# LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**B.Sc.** DEGREE EXAMINATION – **CHEMISTRY**

FIRST SEMESTER – **APRIL 2016**

**CH 1506/CH 1503/CH 1500 – CONCEPTS IN INORGANIC CHEMISTRY**

Date: 03-05-2016 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

PART A

ANSWER ALL QUESTIONS (10 x 2 = 20)

1. If the velocity of the electron is $1.12 \times 10^{8} ms^{-1}$, calculate its wavelength? (mass of electron = $6.66 \times 10^{-31}$kg; h=$6.626 \times 10^{-34}$Js)
2. The ionization energy is abnormally high – why?
3. Among LiF and $CaF_2$, which has higher lattice energy? Why?
4. State Fajan's rule.
5. List the limitations of Octet rule.
6. Sketch the overlapping of (i) *s*-$p_z$ orbitals and (ii) $p_x - p_x$ orbitals (z-axis is the inter nuclear axis).
7. When ice melts, the volume first decreases and then increases – Give reason.
8. What are clathrates? Give examples.
9. Determine the oxidation state of the underlined element in the following:
   (i) K<u>Mn</u>$O_4$ (ii) $\underline{I}O_3^-$
10. How does Lux – Flood concept explain acidity and basicity of oxides?

PART B

ANSWER ANY EIGHT QUESTIONS (8 x 5 = 40)

11. a) Define Pauli's exclusion principle.
    b) Write the possible *l* and *m* values for $3p^1$ electron. (2.5+2.5)
12. a) The size of $Cl^-$ is larger than that of Cl. Why?
    b) Calculate the electronegativity of carbon atom bassed on Allred – Rochow's approach. ($r_C$ (covalent radius) = 0.77 Å). (2.5+2.5)
13. a) Illustrate diagonal relationship with an example.
    b) How do the following properties favour the formation of ionic compounds?
    (i) Ionization Energy (ii) Electron Affinity. (2 + 3)
14. a) List the various factors that affect the lattice energy and explain them.
15. Account for the following:
    a) $PCl_5$ does not obey octet rule.
    b) $BaSO_4$ is insoluble, but $Na_2SO_4$ is soluble.
16. a) Explain the structure of the following, based on VSEPR theory.
    (i) $SF_4$ (ii) $ICl_2^-$
    b) How are δ – molecular orbitals formed? (3 + 2)
17. a) Explain the formation of $F_2$ molecule, with a neat molecular orbital diagram.
    b) What are n-type and p-type semiconductors? Give examples. (3 + 2)
18. What are intra – and inter – molecular hydrogen bonding? Give examples. Illustrate how such types of hydrogen bonding affect the physical properties of a substance.

19. Identify the type of Acid – Base interactions from the following:

| | | |
|---|---|---|
| (a) $NH_4^+ + NH_2^- \rightarrow 2\ NH_3$ | - | (i) Lux – Flood Theory |
| (b) $2POCl_3 \rightarrow OPCl_2^+ + OPCl_4^-$ | - | (ii) Lewis Theory |
| (c) $SiO_2 + H_2O \rightarrow H_2SiO_3$ | - | (iii) Lowry – Bronsted Theory |
| (d) $R_3N + BF_3 \rightarrow R_3NBF_3$ | - | (iv) Usanovich Theory |
| (e) $OH^- + CO_2 \rightarrow HOCO_2^-$ | - | (v) Solvent system Theory. |

20. a) List the advantages of liquid ammonia as solvent.
    b) Na in liquid ammonia is a good reducing agent – substantiate.
21. a) Give two examples each for protic and aprotic solvents.
    b) What are double decomposition reactions? Give examples.
22. Balance the following redox equation, indicating each step clearly:
    $Cr_2O_7^- + Fe^{2+} \rightarrow Cr^{3+} + Fe^{3+}$ (in acidic medium).

PART C

ANSWER ANY FOUR OF THE FOLLOWING (4 x 10 = 40)

23. Write a short note on: (i) Heisenberg uncertainty principle
    (ii) Inert pair effect. (5 + 5)
24. a) Explain the periodic trends of electron affinity and ionic radii.
    b) Explain how Fajan's rule is useful in predicting the melting point and solubility of substances. (5 + 5)
25. What is meant by Born – Haber cycle? What is the underlying principle of this cycle? Explain each step in the cycle with an example.
26. a) Describe the formation of $CH_2=CH_2$, highlighting the type of hybridization involved and its geometry.
    b) On going down from $NH_3$ to $SbH_3$, how does bond angle change? Explain. (5+5)
27. a) Calculate the bond order in $O_2^+$ and $O_2^{2-}$.
    b) How does Band theory explain the conductivity in conductors and insulators? (3+7)
28. a) Write a detailed account on clathrates.
    b) Define double decomposition reactions. Give examples. (7+3)

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