Rewarding Learning

ADVANCED
General Certificate of Education
2011

Chemistry

Assessment Unit A2 1

assessing

Periodic Trends and Further Organic, Physical and Inorganic Chemistry

[AC212]

MONDAY 23 MAY, AFTERNOON

MARK SCHEME

Section A

1 D

2 D

3 B

4 C

5 A

6 C

7 D

8 B

9 B

10 A

[2] for each correct answer [20] 20

Section A **20**

Section B

11 (a) (i)

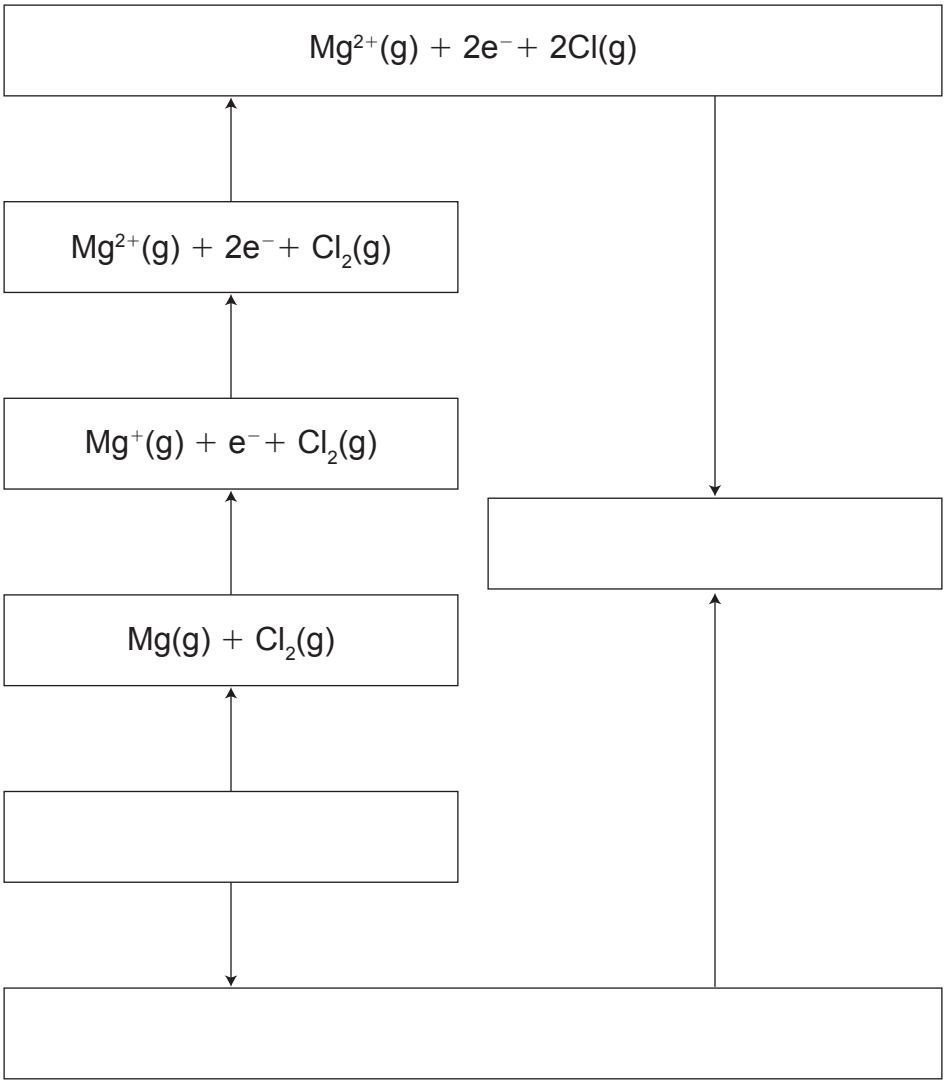
$2CH_3COOH + HOCH_2CH_2OH \rightleftharpoons CH_3COOCH_2CH_2OOCCH_3 + 2H_2O$ [2]

(ii) $K_c = \dfrac{[CH_3COOCH_2CH_2OOCCH_3][H_2O]^2}{[CH_3COOH]^2[HOCH_2CH_2OH]}$

expression [1] No units [1] [2]

(b) $HOCH_2CH_2OH + 4[O] \rightarrow HOOCCOOH + 2H_2O$ [2] 6

12 (a) (i)



[1] per box (order can vary) [4]

(ii) $2(\text{E.A.}) = (-121\times2)+(-1450)+(-736)+(-150)+(-642)+(2493)$ [1]

$\text{E.A.} = -727 \div 2 = -363.5\,\text{kJmol}^{-1}$ [1]

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

(c) The enthalpy change which occurs when one mole of an (ionic) compound dissolves in water [2]

13 (a) (i) $C_nH_{2n}O$ [1]

(ii) 3–methylbutanal [1]

(iii) $CH_3CH_2CH_2COCH_3$ or $CH_3CH_2COCH_2CH_3$ or $(CH_3)_2CHCOCH_3$ [2]

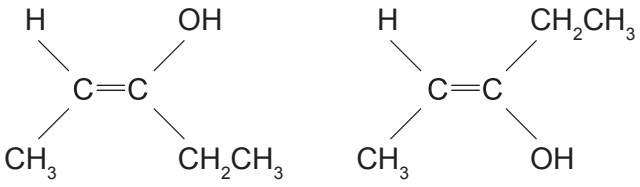
correct name for each structure
pentan–2–one, pentan–3–one or (3–)methylbutan(–2–)one [2]

(iv) suitable reagent
heat
observation for ketone
observation for aldehyde [4]

Quality of written communication [2]

(v) e.g. $CH_3CH = C(OH)CH_2CH_3$ and many others [1]

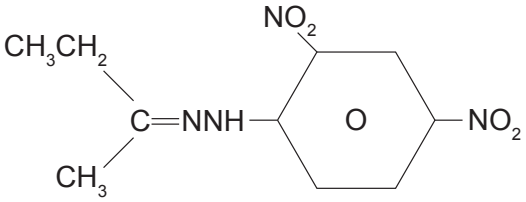
(vi)



e.g. and labels [3]

(b) (i) yellow/orange [1] solid [1] [2]

(ii)



[3]

(iii) melting point determination [1]
match (with melting point of butanone–2,4–dinitrophenylhydrazone) using tables of data [1] [2]

(iv) $CH_3COCH_2CH_3 + 2[H] \rightarrow CH_3CH(OH)CH_2CH_3$ [2]
Butan–2–ol [1]

26

14 (a) (i) fully dissociates [1]

(ii) H^+ donor [1]

(iii) $pH = -\log_{10}[H^+]$ [1]

(iv) $[H^+] = 0.4$ mol dm^{-3}
$pH = 0.40$ [2]

(v) $K_w = [OH^-][H^+]$ [1]

(vi) $[OH^-] = 0.2$ mol dm^{-3} $[H^+] = 5.0 \times 10^{-14}$ [1]
$pH = 13.30$ [1] [2]

(vii) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$ [2]

(b) (i) $K_a = \dfrac{[CH_3COO^-][H^+]}{[CH_3COOH]}$ [1]

(ii) $[H^+]^2 = 3.48 \times 10^{-6}$
$[H^+] = 1.87 \times 10^{-3}$
$pH = 2.73$ [3]

(c) (i) $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$ [1]

(ii) initial moles of ethanoic acid $= 5.0 \times 10^{-3}$
moles of sodium hydroxide added $= 3.0 \times 10^{-3}$
moles of sodium ethanoate formed $= 3.0 \times 10^{-3}$
moles of ethanoic acid left $= 2.0 \times 10^{-3}$

$$[H^+] = 1.74 \times 10^{-5} \times \frac{2.0 \times 10^{-3}}{3.0 \times 10^{-3}} = 1.16 \times 10^{-5} \text{ mol dm}^{-3}$$

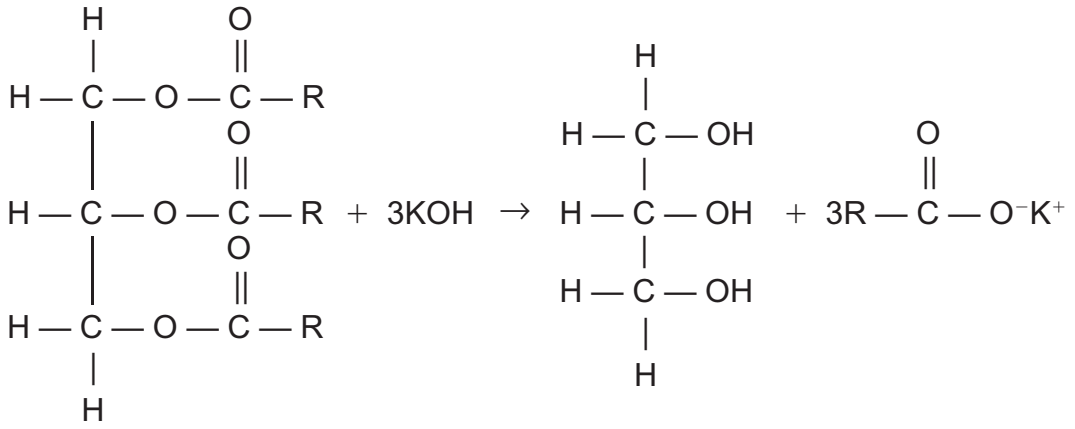
$pH = 4.94$ [4]

(iii) sodium ethanoate gives ethanoate ions
ethanoate ions combine with H^+ ions or equation * essential
$[H^+]$/pH remains approximately constant [2]

(iv) alkaline [1] – the salt of a weak acid and strong base [1] [2]

23

15 (a) (i)



[2]

(ii) propane–1,2,3–triol [1]

(iii) The mass of KOH [1] in mg [1] required to completely hydrolyse/ saponify 1.0 g of a fat. [1] [3]

(iv)

RMM of fat	= 890
moles of fat	= 0.00112
moles of KOH	= 0.00337
mass of KOH (in g)	= 0.189
mass of KOH (in mg)/S.V.	= 189

[4]

(b) (i) $C_{19}H_{38}O_2$ [1]

(ii) $2\ C_{19}H_{38}O_2 + 55O_2 \rightarrow 38CO_2 + 38H_2O$ [2]

(iii) photosynthesis/respiration/solubility in surface waters/decay [2]

15

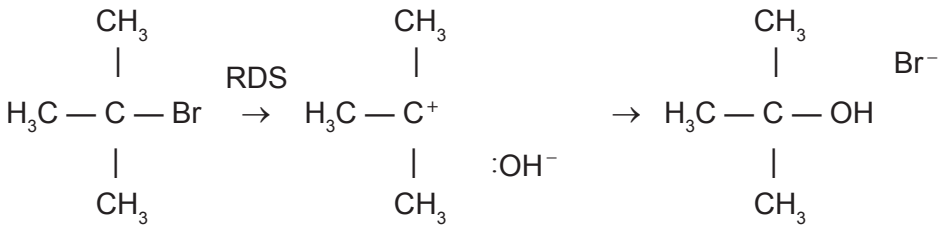
16 (a) (i) First [1] valid explanation [1] [2]

(ii) Zero [1] valid explanation [1] [2]

(iii) Rate = k [C_4H_9Br] [1]

(iv) 2000 [1] s^{-1} [1] [2]

(v) tertiary structure [1]
correct RDS [1]
first step producing correct carbocation and bromide ion [1]
second step involving hydroxide attacking carbocation [1] [4]

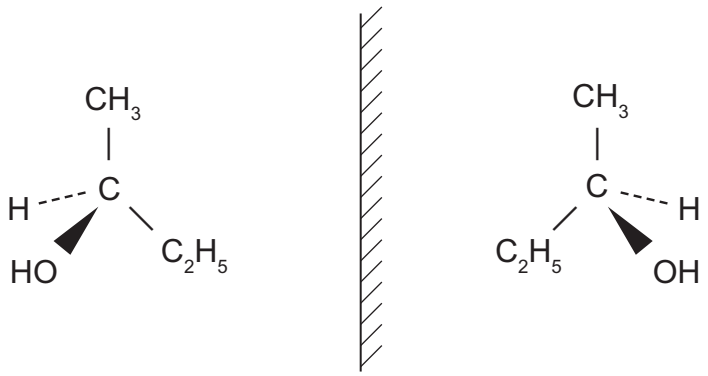


(b) (i) carbon with 4 different atoms/groups attached [1]

(ii) non-superimposable [1] mirror images [1] [2]

(iii) structure [1] butan–2–ol [1] [2]

(iv)



[2]

(v) plane-polarised light [1] rotated in opposite directions [1] [2] 20

Section B **100**

Total **120**