Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2011

Chemistry

Assessment Unit AS 2

assessing

Module 2: Organic, Physical and Inorganic Chemistry

[AC121]

THURSDAY 20 JANUARY, AFTERNOON

MARK SCHEME

6854.01

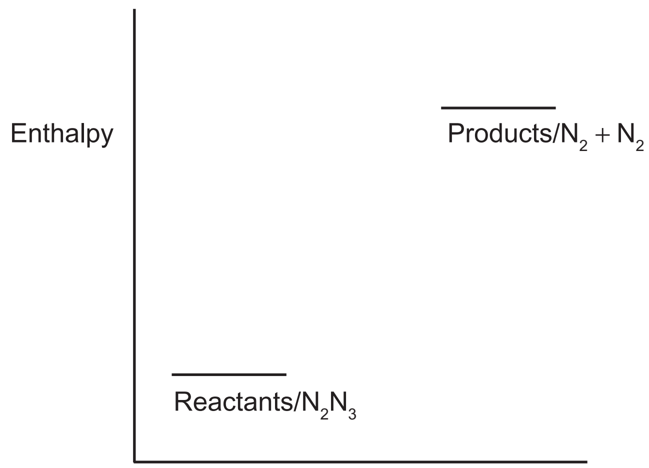
Section A

1	B	[2]	
2	B	[2]	
3	B	[2]	
4	D	[2]	
5	C	[2]	
6	C	[2]	
7	D	[2]	
8	A	[2]	
9	B	[2]	
10	B	[2]	20

Section B

11 (a) (i) Endothermic [1]

(ii)



Reaction path/reaction co-ordinate/extent of reaction/progress

([–1] for each mistake) [3]

(iii) Moles of N_2 = 50/24 = 2.083 mole
Moles of NaN_3 = 2.083 × 2/3 = 1.389 mole
Mass of NaN_3 = 1.389 × 65 = 90.28 g
([–1] for each mistake) [3]

(b) (i) $C_7H_{16} + 11O_2 \rightarrow 7CO_2 + 8H_2O$ [2]

(ii) $2CO + 2NO \rightarrow 2CO_2 + N_2$ [2] 11

12 (a) The outer electrons are in the s-subshell/orbital/shell [1]

(b) (i) $Mg(g) \rightarrow Mg^{+}(g) + e^{-}$
(equation [1], state symbols [1]) [2]

(ii) 1st ionisation energy decreases going down the group [1]
Increased shielding (from inner electrons) [1]
Outer electrons further from the nucleus [1] [3]

(c) (i) $Ca(OH)_2 \rightarrow CaO + H_2O$ [1]

(ii) $Mg(OH)_2$ less stable than $Ba(OH)_2$ [1]
Mg^{2+} smaller/high charge density [1]
Polarisation of OH^{-}/Comparison in size to O^{2-}/OH^{-} [1] [3]

(iii) pH of $Ba(OH)_2 > Mg(OH)_2$ [1]
Solubility of the hydroxides increases going down the group [1] [2] 12

13 (a) Fractional distillation [1]

(b) (i) **Hydrocarbon** – compound containing carbon and hydrogen only [1]
Saturated – contains no C=C bonds [1] [2]

(ii) 2,2,3,3-tetramethylbutane [1]

(c) (i) Cracking [1]

(ii) High temperature/catalyst [1]

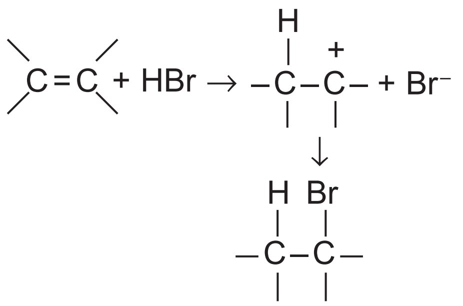
(iii) $C_8H_{18} \rightarrow C_5H_{12} + C_3H_6$ **or**
$C_8H_{18} \rightarrow C_2H_6 + 2C_3H_6$ [1]

(iv) Shake propene gas with bromine water
Decolourises [1] bromine water [1] [2]

(v) $C_3H_6 + Br_2 \rightarrow C_3H_6Br_2$ [1]

(d) High electron density around the double bond [1]

(e) (i)



[3]

(ii) Electrophilic [1] addition [1] [2] 16

14 (a) (i) $\Delta H = mc\Delta T = 100 \times 4.2 \times 0.9$ [1]
$= 378$ J [1] [2]

(ii) 5/80 = 0.0625 [1]

(iii) 378/0.0625 = 6048 (J mol^{-1}) [1]

(b) 5 g produces 0.9 °C change

$\frac{5}{0.9} \times 25$ g produces 25 °C change

$\frac{5}{0.9} \times 25 \times \frac{120}{100}$ in 120 g water = 166.7 g [2] 6

15 (a) Rate of reaction increases as more molecules will have enough energy to react when they collide [1]
(Equilibrium moves to the right) increasing the yield of NO [1]
The forward reaction is endothermic/removes the extra heat [1] [3]

(b) Rate of the reaction will increase due to increased concentration [1]
Equilibrium moves to the right increasing the yield of NO [1]
This removes the additional N_2 (restoring the equilibrium) [1] [3]

(c) Rate of the reaction will increase as this increases the concentration of the gases [1]
Equilibrium position is unaffected [1]
Same volume/number of molecules on each side [1] [3]

(d) Rate of the reaction increases as the catalyst provides an alternative pathway with a lower energy [1]
The catalyst will not affect the position of the equilibrium and the yield will not change [1] [2] 11

16 (a) (i) Molecular vibrations [1]

(ii) **Spectrum A:** C—H bond [1]
Spectrum C: C—O bond [1] [2]

(iii) **Spectrum B:** ethanoic acid [1]
Spectrum C: ethanal [1] [2]

(b) (i) $H^+/Cr_2O_7^{2-}$ acidified dichromate [1]

(ii) Cr^{3+} [1]

(iii) Ethanal: Heat under distillation [1]
Ethanoic acid: Heat under reflux [1] [2]

(c) $Na \rightarrow CH_3CH_2ONa$ [1]
$CH_3COCl \rightarrow CH_3COOCH_2CH_3$ [1]
$SOCl_2 \rightarrow CH_3CH_2Cl$ [1]
$PCl_5 \rightarrow CH_3CH_2Cl$ [1] [4] 13

					AVAILABLE MARKS
17	**(a)**	**(i)**	HBr	[1]	
		(ii)	Nucleophilic [1] substitution [1]	[2]	
		(iii)	Heat [1] with (concentrated) ammonia [1]	[2]	
	(b)		Use of separating funnel [1] Use of $NaHCO_3$ solution (to remove acid impurities) – release pressure [1] Use of anhydrous Na_2SO_4 or $CaCl_2$ (for drying) – filter [1] Distil (product for final purification) [1]	[4]	
			Quality of written communication	[2]	11
				Section B	**80**
				Total	**100**