Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2013

Chemistry

Assessment Unit AS 2

assessing

Module 2: Organic, Physical and Inorganic Chemistry

[AC122]

WEDNESDAY 16 JANUARY, MORNING

MARK SCHEME

Section A

1 A

2 B

3 D

4 D

5 A

6 B

7 A

8 B

9 D

10 C

[2] for each correct answer [20] 20

Section A **20**

Section B

11 **(a)** free radical [1]
substitution [1] [2]

(b) $Cl_2 \rightarrow 2\ Cl^{\bullet}$ [1]

(c) $CH_4 + Cl^{\bullet} \rightarrow CH_3^{\bullet} + HCl$ [1]
$CH_3^{\bullet} + Cl_2 \rightarrow CH_3Cl + Cl^{\bullet}$ [1]

(d) $CH_3^{\bullet} + CH_3^{\bullet} \rightarrow C_2H_6$ [1] 6

12 **(a)** A formula which shows the simplest whole number ratio of atoms of each element in a compound [1]

(b) A formula which shows the actual number of atoms of each element in a molecule [1]

(c) **(i)**

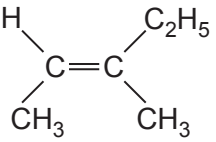
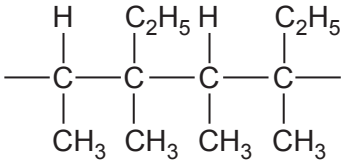
P	O
43.7	56.3
1.410	3.519
1	2.5
2	5

empirical formula P_2O_5

$284 \div 142 = 2$

molecular formula P_4O_{10} [4]

(ii) $12NaOH + P_4O_{10} \rightarrow 4Na_3PO_4 + 6H_2O$ [2] 8

13	**(a)**	**(i)**	Same structural formula	[1]		
			Different arrangement in (3D) space – dependent on first statement	[1]	[2]	
		(ii)	Restricted rotation about C═C	[1]		
			Both carbons in C═C have 2 different atoms/groups attached	[1]	[2]	
		(iii)			[1]	
		(iv)	e.g. $CH_2 = CH(CH_2)_3CH_3$	[1]		
			Correct name, e.g. hex-1-ene	[1]	[2]	
	(b)	**(i)**	Finely divided	[1]		
			nickel	[1]	[2]	
		(ii)	$C_6H_{12} + H_2 \rightarrow C_6H_{14}$	[1]		
			100%	[1]	[2]	
	(c)				[1]	12
14	**(a)**	**(i)**	Enthalpy change	[1]		
			independent of route taken	[1]	[2]	
			(provided the initial and final conditions are the same)			
		(ii)	Enthalpy change when one mole of a substance is completely burnt in oxygen under standard conditions		[2]	
		(iii)	[(2 × –394) + (3 × –286)] – [(–277)]			
			–1646 + 277 = –1369 kJ mol^{-1}		[3]	
	(b)	**(i)**	20064 J		[1]	
		(ii)	20.064 kJ	[1]		
			moles of ethanol = 0.0304	[1]		
			–659 kJ mol^{-1}	[1]	[3]	
		(iii)	heat lost to surroundings	[1]		
			Incomplete combustion	[1]	[2]	13

15 **(a)** **(i)** $2Mg(NO_3)_2 \rightarrow 2MgO + 4NO_2 + O_2$ [2]

(ii) More stable [1]
Sr^{2+} is larger than Mg^{2+}/less polarising/smaller charge density [1] [2]

(b) **(i)** Rate of forward reaction = rate of backward reaction [1]
Amount of any given reactant or product remains constant [1] [2]

(ii) Brown to colourless [1]
2 moles (g) on LHS 1 mole (g) on RHS [1]
Equilibrium shifts to RHS to reduce pressure [1] [3]

(iii) Brown to colourless [1]
(forward) reaction is exothermic [1]
equilibrium shifts to RHS (to increase temperature) [1] [3]

(c) Dissolve samples in water [1]
Add solution of magnesium nitrate to each [1]
Solution of potassium carbonate – white [1] precipitate [1] [1]
Solution of potassium hydrogencarbonate – no ppt [1] [4]
Any 4 from 5

$Mg^{2+}(aq) + CO_3^{2-}(aq) \rightarrow MgCO_3(s)$ [2]

Quality of written communication [2]

(d) 0.050 [1]
0.025 [1]
600 [1] 23

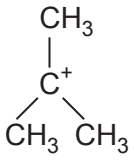
16 **(a)** $C_nH_{2n+1}Br$ [1]

(b) Three carbons (directly) attached to the same carbon as Br [1] [1] [2]

(c) **(i)** Nucleophilic substitution [1]

(ii) $(CH_3)_3CBr \rightarrow (CH_3)_3C^+ + Br^-$ [1]

(iii)



[1]

(iv) $(CH_3)_3C^+ + OH^- \rightarrow (CH_3)_3COH$ [1]

(d) Absence [1]
of O–H absorption [1] [2]

(e) **(i)** $(CH_3)_3CBr + KOH \rightarrow CH_2{=}C(CH_3)_2 + H_2O + KBr$ [2]

(ii) 2–methylpropene or methylpropene [1]

(iii) Elimination [1]

(f) **(i)** Same molecular formula [1]
Different structural formula [1] [2]

(ii) 1-bromobutane [1]
No branching/greater contact between molecules [1]
Greater van der Waals forces [1] [3] 18

Section B **80**

Total **100**