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CHEMISTRY

Unit 4 Trial Examination

SOLUTIONS BOOK

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

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

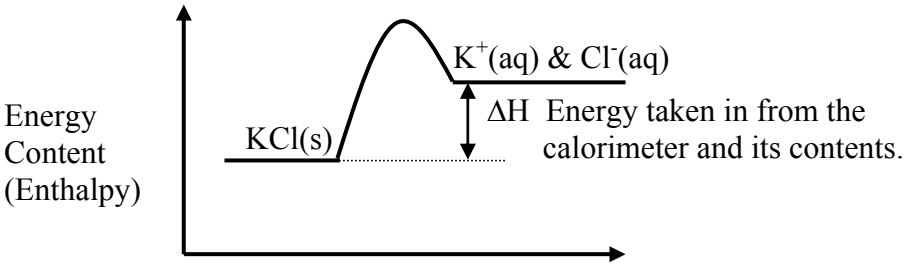
SECTION A

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

SECTION B

Question 1

(a)



(1 mark)

When the potassium chloride dissolves the energy content (enthalpy) of the products is greater than that of the reactants.

(1 mark)

(That is, the bonds in the products are less stable. This is indicated for this endothermic reaction by a positive value of ΔH for the reaction.)

The difference in energy content is absorbed from the surroundings (calorimeter and its contents) resulting in the observed drop in temperature.

(1 mark)

(b) η (KCl) = mass/M = 5.1592/74.6 = 0.069158 mol (1 mark)

Therefore, energy absorbed = 0.069158 x 17.0 = 1.1757 kJ

Energy absorbed = 1.18 kJ (1 mark)

(c) ΔT (temperature change) = 14.56 – 12.08 = 2.48 ^{O}C.

The heat energy to raise the calorimeter and its contents by 1 ^{O}C is the calibration factor (CF) of the calorimeter and its contents.

Therefore, CF = 1.1757/ 2.48 = 0.474068 kJ/ ^{O}C

Calibration Factor is 474 J $^{O}C^{-1}$ (1 mark)

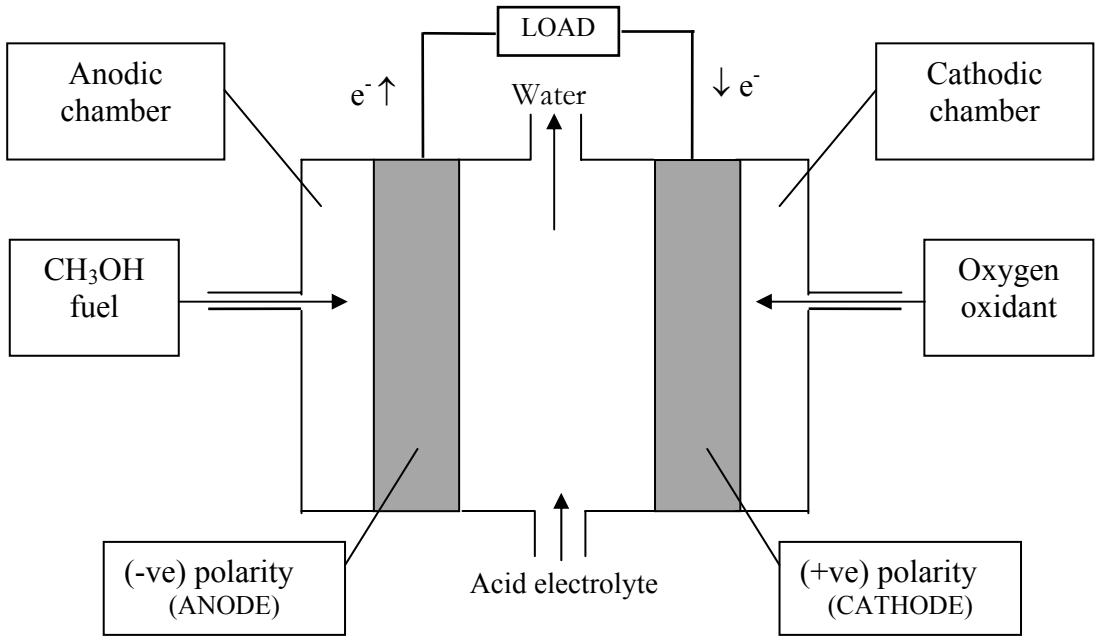
Correct number of significant figures. (This should be exact.) (1 mark)

Question 2

(a) (i) anode $CH_3OH(l) + H_2O(l) \rightarrow CO_2(g) + 6H^+(aq) + 6e^-$ (1 mark)

(ii) cathode $O_2(g) + 4H^+(aq) + 4e^- \rightarrow 2H_2O(l)$ (1 mark)

(b)



(i) anodic and cathodic chambers (1 mark)

(ii) polarity of the electrodes (1 mark)

(iii) input connections for the fuel and oxidant (1 mark)

(c) porous (1 mark)

catalytic (1 mark)

(d) H^+ ions are produced at the anode and therefore the pH decreases near the anode. However the H^+ ions migrate to the cathode where they are consumed. When the rate of production of H^+ at the anode is equal to the rate of migration to the cathode the pH will remain constant.

(1 mark)

(This is assuming that water is removed at the same rate as it is produced.)

d) For example
- more efficient in converting chemical energy into electrical energy *or*
- methanol is renewable *or*
- less polluting

(1 mark)

Question 3

(a) Aluminium electrode (1 mark)

(b) (i) $Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$ (1 mark)

(ii) $2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$ (1 mark)

(c) $2H_2O(l) + 2e^- \rightarrow H_2(g) + 2OH^-(aq)$ (1 mark)

(d) (i) ηZn per 24 hours = mass/molar mass = $\frac{5.5 \times 10^3}{65.4}$ = 84.10 mol (1 mark)

ηZn per hour = $\frac{84.10}{24}$ = 3.5 mol (1 mark)

(ii) $\eta(e^-) = 2 \times \eta Zn = 2 \times 3.504 = 7.0$ mol (1 mark)

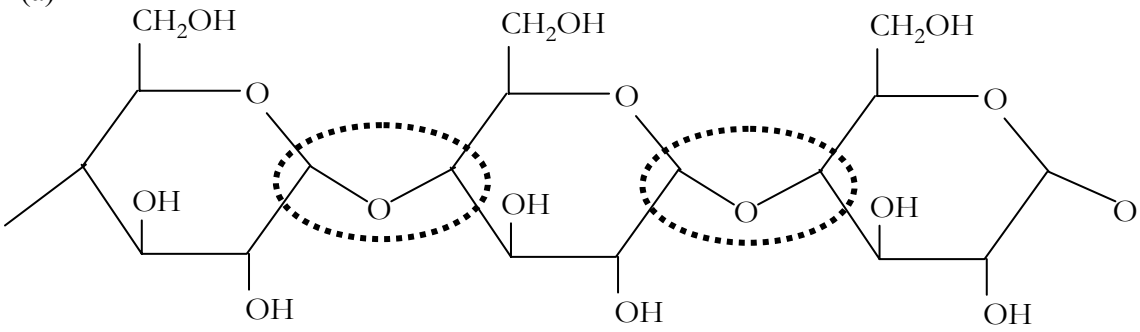
Charge (Q) = $\eta(e^-) \times F = 7.008 \times 96500 = 6.763 \times 10^5$ coulomb

$E = VIt = VQ = 4.1 \times 6.763 \times 10^5 = 2.773 \times 10^6$ joules

Energy required is 2.8 megajoules (1 mark)

Question 4

(a)

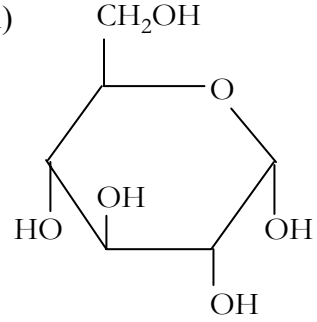


Either of the two complete glycosidic links can be indicated.

(1 mark)

(b) (i) Water (1 mark)

(ii)



(1 mark)

(c) Cellulose does not fit into the active site(s) of the enzyme(s) that hydrolyse starch. (1 mark)

Question 4 (continued)

(d) Starch takes time to be hydrolysed down to simple sugars, such as glucose. This means that it cannot be absorbed into the body rapidly. (1 mark)

(e) (i) $C_6H_{12}O_6(aq) + 6O_2(aq) \rightarrow 6CO_2(aq) + 6H_2O(l)$ (1 mark)

(ii) $M(C_6H_{12}O_6) = 180 \text{ g mol}^{-1}$ (1 mark)

2800 kJ per 1 mole

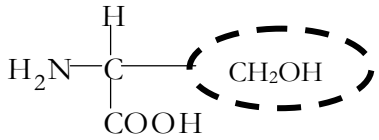
2800 kJ per 180 g

x kJ per 1.0 g

$$x = \frac{1}{180} \times 2800 = 15.6 \text{ kJ g}^{-1}$$ (1 mark)

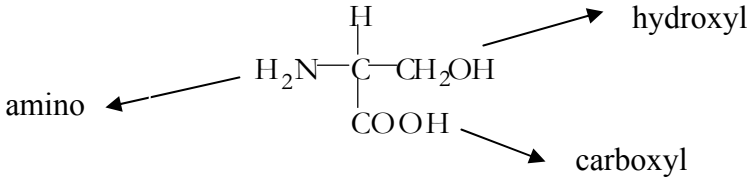
Question 5

(a)



(1 mark)

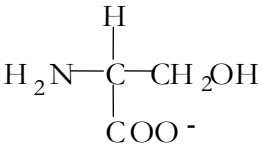
(b)



(1 x 3 = 3 marks)

(c) Yes it will be soluble in water. The functional groups are able to form hydrogen bonds with water. (1 mark)

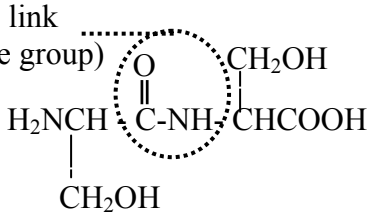
(d)



(1 mark)

(e) condensation (polymerisation) (1 mark)

(f) (i) Peptide link (Peptide group)



(2 marks)

(ii) enzyme catalysed **hydrolysis** (1 mark)

Question 6

(a) (i) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^7 4s^2$ (1 mark)

(ii) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^7$ (1 mark)

(iii) d-block elements (also known as transition metals) have partially filled or *just* completely filled d-subshells. In the case of cobalt the third shell contains a partially filled d-subshell. (1 mark)

(b) (i) Letter X (1 mark)

(ii) Properties typically exhibited by d-block (transition) elements are high melting points, high densities and the ability to conduct an electric current. Only the element corresponding to letter X exhibits these three properties. (1 mark)

Question 7

(a) LHS of nuclear equation = 92 p and 144 n
RHS = 38 p + protons in particle R and (52 + 3) = 55 neutrons and particle R

(i) Therefore the number of protons in particle R is 92 – 38 = 54
Hence atomic number is 54. (1 mark)

(ii) Particle R must have (144 + 92) – (90 + 3) = 236 - 93
Particle R has 143 neutrons and protons
Hence mass number of particle R is 143. (1 mark)

(iii) Atomic number of 54 implies the element is Xenon. (1 mark)

(b) Fission - the neutron induced fission of ^{235}U (1 mark)

(c) Group II or 2 (1 mark)
5^{th} row implies the element is in Period 5 (1 mark)

(d) As strontium is in Group II a charge of 2+ is expected. (1 mark)

(e) SrO (1 mark)

(f) SrO is likely to be ionic so it will be a solid. (1 mark)

END OF SUGGESTED SOLUTIONS