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<u>M.SC.I</u> FCYF605

6th Semester Regular Examination 2016-17 SOLID STATE CHEMISTRY BRANCH(S): Applied Chemistry Time: 3 Hour Max Marks: 70 Q Code:Z416

Question No.1 which is compulsory and any five from the rest The figures in the right hand margin indicate marks.

Q1 Answer the following questions:

(2 x 10)

- a) What are zeolytes? Mention at least two important applications.
- b) A mixed oxide of bivalent barium and tetravalent titanium displays defect crystal structure, leading to an important property. What are the defect structure and the consequence property?
- c) Non-stoichiometry defects are often observed in oxides of metals with a particular property. What is that property?
- d) What kind of three dimensional defects lead to changes in mechanical properties of materials?
- e) 2:3 spinel structures are generally represented by a common type of formula. What is the formula?
- f) 'Atomic Field Microscopy(AFM) is not a very widely used method in the present day'- why?
- g) How do you precisely define a solid state?
- h) Can polymers be good crystals? If not, why not?
- A mixed oxide "AO.^{IV}BO₂ has a specific type of crystal structure. What kind of defect in such a structure leads to an important dielectric property? bput question papers visit http://www.bputonline.com
- j) If the lattice parameter for a cubic crystal is 'a' and the distance between the cation and the anion is a/2, then calculate the value of face diagonal.
- Q2 a) 'An austenite martensite phase transformation is called diffusionless'- (4) Discuss
 - b) How are phase transformations represented? Give two types of such (4) representations with examples.
 - c) Graphite and amorphous carbon are examples of a particular type of (2) transformation at high pressure. What type is this phase transformation?

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| Q3 | 8 a) | Discuss Fick's 1 st law of solid state diffusion, explaining the terms involved. | | | | | |
| | b) | 'Difusivity is strongly is strongly temperature-dependent'- explain. | (3) | | | | |
| | C) | Formation of α - Ag ₂ S from solid Ag metal and molten sulfur follows an orderly reaction'- explain. | (2) | | | | |
| | d) | What kind of mechanistic order is followed in the solid state diffusion mechanism of rusting of iron metal? | (2) | | | | |
| Q4 | la) | On the basis of band theory, qualitatively describe the band picture of a metal, an insulator and a semi-conductor. | | | | | |
| | b) | How many types of extrinsic semi-conduction arise? Explain. | (4) | | | | |
| | c) | What is the probability of occupancy by electrons of an energy level ne | | | | | |
| | | Fermi level at zero Kelvin? bput question papers visit http://www.bputonlin | e.com | | | | |
| Q5 | a) | In a cubic structure of a crystal, the lattice is made up of oxide ions. One eighth of the tetrahedral voids are occupied by A ^{II} cations while one- half of the octahedral voids are occupied by B ^{III} cations. Workout the formula of the oxide and name its crystal structure. | (4) | | | | |
| | b) | Workout the number of atoms per unit cell (APUC) for primitive cubic crystals, using the 'hard sphere model'. | (4) | | | | |
| | c) | Which of the following is/ are close packed arrangement(s)?(i) ABC ABC(ii) AB BA(iii) AB AC(iv) ABC CBC | (2) | | | | |
| Q | 6 a) | Discuss how Schottky and Frenkel defects occur in crystals. How does the bulk density of the crystals change in the above defect structures? | (3+1) | | | | |
| | b) | Give the expressions for the number of defect sites for the above defects taking place in ionic crystals. | (2+2) | | | | |
| | c) | Which kind of primitive cubic structure will have the least Schottky and Frenkel vacancies? | (2) | | | | |
| Q7 | 'a) | What kind of important silicate-glass industries are available? Discuss on any two of them. | (1+3) | | | | |
| | b) | What are the important 'silicate' structures commonly found? Discuss | (3) | | | | |
| | c) | Briefly describe a techno-outline for photo-chromatic glass manufacturer, starting from raw materials, techno-process, finished products, utilities and mechanism of action. | (3) | | | | |
| Q | 3 | Briefly discuss with examples, the principle and working of the following crystal growth methods. | (2.5x4) | | | | |
| | a) | Growth from solutions and wet chemical methods. | | | | | |
| b) Hydrothermal | | Hydrothermal growth Spray- drving and film deposition bput question papers visit http://www.bput | tonline.com | | | | |
| | d) | Crystal purification by r_f heating and zone refining. | refining. | | | | |