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

Code No. : 7771 **Sub. Code : WCHM 12**

M.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2023.

First Semester

Chemistry — Core

STRUCTURE AND BONDING IN INORGANIC COMPOUNDS

(For those who joined in July 2023 onwards)

Time : Three hours Maximum : 75 marks

PART A — (15 × 1 = 15 marks)

Answer ALL questions.

Choose the correct answer :

1. Methane has a bond angle 109.5^0. 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

2. More electronegative substituent occupy the low electro negativity P_Z, d_z^2 orbital in TBP structures. This is known as ————

   (a) Hybridisation (b) Orbital capture

   (c) Ionisation (d) Apicophilicity.

3. Madelung constant is a measure of

   (a) The summation of all the geometrical interactions

   (b) Ionisation energy

   (c) Electron affinity

   (d) Electro negativity.

4. S_4N_4 has a ———— structure

   (a) Extreme cradle (b) Chair

   (c) Half chair (d) Hexagonal

5. Phosphate can be qualitatively analysed using ————

   (a) isopolymolypdate

   (b) isopolyvanadate

   (c) isopolytungstate

   (d) Both (a) and (b)

6. The enthalpy of formation of an ionic compound can be calculated by means of

(a) Born Haber cycle

(b) Born Lande equation

(c) Kapustinki equation

(d) All the above

7. Radius ratio for square planar symmetry with coordination number 4 is ————

(a) 0.414 – 0.732

(b) 0.225 – 0.414

(c) 0.732 -1.0

(d) Above 1.0

8. Bragg's law is represented by

(a) $\sin\theta = n\lambda/2d$ (b) $\sin\theta = h\lambda/2d$

(c) $n\lambda = 2d\cos\theta$ (d) (a) and (b)

9. Which one of the following crystal type has maximum void?

(a) HCP? (b) FCC

(c) BCC (d) Both (a) and (b)

10. Which of the following crystal has sheet like structure

(a) Cadmium iodide

(b) Zinc blende

(c) Spinels

(d) Both (a) and (c)

11. Which of the following metal oxides do not adopt spinel structure?

(a) CO_3O_4 (b) Fe_3O_4

(c) Mn_3O_4 (d) None

12. For rock salt the radius ratio is

(a) 0.52 (b) 0.414

(c) 0.225 (d) 0.761

13. When silicon is doped with phosphorous we get ————semiconductor

(a) n type (b) p type

(c) n-p type (d) p-n type

14. Which of the following crystal defect is rare?

(a) positive ion absent

(b) extra interstial negative ions

(c) interstial positive ions and electrons

(d) negative ion absent

15. Diamond is an example of ————

(a) Semiconductor

(b) Insulator

(c) Conductor

(d) Super conductor

PART B — (5 × 4 = 20 marks)

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

16. (a) Write a note on Kaputstinski equation.

Or

(b) Using the following data predict why $NaCl_2$ does not occur?

U_0 = −2180 kj/mole

ΔH_{IE1} = +496 kj/mole

ΔH_{IE2} = +4562 kj/mole

$2\Delta H_{EA}$ = −698 kj/mole

ΔH_{ANa} = +108 kj/mole

ΔH_{AC1} = +242 kj/mole

17. (a) Write a note on poly molybdate? Give its analytical applications in chemistry.

Or

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

18. (a) Calculate the void space for hexagonal close packing.

Or

(b) What is a glide plane? Explain it with one example.

19. (a) Illustrate the hydrothermal method of the synthesis with an example.

Or

(b) Most of the super conductors crystallises in Perovskite structure. Explain the Perovskite structure with an example.

20. (a) Colour centres are crystal defects. Discuss.

Or

(b) Differentiate the conductivities of conductor, semiconductor and insulator with the help of band theory of solids.

PART C — (5 × 8 = 40 marks)

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

21. (a) Derive the Born Lande equation for the lattice energy of an ionic compound.

Or

(b) What is Bent's rule? Apply Bent's rule to explain the structure of mixed chloro fluorides $PCl_x F_{5-X}$.

22. (a) Predict the structure of B_4H_{10}, $C_2B_{10}H_{12}$ and B_6H_{10} using Wade's rule.

Or

(b) Explain the structure of main group clusters.

23. (a) Calculate packing fraction of FCC close packing.

Or

(b) Calculate the limiting radius ratio values for tetrahedral and octahedral arrangements.

24. (a) Explain the structural features of Nickel arsenide and rock salt.

Or

(b) Bring out four differences between

(i) Normal spinels and Inverse Spinels

(ii) Fluorite and antifluorite.

25. (a) What are metal excess and deficiency defects? Explain their types with an example.

Or

(b) Discuss the electrical and optical properties of semi conductor devices.
