CCEA GCSE DOUBLE AWARD SCIENCE

SCIENCE



EXAM QUESTION PACK

CHEMISTRY UNIT C2 FOUNDATION TIER GSD51 PAPERS

STEMUP

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2016

Double Award Science: Chemistry

Unit C2
Foundation Tier

[GSD51]

GSD51

WEDNESDAY 15 JUNE 2016, AFTERNOON

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

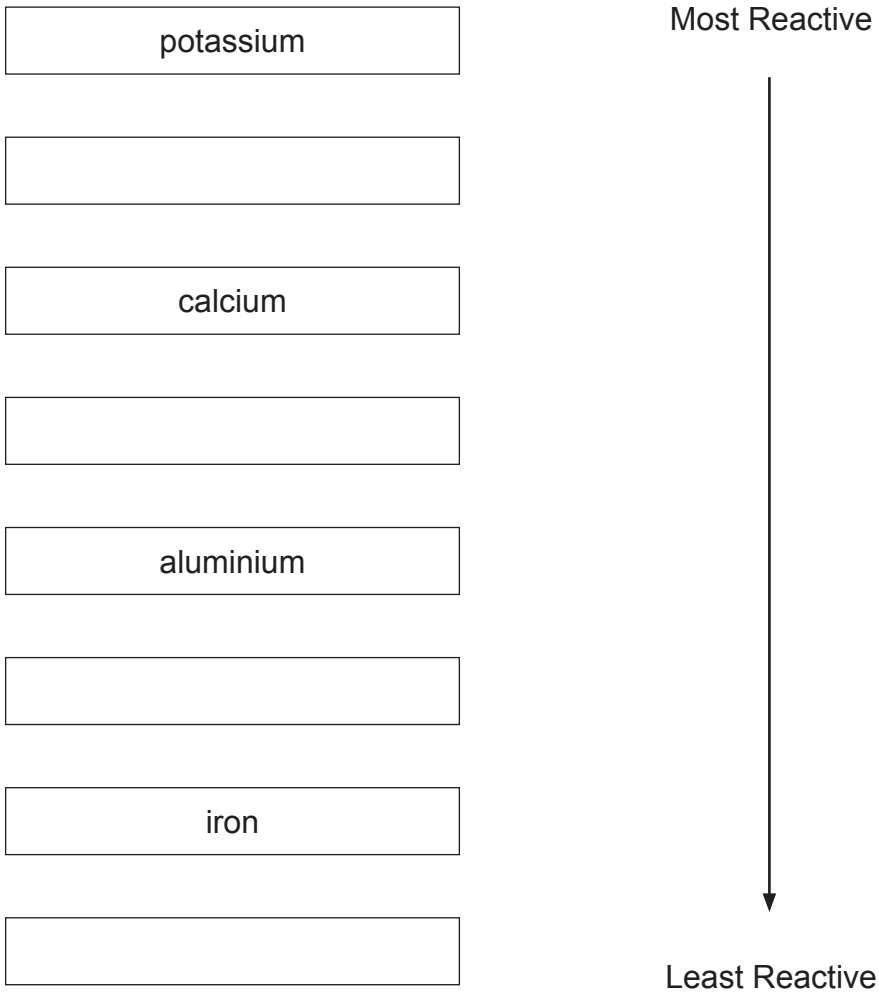
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in blue or black ink only. **Do not write with a gel pen.**
Answer **all nine**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

INFORMATION FOR CANDIDATES

The total mark for this paper is 90.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **5(c)**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

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1 **(a)** Complete the reactivity series below by placing the metals **zinc, copper, sodium and magnesium** in their correct positions.



[4]

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(b) Sodium will react with water. In the table below tick (✓) **four** observations that can be made when sodium reacts with water.

OBSERVATION	TICK
The metal moves about the surface	
The solution changes colour	
The metal sinks to the bottom and rises	
The reaction is vigorous	
A silver ball is formed	
A white solid is formed in the water	
The sodium disappears	

[4]

(c) Complete the word equation for the reaction of sodium with water.

sodium + water → +

[2]

(d) Lithium reacts with water and is below sodium in the reactivity series. Predict how it will react with water by ticking (✓) the **two** statements below which are correct.

STATEMENT	TICK
It will react faster than sodium	
Bubbles of gas will be given off	
It will react more slowly than sodium	
No bubbles of gas will be given off	

[2]

[Turn over

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2 This question is about oxidation, reduction and the rusting of iron.

(a) Complete the sentence below to explain what is meant by oxidation of a substance.

Oxidation is the gain of _____ or the removal

of _____ from a substance. [2]

(b) Different methods can be used to protect iron objects from rusting. Match the objects below to the most suitable rust prevention method. One has been done for you.

Object	Method
Iron gates	Plastic coating
Bicycle chain	Painting
Nuts and bolts	Greasing
Coat hanger	Chrome plating
Bath tap	Oiling

[3]

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(c) Magnesium can be oxidised by burning in air.

(i) Describe how you would burn magnesium in air.

_____

_____

_____ [2]

(ii) Give two safety precautions you should take while doing this experiment.

1. _____

2. _____ [2]

(iii) Describe two things you would observe during this experiment.

1. _____

2. _____ [2]

(d) When zinc metal is burned in oxygen gas a reaction takes place.

(i) Name the substance formed.

_____ [1]

(ii) What is the physical state of the substance formed?

_____ [1]

[Turn over

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3 This question is about the rate of reaction of zinc metal with acid.

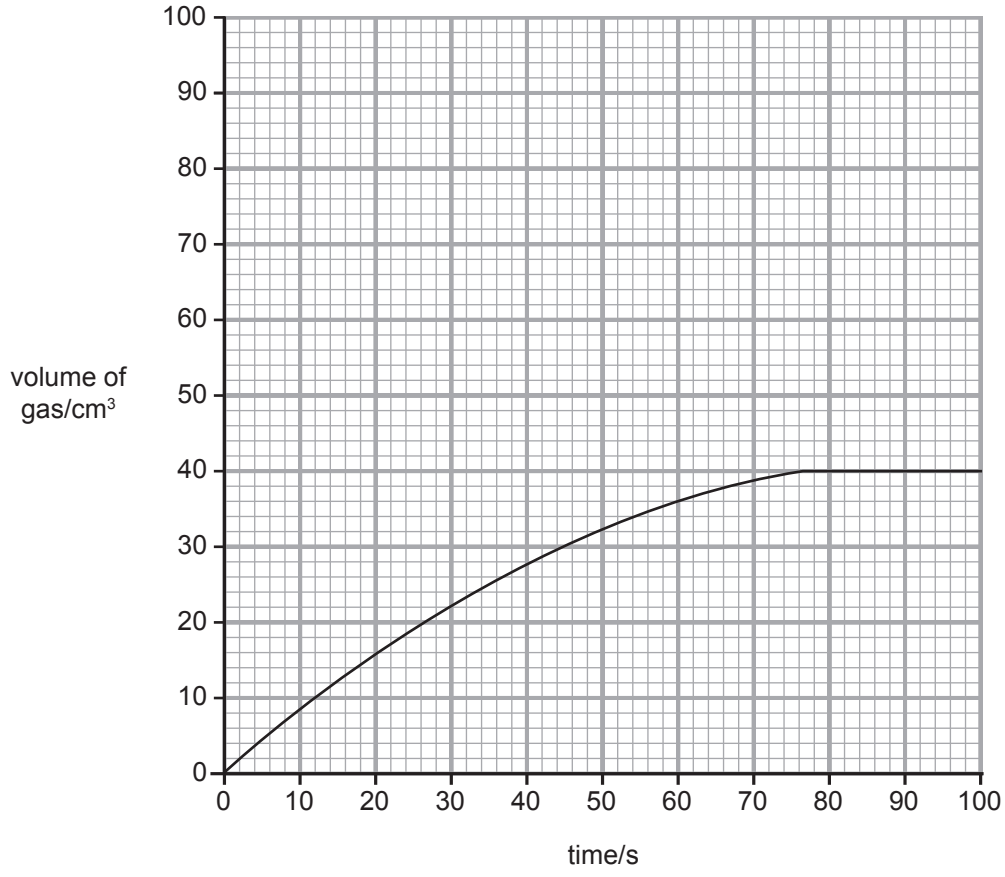
(a) When zinc metal is reacted with acid, the reaction rate can be increased by increasing the concentration of the acid. Give three other things you could do to increase the rate of the reaction.

1. _____

2. _____

3. _____ [3]

(b) A group of students investigated how dilute hydrochloric acid reacted with zinc granules. The volume of hydrogen gas given off was measured every 20 seconds and a graph drawn as shown below. Excess zinc was used to make sure that all the acid reacted.



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(i) How much gas is given off after 40 seconds?

_____ [1]

(ii) After how many seconds did the reaction stop?

_____ [1]

(iii) What happens to the reaction rate as the time increases?

_____

_____ [1]

(c) **On the graph** draw the curve you would expect to get if the acid concentration was doubled and the zinc granules were still in excess. You should assume that the volume of acid used was the same as in the earlier investigation. [2]

[Turn over

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4 This question is about the combustion of carbon and the properties of the products formed.

(a) **(i)** What element apart from carbon is needed for combustion to take place?

_____ [1]

(ii) What compound is formed on the **complete** combustion of carbon?

_____ [1]

(iii) What other compound is formed on the **incomplete** combustion of carbon?

_____ [1]

(iv) Why is combustion not always complete?

_____ [1]

(v) Explain why the compound formed in the incomplete combustion of carbon is so dangerous.

_____

_____ [2]

(b) Carbon dioxide is a gas. Give two other physical properties of carbon dioxide.

1. _____

2. _____ [2]

(c) Complete the word equation below to show what happens when carbon dioxide reacts with water.

carbon dioxide + water →

[1]

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(d) When carbon dioxide is bubbled through limewater ($Ca(OH)_2$) solution a white precipitate is formed. If more carbon dioxide is bubbled through, the precipitate will disappear.

(i) What is the chemical name of the precipitate?

_____ [1]

(ii) Why does the precipitate disappear when excess carbon dioxide is added?

_____

_____

_____ [2]

[Turn over

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5 This question is about sulfur, sulfur dioxide and acid rain.

(a) Give two physical properties of sulfur.

1. _____

2. _____ [2]

(b) Sulfur burns in air/oxygen to give the colourless gas, sulfur dioxide.

(i) What colour is the flame when sulfur burns in air?

_____ [1]

(ii) Circle the word below which best describes the smell of sulfur dioxide gas.

odourless **pungent** **sweet-smelling** **smoky**

[1]

(c) Sulfur dioxide reacts with water in the air to form acid rain.

Describe environmental and economic effects of acid rain and outline measures which are used to help prevent acid rain.

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

[6]

[Turn over

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6 This question is about hard and soft water.

(a) Describe a simple experiment to show that a sample of water is soft water.

_____

_____

_____ [2]

(b) Give three disadvantages of hard water.

1. _____

2. _____

3. _____ [3]

(c) Water containing two of the substances listed below could be described as hard water.

Circle the **two** substances, from the list below, which would make water hard.

sodium chloride **calcium chloride** **copper sulfate**

magnesium sulfate **potassium carbonate** **lithium carbonate**

[2]

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(Questions continue overleaf)

7 This question is about relative formula masses and using and understanding the term mole.

(a) Calculate the relative formula mass of each of the following substances.

(relative atomic masses: H = 1, C = 12, O = 16, N = 14, Na = 23, Mg = 24)

(i) ammonia NH_3

_____ [1]

(ii) sodium carbonate Na_2CO_3

_____ [1]

(iii) magnesium hydroxide $Mg(OH)_2$

_____ [1]

(b) What do you understand by the term "a mole of a substance"?

_____

_____

_____ [2]

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(c) The relative formula mass of sulfur dioxide is 64.

(i) What is the mass of 0.6 moles of sulfur dioxide?

_____ g [1]

(ii) How many moles are in 320 grams of sulfur dioxide?

_____ [1]

[Turn over

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8 **(a)** Adding water to anhydrous copper sulfate can be used as a test for water.

(i) Describe the colour change when water is added drop by drop to anhydrous copper sulfate.

from _____ to _____ [2]

(ii) Is this an exothermic or endothermic reaction?

_____ [1]

(b) When bonds are made in a reaction is energy released or is it taken in?

_____ [1]

(c) When copper carbonate is heated it undergoes thermal decomposition.

(i) Complete the word equation for this reaction.

Copper carbonate → [2]

(ii) Describe the colour change when copper carbonate is heated.

from _____ to _____ [2]

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(Questions continue overleaf)

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20GSD5117

9 **(a)** Crude oil is a source of compounds called alkanes which are hydrocarbons.

What is meant by the term hydrocarbon?

_____

_____ [2]

(b) Explain how fractional distillation separates the compounds found in crude oil.

_____

_____

_____

_____ [3]

(c) Complete the table below by giving the molecular and structural formula of the named compounds.

Name	Molecular Formula	Structural Formula
Ethane		
Ethene		

[4]

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(d) The alkene ethene undergoes addition polymerisation to form the polymer polythene.
Addition polymers are non-biodegradable and so they cannot be broken down in the environment.
There are two methods of disposal of these polymers – landfill and incineration.
Compare advantages and disadvantages of the two methods of disposal.

Landfill

Advantage: _____

_____

Disadvantage: _____

_____

Incineration

Advantage: _____

_____

Disadvantage: _____

_____ [4]

THIS IS THE END OF THE QUESTION PAPER

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

Examiner Number

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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.

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Solubility of Common Salts 4

gcse
science
chemistry
double award
single award

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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

Double Award Science: Chemistry

Unit C2

Foundation Tier

[GSD51]

WEDNESDAY 15 JUNE 2016, AFTERNOON

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 **(a)** 1. Potassium
2. Sodium [1]
3. Calcium
4. Magnesium [1]
5. Aluminium
6. Zinc [1]
7. Iron
8. Copper [1] [4]

(b)

OBSERVATION	TICK
The metal moves about the surface	✓
The solution changes colour	
The metal sinks to the bottom and rises	
The reaction is vigorous	✓
A silver ball is formed	✓
A white solid is formed in the water	
The sodium disappears	✓

Each correct tick gains [1] mark but if more than 4 ticks then each error reduces maximum mark by 1, e.g. 5 ticks – 3 correct and 2 wrong would get [2] marks. [4]

(c) sodium + water → sodium hydroxide + hydrogen
[1] [1] [2]

(d)

STATEMENT	TICK
It will react faster than sodium	
Bubbles of gas will be given off	✓ [1]
It will react more slowly than sodium	✓ [1]
No bubbles of gas will be given off	

[2] 12

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			AVAILABLE MARKS
2	**(a)**	oxygen [1] hydrogen [1] (accept electrons) [2]	
	(b)	Iron gates – painting Bicycle chain – oiling Coat hanger – plastic coating Bath tap – chrome plating 4 correct – [3], 2 or 3 correct [2], 1 correct [1] [3]	
	(c) **(i)**	Use tongs to hold magnesium/place magnesium in crucible/on crucible lid/on gauze [1] Heat using a Bunsen burner/Bunsen [1] accept idea of heat using a flame. (**Not just heat**) [2]	
	(ii)	Any **two** of: use a fume cupboard/safety screen wear (safety) goggles idea of heating at arm's length use tongs idea of not looking directly at flame wear heat proof gloves not wear gloves any 2 × [1] [2] **not general answers** such as tie hair back or clear the bench	
	(iii)	Any **two** of: burns with a bright white flame/bright white light/bright light – unless wrongly qualified form a **white** powder/ash Accept colour as grey-white **not** grey idea of very vigorous idea of smoke produced unless wrongly qualified (**not** gas produced) or other correct any 2 × [1] [2]	
	(d) **(i)**	Zinc oxide [1]	
	(ii)	solid [1]	13
3	**(a)**	Any **three** of: heat (the reaction flask)/idea of increasing the temperature idea of using zinc powder/smaller pieces of zinc/increasing surface area of zinc (**not just** increasing surface area) add a catalyst idea of stirring, shaking or agitating or other correct any 3 × [1] [3]	
	(b) **(i)**	accept answers in range 27–28cm^3 [1] But not, e.g. 28 or 28 gas/cm^3 correct units needed [1]	
	(ii)	76 ± 1 s units not needed [1]	
	(iii)	Rate slows down/decreases [1]	
	(c)	Steeper slope [1] Double volume of gas [1] [2]	8

				AVAILABLE MARKS
4	(a)	(i)	oxygen [1]	
		(ii)	carbon dioxide [1]	
		(iii)	carbon monoxide [1]	
		(iv)	not enough oxygen [1]	
		(v)	toxic/poisonous/silent killer [1] **not just 'kills'** no colour/smell/taste **or** idea of it combining/with haemoglobin/red blood cells [1] **or** (alternative answer) idea of it combining/binding with haemoglobin/red blood cells [1] idea of this (combining) being in place of oxygen/reducing oxygen/being irreversible [1] [2]	
	(b)		Any **two** of: colourless odourless tasteless denser than air **or** heavier than air slightly soluble in water or other correct any 2 × [1] [2]	
	(c)		carbonic acid or H_2CO_3 [1]	
	(d)	**(i)**	calcium carbonate [1] [1]	
		(ii)	calcium hydrogen carbonate (is formed) [1] i.e. temporary hardness is caused by calcium hydrogen carbonate explicit that calcium hydrogen carbonate/the **product** from the reaction is soluble/has dissolved [1] **Do not credit** idea that "the precipitate"/"calcium carbonate" dissolves, i.e. the second marking point is dependent on recognising that the precipitate has reacted. [2]	12

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AVAILABLE MARKS

5 **(a)** Any **two** of:
solid/powder
yellow/pale yellow
brittle/hard
insoluble in water
odourless/slight odour **not pungent**
does not conduct heat/electricity
or other correct, e.g. correct melting point 115° C
any 2 × [1] [2]

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

(ii) pungent [1]

(c) **Indicative points:**
Effects of acid rain
- corrosion of (limestone) buildings/statues/metal (e.g. bridges/cars) **not** destroys or dissolves **not** rocks
- kills fish/aquatic life (ignore references to animal habitats or animals)
- idea of defoliation/damages trees **or** plants **or** crops/deforestation
- specific economic reason (1)
  specific economic reason (2) **or** idea of causing respiratory problems/ asthma – not just health

Not any answer relating to increasing global warming

Preventing acid rain
- burn less fossil fuels/use alternative fuel/energy sources/limiting transportation
- idea of removing sulfur dioxide from industrial/vehicle emissions
  NB not removing sulfur
- idea of desulfurization i.e. removing sulfur from fuels
- idea of government legislation (clean air act)

Response	**Marks**
Candidates must use specialist terms throughout. (6–9 indicative points required). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
Candidates use some specialist terms throughout (4–5 indicative points required). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates give 1–3 of the indicative points but not necessarily in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	[1]–[2]
Response not worthy of credit. Candidates make no reference to the points above and offer no other suitable response.	[0]

[6] 10

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				AVAILABLE MARKS
6	(a)	Idea of using/shaking soap with water [1] idea that a lather is formed with soft water [1] second mark depends on first	[2]	
	(b)	Any **three** of: wastes soap (**not** doesn't lather with soap) produces (lime)scale (or fur) in pipes/boilers/kettles (allow blocks **hot** water pipes but **not** "blocks pipes") **not** scale on its own produces scum **with soap** one clear, explicit economic disadvantage, e.g. the need to buy dishwater salt **or** need to replace kettles or other correct, e.g. idea of not being good for washing clothes/hair or "stains clothes" any 3 × [1]	[3]	
	(c)	calcium chloride [1] magnesium sulfate [1]	[2]	7
7	(a)	**(i)** 17	[1]	
		(ii) 106	[1]	
		(iii) 58	[1]	
	(b)	The relative formula mass [1] of the substance in grams [1] second mark dependent on first. **Do not give credit for** the mass (in grams) divided by the relative formula mass or the relative formula mass divided by the mass, i.e. RFM must not be wrongly qualified **Alternative answer 1:** The mass of a substance which contains the same number of particles as there are in 12 g of the carbon–12 (isotope) [2] **Alternative answer 2:** Idea that a mole contains 6×10^{23} particles [2]	[2]	
	(c)	**(i)** 38.4 g	[1]	
		(ii) 5	[1]	7
8	(a)	**(i)** white [1] to blue [1]	[2]	
		(ii) exothermic	[1]	
	(b)	released	[1]	
	(c)	**(i)** copper carbonate → copper oxide [1] + carbon dioxide [1]	[2]	
		(ii) colour change from green [1] to black [1]	[2]	8

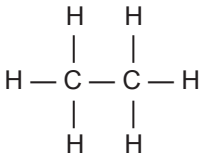
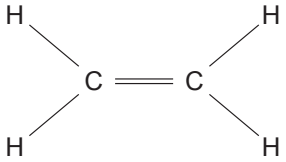
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AVAILABLE MARKS

9 **(a)** A compound/substance made up of carbon and hydrogen atoms **only** (clearly implied) [2]
A compound/substance which contains carbon and hydrogen atoms [1] [2]

(b) clear idea that crude oil is heated (to 400° C) [1]
idea that it undergoes a series of evaporations and condensations/vapours condense at different temperatures/idea that fractions condense or are collected at different levels in the column [1]
fractions are separated due to differences in boiling point [1] [3]

(c)

Name	Molecular Formula	Structural Formula
Ethane	C_2H_6 [1]	 [1]
Ethene	C_2H_4 [1]	 [1]

[4]

(d) Landfill
Advantage: – local treatment of waste so less transport of waste needed
– land can be re-landscaped after use/makes use of disused quarries
– cheap option (**not** quick)
– uses different types of waste – can be used for variety of waste
or other correct [1]

Disadvantage: – wastes land
– eyesore
– polluting gases released
– local streams can be polluted
– damages/destroys habitats
or other correct [1]

Incineration
Advantage: – idea of getting rid of waste completely/permanently
– idea that waste does not remain for a long time
– accept idea of not being an eyesore
– heat energy can be harnessed to generate electricity
or other correct [1]

Disadvantage: – ash residue is toxic and specialised landfill needed
– expensive
– idea that gases produced are toxic or dangerous
– idea that greenhouse gases are produced
or other correct [1] [4]

13

Total **90**

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015

Double Award Science: Chemistry

Unit C2
Foundation Tier

[GSD51]

GSD51

TUESDAY 9 JUNE 2015, 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.
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 nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 90.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **5(a)**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

9720

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1 **(a)** Fossil fuels contain carbon and are non-renewable.
Circle **three** fossil fuels in the list below.

coal	**sulfur**	**oil**
wood	**peat**	**hydrogen**

[3]

(b) Complete the sentence below by choosing one word from each box.
Put a circle around the correct word in each box.

During combustion a fuel reacts with

hydrogen
oxygen
sulfur dioxide

to release

carbon
nitrogen
energy

.

[2]

(c) This part of the question is about the reactions of oxygen with carbon and copper.

(i) Give two observations you could make when carbon is burned in a plentiful supply of oxygen.

1. _____

2. _____ [2]

(ii) What is the name of the compound formed in the reaction of carbon with excess oxygen?

_____ [1]

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(iii) When copper metal is heated in oxygen what compound is formed and what colour change would you observe in the solid?

Compound _____

Colour change from _____ to _____ [3]

[Turn over

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2 **(a)** An experiment was carried out to investigate the effect of soap and of detergent on samples of hard and soft water.

Complete the results table below to show what would be observed (for each water sample) by ticking the correct answers. One has been done for you.

Water sample	**Soap** added and shaken		**Detergent** added and shaken	
	lather	no lather	lather	no lather
hard water				
soft water			✓	

[3]

(b) Read the passage below about hard water.

Hard water tastes better than soft water. Hard water wastes soap and causes scum when it reacts with soap. It contains calcium ions and so it is good for bones and teeth. Hard water can cause fur or scale to form in kettles and limescale to form in hot water pipes. It is used in brewing beer and it is thought to help prevent heart disease.

From the information given in the passage, give two advantages and two disadvantages of living in a hard water region.

Advantages:

1. _____

2. _____

Disadvantages:

1. _____

2. _____ [4]

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(Questions continue overleaf)

[Turn over

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3 **(a)** **(i)** Exothermic processes give out heat. Complete the table below to show which processes are exothermic. The first one has been done for you.

Process	Exothermic Yes/No
Ice turning into water	No
Petrol burning	
Neutralising acid with alkali	
Thermal decomposition of copper carbonate	

[3]

(ii) When ice turns into water heat is taken in by the ice.
The word used to describe heat being taken in during

the process is: _____. [1]

(iii) Calcium carbonate can be broken down by heating. Complete the word equation below which describes the effect of heat on calcium carbonate.

calcium carbonate → + [2]

(b) This part of the question is about the quarrying and uses of limestone.

(i) From the list below, circle **two** uses of limestone.

fuel **neutralise acidity in soil**

building material **manufacture of alcohol**

[2]

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(ii) Limestone is taken from the ground by quarrying. Complete the table below, by ticking the correct boxes, to show advantages and disadvantages of quarrying limestone. The first one has been done for you.

Quarrying	Advantage	Disadvantage
produces noise		✓
provides jobs		
affects natural habitats		
produces dust		
affects the local economy		

[4]

[Turn over

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4 **(a)** A student prepared some hydrogen gas by reacting a metal with an acid.

(i) Complete the table below to show the test she could do to prove that the gas is hydrogen and what result she would expect.

Test	Result

[2]

(ii) Give two physical properties of hydrogen gas.

1. _____

2. _____ [2]

(b) Hydrogen gas can be used as a clean fuel.

(i) Write a word equation for the burning of hydrogen in oxygen.

_____ [2]

(ii) Why is hydrogen considered to be a clean fuel?

_____

_____ [2]

(c) Apart from its use as a fuel, give one other use of hydrogen gas.

_____ [1]

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(Questions continue overleaf)

[Turn over

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5 A student is given three gas jars labelled A, B and C and told that one contains nitrogen, one contains carbon dioxide and one contains oxygen. The student does not know which gas jar contains which gas.

(a) Give two similarities between the three gases and describe how, using tests for gases, you would work out which gas jar contains nitrogen.
Additional gas jars containing gases A, B and C are available as needed.

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

[6]

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(b) The atmosphere contains a mixture of gases. How was the early atmosphere formed?

_____

_____ [2]

(c) The two main gases in the atmosphere make up about 99%.

(i) Just under 80% of the atmosphere is made up of nitrogen. Which is the second most abundant gas in our atmosphere?

_____ [1]

(ii) Which **one** of the gases below is considered to be an atmospheric gas? Circle the correct answer.

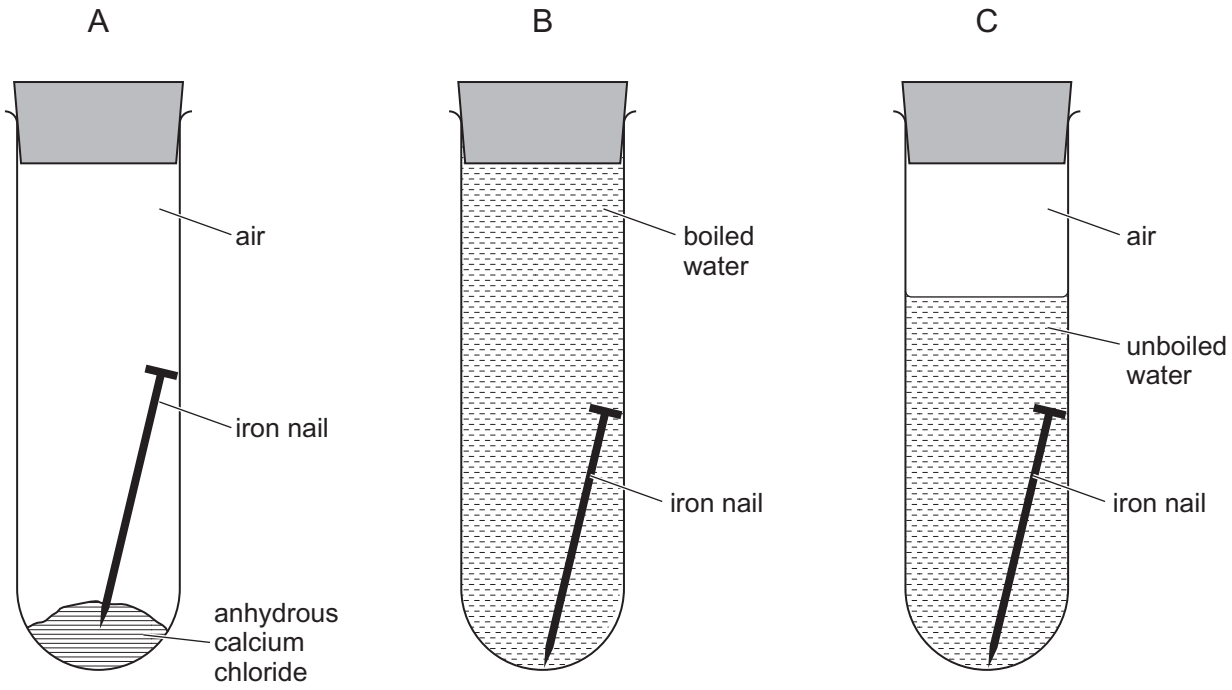
argon **hydrogen** **chlorine**

[1]

[Turn over

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6 **(a)** A student set up 3 test tubes as shown below to investigate the conditions needed for the rusting of iron.



(i) After a week, which was the only test tube, A, B or C to have a rusty nail?

_____ [1]

(ii) How did the student make the test fair?

_____

_____ [1]

(iii) Why had the water in test tube B been boiled?

_____ [1]

(iv) What **two** conditions are necessary for the rusting of iron to occur?

_____ and _____ [1]

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(b) Magnesium reacts with steam to give two products.

(i) Complete the word equation for the reaction of magnesium with steam.

magnesium + steam → + [2]

(ii) Describe **one** observation you would make during this reaction.

_____ [1]

(c) Magnesium powder reacts quickly with copper(II) sulfate solution.

(i) Describe two things you would expect to **see** happening in this reaction.

1. _____

2. _____ [2]

(ii) What does this reaction tell you about the reactivity of magnesium compared to that of copper?

_____ [1]

(d) This part of the question is about the reaction of iron with sulfur.

When a mixture of sulfur powder and iron filings is placed in a boiling tube and then heated a chemical reaction takes place.

(i) When the mixture is heated an orange-red glow is seen in the boiling tube. What is observed when the heating is stopped?

_____

_____ [2]

(ii) Write a balanced symbol equation for the reaction between iron and sulfur.

_____ [2]

[Turn over

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7 This question is about relative atomic mass, relative formula masses and using mole calculations.

(a) What do you understand by the **relative atomic mass** of an element?

_____

_____

_____ [3]

(b) Calculate the relative formula mass of each of the following substances.
(Relative atomic masses: H = 1, O = 16, Na = 23, Al = 27, S = 32)

(i) Sulfur dioxide SO_2

_____ [1]

(ii) Sodium sulfate Na_2SO_4

_____ [1]

(iii) Aluminium hydroxide $Al(OH)_3$

_____ [1]

(c) Silver nitrate ($AgNO_3$) has a relative formula mass of 170.

(i) How many moles of silver nitrate are there in 340 g of the substance?

Answer _____ moles [1]

(ii) What is the mass of 0.3 moles of silver nitrate?

Answer _____ g [1]

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(Questions continue overleaf)

[Turn over

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8 Calcium carbonate powder reacts with excess dilute hydrochloric acid to form carbon dioxide, water and calcium chloride solution.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

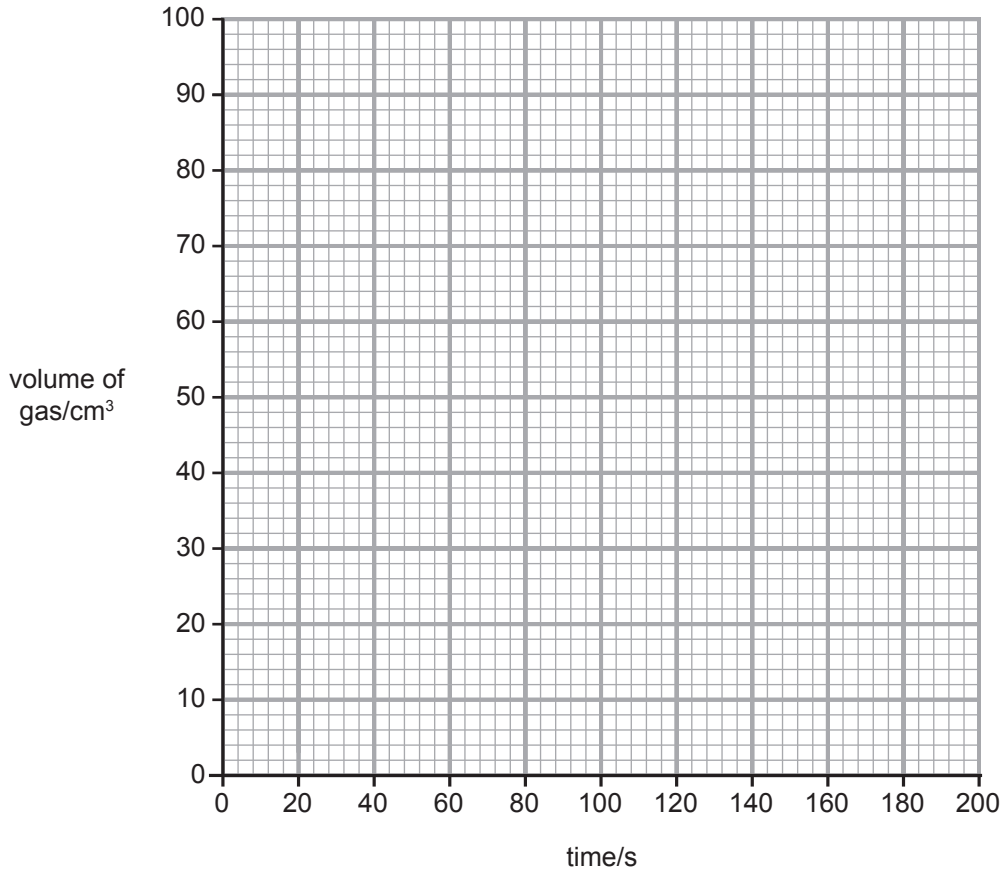
A student investigated the rate of this reaction by measuring the volume of carbon dioxide gas produced over a period of time. The total volume of gas measured at 20 second intervals is recorded in the table below.

Time/s	0	20	40	60	80	100	120	140	160
Volume/cm^3	0	32	50	66	76	83	87	90	90

(a) Name a piece of apparatus that the student could use to measure the volume of gas produced.

_____ [1]

(b) On the grid below, plot the results given in the table. Draw a curve of best fit. [3]



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

_____ [1]

(ii) What volume of gas had been collected at 30 seconds?

_____ [1]

(d) The reaction was repeated using the same amount of calcium carbonate and the same amount of excess dilute hydrochloric acid but using a large lump of calcium carbonate instead of the powder.

What effect would this change have on:

(i) the rate of the reaction?

_____ [1]

(ii) the total volume of carbon dioxide produced?

_____ [1]

[Turn over

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9 **(a)** A recent spillage of crude oil onto the shores of the USA caused serious environmental problems. It is important that oil spillages are dealt with quickly.

(i) Give **three** examples of environmental problems caused by oil spillage.

1. _____

_____

2. _____

_____

3. _____

_____ [3]

(ii) How are oil spillages cleaned up?

_____

_____ [1]

(b) The hydrocarbon methane is a major source of energy.

Write a word equation for the combustion of methane in a plentiful supply of air.

_____ [3]

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(c) Ethanoic acid shows typical reactions of an acid.

(i) Describe two observations you could make when ethanoic acid is added to solid copper carbonate.

1. _____

_____

2. _____

_____ [2]

(ii) Name a metal that you could react safely with ethanoic acid to form hydrogen gas.

_____ [1]

(iii) Give one use of ethanoic acid.

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

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

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
2015

Double Award Science: Chemistry

Unit C2

Foundation Tier

[GSD51]

TUESDAY 9 JUNE 2015, AFTERNOON

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)** coal [1] oil [1] peat [1] [3]

(b) oxygen [1] energy [1] [2]

(c) **(i)** Any **two** of:
Smoke/gas given off
(carbon) sparks
glows/bright light/orange-yellow flame/bright flame
heat given off
Not white light; **not** pungent smell; **not** bubbles; **not** fizzing; **not** just flame
or other correct
e.g. carbon disappears
2 × [1] [2]

(ii) Carbon dioxide [1]

(iii) Copper (II) oxide **or** copper oxide [1]
orange/pink/red-brown **or** similar (accept brown) [1] to black [1]
Allow 'copper coloured'; **not** 'copper'; **not** red [3]

AVAILABLE MARKS

11

2 **(a)**

Water sample	Soap added and shaken		Detergent added and shaken	
	lather	no lather	lather	no lather
hard water		✓ [1]	✓ [1]	
soft water	✓ [1]		✓	

[3]

(b) Advantages
Any **two** of:
Water tastes better
Good for bones and teeth
Prevent heart disease
Brewing of beer
Not contains calcium ions
or other correct 2 × [1]

Disadvantages
Any **two** of:
Wastes soap
Causes scum when it (hard water) reacts with soap
Causes fur in kettles
Limescale in hot water pipes
Allow cost if correctly linked
Not just 'fur', 'scale', 'scum' – must be link
or other correct 2 × [1] [4]

7

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					AVAILABLE MARKS
3	**(a)**	**(i)**	Petrol burning – yes [1] Neutralising – yes [1] Thermal decomposition – no [1]	[3]	
		(ii)	Endothermic	[1]	
		(iii)	Calcium Oxide [1] Carbon Dioxide [1] either order	[2]	
	(b)	**(i)**	Neutralising acidity in soil [1] Building material [1]	[2]	
		(ii)	Provide jobs – advantage [1] Affects habitats – disadvantage [1] Produces dust – disadvantage [1] Affects local economy – advantage [1]	[4]	12
4	**(a)**	**(i)**		[2]	

Test	Result
Lit/Lighted splint [1]	Pop [1]

		(ii)	Any **two** of: colourless/odourless/tasteless gas/lighter than air/insoluble in water **Not** just 'light'; **not** 'low density' (2 × [1])	[2]	
	(b)	**(i)**	hydrogen + oxygen → water LHS [1] RHS [1]	[2]	
		(ii)	When hydrogen is burned it produces no toxic/harmful waste products [1] (only) water produced [1] no carbon dioxide produced/does not contribute to global warming/ does not contribute to greenhouse effect [1] idea of **product** as non-polluting [1] or other correct Any 2 × [1]	[2]	
	(c)		reducing agent/welding/weather balloons/manufacture of ammonia/or other correct	[1]	9

AVAILABLE MARKS

5 (a) Indicative Points

Similarities

All three gases are:

- colourless
- odourless
- not toxic
- tasteless
- all found in the atmosphere/air

any other correct (for all three gases)
maximum 2 indicative points for similarities

Testing

- idea of testing in logical order, e.g. take **a** jar (not **the** gas jar) and test all three
- use a glowing splint/lit splint
- result: it relights/burns more brightly with oxygen
- add limewater
- result: it turns milky with carbon dioxide
- nitrogen identified by elimination

N.B. indicative points for results are dependent on correct tests

Response	Marks
Candidates must use specialist terms throughout to plan the experiment (7–8 indicative points required including the idea of testing in order). They use good spelling, punctuation and grammar and the form and style are of a high standard.	5–6
Candidates use some specialist terms to plan the experiment (4 to 6 indicative points required). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	3–4
Candidates give 1–3 of the indicative points but not necessarily in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	1–2
Response not worthy of credit.	0

[6]

(b) idea of (intense) volcanic activity [1]
which released gases into the atmosphere [1]
N.B. For any credit volcanoes must be mentioned
Credit release of gases unless wrongly qualified, e.g. toxic, dangerous, SO_2 [2]

(c) (i) oxygen [1]

(ii) argon [1]

10

					AVAILABLE MARKS
6	**(a)**	**(i)**	C	[1]	
		(ii)	Let 3 nails remain for same time/same size of nail/same temperature/ same <u>type</u> of nail/same size of test tube **Ignore** 'bung' or idea of 'control'	[1]	
		(iii)	To remove air or oxygen	[1]	
		(iv)	Air/oxygen and water/moisture/dampness/wetness	[1]	
	(b)	**(i)**	Magnesium oxide [1] Hydrogen [1]	[2]	
		(ii)	Solid goes (from grey) to white or solid glows brightly **Allow** white light; **not** white flame	[1]	
	(c)	**(i)**	Any **two** of: (Blue) solution goes colourless or fades Magnesium dissolves/disappears Reddish-brown/pink/brown/orange/copper coloured **Not** heat produced **Not** red; **not** 'copper' Or other correct – 2 × [1]	[2]	
		(ii)	Magnesium is more reactive (than copper) or vice-versa **Not** faster	[1]	
	(d)	**(i)**	it continues to glow [1] idea that a grey or black solid (**not** powder) is formed [1] **Allow** idea of turning grey or black unless wrongly qualified; **not** 'soot'; **not** 'powder' **Not** pungent smell	[2]	
		(ii)	Fe + S → FeS LHS [1] RHS [1] If balancing wrong but formulae **all** correct award [1]	[2]	14
7	**(a)**		Average mass of an **atom** (of an element) [1] compared with that of a carbon-12 (isotope) [1] which has mass of exactly (clearly implied) 12 [1]	[3]	
	(b)	**(i)**	sulfur dioxide 64	[1]	
		(ii)	sodium sulfate 142	[1]	
		(iii)	aluminium hydroxide 78	[1]	
	(c)	**(i)**	2	[1]	
		(ii)	51 g	[1]	8

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					AVAILABLE MARKS
8	**(a)**		burette/measuring cylinder/(gas) syringe/graduated test tube	[1]	
	(b)		8–9 points [2] 5–7 points correct [1] appropriate hand drawn curve [1]	[3]	
	(c)	**(i)**	140 s or 140 seconds (units needed)	[1]	
		(ii)	41 cm^3 ± 1	[1]	
	(d)	**(i)**	decrease or equivalent	[1]	
		(ii)	stay the same	[1]	8
9	**(a)**	**(i)**	Any **three** of: water pollution damages beaches kills or damages birds kills or damages sea life destroys habitats/breeding grounds destroys marine plant life idea of effect of light on sea life can stay a long time **Ignore** eyesore **Not** defoliates trees; **not** animals except reference to habitats; **not** cost of cleaning or other correct Any 3 × [1]	[3]	
		(ii)	Oil spillages are cleaned up by spraying them with detergents/ idea of physical removal/dispersants/bacteria or other correct **Not** burning; **not** filtering; **not** neutralising	[1]	
	(b)		methane + oxygen → carbon dioxide + water [1] [1] [1]	[3]	
	(c)	**(i)**	Any **two** of: effervescence/bubbles/fizzing/gas given off idea that the gas is colourless solid dissolves/disappears blue solution formed heat evolved **Not** 'copper' dissolves or other correct Any 2 × [1]	[2]	
		(ii)	Magnesium/zinc/aluminium/iron or other correct **Not** potassium, sodium, lithium, calcium, copper, gold etc.	[1]	
		(iii)	food flavouring/vinegar/food preservation or other correct e.g. cleaning – **not** industrial; **not** disinfectant **Allow** used for **wasp** stings, **not** bee stings	[1]	11
				Total	**90**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2014

Double Award Science: Chemistry

Unit C2

Foundation Tier

[GSD51]

GSD51

TUESDAY 10 JUNE 2014, 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 nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 90.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **4(b)**.
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 **(a)** This part of the question is about oxidation. Complete the sentences below by choosing from the words in the list.

hydrogen	**nitrogen**	**oxygen**
rusting	**neutralisation**	**reduction**

(i) Oxidation is the addition of _____

to a substance, or the removal of _____

from a substance. [2]

(ii) The reverse of oxidation is called _____. [1]

(b) Below are 5 chemical equations. Tick (✓) the **three** equations which represent oxidation reactions.

$NaOH + HCl \rightarrow NaCl + H_2O$ ☐

$2Cu + O_2 \rightarrow 2CuO$ ☐

$CuCO_3 \rightarrow CuO + CO_2$ ☐

$2HI \rightarrow H_2 + I_2$ ☐

$CuS + O_2 \rightarrow Cu + SO_2$ ☐

[3]

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Examiner Only	
Marks	Remark

2 **(a)** The element oxygen is a gas.

Give two **other** physical properties of oxygen.

1. _____

2. _____ [2]

(b) Give two uses of oxygen gas.

1. _____

2. _____ [2]

(c) Oxygen is a reactive element which reacts with both metals and non-metals such as magnesium and sulfur.

Complete the table below.

Element	Colour of element	Colour of flame during heating with oxygen	Description of product
sulfur	[1]	[1]	[2]
magnesium	[1]	[1]	[2]

[8]

Examiner Only	
Marks	Remark

3 **(a)** This part of the question is about the burning of coal or carbon.

When coal burns in an efficient fire, carbon dioxide gas is produced. Sometimes a faulty fire can produce a lot of carbon monoxide gas.

(i) Why is carbon monoxide gas very dangerous?

_____

_____ [2]

(ii) What causes carbon monoxide to be formed in a faulty fire?

_____ [1]

(b) This part of the question is about the properties and uses of carbon dioxide.

(i) Listed below are some properties of gases. Circle **two** of those properties which apply to carbon dioxide gas.

colourless **pungent smell** **denser than air**

burns **insoluble in water**

[2]

(ii) Give a reason why carbon dioxide is used in fizzy drinks.

_____ [1]

(iii) Give two **other** uses of carbon dioxide.

1. _____

2. _____ [2]

(c) Burning coal and other fossil fuels has led to increased levels of carbon dioxide in the atmosphere.

(i) What name is given to the effect of increased levels of carbon dioxide in the atmosphere?

_____ effect [1]

(ii) Give two ways in which the increasing levels of carbon dioxide in the atmosphere are changing our planet.

1. _____

_____

2. _____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 **(a)** A teacher demonstrated the reaction of zinc with dilute sulfuric acid. The acid was in a beaker and the teacher added some large zinc granules to the beaker. The reaction was very slow.

Give three things the teacher could do to help speed up the reaction.

1. _____

2. _____

3. _____ [3]

(b) The reaction between dilute hydrochloric acid and marble chips is given in the equation below:

$$CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2\,(aq)} + CO_{2(g)} + H_2O_{(l)}$$

Plan a method to study the rate of reaction between dilute hydrochloric acid and marble chips.

You should give clear details of how you would carry out your investigation, including a description of what results you will need to record. Explain how you would use your results.

You will be assessed on your written communication skills including the use of specialist scientific terms.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [6]

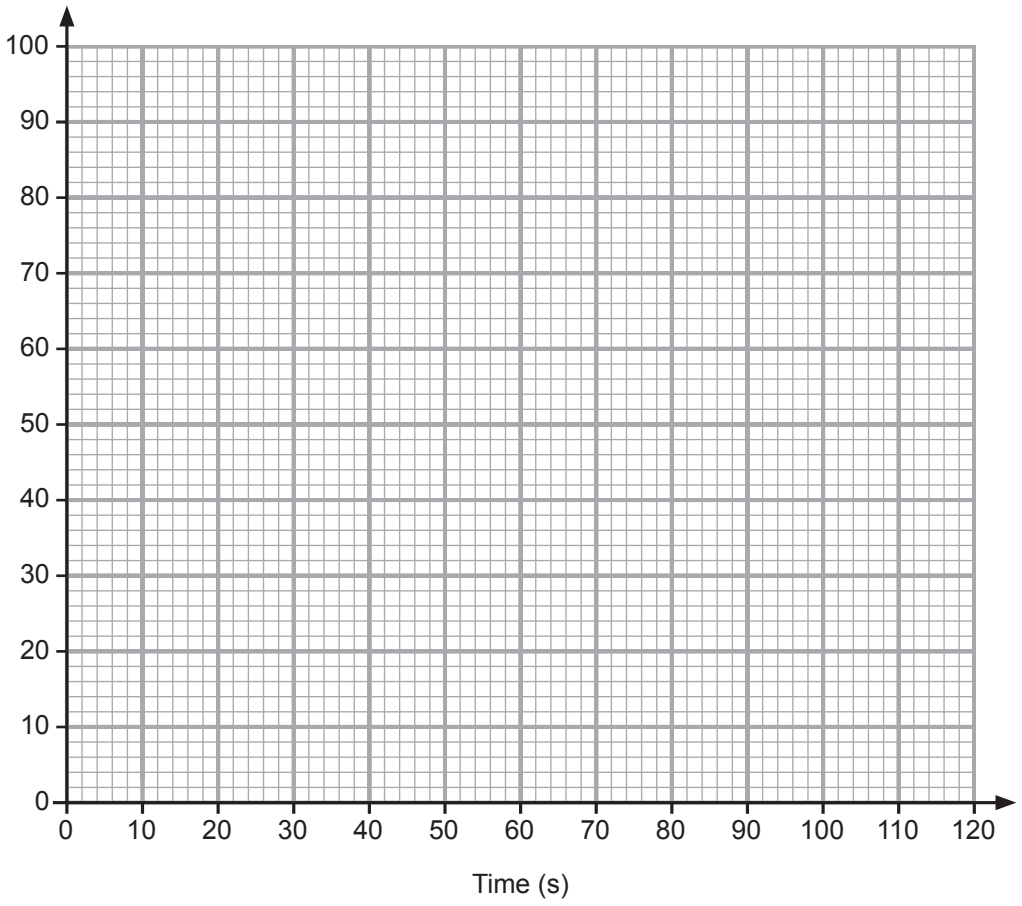
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(c) Magnesium ribbon reacts with dilute hydrochloric acid to produce hydrogen gas. A student measured the volume of gas produced over a period of time. The results are shown in the table below.

Volume of H_2 gas (cm^3)	0	23	40	58	71	75	78	80	80
Time (s)	0	10	20	40	60	70	80	90	100

(i) Label the y-axis on the grid below. [1]

(ii) Use the grid to plot a curve showing the results of the experiment. [3]



(iii) At what time did the reaction stop?

_____ [1]

(iv) From your graph, how long did it take for 50 cm^3 of hydrogen to be formed?

_____ [1]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

5 **(a)** To find the order of the reactivity of copper, nickel and zinc, a small amount of each metal was placed into a test tube containing a solution of a salt of one of the other metals. For example, when some copper was added to a test tube containing nickel nitrate solution there was no reaction.

The table below illustrates the results for the whole investigation.

metal / salt solution	copper	nickel	zinc
copper(II) sulfate		reaction	reaction
nickel nitrate	no reaction		reaction
zinc chloride	no reaction	no reaction	

(i) From the table, work out the order of reactivity of these three metals from most to least reactive.

Most reactive _____

↓

_____

Least reactive _____ [2]

(ii) Why could a similar type of investigation **not** be used to find the order of reactivity of calcium, potassium and sodium?

_____ [1]

(iii) Describe the colour change, in the solution, when zinc reacts with the copper sulfate solution.

from _____ to _____ [2]

(iv) Zinc can be obtained in the laboratory from zinc chloride solution by displacement with metal X.

Name a metal which could be used as metal X.

_____ [1]

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Examiner Only	
Marks	Remark

(b) The method of extraction of a metal from its ore depends on the position of the metal in the reactivity series. The order of reactivity of some metals and of carbon is given below. Use this order of reactivity to help you answer the question.

most reactive	calcium
↓	aluminium
	carbon
	iron
	lead
	silver
least reactive	gold

(i) Which one of the metals in the list above is most likely to be found in the ground as the pure metal?

_____ [1]

(ii) Name one of the metals in the list which will need to be extracted from its ore by electrolysis.

_____ [1]

(iii) Name one of the metals in the list which could be extracted from its ore by chemical reduction with carbon or carbon monoxide.

_____ [1]

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Examiner Only	
Marks	Remark

6 **(a)** Calculate the relative formula mass of each of the following substances.

(Relative atomic masses: H = 1, N = 14, O = 16, Na = 23, S = 32, Ca = 40)

(i) sodium nitrate $NaNO_3$

_____ [1]

(ii) sulfuric acid H_2SO_4

_____ [1]

(iii) calcium hydroxide $Ca(OH)_2$

_____ [1]

(b) What is meant by one mole of a substance?

_____

_____

_____ [2]

(c) The compound Fe_2O_3 has a relative formula mass of 160.

(i) How many moles are there in 80 g of Fe_2O_3?

Answer _____ moles [1]

(ii) How many moles are there in 8 tonnes of Fe_2O_3?
(1 tonne = 1000 kg)

Answer _____ moles [2]

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(Questions continue overleaf)

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Examiner Only	
Marks	Remark

7 **(a)** This part of the question is about the heating of solid calcium carbonate.

(i) Complete the word equation for this reaction.

calcium carbonate $\xrightarrow{\text{heat}}$ + [2]

(ii) The reaction in part **(i)** is an example of an endothermic change. Which one of the following statements describes an endothermic reaction? Tick (✓) the correct statement.

Gives out heat energy to the surroundings ☐

Takes in heat energy from the surroundings ☐

No change in energy during reaction ☐

[1]

(iii) Circle the term below which best describes the type of reaction which occurs when calcium carbonate is heated.

thermal cracking **displacement** **neutralisation**

thermal decomposition **photosynthesis**

[1]

(b) Temporary hard water is found in limestone regions.

Explain how water in limestone regions becomes hard.

_____

_____

_____

_____

_____

_____ [4]

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(c) During the first billion years of the Earth's existence, there was intense volcanic activity which released gases that formed the early atmosphere. The early atmosphere contained over 90% carbon dioxide, 5% nitrogen, 3% sulfur dioxide and traces of hydrogen sulfide, ammonia and methane, but no oxygen. It was hot, smelly and deadly poisonous.

(i) What is the **difference** in percentage composition of nitrogen gas found in the atmosphere today compared to its composition in the early atmosphere?

_____ [1]

(ii) One theory suggests that the early atmosphere changed as living organisms evolved. State two ways that the carbon dioxide could have been removed from the early atmosphere.

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

8 **(a)** This part of the question is about the physical properties and uses of nitrogen gas.

(i) From the list below tick (✓) the **two** physical properties of nitrogen gas.

very soluble in water ☐

pale green coloured ☐

colourless ☐

odourless ☐

sweet smelling ☐

[2]

(ii) Nitrogen is used in the manufacture of ammonia. Give one other use of nitrogen.

_____ [1]

(b) Ammonia gas is manufactured in the Haber Process by reacting hydrogen with nitrogen:

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

(i) Complete the table below to give the conditions needed for this reaction to occur. Include units where appropriate.

temperature	
catalyst	
pressure	

[3]

(ii) Give two uses of ammonia.

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

9 **(a)** Ethene is a member of the alkene homologous series. Its molecular formula is C_2H_4.

(i) Give the name and molecular formula of one other alkene.

Name _____ [1]

Molecular formula _____ [1]

(ii) When hydrocarbons, such as ethene are completely burnt in air (oxygen) what two compounds are always formed?

_____ and _____ [2]

(iii) Ethene molecules are able to join together to make a very long chain molecule, called a polymer. What is the name of the polymer formed from ethene?

_____ [1]

(iv) Many polymers, such as those used to make plastic bottles, are non-biodegradable. Give two disadvantages of disposing of polymers in landfill sites.

1. _____ [1]

2. _____ [1]

(b) **(i)** Ethanol is used in alcoholic drinks. Give one other use of ethanol.

_____ [1]

(ii) Drinking alcohol, in large quantities or over a long period of time, can have harmful effects. Describe two harmful effects which can arise from drinking alcohol.

1. _____

_____

2. _____

_____ [2]

THIS IS THE END OF THE QUESTION PAPER

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113177

Rewarding Learning

General Certificate of Secondary Education
2014

Double Award Science: Chemistry

Unit C2

Foundation Tier

[GSD51]

TUESDAY 10 JUNE 2014, AFTERNOON

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 **(a)** **(i)**	oxygen [1] hydrogen [1] [2]	
(ii)	reduction [1]	
(b)	$2Cu + O_2 \rightarrow 2CuO$ [1] $2HI \rightarrow H_2 + I_2$ [1] $CuS + O_2 \rightarrow Cu + SO_2$ [1] [3]	6
2 **(a)**	Colourless/odourless/tasteless/ or other correct physical property Accept (slightly) soluble in water **Not** gas, **not** low boiling point, **not** low density [1] for each correct answer **max** (2 × [1]) [2]	
(b)	Breathing (apparatus)/steel making/welding/rocket engines or other correct **Not** combustion, **not** hospitals (not medical use unless qualified) [1] for each correct answer **max** (2 × [1]) [2]	
(c)		

Element	Colour of element	Colour of flame during heating with oxygen	Description of product
sulfur	yellow [1]	blue [1]	choking/colourless/ pungent/acidic [1] gas [1]
magnesium	grey/silver-grey [1] Accept silver **Not** shiny	bright/white [1]	white or white/grey [1] **Not** grey solid/ash/powder [1]

[8] 12

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					AVAILABLE MARKS
3	(a)	(i)	Poisonous or toxic **or** explanation linked to haemoglobin/red blood cells [1] Colourless or odourless [1] **second mark dependent on first**	[2]	
		(ii)	Idea of lack of oxygen gas/incomplete combustion	[1]	
	(b)	(i)	colourless [1] denser than air [1]	[2]	
		(ii)	Soluble/odourless/colourless/tasteless **Not** cheap, **not** idea of keeping drinks fizzy/**not** toxic/**not** harmful	[1]	
		(iii)	Fire extinguishers/dry ice or other correct [1] for each correct answer **max** (2 × [1])	[2]	
	(c)	(i)	Greenhouse effect	[1]	
		(ii)	Any **two** of the following: • Increase in the Earth's temperature/global warming • Decrease in rainfall • Melting of polar ice caps • Sea levels rising • Flooding in low lying areas or other correct **Not** climate/not weather change – unless qualified **Not** ozone layer ideas [1] for each correct answer **max** (2 × [1])	[2]	11

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AVAILABLE MARKS

4 **(a)** Any **three** of the following:

- Heat
- Use zinc powder or smaller granules or increase surface area
- Use **more concentrated** acid **not** more acid **not** stronger
- Add a catalyst
- Shake/stir/mix

or other correct
[1] for each correct answer
max (3 × [1]) [3]

(b) *Feasible methods enable either the (loss in) mass to be measured/ recorded or the volume of gas produced to be measured/recorded.*

Indicative content

- Placing the dilute acid and the marble chips in a suitable reaction container
- Using a (top pan) balance **or** using a gas syringe – in a correct context
- Idea of start the clock/time
- At the start weigh the contents of the beaker/flask **or** at the start take an initial syringe reading/zero the syringe
- Measure/record loss in mass **or** gain in (gas) volume **or** time needed for marble chip(s) to disappear/reaction to stop
- Idea of measuring/recording the change at different times **or** if time was measured for marble chip(s) to disappear then loss in mass is also measured/recorded
- Idea of plotting a graph (using the results) **or** idea of calculating the rate
- Idea that the graph should be mass **or** volume against time **or** that the rate calculation is mass or volume/time

Response	Mark
Candidates must use specialist terms throughout to plan the experiment in a logical sequence (6 or more indicative points required). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
Candidates use some specialist terms to plan the experiment in a logical sequence (4 to 5 indicative points required). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates give 1 to 3 of the indicative points tested but not necessarily in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

[6]

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					AVAILABLE MARKS
	(c)	**(i)**	Volume of H_2 gas (cm^3) unit needed	[1]	
		(ii)	8–9 correct points – within $\frac{1}{2}$ square [2] 7 correct points [1] Smooth curve starting at zero [1]	[3]	
		(iii)	90(s) **or** 90 seconds units needed	[1]	
		(iv)	30 ±1(s) **or** seconds If units absent in **(iii)** and **(iv)** apply CM If answer outside 29–31 seconds range check graph again – if answer/error due to poor curve penalise curve in **4(c)(ii)** but allow answer in **4(c)(iv)**	[1]	15
5	**(a)**	**(i)**	Most reactive zinc nickel Least reactive copper all three correct [2] all correct but reversed [1] No credit for listing compounds	[2]	
		(ii)	Idea of being too reactive or of reacting with the water	[1]	
		(iii)	(Light) blue [1] → colourless **or** idea that a blue solution fades [1] **Not** clear	[2]	
		(iv)	Magnesium/aluminium	[1]	
	(b)	**(i)**	Gold	[1]	
		(ii)	Aluminium or calcium	[1]	
		(iii)	Iron or lead – allow silver or gold	[1]	9
6	**(a)**	**(i)**	85	[1]	
		(ii)	98	[1]	
		(iii)	74	[1]	
	(b)		The relative formula mass [1] in grams [1] of a substance Second mark depends on first	[2]	
	(c)	**(i)**	0.5 mole	[1]	
		(ii)	8 tonne = 8000 kg or 8 000 000 g 8 tonne = 50 000 moles [2] (1 method mark for correct step but incorrect answer) e.g. $\frac{8000}{160} = 50$ **or** $0.5 \times 100 = 50$	[2]	8

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					AVAILABLE MARKS
7	(a)	(i)	calcium oxide [1] carbon dioxide [1] either order	[2]	
		(ii)	Takes in heat energy from the surroundings	[1]	
		(iii)	thermal decomposition	[1]	
	(b)		Carbon dioxide dissolves in rain water [1] to form (carbonic) acid/an acidic solution [1] This **reacts** with (insoluble) calcium carbonate/limestone [1] to form **a soluble** calcium compound/calcium hydrogencarbonate/calcium ions in solution [1]	[4]	
	(c)	(i)	73–75%	[1]	
		(ii)	Idea of being 'locked'/trapped in fossil fuels Idea of being 'locked'/trapped in carbonates/limestone Idea of being absorbed/used by plants/trees in photosynthesis Idea of being dissolved in oceans Any 2 × [1]	[2]	11
8	(a)	(i)	colourless [1] odourless [1] if 3 ticks – 2 correct award [1]	[2]	
		(ii)	Food packaging/coolant or other correct	[1]	
	(b)	(i)	temperature: 250–450 °C [1] catalyst: Iron [1] pressure: 200–500 atm [1]	[3]	
		(ii)	Manufacture of fertilisers Production of nitric acid Manufacture of nylon Or other correct **max** (2 × [1])	[2]	8

						AVAILABLE MARKS
9	**(a)**	**(i)**	Name: Propene or other correct [1] Molecular formula C_3H_6 or other correct [1]		[2]	
		(ii)	Carbon dioxide [1] water [1] either order		[2]	
		(iii)	Polyethene **or** Polythene		[1]	
		(iv)	Disadvantage: Can be unsightly/Idea that they are not broken down/remain for many years/lack of recycling or other correct idea, e.g. idea of harming animals **Not** loss of habitat, **not** pollution, **not** non-biodegradable		[2]	
	(b)	**(i)**	Solvent/fuel or other correct		[1]	
		(ii)	Idea of effect or effects resulting from incapacitation, e.g. dangerous to drive, can leave people vulnerable to be taken advantage of Idea of effect(s) linked to health, e.g. liver damage/brain damage/ heart attack/kidney damage Idea of addiction and financial/social effects Allow any **two** reasonable answers **max** (2 × [1])		[2]	10
				Total		**90**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2013

Double Award Science: Chemistry

Unit C2

Foundation Tier

[GSD51]

GSD51

MONDAY 10 JUNE 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 nine** questions.

INFORMATION FOR CANDIDATES

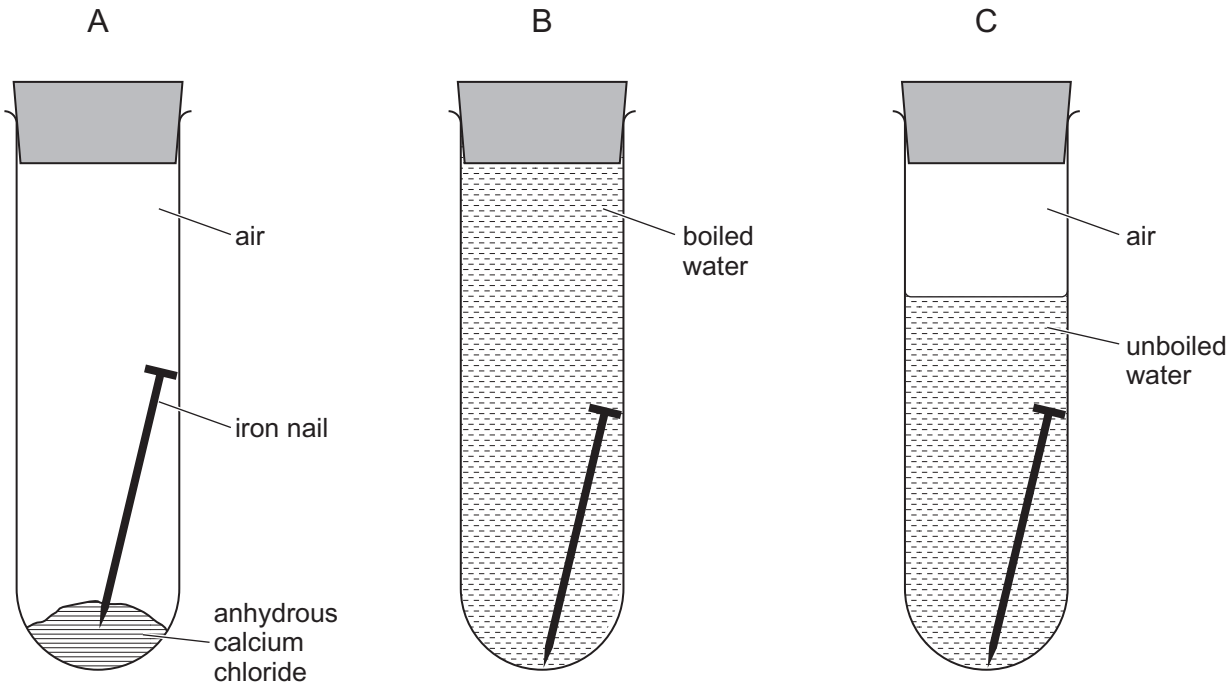
The total mark for this paper is 90.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **6(a)**.
A Data Leaflet, which includes a Periodic Table of the Elements, is 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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1 **(a)** An experiment was carried out to investigate the conditions needed for iron nails to rust.

After one week only one of the test tubes contained a rusty nail.



Examiner Only	
Marks	Remark

(i) In test tube B, why was the water boiled?

_____ [1]

(ii) What is the purpose of having **anhydrous** calcium chloride in test tube A?

_____ [1]

(iii) What **two** conditions are necessary for the rusting of iron to occur?

_____ and _____ [1]

(iv) From the list below, **circle** the word which best describes rusting.

decomposition displacement

neutralisation oxidation reduction [1]

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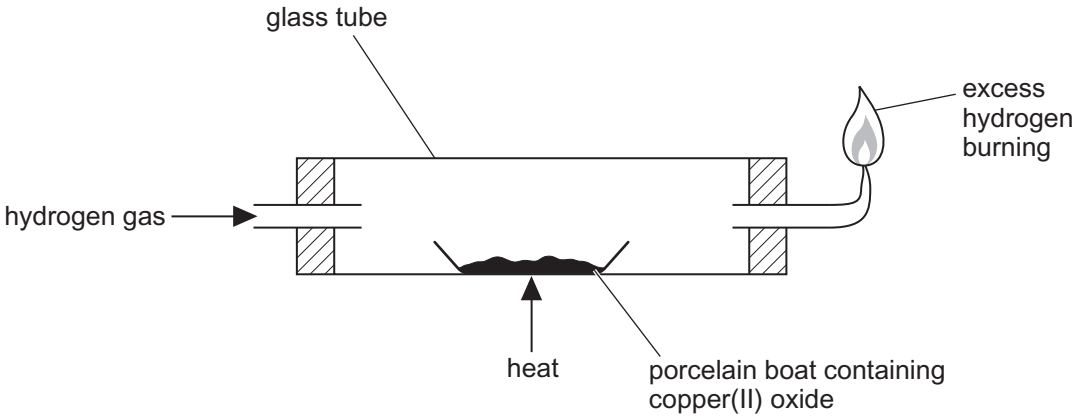
Examiner Only	
Marks	Remark

(b) Give two suitable methods that could be used to prevent the bars of an iron gate from rusting.

1. _____

2. _____ [2]

(c) The reaction between hydrogen gas and copper(II) oxide can be carried out using the apparatus shown below.



(i) What colour change takes place during this reaction?

from _____ to _____ [2]

(ii) Complete the word equation for the reaction.

copper(II) oxide + hydrogen → + [2]

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Examiner Only	
Marks	Remark

2 This question is about the reaction between zinc powder and dilute hydrochloric acid. The reaction rate can be altered by making some changes.

(a) Complete the table by stating if the changes given will speed up the reaction or not. One has been done for you.

Change	Speed up Reaction? Yes or No
stir the reaction mixture	Yes
cool the reaction mixture down	
use hydrochloric acid which is more concentrated	
add a catalyst	
use a larger lump of zinc	

[4]

(b) The rate of the reaction can be measured by timing how long it takes for the reaction to stop and then using one of the formulae given below.
Which is the correct formula? Put a tick (✓) in the box beside the correct formula for the rate of a reaction.

rate = time ☐

rate = $2 \times$ time ☐

rate = $\frac{1}{\text{time}}$ ☐

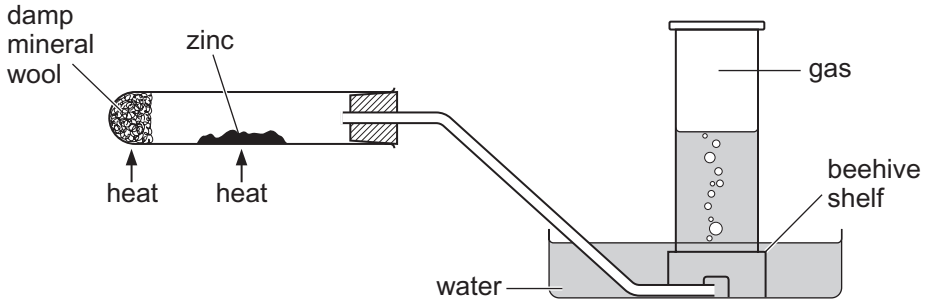
rate = $(\text{time})^2$ ☐

[1]

Examiner Only	
Marks	Remark

3 **(a)** Zinc does not react with cold water, but does react with steam.

The diagram below shows the apparatus used to react zinc with steam and to collect the gas produced.



(i) What gas is produced when zinc reacts with steam?

_____ [1]

(ii) Why is the damp mineral wool heated?

_____ [1]

(iii) What colour is the solid product formed from zinc in this reaction?

_____ [1]

(iv) Name a metal, other than zinc, which will react with steam but not with cold water.

_____ [1]

(b) Magnesium is a Group 2 metal.

(i) Give two observations made when magnesium is burned in air.

1. _____

2. _____ [2]

(ii) Complete and balance the symbol equation for the reaction of magnesium with air.

$$Mg + O_2 \longrightarrow$$

[2]

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Examiner Only	
Marks	Remark

4 **(a)** Exothermic reactions give out heat and endothermic reactions take in heat.

(i) Complete the table to show which of the processes are exothermic and which are endothermic. One has been done for you.

Process	Exothermic or Endothermic
photosynthesis	endothermic
neutralisation of sodium hydroxide with hydrochloric acid	
dehydration of blue copper(II) sulfate crystals	
burning coal	

[3]

(ii) Calcium carbonate can be broken down into simpler substances by heating it. What two words are used to describe this type of endothermic reaction?

_____ [2]

(iii) Complete the word equation by identifying the gas given off when calcium carbonate is heated.

calcium carbonate → calcium oxide +

[1]

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(b) Limestone is taken from the ground by quarrying and has many uses.

(i) Give one use of limestone.

_____ [1]

(ii) Complete the table below which shows some positive and negative effects of quarrying limestone. The first one has been done for you.

Effect of Quarrying	Positive	Negative
Produces a cheap material with many uses	✓	
Disused quarries can be used for landfill		
Natural habitats disrupted		
Creates jobs in the community		
Produces dust		
Quarries can be unsightly		

[5]

Examiner Only

Marks	Remark

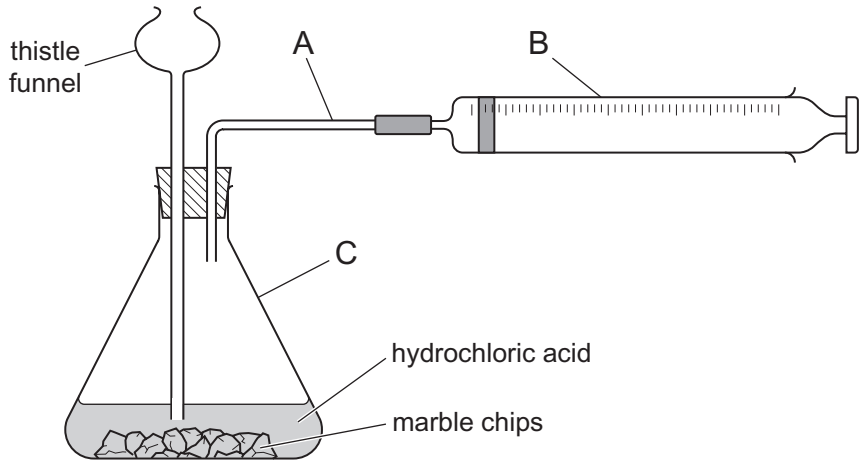
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5 **(a)** Complete the table below to describe the tests for two gases.

Gas	Test	Result
oxygen		
hydrogen		

[4]

(b) Carbon dioxide gas can be prepared in the school laboratory using the apparatus below:



Name the pieces of apparatus A, B and C

A _____ [1]

B _____ [1]

C _____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

(c) This part of the question is about the non-metal sulfur and some of its compounds. For each of the statements below three ways of completing the statement are given. Only **one** is correct. Put a ring round the correct answer. One has been done for you.

When sulfur burns in air it reacts with:

nitrogen hydrogen (oxygen)

(i) The flame produced when sulfur burns in air is:

white blue black [1]

(ii) Sulfur is a:

yellow gas yellow solid white solid [1]

(iii) When a mixture of iron and sulfur is heated the mixture:

evaporates glows turns white [1]

(iv) FeS is the formula of:

iron(II) sulfide iron(II) sulfate iron(II) sulfite [1]

(v) Sulfur dioxide is a colourless gas. It has:

no smell a pungent smell a pleasant smell [1]

(vi) Sulfur dioxide causes:

acid rain hard water dry ice [1]

(vii) Sulfur is sometimes:

removed from fuels added to fuels used as a fuel [1]

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Examiner Only	
Marks	Remark

6 Town A has a hard water supply and town B has a soft water supply. You are provided with two samples of water, one from town A and the other from town B.

(a) Explain what is meant by hard water and describe a **fair** test you could carry out to find which is the hard water sample.

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

[6]

(b) The water in town A is hard water.

(i) Name an ion which causes water to be hard.

_____ [1]

(ii) Why is hard water thought to be good for your health?

_____

_____ [1]

(iii) Name one industry which benefits from hard water.

_____ [1]

(iv) Why could it be less expensive to live in town B, where the water is soft, rather than town A?

_____

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

7 This question is about relative atomic mass and using relative atomic masses to calculate the relative formula mass of compounds.

(a) What do you understand by the relative atomic mass of an atom?

_____

_____

_____ [3]

(b) **(i)** Calculate the relative formula mass of nitric acid HNO_3.
(Relative atomic masses: H = 1; N = 14; O = 16)

Answer _____ [1]

(ii) The relative formula mass of zinc oxide is 81. Calculate the mass of 0.5 moles of zinc oxide. Include the unit in your answer.

Answer _____ [2]

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(Questions continue overleaf)

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Examiner Only	
Marks	Remark

8 This question is about carbon dioxide and the gases in the Earth's atmosphere.

(a) The atmosphere contains about 0.04% carbon dioxide gas. Complete the table below by adding the two most abundant gases in the atmosphere and their approximate proportions.

Gas	Approximate proportion in the atmosphere
carbon dioxide	about 0.04%

[4]

(b) The table below shows how the level of carbon dioxide in the Earth's atmosphere has changed over the last 150 years. The table also shows the change in average global temperature in the same time span.

Year	1750	1800	1850	1900	1950	2000
concentration of CO_2 in atmosphere/% by volume	0.027	0.028	0.029	0.030	0.032	0.037
average global temperature/°C	13.3	13.4	13.5	13.6	13.8	14.4

(i) Use the information in the table to describe the pattern of change in carbon dioxide levels in the atmosphere between 1750 and 2000.

_____

_____

_____

_____ [2]

(ii) What is the relationship between the level of carbon dioxide in the atmosphere and average global temperature?

_____

_____ [1]

(iii) Give one reason for the changing amounts of carbon dioxide in the atmosphere.

_____

_____ [1]

(iv) Give one way in which our planet is affected by global warming.

_____

_____ [1]

(c) Carbon dioxide is used to make fizzy drinks and can be tested for in the laboratory using limewater solution.

(i) Give one physical property which makes carbon dioxide suitable for use in fizzy drinks.

_____ [1]

(ii) What is the name of the substance formed when carbon dioxide dissolves in water?

_____ [1]

(iii) What would be observed when carbon dioxide gas is bubbled through limewater solution?

_____

_____ [2]

(iv) What would be observed if you continued to bubble carbon dioxide gas through limewater solution?

_____

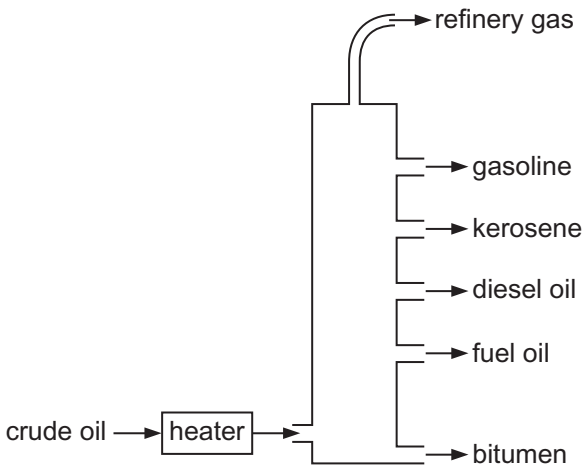
_____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

9 **(a)** The diagram below shows how crude oil can be separated into useful products:



(i) Name the separation process shown in the diagram.

_____ [2]

(ii) Explain how the crude oil is separated into useful products by this method.

_____

_____

_____

_____

_____

_____

_____ [2]

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Examiner Only	
Marks	Remark

(b) Natural gas is an important fossil fuel that is found in refinery gases. It is described as a non-renewable fuel.

(i) What is a **fossil fuel**?

_____

_____ [1]

(ii) What element is present in all fossil fuels?

_____ [1]

(iii) Natural gas is described as **non-renewable**. What does this mean?

_____

_____ [1]

(c) Ethanol is a renewable fuel. It is produced from food crops. Distillation is needed in the manufacture of ethanol. Burning ethanol produces less carbon dioxide than burning natural gas but ethanol is more expensive to produce than natural gas.

(i) Suggest one reason why ethanol is used as a fuel.

_____

_____ [1]

(ii) Suggest one reason why there could be concerns about replacing natural gas with ethanol as a fuel.

_____

_____ [1]

(iii) Why is hydrogen considered to be a “cleaner” fuel than either ethanol or natural gas?

_____

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

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113177

Rewarding Learning

General Certificate of Secondary Education
2013

Double Award Science: Chemistry

Unit C2

Foundation Tier

[GSD51]

MONDAY 10 JUNE 2013, AFTERNOON

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	**(a)**	**(i)**	To remove oxygen or air	[1]	
		(ii)	To remove water (moisture)/keep test tube dry	[1]	
		(iii)	Water and oxygen/air (Allow moisture/dampness)	[1]	
		(iv)	Oxidation	[1]	
	(b)		Painting [1] Galvanising [1] **or** other correct, e.g. plastic coating **not** oil/grease/varnish **not** sacrificial protection	[2]	
	(c)	**(i)**	Black [1] to pink/reddish orange/red-brown/orange-brown [1]	[2]	
		(ii)	Copper [1] Water [1] either order	[2]	10
2	**(a)**		No [1] Yes [1] Yes [1] No [1]	[4]	
	(b)		Rate = $\frac{1}{\text{Time}}$	[1]	5
3	**(a)**	**(i)**	Hydrogen	[1]	
		(ii)	Idea of producing the steam	[1]	
		(iii)	White allow yellow	[1]	
		(iv)	Magnesium/aluminium/iron	[1]	
	(b)	**(i)**	Any **two** of: (burns with) a bright/white light/flame [1] to form a white powder/ash/solid [1] allow white smoke heat given out/exothermic reaction [1] idea of (very) vigorous reaction [1] (max 2 × [1]) **not** sparks	[2]	
		(ii)	$2Mg + O_2 \rightarrow 2MgO$ [1] for MgO and [1] for balancing if formula is correct	[2]	8

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AVAILABLE MARKS

4 **(a)** **(i)** Exothermic [1]
Endothermic [1]
Exothermic [1] [3]

(ii) Thermal [1] decomposition [1] [2]

(iii) Carbon dioxide [1]

(b) **(i)** Building material/neutralising acidic soils/**or** other correct, e.g. used in blast furnaces/making cement/tiles/toothpaste/paint [1]

(ii)

Effect of Quarrying	**Positive**	**Negative**
Produces a cheap material with many uses	✓	
Disused quarries can be used for landfill	✓ [1]	
Natural habitats disrupted		✓ [1]
Creates jobs in the community	✓ [1]	
Produces dust		✓ [1]
Quarries can be unsightly		✓ [1]

[5] 12

5 **(a)**

Gas	**Test**	**Result**
oxygen	Use a **glowing** splint [1]	**Relights** [1]
hydrogen	**Use a lit splint/taper** [1]	**Pops** [1]

[4]

(b) A = delivery tube/glass tube [1]
B = (graduated) syringe/gas syringe [1]
C = conical flask [1]

(c) **(i)** Blue [1]

(ii) Yellow solid [1]

(iii) Glows [1]

(iv) Iron(II) sulfide [1]

(v) A pungent smell [1]

(vi) Acid rain [1]

(vii) Removed from fuels [1] 14

AVAILABLE MARKS

6 (a) Indicative content

- Water containing calcium and/or magnesium ions **or** does not form a lather easily with soap/**or** forms a scum with soap
- Same volume of two water samples unless wrongly qualified
- Addition of soap (solution)
- Idea of 1 cm^3 at a time/idea of one fixed volume of soap
- Shaken/stir
- Addition repeated until a permanent lather is formed – or measure height of lather
- Correct statement of results: the sample needing most soap to lather is hard **or** converse/**or** sample with least lather is hard **or** converse

Response	Mark
Candidates must use specialist terms throughout to fully explain definition of hard water and describe a fair test which you could carry out to find which is a hard water sample in a logical sequence (6 or 7 indicative points are required). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
Candidates use some specialist terms to explain the definition of hard water and describe a fair test which you could carry out to find which is the hard water sample in a logical sequence (4 or 5 indicative points are required). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates explain the definition of hard water or describe a fair test which could be carried out to find which is a hard water sample. 1–3 indicative points are required. They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	[1]–[2]
Response not worthy of credit	[0]

[6]

(b) (i) Calcium/magnesium ion **or** Ca^{2+}/Mg^{2+} [1]

(ii) Good for teeth and bones/reduces heart disease [1]

(iii) Brewing/**or** other correct, e.g. bottled water, water softening/soap making Allow plumbing [1]

(iv) An advantage of soft water [1] related to less cost [1]
e.g. Less soap is needed to form lather [1]
Idea that householder spends less money on soap [1]
or
e.g. Idea that in hard water town limescale builds up on pipes [1]
Pipes may have to be replaced [1]
or
Fur in kettle [1] **not** scum
More electricity required to boil kettle [1]
or other correct, e.g. having to replace/use more energy with an electrical device which uses hot water gets the expense mark. [2]
Problem caused by the water needed for second mark

11

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				AVAILABLE MARKS
7	**(a)**	Mass of an atom [1] compared with that of a carbon-12 isotope [1] which has mass of exactly (clearly implied) 12 [1]	[3]	
	(b)	**(i)** 63	[1]	
		(ii) 40.5 [1] g [1]	[2]	6
8	**(a)**	Nitrogen [1] 79% ± 1% [1]		
		Oxygen [1] 20% ± 1% [1]	[4]	
	(b)	**(i)** Idea that between 1750 and 1900 there was a gradual increase [1] Idea that 1900–2000 – greater increase in CO_2 level [1] Idea of increase over time gains [1] NB Answer which links CO_2 with temperature gains no credit	[2]	
		(ii) Idea that as carbon dioxide level increases global temperature increases **not** idea that as temperature increases so does carbon dioxide level	[1]	
		(iii) Burning of (more) fossil fuels/deforestation **or** other correct, e.g. idea of more vehicles **not** population increase	[1]	
		(iv) Idea of melting of polar ice caps/sea levels rising/flooding in low lying areas/droughts in some areas/ecosystems will change **or** other correct	[1]	
	(c)	**(i)** Soluble in water/accept idea of non-toxic/no smell/colourless/ tasteless	[1]	
		(ii) Carbonic acid	[1]	
		(iii) Limewater is colourless [1] **not** clear Turns milky or cloudy [1] **not** just white	[2]	
		(iv) Then turns colourless/idea that cloudiness disappears/precipitate dissolves	[1]	14

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					AVAILABLE MARKS
9	(a)	(i)	Fractional [1] distillation [1]	[2]	
		(ii)	Idea of crude oil being heated until it boils [1] Idea of compounds/fractions having different boiling points [1]	[2]	
	(b)	(i)	Idea that fossil fuels have been formed from living organism	[1]	
		(ii)	Carbon	[1]	
		(iii)	Clear idea that the resource is finite **not** idea that it can only be used once	[1]	
	(c)	(i)	It burns to give out energy/burning ethanol produces less carbon dioxide than natural gas/other fuels/it can be obtained from crops/it can be used in cars/**or** other correct, e.g. idea that it is renewable **or** that it saves using fossil fuels	[1]	
		(ii)	Idea of cost of production/idea that using food crops could mean that people could go hungry/**or** other correct	[1]	
		(iii)	Idea that burning hydrogen does not produce any carbon dioxide/ greenhouse gases **or** only product is water – non-polluting	[1]	10
				Total	**90**