Practice Questions 24-05-2022

1. Draw the energy level diagrams to show the splitting of d orbitals in an octahedral and tetrahedral ligand field.
2. Calculate the spin only magnetic moment for a d8 ion in an octahedral and tetrahedral high spin complex.
3. Discuss in detail the vibrational spectrum of a diatomic molecule undergoing simple harmonic motion.
4. Discuss the principle, instrumentation and applications of XPS.
5. Explain the spectrochemical series and briefly give details about high spin and low spin complexes with examples.
6. Discuss in detail about the selection rule for rotational spectrum of a rigid diatomic molecule by invoking a rigid rotor model.
7. Explain why there is a substantial decrease in first ionization energy observed between Na and K and not between Al and Ga.
8. What is screening effect? Calculate the shielding constant and effective nuclear charge for i. 4s electron in Manganese ii. 3d electron in Copper. iii. 2p electron in Scandium
9. The Ionization energy of O_2 is less than that of O_2^+. Explain.
10. Derive Braggs law and give its application
11. Calculate the CFSE for $[FeF_6]^{3-}$ and $[Co(CN)_6]^{3-}$ ions.
12. Give reasons for the following
    a) Ongoing from C to N in the second period, the values of electron affinity decrease instead of increasing.
    b) Ca^{2+}has a smaller ionic radius than K^+
    c) Sr has larger atomic size when compared to Mg.
13. For each of the following coordination complexes, identify if it is paramagnetic or diamagnetic based on magnetic moment values?
    Octahedral-low spin-d4, b. octahedral- high spin-d6, c. tetrahedral- high spin-d7.
14. Calculate the magnetic moment for the following complexes.
    i. $[CoF_6]^{3-}$ ii. $[NiCl_4]^{2-}$ iii. $[Fe\ (CN)_6]^{3-}$ iv. $[Co(H_2O)_6]^{3+}$ v.$[FeCl_4]^-$

15. Discuss in detail about the selection rule for rotational and vibrational spectrum of a diatomic molecule.

16. Explain how Hooke's law is useful in comparing the vibrating bond to the physical model of a vibrating spring system.

17. Explain in detail the influence of electronic environment on the position of signals taking an example (ethanol) in NMR spectroscopy.

18. What is shielding and de-shielding effect in NMR spectra?

19. Compute the Miller Indices for a plane intersecting at x= ¼, y=1, and z=1/2.

20. What do you understand by the term electronegativity? List out the elements from the following the most electropositive and electronegative element. Li, Be, B, C, K and Flourine.

21. What are atomic radii? Give its variation along the period and down the group taking examples. Arrange the following in the increasing order of atomic radii and give reasons: N, S, P and O.

22. What is Polarizability, electron affinity and ionic size? Explain with examples how cationic and anionic size varies along the period and group?

23. What are the different regions of electromagnetic radiations and explain the characteristics?

24. What is the significance of selection rule in spectroscopy? Explain with an example.