

**STAV Publishing Pty Ltd  
2003**

**CHEMISTRY  
UNIT 4 Trial Examination**

**SOLUTIONS**

Published by STAV Publishing Pty Ltd. STAV House, 5 Munro Street, Coburg VIC 3058 Australia.  
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ABN 51 007 165 611

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**Semester 2, 2003**

Use this page as an overlay for marking the multiple choice answer sheets. Simply photocopy the page onto an overhead projector sheet. The correct answers are open boxes below. Students should have marked their answers with a cross. Therefore, any open box with a cross inside it is correct and scores 1 mark.

1.	A	B		D
2.		B	C	D
3.	A	B	C	
4.	A	B		D
5.	A		C	D
6.	A		C	D
7.	A		C	D
8.	A		C	D
9.		B	C	D
10.	A	B		D

11.	A	B		D
12.		B	C	D
13.	A	B	C	
14.	A		C	D
15.	A	B		D
16.		B	C	D
17.	A	B	C	
18.	A	B	C	
19.	A	B	C	
20.		B	C	D

**SECTION A**

<b>1.</b>	C	<b>2.</b>	A	<b>3.</b>	D	<b>4.</b>	C	<b>5.</b>	B
<b>6.</b>	B	<b>7.</b>	B	<b>8.</b>	B	<b>9.</b>	A	<b>10.</b>	C
<b>11.</b>	C	<b>12.</b>	A	<b>13.</b>	D	<b>14.</b>	B	<b>15.</b>	C
<b>16.</b>	A	<b>17.</b>	D	<b>18.</b>	D	<b>19.</b>	D	<b>20.</b>	A

**SECTION B****Question 1**

- a. A car battery is an example of a secondary galvanic cell. In this type of cell the electrode processes can be reversed. 1 mark  
This can occur because the reaction product(s) stay in contact with the electrodes. 1 mark
- b. The loss of electrons is a typical metallic property. As you move down a Group, the outer shell electrons are further from the nucleus. 1 mark  
Therefore the outer shell electrons are less strongly held to the nucleus and are therefore more easily removed. 1 mark
- c. As you move across a Period of the Periodic table the core charge (the attraction for the nucleus for the outer shell electrons) increases. 1 mark  
This results in the electrons being pulled closer to the nucleus and therefore the atomic radius decreases. 1 mark
- d. Electronegativity is a measure of the electron attracting power of an atom for electrons of other atoms in a chemical bond. 1 mark  
As chlorine has the greater atomic radius (due to more occupied shells) its nucleus has less attraction for the electrons of another atom compared to fluorine. 1 mark
- e. Zinc only forms a  $Zn^{2+}$  ion which has a complete 3d subshell. 1 mark  
Therefore zinc is unable to promote electrons to other 3d orbitals. 1 mark
- f. Antioxidants are included to prevent the oxidation by oxygen of the double bonds in unsaturated fats in the margarine. 1 mark  
Emulsifiers allow water and oil to form a homogeneous mixture. In margarine (a 'water in oil' emulsion) they prevent fat and water from separating. 1 mark

## Question 2

- a. i. The electrons move from the zinc electrode through the globe to the copper cylinder (electrode). 1 mark
- ii. The zinc rod is negative and the copper cylinder is positive. 1 mark
- b. Positive electrode (cathode)  $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$  1 mark  
 Negative electrode (anode)  $\text{Zn}(\text{s}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{e}^-$  1 mark
- c.  $\text{Cu}^{2+}(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu}(\text{s})$  1 mark
- d. It completes the electrical circuit by allowing the slow migration of ions to maintain electrical neutrality around the electrodes. 1 mark
- e. A zinc outer cylinder would eventually corrode and leak. 1 mark
- f. i.  $\eta_{\text{Zn}} = m/M = 125/65.4 = 1.9113 \text{ mol}$   
 $\eta_{\text{e}} = 2\eta_{\text{Zn}} = 2 \times 1.9113 = 3.8226 \text{ mol}$  1 mark  
 $Q = \eta_{\text{e}} \times F = 3.8226 \times 96500 = 368880.9 \text{ C}$   
 Charge =  $3.69 \times 10^5 \text{ C}$  1 mark
- ii. Energy =  $V \times Q$  (joules)  
 Energy =  $1.10 \times 3.69 \times 10^5 = 4.06 \times 10^5 \text{ J} = 406 \text{ kJ}$  1 mark

## Question 3

a.

	Electrode material	Electrode reaction
Anode	<b>Carbon</b>	$\text{C}(\text{s}) + 2\text{O}^{2-}(\text{in cryolite}) \rightarrow \text{CO}_2(\text{g}) + 4\text{e}^-$ 1 mark
Cathode	<b>Carbon / molten Al</b>	$\text{Al}^{3+}(\text{in cryolite}) + 3\text{e}^- \rightarrow \text{Al}(\text{l})$ 1 mark

- b. Molten cryolite,  $\text{Na}_3\text{AlF}_6$ , acts as a solvent, dissolving the alumina and enabling the  $\text{Al}^{3+}$  and  $\text{O}^{2-}$  ions to be dissociated at a lower temperature. 1 mark  
 (Note: cryolite melting point of about  $1000^\circ\text{C}$  is much lower than that of alumina (greater than  $2000^\circ\text{C}$ ). In addition, when the cryolite dissolves the alumina, the solution has a lower melting point of about  $850^\circ\text{C}$ .)
- c. Water is a stronger oxidant than the  $\text{Al}^{3+}$  ions and would be reduced in preference. 1 mark

d. Any two of the following examples.

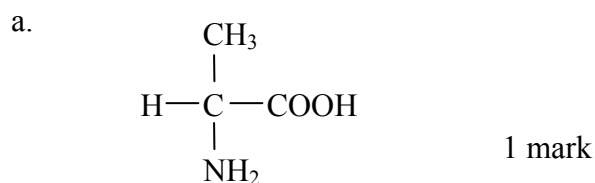
- Large amounts of CO<sub>2</sub> are produced both from generation of electricity and due to the anode reaction. CO<sub>2</sub> is a 'Greenhouse Gas'.
- Mining of the bauxite to produce the alumina has a negative impact on flora and fauna.
- Mining of coal does much damage to the environment.
- Fluorine compounds and fluorine gas are emitted with the flue gases. These substances are highly toxic.
- Visual impact of power lines from source of energy to site of aluminium production.

2 x 1 = 2 marks

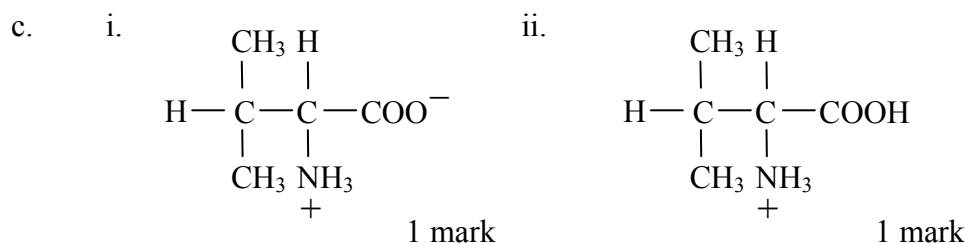
#### Question 4

- a. Condensation (polymerisation) reaction. 1 mark
- b. H<sub>2</sub>O (Do not accept 'water'.) 1 mark
- c. (1) Either monosaccharides *or* hexoses. 1 mark  
(2) Disaccharides. 1 mark
- d. i. Glucose *or* α-glucose 1 mark  
ii. C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> + 6O<sub>2</sub> → 6CO<sub>2</sub> + 6H<sub>2</sub>O (Subscripts not required on this equation.) 1 mark  
iii. Name: glycogen 1 mark  
Empirical formula: C<sub>6</sub>H<sub>10</sub>O<sub>5</sub> *or*  $\text{-(C}_6\text{H}_{10}\text{O}_5\text{)}_n$  1 mark  
Function: (Short term) Storage of energy (in the liver). 1 mark

#### Question 5



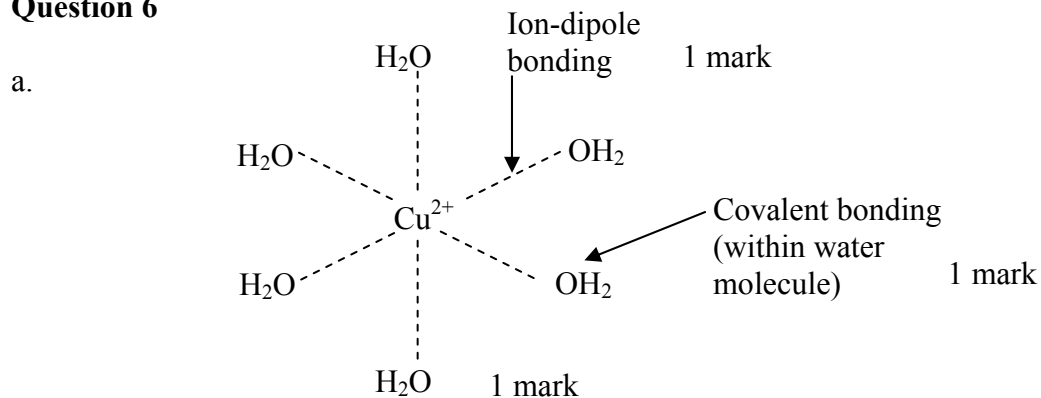
- b. The three functional groups are: hydroxy(l), carboxyl and amino. All three for 1 mark



1 mark

- d. i. Proteins (accept catalysts)
- ii. • denaturation 1 mark
- eg one of 'pH change' or 'temperature change' 1 mark

### Question 6



- b. Ligands 1 mark
- c.  $\text{Cu}^{2+}(\text{aq}) + 2\text{OH}^{-}(\text{aq}) \rightarrow \text{Cu}(\text{OH})_2(\text{s})$
- d. The presence of the ligands around the  $\text{Cu}^{2+}$  cation causes the energy levels of the electrons in the 3d orbitals to change (be distorted). 1 mark
- $\text{NH}_3$  ligands cause a different distorting of the 3d orbitals than  $\text{H}_2\text{O}$  ligands. Therefore the wavelengths of light absorbed are different resulting in a change in colour of the transmitted light. 1 mark
- e.  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$  1 mark
- (Must use *s*, *p*, *d* notation for mark)

**END OF SUGGESTED SOLUTIONS**