MANIPAL UNIVERSITY

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DEPARTMENT OF SCIENCES, I SEMESTER M.Sc (P/C/M/G))
END SEMESTER EXAMINATIONS, Nov/Dec 2017

Subject: Inorganic chemistry I [CHM 4101]

(REVISED CREDIT SYSTEM-2017)

Time: 3 Hours Date:16.11.2017 MAX. MARKS: 50

Note: (i) Answer all FIVE FULL questions

(ii) Draw diagrams, and write equations wherever necessary

1. A. i) Explain the energy profiles during the formation of H_2 molecule and NaCl compound.

ii) Construct fully labelled Born-Haber cycle for the formation of the following compounds; CaO, CaF_2, Al_2O_3

B. Account for the following;

i) The solubility of silver halides in water decreases from AgF to AgI

ii) Reaction between ionic compounds in aqueous medium is instantaneous while that between organic compounds is slow

iii) BF_3 molecule is trigonal planar whereas the NF_3 molecule is trigonal pyramidal though both contain the same number of atoms

iv) Diamond does not conduct electricity, but graphite does (6+4)

2. A. i) Sketch sigma bonding orbitals that result from the combination of the following orbitals on separate atoms; p_z and p_z, s and p_z, p_z and d_z^2.

ii) Write the molecular orbital configurations and give the bond orders of NO^+, CO & O_2^-. Which of these species should be paramagnetic?

B. Give reasons for the following;

i) Table salt solution conducts electricity, but not the table sugar solution

ii) AlF_3 is predominantly ionic while $AlCl_3$ shows covalent character

iii) $CHCl_3$ is polar while CCl_4 is non-polar

iv) Melting points of ionic solids are higher than those of covalent molecular compounds. (6+4)

3. A. i) Describe the characteristic features and their suitability for gravimetric analysis of any two types of precipitates. Discuss the conditions for the formation of ionic bonding and hydrogen bonding.

ii) The gaseous KCl has the actual dipole moment of 3.336×10^{-29} Cm. The bond length is 2.67×10^{-8} cm. Calculate the dipole moment of KCl if it were completely ionic and also percent ionic character.

iii) Sample of iron in its ore by volumetric analysis gave the percentages 67.48, 67.37, 67.43, and 67.40. Calculate the average deviation and standard deviation.

B. i) What is nitrogen cycle? Explain the in-vitro nitrogen fixation methods.

ii) Why is the basic strength of alkaline earth metal hydroxides increase down the group?

iii) Give reason; Metallic hydrides are less dense than the corresponding metals. (6+4)

4. A. i) What are pyroxene and amphiboles? Explain any two important applications of zeolites.

ii) How do you prepare sulphur nitride and borazine? Explain the structural features of IF_7 and $XeOF_4$.

B. Account for the following;

i) The absorption spectra of lanthanides are sharp lines unlike that of transition metals.

ii) 4f-5d transition is favorable in Ce^{3+}

iii) Lanthanides form fewer complexes with CN^- and CO ligands.

iv) Lower actinides have higher stable oxidation states. (6+4)

5. A. i) Explain the structure of fullerenes, phosphonitrile trimer and pentaborane – 9.

ii) What is lanthanide contraction? What are its consequences?

B. i) What are interhalogens and pseudohalogens? Give an example of each. Why are interhalogens more reactive than corresponding halogens?

ii) Compare the features of alkali and alkaline earth metals on the following

a) Cohesive energy b) Complex formation (6+4)

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