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**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 : 1×3=3

*(a)* Calculate the magnetic moment of $Mn^{2+}$ ion.

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

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(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

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UNIT—III

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

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UNIT—V

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