



Register Number:

Date:

**ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27**  
**M.Sc. ANALYTICAL/ORGANIC CHEMISTRY - I SEMESTER**  
**SEMESTER EXAMINATION: OCTOBER-2021**  
(Examination conducted in Jan-March 2022)  
**CH7121/OCH7121/CH7118/OCH7118: INORGANIC CHEMISTRY - I**

The question paper has four printed pages and three parts.

**Time: 2 ½ hrs**

**Max Marks: 70**

**Part – A**

Answer any **six** questions.

**[6 X 2 = 12]**

1. What are quadrupole bonds? Give an example.
2. What is meant by Goldschmidt correction? Calculate the metallic radius for Cs element using Goldschmidt correction. (Empirical atomic radius of Cs: 265pm, CN:8, relative radius:0.97)
3. Draw the face centred cubic lattice 3D projection representation and convert to the 2D projection representation.
4. Write a note on agostic bond.
5. Arrange the following in the increasing order of acid strength and give reasons.
  - i) (MeO)CH<sub>2</sub>COOH, CH<sub>3</sub>COOH, (MeS)CH<sub>2</sub>COOH.
  - ii) CH<sub>3</sub>COOH, Me<sub>3</sub>CCH<sub>2</sub>COOH, Me<sub>3</sub>SiCH<sub>2</sub>COOH.
6. What is the application of HSAB concept in qualitative analysis? Explain using a suitable example.
7. Give an acid base reaction each in i) molten salt and ii) BrF<sub>3</sub>.
8. How are 'N' and 'C' substituted borazine prepared? Give chemical equations.

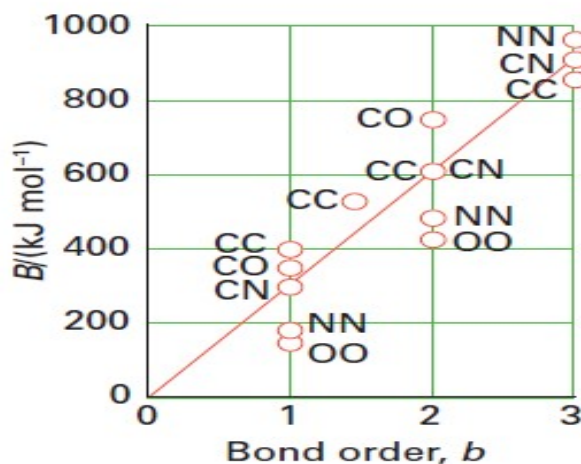
**Part – B**

Answer any **four** questions.

**[12 X 4 =48]**

9.
  - a) Draw the molecular orbital diagram for heteronuclear diatomic molecule CO. Give its i) ground state electron configuration ii) Indicate HOMO and LUMO.
  - b) Discuss the geometry of BeH<sub>2</sub> based on Walsh diagram.

- c) Predict the order of bond enthalpies, bond strength and bond lengths for C—N, C=N, and C≡N bonds using the graph given below. (4+4+4)



10.

- Explain the concept of hypervalence for SF<sub>6</sub> molecule using molecular orbital diagram.
- Discuss the following (i) Schottky defect (ii) Frenkel defect.
- What are Zintl phases? Give an example and identify the position of Zintl phases in the Ketelaar triangle. (4+4+4)

11.

- Calculate the radius of octahedral hole in a cubic closed packed lattice.
- What are solid solutions? Explain types of solid solutions with an example each.
- Sketch the 3D and 2D projection representation of fluorite unit cell structure and discuss the number of ions in the unit cell lattice. (4+4+4)

12.

- What are supercritical fluids? Give two reactions in supercritical fluids.
- What are ionic liquids? How is 1-butyl-3-methylimidazolium hexafluorophosphate synthesized?
- Give the geometrical and Lipscomb's structures of B<sub>6</sub>H<sub>11</sub>.
- What are metallocarboranes? Give a method of preparation. (3+3+3+3)

13.

- Give the structural differences between graphite and diamond.
- Discuss the different types of steric factors governing the acid-base strength.
- Draw the structures of S<sub>4</sub>N<sub>4</sub> and S<sub>4</sub>N<sub>2</sub>.
- What are condensed phosphates? Give the structure of a meta phosphate. (3+3+3+3)

14.

- Which allotropes of sulphur have the following shapes? i) crown ii) chair iii) helical.
- Explain the bonding in cyclophosphazenes.
- What are the different forms of black phosphorus? Draw their structures.
- What are silicates? How are they classified? Give the structure of pyrosilicate. (3+3+3+3)

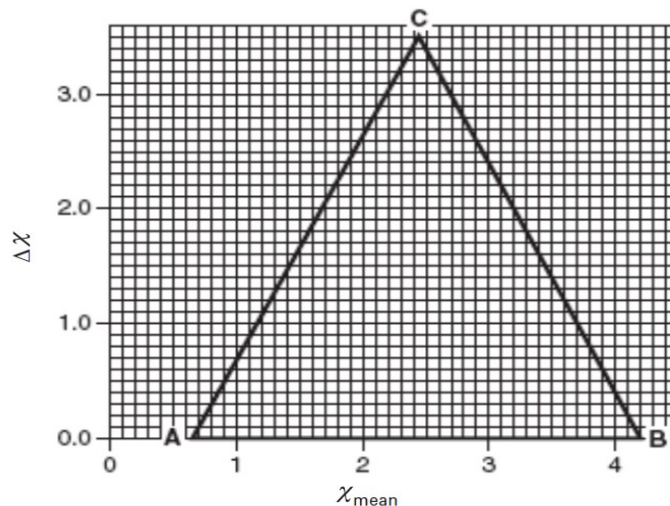
### Part – C

Answer any two questions.

[5 X 2 = 10]

15.

- a) Where the SrO compound will occupy in Ketelaar triangle? The Pauling electronegativity value of strontium is 0.95 and oxygen is 3.44. What type of chemical bonding formed between strontium and oxygen?



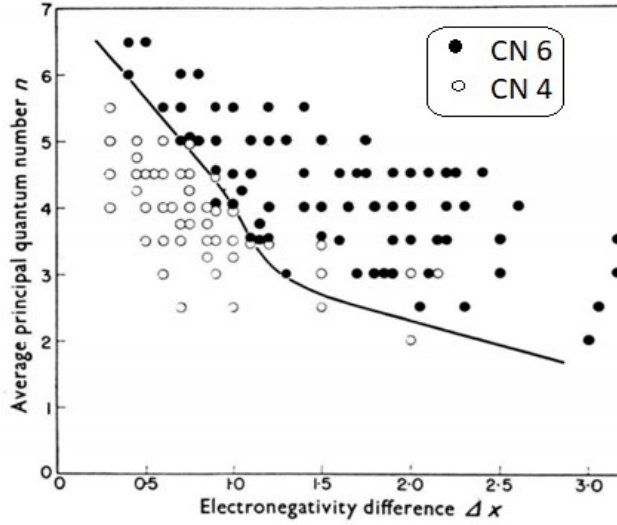
- b) Calculate enthalpy of formation of the reaction between trimethylamine and  $\text{SO}_2$ . Following are the E and C parameters of acid and base.  
 $(\text{CH}_3)_3\text{N}$ ;  $E_b=1.21, C_b=5.61$ ;  $\text{SO}_2$ :  $E_a=0.56, C_a=1.52$ ; All values are in kcal/mol.  
(2+3)

16.

- a) In which direction the following reactions would proceed more? Right or left? Give reason.
- i)  $\text{AsF}_3 + \text{PI}_3 \rightleftharpoons \text{AsI}_3 + \text{PF}_3$
  - ii)  $\text{LiF} + \text{CsI} \rightleftharpoons \text{LiI} + \text{CsF}$
- b) Calculate the number of 2c-2e bonds ( $\alpha$ ) and 3c- 2e bonds ( $\beta$ ) in i)  $\text{B}_{10}\text{H}_{14}$  and  
 ii)  $\text{B}_5\text{H}_{10}^-$   
(2+3)

17.

- a) Use the structure map to predict the coordination numbers of the cations and anions in MgO. Pauling electronegativity for magnesium and oxygen are 1.31 and 3.44 respectively.



- b) The radius of a calcium ion is 99 pm and of an oxide ion is 141 pm. Predict the crystal structure of calcium oxide. (2+3)

Part of the modern PERIODIC TABLE showing atomic (proton) numbers AND the elements's relative atomic mass																		
1 H 1.008																		
3 Li 6.939	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18	
11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95	
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.71	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80	
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (99)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3	
55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 181.0	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)	
87 Fr (223)	88 Ra (226)	89 Ac (227)																

the top number is the atomic or proton number.  
the bottom number is the relative atomic mass.  
(which used to be called the 'atomic weight')