



Ph.D. COMMON ENTRANCE TEST - JANUARY 2025

SUBJECT –NANOTECHNOLOGY

PART B

Roll No:

Duration: 60 minutes

Maximum Marks: 50

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

1.	The correct order of electromagnetic radiation in increasing order of wavelength A. microwave < IR < visible < UV B. UV < visible < IR < microwave C. microwave < visible < UV < IR D. IR < visible < UV < microwave	<input type="text"/>
2.	Which of the following causes the vibration of atoms? A. The number of protons contained in a nucleus. B. Electron movement to higher energy levels. C. The molecule's total molecular weight. D. Dipole moments between atoms.	<input type="text"/>
3.	Who is popularly known as father of nanotechnology? A. Richard Feynman B. Gordon E. Moore C. Newton D. Michael Faraday	<input type="text"/>
4.	The creation of nanoscale materials by chemically or physically breaking down the larger materials is known as _____ approach in nanotechnology. A. Top-down B. Bottom-up C. Bottom-down D. None of the above	<input type="text"/>
5.	A crystalline solid: A. changes abruptly from solid to liquid when heated.	

	B. has no definite melting point. C. undergoes deformation of its geometry easily D. has irregular 3-dimensional arrangements	<input type="checkbox"/>
6.	The advantages of quantum dots over molecular fluorophore include A) broad absorption B) sharp emission C) high quantum yield D) All of the above	<input type="checkbox"/>
7.	The color of gold nanoparticles arise from A) Luminescence B) Absorbance C) Fluorescence D) Phosphorescence	<input type="checkbox"/>
8.	A semiconductor whose excitons are confined in all three spatial dimensions is called as _____ a) qubit b) bucky ball c) quantum dot d) dot	<input type="checkbox"/>
9.	Pick an anisotropic nanostructure A. Nanosphere B. Nanorod C. Fullerene D. None of the above	<input type="checkbox"/>
10	Materials with size less than _____ nm is called nanomaterial A. 1000 B. Sub-micrometre C. 100 D. None of the above	<input type="checkbox"/>
11	Pick a more appropriate 1D nanostructure A. Carbon nanotube B. Fullerene C. Graphene D. Graphite	<input type="checkbox"/>
12	Graphene nanoribbons can be produced by unzipping carbon nanotubes. A. True B. False	<input type="checkbox"/>
13	Chemical vapor deposition is used for synthesis of A. Carbon nanotubes B. Graphene C. Fullerene D. Carbin nanotubes and Graphene both	<input type="checkbox"/>
14	Find the top-down approaches A. Ball milling B. Chemical vapor deposition C. Chemical reduction D. None of the above	<input type="checkbox"/>
15	Color of a semiconductor nanoparticle solution depend on a) Light used to observe it	

	b) size of the particle c) shape of particle d) All of them	<input type="checkbox"/>
16	Band gap of the nanomaterials can be determined by A. UV-visible spectroscopy B. FTIR spectroscopy C. Transmission electron microscope D. Atomic force microscope	<input type="checkbox"/>
17	Glass-liquid transition is defined as A. the reversible change to a rubbery or viscous state B. the irreversible change to a rubbery or viscous state C. The transition where glass is soluble in any liquid D. None of the above	<input type="checkbox"/>
18	The glass transition causes changes in the following properties. A. Heat capacity B. Thermal expansion C. Viscosity D. All of the above	<input type="checkbox"/>
19	Choose the correct statements about glass transition temperature (T_g) and melting point (T_m) A. T_g is generally lower than T_m B. T_g applies to amorphous materials, while T_m can apply to both crystalline and semi-crystalline materials C. T_g doesn't involve a phase change, while T_m does D. All of the above	<input type="checkbox"/>
20	Find the correct statement about biodegradable polymers. A. They are environmentally friendly materials. B. These break down under the action of microorganisms or enzymes to produce simple byproducts. C. Both A and B are correct D. None of the above	<input type="checkbox"/>
21	Select the biodegradable polymers. A. Chitosan B. Poly(lactic acid) C. Poly(glycolic acid) D. All of the above	<input type="checkbox"/>
22	Which is true about the XRD. A. It is a destructive technique B. It gives the information about the functional groups C. It gives information about the surface morphology D. It gives information about the crystal structure	<input type="checkbox"/>
23	XRD can be used to analyze A. Crystallite size B. Crystal orientation C. Residual stress D. All of the above	<input type="checkbox"/>
24	Which instrument has the highest resolution A. Optical microscope B. Scanning electron microscope C. Transmission electron microscope	<input type="checkbox"/>

	D. Atomic Force microscope	
25	Differential scanning calorimeter can be used for A. Stability of the material B. To study phase transitions C. Conformational changes in the food proteins D. All of the above	<input type="checkbox"/>
26	Which of the following statements is not true about the Thermogravimetric analysis A. Change of mass as a function of temperature B. Impurities in materials C. Thermal stability of the compound D. It gives the information about the lattice spacing.	<input type="checkbox"/>
27	Electrochemical characterization is used to measure A. Electrochemically active surface area B. Resistance of the materials C. Charge storage in the material D. All the above	<input type="checkbox"/>
28	X-ray Photoelectron Spectroscopy is A. Surface-sensitive technique B. It uses gamma rays as a source C. It gives the binding energy D. A and C are true about XPS	<input type="checkbox"/>
29	X-ray Photoelectron Spectroscopy can determine A. Difference between sulfate and sulfide groups present in the sample B. Measure the oxidation state of the elements C. Identify the elements present D. All of the above	<input type="checkbox"/>
30	Find the correct statement about the Nanoindentation A. It is used to measure mechanical properties on a submicroscopic scale B. It gives information about the surface functional group C. It gives information about the oxidation states of elements D. None of the above	<input type="checkbox"/>

Section - B

Answer any four questions (Each question carry 5 marks)

4*5 = 20

1. Explain the bonding in solids with suitable examples.
2. What is the bandgap of material? Based on bandgap, describe the types of material.
3. Define the glass transition and melting temperature. What is the significance of T_g? Discuss factors affecting T_g.
4. Explain any two techniques in detail.
 - (i) Scanning electron microscopy
 - (ii) Transmission electron microscopy
 - (iii) X-ray photoelectron spectroscopy

5. Explain the principle and working of the chemical vapor deposition (CVD) technique in detail. Discuss the advantages and limitations.
6. Briefly describe any two (i) Schottky and Frenkel defects, (ii) Hydrothermal synthesis, and (iii) Self-cleaning nanocomposites.