

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) $2\text{Cl}^-(\text{l}) \rightarrow \text{Cl}_2(\text{g}) + 2\text{e}^-$ (*)
- (ii) $\text{Mg}^{2+}(\text{l}) + 2\text{e}^- \rightarrow \text{Mg}(\text{l})$ (*)
- (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) $Q = It = 2.0/1000 \times 30 \times 24 \times 60 = 5184 \text{C}$ (*)

$n(\text{e}^-) = Q/F = 5184/96500 = 0.054 \text{ mol}$ (*)

$n(\text{Zn}) = 1/2 \times n(\text{e}^-) = 0.027 \text{ mol}$

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

(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)

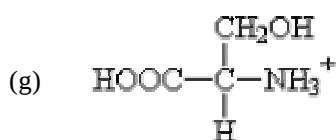
- (a) Stage I nuclear to thermal.
 Stage II thermal to kinetic. (*) (*) (*)
 Stage III kinetic to mechanical.
- (b) Any two of. Large accessible reserves of coal are available.
 Coal is comparatively inexpensive.
 Does not require handling of radioactive substances. (*) (*)
- (c) Any two of: Produces large quantities of greenhouse gases
 Environmental damage caused by mining processes.
 Thermal pollutant.
 Produce pollutants that cause acid rain and particulate matter (*) (*)

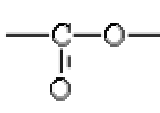
Question 3 (8 marks)

- (a) $C_F = E/\Delta T = VI t / \Delta T = (5.00 \times 5.10 \times 1.02 \times 60) / (21.202 - 20.514) = 2.27 \times 10^3 \text{ J } ^\circ\text{C}^{-1}$ (*) (*)
- (b) $E = C_F \times \Delta T = 2.27 \times 10^3 \times (20.514 - 17.234)$ (*)
 $= 7.44 \times 10^3 \text{ J} = 7.44 \text{ kJ}$
- (c) Energy content = $7.44 / 0.298 = 25.0 \text{ kJ/g}$ (*)
- (d) Any of: lacks minerals, vitamins, carbohydrates, fibre, essential amino acids, essential fatty acids (*)
- (e) $(F) \times 37 / 100 + (100 - F) \times 17 / 100 = 24.9$ (*) (*)
 $1700 - 17 F + 37 F = 2490$
 $20 F = 2500 - 1700$
 $F = 40\%$ 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. (*)

**Question 5 (5 marks)**

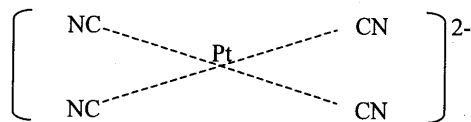
- (a) $\text{C}_6\text{H}_{12}\text{O}_6$ (*)
- (b)  (*)
- (c) NH_4^+ , NO_2^- , NO_3^- (*)
- (d) C, O, H (*)
- (e) Structural formula of glycerol. (*)

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

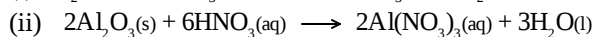
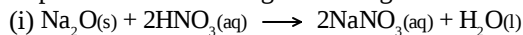
(iii) +7 (*)

(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.

- Ionization energy increase.
- Electronegativity increases.
- Metallic character decreases.
- First ionization energy increases.
- Oxidising strength increases
- Explanation – increasing core charge attracts electrons more strongly.



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.