U.G. 3rd Semester Examination - 2019

CHEMISTRY

[HONOURS]

Course Code : CHEM(H)CC-06-T

Full Marks : 40 Time : $2\frac{1}{2}$ Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer any **five** questions: 2×5=10

   a) How many atoms are present in the unit cell of end-centred cubic lattice and face-centred cubic lattices?

   b) In which type of stoichiometric crystal defect, the density of the crystal does not change and why?

   c) Give example of molecules or ions with Sp^3d and d^3s hybridizations.

   d) He_2 does not exist– Explain why.

   e) Define lattice energy and hydration energy.

   f) What is Madelung Constant? What is its significance?

   g) Show the type of hybridisation of the core element in $POCl_3$.

   h) Why lithium halides (Licl, LiBr & LiI) do not obey radius ratio rule?

2. Answer any **two** questions: 5×2=10

   a) i) Discuss briefly on the perovskite structure.

      ii) Find out the limiting value of radius ratio for tetrahedral co-ordination. 2+3

   b) Write down the name and formula of important ores of Titanium and nickel. How Titanium metal is purified by Van-Arkel-de Boer process? 2+3

   c) What are intrinsic and extrinsic semiconductors? Using band theory explain the conductivity of metals and semiconductors. 2+3

   d) i) The <HoH bond angle in H_2O molecule is 104.5° whereas <HSH angle in H_2S molecule is 92°— Explain.

      ii) Write a brief account of hydrogen bonding in biological systems. 2+3

3. Answer any **two** questions: 10×2=20

a) i) Draw the molecular orbital diagram of CO and N_2. Then explain why CO acts as a good Π-acidic ligand and stabilize the low oxidation state of the metal atom whereas N_2 does not.

ii) Differentiate between the Zinc blende and Wurtzite structures. (2+2+3)+3

b) i) What type of crystal defect is expected in ZnO on heating?

ii) State and explain the position of lone pair according to Bent's rule.

iii) What are the common ores of uranium? Discuss the methodology for extraction of uranium from one of its ore. 2+2+(2+4)

c) i) What are tetrahedral and octahedral voids?

ii) Explain why electrical conductivity of metal decreases with rise of temperature but the reverse occurs with semiconductors.

iii) Define fluxional molecule and discuss berry pseudorotation with reference to TBP geometry. 3+3+(2+2)

d) i) Calculate the limiting value of radius ratio for an ionic crystalline solid when the co-ordination number is 6.

ii) What is Mond's process?

iii) What type of crystal defect is expected in FeO?

iv) $MfCO_3$ is thermally less stable than $CaCO_3$ – explain with the help of Fajan's rule. 4+2+2+2
