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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

		AVAILABLE MARKS
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**

AVAILABLE
MARKS

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

8245.01   3

						AVAILABLE MARKS

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) $[(2 \times -394) + (3 \times -286)] - [(-277)]$
$-1646 + 277 = -1369$ 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

8245.01   **4**

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

				AVAILABLE MARKS

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

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

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

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

(iii)
$$\begin{array}{c} CH_3 \\ | \\ C^+ \\ \diagup \quad \diagdown \\ CH_3 \quad CH_3 \end{array}$$

[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**