Bsc Physic Sem - V

Paper 2 (Quantum mechanics, Nanomaterials and Nanotechnology)

Question Bank

1) State de-Broglie's hypothesis for matter waves. Explain Davission and Germer experiment.
2) What is comptoneffect? On what factors do Compton shift depend?
3) An X-ray photon of initial energy 90 keV under-goes compton
4) scattering at angle of 60º, find energy of recoiled electron.
5) Calculate the de-Broglie wavelength of an electron accelerated through a potential difference of 1.25 kV.
6) How the classical mechanics failed to explain black body radiation spectrum?
7) Give analytical treatment for the formation of wave packet.
8) What is free particle ? Obtain an expression for eigen energy and
9) eigen wave function of free particle in one dimensional box.
10) What is operator ? Obtain an expression for momentum operator.
11) Show that the function f(x) = sin ax is Eigen function corresponding to the operator 22 dx
12) Give physical significance of wave function y.
13) Obtain Schrodinger's time dependent equation.
14) What are the postulates of quantum mechanics?
15) Find the lowest energy of an electron confined to move in one-
16) dimensional potential box of length 5Å.
17) Explain top down approach and bottom up approach for the
18) synthesis of nanomaterials.
19) What are physical and chemical properties of nanomaterials?

20) What would be the surface to volume ratio of a nanosphere of radius 2 nm?
21) Differentiate nanomaterials from bulk materials.
22) What are quantum dots? Enlist their properties.
23) The surface to volume ratio of nanocubes is 0.5 per nanometer.
24) What would be the side length of nanocubes ?
25) What are fullerences? State their properties.
26) What is transmission electron microscopy? Explain the working
27) of TEM with the help of neat diagram. State its dis-advantages.
28) Explain synthesis of nanoparticles by ball milling method.
29) Calculate the FWHM XRD pattern of Ni with crystallite size of 20
30) nm diffracting angle of 38.2º with X-rays of wavelength 1.54 Å.
31) Explain sol-gel method for synthesis of nanomaterials.
32) What are the different methods for determination of size of
33) nanoparticles? State Schever's formula with symbols.
34) How nanotechnology is useful in home appliances?
35) X-rays of wavelength 1.54Å are diffracted from nanoparticles at
36) Diffracting angle 27º with full width at half maxima of 1º. Calculate
37) the size of nanocrystals.
38) State Planck's quantum hypothesis.
39) Define wave packet.
40) An electron has a speed of 300 m/sec accurate to 0.01% with what fundamental accuracy can we locate the position of electron.
41) Define expectation value.
42) If wave function y(x) = e 3x, find eigen value for the operator dx/d
43) What is probability density?
44) What is quantum well?

45) State two examples of two dimensional nanomaterials.
46) If radius of quantum dot is 1.5 pm. Calculate surface to volume ratio.
47) What are the limitations of SEM?
48) What is aero gel ?
49) Convert F.W.H.M. of 0.7 radian into degree.
50) State de-Broglie's hypothesis for matter waves and establish the
51) relation.
52) Calculate the de-Broglie wavelength of an electron accelerated
53) through potential difference of 5 kV. (Given : e = 1.6 × 10–19 c, m
54) = 9.1 × 10–31 kg, h = 6.63 × 10–34 J–S)
55) What is black body radiation ? How has classical mechanics failed
56) to explain it ?
57) An electron and a bullet of mass 150 gms give travel with velocity of 220 m/s, measured to an accuracy of 0.005 %. Calculate and compare uncertainty in position of each.
58) Explain, how Davison and Germer's experiment process the wave nature of particle.
59) Describe the concept of wavepacket.
60) Obtain an expression for eigen function and eigen value for energy of a particle in three dimensional box.
61) Derive Schrodinger's time independent equation for the matter wave.
62) What are non-degenerate and degenerate energy levels ? Explain with examples.
63) Obtain an expression for quantum mechanical operator for linear

64) momentum of a particle.
65) An electron is combined in a one dimensional box of length 1Å.
66) Find the values of momentum and energy for the ground state.
67) State the postulates of quantum mechanics.
68) Explain how the reduction of dimensions 3D, 2D, 1D and 0D
69) materials take place. Explain diagrammatically density of states for
70) 0D, 1D, 2D and bulk materials.
71) What are the induced effects due to increase in surface area of
72) nanoparticles?
73) What would be the surface to volume ratio of a nanosphere of
74) radius 2 nm ?
75) Explain various morphologies of nanomaterials with examples
76) Explain top down approach for synthesis of nanomaterials.
77) The surface to volume ratio of a nanocube is 1.5/nm. Calculate the side length of a nanocube.
78) Explain optical and electrical properties of nanomaterials.
79) Explain the construction and working of Transmission Electron
80) Microscope (TEM).