



Register Number:

Date: 5-1-21

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE - 27

M.Sc. CHEMISTRY – I SEMESTER

END-SEMESTER EXAMINATION – January 2021

CH 7118 - INORGANIC CHEMISTRY

Time: 2 ½ hours

Maximum marks: 70

Note: This question paper has four printed pages and three parts and 17 questions. All parts are compulsory.

Part A

Answer any SIX questions from the following.

(2 x 6 = 12 marks)

- 1) Write the Lewis structure of CN. Using formal charge calculation, predict the best structure possible.
- 2) Based on VSEPR theory, predict the shape of PCl_4^+ .
- 3) a) Obtain the formula of a compound in which the element Y forms CCP lattice, and atoms of element X occupy $1/3^{\text{rd}}$ of tetrahedral voids.
b) Obtain the formula of a compound in which the element Y forms CCP lattice, and atoms of element X occupy $2/3^{\text{rd}}$ of octahedral voids.
- 4) What is Goldschmidt correction? Calculate the Goldschmidt correction radius for potassium atom. The atomic radius of potassium is 223 pm. In six-fold coordination factor, the relative radius is given to be 0.96.
- 5) Arrange the following compounds in the order of decreasing acid strength: $(\text{MeS})\text{CH}_2\text{COOH}$, $(\text{MeO})\text{CH}_2\text{COOH}$, CH_3COOH . Give reason.
- 6) Write the resonance structures of S_4N_4 .
- 7) Mention two differences between SWCNT and MWCNT.
- 8) What are ionic liquids? Give an example.

Part B

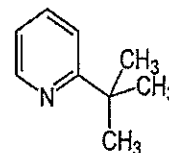
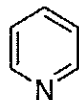
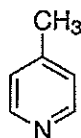
Answer any FOUR questions from the following.

(4 x 12 = 48 marks)

- 9) a) Explain the fluorite structure and give its projection representation.
b) Taking the example of SF_6 , explain the limitations of Valence Bond Theory.

[6 + 6]

- 10) a) Draw the MO diagram for ICl. Write the (i) ground state electronic configuration (ii) HOMO and LUMO.
 b) Explain with diagrams: (i) Schottky defect (ii) Frenkel defect.
 c) Discuss the Walsh approach of geometry of XH_2 type molecule. [4 + 4 + 4]
- 11) a) Calculate the number of ions per formula unit of $NaNO_3$. Estimate the lattice enthalpy of the ionic compound $NaNO_3$ using Kapustinskii equation.
 Given thermochemical radii of $Na^+ = 102$ pm, $NO_3^- = 189$ pm; $d^* = 34.5$ pm;
 $k = 1.21 \times 10^5$ kJ pm mol⁻¹.
 b) Discuss the possibility of formation of substitutional solid solutions in the following examples.
 (i) Cu (atomic radius = 128 pm, CCP) and Ni (atomic radius = 125 pm, CCP)
 (ii) Zn (atomic radius = 137 pm, HCP) and Cu (atomic radius = 128 pm, CCP)
 c) (i) Predict whether zinc forms Zintl phase with Na or with Cu. Give reason.
 (ii) Find the number of atoms per unit cell of zinc blende (ZnS) and obtain its formula unit. [4 + 4 + 4]
- 12) a) Discuss Pearson concept of acids and bases. What is HSAB principle?
 b) Explain the base strength of the following. Arrange them in the increasing order of their base strength.



- c) Compare the reactions of diborane with (i) ammonia (ii) triethylamine. Give the mechanisms. [3 + 4 + 5]
- 13) a) Discuss the structure-property correlations in diamond and graphite.
 b) With a suitable example with equations, give one difference in the chemical property of borazine and benzene.
 c) Explain symbiosis in Lewis acid-base interaction using an example.
 d) Give an acid-base reaction in N_2O_4 with equations. [3 + 3 + 3 + 3]

- 14) a) How are boranes classified? Explain each class of boranes using an example each.
 b) Briefly explain the structure of fullerenes.
 c) White phosphorus catches fire spontaneously in air while red phosphorus does not. Explain based on structural differences.
 d) What are (i) linear phosphazenes (ii) polyhalide ions? Give an example each.

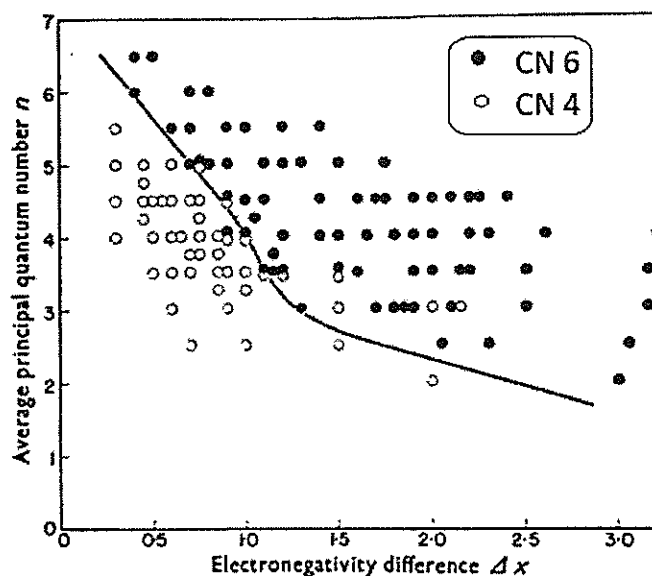
[3 + 3 + 3 + 3]

Part C

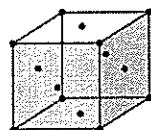
Answer any **TWO** questions from the following. (5 x 2 = 10 marks)

- 15) A borane has seven of 2-centre-2-electron bonds and five of 3-centre-2-electron bonds. What is the molecular formula of the compound? Write its geometrical and Lipscomb's semitopological structures.

- 16) a) Use the structure map to predict the coordination numbers of the cation and anion in (i) LiF (ii) BeO.

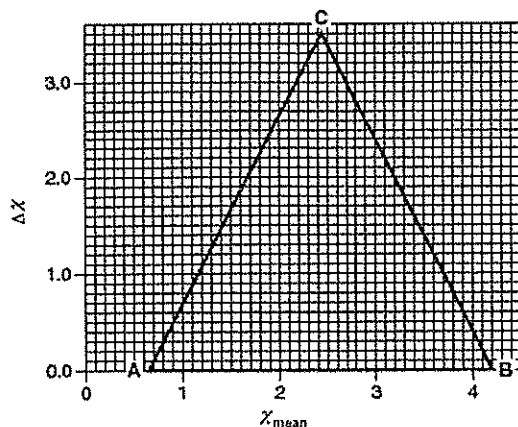


- b) Convert the face centered cubic lattice shown in the below diagram into the projection representation.



[3 + 2]

- 17) a) Find the region where the compound BaO will occupy in Ketelaar triangle. The Pauling value of electronegativity of Ba is 0.89 and O is 3.44. What type of chemical bond is formed between Ba and O?



- b) The donor atoms in $(\text{CH}_3)_2\text{NCH}_2\text{PF}_2$ are N and P. Through which donor atom of this molecule will the following acids form a bond (i) BH_3 (ii) BF_3 ? Give reason.

[3 + 2]

																<table border="1"> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">H</td> </tr> <tr> <td style="text-align: center;">1.008</td> <td></td> </tr> </table>		1	H	1.008																																																																																																																																																																																																																																																																																					
																1	H																																																																																																																																																																																																																																																																																								
1.008																																																																																																																																																																																																																																																																																																									
<p>Part of the modern PERIODIC TABLE showing atomic (proton) numbers AND the elements' relative atomic mass</p>																																																																																																																																																																																																																																																																																																									
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300

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')