MANIPAL
ACADEMY of HIGHER EDUCATION

DEPARTMENT OF SCIENCES, I SEMESTER M.Sc. (CHEMISTRY)
END SEMESTER EXAMINATIONS, Feb 2021

Subject: Inorganic Chemistry-I, [CHM 5151]

(Choice-Based Credit System, 2020)

Time: 3 Hours Date: Feb 2021 MAX. MARKS: 50

Note: **a)** Answer all five questions. **b)** Write diagrams, equations, or examples wherever necessary.

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1. A. i) What are the properties of an ideal primary standard? What is the importance of each property?

ii) What are the differences between the endpoint and the equivalence point in an acid-base titration?

iii) The dipole moment of HBr is 2.60×10^{-30} Cm and the interatomic spacing is 141 pm. Calculate the percent ionic character of this molecule.

B. Give reasons for the following observations:

i) The C-O bond distances in dimethyl ether, carbon dioxide, and carbon monoxide are 0.14, 0.12, and 0.11 nm, respectively.

ii) The bond angles in H_2O, H_2S, and H_2Se are 104.5, 92.2, and 91.0°, respectively.

iii) The bond enthalpy values of N_2, O_2, and F_2 are 945, 496, and 158 $KJmol^{-1}$, respectively.

iv) The bond order of NO, NO^+, and NO^- are 2.5, 3, and 2, respectively. **(6+4)**

2. A. i) What shape would you predict for the following: NH_4^+, NH_3, NH_2^-?

ii) Why does sodium chloride dissolves nicely in water, but not in octane?

iii) Describe the method of determining the magnetic susceptibility using the Gouy method.

B. Define and illustrate the following terms clearly and concisely:

i) standard solution **ii)** titration **iii)** primary standard **iv)** secondary standard **(6+4)**

3. **A.** i) Compare and contrast the lanthanides and actinides.

ii) Explain the physical significance of Ψ and Ψ^2. Describe the changes in the composition of the solutions as the titration proceeds when a strong acid is titrated with a strong base.

iii) Identify four types of gravimetric precipitates by pointing out similarities and distinctive features.

B. Distinguish a paramagnetic material from a diamagnetic one. How does each behave in a magnetic field? Describe the band theory of metals and explain the electrical conductivity in metals based on this theory. **(6+4)**

4. **A.** i) Describe the following; **a)** The Rock-salt lattice structure **b)** BCC structure in metallic crystals.

ii) Draw a complete, fully labeled Born-Haber cycle for the formation of CaO.

B. Distinguish between the following with illustrative examples;

i) Volumetric and gravimetric methods of analysis

ii) Bonding and antibonding molecular orbitals

iii) Accuracy and precision

iv) Bond energy and bond dissociation energy **(6+4)**

5. **A.** i) Write a technical note on the application of crown ethers in the extraction of alkali and alkaline earth metals.

ii) Explain the structure and bonding in diborane and higher boranes.

iii) The normality of a solution as determined by four separate titrations are found to be 0.2041, 0.2039, 0.2049, and 0.2043. Calculate the median, average deviation, standard deviation, and coefficient of variation.

B. Account for the following;

i) Stability in metals is not attained through the inert gas electronic structure

ii) Metallic bonding becomes gradually stronger from Na $\rightarrow$Mg $\rightarrow$Al

iii) An image in a mirror is a faithful portrayal of the reflected object

iv) Graphite acts as a solid lubricant **(6+4)**

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