

**2026/FYUG/EVEN/SEM/
CHMDSM151T/117**

FYUG Even Semester Exam., 2026

CHEMISTRY

(2nd Semester)

Paper Code : CHMDSM151

(Fundamentals of Chemistry—I)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

*The figures in the margin indicate full marks
for the questions.*

UNIT—I

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

2×2=4

(a) Mention any two limitations of Bohr's atomic model.

(b) State Heisenberg's uncertainty principle and give mathematical expression for it.

(c) Calculate the number of unpaired electrons in the following ions : $\frac{1}{2} \times 4 = 2$

$\text{Mn}^{3+}, \text{V}^{3+}, \text{Ti}^{3+}, \text{Cr}^{3+}$

26J/1341

(Turn Over)



2. Answer any *one* of the following questions : 10

(a) (i) Deduce the expression for de Broglie's equation. 2

(ii) Write the three-dimensional Schrödinger wave equation for hydrogen atom and explain each term involved in the equation. $1+2=3$

(iii) What are quantum numbers? Which quantum number represents the shape of the orbital? $1+1=2$

(iv) Comment on the stability of exactly half-filled and completely-filled orbitals. 3

(b) (i) Discuss the significance of ψ and ψ^2 . 2

(ii) Draw the radial probability distribution curves for 2s and 2p orbitals. 2

(iii) Which quantum number gives the orientation of an orbital in a space? Write the different quantum numbers for the $3s^1$ electron. $1+2=3$

(iv) State Pauli's exclusion principle. Write the electronic configuration of Cr^{3+} and justify your answer. $1+2=3$

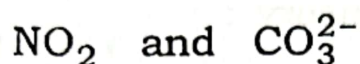
UNIT—II

3. Answer any *two* of the following questions :

2×2=4

(a) Define the terms 'polarizing power' and 'polarizability'.

(b) Draw the resonating structures for the following :



(c) What are bonding and anti-bonding orbitals?

4. Answer any *one* of the following questions : 10

(a) (i) $[\text{FeF}_6]^{3-}$ has a magnetic moment of 5.92 BM. Explain on the basis of VBT. 2

(ii) State the main postulates of VBT. 3

(iii) Explain the structure of XeF_6 on the basis of VSEPR theory. 2

(iv) Draw the MO diagram of O_2 molecule and comment on its magnetic property. 2+1=3

(b) (i) He_2 molecule does not exist but $\text{He}_2^{(+)}$ can exist. Explain. 2

(ii) What is Fajan's rule? Arrange the following in the increasing order of stability : 2+1=3

NaF , NaI , NaBr , NaCl

(iii) Predict and draw the shape of the following on the basis of VSEPR theory : 1+1=2

NH_3 and XeF_2

(iv) Draw the MO diagram of CO molecule and comment on its magnetic property and bond order. 2+1=3

UNIT—III

5. Answer any *two* of the following questions : 2×2=4

(a) Mention two postulates of kinetic theory of gases.

(b) What is meant by compressibility factor?

(c) Write down the SI units of the van der Waals' constants a and b .

6. Answer any one of the following questions : 10

(a) (i) What is an ideal gas? Mention two reasons for the deviation of real gases from ideality. 1+1=2

(ii) From kinetic theory of gases, derive the relation $PV = \frac{1}{3} Mc^2$, where symbols have their usual meanings. 4

(iii) What is mean-free-path? How does it vary with temperature and pressure? 1+3=4

(b) (i) Write down van der Waals' equation for n moles of a real gas. 2

(ii) Define collision frequency. Mention the factors that affect collision frequency. 1+3=4

(iii) What are RMS velocity and most probable velocity? Establish a relation amongst average velocity, most probable velocity and RMS velocity. 2+2=4

UNIT—IV

7. Answer any two of the following questions : 2×2=4

(a) What is surface tension? Write one practical application of it.

(b) Differentiate between Schottky and Frenkel defects.

(c) Calculate the number of atoms per unit cell of FCC lattice.

8. Answer any one of the following questions : 10

(a) (i) What is coefficient of viscosity? Describe its determination using Ostwald viscometer. 1+3=4

(ii) What are surface active agents? Describe the cleansing action of soaps. 1+3=4

(iii) Explain the term 'Bravais lattice'. 2

(b) (i) How does surface tension vary with temperature? Describe drop number method for determination of surface tension using stalagmometer. 1+4=5

(ii) What are covalent solids? Give two examples. 2

(iii) Define viscosity of a liquid. How does it vary with temperature and pressure? 1+2=3

UNIT—V

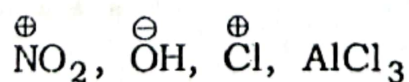
9. Answer any *two* of the following questions :

2×2=4

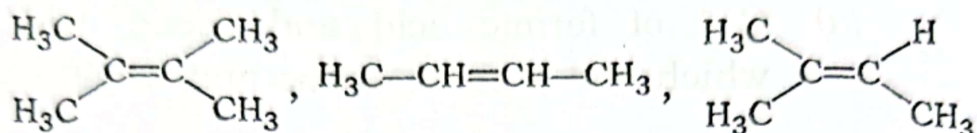
- (a) Out of formic acid and acetic acid, which one is more acidic and why?
- (b) Define the term 'heterolytic cleavage'. What kind of cleavage is expected in case of Cl_2 in presence of sunlight? 1+1=2
- (c) What are nucleophiles? Give two examples of neutral nucleophiles. 1+1=2

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

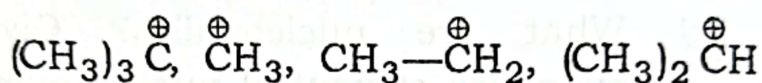
- (a) (i) Define inductive effect. Write the differences between inductive effect and electromeric effect. 1+2=3
- (ii) Define the term 'resonance'. Draw the resonating structure for allyl cation. 1+1=2
- (iii) Classify the following into nucleophiles and electrophiles : 2



- (iv) What is meant by hyper-conjugation? Arrange the following in increasing order of stability and justify your answer : 1+2=3

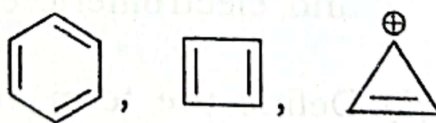


- (b) (i) What are carbocations? Arrange the following in decreasing order of stability : 1+1=2



- (ii) Out of ammonia and ethyl amine, which one is expected to be more basic and why? 2

- (iii) Define the term 'aromaticity'. Classify the following into aromatic/anti-aromatic and give reason also : 1+2=3



- (iv) Explain the terms 'homolysis' and 'heterolysis' taking suitable examples. 3
