B.Tech. Fourth Semester (Chemical Engineering) (Old)

10994 : Applied Physical Chemistry : 4 CH 04

P. Pages : 3

Time : Three Hours

AW - 3067

Max. Marks : 80

Notes :
1. Answer **three** question from Section A and **three** question from Section B.
2. Assume suitable data wherever necessary.
3. Diagrams and chemical equations should be given wherever necessary.
4. Illustrate your answer necessary with the help of neat sketches.
5. Discuss the reaction, mechanism wherever necessary.
6. Use of pen Blue/Black ink/refill only for writing the answer book.

1. a) What is conductance of an electrolyte? Explain different types of conductometric titrations. **6**

b) How will you determine pH of unknown solution for following cell, using EMF measurement **4**

$$Hg \mid Hg_2Cl_2, KCl_{(Sat)} \parallel \text{unknown}_{\text{solution}}, \phi, \phi H_2 \mid Pt$$

c) The molar conductance at infinite dilutions for sodium acetate and hydrogen chloride at 30° C are 91.0×10^{4} and $426.16\times10^{4}\,Sm^{2}mol^{1}$ respectively. Also for H^{+} ions in HCl, t is 0.821 and for CH_3COO^{-} ions in CH_3COONa, t is 0.556. Assuming that $t\pm = t^{\circ}_{\pm}$. Calculate $\wedge^{o}m$ for CH_3COOH. **4**

OR

2. a) What are concentration cells? Derive expressions for the EMF of concentration cells. **6**
i) With transference ii) Without transference

b) What do you mean by specific and equivalent conductance of an electrolytic solutions? Write their interrelation. **4**

c) At 25°C, the degree of dissociation (α) of pure water is 1.90×10^{9}. Calculate the molar conductance ($\wedge^{o}m$) and specific conductance (k) of water at this temperature. The molar ionic conductance of 4^{+} andOH^{-} ions are 349.83×10^{4} and 198.50×10^{4} Sm' mol' respectively. **4**

3. a) Define collision parameter and derive an expression for collision number. **6**

b) State law of corresponding state. **3**

c) Critical constants for benzene are $T_c = 560.5k$ and $P_c = 47.5atm$. Calculate the van-der wall's constants. **4**

OR

4. a) Explain critical temperature, pressure, volume and state relation between van-der-wall's equation and critical state. 6

b) State the postulates of Kinetic theory of gases. 3

c) Find average and most probable velocity of CO_2 gas at 30° C. ($R = 8.31 Jk^{-1}mol^{-1}$) 4

5. a) State stark - Einstein law of photochemistry and give the examples of photochemical reactions which shows deviation from this law. 6

b) Define:- 3
i) Wavelength ii) Wave number iii) Chemical shift

c) What is the selection rule for IR and NMR spectroscopy? 4

OR

6. a) Derive an expression for moment of Inertia frequency of spectral lines of a diatomic molecule acts as rigid rotator. 6

b) Define: 3
i) Electromagnetic spectrum ii) Photosensitization
iii) Phosphorescence

c) Define Quantum yield of photochemical reaction. Give the reason of low quantum yield of a photochemical reaction. 4

7. a) State and explain BET equation for multilayer adsorption. 6

b) Distinguish between physisorption and chemisorption. 4

c) Explain homogenous catalysis with acid - base catalysis. 4

OR

8. a) Derive Langmuir adsorption isotherm. Write the factors on which adsorption depends. 6

b) Explain the various characteristics of catalyst. 4

c) Explain the following with examples. 4
i) Catalytic poisoning ii) Auto catalysis

9. a) Derive rate equation for first order reaction and write two examples. (reactions). 6

b) In first order reaction, it takes the reactant 40.5 min. to be 25% decomposed. Calculate the rate constant of reaction. 3

c) What is Zero order reaction. Explain with example. 4

OR

10. a) Derive inter - relation between K_p and K_c 6

b) Show that for first order reaction, the time required for 99.9% completion of the reaction is 10 times that required for 50% completion. 3

c) What is order of reaction? Explain Pseudo - unimolecular reaction with example. 4

11. a) Discuss the thermodynamic scale of temperature. 6

b) State first law of thermodynamics with its limitations. 4

c) Define 3
i) Enthalpy
ii) Entropy
iii) Gibb's free energy

OR

12. a) State the third law of thermodynamics and Explain how absolute entropy can be calculated from this law. 6

b) Define 4
i) Free Energy
ii) Chemical potential

c) Explain the following 3
i) Isolated system
ii) Open system
iii) Adiabatic process

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