



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

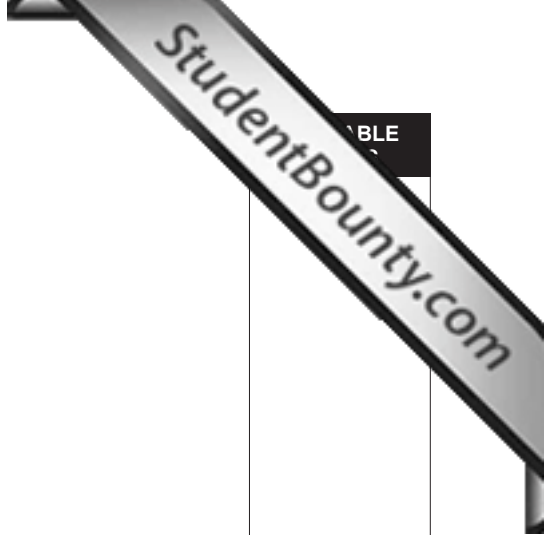
MARK SCHEME

Section A

- 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

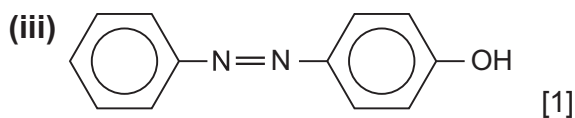
[20]	20
Section A	20



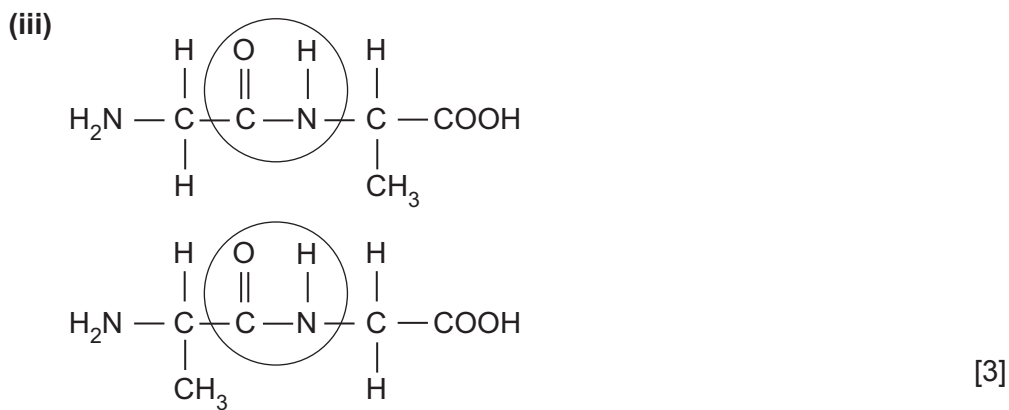
Section B

- 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]

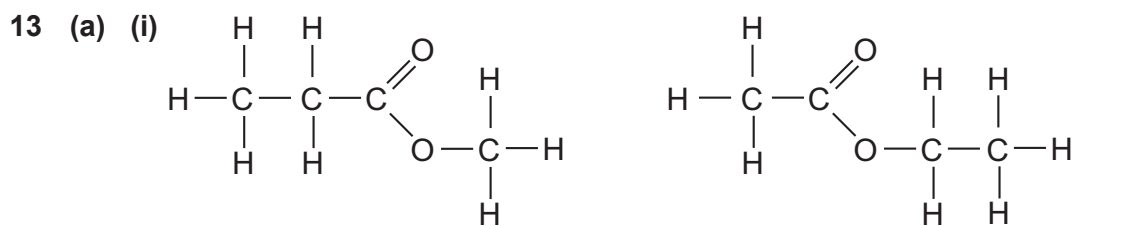


- orange solid [1]
 4-hydroxyazobenzene/4-hydroxyphenylazobenzene [1] [3]

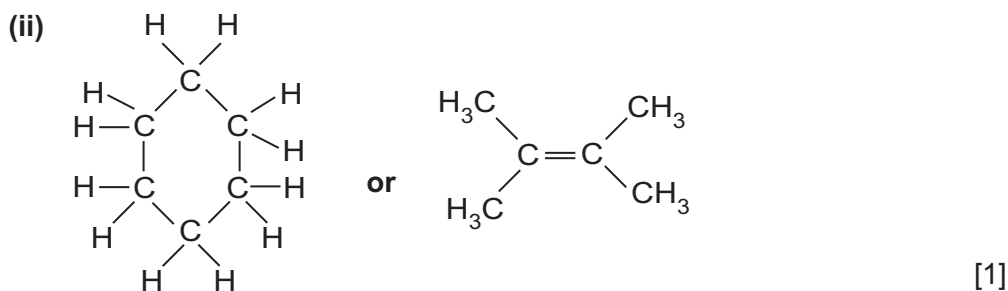


- 12 (a) The potential difference [1] measured when a half-cell is connected to a hydrogen electrode [1] under standard conditions [1] [3]
- (b) Na(s) [1]
- (c) $2\text{Al} + 3\text{Zn}^{2+} \rightarrow 2\text{Al}^{3+} + 3\text{Zn}$ [2]
 $-0.76 - (-1.66)$
 $+ 1.66 - 0.76 = +0.90 \text{ V}$ [1] [3]
- (d) $+0.32 = x - (-0.76)$
 -0.44V [1]

8



[2]



[1]



[1]

- (b) (i) 2 isotopes [1] of chlorine [1]
or ^{35}Cl and ^{37}Cl [1] [2]
- (ii) $\text{C}_3\text{H}_4^{35}\text{ClO}^+$ [2]

(iii)

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

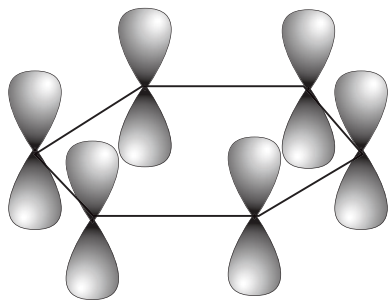
[4]

12

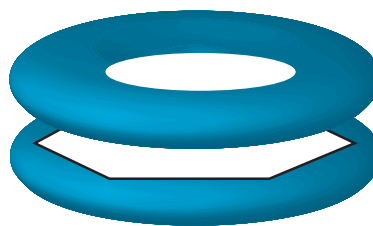
- 14 (a) (i) $\text{MnO}_4^- + 8\text{H}^+ + 5\text{Fe}^{2+} \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O} + 5\text{Fe}^{3+}$ [2]
- (ii) colourless to pink [2]
- (iii) moles of manganate(VII) = 0.00048
 moles of iron(II) in 25 cm³ = 0.0024
 moles of iron(II) in 250 cm³ = 0.024
 mass of FeSO₄·7H₂O = 0.024 × 278 = 6.672 g
 % hydrated iron(II) sulfate = 83.4% [5]
 Each error [-1]
- (b) (i) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+} \rightleftharpoons [\text{Fe}(\text{OH})(\text{H}_2\text{O})_5]^{2+} + \text{H}^+$ [2]
- (ii)
$$K_a = \frac{[\text{Fe}(\text{OH})(\text{H}_2\text{O})_5^{2+}][\text{H}^+]}{[\text{Fe}(\text{H}_2\text{O})_6^{3+}]}$$
 [1]
- (iii) a rust/brown [1] precipitate [1] [2]
- (iv) (potassium) thiocyanate solution [1]
 blood red [1] solution [1]
 $[\text{Fe}(\text{SCN})(\text{H}_2\text{O})_5]^{2+}$ [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

15 (a)

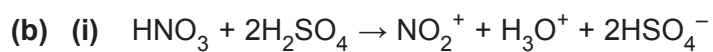


before



after

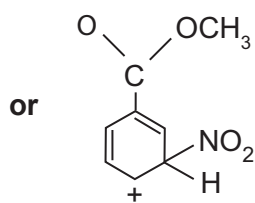
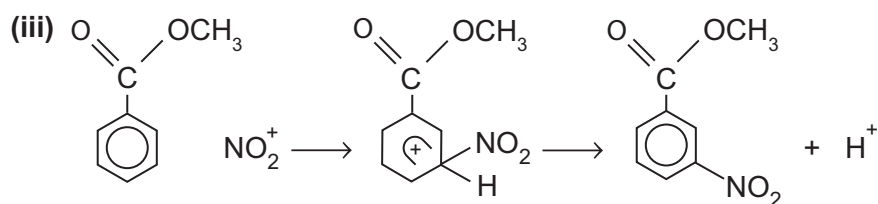
[2]



[2]

(ii) nitronium ion

[1]



[3]

electrophilic substitution

[1]

[4]

(iv) methyl 3-nitrobenzoate

[1]

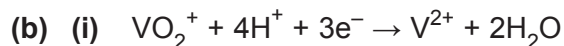
(v) cream [1] solid [1]

[2]

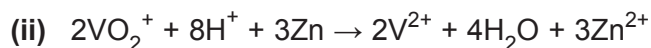
12

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

[1]
 [1] [2]



[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]

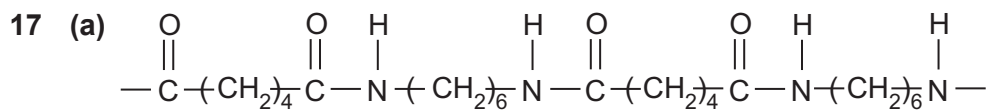
Quality of written communication

[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



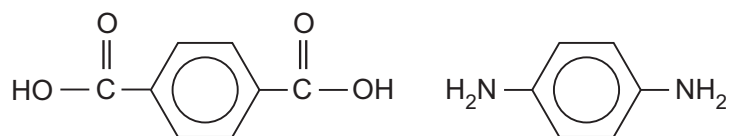
Each error [-1]



(ii) ethane-1,2-diol

(c) (i) 2

(ii)



(d) 3-methylpent-2-ene

Section B

Total

[3]

[1]

[1]

[1]

[2]

[2]

10

100

120