Rewarding Learning

General Certificate of Secondary Education
2011

Science: Chemistry

Paper 1
Higher Tier
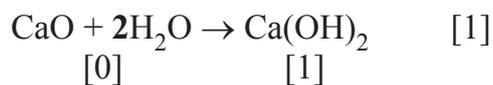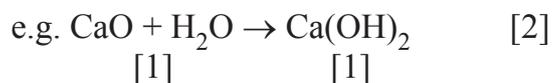
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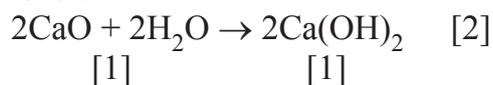**FRIDAY 27 MAY, MORNING**

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]
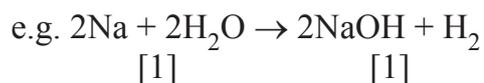   [1]   [1]

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]
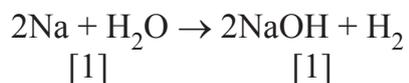
    No balancing mark = [2]

6344.01   **2**

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

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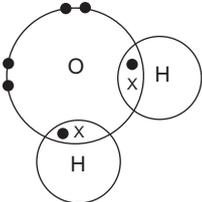Label on right = shell [1]   [2]

(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]
$\dfrac{1}{1840}$	−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

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

    (b) (i) magnesium in boiling tube or suitable container ⎫
          mineral wool soaked in water   ⎬ max [2] for
          heat   ⎭ 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]   27

  correct ion formula, incorrectly allocated = 1

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

5 **(a)** **(i)** moles $= \dfrac{3.71}{106\ [1]} = 0.035$ [1] [2]

(ii) concentration $= \dfrac{0.035}{250} \times 1000$ [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 $= \dfrac{31.25 \times 0.16}{1000}$ [1] $= 0.005$ [1] [2]

(v) mole ratio Na$_2$CO$_3$:H$_2$SO$_4$ = 1:1 [1]
moles of H$_2$SO$_4$ = 0.005 [1] [2]

(vi) concentration $= \dfrac{0.005}{25} \times 1000$ [1] $= 0.2$ [1] mol/dm^3 [2]

(c) **(i)** moles NaHCO$_3 = \dfrac{3.36}{84\ [1]} = 0.04$ [1]

moles Na$_2$CO$_3 = \dfrac{0.04}{2} = 0.02$ [1]

mass of Na$_2$CO$_3$ = 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**