Q.P. Code – 42434

Fourth Semester B.Sc. Degree Examination, September 2020

(CBCS Scheme)

CHEMISTRY

Paper IV

Time : 3 Hours] *[Max. Marks : 90*

Instructions to Candidates :

1) *The question paper has two Parts A and B. Both the parts should be answered.*
2) *Write the equations/diagrams wherever necessary.*

PART – A

Answer any **TEN** of the following questions. Each question carries **2** marks : **(10 × 2 = 20)**

1. Write the structure of chromate $[CrO_4^{2-}]$ and dichromate $[Cr_2O_7^{2-}]$ ions.

2. Calculate the magnetic moment of $[Fe(CN)_6]^{4-}$.

3. Mention any two limitations of VBT.

4. What are lanthanides? Give its general electronic configuration.

5. Write the IUPAC names for (a) $[Cr(en)_3]Cl_3$ (b) $Fe(CO)_5$.

6. What is spectrochemical series?

7. Define inversion temperature. How is it related to van der Waal's constants?

8. In a diffraction experiment, angle of diffraction (θ) is 17° and wavelength of X-rays is 136 pm. Calculate the distance between the layers of atom assuming $n = 1$.

9. Write any two differences between order and molecularity.

10. Give the expressions for RMS velocity and average velocity.

11. State law of rational indices.

12. Define half life of a reaction. Give the expression for half life of first order reaction.

PART – B

Answer any **SEVEN** questions. Each question carries **10** marks : **(7 × 10 = 70)**

13. (a) Account for the following in respect of transition elements (3d series)
    (i) Variable oxidation states
    (ii) Formation of colored compounds
    (b) Discuss the aqueous chemistry of Fe(II) and Fe(III).
    (c) Write the structure and uses of $CrO(O_2)_2$ and $(NH_3)_3CrO_4$. **(4 + 3 + 3)**

14. (a) Explain the properties of actinides with respect to
    (i) Oxidation states
    (ii) Ionic radii
    (b) How Lanthanides are separated by ion exchange method?
    (c) How do you prepare (i) potassium dichromate (ii) $K_4[Fe(CN)_6]$? **(4 + 3 + 3)**

15. (a) Explain the formation, structure and magnetic properties of $[Fe(CN)_6]^{3-}$ complex on the basis of VBT.
    (b) Explain Geometrical isomerism in octahedral complexes with an example.
    (c) Define a ligand. How are they classified? **(4 + 3 + 3)**

16. (a) Discuss the crystal field splitting of d-orbitals in octahedral complexes.
    (b) Explain electronic spectrum of transition metal complexes having d' system $[Ti(H_2O)_6]^{3+}$.
    (c) What are weak field and strong field ligands? Give an example for each. **(4 + 3 + 3)**

17. (a) Explain ionization and hydrate isomerism with an example for each.
    (b) What are Latimer diagrams? Latimer diagram for copper is

$$Cu^{2+} \xrightarrow{+0.15\ V} Cu^{+} \xrightarrow{+0.50\ V} Cu^{\circ}$$

    Predict whether disproportionation of Cu^+ into Cu^{2+} and Cu° is feasible or not.
    (c) Write a note on Jahn-Teller effect. **(4 + 3 + 3)**

18. (a) Derive an expression for most probable velocity from Maxwell Boltzmann equation.

(b) Briefly describe Linde's process for the liquifaction of air.

(c) Calculate the Root mean square velocity, average velocity and most probable velocity of Nitrogen molecule at 300 K. **(4 + 3 + 3)**

19. (a) Explain the determination of surface tension using stalogmometer.

(b) What is the effect of temperature on

(i) Surface tension

(ii) Coefficient of viscosity

(c) Water requires 120.5 seconds to flow through a viscometer and the same volume of acetone requires 49.5 seconds. If the densities of water and acetone at 293 K are 9.982×10^2 kg/m^3 and 7.92×10^2 kg/m^3 respectively and the viscosity of water at 293 K is 1.005×10^3 Nm^2 s^{-1}, calculate the viscosity of acetone at 293 K. **(4 + 3 + 3)**

20. (a) Derive Bragg's equation.

(b) Write a note on stoichiometric defects.

(c) What are Miller indices? Discuss the procedure for its calculation. **(4 + 3 + 3)**

21. (a) Derive an expression for the rate constant of second order reaction where the concentrations of reactants are equal.

(b) Discuss Lindemann's theory of unimolecular reactions.

(c) Define activation energy. How it is calculated from Arrhenius equation? **(4 + 3 + 3)**

22. (a) Calculate the rate constant for a reaction at 700 K given the rate constant at 600 K is $3.5 \times 10^4 \text{mol}^{-1}\text{s}^{-1}$. The energy of activation in this temperature range is 140.3 kJ/mol.

(b) Derive critical constants from van der Waal's equation.

(c) Discuss the types of liquid crystals. **(4 + 3 + 3)**
