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Reg. No. : .....

Code No. : 5044

Sub. Code : ZCHM 12

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

First Semester

Chemistry – Core

FUNDAMENTALS OF INORGANIC CHEMISTRY,  
NUCLEAR CHEMISTRY AND  
INORGANIC POLYMERS

(For those who joined in July 2021-2022 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Which of the following species has negative electron affinity value?
- (a)  $O_2$                       (b)  $O_2^-$   
(c)  $O_2^{2-}$                       (d) S

2. Which one of the following is the most electronegative element?
- (a) Cl                              (b) Br  
(c) I                                (d) F
3. Methane has a bond angle  $109.5^\circ$ . The percentage of P and S character in hybridisation of methane is respectively
- (a) 75 and 25                      (b) 70 and 30  
(c) 60 and 40                      (d) 50 and 50
4. More electronegative substituent occupy the low electronegativity  $P_z, d_z^2$  orbital in TBP structure. This is known as
- (a) Hybridisation                      (b) Orbital capture  
(c) Ionisation                      (d) Apicophilicity
5. Example of a non ionising solvent is
- (a)  $NH_3$                               (b)  $H_2O$   
(c) HF                                (d) None
6. Which of the following solvent gives blue colour solution with sodium metal?
- (a)  $NH_3$                               (b)  $SO_2$   
(c)  $H_2SO_4$                               (d) None

7. The energy of sun is produced by
- (a) Nuclear fission
  - (b) Nuclear fusion
  - (c) Spallation reaction
  - (d) Pick up and stripping up reaction
8. The average number of neutrons produced during the nuclear fission of  $U^{235}$  is
- (a) 2.5 neutrons
  - (b) 3 neutrons
  - (c) 4 neutrons
  - (d) 1 neutron.
9. Phosphate can be qualitatively analysed using
- (a) Isopoly molybdate
  - (b) Isopoly vanadate
  - (c) Isopoly tungstate
  - (d) Both (a) and (b)
10. Artificial blood vessels can be manufactured from
- (a) phosphazene polymers
  - (b) borazines
  - (c) sulphur nitrilic compounds
  - (d) none

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).  
Each answer should not exceed 250 words.

11. (a) Explain the Slater rules with an example.

Or

- (b) Give any two factors affecting redox potential.

12. (a) What is Bent's rule? Apply Bent's rule to predict the structure of  $PCl_3F_2$ .

Or

- (b) Derive the Born-Landé equation for an ionic compound.

13. (a) Discuss the acid-base concepts of Lux Flood and Usanovich. What are its limitations?

Or

- (b) In the light of HSAB concept explain symbiosis.

14. (a) What is Q value? Explain with an example.

Or

(b) Write a short note on stripping and pick up reaction. Give example.

15. (a) Discuss the structure of Borazine and differentiate it from benzene using its chemical reactions (two reactions)

Or

(b) What are zintl ions? Give examples.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b)  
Each answer should not exceed 600 words.

16. (a) Explain the variation of ionisation potential and ionic radius in the periodic table.

Or

(b) Discuss any two applications of redox potentials.

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17. (a) Discuss the molecular orbital theory of  $\text{BeH}_2$  and  $\text{CO}_2$  molecules.

Or

(b) Apply the Born Haber cycle to calculate the electron affinity of chlorine atom and the lattice energy of  $\text{NaCl}$ .

18. (a) With example explain the following reactions that occur in ammonia.

- (i) Acid base reaction
- (ii) Solvolytic reaction
- (iii) Precipitation reaction
- (iv) Complex formation.

Or

(b) Explain the theory of hardness and softness of acid bases. Give its applications.

19. (a) Explain the mass distribution of fission products using  $^{235}\text{U}$  and  $^{238}\text{U}$  as examples.

Or

- (b) Write a note on :
- (i) Neutron activation analysis
  - (ii) Radiometric titration.

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20. (a) What is Wade's rule? Apply Wade's rule to  $B_4H_{10}$  and  $C_2B_{10}H_{12}$ .

Or

(b) Discuss the structure of  $[Re_2Cl_8]^{2-}$  and  $[Mo_4Cl_8(R_3P)_4]$ .

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