Class – B.Sc-II (BT)

Subject – Physical Chemistry

Time Allowed : 3 Hours Maximum Marks : 40

Note:– All the questions of Section–A are compulsory. Attempt any 5 questions from Section–B and 2 questions from Section–C. (Use of simple calculator is allowed)

SECTION-A

1. Give an example of an irreversible cell. Explain as to why it is irreversible.
2. Represent the cell in which following reaction takes place

   $Mg\ (s) + 2\ Ag^{+} \rightarrow Mg^{2+} + 2\ Ag\ (s)$
3. Why EMF of the electrochemical cell cannot be determined with the help of simple voltmeter?
4. What is function of platinised platinum in standard hydrogen electrode?
5. Why transport number of cd^{2+} ion in cdI_2 falls in highly concentrated solutions.
6. Why Kohlrausch's law is called the law of independent migration of ion?
7. Why do acetate ions have lower ionic conductance than chloride ion?
8. Anhydrous HCl is a bad conductor of electricity but aqueous HCl is a good conductor why?

SECTION-B

9. What is reference electrode? Describe the construction and working of calomel electrode as a reference electrode.

10. What is liquid Junction potential? How can it be minimised? Is it possible to reduce it to zero? 4

11. Write the half cell reactions and the overall reaction for the electrochemical cell Zn, Zn^{2+} (0.1m) || Cd^{2+} (0.01m), Cd and calculate the e.m.f. at 25°C, assuming ideality. The standard reduction potentials of the redox couples Cd^{+2}/Cd and Zn^{+2}/Zn are 0.40V and –0.76V respectively. 4

12. (a) What are concentration cell? Describe and discuss a concentration cell without transfer.

    (b) Write down Nernst equation for the oxidation potential of a metal-metal electrode. 4

13. Define transference number. Describe briefly the principle of experimental determination of transference number by Hittorf' method. 4

14. Describe Debye-Huckel-Onsagar theory for the variation of equivalent conductance with concentration of uniunivalent electrolyte. 4

15. Calculate the dissolution constant of acetic acid at 298k if 0.01M solution of the acid has a molar conductance of 1.63×10^{-2} Sm^{-1}. Given ($\lambda^0 H^+ = 349.6 \times 10^{-4}$ Sm^2 mol^{-1} and $\lambda^o (CH_3COO^-) = 40.9 \times 10^{-4}$ Sm^2 mol^{-1}) 4

16. Show that for an aqueous solution of a salt of weak acid and strong base $pH = -\log \sqrt{\frac{k_w k_a}{C}}$ 4

SECTION-C

17. (a) Discuss the principle of potentiometric titrations. Explain potentiometric method for determining pH of a solution. 5

(b) Why is quinhydrone electrode not suitable for measuring the pH of a strongly basic solution? 1

18. What is chemical galvanic cell? Give an example of a chemical cell without transference. Describe how this cell can be used to find the standard potential of an electrode and the activity co-efficient of an electrolyte? 6

19. (a) Describe conductometric titration of a mixture of strong and weak acid against strong base. 4

(b) What is buffer solution? Show with example how it results the action of acid or base towards change in pH. 2

20. Discuss the theory of Debye Huckel limiting law which is applicable to the determination of activity and activity coefficient of electrolytes. What modifications are required when applied at higher concentrations. 6

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