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CHEMISTRY
UNIT 4 Trial Examination

SOLUTIONS

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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

1.	C	**2.**	A	**3.**	D	**4.**	C	**5.**	B
6.	B	**7.**	B	**8.**	B	**9.**	A	**10.**	C
11.	C	**12.**	A	**13.**	D	**14.**	B	**15.**	C
16.	A	**17.**	D	**18.**	D	**19.**	D	**20.**	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) $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ 1 mark

Negative electrode (anode) $Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$ 1 mark

c. $Cu^{2+}(aq) + Zn(s) \rightarrow Zn^{2+}(aq) + Cu(s)$ 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. η Zn = m/ M = 125/ 65.4 = 1.9113 mol

$\eta_e = 2\eta_{Zn} = 2 \times 1.9113 = 3.8226$ mol 1 mark

$Q = \eta_e \times F = 3.8226 \times 96500 = 368880.9$ C

Charge = 3.69×10^5 C 1 mark

ii. Energy = V x Q (joules)
Energy = $1.10 \times 3.69 \times 10^5 = 4.06 \times 10^5$ J = 406 kJ 1 mark

Question 3

a.

	Electrode material	Electrode reaction
Anode	**Carbon**	**$C(s) + 2O^{2-}$(in cryolite) $\rightarrow CO_2(g) + 4e^-$** 1 mark
Cathode	**Carbon / molten Al**	**Al^{3+}(in cryolite) + $3e^- \rightarrow Al(l)$** 1 mark

b. Molten cryolite, Na_3AlF_6, acts as a solvent, dissolving the alumina and enabling the Al^{3+} and O^{2-} ions to be dissociated at a lower temperature. 1 mark

(Note: cryolite melting point of about 1000 ^oC is much lower than that of alumina (greater than 2000 ^oC). In addition, when the cryolite dissolves the alumina, the solution has a lower melting point of about 850 ^oC.)

c. Water is a stronger oxidant than the Al^{3+} ions and would be reduced in preference. 1 mark

d. Any two of the following examples.

- Large amounts of CO_2 are produced both from generation of electricity and due to the anode reaction. CO_2 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_2O (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

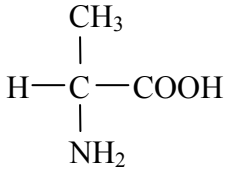
ii. $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ (Subscripts not required on this equation.) 1 mark

iii. Name: glycogen 1 mark
Empirical formula: $C_6H_{10}O_5$ *or* $\left[C_6H_{10}O_5\right]_n$ 1 mark

Function: (Short term) Storage of energy (in the liver). 1 mark

Question 5

a.

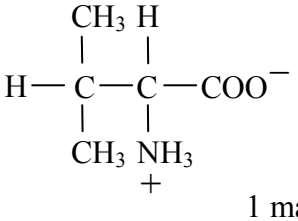


1 mark

b. The three functional groups are: hydroxy(l), carboxyl and amino.

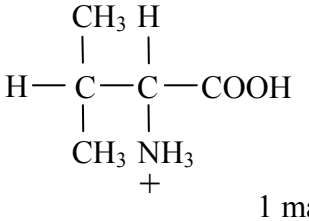
All three for 1 mark

c. i.



1 mark

ii.



1 mark

1 mark

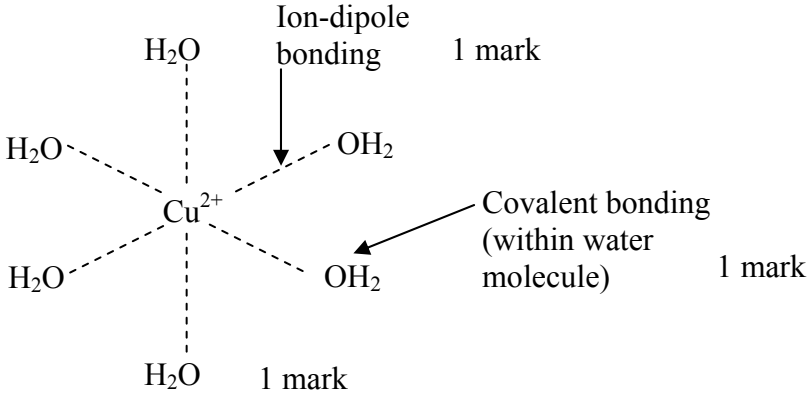
d. i. Proteins (accept catalysts)

ii. • denaturation 1 mark

• eg one of 'pH change' *or* 'temperature change' 1 mark

Question 6

a.



b. Ligands 1 mark

c. $Cu^{2+}(aq) + 2OH^-(aq) \rightarrow Cu(OH)_2(s)$

d. The presence of the ligands around the Cu^{2+} cation causes the energy levels of the electrons in the 3d orbitals to change (be distorted). 1 mark

NH_3 ligands cause a different distorting of the 3d orbitals than H_2O ligands. Therefore the wavelengths of light absorbed are different resulting in a change in colour of the transmitted light. 1 mark

e. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$
(Must use *s, p, d* notation for mark) 1 mark

END OF SUGGESTED SOLUTIONS