(6 pages) **Reg. No. :** .....

Code No. : 7044 **Sub. Code : ZCHM 12**

M.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2025.

First Semester

Chemistry – Core

FUNDAMENTALS OF INORGANIC CHEMISTRY, NUCLEAR CHEMISTRY AND INORGANIC POLYMERS

(For those who joined in July 2021 – 2022 only)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. The effective nuclear charge for the outermost electron of oxygen atom is

(a) 4.55 (b) 5.35

(c) 6.68 (d) 7.58

2. The electron affinity for the inert gases is

(a) Negative (b) High

(c) Zero (d) Positive

3. Find the molecule having the highest bond order

(a) O_2^+ (b) O_2^-

(c) O_2^{2-} (d) O_2

4. Find the molecule in which the central atom is having one lone pair of electrons

(a) CH_4 (b) PCl_5

(c) H_2O (d) NH_3

5. According to Bronsted-Lowry concept NH_3 is

(a) Proton donor (b) Bronsted acid

(c) Bronsted base (d) Solvent

6. Auto-ionisation of liquid ammonia gives

(a) Ammonia

(b) Amide ion (NH_2^-)

(c) Imide ion (NH^{2-})

(d) Nitride ion (NH^{3-})

7. When ^{235}U is bombarded with one neutron, fission occurs and the products are three neutrons, ^{94}Kr, and

(a) ^{139}Ba (b) ^{141}Ba

(c) ^{132}Ce (d) ^{142}I

8. Radio carbon dating technique is used to estimate the age of

(a) Rocks (b) Minerals

(c) Buildings (d) Fossils

9. Based on Wade's rule, the structure-type of $[B_5H_8]^-$

(a) Closo (b) Nido

(c) Arachno (d) Hypho

10. BCl_3 and NH_4Cl were heated at 140°C to give compound "X", which then treated NaBH4 gave compound Y. X and Y are

(a) $X=B_3N_3H_3Cl_3$, $Y=B_3N_3H_6$

(b) $X=B_3N_3H_9Cl_{13}$, $Y=B_3N_3H_6$

(c) $X=B_3N_3H_9Cl_{13}$, $Y=B_3N_3H_{12}$

(d) $X=B_3N_3C_{16}$, $Y=B_3N_3H_6$

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Give a brief account on electronegativity and its applications.

Or

(b) What are the factors which affects redox potential? Explain.

12. (a) Construct the MO of HF.

Or

(b) Construct Born Haber cycle for NaCl(s). Mention the terms involved.

13. (a) Explain the concept of relative strength of acids and bases.

Or

(b) Write a note on reactions in sulfuric acid.

14. (a) Compare nuclear fusion and fission.

Or

(b) Write a note on radiometric titrations.

15. (a) Discuss about the structure of isopoly anions and heteropoly anions.

Or

(b) Discuss the structure and bonding of $[Re_2Cl_8]^{2-}$ and Re_3Cl_9.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b)

Each answer should not exceed 600 words.

16. (a) What are the different kinds of radii? Explain with examples.

Or

(b) Write a short essay on Chemical forces.

17. (a) Write a note on Bent's rule.

Or

(b) Explain the construction of MO of BeH_2.

18. (a) Define :

(i) Lux flood and Usanovich Acid-base concepts.

(ii) Self-ionization and levelling effect of non-aqueous solvents.

Or

(b) Explain :

(i) Steric and solvation effects.

(ii) Acid-base reactions in non-aqueous solvents.

19. (a) Write an essay on direct nuclear reactions.

Or

(b) Write short notes on :

(i) Radiometric titrations

(ii) Isotopic dilution analysis.

20. (a) Explain the synthesis, structure and bonding of polymeric sulfur nitride compounds.

Or

(b) Write down the structure and bonding in $[Nb_6Cl_{12}]^{2+}$, $[Os_6(CO)_{18})]^{2-}$ and $[Mo_6Cl_8]$ Cl_4.

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