**Ph.D. COMMON ENTRANCE TEST**

**SUBJECT – NANOTECHNOLOGY**

**Roll No:**

**PART B**

**Duration: 60 minutes Maximum Marks: 50**

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| **Instructions:**   1. **This entrance test question paper is not to be taken out of the examination hall** 2. **Question paper consists of Section A and Section B** 3. **Section A consists of 30 MCQs carrying 1 Mark each. Write the Alphabet of the correct answer in the space given.** 4. **Section B consists of Descriptive questions carrying 5 marks each. Restrict your answer to 500 words. Additional plain sheets have been attached to the question paper to answer Section B** |

**SECTION – A**

**Answer the following questions by writing the Alphabet of the correct answer in the Box given: 30 X 1 = 30**

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|  | Which of the following electromagnetic waves has the maximum frequency.  A. X-Rays  B. Gamma Rays  C. Microwaves  D. Radio waves |
|  | The sky looks blue due to  A. Reflection  B. Refraction  C. Scattering  D. Diffraction |
|  | The origin of resistance in a metal arises because of  A. Movement of free electrons  B. Movement of ions  C. Bombardment of free electrons with the surface of metal  D. Concerntration of free electrons |
|  | Working of a thermocouple is based on the principle of  A. Seebeck effect  B. Peltier effect  C. Thompson effect  D. All the above |
|  | Which among the following materials displays higher magnetic susceptibility?  A. Ferromagnetic material  B. Paramagnetic material  C. Diamagnetic material  D. None of the above |
|  | The Fermi level of an Extrinsic n- type Semiconductor lies  A. Close to the valence band  B. Close to the conduction band  C. Mid-way between the valence and conduction band  D. Does not exist |
|  | Which of the following does not belong in the category of electrochemical cells?  A.Voltaic cell  B. Photovoltaic cell  C. Electrolytic cell  D. Fuel Cell |
|  | Which of the following is a reversible process ?  A. Dissolving of Salt and sugar in water  B. Rusting of iron  C. The decay of organic matter  D. Melting of ice |
|  | Find the correct expression for Gibbs free energy  A. ∆G = ∆H + T ∆S  B. ∆G = ∆H - T ∆S  C. ∆G = T ∆S- ∆H  D. None of the above |
|  | How many atoms are present in each unit cell of an FCC crystal?  A. 2  B. 3  C. 4  D. 6 |
|  | What is the percentage of free space in a BCC unit cell?  A. 26 %  B. 24 %  C. 32 %  D. 68 % |
|  | Twin boundaries belong to which type of crystal defects?  A. Point defect  B. Line defect  C. Surface defect  D. Volume defect |
|  | Which of the nanomaterials exhibit confinement in 2 dimensions?  A. Quantum dot  B. Nanowire  C. 2D sheet  D. Nanosphere |
|  | Which of the following is an example of the Bottom Up approach?  A. Ball milling  B. Etching  C. Exfoliation  D. Chemical vapor deposition |
|  | The color of the gold nanoparticles is  A. Red  B. Orange  C. Yellow  D. Variable |
|  | Which property of nanoparticles provides driving force for diffusion?  A. Optical property  B. Mechanical property  C. High surface to volume ratio  D. There is no such property |
|  | Quantum dots can be used in  A. Crystallography  B. Optoelectronics  C. Mechanics  D. Thermodynamics |
|  | The first lecture about nanotechnology is given by  A. Newton  B. Summerfeld  C. Bohr  D. Rechard Feynman |
|  | Which metal nanoparticles are prepared by chemical reduction method?  A. Gold  B. Silver  C. Platinum  D. Tungsten |
|  | The sol-gel is a \_\_\_ of solid particle  A. Sublimation  B. Melting  C. Colloidal suspension  D. Cool down |
|  | The metal and metal- oxide based nanoparticles are called ----------nanoparticles  A. Organic  B. Inorganic  C. Both A and B  D. None of the above |
|  | The carbon nanotubes, graphene and fullerenes are ------------ based nanoparticles  A. Organic  B. Inorganic  C. Carbon based  D. None of the above |
|  | Which property of Nanomaterials make them suitable to be used for elimination of pollutants?   1. High electrical conductivity 2. Better thermal conductivity 3. Enhanced chemical activity 4. Small size |
|  | The main purpose of CNTs in fuel cells is --------.   1. Production of energy 2. Active medium 3. Catalyst 4. Storage |
|  | Which nanomaterial is used for cutting tools?   1. Fullerene 2. Aerogel 3. Tungsten Carbide 4. Gold |
|  | The wavelength range of X-rays is \_\_\_\_\_\_\_\_\_   1. 1 mm to 700 nm 2. 400 nm to 1 nm 3. 1 nm to 0.001 nm 4. 0.1 m to 1 mm |
|  | The process of using X-rays for identifying atomic structure is called \_\_\_\_\_\_\_\_\_   1. X-ray Radiography 2. X-ray Crystallography 3. X-ray Diagnosis 4. X-ray Fluorescence |
|  | The resolving power of TEM is derived from \_\_\_\_\_\_\_\_\_   1. Electrons 2. Specimens 3. Power 4. None of the above |
|  | Metal which is used for electron beam generation in SEM?  A. Mg  B. W  C. Hg  D. Zn |
|  | Which of the following bonds is the most brittle?  A. Metallic bond  B. Ionic Bond  C. Covalent bond  D. Van der Waals bond |

**Section - B**

**Answer any four questions (Each question carry 5 marks ) 4\*5 = 20**

1. Write three major differences between top-down approach and bottom-up approach for synthesis of nanomaterials. Name two methods under each approach.

2. Draw the resistivity vs. temperature curves for a metal, semiconductor and superconductor.

Why is the resistivity of metal lower than semiconductor?

3. Mention the difference between intrinsic and extrinsic semiconductor with examples. Draw the Fermi levels in n-type and p-type semiconductor.

4. What are X-Rays? Derive Bragg’s law of diffraction

5. What do you mean by nanomaterial? Classify the nanomaterials based on their dimensionality and write one example under each type of nanomaterial.

6. Write down various applications of nanomaterials.

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