Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2011

Chemistry

Assessment Unit AS 1

assessing

Basic Concepts in Physical and Inorganic Chemistry

[AC111]

THURSDAY 13 JANUARY, MORNING

MARK SCHEME

Section A

1 B

2 D

3 C

4 B

5 D

6 C

7 C

8 D

9 C

10 B

[2] for each correct answer [20] 20

Section A **20**

Section B

11 (a) $305 \times 10^3 = 3.05 \times 10^5$ J [1]

(b) $\dfrac{3.05 \times 10^5}{6.02 \times 10^{23}} = 5.07 \times 10^{-19}$ J [1]

(c) $0.507 \times 10^{-18} = 6.63 \times 10^{-34} \times f$
$f = 0.076 \times 10^{16}$
$= 7.6 \times 10^{14}$ s^{-1}/Hz [1] 3

12 (a) $Be_3Al_2Si_6O_{18} = 3 \times 9 + 2 \times 27 + 6 \times 28 + 18 \times 16$
$= 27 + 54 + 168 + 288$
$= 537$
$\%\ Be = \dfrac{27}{537} \times 100 = 5.03\%$ [3]

(b) (i) $Be^{2+} + 2e^- \rightarrow Be$ [1]

(ii) $BeF_2 + Mg \rightarrow Be + MgF_2$ [1]

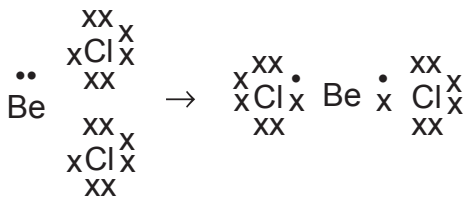
(c) (i) ability of an atom in a covalent bond to attract (bonding) electrons [2]

(ii) Be and Cl have similar EN values [1]
Ba and Cl have (very) different EN values [1] [2]

(iii) melting point, boiling point, "reaction" with water, (electrical) conductivity etc.
2 from list [2]

(d) (i) $Be + 2HCl \rightarrow BeCl_2 + H_2$ [1]

(ii)



[3]

(iii) 8 electrons around an atom in outer shell [2]

(iv) 8 electrons around Cl [1]
4 electrons around Be [1] [2]

(v) Cl — Be — Cl [1]

(vi) linear/straight [1]

(vii) bond electrons repel [1] to minimise forces [1] [2] 23

13 (a) chlorine(VII) oxide [1]

(b) (i) atom raises and lowers its oxidation number during a chemical reaction [1]

(ii) ClO_2 +4
$HClO_3$ +5 HCl –1 } [2]
$\because +4 \rightarrow +5$ oxidation
$+4 \rightarrow -1$ reduction } [1]
[3]

(c) (i) $Cl_2 = 2 \times 35.5 = 71$

$0.8\,g = \frac{0.8}{71} = 0.01127$ mol

$\because 0.113$ M [2]

(ii) e.g. hexane [1] 8

14 (a) ✓✓✗ [2]
(Note that the marking of the colour changes in this question will be subject to the application of the "colour changes" scheme.)

(b) (i) compare colours with original solutions
it should go darker
colour of iodine is darker than bromine [2]

(ii) $Br_2 + 2I^- \rightarrow 2Br^- + I_2$ [1]
no state symbols required

(c) (i) colourless solution [1]
orange/yellow/brown colour produced [1] [2]

(ii) $Cl_2 + 2NaBr \rightarrow 2NaCl + Br_2$ [1]
no state symbols required

(d) iodide: yellow ppt insoluble in (both dilute and conc.) ammonia solution [2]
bromide: cream ppt soluble in conc NH_3 [2]
chloride: white ppt soluble in dil NH_3 [2] [6]

Quality of written communication [2] 16

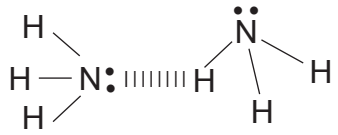
15 **(a)** van der Waals [1]
dipole – dipole [1] [2]

(b) **(i)** attraction between lone pair on O and a H atom on another water molecule [2]

(ii) distance between water molecules in ice greater than in water [1]
open structure [1] longer/expanded H-bonds [1] fixed H-bonds [1]
any 2 [2]

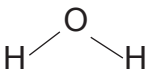
(c) F more electronegative than oxygen/H—F bond more polarised [1]
F⁞⁞⁞⁞H bond stronger [1]
movement of water molecules breaks H bonds [1] [2]

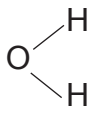
(d) **(i)**



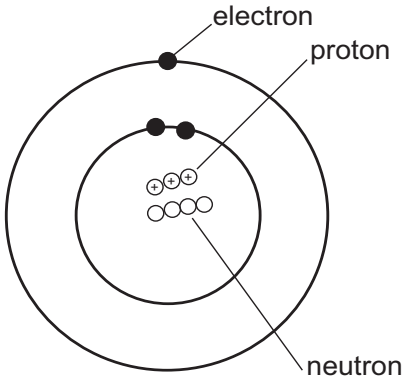
[2]

(ii) lone pair removed/forms a dative bond [1]

(e) N: forms hydrogen bonds with  [1]

and N—H forms hydrogen bonds with  [1] [2] 13

16 (a)



[3]

(b) s block [1]
outer electron in s shell [1]

(c) 7.42 3 6 5 44.52

92.58 3 7 5 648.06

Total 5 692.58

4 100 5 6.9258

5 6.93 [3]

(d) **(i)** water chemically bonded in salt [1]

(ii) Li_2SO_4 [1]

(iii) Li_2SO_4
5 2 3 7 1 32 1 64 5 110
moles 5 $\frac{3.23}{110}$ 5 0.029
H_2O
5 2 1 16 5 18
moles 5 $\frac{0.53}{18}$ 5 0.029
{ $Li_2SO_4 \cdot H_2O$ [3]

(e) conc hydrochloric acid
blue Bunsen flame
nichrome (platinum) wire
crimson flame [4] 17

Section B **80**

Total **100**