Rewarding Learning

General Certificate of Secondary Education
2011

Science: Chemistry

Paper 2
Higher Tier

[G1404]

TUESDAY 7 JUNE, AFTERNOON

MARK SCHEME

Guidelines for marking equations

Equations where the stoichiometry is 1 gain [2] maximum

[1] for correct formula of reactant/s
[1] for correct formula of product/s

e.g. $CaO + H_2O \rightarrow Ca(OH)_2$ [2]
[1] [1]

$CaO + \mathbf{2}H_2O \rightarrow Ca(OH)_2$ [1]
[0] [1]

However:
$2CaO + 2H_2O \rightarrow 2Ca(OH)_2$ [2]
[1] [1]

Equations where the stoichiometry is more than 1 gain [3]

[1] for correct formula of reactant/s
[1] for correct formula of product/s
[1] for correct balancing

e.g. $2Na + 2H_2O \rightarrow 2NaOH + H_2$
[1] [1]

+ [1] for balancing = [3]

$2Na + H_2O \rightarrow 2NaOH + H_2$
[1] [1]

No balancing mark = [2]

AVAILABLE MARKS

1 (a)

Name	Ammonia
State at room temperature and pressure	gas [1]
Colour	colourless [1]
Odour	pungent [1]
pH of aqueous ammonia	9–11 [1]

[4]

(b) (i) white [1] smoke/fumes/solid/cloud [1] [2]

(ii) corrosive [1]

(iii) gloves/lab coat/fume cupboard [1]

(c) (i) $NH_3 + HNO_3 \rightarrow NH_4NO_3$ [2]

(ii) eutrophication [1]

(iii) some algae die [1]
decomposing bacteria/organisms use up oxygen [1]
less oxygen available for fish [1] [3]

(d) ammonia [1] excess [1] air [1]
900–1000°C [1] } units essential and must be
1–10 atm [1] } related to this first step
Pt/Rh [1] catalyst [1]
$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$ [3]

nitrogen monoxide [1] mixed with (more) air [1]
$2NO + O_2 \rightarrow 2NO_2$ [3]

nitrogen dioxide [1] mixed with more air [1] and
(passed up tower of glass beads with) water [1] running down
$4NO_2 + O_2 + 2H_2O \rightarrow 4HNO_3$ [3] max [15] 29

AVAILABLE MARKS

2 **(a)** sodium chloride [1]

(b) **(i)** 0.02 [1]

(ii) Effect: increasing temperature increases rate
or decreasing temperature decreases rate [1] * essential

Explanation: particles have more energy/move faster [1]
more collisions [1]
more successful collisions [1]
in a given period of time/idea of frequency [1] max [3]
Converse argument for decrease in temperature [4]

(iii) only temperature has been changed/one factor changed/all other variables same [1]

(iv) powdered Mg [1]
all other factors kept the same [1] [2]

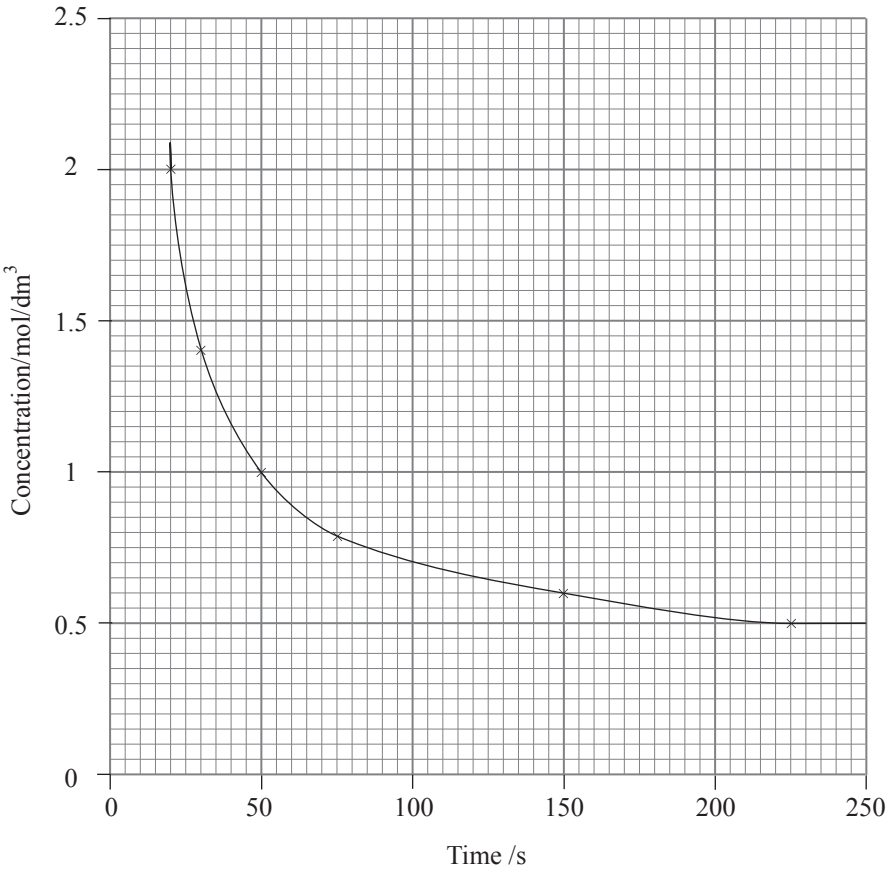
(c) **(i)** individual marks are for correctly labelled and recognisable drawings
No labels = 0 marks

conical flask [1]
Mg ribbon + acid in contact [1]
stop clock [1] [3]

(ii) no more bubbles/Mg disappears [1]

AVAILABLE MARKS

(iii) 5 or 6 points plotted correctly [2]
3 or 4 points plotted correctly [1]
0, 1, 2 points plotted correctly [0]
curve [1] [3]



(iv) 27 [1] s (accept 25–30) [1]

(v) decreases [1]

(d) a substance which increases [1] rate of reaction [1]
(or <u>speeds up</u> [1] a reaction [1])
without being used up/chemically unchanged at end [1] [3] 21

AVAILABLE MARKS

3 **(a)** copper: electrons carry charge/electrons can move [1]
no effect/no decomposition [1]

molten lead(II) bromide: ions carry charge/ions can move [1]
decomposes [1] [4]

(b) **(i)** A = anode [1]
B = cathode [1]
C = evaporating basin/crucible/evaporating dish [1] [3]

(ii) bulb/ammeter [1]

(iii)

Electrode	Observations	Name of Product	Half equation
A	red-brown [1] pungent [1] gas [1] **max [2]**	bromine	$2Br^- \rightarrow Br_2 + 2e^-$ [2]
B	silvery grey bead	lead [1]	$Pb^{2+} + 2e^- \rightarrow Pb$ [2]

[7]

(iv) bromine/lead (fumes) are toxic/poisonous [1]

(c) **(i)** **D** impure copper [1]
E pure copper [1] [2]

(ii) copper sulphate/copper chloride/copper nitrate [1]

(iii) $Cu^{2+} + 2e^- \rightarrow Cu$ [2]

(iv) ductile [1]

22

AVAILABLE MARKS

4 **(a)** **(i)** add universal indicator/pH paper [1] compare to colour chart [1]
or use pH meter [1] read off value [1] [2]

(ii) weak acid — lemon juice [1]
strong alkali — sodium hydroxide [1]
neutral — water [1] [3]

(iii) H^+ [1]

(iv) hydroxide [1]

(v) sodium sulphate [1]

(vi) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$ [3]

(b) **(i)** lead nitrate [1]
any soluble iodide, e.g. sodium iodide, potassium iodide etc. [1] [2]

(ii) individual marks are for correctly labelled and recognisable pieces of assembled apparatus
labels: filter funnel [1]
filter paper [1]
conical flask/suitable container [1] [3]

(iii) $Pb^{2+} + 2I^- \rightarrow PbI_2$ [3]

(c) **(i)** $BaCl_2 + Na_2SO_4 \rightarrow 2NaCl + BaSO_4$ [3]

(ii) low temperature oven/desiccator [1] 23

AVAILABLE MARKS

5 **(a)** **(i)** **A** = ethane [1]
B = propene [1]
C = ethene [1]
D = butane [1] [4]

(ii) C_4H_{10} [1]

(iii) **A** [1]

(iv) $2C_3H_6 + 9O_2 \rightarrow 6CO_2 + 6H_2O$ [3]

(v) same general formula [1]
differ by CH_2 unit [1]
similar/same chemical properties [1]
gradation in physical properties [1] max [3]

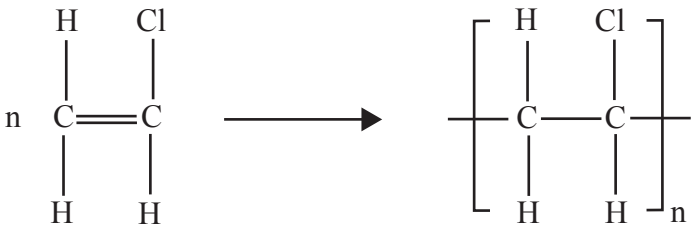
(b) **(i)** substance containing only [1] carbon and hydrogen [1] [2]

(ii) addition [1]

(iii) idea of large number [1] of
monomers/small molecules/repeating unit/alkene [1]
(bond) to form a chain [1] max [2]

(iv) ethene [1]

(v)



[1] for correct monomer structure
[1] for correct polymer structure in brackets
[1] for n before ethene
[1] for indicating repeat (repeat can be brackets and n after or a min of 3 repeating units) [4]

		AVAILABLE MARKS
(c)	polystyrene [1] polythene [1] PVC [1] [3]	25
6 **(a)**	gives out heat [1]	
(b) **(i)**	A combustion [1]	
	B neutralisation [1]	
(ii)	$NaOH + HCl \rightarrow NaCl + H_2O$ [2]	
(iii)	$2Mg + CO_2 \rightarrow 2MgO + C$ [3]	
(iv)	magnesium continues to burn [1] white light [1] white [1] solid [1] black specks [1] max [3]	
(c) **(i)**	blue [1] solution fades/changes to colourless [1] brown/black [1] solid [1] formed heat released [1] max [3]	
(ii)	magnesium (atom) loses electrons [2] or $Mg \rightarrow Mg^{2+} + 2e^-$ [2] loss of electrons is oxidation [1] copper <u>ions</u> gain electrons [2] or $Cu^{2+} + 2e^- \rightarrow Cu$ [2] gain of electrons is reduction [1] oxidation and reduction occurring simultaneously/in same reaction [1] [7]	
	Quality of written communication [2]	23

			AVAILABLE MARKS
7	**(a)**	**(i)** wastes land [1] unpleasant smell [1] eyesore [1] loss of habitat [1] toxic waste leaches into land [1] max [2]	
		(ii) greenhouse effect/global warming [1]	
		(iii) idea of saves resources/prevents landfill or incineration [1]	
		(iv) good conductors of electricity [1]	
	(b)	**(i)** advantage: heat produced can be harnessed [1] disadvantage: toxic fumes/greenhouse effect [1] [2]	
		(ii) mixture of metals [1]	
		(iii) $Al_2(SiO_3)_3$ [1]	
	(c)	**(i)**	

Raw material	Formula	Name of chemical
Haematite	Fe_2O_3 [1]	iron(III) oxide
Limestone	$CaCO_3$	calcium carbonate [1]

[2]

		(ii) coke/carbon [1]	
		(iii) more employment [1] boosts local economy [1] improved road and transport infrastructure [1] max [2]	
		(iv) carbon monoxide [1]	
		(v) $CaO + SiO_2 \rightarrow CaSiO_3$ [2]	17
		Total	**160**