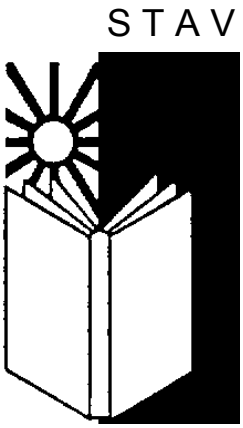

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CHEMISTRY
UNIT 4 Trial Examination

SOLUTIONS

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Semester 2, 2000

MULTIPLE CHOICE

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

SHORT ANSWER QUESTIONS

Question 1

(a) (i) $Pb_{(s)} + SO_4^{2-}{}_{(aq)} \rightarrow PbSO_{4(s)} + 2e^-$ (1 mark)

(ii) $PbO_{2(s)} + SO_4^{2-}{}_{(aq)} + 4H^+{}_{(aq)} + 2e^- \rightarrow PbSO_{4(s)} + 2H_2O_{(l)}$ (1 mark)

1 mark total if equations are correct, but in the incorrect positions

(b) H^+(aq) ions are consumed in the discharge reaction (1 mark) so pH will increase as the battery is used (1 mark).

Question 2

(a) $C_2H_5OH_{(l)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 3H_2O_{(g)}$ (1 mark)

(b) heat released = $4.180 \times 49.80 \times (75.60 - 16.60) = 12281.676$ J (1 mark) = 12.282 kJ

$$\text{n (ethanol)} = \frac{m\,(ethanol)}{n\,(ethanol)} = \frac{0.414}{46.0} = 0.0090 \text{ mol}$$ (1 mark)

$$\Delta H = \frac{heat\ released)}{n\,(ethanol)} = \frac{12.282}{0.0090} = 1365 \text{ kJ mol}^{-1}$$ (1 mark)

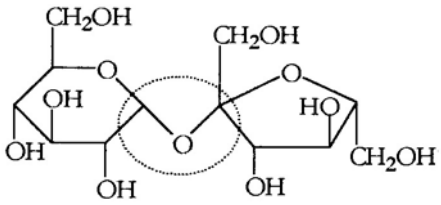
(c) $$\text{ethanol} = \frac{\Delta H}{M\,(ethanol)} = \frac{1365}{46.0} = 29.7 \text{ kJ g}^{-1}$$ (1 mark)

$$\text{propanol} = \frac{\Delta H}{M\,(propanol)} = \frac{2016}{60.0} = 33.6 \text{ kJ g}^{-1}$$ (1 mark)

(d) Ethanol is more easily produced from renewable sources than is propanol;
or the processes for producing ethanol on a large scale are already well known, and are in use;
or ethanol is less toxic than propanol.
One of the above or any other suitable alternative for (1 mark)

Question 3

(a) (1 mark) for correct circle on diagram



(b) (i) monosaccharides (1 mark)
(ii) $C_6H_{12}O_6$ (1 mark)
(iii) enzymes (1 mark) and water (1 mark)
(iv) hydrolysis (1 mark)
(v) to provide energy through the process of aerobic respiration (1 mark)

Question 4

(a) anode $2H_2O_{(l)} \rightarrow O_{2(g)} + 4H^+_{(aq)} + 4e^-$ (1 mark)
cathode $2H_2O_{(l)} + 4e^- \rightarrow H_{2(g)} + 2OH^-_{(aq)}$ (1 mark)

(b) (i) Chlorine may be produced by the use of non-standard conditions, in this case the use of a saturated (approx. 5 M) sodium chloride solution (1 mark) so that Cl^- ions are preferentially oxidised at the anode. (1 mark)

(ii) $2Cl^-_{(aq)} \rightarrow Cl_{2(g)} + 2e^-$ (1 mark)

(c) Semi-permeable membrane allows Na^+(aq) ions to pass from the anode chamber to the cathode chamber but does not allow Cl^-(aq) or OH^-(aq) to move from one chamber to the other (1 mark) enabling a purer solution of sodium hydroxide to be collected. This prevents the products at the two electrodes from mixing and reacting (1 mark) while allowing for efficient movement of electrolyte between the two electrodes to complete the circuit (1 mark)

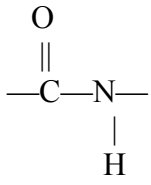
(d) (i) $n(e) = \frac{I\,t}{F} = \frac{1.50 \times 10^5 \times (24 \times 60 \times 60)}{96500}$ (1mark) $= 134301$ mol (1 mark)

$n(Cl_2) = \frac{n(e)}{2} = \frac{134301}{2} = 67150.5$ mol (1 mark)

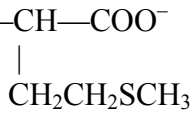
$V(Cl_2) = n(Cl_2) \times Vm = 67150.5 \times 24.5 = 1.6 \times 10^6$ L (1 mark)

(ii) Side reactions may have occurred, which consumed electrons but did not produce chlorine;
or, small amounts of chlorine remain dissolved in solution (1 mark)

Question 5

(a)

(1 mark)

(b) (i) alanine (1 mark) and glycine (1 mark)
(ii) hydrolysis (1 mark)

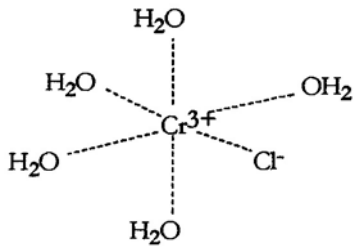
(c)

(1 mark)

Question 6

(a) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$ or $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4 4s^2$ (1 mark)

(b) (i) $Cr(OH)_2$ O.N. = +2 (1 mark)
$Na_2Cr_2O_7$ O.N. = +6 (1 mark)
(ii) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4$ (1 mark)

(c) (i) H_2O (1 mark) and Cl^- (1 mark)
(ii) Polar molecules such as H_2O, CO and NH_3 and anions such as fluoride, F^-, chloride, Cl^-, and cyanide, CN^- able to form interactions with transition metal ions. (1 mark)
(iii)



(1 mark)

(iv) Transition element ions are smaller than their main group counterparts due to a greater nuclear charge and generally carry a higher amount of charge. In aqueous solution therefore they are able to more strongly attract a definite number of water molecules to form complex ions

(1 mark)

Question 7

(a) The high temperatures are required to overcome the forces of repulsion between nuclei (1 mark) allowing them to come close enough for nuclear binding forces to operate. (1 mark)

(b) total mass of helium nuclei = $3 \times 4.0015 = 12.0045$ g (1 mark)
mass loss in forming carbon nucleus = $12.0045 - 11.9965 = 0.0080$ g (1 mark)

(c) The mass lost is converted into energy (1 mark)

END OF SUGGESTED SOLUTIONS