

V Semester B.Sc. Examination, November/December 2014

(OS) (Prior to 2013-14)

CHEMISTRY - VI

(Physical Chemistry)

Time: 3 Hours

Max. Marks : 60

- Instructions:** i) The question paper has **two** Parts.
ii) Answer **both** the Parts.

PART - A

Answer **any six** of the following questions. **Each** question carries **two** marks. (6×2=12)

1. Define the terms specific conductance. How is equivalent conductance is related to specific conductance ?

2. State two limitations of glass electrode.

3. An aqueous solution of ammonium acetate is neither acidic nor basic even though hydrolysis occurs. Give reason.

4. Calculate the electrode potential of the half cell Zn/Zn⁺² at 298 K.

Given : $[Zn^{+2}] = 1 \times 10^{-3} M$, $E_{Zn}^0 = -0.76 V$

5. What is the net dipole moment of a molecule with octahedral geometry and carbon tetrachloride ?

6. Classify the following into paramagnetic and ferromagnetic substances.

Ni, O₂, Pt, C₆₀.

7. What is polarisability factor of a molecule ?

8. Draw different modes of vibrations of water molecule. Which mode is infrared active ?

9. State Franck-Condon principle.

10. State Lambert-Beer law.

PART - B

Answer **any eight** of the following questions. **Each** question carries **six** marks. (8×6=48)

1. a) Describe, how will you measure the emf of a given cell by compensation method.

b) Calculate the equivalent conductance at 20°C of NH₄OH at infinite dilution.

Given : $\lambda_{\infty}(NH_4Cl) = 130 \times 10^{-4} Sm^2 eq^{-1}$,

$\lambda_{\infty}(OH^-) = 174 \times 10^{-4} Sm^2 eq^{-1}$,

$\lambda_{\infty}(Cl) = 66 \times 10^{-4} Sm^2 eq^{-1}$.

(4+2)



12. a) Outline the potentiometric method of determining the equivalence point of redox titration of $K_2Cr_2O_7$ versus $FeSO_4$.
b) Define transport number of an ion. How is it related to ionic conductance?
13. a) Derive an expression for the single electrode potential.
b) Why is KCl or KNO_3 preferred to make salt bridges?
14. a) Describe quinhydrone electrode. Explain how is pH of a solution is determined using this electrode?
b) With an example explain reversible cell.
15. a) Derive an expression to calculate the pH of sodium acetate in terms of their ionisation constant of the weak electrolyte involved.
b) Calculate the hydrolysis constant of 0.1M solution of aniline hydrochloride. Given $K_b = 5.94 \times 10^{-10}$ and $K_w = 1.0 \times 10^{-14}$ at 298 K.
16. a) How many types of electrons exists in a acetone molecule? Write the different electronic transitions involved in it.
b) Calculate the emf of the cell $Zn/Zn^{+2} (0.05 M || Zn^{+2} (0.25 M)/Zn$ at 298 K.
17. a) What do you understand by the term electrical polarisation of a molecule? Distinguish between induced polarisation and orientation polarisation.
b) How would you account for anti ferromagnetism?
18. a) Write the expression for the fundamental vibrational frequency of a diatomic molecule and explain the terms in it.
b) What is meant by anharmonicity?
19. a) Write the different modes of vibrations of carbon dioxide molecule. Which mode is infrared active and why?
b) Define the term overtones and fundamental band.
20. a) Discuss the origin of Raman spectra. Explain the terms : i) stokes lines
ii) antistokes lines.
b) Write the selection rule for microwave and vibrational spectra.
21. a) How is $Fe(III)$ ion in a solution can be determined colorimetrically? Explain.
b) What is singlet and triplet state?
22. a) Give the various steps involved in the photochemical combination of hydrogen and chlorine. Account for the high quantum efficiency of the reaction.
b) Explain chemiluminescence with an example.