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CHSE-10T

**M.Sc. (Chemistry) (Semester-II)
Examination, Jan.-June, 2025**

(Regular)

(NEP)

**SOLID STATE AND
NANOMATERIALS CHEMISTRY**

Time Allowed : Three Hours

Maximum Marks : 35

Note : Attempt questions from each section as directed.

Section-A

(Multiple Choice Questions)

Note : Answer the following multiple choice questions :

Q.1. Dislocations present in materials are ____ defects.

- (a) point
- (b) line
- (c) surface
- (d) planar

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(1)

[P.T.O.]

Q.2. Which of the following compounds shows both Schottky and Frenkel defect?

- (a) AgF
- (b) AgBr
- (c) AgCl
- (d) NaCl

Q.3. The energy gap is maximum in :

- (a) Insulators
- (b) Conductor
- (c) Semiconductors
- (d) Superconductors

Q.4. A material that has zero resistance is called :

- (a) Insulator
- (b) Conductor
- (c) Superconductor
- (d) Semiconductor

Q.5. What is the typical size range of nanoparticles?

- (a) 1-100 mm
- (b) 1-100 μm
- (c) 1-100 nm
- (d) 1-100 pm

Q.6. Which of the following is not a characteristic of nanomaterials?

- (a) High surface area to volume ratio
- (b) Reduced reactivity due to large particle size
- (c) Increased strength and hardness compared to bulk materials
- (d) Unique optical, electrical and magnetic properties

Q.7. Which method is commonly used to synthesize metal oxide nanoparticles?

- (a) Ball milling
- (b) Sol-Gel
- (c) Chemical vapour deposition (CVD)
- (d) Plasma arc

Q.8. Identify a method used for characterization of nanoparticles :

- (a) Centrifugation
- (b) Filtration
- (c) Chromatography
- (d) Transmission Electron Microscope (TEM)

Q.9. Which of the following is used for secondary electron detection in SEM?

- (a) Geiger-Muller counter

(b) Everhart-Thomley detector

(c) Refractive index detector

(d) Neutrino detector

Q.10. How can the emitted X-rays be made monochromatic?

(a) Using storage ring

(b) Using cyclotron

(c) Using filters

(d) Using synchrotron

Section-B

(Short Answer Type Questions)

Note: Attempt all questions.

Q.1. Explain Schottky and Frenkel defects with suitable examples.

Q.2. Discuss intrinsic and extrinsic semiconductors.

Q.3. Describe the synthesis of nanoparticles by green routes.

Q.4. Write the applications of nanomaterials in biology

Q.5. Write a short note on metals, semiconductors and insulators.

Section-C

(Long Answer Type Questions)

Note: Attempt all questions.

Q.1. Write short notes on the following :

(a) Perfect and imperfect crystals

(b) Metal excess defects

(c) Metal deficiency defects

(d) Line defects

(e) Colour centres

OR

Discuss the thermodynamics of Schottky and Frenkel defect formation.

Q.2. (a) Describe the classification of materials based on their magnetic properties.

(b) Discuss the band structure of metals, insulators and semiconductors.

OR

(a) Write a short note on optical reflectance and photoelectric effect.

(b) Write a short note on P-N junction and superconductors.

Q.3. (a) What are nanomaterials? Discuss their optical, electrical and magnetic properties.

(b) Write the applications of nanomaterials.

OR

Discuss **any two** methods of synthesis of nanoparticles:

- (i) Sol-Gel
- (ii) Micelle
- (iii) Micro emulsion

Q.4. Describe the principle, instrumentation and applications of Fourier Transform Infrared (FTIR) spectroscopy.

OR

Write notes on **any two** of the following :

- (i) Principle of scanning electron microscope (SEM)
- (ii) Nanosensors
- (iii) Thermogravimetric analysis (TGA)
- (iv) X-ray diffraction (XRD)

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