Unique Paper Code	:	32177901
Name of the Paper	:	DSE-1 Novel Inorganic Solids
Name of the Course	:	B.Sc.(H) Chemistry
Semester	:	V
Duration	:	3 hours
Maximum Marks	:	75

Instructions for Candidate

Attempt FOUR QUESTIONS in all.
QUESTION NO.1 is compulsory.
All Questions carry equal marks

1. (a) Fill in the blanks:

(i) Germanium (Ge) and Silicon (Si) are the most common examples of …….. type of semiconductors.

(ii) ……..is an appropriate source reagent for the synthesis of solid TiO_2 by the Sol-gel method?

(iii) …….. materials are fluid, but with positional order in at least one dimension.

(iv) ……technique is used to characterize a conductive surface of nanomaterials.

(v) $RbAg_4I_5$ is a good ionic conductor, due to the mobility of the …….. ions.

(vi) ……rule suggests that a temperature of about two-third of the melting point (K) of the lower melting reactant in solids is required to react in a practical time.

(6×1=6)

(b) Answer the following as True or False:

(i) Deuterium lamp is used as a visible radiation source in the visible spectrophotometer.

(ii) H^+ ion is the conducting ion in $CsHSO_4$.

(iii) Graphene is a carbon atom monolayer. It is possible to roll it, but not to wrap it.

(iv) The particle size of dyes is much smaller than pigments.

(v) Due to interactions between molecules, single-molecule magnets stay magnetized even when the magnetic field is turned off.

(vi) Prussian blue pigment imparts color due to charge-transfer transition.

(6×1=6)

(c) Answer the following in short:

(i) Why does increased pressure reduce the conductivity of K^+ in β-alumina more than that of Na^+ in β -alumina?

(ii) How does Pt-Pt bond distance is affected in $K_2Pt(CN)_4$ complex on oxidation?

(iii) Mention the factors on which the ultimate resolution of SEM depends.

(iv) An intercalation reaction is an example of a Topochemical reaction. Explain.

(v) Why $Ba_2Mn_4O_{10}$ does not build up heat as compared to other black pigments?

(vi) Does λ_{max} of sample change within the same solvent but with a difference in

molarity? If so, why?

(1.25+1.25+1.25+1.25+1.25+1.75=6.75)

2. (a) The inclusion of metal in liquid crystals provides extra features to the organic system. Propose and explain a system in which the metal ion confers extra features.
   (b) What are condensates? Explain that DNA condensation is carried out in-vitro either by applying force or by inducing attractive interaction between DNA segments.
   (c) Discuss how Solid Oxide Fuel Cells (SOFCs) work. Also, give its schematic representation.

   (6.25×3=18.75)

3. (a) State the law that relates the angles for the coherent scattering of waves from a crystalline solid. Give a schematic diagram of a powder diffractometer. What is the working principle of the Michelson interferometer?
   (b) What is Peierls distortion? Give its significance in one-dimensional metals.
   (c) Why is $MgAl_2O_4$ Spinel nucleation on MgO and Al_2O_3 considered a topotactic reaction? Explain.

   (6.25×3=18.75)

4. (a) What are the two approaches for the synthesis of nanoparticles? Explain any one method for the synthesis of Gold nanoparticles in detail.
   (b) How does the structure of Zirconia, ZrO_2 support it to function as a solid electrolyte? Discuss in detail.
   (c) Discuss the conduction mechanism of conducting polymer polyacetylene. Also, give its applications.

   (6.25×3=18.75)

5. (a) Describe the reactions that occur during each step of the sol-gel synthesis of inorganic solids utilizing alkoxides as precursors.
   (b) What are refractories? Explain the different types of refractories and their applications.
   (c) Explain the role of matrix and reinforcement in composite materials. Discuss the effect of the environment on various composite materials.

   (6.25×3=18.75)

6. Write short notes on *any three* of the following:
   (a) Inorganic phosphors
   (b) Morphosynthesis
   (c) Ion exchange resins
   (d) Self-assembly

   (6.25×3=18.75)

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