Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2011

Chemistry

Assessment Unit AS 2

assessing

Module 2: Organic, Physical and Inorganic Chemistry

[AC121] [AC122]

FRIDAY 24 JUNE, MORNING

MARK SCHEME

Section A

1 B

2 B

3 D

4 B

5 A

6 B

7 C

8 C

9 A

10 C

[2] for each correct answer [20] 20

Section A **20**

Section B

11 thiocyanate (ion) [1]
$K_2Cr_2O_7$ [1]
iodoform/triiodomethane [1]
$SOCl_2$ [1] 4

12 **(a)** H_2O, C, CO or names [2]

(b) spillage aesthetic aspects [1]
oil on birds/animals (explained) [1] oil on plants (explained) [1]
non-biodegradable [1]
combustion CO_2 – greenhouse effect/global warming [1]
problems with particulates (smoke, carbon) explained – respiratory problems [1]
carbon monoxide is poisonous [1]
sulfur dioxide – acid rain [1]
or oxides of nitrogen
hydrocarbons – non renewable [1] [5]

Quality of written communication [2] 9

13 **(a)** metals are (very) reactive/react with O or S/form compounds [1]

(b) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ [1]

(c) **(i)** increased number of shells [1]

(ii) larger atomic radius in Group 1 due to smaller nuclear charge [2]

(iii)

0.160	0.197	0.215	0.224
0.037	0.018	0.009	

[1]

(iv) size of strontium similar/close to barium [1]
mass of barium larger than strontium [1] [2]

(d) **(i)** M^{2+} [1]

(ii) energy needed to convert 1 mole of gaseous atoms into gaseous ions with a charge of 1+ [1]

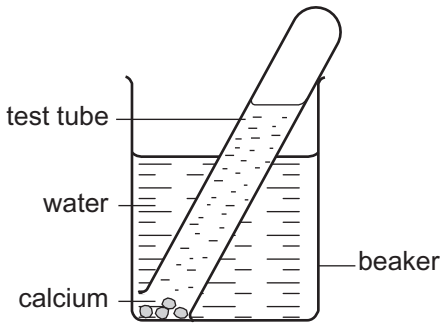
(iii) $Mg(g) \rightarrow Mg^+(g) + e^-$ [2]

(e) **(i)** calcium heavier/denser than water [1]
sinks [1] [2]

(ii) bubbles [1]
white solid appears [1]
heat evolved [1]
Ca gets smaller [1] any 2 [2]

(iii) $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$ [2]

(iv)



[3]

(f) $BaCO_3 \rightarrow BaO + CO_2$

$BaCO_3 = 137 + 12 + 48 = 197$
$BaO = 137 + 16 = 153$

atom economy $= 153/197 \times 100 = 77.7\%$
$= 78\%$ [3] 24

14 **(a)** **(i)** $100 \times 1.2 \times 4.2 = -504\,J\ (-10.08\,kJ\ mol^{-1})$ [1]

(ii) $100 \times 1.4 \times 4.2 = +588\,J\ (+11.76\,kJ\ mol^{-1})$ [1]

(b) enthalpy change is independent of route [2]
(in a series of reactions)

(c) $CuSO_4 = 64 + 32 + 64 = 160$
$5H_2O = 5 \times 18 = 90$
$CuSO_4.5H_2O = 160 + 90 = 250$

$12.5\,g = 12.5/250 = 0.05\,mol$
$8.0\,g = 8.0/160 = 0.05\,mol$

$\Delta H + \Delta H_2 = \Delta H_1$

$\Delta H + 588 = -504$
$\Delta H = -588 - 504 = -1092\,J$

For one mol $-1092/0.05 = -21840\,J\ mol^{-1}$
$-21.84\,kJ\ mol^{-1}$ [3]

(d) blue precipitate [1]
in xs ammonia dissolves to give dark/deep blue solution [1] [2] 9

15 **(a)** **(i)** ammonia present which is alkaline [1]

(ii) hydrogen chloride present which is acidic [1]

(b) to separate NH_3 from HCl [1]

(c) endothermic [1]
equilibrium absorbs heat/to reduce temperature [1]/heat is needed [2]

(d) **(i)** add sodium hydroxide (essential) [1]/heat [1]
stopper/glass rod with conc HCl giving white fumes/
smoke [1] [3]

(ii) add silver nitrate solution (essential) [1]
white [1]
precipitate [1] [3]

(e) $NH_4Cl = 14 + 4 + 35.5 = 53.5$
$37.2/53.5 = 0.695$ mol
$0.695 \times 24\,dm^3 = 16.69\,dm^3 = 16.7\,dm^3$ [3] 14

16 **(a)** 2-chloro(-2-)methylpropane [2]

(b) **(i)** $C_nH_{2n+1}Cl$ [1]

(ii) C_4H_9Cl [1]

(iii) less van der Waals forces [1]
spherical molecule/branching [1]
or
linear molecules greater attractive forces [1] [2]

(iv) same molecular formula [1]
different structure [1] [2]

(v) secondary [1]

(c) **(i)** release the pressure/gases [1]

(ii) remove acids/hydrogen chloride/hydrochloric acid [1]

(iii) remove inorganic material/NaCl/$NaHCO_3$/alcohol/soluble
impurities [1]

(iv) dry the butyl chloride [1]

(v) smooth boiling [1]

(vi) $(CH_3)_3COH = C_4H_9OH = C_4H_{10}O$
$= 48 + 10 + 16 = 74$

$25/74 = 0.34$ mol

$(CH_3)_3CCl = C_4H_9Cl$
$= 48 + 9 + 35.5 = 92.5$

$28/92.5 = 0.30$ mol

percentage yield $= 0.30/0.34 \times 100 = 88\%$ [3]

(d) faster [1]
reference to tertiary versus primary structure [1]
weaker (C — Cl) bond or correct reference to S_N1/S_N2 [1] [3] 20

Section B **80**

Total **100**