GCSE

Science: Chemistry

Summer 2010

Mark Schemes

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NORTHERN IRELAND GENERAL CERTIFICATE OF SECONDARY EDUCATION (GCSE)
AND NORTHERN IRELAND GENERAL CERTIFICATE OF EDUCATION (GCE)

MARK SCHEMES (2010)

Foreword

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 16- and 18-year-old 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 a 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.

The Council hopes that the mark schemes will be viewed and used in a constructive way as a further support to the teaching and learning processes.

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Rewarding Learning

General Certificate of Secondary Education
2010

Science: Chemistry

Paper 1
Foundation Tier

[G1401]

WEDNESDAY 26 MAY, MORNING

MARK SCHEME

				AVAILABLE MARKS
1	**(a)**	**(i)**	(law of) octaves [1]	
		(ii)	**any three from** no noble gases/fewer groups gaps (for undiscovered elements) order of atomic mass no mass number no atomic number some elements in different position no **block** of transition metals/no d-block no lanthanides/no actinides/no f-block less elements [3]	
	(b)		alkali metals [1] halogens [1] [2]	
	(c)	**(i)**	helium/neon/argon/krypton [1]	
		(ii)	bromine [1]	
		(iii)	hydrogen/nitrogen/oxygen/fluorine/chlorine [1]	
		(iv)	boron/carbon/silicon/phosphorus/sulphur/arsenic/selenium [1]	
		(v)	oxygen/sulphur/selenium [1]	
		(vi)	forms H^+ ion/valency = 1/forms HX with halogens/1 e^- in outer shell/ correct formula pattern [1]	
	(d)	**(i)**	Al_2O_3 [1]	
		(ii)	$2Al + 3Cl_2 \rightarrow 2AlCl_3$ [3]	
		(iii)	4 [1]	
		(iv)	boron [1]	
		(v)	iron/chromium/vanadium/scandium [1]	19

				AVAILABLE MARKS
2	(a)	(i)	H_2O [1]	
		(ii)	colourless [1] liquid [1] density 1 g cm^{-3} [1] odourless [1] does not conduct electricity [1] neutral [1] max [2]	
		(iii)	hydrogen [1] and oxygen [1] [2]	
		(iv)	white [1] anhydrous copper(II) sulphate [1] changes to blue [1] **or** blue [1] anhydrous cobalt(II) chloride/cobalt(II) chloride paper [1] changes to pink [1] [3]	
			Quality of written communication 2 → 3 max [2] / 1 max [1] / 0 [0] [2]	
	(b)	(i)	white pellet/solid/substance [1] colourless [1] solution/liquid [1] which forms white crust/flakes/powder [1] max [3]	
		(ii)	contains no water [1] contains no water of crystallisation [2] max [2]	
	(c)	(i)	mass [1] of substance that dissolves in and saturates [1] <u>100 g of water</u> [1] at a particular temperature [1] **or** maximum [1] mass [1] of substance that dissolves in <u>100 g of water</u> [1] at a particular temperature [1] [4]	
		(ii)	stirring/shaking [1] heat the water [1] crush the crystals [1] add more water [1] max [2]	21

3 **(a)** The element sulphur is a NON-METAL [1]. It has an atomic number of 16. Sulphur exists in three different solid forms known as ALLOTROPES [1]. One form is known as rhombic sulphur whilst the other two forms are known as PLASTIC [1] sulphur and MONOCLINIC [1] (either order) sulphur. Sulphur is YELLOW [1] in colour and is INSOLUBLE [1] in water. [6]

(b) **(i)** $S + O_2 \rightarrow SO_2$ [2]

(ii) melts/liquid formed [1] dark red/brown [1]
blue [1] flame [1] more viscous [1]
colourless/misty [1] pungent/bad smell [1] gas [1] max [3]

(c) **(i)** fossil fuels burning/vehicle exhausts/power stations/volcanic gases/ burning rubber tyres [1]

(ii) $SO_2 + H_2O \rightarrow H_2SO_3$ [2]

(iii) 3–6.9 [1]

(iv) corrodes limestone statues and buildings [1]
kills fish (in rivers and lakes)/acidifies waterways [1]
defoliates trees/damages vegetation [1] max [2]

(v) remove sulphur from fuels before use [1]
treat emissions from power stations and factories [1]
burning less fossil fuels/use renewable fuels/use alternative energy sources [1]
catalytic convertors [1] max [2]

AVAILABLE MARKS

19

AVAILABLE MARKS

4 **(a)** **(i)** hydrochloric acid [1]

(ii) LiCl [1]

(iii) cooling [1]

(iv) decomposition [1]
using (a direct current of) electricity [1] [2]

(b)

Substance	Conducts electricity	Does not conduct electricity
solid lithium	✓ [1]	
molten lithium	✓ [1]	
molten lithium chloride	✓ [1]	
solid lithium chloride		✓ [1]
lithium chloride solution	✓ [1]	

[5]

(c) **(i)** A = anode [1]
B = cathode [1] [2]

(ii) graphite/carbon/platinum [1]

(iii) unreactive/(good) conductor of electricity [1]

(iv) B/cathode [1] 15

					AVAILABLE MARKS
5	**(a)**	**(i)**	oil/coal/natural gas/petrol/LPG/diesel/paraffin/candle wax/ peat/lignite/coke any **three** from the list above	[3]	
		(ii)	cannot be replaced [1] idea of in a limited period of time [1] **or** will run out [1] eventually [1]	[2]	
	(b)	**(i)**	reaction [1] (of a substance/fuel) with oxygen [1] to release energy [1] forming oxides [1] max [3]/[4]	[3]	
		(ii)	substance containing carbon and hydrogen [1] only [1]	[2]	
		(iii)	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$	[3]	
		(iv)	greenhouse effect [1] global warming/melting polar caps [1] rising sea levels/flooding [1] climate change [1] acid rain [1] photochemical smog [1]	max [2]	
	(c)		carbon monoxide	[1]	16
				Total	**90**

Rewarding Learning

General Certificate of Secondary Education
2010

Science: Chemistry

Paper 2
Foundation Tier

[G1402]

WEDNESDAY 9 JUNE, AFTERNOON

MARK SCHEME

AVAILABLE MARKS

1 (a) (i)

	Name	Formula
Ion present in all acids.	hydrogen [1]	H^+ [1]
Ion present in all alkalis.	hydroxide [1]	OH^- [1]

[4]

(ii)

Name of acid	Name of salt
Sulphuric acid	sulphate
Nitric acid	nitrate [1]
Hydrochloric acid	chloride [1]

[2]

(b) (i) sodium hydroxide + sulphuric acid → sodium sulphate + water [1]

(ii) $CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$ [2]

(c) (i) to ensure the acid is used up [1]

(ii) blue [1]

(iii) A = filter funnel [1]
B = evaporating basin [1]
Label residue [1]
Label filtrate [1] [4]

(iv) evaporate off half/$\frac{2}{3}$ of the water/heat to concentrate/idea of reduced volume [1] using heat
allow to cool [1] and crystallise [1]
filter [1]
idea of drying (crystals) between sheets of filter paper/in a low temperature oven/in a desiccator [1] max [3]

Quality of written communication [2]–[3] max [1]
[1] max [1] [2]

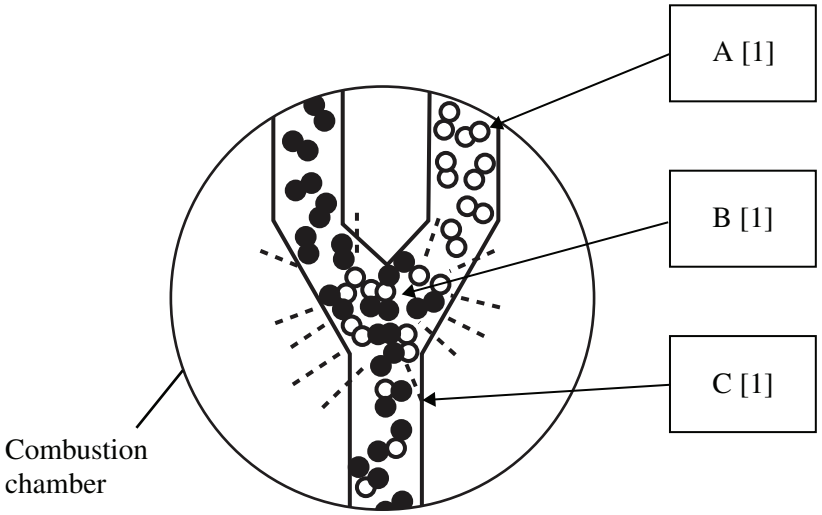
(v) copper carbonate + sulphuric acid → copper sulphate + water + carbon dioxide [1]

(vi) copper does not react (with sulphuric acid)/unreactive/low down in reactivity series [1]

22

AVAILABLE MARKS

2 (a) (i)



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Key
● hydrogen atom
○ oxygen atom [3]

(ii) $2H_2 + O_2 \rightarrow 2H_2O$ [3]

(iii) (combustion) product is water
or
(combustion) product(s) does not cause pollution
or
no solid residue in (combustion) product(s) e.g. no soot produced [1]

(iv) hydrogen gains oxygen [1]
oxidation is gain of oxygen [1] [2]

(b) (i) A = hydrogen/H_2 **not** H
B = heat
C = copper(II) oxide/copper oxide/CuO [3]

(ii) black [1] copper oxide
red-brown [1] copper
condensation/droplets/a colourless liquid [1] max [2]

(iii) $CuO + H_2 \rightarrow Cu + H_2O$ [2]

(iv) copper oxide loses oxygen [1]
reduction is loss of oxygen [1]
or
copper ions gain electrons [1]
reduction is gain of electrons [1] [2]

(c) (i) $2Mg + O_2 \rightarrow 2MgO$ [3]

(ii) white light/bright light
heat (given off) [1] max [1]

22

AVAILABLE MARKS

3 **(a)**

Name	Formula	Relative formula mass
sodium hypochlorite	NaClO	74.5 [1]
chlorine dioxide	ClO_2	67.5 [1]
ozone	O_3	48 [1]

[3]

(b) **(i)**

Symbol	Name of element	Relative atomic mass	Number of atoms of this element present in the molecule
H	hydrogen	1	12
C	carbon	12	**7**
N	nitrogen	**14**	2
Cl	**chlorine**	35.5	1
O	oxygen	16	**1**
Br	bromine	**80**	1

[5]

(ii) bromine and chlorine/Br_2 and Cl_2/Br and Cl any order [1]

(iii) 255.5 CM from table [1]

(iv) $\frac{80}{255.5}$ [1] × 100 = 31.3% [1] apply CM from **(iii)** above and table [2]

(c) $NX_2Cl = 14 + 2X + 35.5 = 51.5$ [1]

$2X = 51.5 – 49.5 = 2$ [1]

division by 2 R.A.M. of X = 1 [1]

Give 3 directly for R.A.M of X = 1 with no working

Identity of X = hydrogen [1] [4]

16

					AVAILABLE MARKS
4	**(a)**	**(i)**	break down [1] using heat [1]	[2]	
		(ii)	$CaCO_3 \rightarrow CaO + CO_2$	[2]	
		(iii)	heat taken in/energy taken in	[1]	
		(iv)	breaking strong/ionic bonds [1] requires a lot of energy [1]	[2]	
		(v)	$CaO + H_2O \rightarrow Ca(OH)_2$	[2]	
	(b)	**(i)**	$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$	[3]	
		(ii)	bubbles/effervescence/gas produced/fizzing [1] idea of solid/calcium carbonate disappears [1] **not** dissolves idea of heat (released) [1] idea of solution remaining colourless [1]	max [2]	
		(iii)	safety goggles	[1]	
	(c)	**(i)**	green [1] to black [1]	[2]	
		(ii)	limewater/calcium hydroxide [1] colourless [1] solution to milky/white (ppte) [1]	[3]	
	(d)		sodium chloride NaCl [1] calcium sulphate $CaSO_4$ [1] calcium hydroxide $Ca(OH)_2$ [1] sodium hydrogen carbonate $NaHCO_3$ [1]	[4]	24

5 **(a)** John Dalton/J Chadwick/Rutherford/Thompson/Bohr [1]

AVAILABLE MARKS

(b) **(i)**

	Symbol	Number of electrons	Electronic configuration
Aluminium atom	Al [1]	13	2,8,3 [1]
Fluoride ion	F^-	10 [1]	2,8 [1]

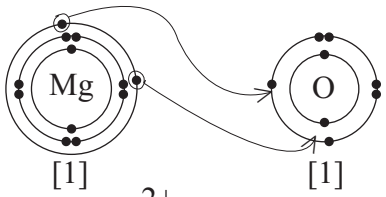
[4]

(ii) AlF_3 [1]

(ii) idea of same <u>number</u> [1] of protons and electrons [1] [2]

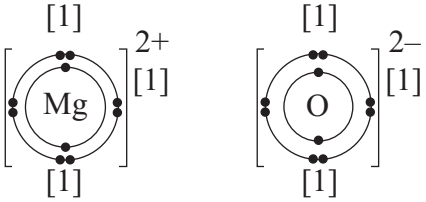
(c) **(i)** A substance made up of only one type of atom [2]
substance made of only one atom [1]
or substance which cannot be broken down (into anything simpler) [1]
by chemical means [1] [2]

(ii) Using full diagrams
magnesium atom 2,8,2 [1]
oxygen atom 2,6 [1]
transfer of 2 electrons from Mg to O [1]



[1] [1]

magnesium ion 2,8 [1]
oxide ion 2,8 [1]



[1] [1] [1] [1]

charge on magnesium ion 2^+ [1]
charge on oxide ion 2^- [1]

attraction between oppositely charged ions/electrostatic attraction [1]
max [6]

(iii) ionic [1]

17

6 (a) (i) 55 [1]

(ii)

External factor	Volume increases	Volume decreases
Increase pressure		✓ [1]
Increase temperature	✓ [1]	

[2]

(b)

Name of gas	Formula of gas
Nitrogen [1]	N_2
Oxygen	O_2 [1]
Carbon dioxide	CO_2 [1]
Helium [1]	He
Argon [1]	Ar

[5]

(c) (i) temperature [1]
at which a solid changes to a liquid [1] [2]

(ii) Gases: fluorine [1] chlorine [1]
Liquids: bromine [1]
Solids: carbon [1] sulphur [1] phosphorus [1] [6]

(d) A = condensing [1]
B = freezing/solidifying [1]
C = subliming [1] [3]

19

Total **120**

AVAILABLE MARKS

Rewarding Learning

General Certificate of Secondary Education
2010

Science: Chemistry

Paper 1
Higher Tier

[G1403]

WEDNESDAY 26 MAY, MORNING

MARK SCHEME

					AVAILABLE MARKS
1	**(a)**	**(i)**	(law of) octaves	[1]	
		(ii)	**any three from** no noble gases/fewer groups gaps (for undiscovered elements) order of atomic mass no mass number no atomic number some elements in different position no lanthanides/no actinides/no f-block less elements no **block** of transition metals/no d-block	[3]	
	(b)		alkali metals [1] halogens [1]	[2]	
	(c)	**(i)**	helium/neon/argon/krypton	[1]	
		(ii)	bromine	[1]	
		(iii)	hydrogen/nitrogen/oxygen/fluorine/chlorine	[1]	
		(iv)	boron/carbon/silicon/phosphorus/sulphur/arsenic/selenium	[1]	
		(v)	oxygen/sulphur/selenium	[1]	
		(vi)	forms H^+ ion/valency = 1/forms HX with halogens/1 e^- in outer shell	[1]	
	(d)	**(i)**	Al_2O_3	[1]	
		(ii)	$2Al + 3Cl_2 \rightarrow 2AlCl_3$	[3]	
		(iii)	4	[1]	
		(iv)	it is a non-metal	[1]	
		(v)	iron/chromium/vanadium/scandium	[1]	19

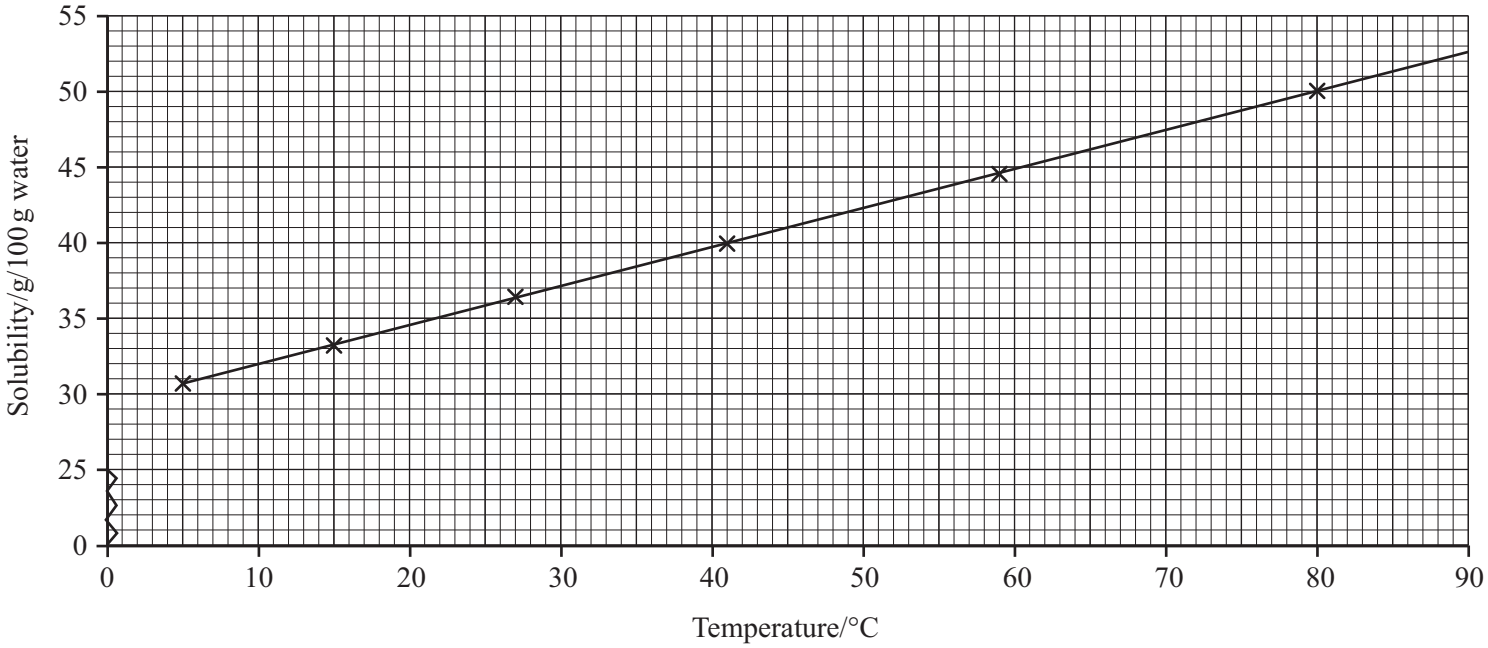
AVAILABLE MARKS

2 **(a)** mass [1] of substance
that (dissolves in and) saturates [1]
100 g of water [1]
at a particular temperature [1]
or
maximum [1] mass [1] of a substance that
dissolves in 100 g of water [1] at a
particular temperature [1] [4]

(b) **(i)** $20 \times 2 = 40$ [1] g/100 g water [1]

(ii) 4 or 5 correct plots [3]
2 or 3 correct plots [2]
1 correct plot [1]

straight line [1]



[4]

(iii) increases [1]

(iv) 32 ± 1 [1]

(v) 50 – 30.8 = 19.2 g [1] subtraction = [1]; division by 2 = [1]
19.2 ÷ 2 [1] = 9.6 g [1] answer = [1] [3]

(c) silver nitrate [1]
precipitate [1]
white [1] only award white if **one** of first two present [3]

				AVAILABLE MARKS
(d)	**(i)**	white pellets/solid/substance [1] colourless [1] solution/liquid [1] forms white crust/flakes/powder [1]	max [3]	
	(ii)	contains no water [1] contains no water of crystallisation [2]	max [2]	
(e)	**(i)**	sodium carbonate	[1]	
	(ii)	$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$	[3]	26
3 **(a)**	**(i)**	$S + O_2 \rightarrow SO_2$	[2]	
	(ii)	yellow [1] solid [1] melts/liquid formed [1] dark red/brown [1] blue [1] flame [1] more viscous [1] colourless/misty [1] pungent/bad smell [1] gas [1]	max [3]	
(b)	**(i)**	fossil fuels burning/vehicle exhausts/power stations/volcanic gases/ burning rubber tyres	[1]	
	(ii)	$SO_2 + H_2O \rightarrow H_2SO_3$	[2]	
	(iii)	3–6	[1]	
	(iv)	corrodes limestone statues and buildings [1] kills fish (in rivers and lakes)/acidifies waterways [1] defoliates trees/damages vegetation [1]	max [2]	
	(v)	remove sulphur from fuels before use [1] treat emissions from power stations and factories [1] burning less fossil fuels/use renewable fuels/use alternative energy sources [1] catalytic converters [1]	max [2]	
(c)	**(i)**	$2SO_2 + O_2 \rightarrow 2SO_3$	[3]	
	(ii)	vanadium(V) oxide/vanadium pentoxide	[1]	
(d)	**(i)**	removes water	[1]	
	(ii)	white [1] solid swells/rises [1] in the container reaction is not immediate [1] heat is released [1] distinct caramel smell [1] pungent odour [1] black [1] solid remains hissing sound [1] porous solid/gas/vapour [1]	max [3]	21

AVAILABLE MARKS

4 **(a)** **(i)** $Li_2CO_3 + 2HCl \rightarrow 2LiCl + CO_2 + H_2O$ [3]

(ii) decomposition [1]
using (a direct current of) electricity [1] [2]

(b)

Substance	Conducts electricity	Does not conduct electricity
solid lithium	✓ [1]	
molten lithium	✓ [1]	
solid lithium chloride		✓ [1]
lithium chloride solution	✓ [1]	

[4]

(c) **(i)** liquid [1]
which conducts electricity [1]
and is decomposed by it [1] [3]

(ii) A = anode [1]
B = cathode [1] [2]

(iii) graphite/carbon/platinum/titanium [1]

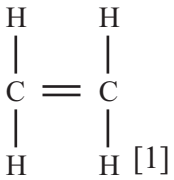
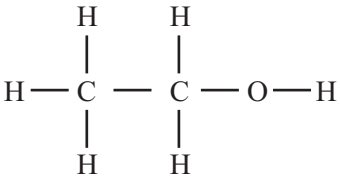
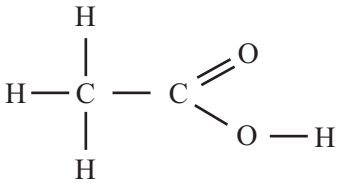
(iv) unreactive/(good) conductor of electricity [1]

(v) B/cathode [1]

(vi) yellow-green [1]
pungent [1]
gas/bubbles [1] max [2]

(vii) electrode A $2Cl^- \rightarrow Cl_2 + 2e^-$ or $2Cl^- - 2e^- \rightarrow Cl_2$ [3]

electrode B $Li^+ + e^- \rightarrow Li$ [2] 24

					AVAILABLE MARKS
5	**(a)**	**(i)**	alkenes	[1]	
		(ii)	C_2H_4 [1]		
			 [1]		
			gas [1]	[3]	
		(iii)	contains one or more C ═ C bonds	[1]	
	(b)	**(i)**	$C_2H_4 + H_2O \rightarrow C_2H_5OH$	[2]	
		(ii)	 [2]	[1] if — OH	[2]
	(c)		*Sugar/starch [1] solution mixed with yeast [1] warm [1] conditions *essential absence of oxygen [1] *carbon dioxide [1]		[5]
			Quality of written communication		[2]
	(d)	**(i)**	$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$		[3]
		(ii)	blue		[1]
	(e)	**(i)**	addition [1] of oxygen [1] (**or** loss [1] of electrons [1] **or** loss [1] of hydrogen [1])		[2]
		(ii)	 [2]	[1] if —OH	[2]
		(iii)	vinegar		[1]
	(f)	**(i)**	bubbles/fizzing/gas produced [1] heat given out [1] metal disappears [1] colourless solution forms [1]		max [2]
		(ii)	$2CH_3COOH + Mg \rightarrow (CH_3COO)_2Mg + H_2$		[3]
					30
				Total	**120**

Rewarding Learning

General Certificate of Secondary Education
2010

Science: Chemistry

Paper 2
Higher Tier

[G1404]

WEDNESDAY 9 JUNE, AFTERNOON

MARK SCHEME

AVAILABLE MARKS

1 (a) (i)

	Name	Formula
Ion present in all acids	hydrogen [1]	H^+ [1]
Ion present in all alkalis	hydroxide [1]	OH^- [1]

[4]

(ii) $H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$ [1] for state symbols [2]

(b) (i) sodium sulphate [1]

(ii) $CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$ [2]

(c) evaporate off half/$\frac{2}{3}$ of the water/heat to concentrate/idea of reduced volume by heating [1]
allow to cool [1] and crystallise [1]
filter [1]
dry between sheets of filter paper/in a low temperature oven/in a desiccator [1] max [3]

Quality of written communication max [2] if [2]–[3] in **(c)**
max [1] if [1] in **(c)**
max [0] if [0] in **(c)** [2]

(d) (i)

	blue/green (flame) [1]
	blue [1] ppt [1] deep/dark blue [1] solution/ppt redissolves [1]

[5]

(ii) add barium nitrate/barium chloride (solution) [1]
ppt [1]
white [1] award mark for "white" if one of the other statements is given correctly [3]

(iii)

		potassium/K^+ [1]
		iodide/I^- [1] (**not** iodine)

Formula of salt **A** KI [1] [3]

25

AVAILABLE MARKS

2 **(a)** **(i)** reaction [1] (of fuels) with oxygen [1] **not** with **air**
producing oxides [1]
releasing energy [1] max [3]

(ii) (combustion) **product** is water
or
(combustion) **product(s)** does not cause pollution
or
no solid residue in (combustion) **product(s)** [1]

(iii) bonds broken in the hydrogen and oxygen [1]
bond breaking takes in energy [1]
bonds made in water [1]
bond making gives out energy [1]
more energy given out in bond making than taken in in bond breaking [1] [5]
Example: There is more energy given out when the bonds are made in water than taken in when the bonds are broken in the hydrogen and oxygen molecules.

(b) **(i)** black [1] copper oxide
red-brown [1] copper
condensation/droplets/of a colourless liquid [1] max [2]

(ii) $CuO + H_2 \rightarrow Cu + H_2O$ [2]

(iii) **copper oxide** loses oxygen [1] reduction is loss of oxygen [1]
or
copper ions gain electrons [1] reduction is gain of electrons [1] [2]

(c) **(i)** larger surface area [1]
react faster [1] [2]

(ii) $2Mg + O_2 \rightarrow 2MgO$ [3]

(iii) white light/bright light [1]
changes from grey to white powder [1]
idea of heat evolved [1] max [1]

(iv) $2e^-$ [1] accept $Mg - 2e^- \rightarrow Mg^{2+}$ / $Mg \rightarrow Mg^{2+} + 2e^-$
magnesium has lost electrons [1]
oxidation is loss of electrons [1] [3] 24

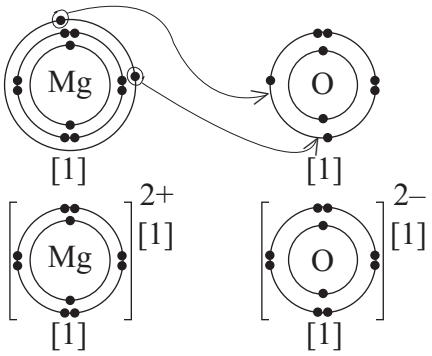
				AVAILABLE MARKS
3	**(a)**	**(i)**	pipette [1]* use safety pipette filler [1] rinse with distilled water [1] rinse with barium hydroxide solution [1] draw up liquid until (bottom of) meniscus on line [1] release [1] into conical flask touch tip of pipette on to surface of solution [1] max [4] * essential	
		(ii)	pink [1] to colourless [1] (wrong way round = [1]) [2]	
	(b)	**(i)**	average titre = 22.45 (cm^3) use of rough titre max [1] (22.57 cm^3) [2]	
		(ii)	moles = $\frac{22.45 \times 0.2}{1000}$ [1] = 0.00449 [1] [2]	
		(iii)	ratio 1 $Ba(OH)_2$: 2HCl or division by 2 [1] = 0.002245 [1] [2]	
		(iv)	$\frac{0.002245 \times 1000}{25.0}$ [1] = 0.0898 [1] [2]	
	(c)	**(i)**	moles Ca = $\frac{0.2}{40}$ [1] = 0.005 [1] ratio 1 Ca:1 H_2/0.005 : 0.005 [1] 0.005 × 24 [1] volume = 0.12 [1] dm^3 [5]	
		(ii)	ratio 1 Ca: 2HNO_3/multiplication by 2 [1] = 0.005 × 2 = 0.01 [1] $\frac{0.01 \times 1000}{2}$ [1] = 5 [1] cm^3 [4]	
		(iii)	% N $\frac{28\ [1]}{164\ [1]} \times 100$ = 17.1% [1] [3]	26

					AVAILABLE MARKS
4	**(a)**	**(i)**	break down [1] using heat [1]	[2]	
		(ii)	$CaCO_3 \rightarrow CaO + CO_2$	[2]	
		(iii)	breaking strong/ionic bonds [1] requires a lot of energy [1]	[2]	
		(iv)	$CaO + H_2O \rightarrow Ca(OH)_2$	[2]	
	(b)	**(i)**	$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$	[3]	
		(ii)	bubbles/effervescence/gas produced [1] idea of solid/calcium carbonate disappears [1] **not** dissolving idea of heat (released/given out) [1] idea that solution remains colourless	max [2]	
		(iii)	$CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$	[2]	
	(c)	**(i)**	$Al(OH)_3 + 3HCl \rightarrow AlCl_3 + 3H_2O$	[3]	
		(ii)	reacts/acts/behaves as an acid and a base	[1]	19

AVAILABLE MARKS

5 **(a)** **(i)** A substance made up of (only) one type of atom [2] (a substance made up of one atom = [1])
or substance which cannot be broken down into anything simpler [1]
by chemical means [1] [2]

(ii) diagrams drawn to show full electronic configuration.
magnesium atom 2,8,2 [1]
oxygen atom 2,6 [1]
transfer of 2 electrons from Mg to O [1]



magnesium ion 2,8 [1]
oxide ion 2,8 [1]

charge on magnesium ion 2^+ [1]
charge on oxide ion 2^- [1]

attraction between oppositely charged ions/electrostatic attraction [1]

max [6]

(iii) ionic/electrostatic [1]

(b) **(i)** different { structure / forms } of the same element [1]
in the same (physical) state [1] [2]

(ii)
- correct bonding in **all** layers shown [1]
- diagram of at least 2 layers [1] max [2] for drawing

labels
- (carbon) atoms
- delocalised electrons
- covalent bond (between carbon atoms)
- weak bonds (between layers) or Van der Waals forces max [4]

(iii) strong **bonds**/covalent **bonds** [1]
tetrahedral [1]
3D/rigid structure/regular structure/giant structure/macromolecular [1]
max [2]

(c) **(i)** shared [1] electrons [1]
idea of pair [1] [3]

(ii) carbon dioxide – simple/molecular (structure) [1]
van der Waals forces/with weak forces/bonds [1]
between molecules [1]
little energy required to break [1] max [3]

23

					AVAILABLE MARKS
6	**(a)**	**(i)**	coke	[1]	
		(ii)	(hot) air	[1]	
		(iii)	Reaction 1: $C + O_2 \rightarrow CO_2$ Reaction 2: $CO_2 + C \rightarrow 2CO$	[2] [3]	
		(iv)	$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$	[3]	
	(b)	**(i)**	A = carbon dioxide [1] CO_2 B = calcium oxide [1] CaO/quicklime	[2]	
		(ii)	silicon dioxide/sand	[1]	
		(iii)	Reaction 4: $CaO + SiO_2 \rightarrow CaSiO_3$	[2]	
		(iv)	carbon monoxide/nitrogen/argon/any other noble gas	[1]	16

		AVAILABLE MARKS
7 **(a)** **(i)**	Reaction A: $Mg + HCl \rightarrow MgCl_2 + (H_2)$ Reaction B: $2H_2O_2 \rightarrow 2H_2O + (O_2)$ Reaction C: $Na_2S_2O_3 + 2HCl \rightarrow 2NaCl + (SO_2) + S + H_2O$ [1] for each correct circle [3]	
(ii)	hydrogen peroxide [1]	
(iii)	(substance which) increases rate/speeds up [1] reaction [1] idea of without being used up [1] [3] **not** does not take part in the reaction	
(iv)	manganese(IV) oxide/manganese dioxide [1]	
(b) **(i)**	A = **thistle** funnel [1] B = delivery tube/connecting tubing [1] C = (gas) syringe [1] [3]	
(ii)	(stop)clock/watch/timer [1]	
(iii)	idea of prevent gas escaping [1]	
(c) **(i)**	117.2 – 116.76 [1] = 0.44 [1] g [2]	
(ii)	idea of prevent loss of liquid/spray **not** loss of gas [1]	
(iii)	starts at 117.20 **and** stays lower [1] ends at same mass [1] [2]	
(iv)	more energy/move faster [1] more collisions [1] more successful collision [1] } max [2]/[3] * in a given period of time [1] **essential** max [3]	
(v)	stir/shaking [1] increase concentration of (hydrochloric) acid [1] crush marble chips/increase surface area of solid/marble chips [1] any [2]	
(d)	<table><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td>platinum/(rhodium) [1]</td></tr><tr><td></td><td>$N_2 + 3H_2 \rightarrow 2NH_3$ [3]</td><td></td></tr></table> [4]	27
	Total	**160**