

CSE TEST – OCTOBER 2010

YEAR 12 – CHEMISTRY

Written test 2

SOLUTIONS BOOK

SECTION A – Multiple choice questions (20 marks)

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

Question 1 (5 marks)

a. $\Delta H = +60 \text{ kJ mol}^{-1}$

1 mark

b. Greater

1 mark

c. Reactants because energy absorbed in formation of products

1 mark

d. Lower the E_A

1 mark

e. No effect

1 mark

Question 2 (6 marks)

a. Increase as the ethanoic acid is diluted and this is more significant than increased ionisation.

1 mark

b. $K_a = \frac{[\text{H}_3\text{O}^+][\text{CH}_3\text{COO}^-]}{[\text{CH}_3\text{COOH}]}$

1 mark

c. $c_1V_1 = c_2V_2$ $c_2 = 0.100 \times 0.0100 / 0.020 = 0.0500$

$$1.7 \times 10^{-5} = \frac{[\text{H}_3\text{O}^+]^2}{0.100} \quad [\text{H}_3\text{O}^+] = (1.7 \times 10^{-5} \times 0.100)^{1/2} = 1.30 \times 10^{-3} \quad \text{pH} = 2.88 \quad [0.10]$$

$$1.7 \times 10^{-5} = \frac{[\text{H}_3\text{O}^+]^2}{0.0500} \quad [\text{H}_3\text{O}^+] = (1.7 \times 10^{-5} \times 0.0500)^{1/2} = 9.22 \times 10^{-4} \quad \text{pH} = 3.04 \quad [0.05]$$

$$\text{Change of pH} = 3.04 - 2.88 = 0.16$$

2 marks

d. K_a remains constant at constant temperature.

1 mark

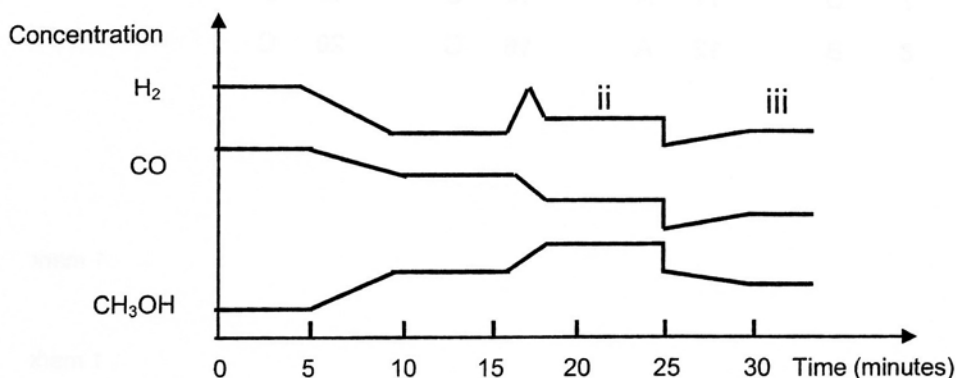
e. Phenolphthalein (phenol red acceptable)

1 mark

Question 3 (8 marks)

a.

i. After 5 minutes the temperature of the system was decreased.



3 marks

b.

Change to the system	Net shift	Effect on the number of moles of O ₂	Effect on the concentration of Cl ₂
Addition of nitrogen gas at constant volume	none	none	none
Increase in pressure	right	decrease	increase
The temperature is raised to 150°C.	left	increase	decrease
Steam is removed	right	decrease	increase
Addition of a catalyst	none	none	none

5 marks

Question 4 (4 marks)

a. $CF = Vt/\Delta T = 5.50 \times 2.50 \times 60.0 / 0.53 = 1600 \text{ J } ^\circ\text{C}^{-1}$

1 mark

b. $n_{\text{sucrose}} = 1.50/342 = 4.386 \times 10^{-3} \text{ mol}$

$$\Delta H = E/n = CF \times \Delta T/n = 1600 \times (31.30 - 17.30) \times 10^{-3} / 4.386 \times 10^{-3} = -5100 \text{ kJ mol}^{-1}$$

2 marks

c. Combustion may be incomplete, experimental measurement errors and heat loss.

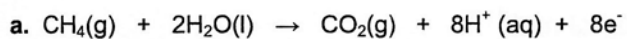
1 mark

Question 5 (9 marks)

- a. $\text{H}_2\text{O(s)} \rightarrow \text{H}_2\text{O(l)}$ $\Delta H = +6.02 \text{ kJ mol}^{-1}$ 1 mark
- b. $\Delta H = 6.02/18 = 0.334 \text{ kJ g}^{-1} = 334 \text{ J g}^{-1}$ 1 mark
- c. $E = 334 \times 50.0 / 1000 = 16.7 \text{ kJ}$ 1 mark
- d. $E = 4.18 \times 50.0 \times 25.0 = 5230 \text{ J}$
Total energy = $5.23 \text{ kJ} + 16.7 = 21.9 \text{ kJ}$ 2 marks
- e. $n(\text{H}_2\text{O}) = E / \Delta H$ $n = 5.50 / 6.02 = 0.914 \text{ mol}$ $m = n \times M_r = 0.914 \times 18.0 = 16.4 \text{ g}$
mass remaining = $93.5 - 16.5 = 77.1 \text{ g}$ 2 marks
- f. $\Delta H_{\text{freezing}} = -\Delta H_{\text{fusion}} = -6.02 \text{ kJ mol}^{-1}$ 1 mark
- g. Heat used to break the intermolecular H-bonds rather than to increase the temperature. 1 mark

Question 6 (8 marks)

- a. +16/3 1 mark
- b. $\text{U}_3\text{O}_8(\text{s}) + 4\text{H}^+(\text{aq}) + 4\text{e}^- \rightarrow 3\text{UO}_2(\text{s}) + 2\text{H}_2\text{O}(\text{l})$ 1 mark
- c. $\text{H}_2(\text{g}) \rightarrow 2\text{H}^+(\text{aq}) + 2\text{e}^-$ 1 mark
- d. $\text{U}_3\text{O}_8(\text{s}) + 2\text{H}_2(\text{g}) \rightarrow 3\text{UO}_2(\text{s}) + 2\text{H}_2\text{O}(\text{l})$ 1 mark
- e. i. Two of disposal of nuclear waste, terrorist attack, cost, safe operation 1 mark
- ii. Two of no greenhouse gas emissions, large energy reserves, no fossil fuel combustion gas emissions, conserves fossil fuels 1 mark
- iii. The sun has fusion nuclear reactions whereas uranium undergoes nuclear fission 1 mark
- iv. Two of biomass, hydroelectricity, wind generation, geothermal, solar, ethanol 1 mark

Question 7 (5 marks)

1 mark

b. Anode

1 mark

c. To prevent poisoning the electrodes containing the catalyst.

1 mark

d. The *BlueGen* units having a single energy conversion and are more efficient so less CO_2 is produced.

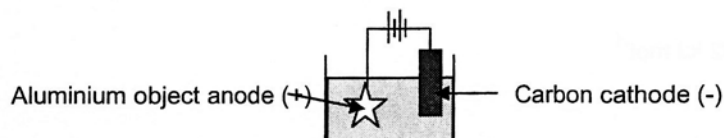
1 mark

e. They use stacks of solid electrolyte plates which are excellent conductors and permeable to gases.

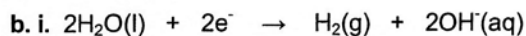
1 mark

Question 8 (9 marks)

a.



3 marks



1 mark



1 mark

c. i. Volume = surface x thickness = $1130 \times 90.0 \times 10^{-4} = 10.2 \text{ cm}^3$

1 mark

$$m = d \times V = 3.95 \times 10.17 = 40.2 \text{ g}$$

1 mark

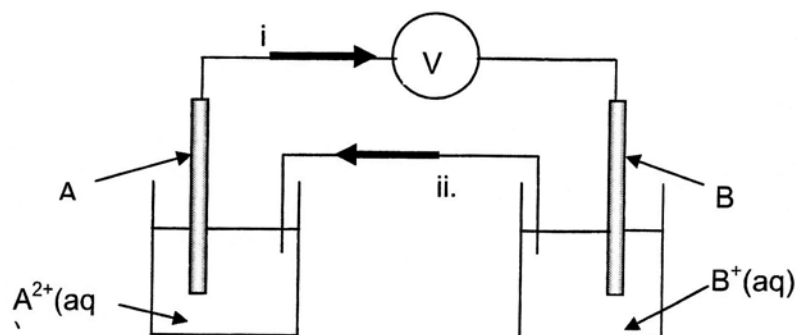
ii. $n(\text{Al}_2\text{O}_3) = 40.2/102.0$ $n_{\text{e}^-} = 40.2 \times 6 / 102.0$

$$t = Q/I = (40.2 \times 6 \times 96500 / 102.0) / 2.5 = 91278 \text{ s} = 25.4 \text{ hrs}$$

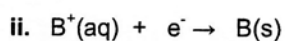
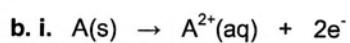
2 marks

Question 9 (6 marks)

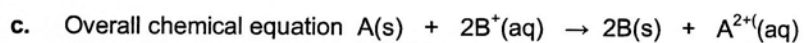
a.



2 marks



2 marks



$$n_{Ag} = 5.8/107.9$$

$$n_A = 5.8 / 107.9 \times 2 = 3.2 / M_A$$

$$M_A = 119 = \text{Tin}$$

2 marks

Question 10 (5 marks)

a. i. Correct name of industrial process and equation

1 mark

ii. Conditions relate to rate and equilibrium concepts such as catalyst, pressure, temperature

1 mark

iii. Use appropriate for that chemical.

1 mark

b. Removal of a product, excess of a reactant

2 marks