Engg. Physics

Question Bank

Q1. Give the qualitative analysis of band theory of solids and hence make a distinction between conduction and insulation

Q2. Drive an expression for Fermi energy at absolute zero. How Fermi energy does depend on temperature?

Q3. Show that the total energy of a three dimensional gas of N free electron at 0K is $E_0 = 3/5 NE_{F(0)}$

Q4. Give band theory of insulators. Hence show that the Fermi level of an insulator lies exactly at the middle of the forbidden gap.

Q5. What do you mean by intrinsic and extrinsic semi-conductor? Is the location of Fermi level temperature dependent?

Q6. Obtain an expression for the intrinsic carrier concentration in an intrinsic semi-conductor. Under what condition will Fermi –level be in the middle of the forbidden gap?

Q7. What do you mean by Nano materials? Discuss the properties of metallic and semiconducting nanomaterial.

Q8. Describe two methods for synthesis of Nano materials.

Q9. What do you mean by C_{60} Bucky ball? How was it discovered? Discuss its electrical properties.

Q11. How does an electrical property changes if we doped with potassium?

Q12. Describe two methods for fabrication of carbon Nano tubes.

Q13 Describe the properties and uses of carbon nanotubes.

Q14. What do mean by superconductivity? What are chief characteristics of superconducting state?

Q15. What are superconductors? Explain the effect of magnetic field on superconductors.

Q16. What is Meissner effect? Distinguish between type I and type II superconductors.

Q17. Give a quantitative explanation of BCS theory of superconductors? How does this theory explain chief characteristics of superconductor?

Q.18 Derive Maxwell's equations. Explain the physical significance of each equation.

Q.19 Define Poynting vector. Derive an expression for it and explain its physical significance for electromagnetic wave in free space.

Q.20 (a) Write Maxwell's equations in differential and integral forms and explain their physical significance

(b) Derive expression for speed of light in free space.

Q.21 Deduce the equation for the propagation for the plane electromagnetic wave in free space. Show that the electric and magnetic vectors are normal to the direction of propagation of wave.

Q22.What do you mean by superconductivity?

Q23. What are the chief characteristics of superconducting state?

Q24. Give an account of the phenomenon of superconductivity. What are the electrical and magnetic properties of superconductors? How they have been explained

Q25. What is Meissner effect? Explain.

Q26. Describe briefly electrical, magnetic, thermal, and optical properties of superconductors.

Q27 What are type Iand type II superconductors? Explain what theoretical attempts have been made to explain the phenomenon.

Q28. What is the penetration depth of magnetic field for superconductors?

Q29. What is the significance of critical temperature, critical magnetic field and critical current density for superconductors?

Q30. Give a quantitative explanation of BCS theory of superconductors. How does this theory explain chief characteristics of superconductors?

Q31. A superconducting tin has a critical temperature of 3.7 K at zero magnetic field and a critical magnetic field 0.0306 tesla at 0K.Find the critical magnetic field at 2K

Q32. The critical field of a lead superconductor at 5K is 3.3x104 Am-1. If critical temperature of lead is 7.2k, what is its critical field at 0K?

Q33.The penetration depth of mercury at 3.5K is about 750A0 .What will be the penetration depth at 0K? For mercury critical temperature Tc=4.2K

Q34   what do you mean by nonmaterial? Discuss the properties of metallic and semi conducting nonmaterial.

Q35 What do you mean by nanoparticales?

Q36 Why does the colour of nanoparticales depend on the size of the cluster?

Q37 Describe two methods for synthesis of nanoparticales

Q38 What do mean by C60 bucky ball?

Q39 How was bucky ball discovered?

Q40 Discuss the electrical property of bucky ball. How an electrical property does changes if it is doped with potassium?

Q41 Explain the structure of C60 bucky ball .How can it be made superconducting?

Q42 Describe two methods for fabrication of carbon nanotubes.

Q43. Describe bucky balls and their properties and its uses

Q44. Describe the properties and use of carbon nanotubes.

Q45.Discus various application of nanotechnology.

Q46. How does the resistance of carbon nanotubes depend on temperature?

Q47. How does the frequency of vibration of carbon nanotube depend on its sizes

Q48.Discuss Langevin's theory of diamagnetism. Show that the diamagnetic susceptibility is negative and independent of temperature and field strength.

Q49.Explain diamagnetism, paramagnetism and ferromagnetism on the basis of magnetic domains of the atom?

Q50. Explain ferromagnetism. What is hysteresis? Show that hysteresis loss equals to area of loop.

Q51. Discuss the nature of magnetic fields in magnetic materials. Describe Langevin's theory of paramagnetism.

Q52. What is meant by 'Hysteresis' ? Explain hysteresis loss . How would you use hysteresis curve to select material for construction of permanent magnets?

Q53. Discuss Langevin's theory of diamagnetism and show that diamagnetic susceptibility is independent of temperature.

Q54. What are diamagnetic, paramagnetic and ferromagnetic substances? Define magnetic permeability and magnetic susceptibility and establish the $B = \mu_0 \, (H + M)$.

Q55. Discuss Langevin's theory of paramagnetism in a gas.

Q56. What do you understand by magnetisation, permeability and susceptibility of a magnetic substance?

Q57. What is hysteresis curve? Explain residual magnetism and coercive force.

Q58. What is Curie temperature? It is unique for all substances?

Q59. Which material is suitable for magnetic shielding ?

Q60. What is hysteresis ? What does the area of hysteresis curve represent?

Q61. A bar-magnetic has a coercivity of 5×10^3 ampere/metre. It is desired to demagnetise it by inserting it inside a solenoid 10 cm long and having 50 turns. What current should be sent through the solenoid?

Q62. The magnetic susceptibility of medium is 9.48×10^{-9}. Calculate the relative permeability.

Q63. Does dielectric constant depend on frequency? Explain.

Q64. What is meant by dielectric loss? Derive expression for it.

Q65. Explain the mechanism contributing to dielectric polarisation. Discuss the behaviour of dielectric in an alternating field.

Q66. Explain the behaviour of a dielectric in an a.c. field and discuss the dielectric losses.