

[3]

(b) Name the element that alkanes react with when they burn.

_____ [1]

(c) Name the process that makes many small molecules, such as propene, into longer chain molecules, such as polypropene.

_____ [1]

Examiner Only	
Marks	Remark

10 (a) Elements react in different ways to form compounds. During a reaction bonds are formed that hold atoms together.

Describe the different types of bonds between atoms when:

- sodium reacts with chlorine
- hydrogen reacts with oxygen

Your answer should include the names of the products formed.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

(b) Write a balanced symbol equation for the reaction between sodium and chlorine.

[ ] + [ ] → [ ]

[3]

THIS IS THE END OF THE QUESTION PAPER

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113159

Rewarding Learning

General Certificate of Secondary Education
2014–2015

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

WEDNESDAY 25 FEBRUARY 2015, MORNING

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

				AVAILABLE MARKS
1	**(a)**	**(i)**	Calcium chloride ($CaCl_2$) [1] water (H_2O) [1] (any order) [2]	
		(ii)	Neutralisation [1]	
	(b)		The volume of CO_2 increases with time [1] after 3 mins no more CO_2 produced/stops increasing after 25 cm^3 [1] [2]	
	(c)		Limewater [1] turns cloudy/milky [1] [2]	7
2	**(a)**		Mendeleev [1]	
	(b)		Noble gases [1]	
	(c)	**(i)**		

	Number of protons	Number of neutrons	Number of electrons
Sodium (Na)	11 [1]	12 [1]	11 [1]

[3]

		(ii)	Correct electronic structure drawn; 2.8.1 Consequential (c)(i) (12 or 23 only) [1]	
	(d)	**(i)**	Any **two** from: • yellow or orange flame/sparks • bubbles/fizzing/hissing/gas given off • exothermic/(melts) to form a ball • dissolves/disappears [2]	
		(ii)	Sodium hydroxide [1]	
	(e)		Any **two** from: • both alkali metals • both have one electron in outside shells • both have similar (chemical) reactions/properties [2]	11
3	**(a)**	**(i)**	Burette/measuring cylinder/syringe/pipette [1]	
		(ii)	Repeat the experiment [1]	
	(b)		Y is a mixture of permanent and temporary hard water [1] It needed a lot of soap solution both before and after boiling [1] [2]	
	(c)		Causes 'fur' on kettles/limescale in pipes/leaves stains on clothing/ block in pipes/cost qualified (e.g. replace kettles/more energy) **Not** soap related [1]	5

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4 Indicative Content:

AVAILABLE MARKS

- A displacement reaction has occurred
- Displacement is when a more reactive metal takes the place of a less reactive metal in a compound/full equation
- Magnesium is more reactive than copper/magnesium is higher in the reactivity series
- Copper sulfate is blue
- Solution fades/goes colourless
- Pink/red/brown solid is produced
- Silver/grey solid disappears
- Exothermic

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe the displacement reaction using **five or more** of the points above, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe the displacement reaction using **three to four** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe the displacement reaction using **one or two** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Not worthy of credit.	[0]

[6] 6

5 (a) Stainless steel [1]

(b) It can withstand high temperatures (only) [1]

(c) Low carbon steel [1]
(strong) and easily shaped [1]
(penalise reference to hard and ignore cost) [2]

(d) Stainless steel [1]
resistant to rusting [1] [2]

(e) Low carbon steel **combines** two different materials/elements/ carbon + iron [1]
harder/stronger than iron/has different properties to iron [1] [2] 8

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				AVAILABLE MARKS
6	**(a)**	Continents were once one land mass/Pangaea and have drifted/moved apart [1] over millions of years [1]	[2]	
	(b)	The continents move because the mantle moves	[1]	
	(c)	Tectonic plates move past each other [1] pressure/tension builds up [1] sudden movement/release of this pressure causes an earthquake [1]	[3]	
	(d)	The Richter scale	[1]	
	(e)	Volcanoes [1] mountain building/ranges [1]	[2]	9
7	**(a)**	H_2O [1] CO_2 [1] either order correct balancing [1]	[3]	
	(b)	It produces carbon dioxide/gas [1] which allows the cakes to rise/gives them a lighter texture [1]	[2]	5
8	**(a)**	**(i)** Red	[1]	
		(ii) Red cabbage	[1]	
	(b)	Litmus solution [1] it has a unique colour at pH7/neutral [1]	[2]	
	(c)	**(i)** pH sensor, universal indicator, litmus indicator	[1]	
		(ii) pH sensor gives a digital reading/pH to decimal places/exact number [1] universal indicator gives a range of (14) colours/shows strength [1] litmus only has two/three colours [1]	[3]	
	(d)	Graph drops at 20 cm^3 [1] levels/finishes at pH 1/2 [1]	[2]	10
9	**(a)**	Methane [1] correct structural formula for C_3H_8 [1] C_4H_{10} [1]	[3]	
	(b)	Oxygen	[1]	
	(c)	Polymerisation	[1]	5

10 (a) Indicative content

AVAILABLE MARKS

- Sodium loses one electron
- Chlorine gains one electron
- Idea of **transfer** from sodium to chlorine
- Sodium chloride

- There are two hydrogen atoms for every oxygen atom
- Idea of **sharing** electrons
- **Each** hydrogen atom shares **one** electron
- Water

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe the bonding using **five or more** of the points above, in a logical sequence making reference to both compounds. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe the bonding using **three to four** of the points above, in a logical sequence making reference to both compounds. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe the bonding using **one or two** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Not worthy of credit.	[0]

[6]

(b) **2**Na + Cl_2 → **2**NaCl
LHS [1] RHS [1]
correct balancing [1] [3] 9

Total **75**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2014–2015

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

GSS22

THURSDAY 13 NOVEMBER 2014, MORNING

TIME

1 hour 15 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 eleven** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Quality of written communication will be assessed in Questions **3** and **11**.
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 included in this question paper.

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

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1 Below is an outline of the modern Periodic Table.

																	He
Li																	
	Mg															Cl	Ar
										Cu							
										Ag							

(a) Using only the elements shown above and your knowledge, answer the following questions.

(i) Give the symbol of an element that is in **Group 2**.

_____ [1]

(ii) Name **two** elements that are in the same **period**.

_____ and _____ [1]

(iii) Name the element that has **only one** electron in its outer shell.

_____ [1]

(iv) Give the name of a gas shown on the Periodic Table above.

_____ [1]

(b) What name is given to elements in Group 7?

_____ [1]

(c) On the outline Periodic Table above, write the symbol for hydrogen in its correct position. [1]

Examiner Only	
Marks	Remark

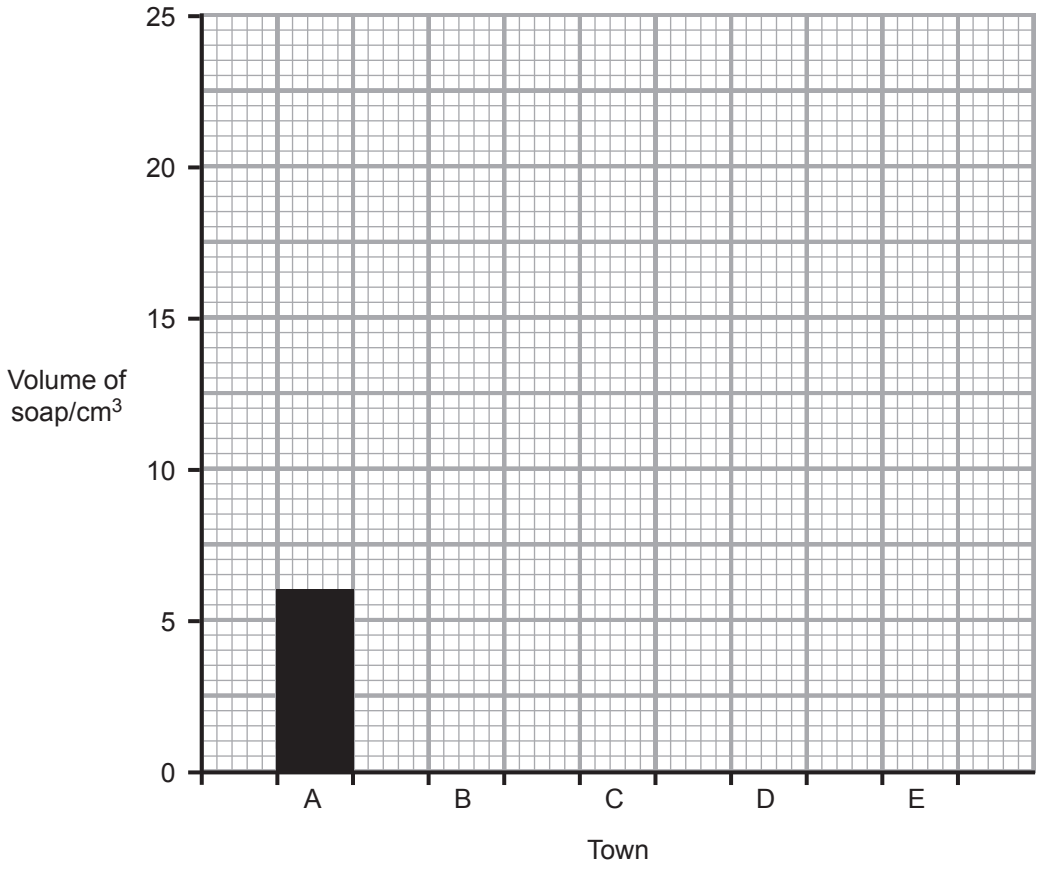
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Examiner Only	
Marks	Remark

2 **(a)** A scientist collected water samples from five towns (**A**, **B**, **C**, **D** and **E**). The table below gives the volume of soap solution needed to produce a lather with each of the samples.

Town	Volume of water/ cm^3	Volume of soap/ cm^3
A	50	6
B	50	17
C	50	24
D	50	20
E	50	11

(i) Use the information in the table to complete the bar chart below.



[2]

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Examiner Only	
Marks	Remark

(ii) Which town (**A**, **B**, **C**, **D** or **E**) has the hardest water?
Explain your answer.

Town _____

Explanation _____

_____ [2]

(iii) Scientists found that they needed 11 cm^3 of soap to produce a lather after shaking the water sample from **town E**.
Describe how they could continue their investigation to prove that the water is temporary hard water, including how the results should show this.

_____

_____

_____

_____

_____ [3]

(b) **(i)** Name **two** metal ions that cause hard water.

_____ and _____ [2]

(ii) Apart from taste, give **one** advantage of drinking hard water.

_____ [1]

(c) Hard water can cause undesirable deposits (fur) in kettles.

(i) Complete the word equation to show how these undesirable deposits form in kettles.

calcium hydrogencarbonate	→		+		+	

[3]

Examiner Only	
Marks	Remark

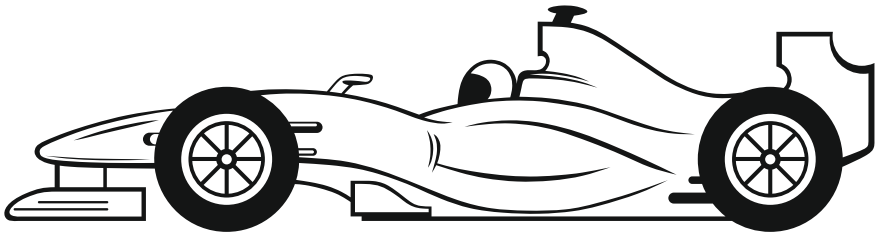
(ii) Give **one** reason why these deposits cause problems in kettles.

_____ [1]

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Examiner Only	
Marks	Remark

3 The first racing cars were built using aluminium. Around 1990 this was replaced with glass fibre, a composite material.



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Explain why the makers of modern Formula One cars choose glass fibre instead of aluminium to make the car bodies.

Your answer should include:

- a full explanation of what a composite material is
- the advantages of using glass fibre in Formula One car bodies
- a disadvantage of glass fibre.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

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(Questions continue overleaf)

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4 Given below is information about the reactions of some metals.

Metal	**Reaction with water**	**Reaction with hot water or steam**	**Reaction with air (when heated)**
Zinc	No reaction	Reacts slowly giving off a gas	Burns slowly to form a white powder
Magnesium	Very slow reaction	Reacts readily giving off a gas	Burns with a bright white light
Potassium	Violent reaction. It floats on the water surface, burning with a coloured flame	Extremely violent reaction. Burns with a coloured flame	Burns violently with a coloured flame
Copper	No reaction	No reaction	Reacts very slowly
Lead	No reaction	Reacts very slowly	Reacts slowly

Examiner Only	
Marks	Remark

(a) Use the information to put the metals in order of decreasing reactivity. The first one has been done for you.

Potassium

_____

_____

_____

_____

_____

[2]

(b) What colour is the flame produced by potassium in water?

_____ [1]

(c) Suggest why the reaction of potassium with hot water is not normally carried out in schools.

_____

_____ [1]

(d) Complete the word equation for the reaction of potassium with water.

potassium + water → [ ] + [ ]

[2]

(e) Choose a metal from the table opposite that would be most suitable for making water pipes in houses. Explain your answer.

_____

_____

_____ [2]

(f) Recent nanotechnology research has found that nano-sized particles of copper can be used to remove bacteria from drinking water. Explain fully what is meant by the term 'nanotechnology'.

_____

_____

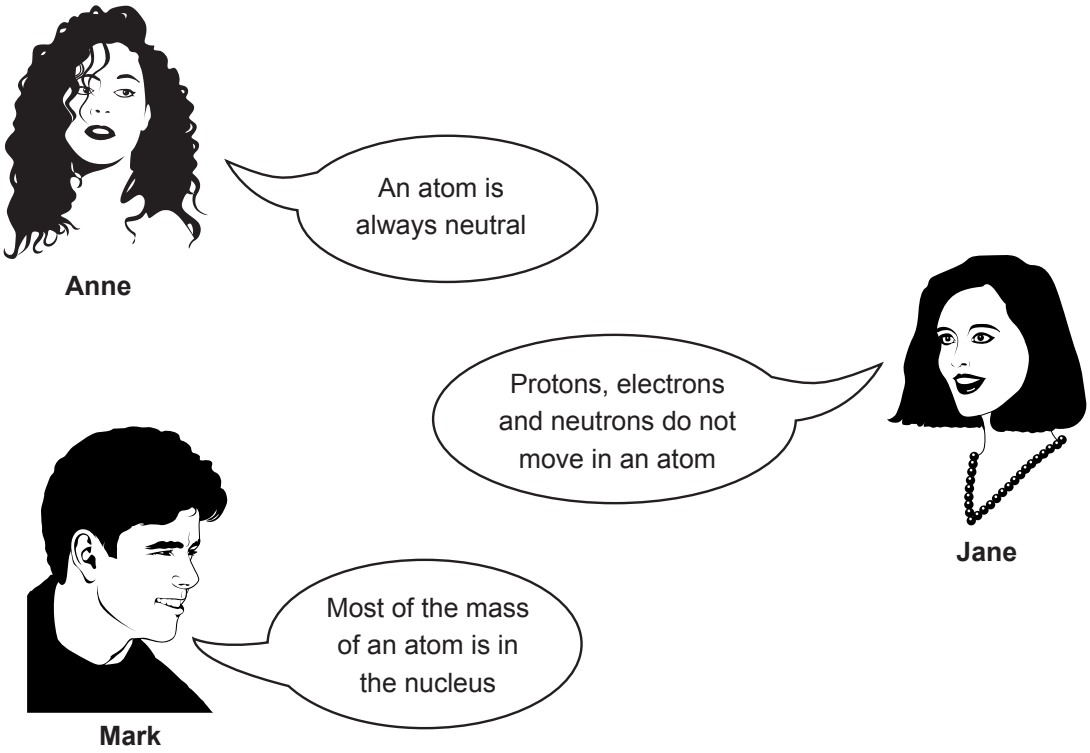
_____ [2]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

5 Shown below are three statements made by pupils in a class discussion about atoms. However, **one** is incorrect.



Name the pupil who gave the **incorrect** statement. Explain why this statement is incorrect.

_____

_____

_____

_____ [2]

BLANK PAGE

(Questions continue overleaf)

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6 Below is information about some gases that can pollute the atmosphere.

Gas	Formula	Lifetime in upper atmosphere /years	Contribution to greenhouse effect/%	Source of gas
Carbon dioxide	CO_2	7	50	Burning fossil fuels
CFC	CF_2Cl_2	100	14	Coolants in fridges
Methane	CH_4	10	18	Breakdown of organic waste Cows
Nitrous oxide	N_2O	170	6	Fertilisers Exhaust fumes Burning fossil fuels

Use the information in the table and your knowledge to answer the following questions.

(a) Name the gas which is a hydrocarbon.

_____ [1]

(b) Name the gas that contains three elements.

_____ [1]

(c) Name the gas(es) with five atoms in their formula.

_____ [1]

Examiner Only

Marks	Remark

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(d) Governments have set targets to reduce the greenhouse effect over the next twenty years.
Using the table, explain why a reduction in the use of fossil fuels would be the best way to achieve this.

_____

_____

_____

_____ [2]

(e) Methane burns to produce carbon dioxide. Complete the balanced symbol equation for the burning of methane.

CH_4 + ☐ → CO_2 + ☐

[3]

Examiner Only

Marks	Remark

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7 Below are the symbol equations for some chemical reactions.

Examiner Only	
Marks	Remark

A $HCl + NaOH \rightarrow NaCl + H_2O$

B $Mg + CuSO_4 \rightarrow MgSO_4 + Cu$

C $CuO + H_2 \rightarrow Cu + H_2O$

D $2Mg + O_2 \rightarrow 2MgO$

(a) Which reaction (**A**, **B**, **C** or **D**) represents a displacement reaction?

_____ [1]

(b) Which reaction (**A**, **B**, **C** or **D**) represents a neutralisation reaction? Explain your answer.

_____

_____ [2]

(c) One of these reactions represents reduction. Explain the term 'reduction'.

_____

_____ [1]

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Examiner Only	
Marks	Remark

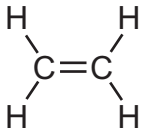
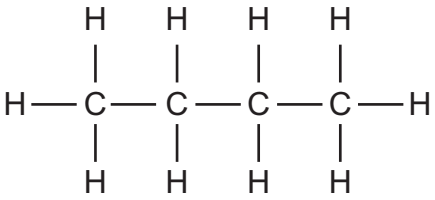
8 The compounds below are all hydrocarbons.

butane **ethane** **propene** **propane**

(a) Which of the above compounds is **not** an alkane?

_____ [1]

(b) Complete the table below about some hydrocarbons.

Name of hydrocarbon	Molecular formula	Structural formula
propane	C_3H_8	
ethene		
	C_4H_{10}	

[3]

(c) Propene can undergo polymerisation to form polypropene. Explain what is meant by the term 'polymerisation'.

_____

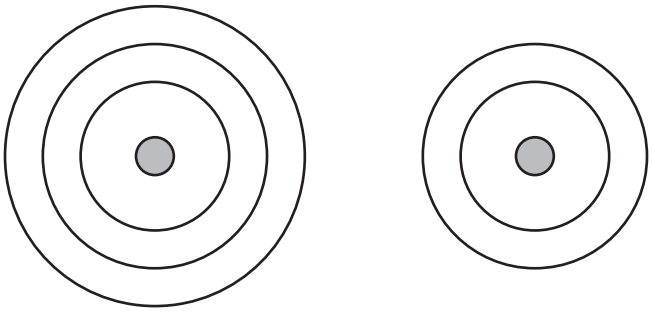
_____ [2]

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Examiner Only	
Marks	Remark

9 **(a)** Magnesium can react with oxygen to produce magnesium oxide.

(i) Complete the diagrams below to show the electronic structures of magnesium and oxygen.

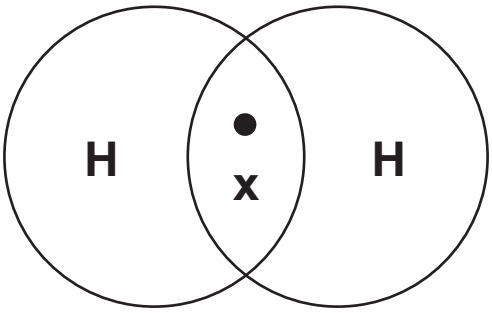


Magnesium Oxygen

[2]

(ii) Draw arrows on the diagrams above to show how electrons are transferred when these atoms combine to form magnesium oxide. [2]

(b) Below is a diagram of a hydrogen molecule.



In terms of electrons, describe the bonding in a molecule of hydrogen.

_____

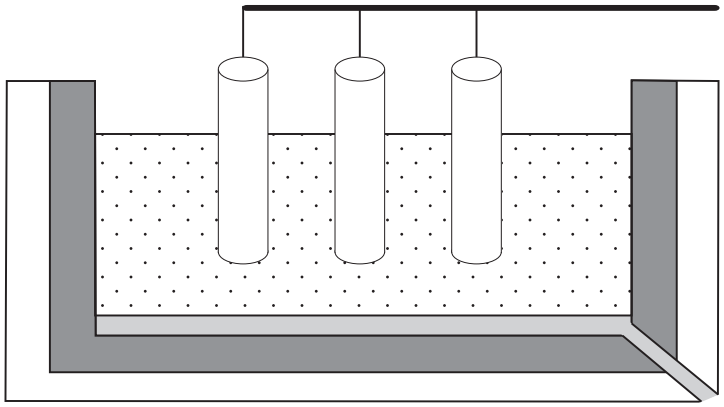
_____

_____ [2]

10 Aluminium can be extracted from aluminium oxide using electrolysis.

Examiner Only

Marks	Remark



(a) On the diagram above, label the anode and cathode. [2]

(b) What is meant by the term 'electrolysis'?

_____

_____ [2]

(c) Aluminium is produced at the cathode. Complete the ionic equation for this reaction.

_____ + _____ → Al

[2]

(d) Name the gas produced at the anode.

_____ [1]

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Examiner Only	
Marks	Remark

11 The **Greeks** were the first to have the idea of elements. Early work on the Periodic Table began in the 19th Century by an English chemist called **John Newlands**. It was further refined by a Russian chemist called **Dmitri Mendeleev**.

Outline the development of the modern Periodic Table, starting with the early ideas of the Greeks.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

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Rewarding Learning

General Certificate of Secondary Education
2014–2015

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

THURSDAY 13 NOVEMBER 2014, MORNING

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

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					AVAILABLE MARKS
1	(a)	(i)	Mg/magnesium	[1]	
		(ii)	Any **two**: Magnesium/chlorine/argon (accept symbols)	[1]	
		(iii)	Lithium/Li	[1]	
		(iv)	Chlorine/helium/argon (accept symbols)	[1]	
	(b)		The Halogens	[1]	
	(c)		H in correct position	[1]	6
2	(a)	(i)	All four bars drawn correctly (three bars drawn correctly award [1])	[2]	
		(ii)	C [1] It took the most soap to produce a lather [1]	[2]	
		(iii)	Measure out 50 cm^3 of water/measure same volume [1] boil the sample [1] less soap is needed after boiling [1]	[3]	
	(b)	(i)	Calcium [1] and magnesium [1] (either order)	[2]	
		(ii)	Good for teeth or bones/prevents heart disease	[1]	
	(c)	(i)	Calcium carbonate [1] water [1] carbon dioxide [1] (any order)	[3]	
		(ii)	It stops kettles working properly/wastes energy	[1]	14

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3 Indicative Content:

AVAILABLE MARKS

- A composite material is one that combines the properties of more than one material
- to produce a more useful/new material for a particular purpose
- **Three** from glass fibre is light/glass fibre is easily moulded/car can go faster/ car will use less fuel or other suitable
- Composites are expensive [6]

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe composite materials using **five or more** of the points above, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe composite materials using **three or four** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe composite materials using **one or two** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Not worthy of credit.	[0]

6

4 (a) Magnesium, zinc, lead, copper (any two in correct order [1]) [2]

(b) Lilac [1]

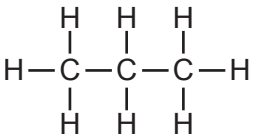
(c) Too dangerous/too violent/too reactive [1]

(d) potassium hydroxide [1]
hydrogen [1] (either order) [2]

(e) Copper [1]
it does not react with cold or hot water [1] [2]

(f) The reduction of the size of particles (particles are 1×10^{-9} m) [1]
to produce new properties [1] [2]

10

				AVAILABLE MARKS
5	Pupil: Jane [1] Explanation: electrons do move/orbit the nucleus [1]		[2]	2
6	**(a)** Methane		[1]	
	(b) CFC		[1]	
	(c) CFC and methane		[1]	
	(d) Contributes to at least 50% of greenhouse effect/most of greenhouse effect [1] reduction would happen quickly/only lasts for 7 years in upper atmosphere [1]		[2]	
	(e) O_2 [1] H_2O [1] Correct balancing [1]		[3]	8
7	**(a)** B		[1]	
	(b) A [1] it shows an acid and alkali reacting/to produce salt and water [1]		[2]	
	(c) Removal of oxygen/addition of hydrogen		[1]	4
8	**(a)** propene		[1]	
	(b) 	[1]		
	C_2H_4	[1]		
	Butane	[1]	[3]	
	(c) **Many** small molecules/monomers [1] joining together (in long chains) [1]		[2]	6

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					AVAILABLE MARKS
9	**(a)**	**(i)**	Mg: 2.8.2 [1] O: 2.6 [1]	[2]	
		(ii)	Arrow (s) drawn to indicate: 2 electrons moving [1] from magnesium to oxygen [1]	[2]	
	(b)		Idea of sharing [1] each hydrogen shares 1 electron [1]	[2]	6
10	**(a)**		Correct labels for anode [1] and cathode [1]	[2]	
	(b)		Using electricity [1] to break down/decompose a compound [1]	[2]	
	(c)		Al^{3+} [1] 3e [1]	[2]	
	(d)		Oxygen (accept carbon dioxide)	[1]	7

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11 Indicative Content:

AVAILABLE MARKS

- The Greeks had four elements
- Earth, fire, air and water (any 3 named)
- John Newlands developed the law of octaves
- Each eighth element was similar
- Mendeleev ordered the elements into group and periods/separated metals and non-metals
- Newlands/Mendeleev ordered the elements according to mass number/ atomic mass
- Mendeleev left gaps for undiscovered elements
- Modern periodic table is ordered by atomic number/includes more elements/includes noble gases [6]

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe the development of the periodic table using **six or more** of the points above, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe the development of the periodic table using **three – five** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe the development of the periodic table using **one or two** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Not worthy of credit.	[0]

6

Total **75**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2013–2014

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

GSS22

THURSDAY 15 MAY 2014, MORNING

TIME

1 hour 15 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 nine** questions.

INFORMATION FOR CANDIDATES

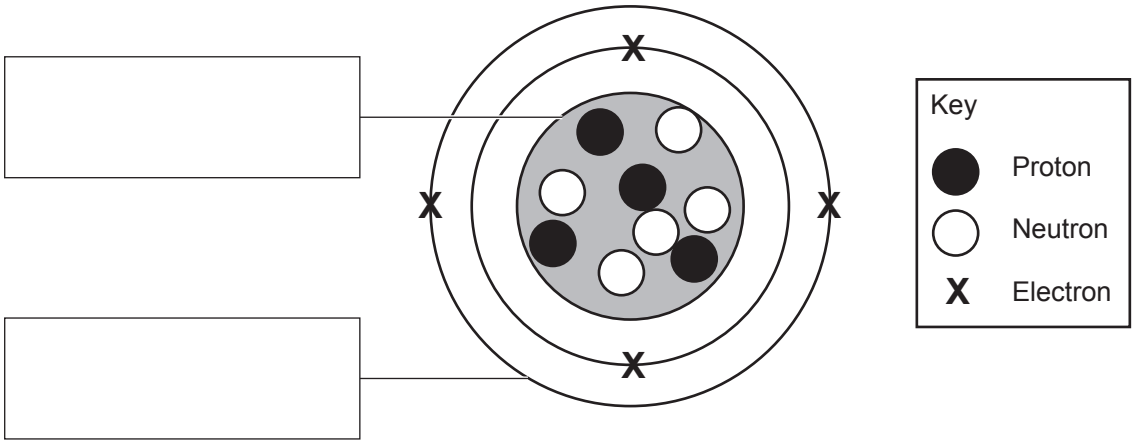
The total mark for this paper is 75.
Quality of written communication will be assessed in Questions **3(a)** and **9**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

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

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Examiner Only	
Marks	Remark

1 The diagram below shows an atom of an element.



(a) Complete the diagram above by adding labels to the two boxes. [2]

(b) What is the **atomic number** of this element?

_____ [1]

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

_____

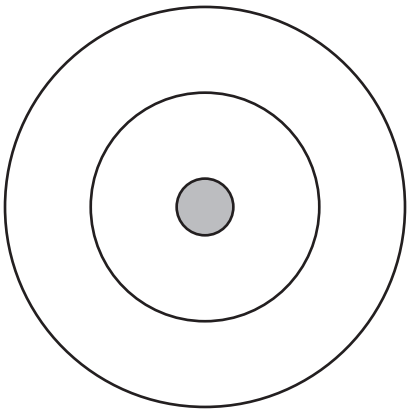
_____ [1]

(d) To which group of the Periodic Table does this element belong? Explain your answer in terms of its electronic structure.

_____

_____ [2]

(e) Oxygen has eight electrons. Complete the diagram below to show the electronic structure of oxygen.



[1]

(f) **(i)** Name the compound formed in the reaction between magnesium and oxygen.

_____ [1]

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

_____ [1]

Examiner Only

Marks	Remark

2 The table below shows the percentage of the most common elements found in the igneous rocks in the Earth's crust.

Element	Percentage
Aluminium	8.1
Calcium	3.6
Iron	5.0
Magnesium	2.1
Oxygen	47.0
Phosphorus	0.1
Potassium	2.6
Silicon	28.0
Sodium	2.9
Titanium	0.6

Use the information in the table and your knowledge to answer the following questions.
You may find your Data Leaflet helpful.

(a) Igneous rocks are only one **type** of rock. Name the other two types.

_____ and _____ [2]

(b) Name the most common **metal** in the Earth's crust.

_____ [1]

(c) Calculate the total percentage of alkaline earth metals in the Earth's crust.

_____ % [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

3 **(a)** Potassium and sodium are Group 1 metals. Compare their reactivity with water.

Your answer should include:

- two similarities between the reactions
- two differences between the reactions
- the products of one of the reactions

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

(b) Francium is another Group 1 metal. Explain fully why it is not used in the school laboratory to demonstrate the reactions of Group 1 metals with water.

[2]

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Examiner Only	
Marks	Remark

4 Acid indigestion is caused by excess hydrochloric acid in the stomach. It can be treated using antacid tablets which contain sodium hydrogencarbonate.



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(a) Complete the word equation for the reaction between stomach acid and the antacid tablet.

sodium hydrogencarbonate + hydrochloric acid → [ ] + [ ] + [ ]

[3]

(b) Suggest one reason why antacid tablets do **not** contain sodium hydroxide.

_____

_____ [1]

(c) Sodium hydrogencarbonate is also found in baking soda. The symbol equation showing the effect of heat on sodium hydrogencarbonate is given below. Balance this equation.

$$NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$$

[1]

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Examiner Only	
Marks	Remark

5 **(a)** Spinel ($MgAl_2O_4$) is a mineral that contains aluminium.

(i) How many elements are present in spinel?

_____ [1]

(ii) Name the metals present in spinel.

_____ [1]

(iii) How many atoms are represented in the formula for spinel?

_____ [1]

(b) Bauxite is the most common mineral containing aluminium. It contains two aluminium atoms and three oxygen atoms. Write the chemical formula for bauxite.

_____ [1]

(c) Below is a displacement reaction involving aluminium.

aluminium + iron sulfate $\rightarrow$ iron + aluminium sulfate

Using this example, explain fully what is meant by the term **displacement**.

_____

_____

_____ [2]

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Examiner Only	
Marks	Remark

6 **(a)** Aquavol is bottled natural spring water. The label from a bottle is shown below.

Aquavol Analysis

Bottle contents in 0.25 litres

Ions	**mg**
calcium	2.5
magnesium	1.0
sodium	1.6
potassium	1.75
chlorides	2.0
nitrates	1.0
sulfates	1.5

Aquavol is suitable for a low sodium diet

9 781565 924796

(i) Calculate the mass of sodium ions you would consume if you drank **one** litre of Aquavol water.

(Show your working out.)

_____ mg [2]

(ii) Name two metal ions from the label that are responsible for hard water.

_____ and _____ [1]

(b) (i) What is meant by the term hard water?

_____

_____ [1]

(ii) Give two ways that **permanent** hard water can be softened.

1. _____

2. _____ [2]

(c) Temporary hard water can form undesirable deposits of calcium carbonate on shower doors. This can be removed by cleaning products containing a dilute solution of hydrochloric acid. Complete the balanced symbol equation below to show this reaction.

$$\square + CaCO_3 \rightarrow \square + CO_2 + H_2O$$

[3]

Examiner Only

Marks	Remark

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(d) A student conducted a fair test to investigate the hardness of different samples of water.
The results are shown below.

Sample	Height of lather before boiling/mm	Height of lather after boiling/mm
A	8	8
B	15	24
C	28	28

(i) What can be concluded about the type of water in sample **B**?
Explain your answer.

_____

_____

_____ [2]

(ii) Suggest how the student could have carried out this investigation.

_____

_____

_____

_____

_____ [3]

(iii) Describe how the student could have ensured this investigation was valid (fair).

_____

_____ [2]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

7 Compounds can be formed by two different types of bonds.

(a) (i) Describe in terms of electrons how the compound sodium chloride is formed from sodium and chlorine.

_____

_____

_____

_____ [3]

(ii) Name another compound that has the same type of bonding as sodium chloride.

_____ [1]

(b) Water is a compound that has a different type of bond to sodium chloride.

(i) Draw a diagram (showing the outer electrons only) of the bonding in a molecule of water.

[3]

(ii) The bonding in a hydrogen molecule is the same type as in a water molecule. Why is the hydrogen molecule **not** described as a compound?

_____

_____ [1]

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Examiner Only	
Marks	Remark

8 **(a)** The table shows some information about different plastics.

Plastic	Density kg/m^3	Maximum usable temperature/°C	Solubility in oil
low density polyethene	920	85	insoluble below 80 °C
high density polyethene	960	120	insoluble below 110 °C
polystyrene	1050	65	soluble
polychloroethene	1390	60	soluble
polypropene	900	150	soluble above 80 °C

(i) The boiling point of water is 100 °C. Explain which type of polyethene is most suitable to be used to make a kettle.

_____

_____ [1]

(ii) Which plastic would be the most suitable to make a pipe to carry oil at 90 °C? Explain your choice fully.

_____

_____

_____

_____ [3]

(b) Scientists are trying to make more plastics that are biodegradable. Explain fully why it is important to the environment to make such plastics.

_____

_____

_____ [2]

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(c) Polyethene is made from ethene.

(i) Name and explain fully the process used.

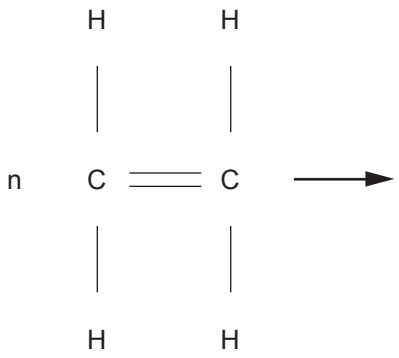
_____

_____

_____

_____ [3]

(ii) Complete the balanced symbol equation below for the reaction involved.



[3]

(d) Many useful chemicals can be extracted from crude oil.
What name is given to the method of separating useful chemicals from crude oil?

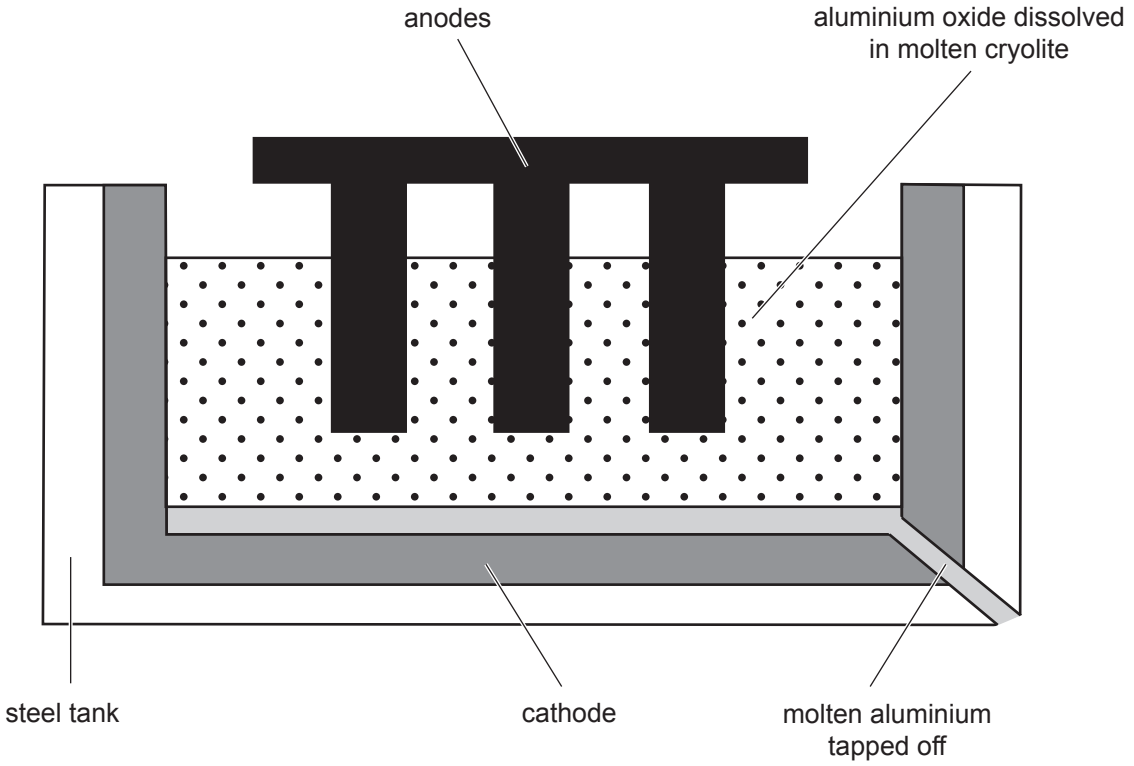
_____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

9 Aluminium metal can be extracted from aluminium oxide by electrolysis as shown in the diagram below.



Explain how the process of electrolysis is used to extract aluminium.
Your answer should state what electrolysis is and make reference to the **ions** involved in the extraction of aluminium.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

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2013–2014

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

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				AVAILABLE MARKS
1	**(a)**	Nucleus [1] (electron) shell [1]	[2]	
	(b)	4	[1]	
	(c)	The number of protons **and** neutrons	[1]	
	(d)	Group 2 [1] the atom has two electrons in its outside shell [1]	[2]	
	(e)	2.6	[1]	
	(f) **(i)**	Magnesium oxide	[1]	
	(ii)	Oxidation (accept combustion)	[1]	9
2	**(a)**	Sedimentary [1] metamorphic [1] (Any order)	[2]	
	(b)	Aluminium	[1]	
	(c)	5.7	[1]	4

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AVAILABLE MARKS

3 (a) Indicative Content:

- Similarities: **two** from: metal floats on water, bubbles/fizzing/gas given off, moves on water, metal dissolves/disappears, exothermic
- Differences: **two** from: potassium more vigorous, faster, lilac flame
- Products: metal hydroxide and hydrogen [6]

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to compare the reactivity of potassium and sodium with water using **five or six** of the points above, in a logical sequence which includes a named product. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to compare the reactivity of potassium and sodium with water using **three to four** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates compare the reactivity of potassium and sodium with water using **one or two** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Not worthy of credit.	[0]

(b) Francium is very/too reactive [1]
it would be dangerous [1] [2]

8

4 (a) Sodium chloride [1]
water [1]
carbon dioxide [1] (Any order) [3]

(b) Sodium hydroxide is a strong alkali/too corrosive [1]

(c) $2NaHCO_3$ [1]

5

5 (a) (i) Three [1]

(ii) Magnesium and aluminium [1]

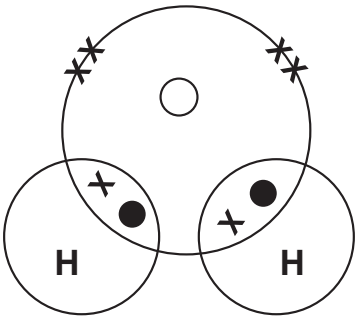
(iii) Seven [1]

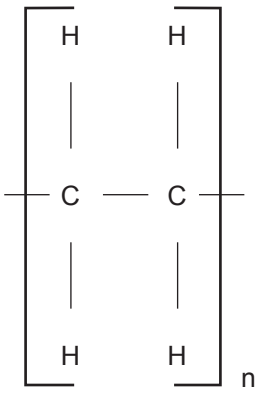
(b) Al_2O_3 [1]

(c) Aluminium is more reactive than iron [1]
and replaces a less reactive metal from its salt [1] [2]

6

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					AVAILABLE MARKS
6	**(a)**	**(i)**	1.6 × 4 [1] 6.4 [1]	[2]	
		(ii)	Calcium **and** magnesium	[1]	
	(b)	**(i)**	Difficult to lather with soap/forms scum with soap	[1]	
		(ii)	Any two from: adding washing soda/ion exchange/distillation	[2]	
	(c)		HCl [1] $CaCl_2$ [1] correct balancing [1] (**2**HCl)	[3]	
	(d)	**(i)**	B is temporary hard water [1] there was more lather after boiling than before/boiling softened the water [1]	[2]	
		(ii)	Add soap and shake [1] until a permanent lather forms/measure the height of the lather [1] repeat with boiled water samples [1]	[3]	
		(iii)	Any two from: same amount of soap [1] same amount of water [1] same amount of shaking [1] or other suitable [1]	[2]	16
7	**(a)**	**(i)**	Sodium loses one electron [1] chlorine gains one electron [1] to form full outer shells/idea of electrostatic attraction/idea of forming ions [1]	[3]	
		(ii)	Any named ionic compound, e.g. magnesium oxide	[1]	
	(b)	**(i)**	Correct diagram including:  1 oxygen and 2 hydrogens [1] Correct sharing [1] Correct total number of electrons [1]	[3]	
		(ii)	The two atoms are the same/only one element	[1]	8

				AVAILABLE MARKS
8	**(a)**	**(i)**	High density polyethene's maximum usable temperature is above 100 °C (penalise other responses) [1]	
		(ii)	High density polyethene [1] insoluble in oil below 110 °C [1] maximum usable temperature above 90 °C [1] (penalise reference to density) [3]	
	(b)		Biodegradable plastics will decompose [1] reduce landfill sites or other suitable [1] [2]	
	(c)	**(i)**	Polymerisation [1] **Many** small molecules/ethene molecules [1] Join together/make a long chain polymer [1] [3]	
		(ii)	 Double bond removed [1] (Square) brackets [1] n in correct position [1] [3]	
	(d)		Fractional distillation [1]	13

9 Indicative Content:

- Electrolysis is the breaking down of a substance/bauxite
- Using electricity
- Anode is the positive electrode and cathode is the negative electrode
- Anode/cathode are made from carbon/graphite
- Aluminium ions move [1]
- to the negative electrode/cathode [1]
- where they gain three [1]
- electrons [1]

(Ionic equation acceptable $Al^{3+} + 3e^- \rightarrow Al$ [2])

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe the process of electrolysis and its role in the extraction of aluminium using **five or more** of the points above, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to describe the process of electrolysis and its role in the extraction of aluminium using **three to four** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe the process of electrolysis and its role in the extraction of aluminium using **one or two** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Not worthy of credit.	[0]

[6] 6

Total **75**

AVAILABLE MARKS

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2013–2014

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

GSS22

TUESDAY 25 FEBRUARY 2014, MORNING

TIME

1 hour 15 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 eleven** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Quality of written communication will be assessed in Questions **3(b)** and **11(b)**.
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 included for your use.

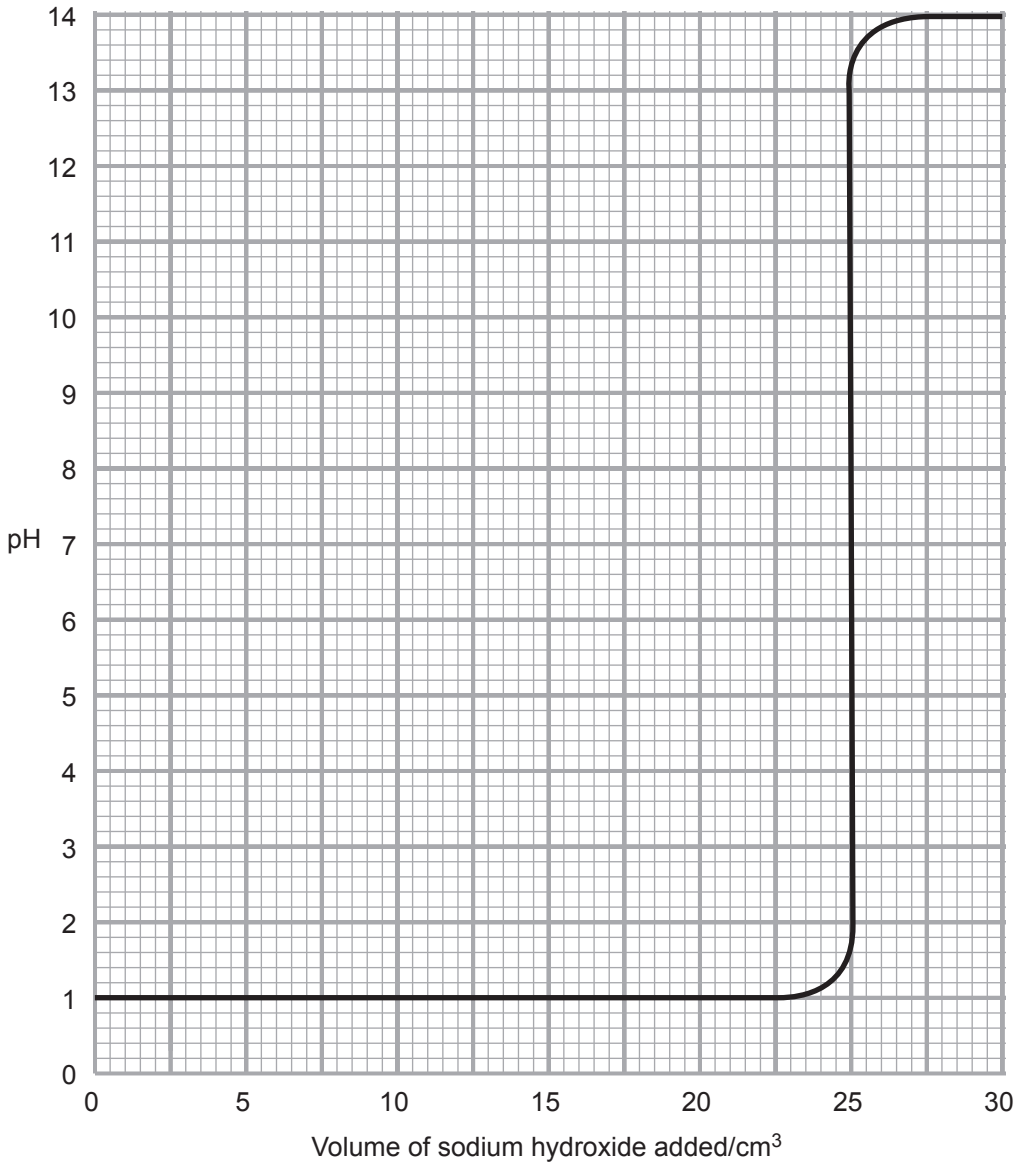
For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total Marks	

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Examiner Only	
Marks	Remark

1 A student was asked to investigate how the pH changed during the reaction between hydrochloric acid and sodium hydroxide. Sodium hydroxide solution was added to 25 cm^3 of dilute hydrochloric acid and the pH was recorded using a pH sensor.

The results are shown in the graph below.



(a) Use the graph to give:

(i) the pH of the hydrochloric acid before adding sodium hydroxide.

_____ [1]

(ii) the volume of sodium hydroxide required to neutralise the acid.

_____ cm^3 [1]

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(b) The student could also have investigated the pH change using universal indicator solution.

(i) What colour is universal indicator in a neutral solution?

_____ [1]

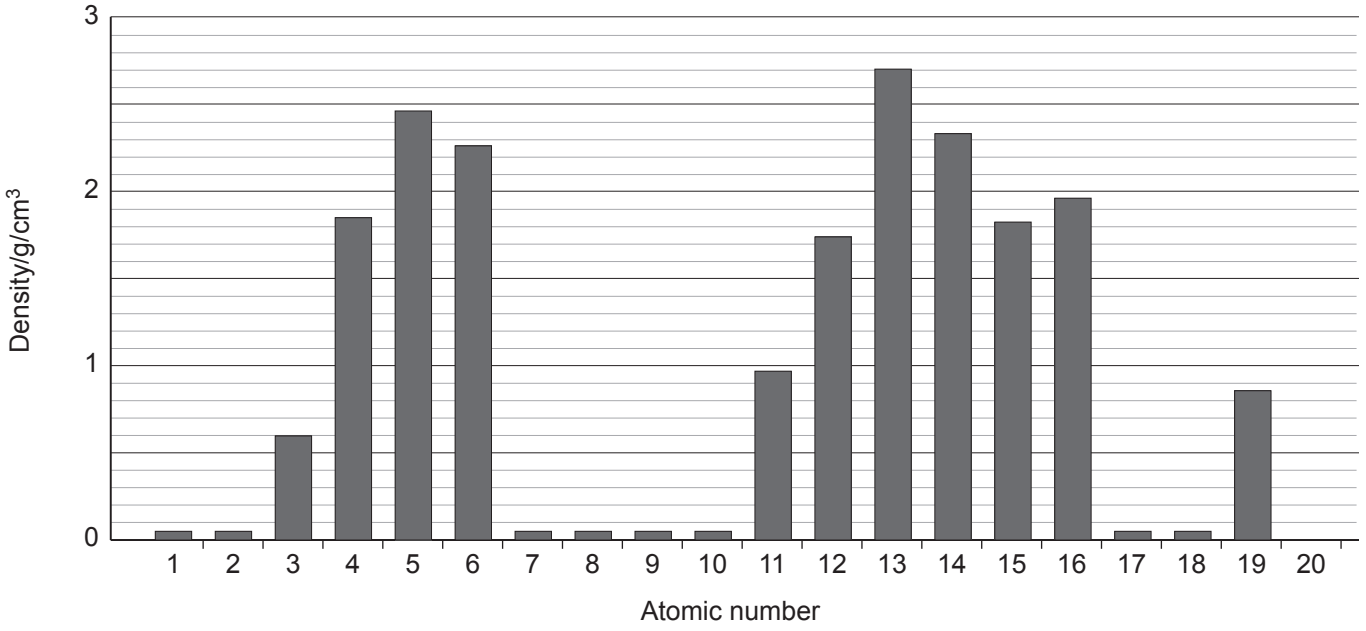
(ii) Give **one** advantage of using a pH sensor rather than universal indicator in this experiment.

_____ [1]

Examiner Only	
Marks	Remark

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2 Below is a graph showing the densities of the first nineteen elements of the Periodic Table.



Use the graph and your Data Leaflet to answer the following questions.

Examiner Only	
Marks	Remark

(a) What is the density of the element with atomic number 3?

_____ g/cm^3 [1]

(b) Name the element with the highest density and state the group of the Periodic Table to which it belongs.

Name _____ Group _____ [2]

(c) Suggest a value for the density of the element with atomic number 20.

_____ g/cm^3 [1]

(d) What do the elements with the lowest densities have in common?

Tick (✓) the correct answer.

☐ They are all metals.

☐ They are all gases.

☐ They are all in the same group of the Periodic Table. [1]

Examiner Only	
Marks	Remark

3 Water can be described as hard or soft.

(a) What is meant by the term hard water?

_____

_____ [2]

(b) Fermanagh is a hard water area. Give the advantages and disadvantages of hard water for the people and the area. Your answer should include the cause of hard water and one method of softening it.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [6]

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Examiner Only	
Marks	Remark

4 A student investigated the reaction between sodium hydrogencarbonate and hydrochloric acid. He used the apparatus shown below to measure the mass of the beaker and its contents for seven minutes. The reaction produces carbon dioxide.

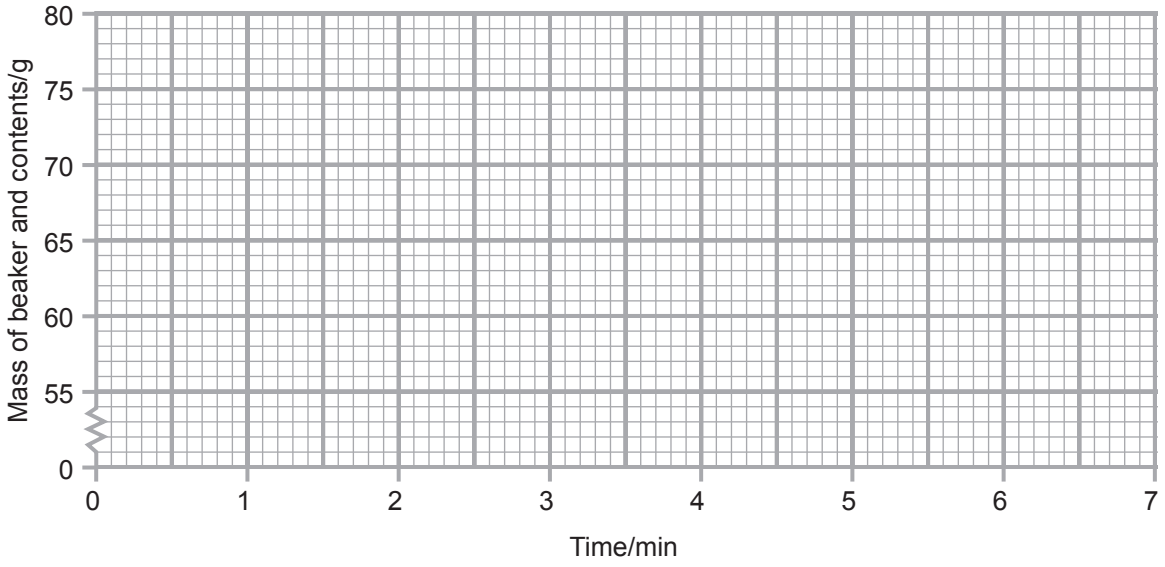


© Andrew Lambert Photography / Science Photo Library

His results are shown in the table.

Time/min	0	1	2	3	4	5	6	7
Mass of beaker and contents/g	80	69	64	61	59	58	58	58

(a) On the grid below plot these points and draw a curve of best fit.



[3]

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(b) How did the student know that the reaction was finished?

_____ [1]

Examiner Only	
Marks	Remark

(c) Complete the word equation for this reaction.

sodium hydrogencarbonate + hydrochloric acid → carbon dioxide + _____ + _____

[2]

(d) Describe the chemical test used to identify carbon dioxide and include the result you would expect.

_____

_____ [2]

(e) **(i)** Calculate the change in mass during this reaction.

_____ g [1]

(ii) Explain why the mass changed during the reaction.

_____

_____ [1]

(f) The student repeats the experiment using weaker ethanoic acid rather than hydrochloric acid.

Describe **one** similarity and **one** difference that would be observed during the reactions of each of these acids with sodium hydrogencarbonate.

_____

_____

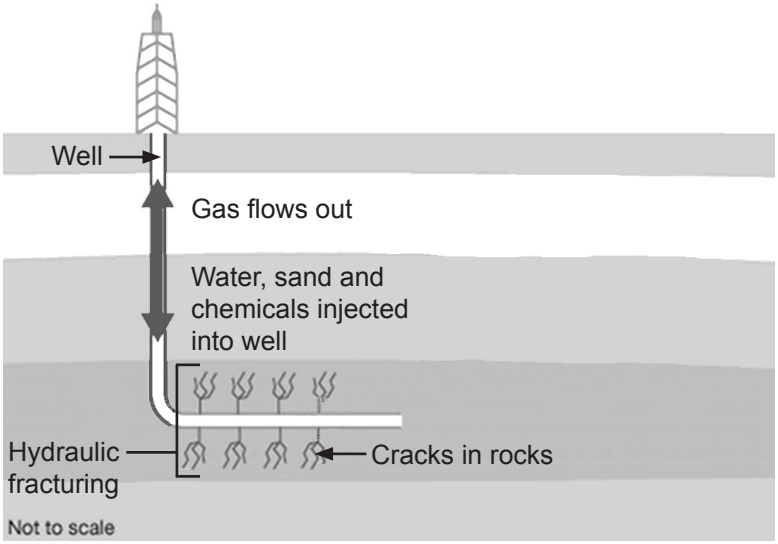
_____

_____ [2]

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Examiner Only	
Marks	Remark

5 Below is some information about hydraulic fracturing (fracking), including an illustration of the process.



Reserves of natural gas and oil are getting harder to find. Fracking allows the production of natural gas from rock deep below the Earth's surface.

Fracking involves drilling into the rock and injecting a high pressure liquid. This creates new cracks in the rock which allows the gas to escape.

Internationally there are concerns about health and safety as well as the effects of fracking on the environment. These include the likely contamination of groundwater, risks to air quality and the possible mishandling of waste. Fracking has been suspended or banned in some countries.

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

(a) Why is it important to find new, more efficient ways of extracting fossil fuels?

_____ [1]

(b) State and explain **one** environmental concern linked with fracking.

_____

_____

_____ [2]

Over its lifetime an average well will require up to 20 000 000 litres of fracking liquid which is mainly water. Chemical additives used in the fracking liquid make up 2% of the total volume.

(c) Calculate how many litres of chemical additives are used in the lifetime of a fracking well.
(Show your working out.)

_____ litres [2]

A report in the UK concluded that fracking was the likely cause of some small earthquakes that happened during drilling. However, fracking does not cause most earthquakes.

(d) Explain how an earthquake typically happens.

_____

_____ [2]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

6 All atoms are made up of three subatomic (smaller) particles.

(a) **(i)** Name the subatomic particle that is the lightest.

_____ [1]

(ii) Name the subatomic particle which has no charge.

_____ [1]

(b) What is meant by the term atomic number?

_____

_____ [1]

(c) Suggest why the overall charge of an atom is neutral.

_____

_____ [1]

(d) Sodium oxide (Na_2O) is used in the manufacture of glass.

Complete the table below giving the number of each named particle.
You may find your Data Leaflet useful.

	Na	O	Na_2O
Number of protons			
Number of electrons			
Number of neutrons			

[3]

BLANK PAGE

(Questions continue overleaf)

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Examiner Only	
Marks	Remark

7 A student investigated the reactions of some metals and their compounds. Some observations of these reactions are given below.

Reactants	Observations
copper + silver nitrate solution	colourless solution turned blue, silver coloured solid formed
iron + zinc sulfate solution	nothing happened
silver + iron(II) sulfate solution	nothing happened
zinc + copper(II) sulfate solution	blue solution turned colourless, pink/brown solid formed
iron + copper(II) sulfate solution	blue solution turned colourless, pink/brown solid formed

(a) What name is given to these types of reactions?

_____ [1]

(b) Complete the word equation for copper reacting with silver nitrate.

copper + silver nitrate → [ ] + [ ]

[2]

(c) Why did the colourless solution turn **blue** when copper reacted with silver nitrate solution?

_____

_____ [1]

(d) Zinc is the most reactive metal used by the student. Complete the reactivity series below for the other metals used.

1 zinc

2 _____

3 _____

4 _____ [1]

(e) These metals will also react with acid. **Balance** the symbol equation below for the reaction of zinc with hydrochloric acid.

$$Zn + HCl \rightarrow ZnCl_2 + H_2$$

[1]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

8 **(a)** In 1658 Archbishop James Ussher calculated the age of the Earth.

(i) Explain fully how he calculated the age of the Earth.

_____

_____

_____ [2]

(ii) What is the age of the Earth estimated by Archbishop Ussher?

_____ [1]

(b) **(i)** Scientists can use radiometric dating of rocks to calculate the age of the Earth. Explain the method of radiometric dating.

_____

_____

_____

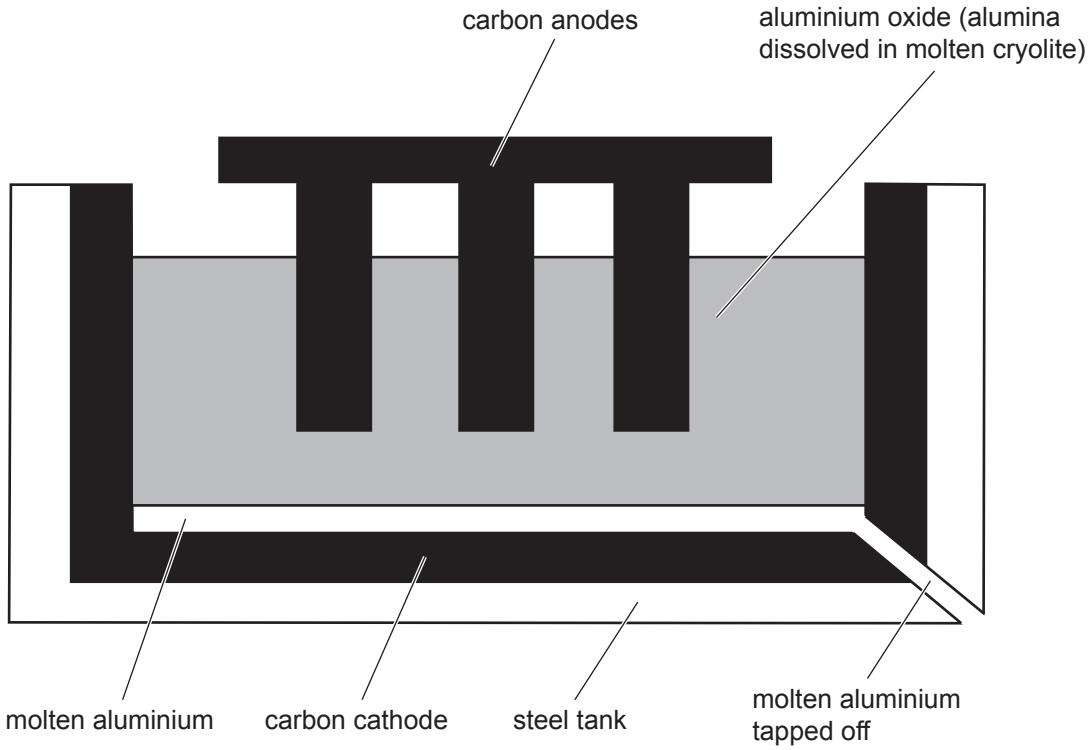
_____ [2]

(ii) What is the age of the Earth as calculated by scientists using radiometric dating?

_____ [1]

Examiner Only	
Marks	Remark

9 Aluminium can be extracted from aluminium oxide using electrolysis. The apparatus is shown below.



(a) What is meant by the term anode?

_____ [1]

(b) Explain in terms of ions and electrons how aluminium is formed at the cathode.

_____

_____

_____

_____ [3]

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10 The table below shows the percentages of the gases in the exhaust fumes from a car.

Name of gas	Formula of gas	Percentage/%
nitrogen	N_2	68.0
carbon dioxide	CO_2	15.0
carbon monoxide	CO	1.0
oxygen	O_2	0.8
nitrogen oxide	NO	0.3
sulfur dioxide	SO_2	0.1
hydrocarbons	No formula	0.1
noble gases	No formula	1.7
water vapour	H_2O	

(a) Calculate the percentage of **water vapour** in exhaust fumes.

_____ % [1]

(b) Calculate the total percentage of gases containing **carbon**.

(Show your working out.)

_____ % [2]

Examiner Only	
Marks	Remark

(c) From the table give the formula of **one** compound.

_____ [1]

(d) One of the hydrocarbons produced is propane. Complete and balance the symbol equation below for the complete combustion of propane.

C_3H_8 + ☐ → ☐ + ☐

[3]

(e) In the space below draw the structural formula of propane.

[1]

Examiner Only

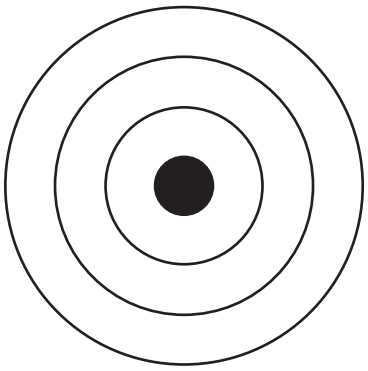
Marks	Remark

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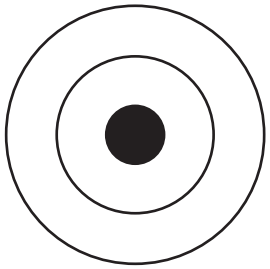
Examiner Only	
Marks	Remark

11 Magnesium reacts with oxygen to form the compound magnesium oxide.

(a) Complete the diagrams to show the arrangement of **all** the electrons in a magnesium atom and an oxygen atom.



magnesium atom



oxygen atom

[2]

(b) Explain fully in terms of the atoms and ions involved, how the electron arrangement changes when magnesium oxide is formed from magnesium and oxygen.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

THIS IS THE END OF THE QUESTION PAPER

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113159

Rewarding Learning

General Certificate of Secondary Education
2013–2014

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

TUESDAY 25 FEBRUARY 2014, MORNING

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

	AVAILABLE MARKS

1 **(a)** **(i)** 1 [1]

(ii) 25 cm^3 [1]

(b) **(i)** Green [1]

(ii) More accurate/gives numbers [1]

4

2 **(a)** 0.6 [1]

(b) Aluminium [1]
3 [1] [2]

(c) 1.0–1.7 g/cm^3 [1]

(d) They are all gases [1]

5

3 **(a)** Hard water is water that is difficult to lather/forms a scum [1]
with soap [1] [2]

(b) Indicative Content:

- Advantages: better taste, helps form stronger bones/teeth
- Advantage: tourism, better for making beer
- Disadvantages: causes stains on washing, clogging water pipes, and fur in kettles
- caused by calcium/magnesium ions/compounds
- softened by, **one** from: thermal decomposition/distillation/ion exchange/ adding washing soda (if temporary, softened by boiling)

Band	Response	Marks
A	Candidates must use appropriate specialist terms throughout to describe hard water using **all** of the points above, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe hard water using **three to four** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe hard water using **one or two** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6]

8

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		AVAILABLE MARKS
4	**(a)** All points plotted correctly [2] [7 points plotted correctly gains 1 mark] smooth curve drawn [1] [3]	
	(b) No more loss in mass/no more bubbles/last values the same [1]	
	(c) sodium chloride [1] water [1] (Any order) [2]	
	(d) Use limewater [1] it turns milky/cloudy [1] [2]	
	(e) **(i)** 22 g [1]	
	(ii) The gas/carbon dioxide escaped from the beaker/given off [1]	
	(f) Bubbles observed/loss in mass [1] slower/less vigorous reaction than with HCl [1] [2]	12
5	**(a)** They are running out/getting harder to find/non-renewable [1]	
	(b) Contamination of ground water/risks to air quality/mishandling of waste [1] chosen concern explained, e.g. ground water can be used as a source of drinking water [1] [2]	
	(c) (20 000 000/100) × 2 [1] 400 000 [1] [2]	
	(d) Tectonic plates [1] suddenly move past each other [1] [2]	7
6	**(a)** **(i)** Electron [1]	
	(ii) Neutron [1]	
	(b) The number of **protons** in an atom [1]	
	(c) Same/equal number of protons and electrons [1]	
	(d)	

	Na	O	Na_2O
Number of protons	11	8	30
Number of electrons	11	8	30
Number of neutrons	12	8	32

[1] for each correct column [3] | 7

				AVAILABLE MARKS
7	**(a)**	Displacement	[1]	
	(b)	silver [1] copper nitrate [1] either order	[2]	
	(c)	Copper nitrate is blue	[1]	
	(d)	Correct order: iron, copper, silver	[1]	
	(e)	$Zn + \mathbf{2}HCl \rightarrow ZnCl_2 + H_2$	[1]	6
8	**(a)**	**(i)** Used Book of Genesis/Bible [1] counted the number of generations [1]	[2]	
		(ii) 6000 years	[1]	
	(b)	**(i)** Use radioactivity/radioisotopes/half-life [1] find the ratio of undecayed : daughter nuclei in rocks [1]	[2]	
		(ii) 4 500 million years	[1]	6
9	**(a)**	Positive electrode	[1]	
	(b)	Positively charged aluminium ions [1] gain electrons [1] idea of **3** electrons [1]	[3]	4
10	**(a)**	13%	[1]	
	(b)	16.1 % (15 + 1 gains [1])	[2]	
	(c)	CO_2 / CO / NO / SO_2 / H_2O	[1]	
	(d)	$C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$ LHS formula [1] RHS formula [1] balancing correct [1]	[3]	
	(e)	Correct structural formula of propane drawn	[1]	8

AVAILABLE MARKS

11 **(a)** Mg: 2.8.2 [1]
O: 2.6 [1] [2]

(b) Indicative content

- Electrons are transferred/gained and lost
- There are **two** electrons involved in transfer
- Magnesium atom loses two electrons to become a **positive** ion/cation
- Magnesium's electron arrangement changes from 2.8.2 to 2.8
- Oxygen atom gains two electrons to become a **negative** ion/anion
- Oxygen's electron arrangement changes from 2.6 to 2.8
- Ionic bonding is involved/electrostatic forces of attraction

Band	Response	Marks
A	Candidates must use appropriate specialist terms throughout to describe the bonding involved using **6 or 7** of the above points. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates must use some appropriate specialist terms throughout to describe the bonding involved, using **3–5** of the above points. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe the bonding involved using only **1 or 2** of the above points. They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	[1]–[2]
D	Response not worthy of credit.	[0]

[6] 8

Total **75**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2013–2014

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

GSS22

THURSDAY 14 NOVEMBER 2013, MORNING

TIME

1 hour 15 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 eleven** questions.

INFORMATION FOR CANDIDATES

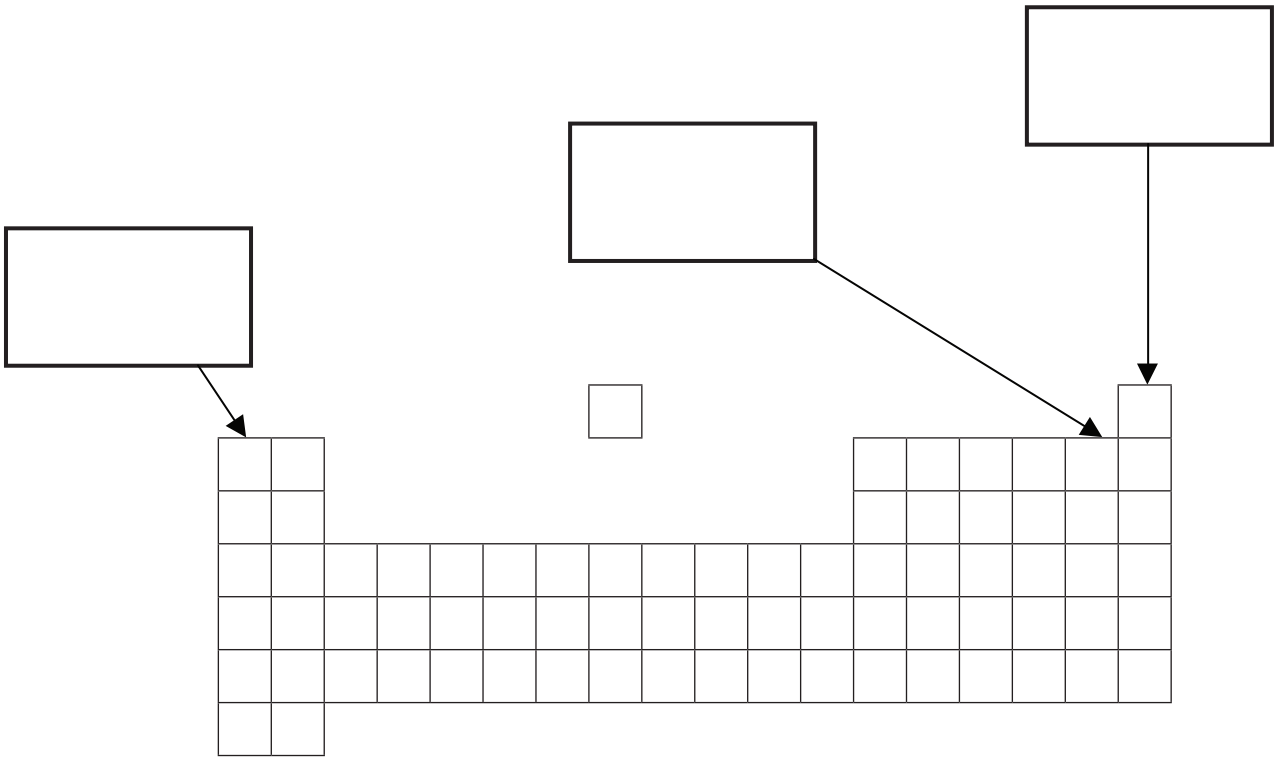
The total mark for this paper is 75.
Quality of written communication will be assessed in Questions **3** and **11**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

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

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1 Below is an outline of the Periodic Table.



Examiner Only	
Marks	Remark

(a) On the diagram above complete the three boxes to name the Groups of the Periodic Table shown.

Choose from:

alkaline earth metals : halogens : alkali metals : noble gases

[3]

(b) Name the scientist who developed a Periodic Table most similar to the one outlined above.

_____ [1]

(c) Complete the following sentence to describe a **trend** in the Periodic Table.

The metallic character of the elements _____ from left to right across the Periodic Table. [1]

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Examiner Only	
Marks	Remark

2 A student investigates the reactivity of four metals: iron, magnesium, zinc and tin.

He added 1 g of each powdered metal to equal volumes of copper sulfate solutions and measured the temperature rise. The larger the temperature rise the more reactive the metal.

The results are shown below.

Metal	Starting temperature/ °C	Highest temperature/ °C	Temperature rise/ °C
iron	20	52	32
magnesium	21		50
zinc	19	60	41
tin	20	41	21

(a) Calculate the highest temperature for the reaction with magnesium.

_____ °C [1]

(b) Name the metal in the table that is the **least** reactive.

_____ [1]

(c) **(i)** Complete the word equation for the reaction between iron and copper sulfate.

iron + copper sulfate → [ ] + [ ]

[2]

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

_____ [1]

(d) The student carried out the same experiment using 1 g of powdered silver metal. There was no temperature rise. Suggest a reason why there was no temperature rise.

_____

_____ [1]

(e) The chemical formula for copper sulfate is $CuSO_4$.

(i) How many elements are present in copper sulfate?

_____ [1]

(ii) How many atoms are represented in this formula?

_____ [1]

Examiner Only	
Marks	Remark

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3 Indigestion can cause severe stomach pain.



© *iStock / Thinkstock*

'Fasteze' indigestion tablets contain sodium hydrogencarbonate.

Explain how indigestion tablets such as 'Fasteze' work. Your answer should include:

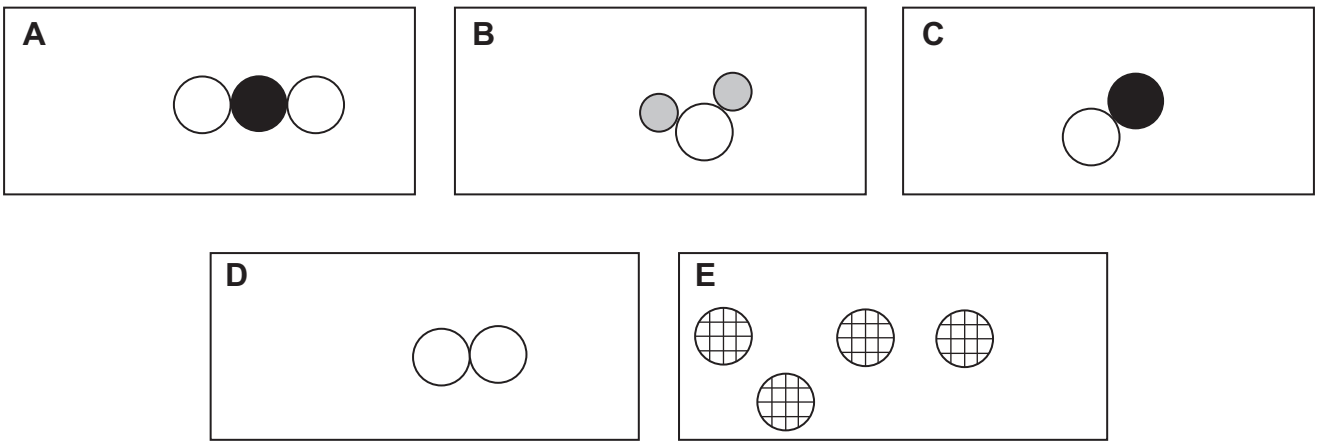
- the cause of stomach indigestion
- how indigestion tablets work
- the names of the chemicals produced during this reaction.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only	
Marks	Remark

4 Shown below are some particle diagrams that represent elements or compounds.



Examiner Only	
Marks	Remark

(a) Which particle diagrams (**A, B, C, D** or **E**) show compounds? Explain your answer.

Diagrams _____

_____

_____ [2]

(b) Atoms of argon do not join with any other atoms. Which diagram (**A, B, C, D** or **E**) best represents argon?

_____ [1]

(c) Carbon monoxide has the formula CO. Which diagram (**A, B, C, D** or **E**) best represents carbon monoxide?

_____ [1]

(d) Hydrogen atoms are smaller than any other atoms. Which diagram (**A, B, C, D** or **E**) best represents water (H_2O)? Explain your answer.

_____

_____

_____ [2]

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5 A flame test can be carried out to identify some metal ions.



© *Science Photo Library*

(a) Describe fully how to carry out a flame test.

_____

_____

_____

_____

_____

_____ [3]

(b) Complete the table below.

Metal ion	Flame colour
Sodium	
	Lilac
Copper	

[3]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

6 The table below gives information about three elements.

(a) Complete the table.

Element	Mass number	Number of protons	Number of electrons	Number of neutrons
Calcium	40	20		20
Carbon	12		6	6
Potassium	39	19	19	

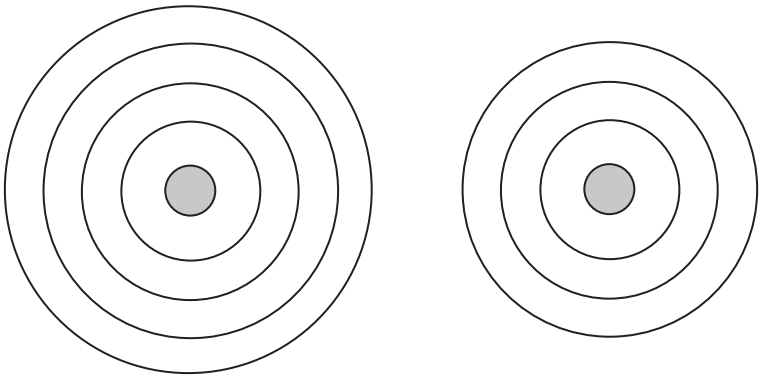
[3]

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

_____

_____ [1]

(c) **(i)** Complete the diagrams below to show how the electrons are arranged in an atom of potassium and an atom of chlorine. (You may find your Data Leaflet helpful.)



potassium chlorine

[2]

(ii) Potassium forms bonds with chlorine in the same way that sodium does when it makes sodium chloride (NaCl).

Explain fully in terms of electrons how potassium forms bonds with chlorine to form potassium chloride (KCl).

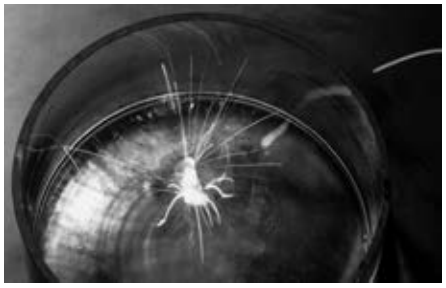
_____

_____

_____

_____ [3]

(iii) Potassium is in Group One of the Periodic Table and reacts vigorously with water.



© Martin Chillmaid / Science Photo Library

Caesium is also a Group One element. Suggest how it will react with water compared to potassium and explain your answer.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

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7 Hard water can form undesirable deposits of calcium carbonate (fur) in kettles.



© Dorling Kindersley RF / Thinkstock

(a) Complete the word equation below for the formation of kettle fur.

	→	calcium carbonate	+		+	

[3]

(b) Suggest **one** reason why fur in kettles or water pipes is a problem.

_____

_____ [1]

(c) Kettle fur can be removed by reacting with acid. Complete and balance the symbol equation below for this reaction.

$CaCO_3$ + HCl → ☐ + ☐ + H_2O

[3]

(d) Give **one** method of softening permanent hard water.

_____ [1]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

8 Japan is a very tectonically active area and suffers about 20% of the world's earthquakes of magnitude 6 or greater.

In March 2012 a major earthquake killed over one thousand people and destroyed an area of several hundred square kilometres.

The table below shows how the Richter scale is used to compare the size of earthquakes.

Richter scale value	Effect of earthquake
Less than 3	People do not feel the earthquake.
3.0 – 5.1	People feel the earthquake but the earthquake rarely causes damage to buildings.
5.2 – 6.4	People feel the earthquake and the earthquake causes minor damage to a few buildings.
6.5 – 7.0	Shaking of the ground and major damage to some buildings.
7.1 – 8.5	Violent shaking of the ground over large areas and many buildings destroyed.
8.6 – 10	Very violent shaking of the ground and most buildings destroyed. Can cause damage to areas of several hundred square kilometres.

(a) Suggest the Richter scale value for the 2012 earthquake in Japan.

_____ [1]

Below is an extract from a Japanese newspaper about the 2012 earthquake.

Half the country was without power and major roads were severely damaged by very violent shaking of the ground.

Rescue efforts were hampered by at least 50 reported aftershocks, including a 6.6 magnitude tremor which hit Tokyo.

The earthquake did not come as a surprise to scientists who predicted the earthquake a week earlier. The Government and people ignored the prediction.

(b) What damage would the aftershocks in Tokyo cause?

_____

_____ [1]

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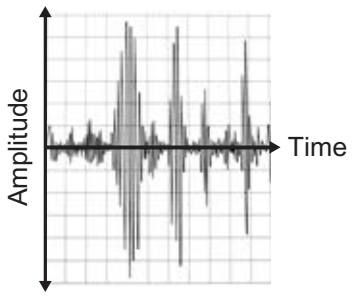
Examiner Only	
Marks	Remark

(c) Governments and people in Japan have often ignored scientists' predictions of an earthquake. Suggest a reason why.

_____

_____ [1]

(d) Below is a printout from a seismometer that is used to produce a Richter scale value for an earthquake.



© *iStock / Thinkstock*

(i) On the printout label the major **earthquake** with the letter **X**. [1]

(ii) Give **two** pieces of information about the earthquake that can be obtained from the printout.

1. _____

2. _____ [2]

(e) During the twentieth century many scientists put forward ideas about the cause of earthquakes. In 1915 Alfred Wegener proposed the idea of continental drift.

(i) Describe Wegener's theory of **continental drift**.

_____

_____

_____

_____ [2]

(ii) Give **one** piece of evidence that supports Wegener's theory.

_____

_____ [1]

9 Below is a table showing some properties of four polymers.

Polymer	Strength N/mm^2	Melting point °C	Density g/cm^3	Maximum continued use temperature °C	Cost £/kg
polypropene	1.5 – 1.7	160	0.91	80	1.00
low density polyethene	0.2 – 0.4	110	0.93	65	1.25
high density polyethene	0.2 – 0.4	126	0.97	65	1.25
silicone	11.0 – 13.0	420	1.29	300	7.30

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

(a) Explain why polypropene would be better than high density polyethene for making garden furniture.

_____

_____

_____ [2]

(b) Some polymers can now be used to make cupcake moulds for baking buns.



© iStock / Thinkstock

Which polymer in the table would be most suitable for this use? Explain your answer.

_____

_____

_____ [2]

Examiner Only

Marks	Remark

(c) Traditionally cake moulds were made from steel. Some properties of steel are shown below.

	Strength N/mm^2	Melting point °C	Density g/cm^3	Cost £/kg
Steel	135.5 – 175.0	1510	7.85	0.55

Using the information provided, explain fully why steel is still the most popular choice for making cake moulds.

_____

_____

_____ [2]

10 Aluminium is produced by the electrolysis of bauxite (aluminium oxide).

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

_____

_____ [2]

(b) The aluminium is formed at the cathode. Complete the **ionic** equation for the reaction at the cathode.

_____ + _____ ⟶ Al

[2]

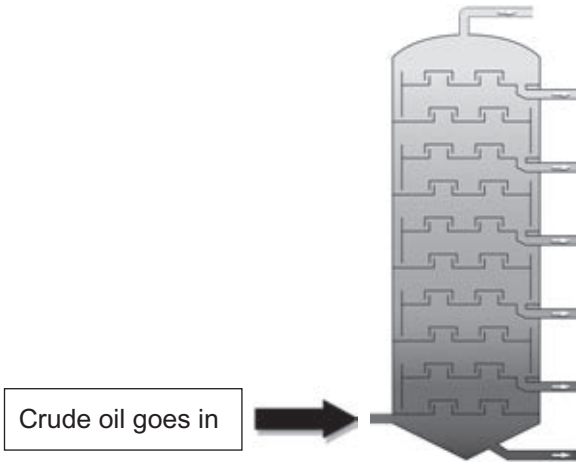
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

11 The diagram below shows how crude oil is separated into different fractions.



© *Science Photo Library*

Name and describe this process. Your answer should also include the names of two of the fractions produced and a use for one of these fractions.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

THIS IS THE END OF THE QUESTION PAPER

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113973

Rewarding Learning

General Certificate of Secondary Education
2013–2014

Science: Single Award

Unit 2: (Chemistry)

Higher Tier

[GSS22]

THURSDAY 14 NOVEMBER 2013, MORNING

MARK SCHEME

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General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

1 **(a)** Alkali metals [1]
halogens [1]
noble gases [1] [3]

(b) (Dmitri) Mendeleev [1]

(c) Decreases [1] 5

2 **(a)** 71 [1]

(b) Tin [1]

(c) **(i)** Iron sulfate [1]
copper [1] either order [2]

(ii) Displacement [1]

(d) Silver is unreactive [1]

(e) **(i)** 3 [1]

(ii) 6 [1] 8

AVAILABLE MARKS

3 Indicative Content:

- indigestion is caused by excess stomach acid
- stomach acid is hydrochloric acid
- indigestion tablets contain an alkali/base
- alkali neutralises the acid/neutralisation reaction
- sodium chloride
- water
- carbon dioxide

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe indigestion using **five to seven** of the points above, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to describe indigestion using **three to four** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe indigestion using **one or two** of the points above. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Not worthy of credit.	[0]

6

4 (a) A, B and C [1]
A compound has two or more elements chemically joined [1] [2]

(b) E [1]

(c) C [1]

(d) B [1]
3 atoms, 2 smaller than the other [1] [2]

6

		AVAILABLE MARKS
5	**(a) Any three from:**	
	• dip the flame test wire into (concentrated) acid • put flame test wire into the Bunsen flame to **clean it** • dip the wire into the metal **ion** sample (and then into Bunsen flame) • record the colour of the flame [3]	
	(b)	

Metal ion	Flame colour
Sodium	**Orange/yellow [1]**
Potassium [1]	Lilac
Copper	**Blue/green [1]**

[3] 6

6 (a)

Element	Mass Number	Number of protons	Number of electrons	Number of neutrons
Calcium	40	20	**20 [1]**	20
Carbon	12	**6 [1]**	6	6
Potassium	39	19	19	**20 [1]**

[3]

(b) The number of protons **and** neutrons in an atom [1]

(c) (i) Correct electronic arrangement for Potassium 2.8.8.1 [1]
correct electronic arrangement for Chlorine 2.8.7 [1] [2]

(ii) Potassium loses 1 electron [1]
chlorine gains 1 electron [1]
idea that electron is transferred from potassium to chlorine [1] [3]

(iii) Caesium will have a more vigorous/violent reaction [1]
caesium is more reactive/lower down Group One [1] [2] 11

7 (a) Calcium hydrogencarbonate [1]
water [1]
carbon dioxide [1] } any order [3]

(b) Blocks pipes/stops water flowing [1]

(c) $CaCl_2$ [1]
CO_2 [1] } any order
correct balancing [1] [3]

(d) Adding washing soda/distillation/ion exchange [1] 8

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				AVAILABLE MARKS
8	**(a)**	8.6–10 Any value in range	[1]	
	(b)	Shaking of the ground/major damage to some buildings	[1]	
	(c)	Earthquakes are very common/predictions not always accurate/ impossible to predict	[1]	
	(d) **(i)**	Correct label of first peaks as earthquake	[1]	
	(ii)	Size of earthquake [1] how long the earthquake lasted [1]	[2]	
	(e) **(i)**	Any **two** of: ● there was originally one continent/"pangaea" ● over 200 million years ago ● it broke up/moved apart forming continents	[2]	
	(ii)	Any **one** of: ● shape of *continents* "fit" like a jigsaw ● *same* fossils on different continents ● *same* rock types on different continents	[1]	9
9	**(a)**	Polypropene is stronger [1] must compare polypropene is cheaper [1]	[2]	
	(b)	Silicone [1] high melting point/can withstand high temperatures [1]	[2]	
	(c)	Cheaper [1] strong with explanation [1]	[2]	6
10	**(a)**	Using electricity [1] to break down a compound [1]	[2]	
	(b)	Al^{3+} [1] $3e^-$ [1] 3e(✓)	[2]	4

11 Indicative Content:

- crude oil is separated by fractional distillation
- crude oil is first heated/evaporated
- it separates into different fractions at different levels/temperatures
- each fraction has a *different* boiling point/condensation point
- any ***two*** fractions named: petrol, naphtha, paraffin, lubricating oil or bitumen
- appropriate use for one of the named fractions

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe fractional distillation using **five to six** of the points above, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to describe fractional distillation using **three to four** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe fractional distillation using **one or two** of the points above. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Not worthy of credit.	[0]

Total

AVAILABLE MARKS

6

75

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

GSS22

MONDAY 20 MAY 2013, AFTERNOON

TIME

1 hour 15 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 eleven** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Quality of written communication will be assessed in Questions **3** and **9(b)**.
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 included in this question paper.

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

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1 The table below shows properties of some plastics.

Plastic	Melting point/°C	Resistance to alkali	Other properties	Cost per kg /£
A	20	highly resistant	strong and flexible	1.1
B	120	slowly reacts	strong and flexible	1.5
C	200	highly resistant	strong and shatters easily	0.5
D	160	highly resistant	strong and not very flexible	2.4

Use the information in the table and your knowledge to answer the questions below.

(a) Suggest why plastic **C** is **not** suitable to cover the copper wire in an electrical cable.

_____

_____ [1]

(b) A company has a large warehouse and wants to use plastic sheets to cover the items it stores. Explain why plastic **B** is a better choice than plastic **D**.

_____

_____ [1]

(c) Large plastic containers are needed to transport a corrosive alkali. The containers will be loaded on and off lorries.

Which plastic (**A**, **B**, **C** or **D**) would be most suitable? Explain your answer fully.

_____

_____

_____

_____ [3]

Examiner Only

Marks	Remark

2 **(a)** Complete the table below about the particles in an atom.

Particle	Relative charge	Relative mass	Location in an atom
proton	+1		the nucleus
electron		$\frac{1}{1840}$	orbits the nucleus
neutron	0	1	

[3]

(b) Given below is the atomic number and mass number of sodium.

$$\begin{matrix} 23 \\ 11 \end{matrix}\ \mathbf{Na}$$

(i) How many protons does an atom of sodium have?

_____ [1]

(ii) Calculate the number of neutrons in an atom of sodium.

_____ [1]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

3 Potassium is a very reactive metal. Describe how a teacher could **safely** demonstrate its reaction with water to a class of pupils. Your answer should include what is observed and the names of any products.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

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(Questions continue overleaf)

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4 The table below gives the colour of four indicators at different pH values.

Indicator	pH value													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Universal	R	R	O	O	Y	Y	G	B	B	I	I	I	V	V
Methyl Red	R	R	R	R	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Thymol Blue	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B	B
Alizarin Yellow	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	R	R	R

Key
R=Red O=Orange Y=Yellow G=Green B=Blue I=Indigo V=Violet

Use the information above to answer the following questions.

Examiner Only	
Marks	Remark

(a) (i) What colour is Methyl Red indicator in a solution of pH 7?

_____ [1]

(ii) What colour is Alizarin Yellow indicator in strong alkali?

_____ [1]

(iii) What colour is Universal indicator in hydrochloric acid?

_____ [1]

(b) A scientist has some acid and is going to add an alkali to it. He needs to stop adding the alkali when the pH value is 7.

(i) What name is given to the reaction of an acid with an alkali?

_____ [1]

(ii) From the table above select the most suitable indicator for his experiment. Explain your choice.

_____

_____

_____ [2]

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(c) The table shows chemical indicators. Suggest a more accurate way to follow the pH change when an alkali is added to an acid.

_____ [1]

(d) Most indicators are made from plants. Describe how you would obtain an indicator from red cabbage.

_____

_____

_____

_____

_____ [3]

(e) Complete the word equation below for the reaction of an acid with an alkali.

hydrochloric acid + magnesium hydroxide → [ ] + water

[1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

5 Below is the ingredients label found on a popular indigestion tablet. Each tablet has a mass of 1500 mg.

Each tablet contains:

Calcium carbonate (700 mg)
Magnesium carbonate (80 mg)
Sucrose (250 mg)
Glucose (250 mg)
Peppermint flavour (20 mg)
Talc
Saccharin sodium (40 mg)
Magnesium stearate (60 mg)

(a) Calculate the mass of talc in each tablet.
(Show your working out.)

_____ mg [2]

(b) The active ingredient in this indigestion tablet is calcium carbonate.

(i) What is the chemical formula for calcium carbonate?

_____ [1]

(ii) Name the gas produced when calcium carbonate is added to an acid.

_____ [1]

(c) Explain fully how an indigestion tablet works to cure indigestion.

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

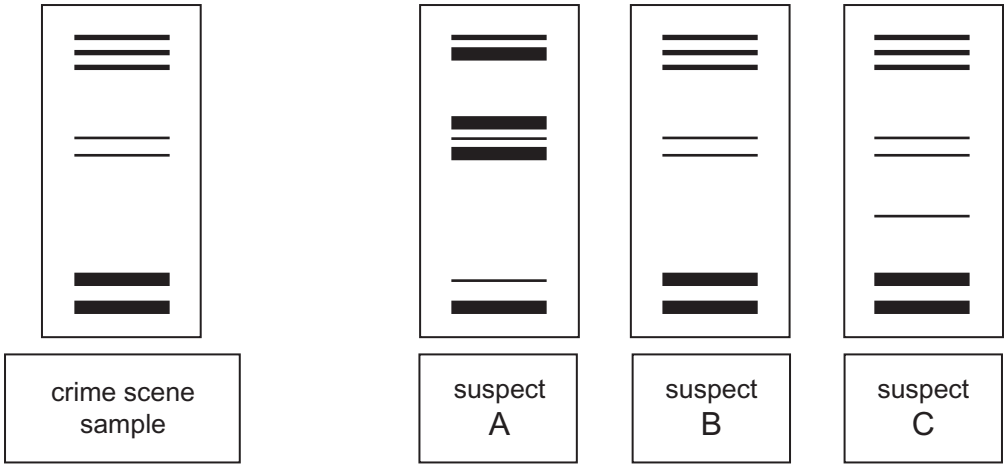
6 Genetic or DNA fingerprinting was introduced by forensic scientists about 30 years ago. It has revolutionised forensic science and crime solving.

(a) This technique only needs small amounts of DNA. Give **two** pieces of evidence that could be collected at a crime scene that could be used for DNA analysis.

1. _____

2. _____ [2]

(b) Below are the genetic fingerprints taken from a crime scene and from three police suspects.



Which suspect does the crime scene sample belong to? Explain your answer.

Suspect: _____

Explanation: _____

_____

_____ [2]

Examiner Only	
Marks	Remark

7 Scientists have concluded the Earth is approximately 4500 million years old.

(a) Name the scientific method used to date the Earth.

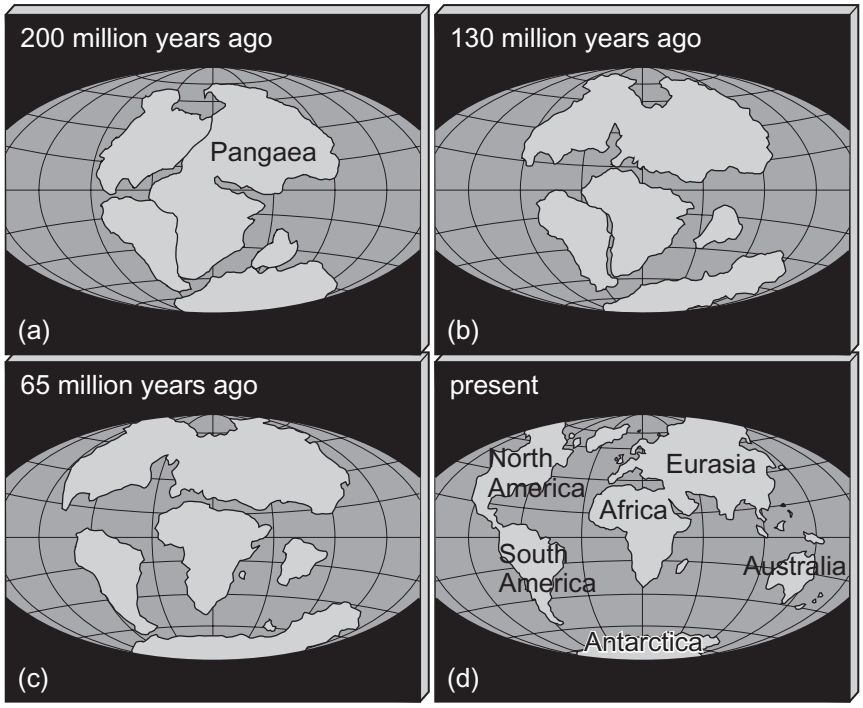
_____ [1]

(b) Explain the idea of 'deep time'.

_____

_____ [1]

(c) Around one hundred years ago Wegener proposed a theory to explain the present positions of continents as shown in diagram (d) below.



CHAISSON, ERIC; MCMILLAN, STEVE, ASTRONOMY TODAY, 3rd Edition, © 1999, p. 168. Reprinted by permission of Pearson Education, Inc., Upper Saddle River, NJ.

Using **only** the information provided, explain Wegener's theory and give **two** pieces of evidence to support it.

_____

_____

_____

_____ [3]

8 The modern Periodic Table took a long time to complete.

- Originally the Greek philosopher Aristotle considered there to be just four elements.
- As knowledge of the elements increased John Newlands noticed a repeating pattern. He tried to put the chemical elements into a table.
- In 1869 Dmitri Mendeleev further developed the idea of a table.

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

(a) Air was one of Aristotle's elements. Name the other three.

_____ [1]

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

_____

_____ [1]

(ii) Give **one** reason why John Newlands' theory was not fully accepted.

_____

_____ [1]

(c) Mendeleev created Groups and Periods. Give **two** other features of his Periodic Table.

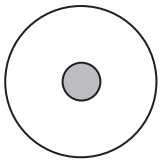
1. _____

2. _____ [2]

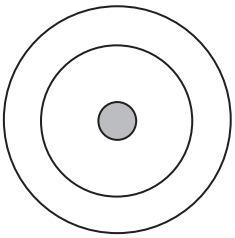
Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

9 **(a)** In the space below complete the diagrams to show how **all** of the electrons are arranged in an atom of hydrogen and an atom of oxygen.



hydrogen atom



oxygen atom

[2]

(b) Explain fully, in terms of the atoms involved and their electrons, how oxygen and hydrogen join to form a molecule of water. You should include the chemical formula for water in your answer.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

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10 Aluminium is extracted from aluminium oxide by electrolysis.

Examiner Only	
Marks	Remark

(a) Explain the meaning of the term **electrolysis**.

_____

_____

_____ [2]

(b) During the production of aluminium, cryolite is used. The chemical formula of cryolite is $\mathbf{Na_3AlF_6}$.

(i) How many different elements does cryolite contain?

_____ [1]

(ii) Name the non-metal element in cryolite.

_____ [1]

(iii) What is the total number of atoms in Na_3AlF_6?

_____ [1]

The table shows some information about aluminium and copper.

Metal	Relative electrical conductivity	Density g/cm^3	Relative strength	Cost per kg/£
aluminium	3.8	2.7	0.4	0.95
copper	5.7	8.9	0.6	3.10

(c) Aluminium is used in overhead electrical cables in the National Grid which carries electricity throughout the country. Use the information to explain fully why aluminium is more suitable than copper for this purpose.

_____

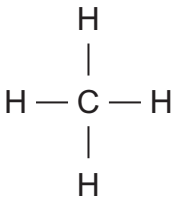
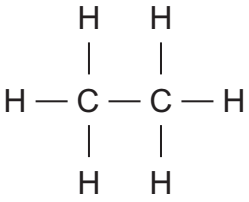
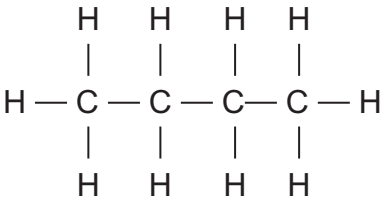
_____

_____

_____ [3]

11 Hydrocarbons are often used as fuels.

(a) Complete the table below about different hydrocarbons.

Hydrocarbon	Molecular formula	Structural formula
methane	CH_4	
	C_2H_6	
propane	C_3H_8	
butane		

[3]

(b) Propane is used as a fuel in camping stoves. Write a **balanced symbol** equation for the complete combustion of propane.

_____ [3]

Examiner Only

Marks	Remark

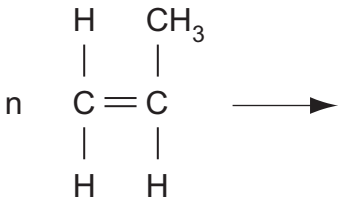
(c) Polypropene can be made by the polymerisation of propene.

(i) Explain what is meant by the term **polymerisation**.

_____

_____ [2]

(ii) Complete the balanced symbol equation for the polymerisation of propene.



[3]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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Rewarding Learning

General Certificate of Secondary Education
2012– 2013

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

MONDAY 20 MAY 2013, AFTERNOON

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

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				AVAILABLE MARKS
1	**(a)**	It is not flexible/it shatters easily (cheaper/high resistance marked wrong)	[1]	
	(b)	Plastic B is cheaper/more flexible	[1]	
	(c)	Plastic D (essential) [1] Any ***two*** ● Because it is resistant to alkali [1] ● It is not easily shattered/not flexible [1] ● Melting point is quite high [1] In correct plastic but correct property/s gains [1] OR [2]	[3]	5
2	**(a)**	*proton* 1 [1] *electron* −1 [1] *neutron* in the nucleus [1]	[3]	
	(b)	**(i)** 11	[1]	
		(ii) 12	[1]	5

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AVAILABLE MARKS

3 Indicative Content

Safety: (max 2)

- use a small piece of potassium
- handle with tongs
- use a large amount/trough of water
- use a safety screen/goggles

Observations: (max 2)

- Lilac Flame
- Potassium floats/stays on surface
- Potassium moves
- Fizzing/bubbles/gas given off
- Potassium dissolves/gets smaller/forms a ball/melts

Products

- Potassium Hydroxide
- Hydrogen accept correct word equation

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe the demonstration using **5 or 6** of the above points. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates must use appropriate specialist terms throughout to describe the demonstration, using **3–4** of the above points. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe the demonstration using only **1 or 2** of the above points. They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	[1–2]
D	Response not worthy of credit.	[0]

6

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				AVAILABLE MARKS
4	**(a)**	**(i)** Yellow	[1]	
		(ii) Red	[1]	
		(iii) Red	[1]	
	(b)	**(i)** Neutralisation	[1]	
		(ii) Universal indicator [1] It is only indicator in the table to change colour at pH7/ have a different colour at pH7 [1]	[2]	
	(c)	pH sensor/data logger	[1]	
	(d)	Add red cabbage to water [1] Boil/grind with mortar and pestle [1] Filter/decant/remove cabbage [1]	[3]	
	(e)	magnesium chloride	[1]	11
5	**(a)**	1500 – 1400 [1] = 100 [1]	[2]	
	(b)	**(i)** $CaCO_3$	[1]	
		(ii) Carbon dioxide	[1]	
	(c)	Indigestion tablet contains an alkali/base/named base [1] Alkali neutralises [1] acid [1]	[3]	7
6	**(a)**	*any **two*** ● hair ● skin ● blood ● semen ● other suitable	[2]	
	(b)	Suspect B [1] The thicknesses and positions of the bands are the same/the bands in suspect B genetic fingerprint match the sample [1]	[2]	4
7	**(a)**	radiometric dating	[1]	
	(b)	a timescale that is difficult to comprehend	[1]	
	(c)	continental drift described [1] shapes of continents fit together [1] over time continents are further apart [1]	[3]	5

AVAILABLE MARKS

8 **(a)** earth, fire and water [1]

(b) **(i)** Every eighth element was similar/similar chemical properties/Law of Octaves [1]

(ii) Two elements in the same position/assumed all elements were discovered/did not leave spaces [1]

(c) Elements in order of mass [1]
Gaps left for undiscovered elements/he put elements together that were not alike [1] [2]

5

9 **(a)** *hydrogen* 1 [1]
oxygen 2.6 [1] [2]

(b) Indicative content

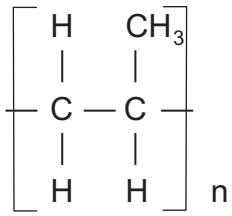
- Electrons are shared
- Hydrogen atom shares one electron
- Oxygen atom shares two electrons/one electron with each hydrogen atom
- There are two hydrogen atoms required for each oxygen atom
- Bonding occurs to give each atom a full outer shell/make each atom stable
- Covalent bonding is involved
- Chemical formula for water is H_2O

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe the bonding involved using **5, 6 or 7** of the above points. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates must use some appropriate specialist terms throughout to describe the bonding involved, using **3-4** of the above points. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe the bonding involved using only **1 or 2** of the above points. They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	[1–2]
D	Response not worthy of credit.	[0]

[6]

8

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			AVAILABLE MARKS
10	**(a)**	Using electricity [1] To split up/break down/decompose a compound [1] [2]	
	(b)	**(i)** 3 [1]	
		(ii) fluorine [1]	
		(iii) 10 [1]	
	(c)	Aluminium is less dense [1] Aluminium is cheaper [1] Suitable explanation e.g. it needs to be cheaper as there is a lot of aluminium needed for the wires in the National Grid [1] [3]	8
11	**(a)**	ethane [1] Correct structure for propane [1] C_4H_{10} [1] [3]	
	(b)	$C_3H_8 + 5O_2 \rightarrow 4H_2O + 3CO_2$ LHS [1] RHS [1] Correct balancing [1] [3]	
	(c)	**(i)** Many monomers/repeating units/small molecules [1] Joined to make a long chain [1] [2]	
		(ii) 	
		single bond [1] brackets and correct atoms [1] correct position of "n" [1] [3]	11
		Total	**75**

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

GSS22

TUESDAY 26 FEBRUARY 2013, MORNING

TIME

1 hour 15 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 nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Quality of written communication will be assessed in questions **3** and **8(a)**.
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 included for your use.

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

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Examiner Only	
Marks	Remark

1 The picture below shows a cyclist wearing a modern cycling suit.



© iStockphoto / Thinkstock

The following table gives some information about materials that could be used to make the cycling suit.

Material	Effect of washing	Can stretch	Effect of sunlight	Effect of sweat
cotton	can shrink	no	colour fades	stains
Lycra	does not shrink	yes	colour does not fade	does not stain
linen	shrinks	no	colour fades	stains
polyester	does not shrink	no	colour does not fade	does not stain

(a) Use this information to decide on the best material to make a modern cycling suit. Explain your answer.

_____

_____

_____

_____

_____ [3]

(b) In Northern Ireland many people used to be employed in the linen industry.

Explain why the numbers employed have fallen.

_____ [1]

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Examiner Only	
Marks	Remark

2 The photograph below shows the Marble Arch Caves in County Fermanagh. The water in this area is described as being hard.



© Northern Ireland Tourist Board

(a) What is meant by the term **hard water**?

_____

_____ [2]

The table below gives the results of an experiment to test the hardness of different water samples.

Water sample	Volume of soap solution needed to form a lather before boiling/cm^3	Volume of soap solution needed to form a lather after boiling/cm^3
A	20	15
B	4	3
C	14	2
D	24	11

(b) Use this information to answer the following questions.

(i) Which sample **A**, **B**, **C** or **D** of water is the least hard?

_____ [1]

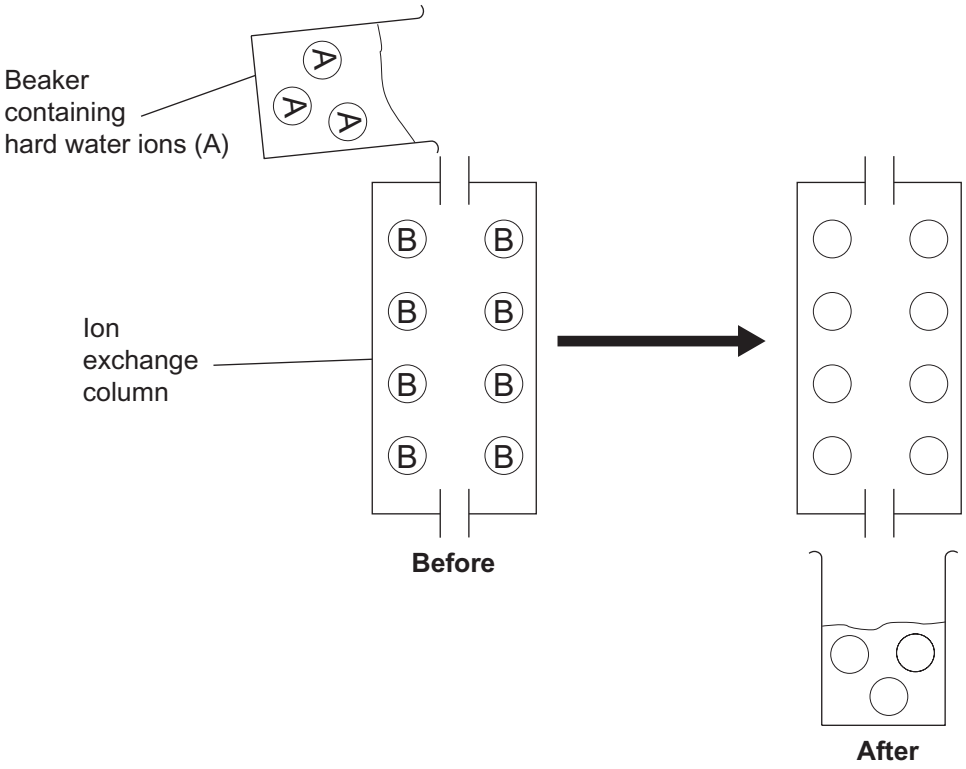
(ii) Which sample **A**, **B**, **C** or **D** contains only temporary hardness?

_____ [1]

(iii) Which **two** samples **A**, **B**, **C** or **D** contain both temporary and permanent hardness?

_____ and _____ [1]

(c) Hard water can be softened by using an ion exchange column.



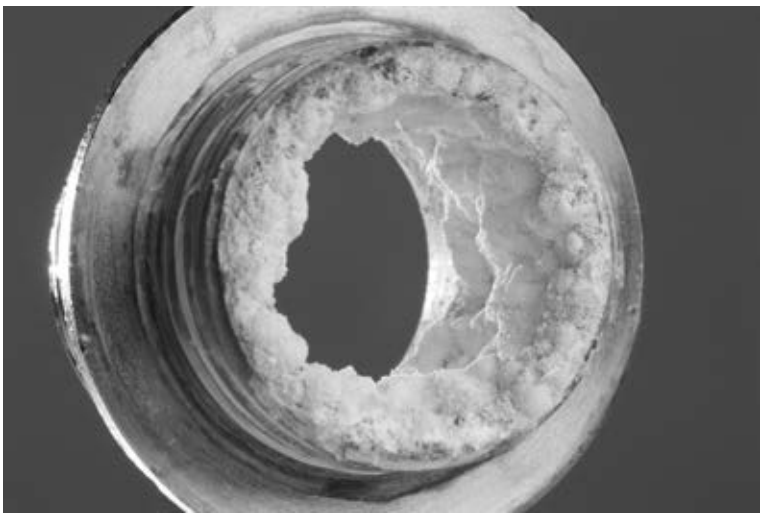
Complete the diagram to show the position of the ions after the water has passed through the column. [2]

Examiner Only

Marks	Remark

(d) Hard water can cause unwanted deposits in hot water pipes.

Examiner Only	
Marks	Remark



© Martyn F Chillmaid / Science Photo Library

Complete the word equation for the reaction that forms the unwanted deposits.

calcium hydrogencarbonate → _____ + _____ + _____

[3]

3 Forensic scientists can help to solve crime by taking and analysing fingerprints found at the scene.

Explain fully why fingerprints are so important.

Your answer should include:

- The different types of fingerprints
- How to obtain a fingerprint from different surfaces
- How they are used in the court system

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

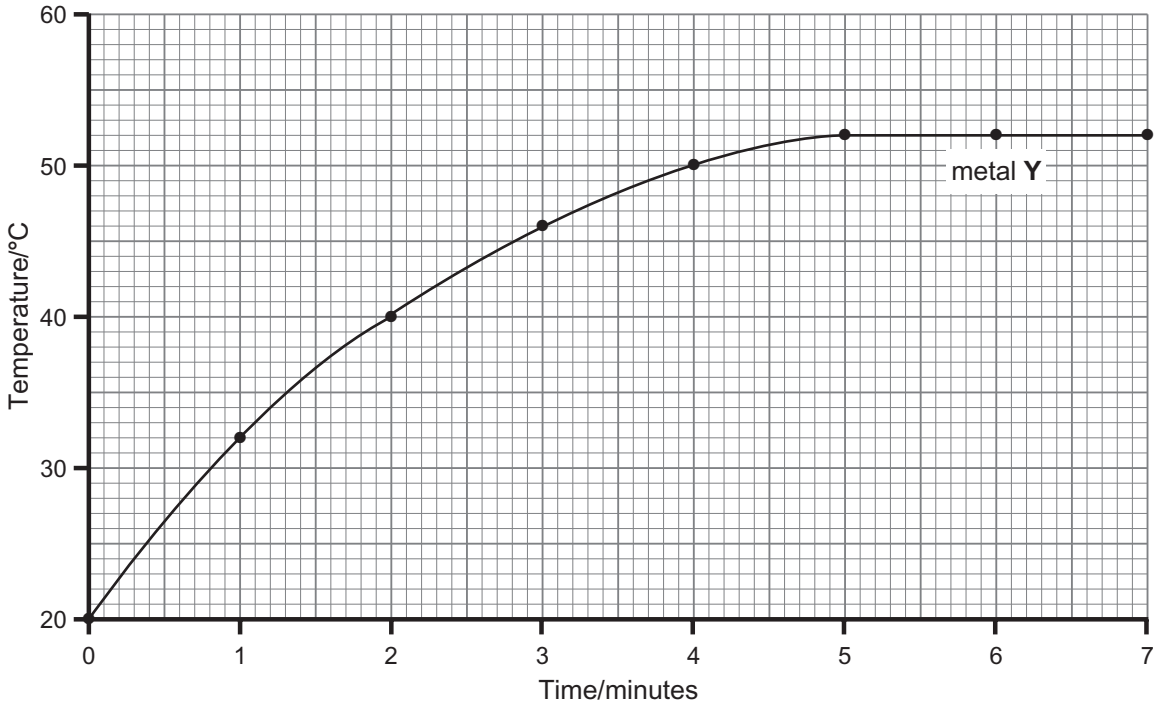
4 Karen carried out an experiment to investigate the reactivity of two metals X and Y. She added 2 grams of metal X to 20 cm^3 of copper sulfate solution (in excess) in a boiling tube. She recorded the temperature of the mixture every minute for seven minutes. She repeated the procedure for metal Y.

The table of results is shown below.

Time/minutes	0	1	2	3	4	5	6	7
Temperature/°C metal X	20	35	44	51	56	58	59	59
Temperature/°C metal Y	20	32	40	46	50	52	52	52

The graph below shows the results for metal **Y**.

(a) On the same grid plot the results for metal **X** and draw a line of best fit.



[3]

(b) (i) Describe the trend shown in the graph for metal **Y**.

_____

_____

_____ [2]

(ii) Describe **one** difference between the results for metals **X** and **Y**.

_____ [1]

(c) (i) Calculate the total increase in temperature for metal **X**.

_____ °C [1]

(ii) What type of chemical reaction caused this increase in temperature?

Choose from:

combustion **displacement** **neutralisation**

_____ [1]

(iii) Using the information from the graph and your knowledge suggest an order of reactivity of the metals, **copper**, **X** and **Y**.

_____ _____ _____ [2]

most reactive least reactive

(d) Karen repeated the experiment using 4 grams of metals **X** and **Y** with excess copper sulfate. Suggest how this would have affected her results.

_____

_____ [1]

(e) One of the metals used was zinc. Name the **two** products formed when zinc reacts with copper sulfate solution.

_____

_____ [2]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

5 **(a)** The table below gives information about three different indicators.

Chemical	Colour of Universal Indicator paper	Colour of red litmus paper	Colour of red cabbage dye	pH range
Hydrochloric acid	red	red	red	1–2
Sodium hydroxide	dark blue	blue	yellow	12–14
Water	green	red	purple	7
Ethanoic acid	orange	red	red	3–6
Sodium hydrogencarbonate	blue	blue	green	8–10

Use this information to answer the questions that follow.

(i) Explain why red litmus paper is not suitable to show that a chemical is acidic.

_____

_____ [2]

(ii) Suggest which indicator would be most useful to give a full range of pH values. Explain fully your answer.

_____

_____

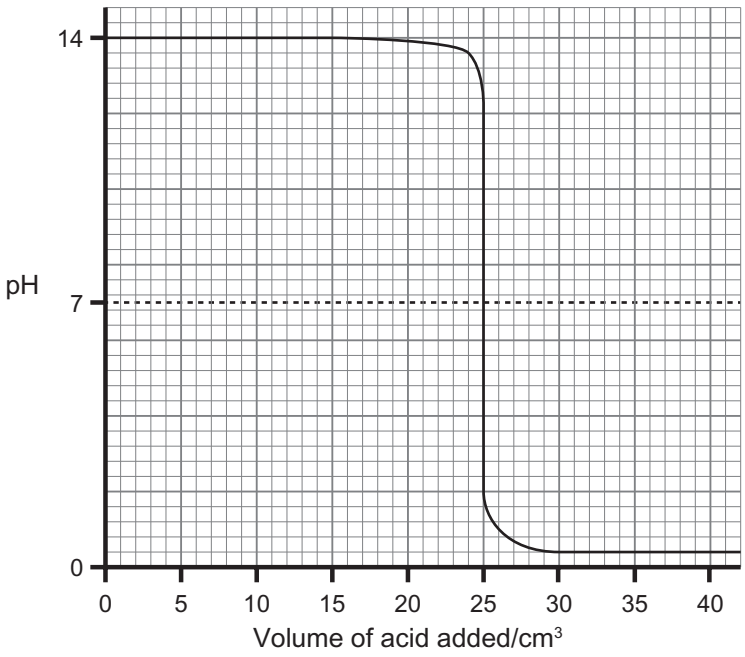
_____

_____

_____ [3]

Examiner Only	
Marks	Remark

(b) The pH changes during the reaction between hydrochloric acid and sodium hydroxide were measured using a pH meter. The following graph was obtained.



(i) What was the pH value of sodium hydroxide at the start of this experiment?

_____ [1]

(ii) What volume of acid was needed to cause a sudden drop in the pH value?

_____ cm^3 [1]

(iii) Name a suitable piece of apparatus that could have been used to add the acid during this experiment.

_____ [1]

(iv) Give the formula of hydrochloric acid and sodium hydroxide.

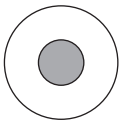
Hydrochloric acid: _____

Sodium hydroxide: _____ [2]

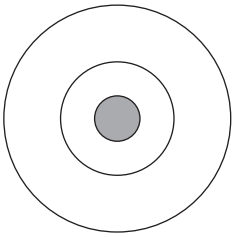
Examiner Only	
Marks	Remark

6 **(a)** Hydrogen reacts with oxygen to form water.

Complete the diagrams below to show the arrangement of all the electrons in an atom of hydrogen and an atom of oxygen.



hydrogen atom



oxygen atom [2]

(b) **(i)** Draw a diagram in the space below to show how the electrons are arranged in a molecule of **water** (H_2O).

[2]

(ii) In terms of electrons explain how the hydrogen and oxygen atoms are held together in a molecule of water.

_____ [1]

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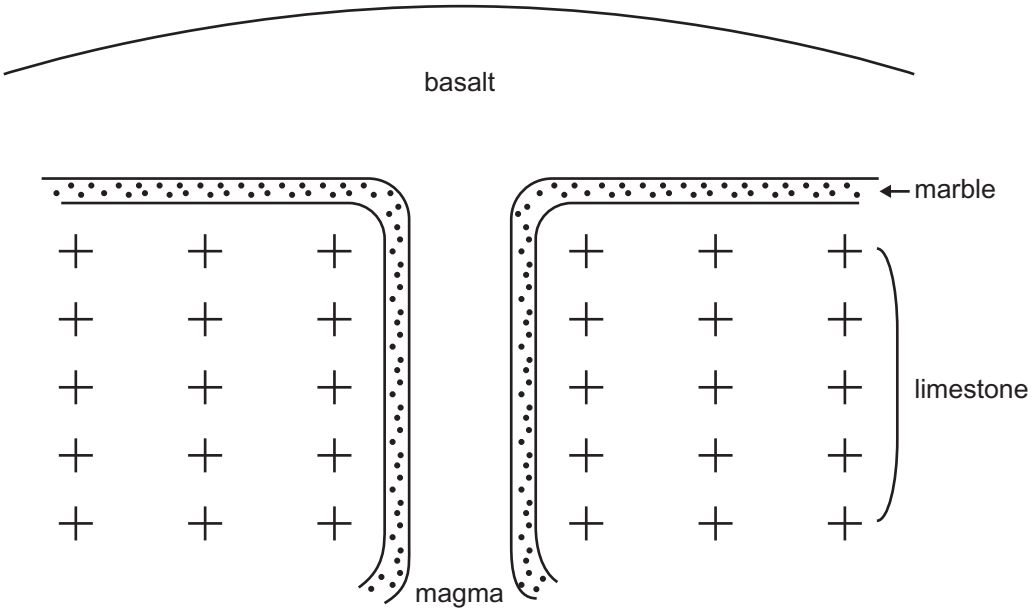
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(Questions continue overleaf)

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Examiner Only	
Marks	Remark

7 **(a)** The diagram below shows the position of three different rocks following a volcanic eruption.



(i) Complete the table below by naming the **type** of each rock.

Example	Type
basalt	Igneous
marble	
limestone	

[1]

(ii) Suggest why some of the limestone has changed into marble.

_____ [1]

(iii) Name the oldest rock in the diagram.

_____ [1]

(b) The age of the Earth can be estimated by radiometric dating. Describe this process.

_____

_____

_____

_____ [3]

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(c) Use the theory of plate tectonics to explain:

(i) how earthquakes happen.

_____

_____

_____ [2]

(ii) how mountains form.

_____

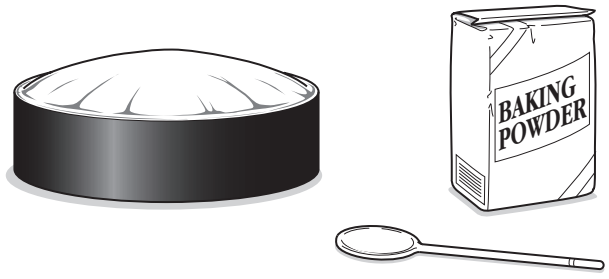
_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

8 Baking powder is a mixture of sodium hydrogencarbonate and tartaric acid.



During the cake making process two chemical reactions take place:

- The effect of heat on sodium hydrogencarbonate.
- The effect of acid on sodium hydrogencarbonate.

(a) Describe fully how sodium hydrogencarbonate in baking powder is used in making cakes. Your answer should describe both types of chemical reactions.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

_____

_____

_____

_____

_____

_____

_____

_____

_____ [6]

(b) Sodium hydrogencarbonate is also used to cure indigestion.

Complete the symbol equation for the reaction of sodium hydrogencarbonate with hydrochloric acid.

$NaHCO_3 + HCl \rightarrow$ _____ + _____ + _____ [3]

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Examiner Only	
Marks	Remark

9 Hydrocarbons are important chemicals used for fuels and for making polymers. They are obtained from crude oil.

Butane has the molecular formula C_4H_{10}.

(a) In the space below draw the structural formula for the hydrocarbon butane (C_4H_{10}), showing all the bonds present.

[1]

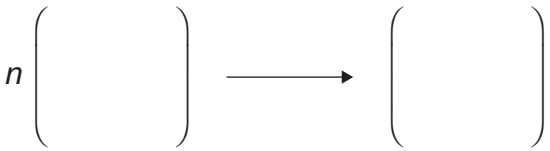
(b) Write a balanced symbol equation for the combustion of the fuel methane (CH_4).

_____ [3]

(c) **(i)** Name the type of reaction that is used to produce PVC from vinyl chloride.

_____ [1]

(ii) Complete the symbol equation to show how PVC is made.



[3]

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Rewarding Learning

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

TUESDAY 26 FEBRUARY 2013
9.30 am–10.45 am

MARK SCHEME

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			AVAILABLE MARKS
1	**(a)**	Lycra [1] plus any two: fits tightly reducing air resistance/drag [1] does not shrink [1] is not affected by sweat [1] keeps its colour [1] (max 2 if polyester is chosen) [3]	
	(b)	linen not used so much today/ other materials available (any suitable)/made more cheaply elsewhere [1]	4
2	**(a)**	water which does not lather easily [1] with soap [1] [2]	
	(b)	**(i)** B [1]	
		(ii) C [1]	
		(iii) A and D [1]	
	(c)	at least 2 A's in the resin [1] only B's in the bottom beaker [1] [2]	
	(d)	Calcium carbonate + water + carbon dioxide [3] [1] [1] [1]	10

3 Indicative content

- Arch, loop, whorl and composite (any two)
- Carbon powder/aluminium powder/white powder/powder
- Dusting off with brush
- Use of sellotape/clear tape/transfer to card
- Compare to database
- Unique

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Band	Response	Mark
A	Candidates use 5 or 6 of the points given in the indicative content to explain, using appropriate specialist terms, and in a logical sequence, the method used to take fingerprints from different types of surfaces. They use good spelling, punctuation and grammar and the form and style are of a high standard.	5–6
B	Candidates use 3 or 4 of the points given in the indicative content to explain, using appropriate specialist terms, and in a logical sequence, the method used to take fingerprints from different types of surfaces. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	3–4
C	Candidates use 1 or 2 of the points given in the indicative content to explain how fingerprints are taken. They use limited spelling, punctuation and grammar and they make little use of specialist terms. The form and style are of a limited standard.	1–2
D	Response not worthy of credit.	0

AVAILABLE MARKS

6

4 **(a)** all 8 points correctly plotted [2]
6 or 7 points correctly plotted [1]
line through points [1] [3]

(b) **(i)** Metal Y increase in temperature with time [1]
level off [1] [2]

(ii) Metal X increases more sharply or produces a greater temperature rise [1] [1]

(c) **(i)** 39 [1]

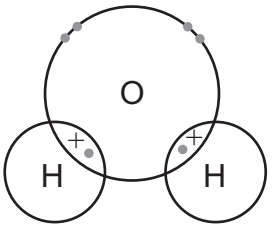
(ii) displacement [1] [1]

(iii) X Y copper [2]

(d) the temperature rise would be higher [1]

(e) zinc sulfate [1]
copper [1] [2]

13

					AVAILABLE MARKS
5	**(a)**	**(i)**	red (in water) [1] red in acid/doesn't change colour [1]	[2]	
		(ii)	universal indicator [1] a good range of colours [1] universal indicator changes colour with the strength of the acid [1]	[3]	
	(b)	**(i)**	14	[1]	
		(ii)	25 cm^3	[1]	
		(iii)	burette	[1]	
		(iv)	HCl [1] NaOH [1]	[2]	10
6	**(a)**		correct hydrogen atom [1] correct 2,6 arrangement [1]	[2]	
	(b)	**(i)**	 correct sharing [1] 8 electrons [1]	[2]	
		(ii)	electrons are shared (pairs)	[1]	5
7	**(a)**	**(i)**	marble – metamorphic limestone – sedimentary } both needed	[1]	
		(ii)	heat/pressure	[1]	
		(iii)	limestone	[1]	
	(b)		use radioactivity [1] radio isotopes [1] half-life [1] daughter nuclei [1] rocks [1] any 3	[3]	
	(c)	**(i)**	(tectonic) plates move [1] past/alongside each other [1]	[2]	
		(ii)	plates come together/slide [1] edge(s) of plate(s) forced upwards [1]	[2]	10

		AVAILABLE MARKS
8	**(a) Indicative content** ● sodium hydrogencarbonate breaks down ● in the heat – dependent on breakdown ● to produce carbon dioxide/bubbles/gas ● to make the cake lighter/rises ● sodium hydrogencarbonate is alkaline/neutralisation ● acid makes more carbon dioxide	

Band	Response	Mark
A	Candidates use 5 or 6 of the points given in the indicative content to explain how cakes are formed from baking soda. They use appropriate specialist terms in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	**5–6**
B	Candidates use 3 or 4 of the points given in the indicative content to explain how cakes are made from baking powder. They use appropriate specialist terms in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	**3–4**
C	Candidates use 1 or 2 of the points given in the indicative content to explain how cakes are made from baking powder. They use limited spelling, punctuation and grammar and they make little use of specialist terms. The form and style are of a limited standard.	**1–2**
D	Response not worthy of credit.	**0**

[6]

(b) $NaCl + CO_2 + H_2O$ [3] — 9

9 **(a)** correct structural formula [1]

(b) $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$
one mark for RHS
one mark for LHS
one mark for correct balancing [3]

(c) **(i)** polymerisation [1]

(ii) correct monomer on LHS [1]
correct single bond structure on RHS [1]
correct position of n [1] [3] — 8

Total — **75**

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New Specification

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

GSS22

TUESDAY 13 NOVEMBER 2012, MORNING

TIME

1 hour 15 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 ten** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
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.
Quality of written communication will be assessed in questions **4** and **8**.

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

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Examiner Only	
Marks	Remark

1 Some students compared the reactivity of four metals (cobalt, iron, copper and magnesium) by adding a small amount of each to sulfate solutions of the other metals. If there was a reaction they used a tick (✓), for no reaction they used (✘).

The results are shown below.

Solution / Metal	Cobalt sulfate	Iron sulfate	Copper sulfate	Magnesium sulfate
Cobalt		✘	✓	✘
Iron	✓		✓	✘
Copper	✘	✘		✘
Magnesium	✓	✓	✓	

(a) Use the information in the table and your knowledge to answer the following questions.

(i) Which metal is the most reactive? _____ [1]

(ii) Which metal is the least reactive? _____ [1]

(iii) Give **two** observations you would make when magnesium is added to copper sulfate solution.

1. _____

_____

2. _____

_____ [2]

(b) Complete the word equation for the reaction of magnesium with iron sulfate.

magnesium + iron sulfate → ☐ + ☐

[2]

(c) Elements and compounds can be represented by chemical symbols, but they must be written correctly. Give the correct formula for the compounds copper sulfate and magnesium chloride.

(You may find your Data Leaflet helpful.)

Circle the correct answers.

(i) copper sulfate

$CuSO_4$ **CoSu** **$CuSO_2$** **$CUSO_4$** [1]

(ii) magnesium chloride

MGCl **$Mgcl_2$** **MC** **$MgCl_2$** [1]

Examiner Only	
Marks	Remark

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2 The table below shows some information about the elements that are found in Period 3 of the Periodic Table.

Name of element	Sodium	Magnesium	Aluminium	Silicon	Phosphorus	Sulfur	Chlorine	Argon
Symbol	Na	Mg	Al	Si	P	S	Cl	Ar
Atomic number	11	12	13	14	15	16	17	18
Melting point/°C	98	639	660	1410	44	113	–101	–189
Boiling point/°C	883	1090	2467	2680	280	445	–35	–186
Metallic character	Metal	Metal	Metal	Semi-metal	Non-metal	Non-metal	Non-metal	Non-metal

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

Examiner Only	
Marks	Remark

(a) Name the **metal** which has the highest melting point.

_____ [1]

(b) Describe the trend in the metallic character across Period 3.

_____

_____ [1]

(c) Name an element from the table that is a **gas** at room temperature (25 °C).

_____ [1]

(d) Name the element which is an **alkali metal**.

_____ [1]

(e) What is the electronic configuration of the **semi-metal**?

Circle the correct answer.

2.8.4 : **2.4.8** : **2.8.6** [1]

(f) Sodium reacts with chlorine to form the compound sodium chloride.
What is the formula for **sodium chloride**?

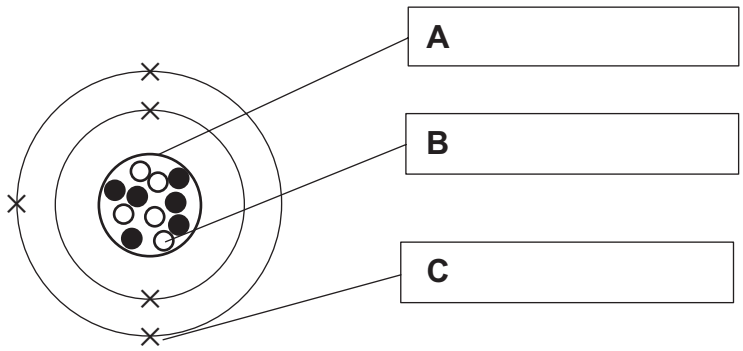
_____ [1]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

3 The diagram shows an atom of boron.



(a) Name the parts labelled **A**, **B** and **C** on the diagram above. [3]

(b) A fluorine atom has nine electrons.

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

[2]

(c) What is meant by the term **atomic number**?

_____

_____ [1]

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(d) The table below contains information about the structure of four elements **W**, **X**, **Y** and **Z**.

Element	Number of protons	Number of neutrons	Number of electrons
W	2	2	2
X	11	12	11
Y	20	20	20
Z	8	8	8

(You may find your Data Leaflet helpful.)

(i) Calculate the mass number of element **Y**.

_____ [1]

(ii) Name the element **X**.

_____ [1]

(iii) Which element (**W**, **X**, **Y**, **Z**) has six electrons in its outer shell?

_____ [1]

(iv) Which element (**W**, **X**, **Y**, **Z**) is a noble gas?

_____ [1]

Examiner Only

Marks	Remark

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4 Flame tests can be used to identify the metal in a compound.

Explain how you would carry out a flame test experiment on solutions of potassium chloride and sodium chloride.

Your answer should include:

- any safety precautions
- the results you would expect to see

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only	
Marks	Remark

5 The table below gives information about some materials.

Material	Relative heaviness	Relative strength	Relative stiffness	Relative cost
Steel	7800	10	105	low
Kevlar	1500	30	95	very high
Carbon fibre reinforced plastic	1600	18	100	high
Glass fibre reinforced plastic	1900	15	10	high

(a) Using the information in the table and your knowledge of materials, give **two** reasons why carbon fibre reinforced plastic has replaced traditional metals such as steel in manufacturing golf clubs.

1. _____

_____

2. _____

_____ [2]

(b) Carbon fibre reinforced plastic can be used as supporting cables in the structure of suspension bridges. Using the information in the table and your knowledge of materials, choose a material that may be more suitable and explain your choice.

_____

_____

_____

_____ [2]

(c) Glass fibre reinforced plastic and carbon fibre reinforced plastic are both described as composite materials. What is meant by the term **composite material**?

_____

_____

_____ [2]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

6 The Marble Arch Caves are found in Fermanagh which is a hard water area.



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(a) Give an **economic** benefit that the caves bring to the Fermanagh area.

_____ [1]

(b) Other than taste, give an **advantage** of drinking hard water.

_____ [1]

(c) Hard water forms undesirable deposits of calcium carbonate in kettles and hot water pipes. Complete the **balanced symbol equation** for this reaction.

$Ca(HCO_3)_2 \longrightarrow$ _____ + _____ + _____ [3]

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(d) The deposits of calcium carbonate inside a kettle are often described as 'fur'. Kettle 'fur' can be removed by reacting it with an acid. Complete the word equation below for this reaction.

calcium carbonate + hydrochloric acid → [ ] + water + [ ]

[2]

(e) A student conducted the following investigation into the hardness of different samples of water. She put 25 cm^3 of four different samples **P**, **Q**, **R**, **S** into separate flasks. She added soap solution to each flask and shook until a lather was formed. She repeated the experiment with boiled samples. The results are shown below.

Sample	Height of lather before boiling/mm	Height of lather after boiling/mm
P	5	5
Q	20	19
R	28	28
S	4	20

(i) The student concluded that samples **Q** and **R** were soft water. Using the information in the table explain why she is correct.

_____

_____

_____ [2]

(ii) What can be concluded about the type of water in sample **S**? Explain your answer.

_____

_____

_____ [2]

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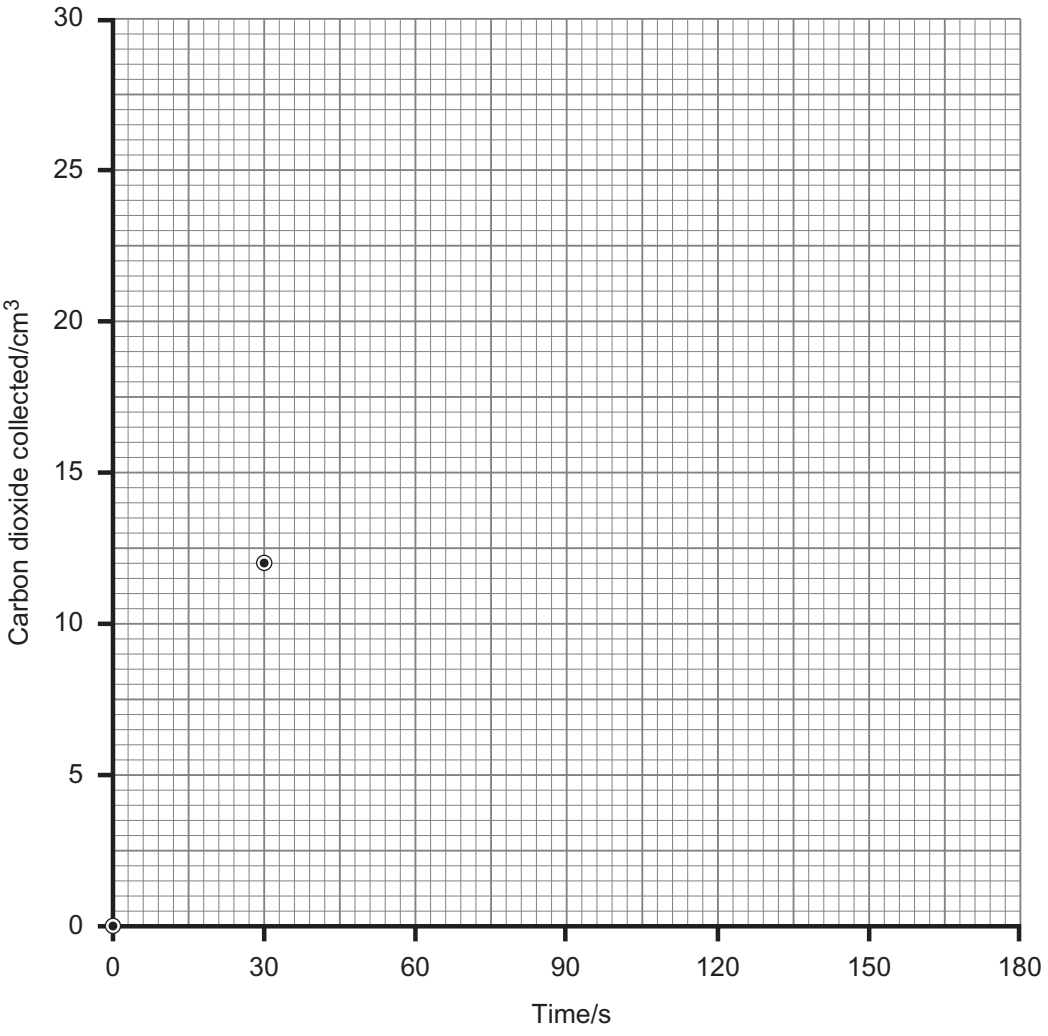
Marks	Remark

Examiner Only	
Marks	Remark

7 James added sodium hydrogencarbonate to a conical flask that contained acid. He measured the amount of carbon dioxide gas produced over a period of 180 seconds. His results are shown below.

Time/s	0	30	60	90	120	150	180
Carbon dioxide collected/cm^3	0	12	18	22	25	27	27

(a) Plot and draw a line graph for these results on the grid below.
The first two points are plotted for you.



[3]

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(b) At what time did the reaction finish?

_____ s [1]

(c) To improve the reliability of the results James should do which of the following?

Tick (✓) the correct box.

Repeat the experiment at least once ☐

Do the experiment for a longer period ☐

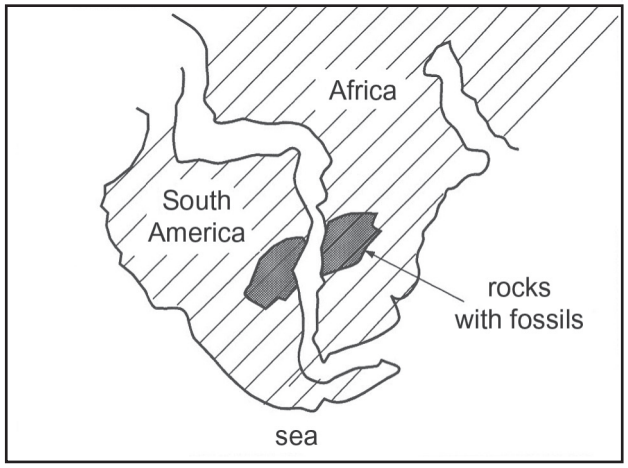
Use stronger acid ☐ [1]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

8 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 of continental drift. 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.

Use the information above and your knowledge to explain Alfred Wegener's theory including the evidence that supports it and reasons why other scientists rejected it.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only	
Marks	Remark

9 When hydrocarbon fuels burn, oxygen from the air combines with atoms of carbon and hydrogen.

The word equation for the combustion of propane is given below.

propane + oxygen ⟶ carbon dioxide + water

(a) Write the **balanced symbol** equation for the combustion of propane.

_____ [3]

(b) During the combustion of any fuel, carbon dioxide is formed. Describe a **chemical** test that could be carried out to identify carbon dioxide including the results you would expect.

_____

_____

_____ [2]

(c) Magnesium burns in air to form magnesium oxide.

(i) As well as a combustion reaction, this reaction can be described as an oxidation reaction. What is meant by the term 'oxidation'?

_____ [1]

(ii) Describe in terms of **electron transfer** how the bond in magnesium oxide is formed.

_____

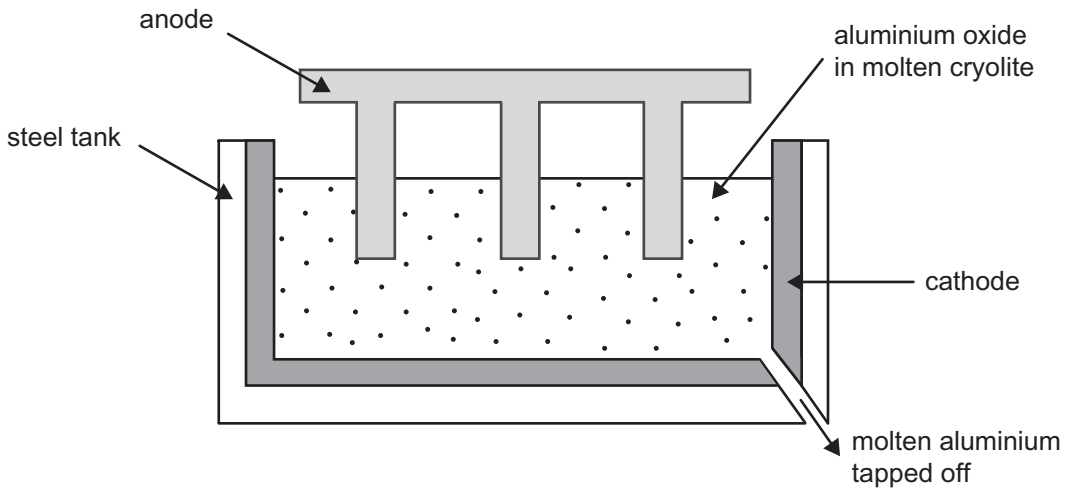
_____

_____

_____ [3]

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10 Aluminium is extracted from aluminium oxide using electrolysis. The apparatus is shown below.



(a) What is the meaning of the term 'electrolysis'?

_____

_____ [2]

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

_____ [1]

(c) Write an **ionic equation** for the formation of aluminium.

_____ [3]

(d) Name a suitable material for the anode and explain why it is used.

_____

_____ [2]

Examiner Only

Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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112973

New Specification

Rewarding Learning

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

TUESDAY 13 NOVEMBER 2012
9.15 am–10.30 am

MARK SCHEME

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				AVAILABLE MARKS
1	**(a)**	**(i)** Magnesium [1]		
		(ii) Copper [1]		
		(iii) Any **two** of: ● Fast/vigorous reaction ● Magnesium dissolves/disappears ● Heat given out/exothermic/temperature rise/gets warmer ● Blue colour of copper sulfate disappears/fades/solution becomes colourless ● Brown/pink solid/copper metal forms ● Other suitable Total [2]		
	(b)	Iron [1] + Magnesium sulfate [1] either order Total [2]		
	(c)	**(i)** $CuSO_4$ [1]		
		(ii) $MgCl_2$ [1]		8
2	**(a)**	Aluminium [1]		
	(b)	Metallic character decreases across the period/changes from metal to non-metal. [1]		
	(c)	Chlorine/Argon [1]		
	(d)	Sodium [1]		
	(e)	2.8.4 [1]		
	(f)	NaCl [1]		6
3	**(a)**	A: Nucleus [1] B: Proton [1] C: Electron [1]		
	(b)	2.7 correct number of shells [1] correct electronic arrangement [1] [2]		
	(c)	The number of protons in an element/atom [1]		
	(d)	**(i)** 40 [1]		
		(ii) Sodium [1]		
		(iii) Z/Oxygen [1]		
		(iv) W/Helium [1]		10

4 Indicative Content

AVAILABLE MARKS

Flame Test

- Use a Flame test rod/inoculating loop
- Clean the rod by dipping into (concentrated) acid or heating in Bunsen Flame
- Dip the rod into the metal solution and place into Bunsen Flame, (record the colour change)/spray the solution into Flame
- Clean the rod and repeat for next solution
- Safety: use goggles and take care with Bunsen Flame

Results

- Sodium – Orange/Yellow Flame
- Potassium – Lilac Flame

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe the experiment, in a logical sequence and using **6 or 7** of the above Flame test points and must also include a result. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates must use some appropriate specialist terms throughout to describe the procedure, using **3 to 5** of the above points. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe the procedure using only **1 or 2** of the above points however these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	[1–2]
D	Response not worthy of credit.	[0]

6

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				AVAILABLE MARKS
5	**(a)**	Carbon fibre reinforced plastic is not as heavy [1] } must be Carbon fibre reinforced plastic is stronger [1] } comparison *Accept reverse arguments for steel*	[2]	
	(b)	Kevlar [1] it is stronger [1]	[2]	
	(c)	Composite materials combine the properties of more than one material [1] to produce a more useful material [1]	[2]	6
6	**(a)**	Tourism	[1]	
	(b)	Any **one** of: ● Stronger Teeth/bones ● Helps prevent heart disease	[1]	
	(c)	$Ca(HCO_3)_2 \longrightarrow CaCO_3 + H_2O + CO_2$ [1] [1] [1]	[3]	
	(d)	Calcium Chloride [1] Carbon Dioxide [1] *Any order*	[2]	
	(e) **(i)**	Both produced a large amount of lather [1] before and after boiling [1]	[2]	
	(ii)	S is temporary hard water [1] hardness removed after boiling [1]	[2]	11
7	**(a)**	5 points plotted correctly [2], 3/4 points plotted correctly [1] Smooth curve [1], Dot–Dot (x) Ruler (x)	[3]	
	(b)	150 [1] allow from graph		
	(c)	Repeat the experiment [1]		5

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8 Indicative Content

Theory

- Originally one continent called ('Pangaea')
- It broke up and formed other continents
- Two million years ago

Evidence

- Continents fitted together like a jigsaw
- Rock (pattern) in one continent extended into another continent
- Fossils found in different continents match up across the joint

Rejection

- Geologists believed that continents could not drift/no evidence at that time/fixed position

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe the theory, in a logical sequence and using **6 or 7** of the above points. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates must use some appropriate specialist terms throughout to describe the theory, using **3 to 5** of the above points. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe the theory using only **1 or 2** of the above points however these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	[1–2]
D	Response not worthy of credit.	[0]

AVAILABLE MARKS

6

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				AVAILABLE MARKS
9	**(a)**	$C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$ LHS [1] RHS [1] Balanced [1]	[3]	
	(b)	Bubble Carbon Dioxide through Limewater [1] Limewater turns milky/cloudy [1] dependant	[2]	
	(c)	**(i)** (Magnesium) gains oxygen	[1]	
		(ii) Magnesium **loses** electrons. [1] *(can be inferred)* Oxygen **gains** electrons. [1] *(can be inferred)* Reference made to **two** electrons [1] (The magnesium atom transfers 2 electrons to the oxygen atom [3])	[3]	9
10	**(a)**	Using electricity [1] to break down/decompose a substance [1]	[2]	
	(b)	Cathode	[1]	
	(c)	$Al^{3+} + 3e^- \longrightarrow Al$ LHS [1] RHS [1] Correct balancing [1]	[3]	
	(d)	Carbon/Graphite [1] it is unreactive/inert [1]	[2]	8
			Total	**75**

New Specification

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

TUESDAY 28 FEBRUARY 2012
11.00 am–12.15 pm

GSS22

TIME

1 hour 15 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 eight** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Quality of written communication will be assessed in questions **2(d)** and **5(b)**.
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.

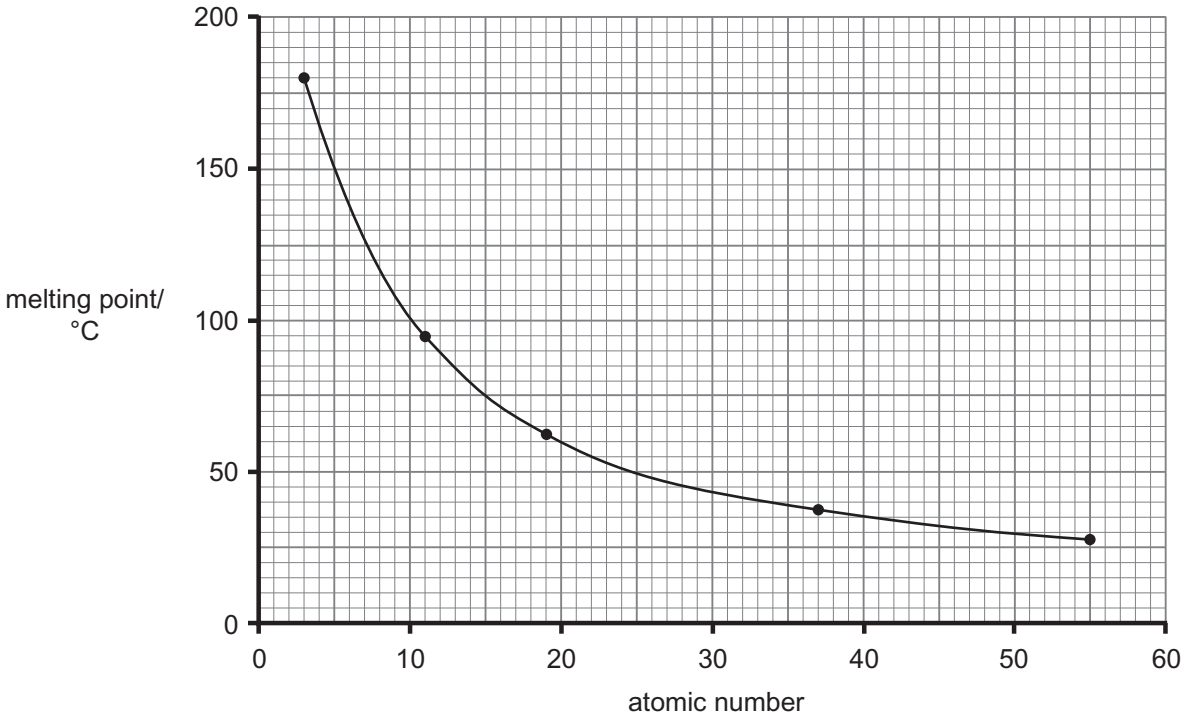
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Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
Total Marks	

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Examiner Only	
Marks	Remark

1 The graph below shows the relationship between the melting point and atomic number of five elements.

The five elements are all from the same group of the Periodic Table.



You may find your Data Leaflet helpful to answer the questions below.

(a) **(i)** What is the atomic number of the element with the highest melting point?

_____ [1]

(ii) Name this element. _____ [1]

(b) **(i)** What is the melting point of the element with atomic number 37?

_____ °C [1]

(ii) Name this element. _____ [1]

(c) To which group of the Periodic Table do these elements belong?

Group _____ [1]

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(d) Describe fully the trend shown by the graph.

Examiner Only

Marks	Remark

_____

_____ [2]

(e) The table below lists some information about the elements called halogens. At the melting point an element changes from a solid to a liquid. At the boiling point an element changes from a liquid to a gas.

Element	Melting point/ °C	Boiling point/ °C	Mass number
Fluorine	−220	−188	19
Chlorine	−101	−35	36
Bromine	−7	59	80
Iodine	113	183	127

(i) Name the element in the table which has the lowest melting point.

_____ [1]

(ii) Name the halogen which is a **liquid** at room temperature (20 °C).

_____ [1]

(iii) Complete the following sentence to describe a trend shown by the results.

As the boiling point of the elements _____

the mass number _____. [1]

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Examiner Only	
Marks	Remark

2 Mineral water contains many different ions which give it a characteristic taste. The table below gives the information shown on the label of a popular brand of mineral water.

Ions present	Concentration/arbitrary units
Magnesium	18
Potassium	3
Calcium	113
Sodium	17
Chloride	32
Hydrogencarbonate	430
Nitrate	11
Phosphate	1
Sulfate	2

(a) (i) Using the information in the table, calculate the total concentration of the ions causing this mineral water to be hard.
(Show your working out.)

_____ arbitrary units [2]

(ii) Name the ion in the table which would be thermally decomposed if the water was boiled.

_____ [1]

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(b) Hard water can cause undesirable deposits of calcium carbonate, called 'fur', in kettles.

Complete the word equation to show how the 'fur' forms in kettles.

	→	calcium carbonate	+		+	

[3]

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

_____

_____ [2]

(d) Describe an experiment you could carry out in the laboratory to compare the hardness of bottled water to the hardness of the tap water in your school.

In this question you will be assessed on your written communication skills including the use of specialist terms.

_____

_____

_____

_____

_____

_____

_____

_____ [6]

(e) Give **one** advantage of drinking hard water.

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

3 **(a)** Aluminium sulfate has the chemical formula $Al_2(SO_4)_3$.

(i) How many different elements are present in this formula?

_____ [1]

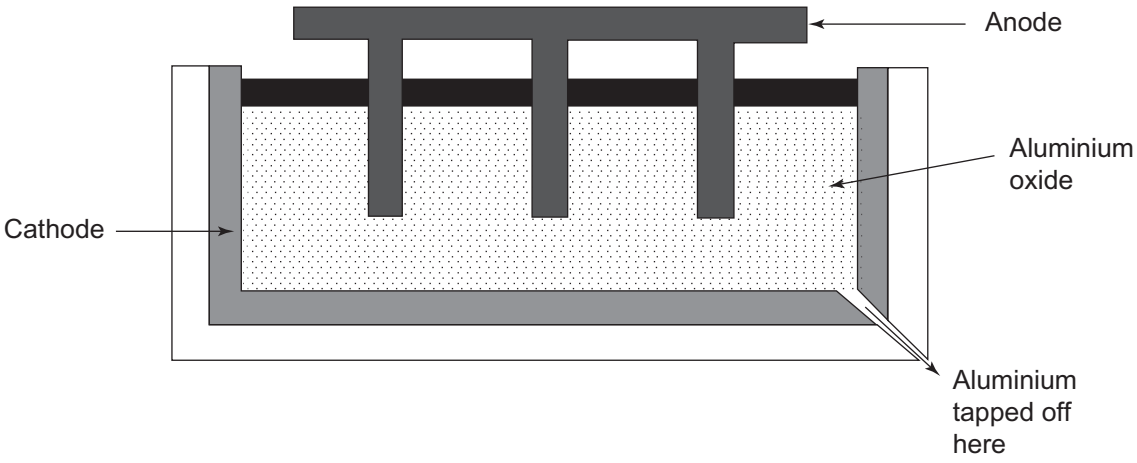
(ii) How many oxygen atoms are there in this formula?

_____ [1]

(iii) What is the total number of atoms in this formula?

_____ [1]

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



(b) Describe how the aluminium is extracted from the aluminium oxide by completing the following sentences.

In this extraction process the cathode is _____ charged

and is made of _____ . The aluminium ions travel to the

_____ where they are discharged and form

_____ metal. Oxide ions travel to the _____

where they form _____ gas. [6]

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(Questions continue overleaf)

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Marks	Remark

4 The properties of four metals are shown in the table below.

Metal	Density/ g/cm^3	Relative strength	Melting point/ °C	Relative electrical conductivity	Cost per tonne/£
Iron	7.9	1.0	1535	1.0	130
Aluminium	2.7	0.3	660	3.7	950
Copper	8.9	0.6	1083	5.8	3100
Silver	10.5	0.4	962	6.1	250 000

(a) Use the information in the table to answer the following questions.

(i) Explain fully why the properties of aluminium make it more suitable than copper for use in overhead electrical cables in the National Grid.

_____

_____

_____ [3]

(ii) Explain why iron is used to make bridges.

_____

_____ [2]

(b) The table below gives some information about materials A, B, C and D. These could be metals, metal compounds or non-metals.

Metal compounds can only conduct electricity in the liquid state.

Material	Electrical conductivity in solid state	Electrical conductivity in liquid state	Melting point/ °C
A	Poor	Poor	3550
B	Good	Good	327
C	Poor	Good	808
D	Good	Good	1540

Use this information to answer the following questions.

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(i) Which material (A, B, C or D) is a metal with a low melting point?

_____ [1]

(ii) Which material (A, B, C or D) is a metal compound?

_____ [1]

(iii) Which material (A, B, C or D) is a non-metal?

_____ [1]

(c) Silver is used in sterilising sprays and wound dressings.

The silver has to be specially prepared to give it new properties for these specialised uses. Fully describe the silver particles that are used in sterilising sprays.

_____

_____ [2]

(d) Some newly developed materials are described as smart materials.

Explain fully what is meant by the term 'smart material'.

_____

_____ [2]

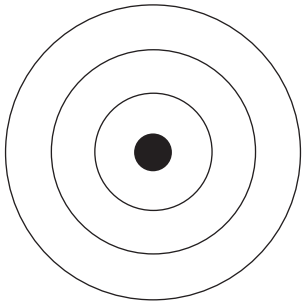
Examiner Only	
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Examiner Only	
Marks	Remark

5 Sodium reacts with chlorine to form the compound sodium chloride.

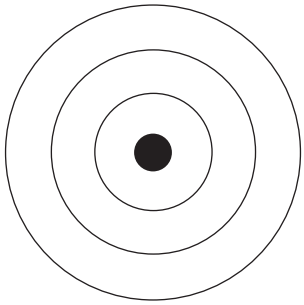
(a) Complete the diagrams below to show the arrangement of **all** of the electrons in a sodium atom and a chlorine atom.

(i) Sodium atom



[1]

(ii) Chlorine atom



[1]

(b) Explain fully in terms of the ions and atoms involved, how the electron arrangement changes when sodium chloride is formed from sodium and chlorine.

In this question you will be assessed on your written communication skills including the use of specialist terms.

[6]

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Examiner Only	
Marks	Remark

6 **(a)** Explain fully how Archbishop Ussher used the Bible to estimate the age of the Earth.

_____

_____

_____

_____ [2]

(b) What is the age of the Earth estimated by Ussher?

_____ [1]

(c) Some rocks contain fossils. These can help scientists in estimating the age of the Earth.

Explain fully what is meant by the term fossil.

_____

_____ [2]

(d) The modern scientific method for estimating the age of the Earth suggests that the Earth is very much older than Ussher's estimate.

Explain fully how the modern scientific method works.

_____

_____

_____

_____

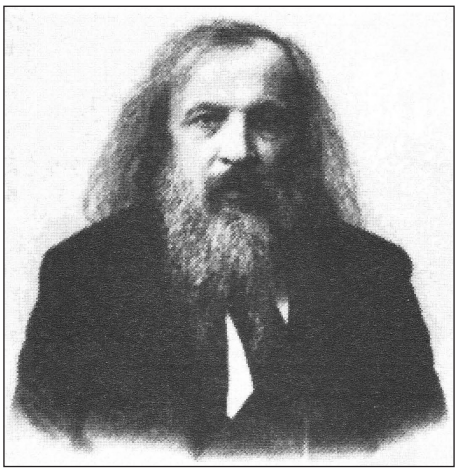
_____ [3]

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Examiner Only	
Marks	Remark

7 The Periodic Table has been developed over a period of time.

Dimitri Mendeleev was one of the chemists who helped to do this.



The Greeks were the first to attempt to classify the elements. They had just four elements.

John Newlands noticed a repeating pattern and he tried to put the chemical elements into a table.

Mendeleev developed the idea of a table further and left some gaps in between the elements.

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

You may find your Data Leaflet helpful.

(a) Name the four elements known to the Greeks.

_____ [1]

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

_____

_____ [1]

(c) **(i)** In what order did Mendeleev arrange the elements?

_____ [1]

(ii) Why did he leave gaps between some of the elements?

_____ [1]

(d) The modern Periodic Table is still very like the one produced by Mendeleev. However much more is now known about the structure of atoms.

How does the modern Periodic Table take account of what is now known about the structure of the atom?

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

8 The following chemical compounds are important hydrocarbons.

methane : ethane : propane : ethene : butane

(a) (i) Which one of these compounds is **not** an alkane?

_____ [1]

(ii) Propane has the molecular formula C_3H_8.

In the space below draw the **structural** formula of propane.

[1]

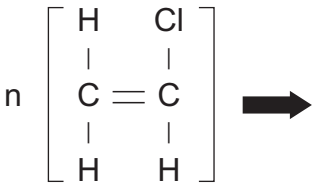
(iii) Give the molecular formula for:

1. butane _____

2. ethene _____ [2]

(b) Vinyl chloride can be polymerised to form the well known polymer PVC.

In the space below, complete the balanced symbol equation for the formation of PVC.



[3]

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THIS IS THE END OF THE QUESTION PAPER

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New Specification

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[GSS22]

TUESDAY 28 FEBRUARY 2012
11.00 am–12.15 pm

MARK SCHEME

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				AVAILABLE MARKS
1	**(a)**	**(i)** 3	[1]	
		(ii) lithium	[1]	
	(b)	**(i)** 37.5 ± 0.5	[1]	
		(ii) rubidium	[1]	
	(c)	one/alkali metals	[1]	
	(d)	as the atomic number increases, the melting point decreases reference to change in slope as atomic number increases	[1] [1]	
	(e)	**(i)** fluorine	[1]	
		(ii) bromine	[1]	
		(iii) increase, increase *or* decrease, decrease	[1]	10
2	**(a)**	**(i)** 18 + 113 [1] = 131 [1]	[2]	
		(ii) hydrogencarbonate	[1]	
	(b)	calcium hydrogencarbonate ⟶ carbon dioxide + water	[3]	
	(c)	does not lather [1] forms scum or/with soap [1]	[2]	

(d) **Indicative content**

- Take a given volume of bottled water
- Add soap solution to get a permanent lather
- Record volume of soap solution
- Repeat procedure for tap water
- Water which requires most soap is hardest
- A correctly named piece of apparatus
- A controlled variable

Band	Response	Mark
A	Using 5–7 of the points shown in the indicative content, candidates describe fully an experiment to test the hardness of two water samples and compare them, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a good high standard.	5–6
B	Using 3–4 of the points shown in the indicative content candidates describe fully an experiment to test the hardness of two water samples and compare them, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	3–4
C	Candidates make reference to 1–2 of the points shown in the indicative content using limited spelling, punctuation and grammar. The form and style is of limited standard and they have made little use of the specialist terms.	1–2
D	Response not worthy of credit.	0

[6]

AVAILABLE MARKS

(e) better taste/stronger teeth and bones/reduce risk of heart disease [1] 15

3 **(a)** **(i)** 3 [1]

(ii) 12 [1]

(iii) $2 + 3 + 12 = 17$ [1]

Alternative answer: Accept graphite.

(b) negatively, carbon, cathode, aluminium anode, oxygen [6] 9

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					AVAILABLE MARKS
4	**(a)**	**(i)**	low density, reasonable cost still a good conductor [1]	*any 2 properties* + 1 explanation [3]	
		(ii)	strong metal, low cost	[2]	
	(b)	**(i)**	B		
		(ii)	C		
		(iii)	A	[3]	
	(c)		the particles are reduced in size [1] to nano size [1]	[2]	
	(d)		material which can change properties with surroundings [1] light/temperature [1]	[2]	12

5 (a) 2, 8, 1 arrangement [1] 2, 8, 7 arrangement [1] [2]

AVAILABLE MARKS

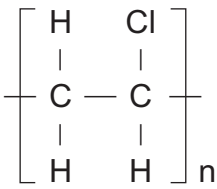
(b) Indicative content

- Transfer
- Correct director of transfer
- Correct number of electrons transferred
- Correct charge on the sodium ion
- Correct charge on the chloride ion
- Correct idea of full outer shells

Band	Response	Mark
A	Using 5–6 of the points shown in the indicative content, candidates describe fully how the atoms of sodium and chlorine join to form sodium chloride in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	5–6
B	Using 3–4 of the points shown in the indicative content candidates describe fully how the atoms of sodium and chlorine join to form sodium chloride in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	3–4
C	Candidates make reference to 1–2 of the points shown in the indicative content using limited spelling, punctuation and grammar. The form and style is of limited standard and they have made little use of the specialist terms.	1–2
D	Response not worthy of credit.	0

[6] 8

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				AVAILABLE MARKS
6	**(a)**	He counted the generations [1] He added them up to get to the present time [1]	[2]	
	(b)	6000 years	[1]	
	(c)	remains of an animal or plant [1] preserved in rock [1]	[2]	
	(d)	radioactivity/use of radio isotopes/uranium or potassium/ presence of daughter nuclei/in rocks *any 3*	[3]	8
7	**(a)**	earth, fire, wind/air, water	[1]	
	(b)	law of octaves/every 8th element/was similar	[1]	
	(c)	**(i)** atomic mass order	[1]	
		(ii) for undiscovered elements	[1]	
	(d)	Idea of increasing atomic number/Proton number order [1] Idea of groups – Noble gases or transition metals [1] number of electrons in outer shell equal to group number [1]	[2]	6
8	**(a)**	**(i)** ethene	[1]	
		(ii) correct structure for propane	[1]	
		(iii) C_4H_{10} [1] C_2H_4 [1]	[2]	
	(b)	 single bond [1] brackets with correct ratio of atoms [1] correct position of “n” [1]	[3]	7
			Total	**75**