SOLID STATE PHYSICS-XIII

MCQ

1. If the lattice contains a small group of points, called **……..**
   A) **Pattern unit**
   B) Single unit
   C) Multiple unit
   D) None of above
2. …… translation vectors which produce a translation operation containing integral coefficients are called primitive translation vectors.

   A) $R' = R + 1/2\ a_2 + 1/2b_2$
   B) **$R' = R + T = R + 0a_1 + 1b_1$**
   C) $R' = R + 1/2\ a_2 + 1/2a_2$
   D) $R' = R + 3/2\ a_2 + 3/2b_2$
3. …… translation vectors which produce a translation operation containing non integral coefficients are called primitive translation vectors.
   A) **$R' = R + 1/2\ a_2 + 1/2b_2$**
   B) $R' = R + T = R + 0a_1 + 1b_1$
   C) $R' = R + 1/2\ a_2 + 1/2a_2$
   D) $R' = R + 3/2\ a_2 + 3/2b_2$
4. A unit cell may be defined as the …….. unit of the lattice which, on continuous repetition, generates the complete lattice.
   A) Biggest
   B) Single unit
   C) Multiple unit
   D) **Smallest**
5. All the lattice points belonging to a …….. cell lie at its corners.
   A) **Primitive**
   B) Non Primitive
   C) Single
   D) Multiple
6. All the lattice points belonging to a …….. cell lie at its corners as will as other locations.
   A) Primitive
   B) **Non Primitive**
   C) Single
   D) Multiple

7. The smallest volume enclosed by the normal is the required primitive cell. Such a cell is called ……

   A) Wigner-Seitz cell

   B) Unit cell

   C) Non Primitive cell

   D) Primitive cell

8. A lattice combined with a basis generates the …… structure.

   A) Lattice

   B) Crystal

   C) Basis

   D) All of Above

9. Crystal structure is mathematically expressed as ……..

   A) Lattice + Basis = Crystal structure

   B) Lattice + Unit = Crystal structure

   C) Basis + Basis = Crystal structure

   D) Lattice + Lattice = Crystal structure

10. Copper is an example of monoatomic …….. cubic structure.

    A) Body Centre

    B) Hexagonal Closed Pack

    C) Face Centre

    D) Non of Above

11. The number of space lattices possible is only …….

    A) Ten

    B) Fourteen

    C) Six

    D) Eight

12. A symmetry operation is that which transforms the …….to itself.

    A) Lattice

    B) Crystal

    C) Basis

    D) Non of above

13. The ……. operation applies to lattices only.

A) Reflection

B) Rotation

C) Translation

D) Inversion

14. The lattice always remains invariant by a rotation of ……

A) 8π

B) 2π

C) 3π

D) 5π

15. In rotation symmetry operations minimum rotation of angle is ……°.

A) 50

B) 60

C) 70

D) 80

16. The lattice which divides it into two identical halves which are mirror images of each other called as …….

A) Rotation

B) Reflection

C) Inversion

D) Translation

17. Inversion is a point operation which is applicable to ……..lattices only.

A) one-dimensional

B) two-dimensional

C) three-dimensional

D) four-dimensional

18. The group of rotations, inversion and reflection symmetry operations at a point is called as ……..

A) Point Group

B) Space Group

C) Single Group

D) Multiple Group

19. How many different point group operations in two dimensions lattice.

A) 20

B) 32

C) 10

D) 12

20. There are a total of …….. point groups in a three-dimensional lattice.

A) 20

B) 32

C) 10

D) 12

21. Three Dimensional Bravais lattices further become parts ……. distinct crystal systems.

A) 10

B) 12

C) 7

D) 5

22. ……, is defined as the ratio of the volume occupied by the atoms present in a unit cell to the total volume of the unit cell.

A) The packing fraction

B) The Coordination number

C) Unit cell

D) Molecular Space

23. How many atoms present in body centre cubic structure.

A) 4

B) 1

C) 2

D) 8

24. How many atoms present in Face centre cubic structure.

A) 5

B) 4

C) 3

D) 1

25. Pair of atoms which is capable of forming a stable ……..bond in the solid state.

A) Chemical

B) Ionic

C) Physical

D) Covalent

26. Potential energy of the system may be arbitrarily taken as ……..

A) One

B) Two

C) Zero

D) Three

27. ……, as in NaCl transfer of valence electrons.

A) Ionic bond

B) Covalent bond

C) Metallic bond

D) Hydrogen bond

28. …….. bonds are called Primary bonds.

A) Ionic

B) Covalent

C) Metallic

D) All of Above

29. The source of cohesive energy which binds the ions together is mainly the……...

A) coulombs electrostatic interaction

B) energy interaction

C) coulombs attraction

D) None of above

30. ……. Ions cannot continuously approach each other under coulomb attracton on account of the exclusion principle.

A) One

B) Two

C) Four

D) Five

31. The cohesive energy of the ionic crystals is of the order of ….. to …… eV.

A) 5, 20

B) 5,10

C) 8,9

D) 10,20

32. In ionic crystals have large binding energy and exhibit ……. Melting and boiling point.

A) Low

B) Minimum

C) High

D) Small

33. A …….. bond is formed by an equal sharing of electrons between two neighbouring atoms each having incomplete outermost shell.

A) Ionic

B) Covalent

C) Metallic

D) Hydrogen

34. The participating atoms attract each other and a ……..is formed.

A) covalent bond

B) Ionic

C) Metallic

D) Hydrogen

35. The number of covalent bonds an atom can form is determined by ……..

A) 5-N rule

B) 6-N rule

C) 8-N rule

D) None of above

36. The metallic bond is …… than ionic or covalent bond.

A) Stronger

B) Weeker

C) Very strong

D) None of above

37. The metallic bonds binding energy ranges from ……. To …… eV.

A) 5, 20

B) 1,5

C) 8,9

D) 10,20

38. The energy released during the formation of van der Waals bond is of the order of …… eV per bond only.

A) 1

B) 0.1

C) 2

D) 0.2

39. The ……..types of bonding exists in atoms or molecules which have there outermost shells completely filled and hence have no tendency to gain, lose or share valence electrons with other atoms or molecules in the solid.

A) covalent bond

B) Ionic

C) Metallic

D) van der Waals

40. …… bonds are stronger than van der Waals bonds but weeker than ionic or covalent bonds.

A) covalent

B) Ionic

C) Metallic

D) Hydrogen

41. …… is equation of Braggs law.

A) $2d \sin \theta = n\lambda$

B) $2d \sin \theta = n$

C) $d \sin \theta = n\lambda$

D) $8d \sin \theta = n\lambda$

42. The ……. Method is mostly used to determine the crystal symmetry.

A) Powder diffraction

B) Rotating crystal

C) Laue's

D) Bragg's

43. A Photographic film is attached at the inner …….surface of the cylinder.

A) Circular

B) Rectangular

C) Square

D) Non of above

44. The symmetry of pattern helps to determine the shape of the ……

A) unit cell

B) Single cell

C) Multiple cell

D) All of above

45. …….. molecule is produced because of the formation of covalent bonds between oxygen atom and two hydrogen atoms.

A) Sodium Chloride

B) Water

C) Silicon

D) Germanium

46. The structure of …… is a good manifestation of the directional properties of covalent bonds.

A) Germanium

B) Silicon

C) Diamond

D) Water

47. The actual structure of sodium metal is …….

A) Face centre cubic

B) Body centre cubic

C) Simple cubic

D) Hexagonal cubic

48. The binding energy of water or ice is ……..

A) 0.1 eV

B) 0.5 eV

C) 10 eV

D) 5 eV

49. The specific heat of substance is defined as the heat required to raise the ……of one gram molecule of the substance through 1^0C

A) Pressure

B) Temperature

C) Heat

D) Volume

50. According to the first law of thermodynamics, the heat added to a system is used up in how many ways?

A) Five

B) One

C) Three

D) Two

51. Which of the correct formula of specific heat of substance.

A. $C = \frac{dF}{dT}$

B. $C = \frac{dQ}{dS}$

C. $C = \frac{dQ}{dV}$

D. $\boldsymbol{C = \frac{dQ}{dT}}$

52. The first contribution arises from the atomic vibrations and may be called the……..

A) lattice specific heat

B) lattice specific gas

C) lattice specific temperature

D) Non of above

53. In general, the specific heat of solid may be expressed as

A) $C_{solid} = C_{lattice} + C_{electric}$

B) $C_{solid} = C_{vibration} + C_{electric}$

C) $C_{solid} = C_{rotation} + C_{electric}$

D) $C_{solid} = C_{inversion} + C_{electric}$

54. Crystal consists of atoms which are arranged in a ……manner and are bound together by strong binding forces.

A) Irregular

B) Periodic

C) Non Periodic

D) All of above

55. The effect of imparting thermal energy to a solid is to increase the ……..in the form of vibrational energy of these harmonic oscillators.

A) External energy

B) Atomic energy

C) Internal energy

D) Molecular energy

56. According to the classical theory, the molar heat capacity of all the solids in constant and is independent of temperature and frequency this called as ……

A) Law of kinetic energy

B) Internal energy

C) Dulong and Petit's Law

D) Non of above

57. Einstein retained all the assumptions of the classical theory as such except replacing the ……. oscillators to …… oscillators.

A) Quantum harmonic, Classical harmonic

B) Classical harmonic, Quantum harmonic

C) Both A and B

D) Non of above

58. The vibrational energy is distributed equally among all the …… degrees of freedom.

A) Two

B) One

C) Three

D) Four

59. The total vibrational energy of a crystal containing N identical atoms or 3N one dimensional harmonic oscillators becomes.

A) $E=3NK_BT$

B) $E=5NK_BT$

C) $E=2NK_BT$

D) $E=NK_BT$

60. The Einstein temperature defined by equation.

A) $\theta E = \frac{\hbar\omega 1}{KB}$

B) $\theta E = \frac{\hbar\omega 2}{KB}$

C) $\boldsymbol{\theta E = \frac{\hbar\omega 0}{KB}}$

D) $\theta E = \frac{\hbar\omega 3}{KB}$

61. Debye temperature defined as

A) $\boldsymbol{\theta D = \frac{hVD}{KB}}$

B) $\theta D = \frac{\hbar\omega 3}{KB}$

C) $\theta E = \frac{\hbar\omega 3}{KBT}$

D) $\theta E = \frac{\hbar\omega}{KBT}$

62. In low temperature case the vibrational energy is directly proportional to ……which is analogous to the Stefen's law of black body radiation.

A) T^2

B) T^3

C) T^5

D) T^4

63. The Debye's continuum model is valid for ……wavelengths only

A) Short

B) Long

C) Small

D) Very Low

64. The first contribution arises from the atomic vibrations and may be called the …….

A) lattice specific heat

B) specific heat of solid

C) electric specific heat

D) electric heat of solid

65. $\frac{1}{2}\hbar\omega$ is the temperature independent …….. contribution.

A) Zero point energy

B) One point energy

C) Two points energy

D) Three points energy

66. Following is the correct one dimensional wave equation.

A) $\frac{\partial^2 u}{\partial x^2} = \frac{1}{Vs^2}\frac{\partial^2 u}{\partial t x^2}$

B) $\frac{\partial^2 u}{\partial x^2} = \frac{1}{Vs^2}\frac{\partial^2 u}{\partial y^2}$

C) $\frac{\partial^2 u}{\partial x^2} = \frac{1}{Vs^2}\frac{\partial^2 u}{\partial z^2}$

D) $\boldsymbol{\frac{\partial^2 u}{\partial x^2} = \frac{1}{Vs^2}\frac{\partial^2 u}{\partial t^2}}$

67. The Debye's theory also obeys the ……as obeyed by the classical theory and the Einstein's theory.

A) Dulong and Petit's Law

B) Debye's law

C) Specific law

D) None of above

68. The system expands against a constant pressure, then the first law can be written as.

A) dQ= dE + pdV

B) dQ = dE + VdP

C) dq = du + pdV

D) dQ = ds + pdV

69. All the oscillators vibrate with the same natural frequency due to the …….. environment of each.

A) Different

B) Identical

C) Both A and B

D) None of above

70. Any number of oscillators may be present in the same ……state.

A) Quantum

B) Classical

C) Both A and B

D) None of above

71. The wave equation three dimensional case can be written as

A) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial x^2} = \frac{1}{Vs^2}\frac{\partial^2 u}{\partial t^2}$

B) $\frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = \frac{1}{Vs^2}\frac{\partial^2 u}{\partial t^2}$

C) $\boldsymbol{\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = \frac{1}{Vs^2}\frac{\partial^2 u}{\partial t^2}}$

D) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial yx^2} + \frac{\partial^2 u}{\partial z^2} = \frac{1}{Vs^2}\frac{\partial^2 u}{\partial t^2}$

72. The total number of vibrational modes are assumed to be …….

A) 2N

B) 3N

C) 4N

D) 1N

73. The total energy of a conduction electron is equal to its ……...

A) Potential energy

B) Kinetic energy

C) Binding energy

D) None of above

74. The electron constituting the electron gas obeys ……statistics under equilibrium condition .

A) Maxwell Boltzmann

B) Bose Einstein

C) Fermi Dirac

D) All of above

75. The metal exabits ……. electrical and thermal conductivity.

A) Low

B) Minimum

C) High

D) None of above

76. The ratio of electrical conductivity and thermal conductivity is called as ……

A) Widemann law

B) Franz law

C) Widemann-Franz law

D) All of above

77. The widemann-Franz law can be written as

A) $\frac{K}{K} = constant$

B) $\frac{1}{K} = constant$

C) $\frac{\sigma}{1} = constant$

D) $\boldsymbol{\frac{\sigma}{K} = constant}$

78. Sommerfeld treated a problem quantum mechanically using the …….. statistics.

A) Maxwell Boltzmann

B) Bose Einstein

C) Fermi Dirac

D) All of above

79. The electron is prevented from leaving the crystal by the presence of a large ……barrier at its surfaces.

A) Kinetic energy

B) Potential energy

C) Total energy

D) All of above

80. The potential energy within the crystal or box is assumed to be …….

A) Zero

B) One

C) Two

D) Three

81. The wave function of the electron occupying the Schrodinger equation.

A) $\frac{\partial^2\psi}{\partial xn^2} + \frac{2m}{h^2}(E_n - V)\psi_n = 0$

B) $\frac{\partial^2\psi}{\partial xy^2} + \frac{2m}{h^2}(E_n - V)\psi_n = 0$

C) $\frac{\partial^2\psi}{\partial x^2} + \frac{4m}{h^2}(E_n - V)\psi_n = 0$

D) $\boldsymbol{\frac{\partial^2\psi}{\partial x^2} + \frac{2m}{h^2}(E_n - V)\psi_n = 0}$

82. No two electrons of same atom can have all the four quantum numbers same is …… Exclusion principle.

A) Einstein

B) Paulies

C) Debye

D) None of above

83. The value of thermal conductivity according to Drude Lorentz theory is ……

A) $\boldsymbol{K=nuk\frac{\lambda}{2}}$

B) $K=nuk\frac{\lambda}{4}$

C) $K=nuk\frac{\lambda}{8}$

D) $K=nuk\frac{\lambda}{3}$

84. C_p-C_v=?

A) R

B) 2R

C) 3R

D) None of above

85. The average kinetic energy of a free electron as given by the classical statistical mechanics is ……..

A) $E_0=\frac{3}{2}K_BT$

B) $E_0=\frac{5}{2}K_BT$

C) $E_0=\frac{8}{2}K_BT$

D) None of above

86. The electronic specific heat is given by

A) $C_P=\frac{3}{2}NK_B$

B) $C_V=\frac{5}{2}NK_B$

C) $C_V=\frac{3}{2}NK_B$

D) $C_P=\frac{5}{2}NK_B$

87. The measurement of ……coefficient of metals indicates that the number of electrons per atom in metals is of the order of unity,

A) Optical reflection

B) Electrical reflection

C) Magnetic reflection

D) Magnetic optical reflection

88. The fermi temperature defined by the equation

A) $E_F= 2K_BT_F$

B) $E_F= K_B2T_F$

C) $E_F= K_BT_F$

D) $E_F= 3K_BT_F$

89. If k is Boltzmann constant then k=……..

A) $\frac{N}{R}$

B) $\frac{R}{N}$

C) $3\frac{N}{R}$

D) $5\frac{N}{R}$

90. The energy passed by an atom or molecule at absolute zero temperature is ……

A) $\hbar\omega$

B) $\hbar\omega/2$

C) $\hbar\omega/3$

D) $\hbar\omega/4$

91. The Einstein's characteristics temperature is given by

A) $\hbar\omega$

B) $\hbar\omega/k$

C) $\hbar\omega/3$

D) $\hbar\omega/R$

92. Thermionic emission of electrons from metal due to at …….. temperature.

A) Low

B) High

C) Both A and B

D) None of above

93. Mobile electrons in metal also called as …….

A) Valance electron

B) Conduction electron

C) Binding electron

D) Free electron

94. The process of emission of electrons from the hot metal surface is called

A) Plastic emission

B) Static emission

C) Thermionic emission

D) Current emission

95. At room temperature, the electron can not escape metal surface due to

A) Attractive forces of nucleus

B) Repulsive forces of electrons

C) Repulsive forces of nucleus

D) Pulling force of protons

96. Ohms law can be written as

A) V=IR

B) R=VR

C) R=VI

D) None of above