



11 Which of the following species is trigonal bipyramidal ?

- (a)  $\text{PCl}_5$ . (b)  $\text{SF}_6$ .  
(c)  $\text{XeF}_2$ . (d)  $\text{CH}_4$ .

12 Fermi energy level for intrinsic semiconductor lies :

- (a) At the middle of band gap. (b) Close to conduction band.  
(c) Close to valence band. (d) None.

(12 × 0.25 = 3 weightage)

II. Answer all *nine* questions. Each question carries a weightage of 1 :

13 State Heisenberg Uncertainty principle.

14 What is black body radiation ?

15 Define Photoelectric effect.

16 What is de Broglie wavelength of an electron with a velocity of  $2 \times 10^7$  m/s ?

17 Write any two postulates of quantum mechanics.

18 Write the Rydberg equation and explain the terms.

19 Draw the potential energy diagram for  $\text{H}_2$  molecule.

20 Mention the type of hybridization in the following compounds :

- (a)  $\text{BH}_3$ . (b)  $\text{CH}_4$ .  
(c)  $\text{PCl}_5$ . (d)  $\text{BeH}_2$ .

21  $\text{SF}_6$  molecule is octahedral in shape. Why ?

(9 × 1 = 9 weightage)

III. Answer any *five* questions. Each question carries a weightage of 2 :

22 What is Sommerfeld's modification of Bohr's atomic model ?

23 Apply quantum mechanics to a particle in one dimensional box.

24 Draw and explain the radial probability distribution curves of 2s and 2p orbitals.

25 Differentiate between bonding and antibonding molecular orbitals. Calculate the bond order of  $\text{O}_2^+$  ion.

26 Draw the MO diagram of CO molecule.

27 Write briefly on band theory of solids.

28 Explain the hybridization in  $\text{IF}_7$ .

(5 × 2 = 10 weightage)

IV. Answer any *two* questions. Each question carries a weightage of 4 :

29 Write the postulates of Bohr theory and derive the Bohr energy equation.

30 What are quantum numbers ? How are they significant ?

31 Compare the VB and MO theories of chemical bonding.

(2 × 4 = 8 weightage)