DA-003-001602 Seat No. _____

B. Sc. (Sem. VI) (CBCS) Examination

April / May – 2015

Statistical Mechanics, Solids State Physics & Plasma Physics : Paper-602

Faculty Code : 003
Subject Code : 001602

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

1 Multiple choice questions : (1 mark each) **20**

(1) The minimum volume of a phase cell is _____.

(A) h (B) h^2

(C) h^3 (D) h^4

(2) Electrons are _____.

(A) Bosons

(B) Fermions

(C) Neutral Particles

(D) Positively charged particles

(3) Fermi Dirac distribution is given by

(A) $ni = \frac{gi}{e^{\alpha+\beta\varepsilon i}}$ (B) $ni = \frac{gi}{e^{\alpha+\beta\varepsilon i}+1}$

(C) $ni = \frac{gi}{e^{\alpha+\beta\varepsilon i}-1}$ (D) None of these

(4) According to Heisenberg's uncertainty principle

(A) $\Delta x \cdot \Delta p = 2h^2$ (B) $\Delta x \cdot \Delta p = h^2$

(C) $\Delta x \cdot \Delta p = h$ (D) $\Delta x \cdot \Delta p = 2h$

(5) A superconductor is a perfect _____ material.

(A) ferromagnetic (B) paramagnetic

(C) diamagnetic (D) none of these

(6) Cooper pair of electrons effectively _____.

(A) repel each other

(B) attract each other

(C) neither attract nor repel

(D) none of these

(7) Expulsion of magnetic field below T_c in a super-conductor is known as

(A) Joule effect (B) Thomson effect

(C) Peltier effect (D) Meissner effect

(8) The production of current, when two superconductors are joined by an insulator is known

(A) Meissner effect

(B) Josephson effect

(C) Peltier effect

(D) Thomson effect

(9) Emission of visible light when X-rays or UV rays are incident on a layer of materials such as Zns:Cu where a potential difference is applied is known as _____.

(A) photoluminescence

(B) electroluminescence

(C) photoelectric effect

(D) none of these

(10) Photoconductivity per unit excitation intensity is known as _____.

(A) photoconductance

(B) photoluminescence

(C) photosensitivity

(D) none of these

(11) When a system absorbs energy in one or the other form, a part of it may be re-emitted. This phenomenon is known as

(A) luminescence (B) photosensitivity

(C) photo conduction (D) none of these

(12) Luminescence in sulphide phosphors can be explained by a model based on _____.

(A) electron theory

(B) hole migration theory

(C) recombination theory

(D) none of these

(13) A type-II superconductor has _____ critical magnetic fields.

(A) one (B) two

(C) zero (D) none of these

(14) Luminescent solid crystals are also known as

(A) Phosphors (B) Sulphides

(C) Nitrides (D) None of these

(15) The ordered arrangement of molecules in the liquid crystalline state is due to _____

(A) weak van der Waals' forces

(B) strong van der Waals' forces

(C) covalent forces

(D) ionic forces

(16) In Lyotropic liquid crystals the molecular ordering changes with change in _____.

(A) concentration

(B) electric field

(C) temperature

(D) pressure

(17) When impurity is added to plasma, its conductivity _____.

(A) remains constant (B) decreases

(C) increases (D) none of these

(18) The nature of plasma is mostly _____.

(A) paramagnetic

(B) ferromagnetic

(C) antiferromagnetic

(D) diamagnetic

(19) The temperature at which a liquid crystal is converted into an isotropic liquid is known as _____.

(A) melting point

(B) solidification point

(C) transparency temperature

(D) critical temperature

(20) Nematic liquid crystals have _____ like molecules.

(A) sphere (B) circle

(C) square (D) rod

2 (a) Answer any three : (2 marks each) **6**

(1) Write a note on phase space.

(2) What are Bosons ? Write two properties of Bosons.

(3) What is Meissner effect ?

(4) Explain the concept of division of phase space.

(5) What are liquid crystals ?

(6) Discuss the wave and particle property of X-rays.

(b) Answer any three : (3 marks each) **9**

(1) Distinguish between Bose-Einstein statistics and Fermi-Dirac statistics.

(2) Write a note on electroluminescence.

(3) Write a note on Cooper pairs.

(4) What is Josephson effect ?

(5) Explain any one method of production of plasma.

(6) Explain thermodynamic probability.

(c) Answer any two : (5 marks each) **10**

(1) Starting with the basic postulates derive Fermi-Dirac statistics.

(2) What is luminescence ? Explain the model of luminescence (hole migration theory) in sulphide phosphors activated by monovalent impurities like Ag.

(3) Write a note on plasma radiations.

(4) Explain Laue method of X-ray diffraction.

(5) Write a note on the applications of liquid crystals.

3 (a) Answer any three : (2 marks each) **6**

(1) Write a note on superconductivity.

(2) What are Fermions ? Write two of their properties.

(3) Derive Dulong and Petit's law for the specific heat of solids.

(4) Define plasma as a state of matter.

(5) What is thermal pinch effect ?

(6) Explain the change in heat capacity in superconducting state.

(b) Answer any three : (3 marks each) **9**

(1) Derive an expression for volume in phase space.

(2) Describe the electrical conductivity of plasma.

(3) Define photosensitivity and derive an expression for it.

(4) Explain the process of excitation and ionization of plasma.

(5) Explain three applications of superconductivity.

(6) Explain the influence of external agents on superconductivity.

(c) Answer any two : (5 marks each) **10**

(1) Derive Einstein's equation for the specific heat of solids.

(2) Derive the equation for plasma frequency.

(3) Derive Planck's radiation law and deduce the classical laws from it.

(4) Write a note on Cholesteric liquid crystals.

(5) Explain the powder crystal method of X-ray diffraction.
