Rewarding Learning

General Certificate of Secondary Education
2011

Science: Chemistry

Paper 1
Higher Tier

[G1403]

FRIDAY 27 MAY, MORNING

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)** Chlorine [1] 7/VII [1]
Nitrogen [1] 5/V [1] or argon [1] 0/8/VIII [1]
Apply CM for group of incorrect element [4]

(b) **(i)**

Group number	Name of group	Number of electrons in the outer shell of an atom
I	**alkali metals** [1]	**1** [1]
7/VII [1]	the halogens	**7** [1]
8/0/VIII [1]	**noble gases** [1]	8

[6]

(ii) bromine/Br/Br_2 [1]

(c)

Element	Metal	Non-metal	Semi-metal
Sodium	✓ [1]		
Silicon			✓ [1]
Bromine		✓ [1]	
Phosphorus		✓ [1]	

[4]

(d) oxides [1]
basic [1] [2]

(e) **(i)** chlorine/Cl/Cl_2 [1]

(ii) Colour: black [1] State: solid [1] [2]

(iii) Name: astatide [1] Charge: –/–1/1– [1] [2]

(iv) more shells (of electrons) [1]

23

AVAILABLE MARKS

2 **(a)** **(i)** Label on left = nucleus [1]
Label on right = shell [1] [2]

(ii) equal number [1]
of *protons and electrons* [1] [2]

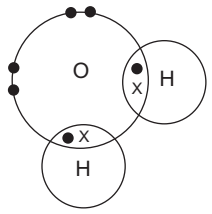
(iii) idea of full outer shell (of electrons) [1]

(iv)

Relative mass	Relative charge	Name of subatomic particle
1 [1]	0	**neutron** [1]
$\frac{1}{1840}$	–1	**electron** [1]
1	**+1** [1]	**proton** [1]

[5]

(b) **(i)**



[1] for correct sharing of electrons
[1] for 2 H each having 1 electron } depends on
[1] for 1 O having 6 electrons } the 1st mark

[3]

(ii) sharing of electrons [1]
idea of a pair of electrons [1] [2]

(iii) water: molecular/simple [1]
diamond: giant/macromolecular [1] [2]

(iv) strong(er) bonds in diamond [1]
weak(er) bonds **between molecules** in water [1]
lot of energy needed to break the bonds (in diamond) [1]
less/little energy needed to break bonds (in water) [1] [4]

(c) bonds broken in hydrogen and oxygen [1]
energy required to break bonds/bond breaking is endothermic [1]
bonds formed in water [1]
energy released when bonds form/bond making is exothermic [1]
more energy released than required [1] [5]

Example: The energy required to break the bonds [1]
in hydrogen and oxygen [1]
is less than [1]
the energy released when the bonds are formed [1]
in water [1]

Quality of Written Communication [2]

28

AVAILABLE MARKS

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

(b) **(i)** magnesium in boiling tube or suitable container
mineral wool soaked in water
heat
} max [2] for all 3 labels

delivery tube [1] } [1] for connection

collection vessel [1]
collection over water [1] } [2] for collection [5]

(ii) $Mg + H_2O \rightarrow MgO + H_2$ [2]

(iii) (silvery) *grey* [1] metal changes to white [1]
solid/powder/ash [1] white light [1] max [2]

(iv) zinc/aluminium/iron [1]

(c) **(i)** $Mg + 2HCl \rightarrow MgCl_2 + H_2$ [3]

(ii) bubbles/ gas given off [1]
heat released [1]
colourless solution [1]
magnesium disappears [1] max [3]

(d) **(i)** potassium [1] carbonate/hydrogen carbonate [1] [2]
K_2CO_3 or $KHCO_3$(apply CM from name) [1]

(ii) aluminium/Al^{3+}/zinc/Zn^{2+} [1]

(iii) (bubble gas through) limewater [1]
(colourless solution) changes to milky [1] [2]

(iv) cation: Ca^{2+} [1]
anion: I^- [1] [2]

correct ion formula, incorrectly allocated = 1

27

AVAILABLE MARKS

4 **(a)** **(i)** water which does not lather readily with soap [2]
water which does not lather with soap [1] [2]

(ii) caves/stalactites/stalagmites/limestone pavements
any two [2]

(iii) add soap [1]
shake [1]
no (immediate) lather/scum forms/a lot of soap needed to form a lather/correct comparison [3]

(iv) wastes soap/limescale/furring inside (hot water) pipes [1]

(b) **(i)** calcium nitrate/calcium chloride/calcium sulphate [1]

(ii) good for teeth and bones/tastes better/reduce heart disease/tanning leather [1]

(c) **(i)** washing soda [1]

(ii) idea of solid [1] appearing when two solutions are mixed [1] [2]

(iii) white [1]

(iv) $Ca^{2+} + CO_3^{2-} \quad CaCO_3$ [2]

(v) ion exchange [1] 17

			AVAILABLE MARKS
5	**(a)** **(i)**	moles = $\frac{3.71}{106\ [1]}$ = 0.035 [1] [2]	
	(ii)	concentration = $\frac{0.035}{250}$ × 1000 [1] = 0.14 [1] mol/dm^3 [2]	
	(b) **(i)**	pipette [1]	
	(ii)	colourless [1] to pink [1] (wrong way round award [1]) [2]	
	(iii)	rinse with (deionised) water [1] rinse with sodium carbonate/solution [1] fill with sodium carbonate/solution [1] ensure jet is filled/no air bubbles allow bottom of meniscus to fall to 0/read volume at bottom of meniscus [1] max [4]	
	(iv)	moles = $\frac{31.25 \times 0.16}{1000}$ [1] = 0.005 [1] [2]	
	(v)	mole ratio Na_2CO_3:H_2SO_4 = 1:1 [1] moles of H_2SO_4 = 0.005 [1] [2]	
	(vi)	concentration = $\frac{0.005}{25}$ × 1000 [1] = 0.2 [1] mol/dm^3 [2]	
	(c) **(i)**	moles $NaHCO_3$ = $\frac{3.36}{84\ [1]}$ = 0.04 [1] moles Na_2CO_3 = $\frac{0.04}{2}$ = 0.02 [1] mass of Na_2CO_3 = 0.02 × 106 [1] = 2.12 [1] g [5]	
	(ii)	moles of CO_2 = 0.02 [1] volume of CO_2 = 0.02 × 24 = 0.48 [1] dm^3 [1] (or 0.02 × 24000 = 480 [1] cm^3 [1]) [3]	25
		Total	**120**