1. Explain p-type and n-type semiconductor with example.
2. Rationalize the bond lengths of CO (1.128Å) and CO+ (1.115Å) with the help of MO diagram. Explain the ligating behaviour of CO.
3. Assuming X-axis as the bonding axis, predict how many π-MO’s would be formed by d-orbitals of two combining atoms. Give the overlap diagram in each case.
4. Justify the following bond energy and bond length data from MO theory with diagram.

NO NO+ NO─

Bond energy (kJ mol─1) 627 1047 488

Bond length (Å) 1.15 1.06 1.26

1. What is intrinsic and extrinsic semiconductor?
2. Construct MO energy level diagram of HF molecule and discuss on which atom bonding and antibonding electrons are located?
3. Discuss Frenkel and Schottky defects. Discuss the kind of crystal defect observed when ZnO is heated. State the detectable change.
4. MgSO4 is freely soluble in water where as BaSO4 is almost insoluble. On the other hand MnO is 2000 times more soluble then MgO in water.
5. Explain ion-dipole, dipole-dipole, and dipole-induced dipole interactions mentioning one example in each case.
6. The thermal stability of isomorphus sulphates of Ca, Sr, and Ba with respect to decomposition into the metal oxide MO and SO3 increases in the sequence CuSO4< SrSO4<BaSO4 – explain.
7. Construct the MO diagram of Li2, Li3, and Lin molecules and analyze the related properties.
8. Construct the MO diagram of H2O molecule and calculate its bond order.
9. Compare electronic configuration, paramagnetic and ligational behaviour of CO, and NO molecule.
10. Solubility trends of fluorides of alkali metals in water are CsF>RbF>NaF>LiF. But this trend is reverse for iodides.
11. With rough energy level diagram, show the ground state electron configuration of (a) H2─, (b)N2, (c) B2─. Find the bond order in each case.
12. Give ground state MO electronic configuration of ClF, CO, and CS.
13. Which of the molecules are expected to be stabilized by (a) addition of electron, (b) removal of electron? (a) NO, (b) C2, (c) O2, (d) CN. Answer by qualitative MO description.
14. Describe in which of the following combinations of the AOs will result in fruitful overlap and formation of MO (consider z axis as the internuclear axis). (a) (3dz2 +3dyz), (b) (3dyz + 3dxz), (c) (2s + 3dx2 – y2)
15. Show the formation of σ, π, and δ bonds by overlap of appropriate d-orbitals of two identical d-bloc atoms (z-axis as the internuclear axis).
16. The energy required to dissociate one O atom from different dioxygen species are reported as (in kJ mol─1): 623, 494, 351, and 205. Correlate these terms with the species O22─, O2─, O2, and O2+. Explain.
17. HF forms stronger H-bonds than H2O. Still ΔHvap of HF is lower than that of H2O. – Explain.
18. Electron affinity of C2 (341 kJmol─1) is much greater than that of N2 ( ─212 kjmol─1) or O2 (42 kjmol─1) – Explain.
19. How and under what condition an insulator can be converted to semiconductor.
20. Draw the MO of HF and HCL and find HOMO, LUMO and the number of non-bonding electrons.
21. CO and N2 are iso-electronic but they differ greatly in donar properties. – Explain.
22. Explain why liquid oxygen sticks to magnetic pot.
23. Indicate the type of semiconductor (n-type or p-type) expected to form in the following, (i) As doped Ge, (ii) B doped Si.
24. State the change of bond orders with reasons in the following ionization processes; (i) O2 → O2+ + e, (ii) NO+ + e → NO.
25. Which one has a higher bond order, N2 or NO?
26. What is the magnetic character of the anion of KO2?
27. Why N2+ has a longer bond length than N2 but O2+ has a smaller bond length than O2.