Rewarding Learning

ADVANCED
General Certificate of Education
2012

Chemistry

Assessment Unit A2 2

assessing

Analytical, Transition Metals, Electrochemistry and Further Organic Chemistry

[AC222]

WEDNESDAY 23 MAY, AFTERNOON

MARK SCHEME

Section A

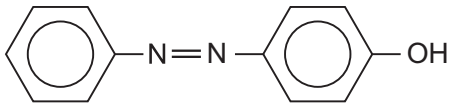
		AVAILABLE MARKS
1 D		
2 B		
3 A		
4 D		
5 A		
6 A		
7 D		
8 D		
9 C		
10 A		
[2] for each correct answer	[20]	20
	Section A	**20**

Section B

AVAILABLE MARKS

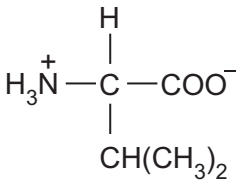
11 **(a)** **(i)** A tin/concentrated hydrochloric acid [2]
B sodium hydroxide [1]
C sodium nitrite/hydrochloric acid [2] [5]

(ii) 0–10°C [1]
benzenediazonium chloride [1] [2]

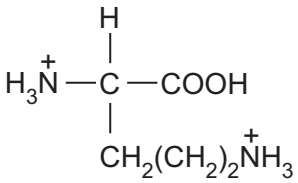
(iii) 

[1]

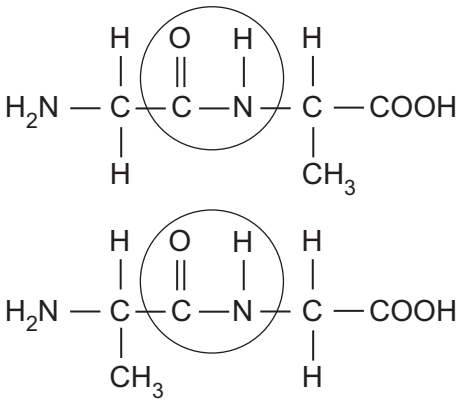
orange solid [1]
4-hydroxyazobenzene/4-hydroxyphenylazobenzene [1] [3]

(b) **(i)** 

[1]

(ii) 

[2]

(iii) 

[3] 16

AVAILABLE MARKS

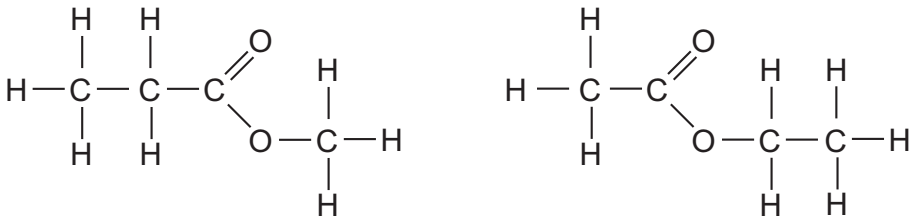
12 **(a)** The potential difference [1] measured
when a half-cell is connected to a hydrogen electrode [1]
under standard conditions [1] [3]

(b) Na(s) [1]

(c) $2Al + 3Zn^{2+} \rightarrow 2Al^{3+} + 3Zn$ [2]
$-0.76 - (-1.66)$
$+ 1.66 - 0.76 = +0.90$ V [1] [3]

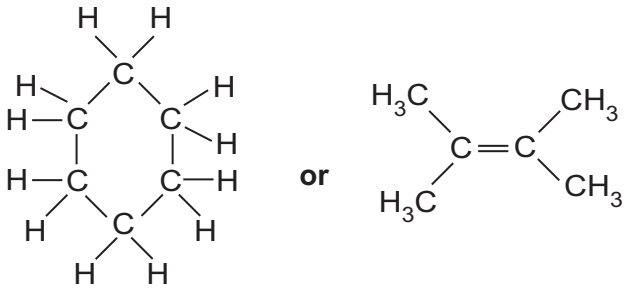
(d) $+0.32 = x - (-0.76)$
-0.44 V [1] 8

13 **(a)** **(i)**



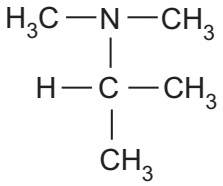
[2]

(ii)



[1]

(iii)



[1]

(b) **(i)** 2 isotopes [1] of chlorine [1]
or ^{35}Cl and ^{37}Cl [1] [2]

(ii) $C_3H_4{}^{35}ClO^+$ [2]

(iii)

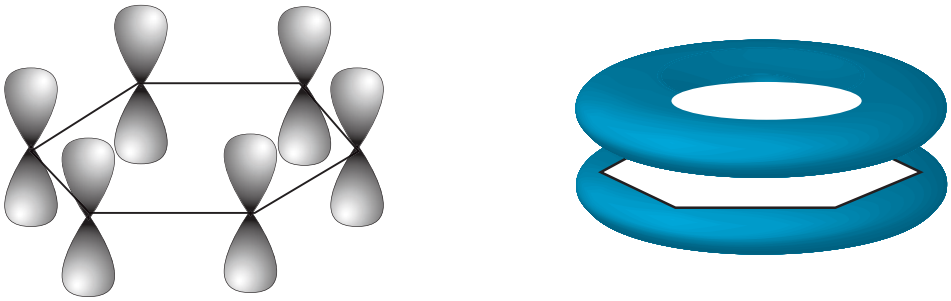
	Peak 1	Peak 2	Peak 3
		1 [1]	**1 [1]**
	Doublet [1]	**Quartet [1]**	

[4] 12

					AVAILABLE MARKS
14	**(a)**	**(i)**	$MnO_4^- + 8H^+ + 5Fe^{2+} \rightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$	[2]	
		(ii)	colourless to pink	[2]	
		(iii)	moles of manganate(VII) = 0.00048 moles of iron(II) in 25 cm^3 = 0.0024 moles of iron(II) in 250 cm^3 = 0.024 mass of $FeSO_4.7H_2O$ = 0.024 × 278 = 6.672 g % hydrated iron(II) sulfate = 83.4% Each error [–1]	[5]	
	(b)	**(i)**	$[Fe(H_2O)_6]^{3+} \rightleftharpoons [Fe(OH)(H_2O)_5]^{2+} + H^+$	[2]	
		(ii)	$K_a = \dfrac{[Fe(OH)(H_2O)_5{}^{2+}][H^+]}{[Fe(H_2O)_6{}^{3+}]}$	[1]	
		(iii)	a rust/brown [1] precipitate [1]	[2]	
		(iv)	(potassium) thiocyanate solution [1] blood red [1] solution [1] $[Fe(SCN)(H_2O)_5]^{2+}$ [1]	[4]	
	(c)		CO forms a very strong bond with the iron(II) ion in haemoglobin [1] this prevents the transportation of oxygen [1]	[2]	20

AVAILABLE MARKS

15 (a)

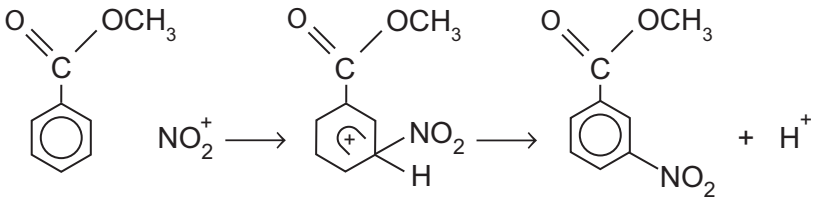


before after [2]

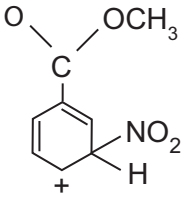
(b) (i) $HNO_3 + 2H_2SO_4 \rightarrow NO_2^+ + H_3O^+ + 2HSO_4^-$ [2]

(ii) nitronium ion [1]

(iii)



or



[3]

electrophilic substitution [1] [4]

(iv) methyl 3-nitrobenzoate [1]

(v) cream [1] solid [1] [2] 12

AVAILABLE MARKS

16 **(a)** Does not have an incomplete d-subshell in its (stable) ion [1]
Zn^{2+} is $3d^{10}$ [1] [2]

(b) **(i)** $VO_2^+ + 4H^+ + 3e^- \rightarrow V^{2+} + 2H_2O$ [2]

(ii) $2VO_2^+ + 8H^+ + 3Zn \rightarrow 2V^{2+} + 4H_2O + 3Zn^{2+}$ [2]

(iii)

Ion	Colour
VO_2^+	**Yellow [1]**
VO^{2+} [1]	Blue
V^{3+} [1]	Green
V^{2+}	**Violet [1]**

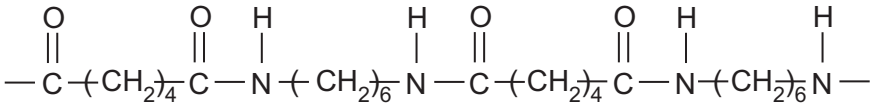
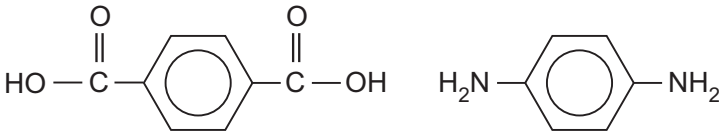
[4]

(c) **(i)** dissolve in water and add (excess) potassium hydroxide [1]
a green-blue precipitate will form and then dissolve to give a deep green solution [1]
add excess hydrogen peroxide and heat [1]
the (green) solution turns yellow [1]
boil the solution (and reduce the volume) [1]
add named acid [1]
orange solution/orange crystals [1]
maximum [6] [6]

Quality of written communication [2]

(ii) moles of chromium(III) chloride hexahydrate = 0.05 [1]
theoretical yield of potassium dichromate = 0.025 mole [1]
actual yield = 0.00997 mole [1]
% yield = 40% [1] [4]

22

			AVAILABLE MARKS
17	**(a)** 		
	Each error [–1]	[3]	
	(b) **(i)** $HOCH_2CH_2OH$	[1]	
	(ii) ethane-1,2-diol	[1]	
	(c) **(i)** 2	[1]	
	(ii) 	[2]	
	(d) 3-methylpent-2-ene	[2]	10
	Section B		**100**
	Total		**120**