TDC (CBCS) Even Semester Exam., 2024

CHEMISTRY

(4th Semester)

Course No. : CHMDSC/GEC–401T

(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 Mn^{2+} ion.

(b) Name one compound of transition metal that acts as catalyst.

(c) Identify the lanthanides with $Z = 58$ and $Z = 71$.

(d) Write down the general electronic configuration of lanthanides.

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

(a) Give a brief account on Latimer diagram.

(b) Discuss lanthanide contraction.

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

(a) Discuss the trend of atomic radii of first transition series. Write a short account on colour and magnetic properties of transition elements. 2+3=5

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

UNIT—II

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

(a) Write down the IUPAC name of $Na_2[CrOF_4]$.

(b) Draw the structure of facial isomers with suitable example.

(c) Draw the crystal field splitting diagram of d^7 system in octahedral low-spin complex.

(d) Draw the structure of $EDTA^{4-}$ ion.

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

(a) Give one example of each of ionization and linkage isomerism.

(b) Define ambidentate ligand with example.

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

(a) Discuss the bonding, structure and magnetic properties of $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$ using VBT. 2½+2½=5

(b) Calculate the CFSE for d^6 system considering weak and strong field ligand. Give a brief account of Jahn-Teller distortion. 3+2=5

(4)

UNIT—III

7. Answer any *three* of the following questions :
$1 \times 3 = 3$

(a) Define mean free path.

(b) Write down the van der Waals' equation for *n* moles of gas.

(c) What is the ratio of three different types of molecular velocities?

(d) Define coefficient of viscosity.

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

(a) Discuss the two faulty postulate of kinetic molecular theory.

(b) What are the units and significance of van der Waals' constants, *a* and *b*?

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

(a) What are the three different types of molecular velocities? Discuss the Maxwell speed distribution of molecular velocity.
$3 + 2 = 5$

(b) Explain the cause of deviation of real gas from ideal behaviour. Discuss the three different types of critical constants.
$2 + 3 = 5$

UNIT—IV

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

$1 \times 3 = 3$

(a) What is the effect of temperature on surface tension?

(b) Explain why liquid drops are spherical.

(c) Calculate the number of atoms per unit cell for f.c.c. crystal.

(d) What is F-centre?

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

(a) State and explain Bragg's law.

(b) Write a brief note on liquid crystal.

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

(a) Define surface tension. Discuss the experimental method of determination of surface tension using stalagmometer. $2+3=5$

(b) State the law of Miller indices. Discuss Schottky and Frenkel defects in crystal. $2+3=5$

(*Turn Over*)

UNIT—V

13. Answer any *three* of the following questions : $1 \times 3 = 3$

(a) What is the unit of rate constant for zero-order reaction?

(b) Give one example of pseudo-unimolecular reaction.

(c) Draw the graph of $t^{1/2}$ vs. $[A]_0$.

(d) Mention one characteristic of first-order reaction.

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

(a) Explain how the rate constant for a first-order reaction can be calculated graphically.

(b) Find an expression for integrated rate equation for first-order reaction.

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

(a) Discuss the effect of temperature on the rate of the reaction using Arrhenius equation. Define activation energy with energy profile diagram. $3 + 2 = 5$

(b) Define order of a reaction. Show that time required for 99·9% of a first-order reaction is ten times the time required for 50% completion of the reaction. 2+3=5

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