B.A./B.Sc. 1st Semester (Batch 2021-24)

CHEMISTRY

(Inorganic Chemistry—I)

Time Allowed—3 Hours]   [Maximum Marks—35

Note :— Attempt *five* questions by selecting at least *one* question from each section, **fifth** question can be attempted from any section. All questions carry equal marks.

SECTION—A

1. (a) Calculate de-Broglie wavelength of an electron moving at 2% speed of light [Given : Mass of electron = 9.1×10^{-31} kg; h = 6.63×10^{-34} kg m^{2}s^{-1}].
2

   (b) Write brief notes on :

   (i) Pauli exclusion principle

   (ii) Heisenberg's uncertainty principle.   5

2. Derive Schrodinger wave equation for hydrogen atom. Also explain the significance of ψ and ψ^2.   7

SECTION—B

3. What is ionization energy ? Give its variation in a period and in a group in the periodic table. Also discuss various factors in detail which affect ionization energy.
7

4. Mention Slater's rules. Calculate the effective nuclear charge for outer electron (4s) of :

   (i) Potassium atom (At. No. = 19)

   (ii) Copper atom (At. No. = 29).   7

SECTION—C

5. Explain the main features of VSEPR theory. Using VSEPR theory, describe the shapes of the following :

   (i) SF$_4$

   (ii) ICl$_2$.   7

6. (a) Calculate the percentage ionic character in HBr molecule. Given electronegativity values of H and Br are 2.1 and 2.8, respectively.   2

   (b) Discuss the limitations of Valence Bond Theory.   2

   (c) Draw MO diagrams of nitrogen molecule. Also calculate its bond order.   3

SECTION—D

7. (a) Write a brief note on radius ratio rules.   3

   (b) Sketch and explain Born-Haber cycle for NaCl(s).   4

8. (a) What are Fajan's rules ? How do they help in deciding the covalent character in a bond ?   5

   (b) Write a brief note on Van der Waals forces.   2