M.Sc. CHEMISTRY
FOURTH SEMESTER
MATERIALS CHEMISTRY & NANOMATERIALS
MSC - 402B

(Use Separate Answer Scripts for Objective & Descriptive)

Duration: 3 hrs. **Full Marks: 70**

[PART-A: Objective]

Time: 20 Min. **Marks : 20**

Choose the correct answer from the following: ***1X20=20***

1. Silicone resins are obtained by blending silicone with
   a. Silicon elastomers b Organic resins
   c. Hydrophobic film d None of the above

2. Water soluble poly (organo phosphazine) with oligo ethylenoxy side chains can be crossed linked by
   a. UV-radiation b IR- radiation
   c. Gamma- radiation d None of the above

3. Decreasing symmetry and lengthening organic substituent in polysilanes
   a. Raises crystalluinity b Lowers crystalinity
   c. Maintains crystalinity d None of the above

4. Phosphazines are organo phosphorus compounds featuring
   a Phosphorus (V) b Phosphorus (IV)
   c Phosphouus (III) d Phosphorus (VI)

5. In siloxanes, Si centres are separated by
   a. Xenon atoms b Oxygen atoms
   c. Phosphous atoms d None of the above

6. Which of the following is corundum structure
   a. A_2O_3 b $BaCl_2$
   c. $Ca(OH)_2$ d NaOH

7. Crystallographic shear planes randomly distributed in the solid are called
   a. Wadesley defects b Frenkel type
   c. Schottky type d None of the above

8. Which of the following is called vacancy defect
   a. Schottky defect b Frenkel type
   c. Screw defects d None of the above

9. A volatile inorganic compound is decomposed above the substrate is called
   a. Chemical vapour deposition b Metallo organic framwork
   c. Solvothermal reaction c None of the above

10. The diffusion of ions in solids is strongly dependent on the presence of
    a. Defects
    b Fuel cell
    c. Minerals
    d None of the above

11. Hydrogen storage material/s is/are
    a. $LiAlH_4$
    b. Nanostructured graphite
    c. Both of the above
    d. None of the above

12. Intense colour of inorganic compounds is due to
    a. d-d transition
    b. Charge transfer
    c. Intervalence charge transfer
    d. All of the above

13. Prussian blue colour of $[Fe(III)]_4[Fe(II)(CN)_6]_3$ is due to
    a. d-d transition
    b. ligand to metal Charge transfer
    c. Charge transfer between two metals
    d. None of the above

14. White pigments are
    a. TiO_2
    b. ZnO
    c. ZnS
    d. All of the above

15. Efficiency of photocatalytic cell can be improved by
    a. Use of dyes
    b. Formation of nanoparticle
    c. Both of the above
    d. None of the above

16. GaN is used in
    a. Luminescent devices
    b. transistors
    c. Both of the above
    d. None of the above

17. Which of the following becomes superconducting below 50 K
    a. Rb_3C_{60}
    b. $CsRb_2C_{60}$
    c. Both of the above
    d. None of the above

18. $(SN)_x$ shows
    a. Liquid crystalline property
    b. Conduction in one direction
    c. Both of the above
    d. None of the above

19. Mesogenic compounds
    a. are organic as well as inorganic
    b. have properties of both solid and liquid
    c. used in displays
    d. All of the above

20. Stabilizers prevent
    a. agglomeration of nanoparticles
    b. Ostwald ripening
    c. Both of the above
    d. None of the above

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PART-B : Descriptive

Time : 2 hrs. 40 min. Marks : 50

[Answer question no.1 & any four (4) from the rest]

1. a. Give a brief account bio-erodable phoszines. **2**

   b. How would you synthesize a sample of the high-temperature superconductor. **2**

   c. Describe synthesis of GaAs. State synthesis of nanoparticle in 'nanovessel'. **3+3=6**

2. a. What are silicones? Give a brief account of the different types of silicones. **4+3+3 =10**

   b. How poly (dimethyl silane) $[(CH_3)_2Si]_x$ was prepared by Charles A Burkhart?

   c. Why polysilanes exhibits photoconductivity?

3. a. What are phosphazines? How are they synthesized? **2+3+3+2 =10**

   b. Give a brief account of the photo elastomers.

   c. How is N-trimethyl borazine obtained?

4. Explain two methods for the synthesis of new materials. **5+5=10**

5. Write short notes on the following **4+3+3 =10**
   a. Chemical deposition
   b. Extended defects
   c. Atoms and ion diffusion

6. a. What are the two types of hydrogen storage materials? In what mechanism these two types of materials store hydrogen. What are the requirements to show good hydrogen storage capacity? **5**

   b. What do you mean by extrinsic and intrinsic semiconductor? What is obtained by exposing solid C_{60} to alkali metal vapour? Write bottom-up approach of gold nanoparticle synthesis. **5**

7. a. Describe plasma synthesis of nanoparticles. Define templated synthesis of nanomaterials. 5

   b. What are the drawbacks of CVD (Chemical vapour deposition) synthesis of nanoparticle? Describe one physical vapour deposition method to synthesize superlattices. 5

8. a. Write definition of mesoporous materials. What are the applications of mesoporous materials? 4

   b. What are the properties of graphene? What are the uses of nanoparticles? 3+3=6

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