YEAR 12 IARTV TEST - OCTOBER 2003 CHEMISTRY - ANSWERS & SOLUTIONS

SECTION A (20 marks)

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

SECTION B

Question 1 (13 marks)

Part A

(a) Anode positive, cathode negative, electron flow from anode to cathode. (*)(*)(*)

(b) (i) $2Cl^-_{(l)} \rightarrow Cl_{2(g)} + 2e^-$ (*)

(ii) $Mg^{2+}_{(l)} + 2e^- \rightarrow Mg_{(l)}$ (*)

(c) (i) If aqueous magnesium chloride were used the reaction above would not occur

H_2O is a stronger oxidant than Mg^{2+} ions and would be preferentially discharged. (*)

(ii) The products will react spontaneously to produce $MgCl_2$. (*)

Part B

(a) $Q=It= 2.0/1000 \times 30 \times 24 \times 60 \times 60 = 5184C$ (*)

$n(e-) = Q/F = 5184/96500 = 0.054$ mol (*)

$n(Zn) = 1/2 \times n(e-) = 0.027$mol

$m(Zn) = n \times M = 0.0269 \times 65.4 = 1.8$ g (*)

(b) (i) Anode O_2, H^+ Cathode Ag (*)

(ii) Anode I_2 Cathode H_2, OH^- (*)

(iii) Anode Br_2 Cathode Cu (*)

Question 2 (7 marks)

(a) Stage I nuclear to thermal.

Stage II thermal to kinetic. (*)(*)(*)

Stage III kinetic to mechanical.

(b) Any two of. Large accessible reserves of coal are available.

Coal is comparatively inexpensive.

Does not require handling of radioactive substances. (*)(*)

(c) Any two of: Produces large quantities of greenhouse gases

Environmental damage caused by mining processes.

Thermal pollutant.

Produce pollutants that cause acid rain and particulate matter (*)(*)

Question 3 (8 marks)

(a) $C_F = E/\Delta T = VIt/\Delta T = (5.00 \times 5.10 \times 1.02 \times 60)/(21.202 - 20.514) = 2.27 \times 10^3\ J^{\circ}C^{-1}$ (*)(*)

(b) $E = CF \times \Delta T = 2.27 \times 10^3 \times (20.514 - 17.234)$ (*)

$= 7.44 \times 103J = 7.44\ kJ$

(c) Energy content = 7.44/ 0.298 = 25.0 kJ/g (*)

(d) Any of: lacks minerals, vitamins, carbohydrates, fibre, essential amino acids, essential fatty acids (*)

(e) (F) x 37 / 100 + (100 - F) x 17 /100 = 24.9 (*)(*)

1700 - 17 F + 37 F = 2490

20 F = 2500 -1700

F = 40% so Protofat has 40% fat content. (*)

Question 4 (8 marks)

(a) Any NHCO linkage. (*)

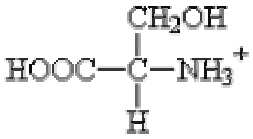
(b) Peptide or amide linkage. (*)

(c) Any hydrogen atom attached to an N or O atom. (*)

(d) 3 (*)

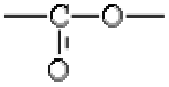
(e) Enzyme. (*)

(f) Urea, carbon dioxide and water. **(*)**

(g) 

Question 5 (5 marks)

(a) $C_6H_{12}O_6$ **(*)**

(b)  (*)

(c) NH_4^+, NO_2^-, NO_3^- (*)

(d) C,O,H (*)

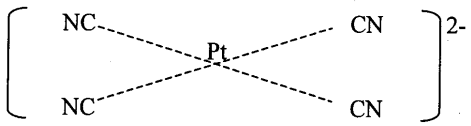
(e) Structural formula of glycerol. (*)

Question 6 (9 marks)

(a) One mark per point. Transition metals have stronger bonds between cations because the atoms are smaller in size than group 1 metals. This is due to a greater nuclear core charge in transition metals. This draws the valence electrons inwards. (*)(*)

(b) (i) +2 (*)

(ii)



(c) (i) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^2$ or other excited state. (*)

(ii) $1s^2 2s^2 2p^3 3s^1$ (*)

(iii) +7 (*)

(iv) Electrons in the 3d and 4s subshells have similar energies. Electrons in both subshells can be lost to form ions with different oxidation states. (*)

Question 7 (4 marks)

(a) Atomic size decreases.
- Ionizatin energy increase.
- Electronegativity increases.
- Metallic character decreases.
- First ionization energy increases.
- Oxidising strength increases
- Explanation – increasing core charge attracts electrons more strongly.s

(i) $Na_2O_{(s)} + 2HNO_{3(aq)} \longrightarrow 2NaNO_{3(aq)} + H_2O_{(l)}$

(ii) $2Al_2O_{3(s)} + 6HNO_{3(aq)} \longrightarrow 2Al(NO_3)_{3(aq)} + 3H_2O_{(l)}$

Question 8

(a) hydrogen undergoes nuclear fusion to form helium atoms and is consumed(*)

(b) light observed from telescope is passed through a prism and the absorption spectra analysed. (*)

(c) our sun is too small a star to reach the temperatures required to produce the range of elements found on earth.