

2025

(NEP—2020)

(1st Semester)

CHEMISTRY (MAJOR/MINOR)

(Inorganic Chemistry—I)

(Revised)

Full Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

Use of Calculator is allowed

(SECTION : A—OBJECTIVE)

(Marks : 10)

Tick (✓) the correct answer in the brackets provided :

1×10=10

1. The maximum number of electrons in a shell with principal quantum number n is

(a) $2n$ ()

(b) n^2 ()

(c) $2n^2$ ()

(d) n ()

2. Which of the following sets of quantum number is feasible?

(a) $n = 2, l = 2, m_l = +2, m_s = +\frac{1}{2}$ ()

(b) $n = 2, l = 1, m_l = +1, m_s = +\frac{1}{2}$ ()

(c) $n = 3, l = 2, m_l = -3, m_s = -\frac{1}{2}$ ()

(d) $n = 3, l = 2, m_l = +2, m_s = 0$ ()

3. What is the main consequence of Hund's rule on electron configuration?

(a) Maximum pairing of electrons ()

(b) Maximum number of unpaired electrons ()

(c) Random distribution of electrons ()

(d) Minimum number of electrons ()

4. The modern periodic law is based on

(a) atomic weight ()

(b) atomic size ()

(c) atomic number ()

(d) mass number ()

5. Which one of the following pairs does not show diagonal relationship?

(a) Li-Mg ()

(b) Be-Al ()

(c) B-Si ()

(d) C-S ()

6. Among the given isoelectronic species, which one is having the smallest ionic radius?

(a) Na^+ ()

(b) Mg^{2+} ()

(c) O^{2-} ()

(d) N^{3-} ()

7. Which of the following compounds is an example of a coordinate covalent bond?

(a) NH_4^+ ()

(b) CH_4 ()

(c) CO_2 ()

(d) H_2O ()

8. Which type of bond is responsible for the high boiling point of water?

- (a) Ionic bond ()
- (b) Covalent bond ()
- (c) Hydrogen bond ()
- (d) van der Waals' bond ()

9. Which of the following reactions is an example of nuclear fusion?

- (a) $^{235}\text{U} + n \rightarrow ^{121}\text{Ba} + ^{92}\text{Kr} + 3n$ ()
- (b) $^2\text{H} + ^3\text{H} \rightarrow ^4\text{He} + n$ ()
- (c) $^{60}\text{Co} \rightarrow ^{60}\text{Ni} + \beta^-$ ()
- (d) $^{238}\text{U} \rightarrow ^{234}\text{Th} + \alpha$ ()

10. The SI unit of radioactivity is

- (a) curie ()
- (b) becquerel ()
- (c) rutherford ()
- (d) gray ()

(SECTION : B—SHORT ANSWERS)

(Marks : 15)

Answer *five* questions, taking at least *one* from each Unit :

3×5=15

UNIT—I

1. Discuss the limitations of Bohr's theory of atomic structure.
2. Explain Pauli's exclusion principle and its significance.

UNIT—II

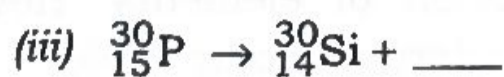
3. What is the relationship between effective nuclear charge and shielding effect?
4. How does atomic radius change across a period and down a group in the periodic table? Explain with examples.

UNIT—III

5. Write a note on covalent character in ionic compounds.
6. What is meant by polarization of ions? What are the factors affecting the polarizing power of a cation?

UNIT—IV

7. What is meant by group displacement law? Give an example.
8. Complete the following nuclear transformations :



(SECTION : C—DESCRIPTIVE)

(Marks : 50)

Answer *five* questions, taking at least *one* from each Unit :

10×5=50

UNIT—I

1. (a) What is meant by radial probability distribution curves? Write the probability distribution curves for 1s, 2s and 2p orbitals. 2+3=5
- (b) Explain briefly the significances of principal quantum number and azimuthal quantum number. 2½+2½=5
2. (a) Write a brief note on Hund's rule of maximum multiplicity. Explain how exchange energy is related to the stability of the half-filled configuration of chromium. 2+3=5
- (b) An electron has a speed of 400 ms⁻¹ accuracy up to 0.002%. What is the uncertainty in locating its position? 5

UNIT—II

3. (a) How does electronic configuration influence periodic properties like atomic radius, ionization energy and electronegativity? Explain with examples. 5
- (b) Explain how electronegativity varies across a period and down a group in the periodic table. Provide examples to illustrate its applications. 5
4. (a) Define ionization energy and explain the factors affecting it. Discuss the periodic trends in ionization energy for s- and p-block elements, highlighting any irregularities. 5
- (b) State the modern periodic law for classification of elements. How many groups and periods are there in the modern periodic table? 5

UNIT—III

5. (a) What is the valence shell electron pair repulsion (VSEPR) theory? Predict the molecular geometry of SF_4 and PCl_5 using VSEPR theory. 5
- (b) Explain Fajans' rule and its significance in understanding the covalent character of ionic compounds. 5
6. (a) Differentiate between ionic and covalent bonds. Write the factors that cause the polarity in covalent bonds. 3+2=5
- (b) What is hybridization? Discuss sp^3 and sp^3d^2 hybridization with suitable examples. 1+4=5

UNIT—IV

7. (a) Define mass defect and nuclear binding energy. How is the binding energy per nucleon related to the nuclear stability? 3+2=5
- (b) What do you mean by half-life and average life periods? The half-life period of radium is 1590 years. After how many years will 1 gram of pure radium be reduced to 100 milligram? 3+2=5
8. (a) Describe the working principle of a nuclear reactor. Explain the differences between fast breeder reactors and thermal reactors. 5
- (b) Discuss the concept of magic numbers and their role in determining the stability of nuclei. 5
