GCSE

Science: Chemistry

Summer 2009

Mark Schemes

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

MARK SCHEMES (2009)

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
2009

Science: Chemistry

Paper 1
Foundation Tier

[G1401]

THURSDAY 4 JUNE, MORNING

MARK SCHEME

AVAILABLE MARKS

1 (a) (i) substance which consists of one type of atom [2] **or**
substance which cannot be broken down into anything simpler [1]
by chemical means [1] [2]

(ii) number of protons [1]

(b) (i)

Particle	Relative mass	Relative charge	Position
proton	1	+1	nucleus
electron	$\frac{1}{1840}$ accept range $\frac{1}{1800} \rightarrow \frac{1}{2000}$ or approximately zero **do NOT accept zero**	−1	shells
neutron	1	0	nucleus

Max [6]: subtract [1] for each error to minimum of [0] [6]

(ii) drawn inner electrons 2,8 [1]
outer shell containing 4 electrons [1] [2]

(c) (i)

Isotope	Number of protons	Number of electrons	Number of neutrons
^{28}Si	14	14	14
^{29}Si	14	14	15
^{30}Si	14	14	16

[1] each row [3]

(ii) atoms of same element/with same atomic number/same number of protons [1] different number of neutrons/different mass number [1] [2]

(d) (i) SiO_2 [1]

(ii) shared electrons [1] idea of pair of electrons [1] [2]

(e) Mg E.C. = 2,8,2 [1]
O E.C. = 2,6 [1]
2 electrons transferred from magnesium to oxygen [1]
Mg^{2+} [1] E.C. = 2,8 [1]
O^{2-} [1] E.C. = 2,8 [1]
Attraction of oppositely charged ions held together by (strong) electrostatic forces [1] **max** [6]

25

				AVAILABLE MARKS
2	**(a)**	**(i)**	colour change/reddish-brown (solid) forms [1]	
		(ii)	zinc/Zn [1]	
		(iii)	greasing/oiling/sacrificial protection/painting/suitable metal plating/plastic coating any **two** [2]	
		(iv)	contains water (of crystallisation)/water bonded in the crystals [1]	
	(b)	**(i)**	$2Cu + O_2 \rightarrow 2CuO$ [3]	
		(ii)	$CuO + CO_2 \rightarrow CuCO_3$ [2]	
		(iii)	red-pink/red-brown [1] black [1] green [1] [3]	
		(iv)	sulphuric acid [1]	
	(c)	**(i)**	$Mg + CuSO_4 \rightarrow MgSO_4 + Cu$ [2]	
		(ii)	displacement/redox/exothermic [1]	
		(iii)	blue [1] solution changes to colourless [1] heat given out [1] solid [1] appears magnesium disappears [1] any **two** [2]	
		(iv)	zinc/iron/aluminium/calcium any metal above copper in reactivity series **not** Group I metal or magnesium [1]	20

AVAILABLE MARKS

3 **(a)** **(i)** decomposition/breakdown [1]
using electricity [1] [2]

(ii) electrode A = anode [1] [1]

(iii) electrolyte [1]

(iv) conducts electricity [1]
inert/does not react with copper(II) sulphate solution [1] [2]

(b)

Name of ion	**Formula of ion (including charge)**	**Attracted to positive electrode**	**Attracted to negative electrode**
	Cu^{2+} [1]		
sulphate [1]		✓ [1]	✗
hydrogen [1]		✗	✓ [1]
	OH^- [1]		

[6] 12

AVAILABLE MARKS

4 **(a)** **(i)**

Name	Physical state at room temperature	Colour
Fluorine	**gas** [1]	**yellow** [1]
Chlorine	gas	**green** [1]
Bromine	**liquid** [1]	red-brown
Iodine	**solid** [1]	**grey/black** [1]

[6]

(ii) molecule containing two atoms [1] (covalently bonded together) [1]

(iii) kills bacteria/sterilise [1]

(iv) Iodine/I_2 [1]

(b) **(i)** $H_2 + Cl_2 \rightarrow 2HCl$ [3]

(ii) safety glasses/fume cupboard/carry out in dark
Any **two** [2]

(iii) red [1]

(iv) glass rod [1]
dipped in concentrated [1] ammonia [1]
white [1]
smoke [1]
Any **four** [4]

Quality of written communication [2] 21

AVAILABLE MARKS

5 **(a)** **(i)**

Mineral	Name of compound	Formula of compound	Relative Formula Mass
Calcite	Calcium carbonate	**$CaCO_3$** [1]	**100** [1]
Haematite	**iron(III) oxide** [1]	Fe_2O_3	**160** [1]
Cinnabar	**mercury sulphide** [1]	HgS	**233** [1]

[6]

(ii) $\frac{48}{80}$ [1] × 100 = 60 [1] % [2]

(b) **(i)** Ag_2O [1]

(ii) 47 [1]

(iii) carbon [1] 12 [1] [2] 12

Total **90**

Rewarding Learning

General Certificate of Secondary Education
2009

Science: Chemistry

Paper 2
Foundation Tier

[G1402]

WEDNESDAY 17 JUNE, MORNING

MARK SCHEME

					AVAILABLE MARKS
1	**(a)**	**(i)**	limewater [1] colourless [1] to milky [1]	[3]	
		(ii)	carbon monoxide	[1]	
		(iii)	carbon dioxide [1] water [1]	[2]	
		(iv)	exothermic	[1]	
		(v)	substance which contains **carbon and hydrogen** [1] only [1]	[2]	
		(vi)	$2H_2 + O_2 \rightarrow 2H_2O$	[3]	
	(b)	**(i)**	hydroelectric/solar/others maximum [2]	[2]	
		(ii)	non-renewable – idea of will eventually run out [1] renewable – idea of can be replaced [1]	[2]	
		(iii)	crude oil	[1]	17

				AVAILABLE MARKS
2	(a)	(i)	a compound [1] formed when an acid reacts with/neutralises **or** when acid hydrogen replaced [1] a base/alkali/metal/carbonate [1] **or** with a metal [1] maximum [2] [2]	
		(ii)	KNO_3 [1]	
		(iii)	potassium oxide/hydroxide/carbonate/hydrogen carbonate [1] nitric acid [1] [2]	
	(b)	(i)	zinc [1] + sulphuric acid [1] → zinc sulphate + hydrogen [2]	
		(ii)	potassium hydroxide/oxide [1] + hydrochloric acid [1] → potassium chloride + water [2]	
	(c)	(i)	**A** = Bunsen burner [1] **B** = measuring cylinder [1] **C** = filter funnel [1] **D** = conical flask [1] **E** = evaporating basin/dish [1] [5]	
		(ii)	**B** [1]	
		(iii)	**D** [1]	
		(iv)	**A** and **E** [2]	
	(d)	(i)	no more gas produced/gas production stops/idea of solid remaining at bottom of beaker [1]	
		(ii)	$ZnCO_3 + 2HCl \rightarrow ZnCl_2 + CO_2 + H_2O$ [3]	22

					AVAILABLE MARKS
3	**(a)**	**(i)**	blue	[1]	
		(ii)	colourless	[1]	
		(iii)	limewater	[1]	
		(iv)	$Ca(OH)_2$	[1]	
		(v)	A solute [1] (dissolved) in a solvent [1]	[2]	
	(b)	**(i)**	increased temperature/heat [1] stir [1] crystals crushed [1]	[3]	
		(ii)	individual marks are given for correctly labelled and recognisable drawing No labels = no marks water and copper sulphate in boiling tube [1] boiling tube in water bath [1] thermometer in boiling tube [1] tripod [1] gauze [1] Bunsen burner/heat [1] maximum [4]	[4]	
		(iii)	no more solid will dissolve/maximum mass dissolved [1] at a particular temperature [1]	[2]	
	(c)		oil/litter/hot water from factories/excess fertilisers/detergents/sewage Any **two**	[2]	
	(d)	**(i)**	decreases	[1]	
		(ii)	preservative/bleach	[1]	
	(e)	**(i)**	without water	[1]	
		(ii)	white	[1]	
		(iii)	(anhydrous) cobalt chloride	[1]	22

					AVAILABLE MARKS
4	**(a)**	**(i)**	Mendeleev	[1]	
		(ii)	number [1] mass [1]	[2]	
		(iii)	Newlands	[1]	
	(b)	**(i)**	8	[1]	
		(ii)	Group I/alkali metals	[1]	
		(iii)	noble gases/Group VIII or 0 **Not** inert gases	[1]	
		(iv)	more reactive/increased reactivity	[1]	
	(c)	**(i)**	Periods	[1]	
		(ii)	number of electrons in outer shell equals group number/as the Periodic Table is crossed from left to right the number of electrons increases	[1]	
		(iii)	2 +	[1]	
	(d)	**(i)**	**C**	[1]	
		(ii)	**B**	[1]	
		(iii)	**A**	[1]	
		(iv)	$MgO + 2HCl \rightarrow MgCl_2 + H_2O$	[3]	
	(e)		Hydrogen [1] H_2O [1] **or** Carbon [1] CO[1] **or** Nitrogen [1] NO [1]	[2]	19

AVAILABLE MARKS

5 (a)

Physical Property	Meaning
malleable	can be hammered into shape/ beaten into sheets [1]
ductile [1]	can be drawn out into wires
lustrous	shiny [1]

[3]

(b)

potassium and water	
observations	floats/on surface [1] moves [1] hisses/gas produced/bubbles/fizzes [1] heat released [1] lilac [1] flame [1] eventually disappears [1] **not** dissolves colourless solution [1] cracks/explodes/sparks/vigorous reaction [1] melts/forms a (silvery) ball [1] maximum [4]
balanced symbol equation	$2K + 2H_2O \rightarrow 2KOH + H_2$

[4]

[3]

calcium and water	
observations	bubbles/gas produced/fizzes [1] heat released [1] eventually disappears [1] **not** dissolves colourless solution [1] Ca sinks/Ca sinks and rises [1] maximum [3]
balanced symbol equation	$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

[3]

[3]

(c) (i) to generate/produce steam [1]

(ii) hydrogen [1]

(iii) $Zn + H_2O \rightarrow ZnO + H_2$ [2]

(iv) aluminium/iron [1]

21

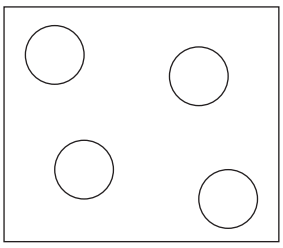
6 **(a)** **(i)** 2, 7 [1]

(ii)

	Element with atomic number 17	**Element with atomic number 35**
Melting point (°C)	–101 [1] (**accept** –100)	–7 [1] (**accept** –5 → –10)
Boiling point (°C)	–35 [1] (**accept** –34 → –36)	59 [1] (**accept** 60)
Physical state at room temperature	gas [1]	liquid [1]

[6]

(iii) allow c.m. from **(ii)** [1]



(iv) particles gain energy [1]
vibrate more [1]
idea of overcome attractive forces [1]
idea of move apart [1]
maximum [3] [3]

Quality of written communication [2]

(v) solid to gas [1]

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

(ii) **E** [1]

(iii) **C** [1]

(iv) **A** [1]

(v) **B** [1] [5]

Total

AVAILABLE MARKS

19

120

Rewarding Learning

General Certificate of Secondary Education
2009

Science: Chemistry

Paper 1
Higher Tier

[G1403]

THURSDAY 4 JUNE, MORNING

MARK SCHEME

AVAILABLE MARKS

1 **(a)** **(i)** substance which consists of one type of atom [2]
or substance which cannot be broken down
(into anything simpler) [1]
by chemical means [1]

[2]

(ii) number of protons in an atom [1] [1]

(b)

Particle	Relative mass	Relative charge
proton	1	+1
electron	$\frac{1}{1840}$ accept range $\frac{1}{1800} \rightarrow \frac{1}{2000}$ or approximately zero **do NOT accept zero**	–1
neutron	1	0

[1] for each correct row [3]

(c) **(i)**

	Number of protons	Number of electrons	Number of neutrons
^{28}Si	14	14	14
^{29}Si	14	14	15
^{30}Si	14	14	16

[1] each row [3]

(ii) atoms of same element/with same atomic number/same number of protons [1]
different number of neutrons/different mass number [1] [2]

			AVAILABLE MARKS
(d)	**(i)**		

Type of bonding present in silicon dioxide	covalent [1]
Type of structure in silicon dioxide	giant/macromolecular [1]

[2]

(ii) Na_4SiO_4 [1]

(iii) high mpt/bpt/solid [1]
conducts electrity when molten/dissolved/does not conduct electricity when solid [1]
soluble in water [1]
brittle/easily cleaved [1] **max** [2]

(e) **(i)** $SiCl_4 + 2Zn \rightarrow Si + 2ZnCl_2$
[1] reactants [1] products [1] balancing [3]

(ii) regular arrangement [1]
of positive ions [1] **or** accept positive ions in diagram
surrounded by a sea of delocalised electrons [1] **or** accept electrons in diagram
the attraction between positive ions and electrons is the metallic bond [1]
any three [3]

(f) **(i)** energy released when bonds are made/band making is exothermic [1]
$Si/CO_2/Si$ and CO_2 [1]
is greater [1] than
energy required when bonds are broken/bond breaking is endothermic [1]
$C/SiO_2/C$ and SiO_2 [1]
accept heat = energy [5]

(ii) silicon dioxide loses oxygen [1]
loss of oxygen is reduction [1] [2] 29

					AVAILABLE MARKS
2	**(a)**	**(i)**	colour change/reddish-brown (solid) forms	[1]	
		(ii)	zinc/Zn	[1]	
		(iii)	greasing/oiling/sacrificial protection/painting/suitable metal plating/plastic coating **any two**	[1] [1]	
		(iv)	contains water of crystallisation	[1]	
	(b)	**(i)**	$Fe_2O_3 + 3H_2SO_4 \rightarrow Fe_2(SO_4)_3 + 3H_2O$ [1] reactants [1] products [1] balancing	[3]	
		(ii)	red-brown [1] ppt [1]	[2]	
	(c)	**(i)**	$2Cu + O_2 \rightarrow 2CuO$ [1] reactants [1] products [1] balancing	[3]	
		(ii)	$CuO + CO_2 \rightarrow CuCO_3$ [1] reactants [1] products	[2]	
		(iii)	red-pink/red-brown [1] black [1] green [1]	[3]	
		(iv)	sulphuric acid	[1]	
	(d)		magnesium [1] loses electrons [1] **or** $Mg \rightarrow Mg^{2+} + 2e^-$ [2]/$Mg - 2e^- \rightarrow Mg^{2+}$ [2] oxidation is loss of electrons/magnesium is oxidised [1] copper ions [1] gain electrons [1] **or** $Cu^{2+} + 2e^- \rightarrow Cu$ [2] reduction is gain of electrons/copper ions reduced [1] oxidation and reduction both occurring in same reaction [1]	[7]	26

3 **(a)** **(i)** decomposition/breakdown [1]
using electricity [1] [2]

AVAILABLE MARKS

(ii)

Name of ion	Formula of ion (including charge)	Attracted to positive electrode	Attracted to negative electrode
	Cu^{2+} [1]		
sulphate [1]		✓ [1]	–
hydrogen [1]		–	✓ [1]
	OH^- [1]		

[6]

(b) **(i)** Gas A is oxygen [1]
Gas B is hydrogen [1] [2]

(ii) Anode: $4OH^- \rightarrow 2H_2O + O_2 + 4e^-$ [3]
or $4OH^- - 4e^- \rightarrow 2H_2O + O_2$

Cathode: $2H^+ + 2e^- \rightarrow H_2$ [3] 16

4 **(a)** **(i)** solid A – potassium permanganate/manganese(IV) oxide [1]
solution B – concentrated [1] hydrochloric acid [1] [3]

(ii) dry the gas/remove moisture/remove water [1]

(b) **(i)** $H_2 + Cl_2 \rightarrow 2HCl$
[1] reactants [1] products [1] balancing [3]

(ii) safety glasses/fume cupboard/carry out in dark
any two [2]

(c) **(i)** solid C – sodium chloride/NaCl [1]
solution D – concentrated [1] sulphuric acid [1] [3]

(ii) bubbles/fizzing [1]
heat given off [1]
misty fumes [1]
immediate reaction [1]
solid disappears [1]
any two [2]

(d) **(i)** $N_2 + 3H_2 \rightarrow 2NH_3$ [3]

(ii)

Name of catalyst	Iron [1]
Temperature (°C)	450 °C (200–450 °C) [1]
Pressure (atm)	350 atm (200–1000 atm) [1]

[3]

(iii) glass rod [1] accept sensible method of application
dipped in concentrated [1] hydrochloric acid [1]
white [1] smoke [1] **max** [4]

Quality of written communication [2]

26

AVAILABLE MARKS

					AVAILABLE MARKS
5	**(a)**	**(i)**	relights	[1]	
		(ii)	number of moles of $Pb_3O_4 = \frac{2.74}{685[1]} = 0.004$ [1] ratio Pb_3O_4:PbO = 2:6/moles of PbO = 0.004 × 3 = 0.012 [1] mass of PbO = 0.012 × 223 [1] = 2.676 [1] g	[5]	
		(iii)	ratio Pb_3O_4:O_2 = 2:1/moles of $O_2 = \frac{0.004}{2} = 0.002$ [1] volume of O_2 = 0.002 × 24 000 = 48 [1] cm^3	[2]	
	(b)	**(i)**	moles of $Na_2S_2O_3 = \frac{5.53}{158[1]} = 0.035$ [1]	[2]	
		(ii)	ratio $Na_2S_2O_3$:HCl = 1:2/moles of HCl = 0.035 × 2 [1] = 0.07 [1]	[2]	
		(iii)	volume of HCl = $\frac{0.07 \times 1000}{2}$ [1] = 35 [1] cm^3	[2]	
	(c)	**(i)**	3–0.55 = 2.45 [1] g	[1]	
		(ii)	moles of HCl = $\frac{50 \times 1}{1000}$ [1] = 0.05 [1]	[2]	
		(iii)	ratio HCl:$M(OH)_2$ = 2:1/moles of $M(OH)_2 = \frac{0.05}{2}$ [1] = 0.025 [1]	[2]	
		(iv)	RFM = $\frac{2.45}{0.025}$ [1] = 98 [1]	[2]	
		(v)	RAM of M = 98 – 34 = 64 [1] Identity of M = Cu [1]	[2]	23
				Total	**120**

Rewarding Learning

General Certificate of Secondary Education
2009

Science: Chemistry

Paper 2
Higher Tier

[G1404]

WEDNESDAY 17 JUNE, MORNING

MARK SCHEME

					AVAILABLE MARKS
1	(a)	(i)	Mendeleev	[1]	
		(ii)	number [1] mass [1]	[2]	
		(iii)	Mendeleev's table had gaps for undiscovered elements **or** any suitable	[1]	
		(iv)	Newlands	[1]	
	(b)	(i)	8	[1]	
		(ii)	Group I/alkali metals	[1]	
		(iii)	noble gases/Group VIII or 0	[1]	
		(iv)	more reactive/increased reactivity	[1]	
	(c)	(i)	Periods	[1]	
		(ii)	number of electrons in outer shell equals group number/as the Periodic Table is crossed from left to right the number of electrons increases	[1]	
		(iii)	decreases	[1]	
		(iv)	silicon/germanium [1] has properties of metals and non-metals [1]	[2]	
	(d)	(i)	**C** [1] **D** [1]	[2]	
		(ii)	**A**	[1]	
		(iii)	copper oxide/magnesium oxide or any other suitable insoluble base	[1]	
	(e)		Hydrogen [1] H_2O [1] **or** Carbon [1] CO [1] **or** Nitrogen [1] NO [1]	[2]	20

				AVAILABLE MARKS
2	**(a)**	**(i)**	a compound [1] formed when an acid reacts with/neutralises **or** when acid hydrogen replaced [1] a base/alkali/metal/carbonate [1] **or** with a metal [1] maximum [2] [2]	
		(ii)	KNO_3 [1]	
		(iii)	potassium oxide/hydroxide/carbonate/hydrogen carbonate [1] nitric acid [1] [2]	
	(b)	**(i)**	green [1] (solid) disappears [1] bubbles [1] colourless [1] to blue [1] heat released [1] maximum [3] [3]	
		(ii)	$CuCO_3 + 2HCl \rightarrow CuCl_2 + CO_2 + H_2O$ [3]	
		(iii)	filter [1]	
		(iv)	$CuCl_2.2H_2O$ [1]	
		(v)	heat [1] appropriate test for water [1] relevant colour change [2] [4]	
	(c)	**(i)**	blue/green [1] white [1] ppt [1] [3]	
		(ii)	flame test rod/nichrome wire [1] dip into deionised water/conc hydrochloric acid [1] place in sample [1] heat in flame and observe colour [1] [4]	
			Quality of written communication [2]	
	(d)	**(i)**	amphoteric [1]	
		(ii)	$Zn(OH)_2 + 2HCl \rightarrow ZnCl_2 + 2H_2O$ [3]	
		(iii)	sodium zincate [1]	
		(iv)	zinc oxide/aluminium oxide/aluminium hydroxide [1]	32

					AVAILABLE MARKS
3	(a)	(i)	blue	[1]	
		(ii)	colourless	[1]	
		(iii)	limewater	[1]	
		(iv)	carbon dioxide	[1]	
	(b)	(i)	individual marks are given for correctly **labelled** and recognisable drawing no labels = no marks water and copper sulphate in boiling tube [1] boiling tube in water bath [1] thermometer in boiling tube [1] tripod [1] gauze [1] Bunsen burner/heat [1] maximum [4]	[4]	
		(ii)	no more solid will dissolve/maximum mass dissolved [1] at a particular temperature [1]	[2]	
		(iii)	6.8×5 [1] = 34 g/100 g [1]	[2]	
	(c)	(i)	water boils at 100 °C	[1]	
		(ii)	47 ±1	[1]	
		(iii)	60 °C	[1]	
		(iv)	40 [1] g/100 g at 60 °C 24 [1] g/100 g at 30 °C 40 – 24 [1] = 16 16/2 = 8 [1] g	[4]	
	(d)	(i)	decreases	[1]	
		(ii)	preservative/bleach	[1]	21

AVAILABLE MARKS

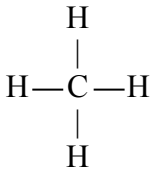
4 **(a)** **(i)** fractional [1]
distillation [1] [2]

(ii) carbon [1]
hydrogen [1] [2]

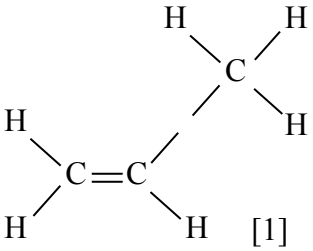
(b) **(i)** cracking [1]

(ii) heat/catalyst [1]

(c) **(i)**



[1]



[1] [2]

(ii) (bubble into) red-brown [1] bromine water [1]
changes to colourless for propene [1]
no change for methane [1] [4]

(iii) $CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$ [3]

(iv) carbon monoxide produced [1]
toxic [1] [2]

(d) **(i)** addition [1] polymerisation [1] [2]

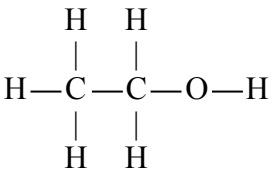
(ii) polythene [1]

(iii) plastic bags/plastic bottles [1]

(iv) repetition of structure/number of monomers/number of ethene molecules [1]

(e) **(i)** $C_2H_4 + H_2O \rightarrow C_2H_5OH$ [2]

(ii)



[2]

(iii) low bpt./evaporates easily [1]

(f) **(i)** yeast [1]

(ii) warm conditions [1]
anaerobic/no air [1] [2]

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AVAILABLE MARKS

5 **(a)** **(i)**

Physical Property	Meaning
ductile [1]	can be drawn out into wires
lustrous	shiny [1]

[2]

(ii) layers [1]
can slide over each other [1] [2]

(b)

potassium and water	
observations	floats [1] moves [1] hisses/gas produced [1] heat released [1] lilac [1] flame [1] eventually disappears [1] colourless solution [1] cracks/explodes [1] maximum [4]
balanced symbol equation	$2K + 2H_2O \rightarrow 2KOH + H_2$

[4]

[3]

calcium and water	
observations	Ca sinks/Ca sinks and rises [1] bubbles/gas produced [1] heat released [1] eventually disappears [1] colourless solution [1] maximum [3]
balanced symbol equation	$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

[3]

[3]

(c) **(i)** to generate/produce steam [1]

(ii) hydrogen [1]

(iii) $Zn + H_2O \rightarrow ZnO + H_2$ [2]

(iv) aluminium/iron [1]

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					AVAILABLE MARKS
6	(a)	(i)	haematite	[1]	
		(ii)	thermal [1] decomposition [1]	[2]	
		(iii)	$CaCO_3 \rightarrow CaO + CO_2$	[2]	
		(iv)	to remove impurities/form slag	[1]	
		(v)	greenhouse effect/global warming	[1]	
	(b)	(i)	Al_2O_3	[1]	
		(ii)	900–1000 °C	[1]	
		(iii)	lower melting point [1] act as solvent [1] increase conductivity [1] maximum [2]	[2]	
		(iv)	energy/electricity costs [1] replacement of anodes [1] raw materials not as readily available [1] raw materials must be purified [1] **or** other suitable maximum [2]	[2]	
		(v)	eyesore [1] noise pollution [1] dust pollution [1] traffic pollution [1] destroys habitats [1] **or** other suitable, e.g. exhausts natural resources maximum [2]	[2]	
		(vi)	electrical power lines/drinks cans/saucepans **or** other suitable	[1]	16

				AVAILABLE MARKS
7	**(a)**	**(i)**	$2H_2O_2 \rightarrow 2H_2O + O_2$ [3]	
		(ii)	prevent loss of liquid spray [1]	
		(iii)	plot points [2] smooth curve [1] [3]	
		(iv)	0.40 (take value from 3 minutes on graph) [1]	
		(v)	measure volume of oxygen produced/use a gas syringe/measure time taken for reaction to complete [1]	
	(b)	**(i)**	individual marks are given for correctly labelled and recognisable drawing No labels = no marks filter funnel [1] filter paper [1] conical flask/beaker/suitable container [1] manganese(IV) oxide/residue [1] **or** evaporating basin [1] heat [1] tripod [1] gauze [1] any **three** [3]	
		(ii)	dry [1] weigh – should be 1.0 g [1] **or** weigh before **and** after [1] compare [1] [2]	
		(iii)	catalyst [1]	
	(c)		Effect: rate increases [1] Explanation: particles move faster/have more energy [1] more collisions [1] more successful collisions [1] in unit time/per sec/min/more frequent [1] (essential mark) maximum [3] [3]	19
			Total	**160**