Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree Examination, March 2022

First Degree Programme Under CBCSS

Chemistry

Complementary Course for Physics

CH 1331.1 : PHYSICAL CHEMISTRY II

(2019 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions. Each question carries **1** mark.

1. What is meant by compressibility factor?

2. In single X-ray diffraction measurement, the crystal is mounted on —————.

3. In the reaction $2A + B \rightarrow A2B$, if the concentration of A is doubled and that of B is halved, then the rate of the reaction will —————.

4. The process of decomposition of an electrolyte by passing electric current through its solution is called as —————.

5. What are redox electrodes? Give an example.

6. H_2O belongs to which point group?

7. The rate constant of zero-order reactions has the unit —————.

8. A catalyst alters ——————— of a chemical reaction.

9. For the orthorhombic system, axial ratios are $a \neq b \neq c$ and the axial angles are ———————.

10. The quantum efficiency of a photochemical reaction is defined as ———————.

$(10 \times 1 = 10 \text{ Marks})$

SECTION – B

Answer any **eight** questions. Each question carries **2** marks.

11. The rms velocity of hydrogen at STP is 1.85×10^5 cm s^{-1} and its mean free path is 1.75×10^{-5} cm. Calculate the collision number.

12. What is Boyle's temperature?

13. Give the Maxwells's distribution of molecular velocities.

14. Give a sketch of the (222) planes of a bcc lattice.

15. What is the relation between the distance between (hkl) planes and the unit cell edge-length for a cubic lattice?

16. How are sodium and chloride ions arranged in sodium chloride crystal?

17. Define half-life period of a reaction.

18. The rate constant of a first order disintegration of a substance is 0.5×10^{-2} s^{-1}. Calculate the time required for 10 g of the substance to disintegrate to 5 g.

19. Define temperature coefficient of a reaction.

20. If the molar conductance at infinite dilution for an electrolyte is 400 S cm^2 mol^{-1} and the molar conductance of a 0.01 M solution of it at the same temperature is 102 S cm^2 mol^{-1}, calculate its degree of dissociation in 0.01 M solution.

21. What do you mean by Reference electrodes? What are the two types of reference electrodes?

22. Explain the term transport numbers. Discuss the moving boundary method of determining transport numbers.

23. Define single electrode potential. Can its absolute value be determined?

24. Define a plane of symmetry.

25. How we can differentiate horizontal and dihedral mirror planes?

26. State Grothus-Drapper law.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. Each question carries **4** marks.

27. Discuss Joule-Thomson effect.

28. Using Van der Waal's equation, calculate the pressure exerted by one mole of a gas enclosed in a 1.5 dm^3 flask at 400 K. Given, a = 3.0 atm dm^6 mol^{-2}, and b = 0.05 dm^3 mol^{-1}.

29. What are Miller indices If a crystal plane makes intercepts ½ a, ½ b and c, what are the Miller indices of the plane?

30. X-rays of wavelength 1.5374 Å are reflected from two parallel planes 2.82 Å apart in a crystal. What is the angle of reflection for n = 1?

31. Derive the integrated rate equation for a first order reaction.

32. Give Arrhenius equation and account for the influence of temperature on the reaction rate on the basis of this equation.

33. Illustrate the principle of conductometric titrations with reference to any two types of acid-base titrations.

34. Discuss the Hittorff's method for the determination of transport numbers of ions.

35. Give the group multiplication table of C_{2v} point group.

36. Explain the terms proper rotation and improper rotation axis with suitable examples.

37. Explain the theory of intermediate compound formation for homogeneous catalysis.

38. An aqueous solution of an organic substance absorbs 25% of the incident radiation in a path length of 3 cm. The molar absorption coefficient of the substance is 1.2 L mol^{-1} cm^{-1}. Calculate the concentration of the solution.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

39. Derive the relationship between van der Waals constants and critical constants.

40. How can the crystal structure of NaCl be deduced from X-ray diffractions studies?

41. What are the main postulates of the collision theory of bimolecular gaseous reactions? How does collision theory explain the effect of temperature on the rate of a reaction?

42. Derive an expression connecting the emf of a galvanic cell to the equilibrium constant of the cell reaction.

43. (a) Assign the point groups of the molecules : BF_3 and NH_3.

    (b) What is the potential at 298 K of the electrode consisting of a silverrod dipping in 0.05 M $AgNO_3$ solution? Given : $E^0_{Ag+:Ag}$ = 0.80 V.

44. (a) Distinguish between phosphorescence and fluorescence by giving importance to their mechanisms.

    (b) Write a note on photosensitization.

(2 × 15 = 30 Marks)

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