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MCH-004

P.G. DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

00772

Term-End Examination

December, 2010

MCH-004 : ELECTROANALYTICAL AND OTHER METHODS

Time : 3 hours *Maximum Marks : 75*

Note : *Answer **any five** questions. All questions **carry equal** marks.*

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1. (a) (i) Depict the cell notation for the following cell reaction : 1

$$Mg(s) + 2Ag^{+}(aq) \rightleftharpoons Mg^{2+}(aq) + 2Ag(s)$$

(ii) Write two practical problems in using hydrogen electrode. 1

(iii) What is saturated calomel electrode ? 1

(iv) Write the formula of cell constant. 1

(v) Define over voltage. 1

(b) (i) Write two main differences between DTA and DSC techniques. 2

(ii) Give two advantages of amperometry. 2

(iii) Why are the mobilities of H^{+} and OH^{-} exceptionaly high ? Explain. 2

(iv) Calculate the percentage mass change (m%) for the following reaction : 2

$$6PbO(s) + O_2(g) \xrightarrow{\Delta} 2Pb_3O_4(s)$$

$[A_r(Pb) = 207.00, A_r(O) = 16.00]$

(v) Complete the following nuclear reactions : 2

A. $^{14}N + ... \rightarrow {}^{17}O + {}^{1}H$

B. $^{35}Cl + ... \rightarrow {}^{36}Cl + r$

2. (a) Write the reaction, calculate the cell potential and predict whether the reaction is spontaneous or not for the following cell : 7

$$Ag/Ag^{+}(0.1M) \parallel Sn^{4+}(0.1M), Sn^{2+}(0.001M)/Pt$$

$$\left[E^{\circ}_{Ag^{+}/Ag} = +0.799V; E^{\circ}_{Sn^{4+}/Sn^{2+}} = +0.154V\right]$$

(b) Derive an expression which relates equilibrium constant and cell potential. 8

3. (a) Taking a suitable example, discuss the principle and working of a solid state membrane electrode. 7

(b) Write five main features of Coulometric methods. 8

4. (a) Calculate the dissociation constant of 0.02 mol dm^{-3} ethanoic acid, if its molar conductivity is $11.57 \times 10^{-4}\ Sm^2\ mol^{-1}$ and limited molar conductivity is $3.90 \times 10^{-2}\ Sm^2\ mol^{-1}$. 7

(b) What are the factors affecting the diffusion current ? Discuss any one of the factor in detail. 8

5. (a) What is stripping voltammetry ? Taking a suitable example discuss the anodic stripping voltammetry. 7

(b) A solution of KCl (0.02 mol dm^{-3}) has conductivity of 0.00227 S cm^{-1}. It is found to have a resistance of 83 Ω. When potassium sulphate (0.005 mol dm^{-3}) solution was substituted, the resistance was 326 Ω. What is the cell constant and what is the conductivity and molar conductivity of the potassium sulphate solution. 8

6. (a) What are background radiations ? Discuss their principal sources. 7

(b) A mixture of $CaCO_3$ and CaO is analysed using TGA method. TG curve of the sample indicates that there is a mass change from 290.6 mg to 230.8 mg between 500 - 900°C. Calculate the percentage of $CaCO_3$ in the sample. 8

$[A_r(Ca) = 40.1, A_r(O) = 16.00, A_r(C) = 12.00]$

7. (a) Write down any five applications of DSC technique. 7

(b) A 0.6 cm^3 solution containing 7.5 $\mu Ci/cm^3$ of 59 Fe was injected into the blood stream of a horse. After equilibrium, 1.0 cm^3 of blood was taken out and it gave 13239 counts in 3 minutes. Calculate the blood volume in the body of horse. 8

8. Write short notes on ***any three*** of the following : **5x3=15**

(a) Neutron Activation Analysis (NAA)

(b) Square wave polarography

(c) Constant potential electrolysis

(d) Applications of Thermometric Titrations