

No. of Printed Pages : 4

**MCH-004**

**P. G. DIPLOMA IN ANALYTICAL  
CHEMISTRY (PGDAC)**

**Term-End Examination**

**December, 2021**

**MCH-004 : ELECTROANALYTIC AND  
OTHER METHODS**

*Time : 3 Hours*

*Maximum Marks : 75*

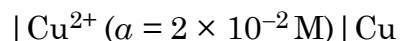
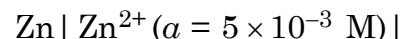
**Note :** (i) Answer any **five** questions. Marks of each part are shown on the RHS.

(ii) Log tables may be used.

(iii) Mass of proton = 1.007823 a.m.u.; Mass of neutron = 1.008665 a.m.u.

1. (a) State Faraday's law and write its mathematical expression. 5

(b) Calculate the cell potential for the cell : 5



$$[E_{\text{Cu}^{2+}|\text{Cu}}^{\circ} = 0.337 \text{ V and}$$

$$E_{\text{Zn}^{2+}|\text{Zn}}^{\circ} = -0.763 \text{ V}]$$

(c) Draw a labelled potentiometric titration curve between volume of titrant *vs.* e.m.f. How will you locate the end point on the curve ? 5

2. (a) Calculate the relative atomic mass (upto 4 decimal places) of oxygen  $^{16}\text{O}$  (99.756%),  $^{17}\text{O}$  (0.039%),  $^{18}\text{O}$  (0.205%). 5

(b) Distinguish between limiting current and diffusion current. 5

(c) What do you understand by the term 'capillary characteristics' ? How do these affect the diffusion current in case of a DME ? 5

3. (a) Explain the principle of potentiostatic coulometry. How is it used for the determination of radioactive materials ? 5

(b) Why are Pt electrodes in a conductivity cell coated with Pt-black ? Explain. 5

(c) What are the differences between DTA and DSC ? Which thermal method will you prefer for quantitative analysis ? Explain reason. 5

4. (a) State laws of radioactive decay. Is there any effect of state of combination or presence of a catalyst on the rate of disintegration ? 5

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- (b) How does a galvanic cell differ from an electrochemical cell? Write an application of each type of these cells. 5
- (c) Draw a pH-metric titration curve of a strong dibasic acid with a strong base. Comment on the observed slope of various segments of the curve. 5
5. (a) Conductivity of a decimolar HCl solution is  $0.394 \Omega^{-1} \text{cm}^{-1}$ . Calculate its molar conductivity. 5
- (b) Differentiate between voltammetry and polarography. How is a potential measured during polarographic studies? 5
- (c) Define the following terms : 5
- (i) Migration current
- (ii) Residual current
6. (a) When  ${}_{13}^{27}\text{Al}$  is bombarded with neutrons, different reactions occur depending upon the energy of the projectile. Explain these observations and write nuclear reactions in each case. 5
- (b) Draw a labelled diagram of a typical enthalpogram of an exothermic reaction.

5

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- (c) Explain polarographic maxima. How can it be suppressed? Explain with aid of C-V curves. 5
7. (a) Explain the method of standard addition in quantitative analysis using an electroanalytical technique. 5
- (b) State the factors which cause errors in pH measurements. 5
- (c) How is peak area of a DTA plot related to the amount of the sample? Write mathematical expression and explain the terms. 5
8. (a) Resistance of a conductivity cell containing  $0.01 \text{ mol dm}^{-3}$  KCl is  $150 \Omega$ . This cell gives a resistance of  $51.4 \Omega$  when filled with  $0.01 \text{ mol dm}^{-3}$  HCl; conductivity of KCl solution is  $1.41 \times 10^{-3} \Omega^{-1} \text{cm}^{-1}$ . Calculate (i) cell constant and (ii) conductivity of HCl solution. 10
- (b) Discuss the principle of electrogravimetric analysis considering a suitable example. 5

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