2023/06

SET A

M.Sc. CHEMISTRY
FOURTH SEMESTER
MATERIAL CHEMISTRY & NANOMATERIALS
MSC – 402B

[USE OMR FOR OBJECTIVE PART]

Duration: 3 hrs. Full Marks: 70

Objective

Time: 30 min. Marks: 20

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

1. Which of the following is the correct formula for Egyptian Blue Pigment:
   a. $BaCuSi_4O_{10}$ b. $CaCuSi_4O_{10}$
   c. $CoAl_2O_4$ d. Both (a) and (b)

2. Color Television requires cathodoluminescent materials to produce a picture. Which of the following Phosphor are responsible for that:
   a. $ZnS:Ag^+$ b. $ZnS:Cu^+$
   c. $ZnS:Ag^+$, $ZnS:Cu^+$, $ZrVO_4:Eu^{3+}$ d. $ZnS:Ag^+$, $ZnS:Cu^+$, $YVO_4:Eu^{3+}$

3. Hydrogen can be stored which way of the following:
   a. As Compressed gas in high pressure tanks b. As liquid in tanks at -253°C
   c. As solid by either absorbing or reacting with metals or storing in alternate chemical form in a chemical compounds d. All of the above

4. Identify the Following: Copper (II) Chromite and TiO_2 respectively:
   a. White Pigment b. Black Pigment
   c. White Pigment and Black Pigment d. Black Pigment and White Pigment

5. The band gap energies between valance band and conduction band for Si and Ge are respectively:
   a. 1.1eV and 0.72 eV b. 0.72 eV and 1.1 eV
   c. 0.05 eV and 0.72 eV d. 0.01 eV and 0.72 eV

6. How can graphene be obtained?
   a. Chemical vapor deposition b. Exfoliation of bulk graphite
   c. Rubbing a lump of graphite d. All of the above

7. What determines the size of the crystalline particles in inverse micelle synthesis?
   a. The concentration of the nonpolar oil b. The water:surfactant ratio
   c. The reactivity of the nanoparticles d. The size of the immiscible liquids

3. What is the typical source used in CVD for producing graphene?
   a. Mixture CH_4 and H_2
   b. H_2
   c. Cu
   d. Polymer film

9. Which property makes super-lattice nitrides desirable?
   a. High thermal conductivity
   b. Optical transparency
   c. Enhanced hardness
   d. Electrical conductivity

10. Which of the following is not true about mesopourous nanomaterials?
   a. They are three dimensional nanomaterial
   b. They are used as heterogeneous catalyst
   c. They have ordered pore structure
   d. The pore size of the materials is around 100 nm.

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

2. Borazine is called Inorganic Benzene as it
   a. Contains alternate single and double bonds.
   b. Is obtained from benzene.
   c. Is isoelectronic with benzene.
   d. None of the above.

3. Water soluble poly(organo phosphazine) with oligoethylenoxy side chains can be crossed linked by
   a. UV-radition
   b. IR-radition
   c. γ- radition
   d. None of the above.

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

5. In the condensation polymerization,
   a. One or more simple molecules are eliminated
   b. One or more polymers are eliminated
   c. One or more simple molecules are absorbed
   d. None of above

6. Many complex solids can be obtained by direct reaction of the components
   a. At high temperatures
   b. At low temperatures
   c. At high pressure
   d. None of the above

7. Solution methods are extended by using which of the following techniques
   a. Hydrothermal
   b. Isothermal
   c. Isobaric
   d. All of the above

18. Which of the following statement is correct

a. Anion mobility can occur at low temperature

b. Anion mobility can occur at high temperature

c. Zirconium ZrO_2 at low temperature has fluorite structure

d. None of the above

19. Neel temperatures means

a. The temperature of the paramagnetic transition

b. The temperature of the antiferromagnetic transition

c. Both (a) and (b)

d. None of the above

20. Which of the following is not correct statement

a. Complex metal nitrides and oxide nitrides are materials containing the N^{3-} ion

b. Examples of metal nitrides are AlN, GaN and Li_3N

c. Simple metal nitrides can be obtained by the direct reaction of the elements

d. None of the above

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(Descriptive)

Time : 2 hrs. 30 mins. Marks : 50

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

1. a. Write down the significance of "Doping method" in Hydrogen Storage materials? Calculate the mass percentage of any one of the following: (a) $NaAlH_4$ or (b) Na_3AlH_6. 1+1=2

   b. Give two examples of each one dimensional, two dimensional and three dimensional nanomaterials. 3

   c. How is borazine synthesized by Stock and Poland method? 2

   d. Explain about extended defects with one example. 3

2. a. Describe the properties of an ideal photocatalyst for water splitting. 5

   b. Discuss n-type and p-type semiconductor with an example. 3

   c. Write the characteristics of atoms and ions diffusion. 2

3. a. What is the different requirement of a static system that might be used to store hydrogen produced from renewable energy? 4+3+3 =10

   b. Write a short note on fullerides.

   c. Write two significance of Inorganic pigments. Give one example of Inorganic pigment.

4. a. What do you mean by top down and bottom up approaches of nanoparticle synthesis? What is the advantage of bottom up approach over top down approach? 3+3+4 =10

   b. What are the basic steps of nanoparticle synthesis by solution based method? What is drawback of this method and how it can be removed?

   c. What properties of graphene lead to its potential applications in electronic displays and smart windows? What are other different applications of graphene?

5. a. Describe in details the solution based nanoparticle synthesis of gold with chemical equations. **5+2.5+2.5=10**
   b. Explain pulsed laser deposition (PLD) for nanomaterial synthesis.
   c. Discuss chemical vapour deposition synthesis of GaAs semiconductor nanomaterial.

6. a. Define quantum wells. Give one example. **2+3+2+3=10**
   b. What are phosphazines? How are they synthesized?
   c. Give a brief account of the phospho-elastomers?
   d. How is N- trimethyl borazine obtained?

7. a. What are silicones? Name the different types of silicones ? **4+3+3=10**
   b. How are polymethyl silanes $[(CH_3)_2Si]_x$ was prepared by Charles A Burkhard?
   c. Why polysilanes exhibit photoconductivity?

8. How does the new material can be obtained? Explain with chemical reactions. **5+5=10**

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