



Nagarjuna Degree College
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Bengaluru - 560 064.

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Reg. No.

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V Semester B.Sc. Degree Examination, April - 2022

CHEMISTRY

Physical Chemistry

(CBCS Scheme 2020-21 onwards (F+R))

Paper : VI

Time : 3 Hours

Maximum Marks : 70

Instructions to Candidates:

- 1) The question paper has two parts. Answer both the parts.
- 2) Draw diagrams and chemical equations wherever necessary.

PART-A

Answer any EIGHT of the following questions. Each question carries Two marks. (8×2=16)

1. What are concentration cells ?
2. Name a primary and secondary electrode used in electrochemical measurements.
3. A solution of a specific conductance $1.4 \times 10^{-1} \text{ S m}^{-1}$ was placed a conductivity cell. The resistance of the solution was found to be 160 ohm. Calculate the cell constant.
4. State Kohlrausch law of independent migration of ions.
5. Write Debye-Huckel-onsager equation, indicate the terms involved.
6. What is the effect of dilution and temperature on the degree of hydrolysis of salt formed from weak acid and a weak base.
7. The dipole moment of HF, HCl, HBr and HI are 2, 1.3, 0.8 and 0.4 Debye/ Arrange them in the increasing order of polar character.
8. The force constant of HF molecule is 970 Nm^{-1} . Calculate the zero point energy.

[P.T.O.]



9. State Franck - Condon principle.
10. N_2 molecule fails to exhibit rotational spectra but CO exhibits. Why ?
11. Write Ilkovic equation and mention the terms.
12. Write any two analytical applications of buffer solutions.

PART - B

II Answer any NINE of the following questions. Each question carries SIX marks. ($9 \times 6 = 54$)

13. a) Define transport number. How is the transport number of an ion determined by moving boundary method ?
b) Mention any two advantages of conductometric titrations.
14. a) Derive Nernst equation for a single electrode system.
b) Give any two limitations of Arrhenius theory.
15. a) Molar conductances of HCl , $NaCl$ and CH_3COONa at infinite dilutions are 4.2616×10^{-2} , 1.2645×10^{-2} and $9.1 \times 10^{-3} \text{ Sm}^2 \text{ Mol}^{-1}$ respectively. Calculate the degree of dissociation of 0.01M acetic acid solution. The molar conductance of acetic acid at 0.01M is $1.58 \times 10^{-3} \text{ Sm}^2 \text{ mol}^{-1}$.
b) Give any limitations of Quinhydrone electrode.
16. a) Explain asymmetric effect and electrophoretic effect of strong electrolytes.
b) Represent Weston-cadmium cell symbolically.
17. a) Describe the determination of P^H of a solution using a quinhydrone electrode.
b) The standard reduction potential of Ag^+/Ag and $Cu^{2+}(IM)/Cu$ electrodes are 0.8V and 0.34V respectively. Represent the cell symbolically and calculate the Emf of the cell.
18. a) Derive the relation : $P^H = 7 + \frac{1}{2} P^{K_a} + \frac{1}{2} P^{K_b}$ in the case of salt hydrolysis of weak acid and weak base.
b) Give reason : aqueous solution of $NaCl$ is neutral to litmus.



19. a) Define solubility product ? Why is NH_4Cl added in excess prior to NH_4OH during the detection of III group basic radicals in the inorganic qualitative analysis.
- b) Explain piezoelectricity with an example.
20. a) Explain seebeck effect and Thomson effect with an example.
- b) Write clausius - Mossotti equation and indicate the terms involved.
21. a) Sketch the normal modes of vibration of CO_2 molecule. Which of these are IR active ?
- b) What is Raman effect ?
22. a) If the energy of transition of $J = 2$ to 3 rotational transition of $1_{\text{H}}^{35}\text{Cl}$ considered as rigid rotator is 63.56 cm^{-1} . Calculate the moment of inertia of the molecule.
- b) Define zero point energy. Give its equation.
23. a) What are stokes and anti-stoke lines? How are they different from Rayleigh line.
- b) The Vibration energy levels of a harmonic oscillator are equally spaced. Justify the statement with appropriate explanation.
24. a) Mention any four advantages of Raman Spectra over IR spectra.
- b) Mention two applications of semiconductors.
25. a) Draw the current-potential curve in a polarographic experiment. Explain the different types of current observed in polarogram.
- b) What is half-wave potential ? Give its significance.
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