TDC (CBCS) Even Semester Exam., 2025

CHEMISTRY

(4th Semester)

Course No. : CHMDSC/GE–401

(Transition Metals, Coordination Chemistry, States of Matter and Chemical Kinetics)

Full Marks : 50

Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

UNIT—I

1. Answer any *three* of the following questions :

$1 \times 3 = 3$

(a) Calculate the magnetic moment of Cu^{2+} ion.

(b) Name the element of transition series that has highest oxidation state.

(c) Define lanthanide contraction.

(d) What are the atomic numbers of cerium and lutetium?

(Turn Over)

2. Answer any *one* of the following questions :   2

    (a) Give a brief account of Latimer diagram.

    (b) Mention the consequences of lanthanide contraction.

3. Answer any *one* of the following questions :   5

    (a) Write down the electronic configurations of chromium and copper. Discuss the variable oxidation states shown by transition elements.   2+3=5

    (b) What are lanthanides? Discuss the ion-exchange method of separation of lanthanide elements.   2+3=5

UNIT—II

4. Answer any *three* of the following questions :

                                          1×3=3

    (a) Write down the IUPAC name of $K_2[HgI_4]$.

    (b) Draw the structures of facial and meridional isomers with suitable examples.

    (c) What are ambidentate ligands?

    (d) What is EDTA?

                                (Continued)

5. Answer any *one* of the following questions :   2

    (a) Give one example of each of linkage and coordination isomer.

    (b) What do you mean by chelates? Draw a suitable structure.

6. Answer any *one* of the following questions :   5

    (a) Discuss bonding, structure and magnetic property of $[CoF_6]^{3-}$ using VBT.

    (b) Calculate CFSE for d^5 system. Give a brief account of Jahn-Teller theory of distortion.   3+2=5

UNIT—III

7. Answer any *three* of the following questions :

                                   1×3=3

    (a) Write down the van der Waals' equation for 1 mole of gas.

    (b) Write down the kinetic gas equation.

    (c) Define Boyle temperature.

    (d) What do you mean by compressibility factor?

8. Answer any *one* of the following questions : 2

   (a) Discuss three important postulates of kinetic gas equation.

   (b) Discuss the effect of temperature on surface tension.

9. Answer any *one* of the following questions : 5

   (a) Discuss the Maxwell distribution of molecular velocity. What are the three different types of molecular velocities?

   2+3=5

   (b) Discuss collision number and mean-free path of molecule. Also discuss viscosity and coefficient of viscosity. 2+3=5

UNIT—IV

10. Answer any *three* of the following questions :

    1×3=3

    (a) Give examples of two viscous liquids.

    (b) What is F-centre?

    (c) Write down the Bragg's equation.

    (d) Mention one characteristic of crystalline solid.

11. Answer any *one* of the following questions :   2

    (a) Calculate the number of atoms per unit cell of cubic crystal.

    (b) Discuss the law of Miller indices.

12. Answer any *one* of the following questions :   5

    (a) What do you mean by defect in crystal? Discuss Schottky and Frenkel defects in crystal.

    (b) Explain why water droplets are spherical. Discuss the experimental method of determination of viscosity by Ostwald viscometer.   1+4=5

UNIT—V

13. Answer any *three* of the following questions :
                               1×3=3

    (a) What do you mean by the term 'rate of a reaction'?

    (b) Give an example of zero-order reaction.

    (c) Draw the graph for a first-order reaction.

    (d) What do you mean by pseudo-unimolecular reaction? Give example.

14. Answer any *one* of the following questions : 2

   (a) Find an expression for rate constant for second-order reaction.

   (b) Mention two characteristics of first-order reaction.

15. Answer any *one* of the following questions : 5

   (a) What do you mean by molecularity of a reaction? Distinguish between order and molecularity of a reaction. Find an expression for half-life period of a first-order reaction. 1+2+2=5

   (b) Discuss the effect of temperature on the rate of the reaction using Arrhenius equation. Draw the activation energy profile for exothermic and endothermic reactions. 3+2=5

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