T. Y. B. Sc. Physics

PHY 3506: A] Elements of Material Science

Class: T.Y. B. Sc. Sem V (Elective) **Paper VI**

Credit: 3 **No of lectures: 48**

QUESTION BANK

OBJECTIVE QUESTIONS

1. Copper is used for making electrical conductors because it is

   (A) Ductile (B) Resists corrosion

   (C) Has low resistance (D) Cheap.

2. Brass is an alloy of

   (A) Copper and zinc (B) Tin and zinc

   (C) Copper and tin (D) Copper and Aluminum.

3. The resistivity of wire is dependent on----

   (A) Wire-length

   (B) Cross-sectional area

   (C) Resistance of wire

   (D) Wire length and cross-sectional area and resistance of wire

4. Materials which can store electrical energy are called

   (A) Magnetic materials (B) Semiconductors

   (C) Dielectric materials (D) Super conductors

5. The property of a material due to which it breaks with little permanent distortion, is called---

   (A) Ductility (B) Brittleness

(C) Strength (D) Malleability

6. Property of material which allows it to be drawn out into wires is

(A) Ductility (B) Solder ability

(C) Super conductivity (D) Malleability

7. Property of material regain its original shape and size is

(A) Ductility (B) Solder ability

(C) Super conductivity (D) elasticity

8. The response of a material due to the function of heat is known as its_____

(A) Thermal property (B) Electrical property

(C) Chemical property (D) Mechanical property

9. The dielectric constant of air is practically taken as

(A) More than unity (B) Unity

(C) Less than unity (D) Zero

10. Gold and silver are

(A) Dielectric materials (B) Low resistivity conducting materials

(C) Magnetic materials (D) Insulating materials

11. Dielectric materials are

(A) Insulating materials (B) Semiconducting materials

(C) Magnetic materials (D) Ferroelectric materials

12. The property due to which material absorbs the energy and gets plastically deformed

without fracturing.

(A) Semi conductivity (B) Toughness

(C) Hardness (D) Magnetostriction.

13. Bronze is an alloy of

(A) Copper (B) Aluminum

(C) Silver (D) Carbon.

14. Ceramics are good

(A) Insulators (B) Conductors

(C) Superconductors (D) Semiconductors

15. The unit of resistivity is---

(A) ohm (B) ohm-cm

(C) ohm-cm^2 (D) ohm^{-1}

16. The unit of conductivity is---

(A) Simen (B) ohm-cm

(C) ohm-cm^2 (D) $(ohm\text{-}cm)^{-1}$

17. Property of material by which it can not regain its original shape and size after removal of external force is

(A) Malleability (B) Solder ability

(C) Super conductivity (D) Plasticity

18. Resistivity is given by-----

(A) $\rho = R.\frac{l}{A}$ (B) $\rho = i \times A$

(C) $\rho = l/A$ (D) tesla

19. Selection of a material mainly depends on---

(A) Ductility property of material (B) Cost of material

(C) Safety in design (D) Application and uses

20. A pure semiconductor under ordinary conditions behaves like

(A) A conductor. (B) An insulator.

(C) A magnetic material. (D) A ferro-electric material.

21. Among the following materials -----is the hardest material.

(A) Nickel (B) Gold

(C) Hydrogen (D) Diamond

22. Copper is completely miscible with

(A) Nickel (B) Gold (C) Hydrogen (D) Lead

23. Resistivity of conductors is most affected by

(A) Composition (B) Temperature

(C) Pressure (D) Current

24. Plastics are

(A) Good conductors of heat (B) Good conductors of electricity

(C) Bad conductors of electricity (D) High density

25. The most malleable, ductile and low resistivity material is

(A) Copper (B) Aluminum

(C) Silver (D) Iron

26. Bronze is an alloy of

(A) Copper and Tin (B) Copper and nitrogen

(C) Copper and Mercury (D) Silver and Aluminum

27. Rate of heat flow in a metal rod is dependent on----

(A) only length of rod

(B) only cross sectional area of rod

(C) only temperature difference

(D) length of rod and cross sectional area of rod and temperature difference

28. Insulators have

(A) A full valence bands (B) An empty conduction bands

(C) A large energy gaps (D) No energy gap

29. Which among the following shows higher electrical conductivity.

(A) Copper (B) Gold (C) Silver (D) Iron.

30. The property, which is different from the group

(A) Ductility (B) Resistivity (C) Tensile strength (D) Hardness

31. Frenkel defect belongs to which of the following classes?

(A) Point defect (B) Linear dislocation

(C) Interfacial defect (D) Bulk defect

32. The ratio of the number of vacancies to a total number of lattice points for a metal near melting temperature is of the order of 10^{-4}. For lower temperatures, the ratio:

(A) increases (B) decreases

(C) remains the same (D) may increase or decrease depending on the metal

33. Foreign species is present in which of the following defects?

(A) Interstitial (B) Vacancy

(C) Substitution (D) All of the mentioned

34. Burger vectors are relevant to which of the following crystalline defects?

(A) Point defects (B) Line defects

(C) Interfacial defects (D) Bulk defects

35. Pores & cracks in crystalline solids can be classified as

(A) Point defect (B) line defect

(C)surface defect (D) volume defect

36. Ferromagnetic material shows strong para-magnetic behaviour due to the formation of domains. These domains belong to:

(A) Point defects (B) Linear defects

(C) Interfacial defects (D) Bulk defects

37. Electrical conductivity of the specimen is a requirement for which of the following microscopic examination techniques?
    (A) Optical microscopy (B) Transmission electron microscopy
    (C) Scanning electron microscopy (D) Scanning probe microscopy
38. Which of the following point defects is non-stoichiometric in nature?
    (A) Schottky defect (B) Metal excess defect
    (C) Interstitial defect (D) Impurity defect
39. The solubility of solute in a solvent in a solid solution is governed by Hume-Rothery rules. The solubility is more if:
    (A) radii of solute are much smaller than that of solvent
    (B) solute an solvent have a similar crystal structure
    (C) solute has low valence
    (D) all of the mentioned
40. Which type of defect are point defects?
    (A) One dimensional defect (B) Zero dimensional defect
    (C) Two dimensional defect (D) Three dimensional defect
41. In which of the following defect the density of the crystal is affected?
    (A) Schottky defect (B) Frenkel defect
    (C) Stone-Wales defect (D) Antisite defect
42. Schottky and Frenkel defects are _____
    (A) Interstitial and vacancy defects respectively
    (B) Vacancy and interstitial defect respectively
    (C) Both interstitial defects
    (D) Both vacancy defects
43. Which thermodynamic property increases in a crystalline solid due to the presence of vacancies?
    (A) Enthalpy (B) Entropy
    (C) Internal energy (D) Work done
44. Which type of diffusion occurs due to the exchange of an atom with vacancies?
    (A) Substitution diffusion (B) Elimination diffusion
    (C) Passive diffusion (D) Facilated diffusion
45. How is the concentration of defect related with free energy?
    (A) The concentration of defect increases free energy
    (B) The concentration of defect decrease free energy

(C) The concentration of defect is equal to free energy

(D) The concentration of defect is not related to free energy

46. In which type of defect smaller cation can get displaced into an interstitial void?

(A) Schottky defect (B) Intrinsic defect

(C) Extrinsic defect (D) Frankel defect

47. Which of the following oxides are highly defective?

(A) Al_2O_3 (B) MgO

(C) CaO (D) FeO

48. A dissolution in which an extra portion of a plane of atoms or a half plane terminates within a crystal is called as _____

(A) Edge dislocation (B) Mixed dislocation

(C) Interfacial dislocation (D) Screw dislocation

49. The magnitude and direction of lattice distortion are expressed in terms of which vector?

(A) Dislocation vector (B) Screw vector

(C) Edge vector (D) Burger vector

50. What type of direction will the burger vector of dislocation for a metallic material show?

(A) Closed-packed crystallographic direction

(B) Rounded-packed crystallographic direction

(C) Open-packed crystallographic direction

(D) Parallel-packed crystallographic direction

51. Path of screw dislocation is in the form of _____

(A) Circular (B) Cylindrical

(C) Spiral or helical (D) Rectangular

52. Which type of deformation occurs due to dislocation?

(A) Slip plastic deformation

(B) Elastic deformation

(C) It does not show deformation

(D) Slip elastic deformation

53. Which type of defect are line defects?

(A) One-dimensional defect

(B) Zero-dimensional defect

(C) Two-dimensional defect

(D) Three-dimensional defect

54. Which of the following statement is false?

(A) Burger vector is the right angle to edge dislocation

(B) In screw defect the line defect is parallel to the displacement vector

(C) Grain boundary defect is a type of line defect

(D) Line defect occurs during the recrystallization process or during slip

55. In which type of dislocation an extra plane is inserted inside the crystal?

(A) Edge dislocation

(B) Screw dislocation

(C) Jog dislocation

(D) Mixed dislocation

56. In which type of dislocation planes are displaced relative to each other through shear?

(A) Edge dislocation

(B) Screw dislocation

(C) Jog dislocation

(D) Mixed dislocation

57. What are the dislocation in which the line direction and Burgers vector are neither perpendicular nor parallel?

(A) Screw dislocation

(B) Edge dislocation

(C) Jog dislocation

(D) Mixed dislocation

58. Volume defect or bulk defects are which dimension defect?

(A) 1 dimension

(B) 2 dimension

(C) 3 dimension

(D) 4 dimension

59. Diffusion is the result of:

(A) Random motion of particles

(B) Concentration gradient

(C) Kinetic energy of particles

(D) A and B and C

60. Concentration gradient refers to:
    (A) Change of concentration with respect to time
    (B) Change of concentration with respect to space
    (C) Change of concentration with respect to temperature
    (D) None of the mentioned
61. As the temperature rises, the rate of vacancy diffusion in metals:
    (A) increases
    (B) decreases
    (C) remains the same
    (D) may increase or decrease
62. Rate of solid-state diffusion does not depend on which of the following?
    (A) Temperature
    (B) Diffusing species
    (C) Host solid
    (D) Gravity
63. Carburisation is a heat treatment used for case hardening steels. Carbon is trapped on steel surface by:
    (A) Osmosis
    (B) Interstitial diffusion
    (C) Vacancy diffusion
    (D) None of the mentioned
64. In steady state diffusion, which of the following remain unchanged with time?
    (A) Concentration at source
    (B) Concentration at sink
    (C) Concentration profile
    (D) Concentration at source and Concentration at sink and Concentration profile

65. For steady-state diffusion, diffusion flux is proportional to the concentration gradient. Concentration gradient is:
    (A) Rate of change of concentration with respect to space
    (B) Rate of change of concentration with respect to time
    (C) Difference in concentrations at the source and sink
    (D) Ratio of concentrations at source and sink

66. Which of the following is not true for steady-state diffusion?
    (A) The concentration profile is linear
    (B) The concentration gradient is constant
    (C) There is no net transfer of mass
    (D) The diffusion flux is constant
67. The relation between temperature and diffusion coefficient is:
    (A) Linear
    (B) Exponential
    (C) Sinusoidal
    (D) Diffusion coefficient is not related to temperature
68. In steady state diffusion which of the following remains constant?
    (A) Concentration gradient
    (B) Kinetic energy of particles
    (C) Potential energy of particles
    (D) Change of concentration with respect to temperature
69. Which of the following gases can be purified by allowing it to diffuse through palladium cap?
    (A) Oxygen
    (B) Hydrogen
    (C) Chlorine
    (D) Nitrogen
70. Which of the following law is used for steady state diffusion?
    (A) Fick's law
    (B) Newton's law of diffusion
    (C) Bragg's law
    (D) Charles's law
71. Which of the following is not a part of Fick's first law?
    (A) Diffusion flux
    (B) Diffusion coefficient
    (C) Change in concentration with respect to the position in space
    (D) Change in concentration with respect to time
72. Velocity of diffusing particles does not depend on _____
    (A) Temperature
    (B) Viscosity of the fluid

(C) Size of the particles

(D) Pressure

73. Which of the following law is used to non-steady state diffusion?

(A) Fick's first law

(B) Fick's second law

(C) Bragg's law

(D) Charles's law

74. Which of the following will diffuse the fastest in iron?

(A) W

(B) C

(C) H

(D) He

75. Which of the following law is a partial differential equation?

(A) Fick's first law

(B) Fick's second law

(C) Bragg's law

(D) Charles's law

76. Concentration gradient varies with time for which of the following processes?

(A) Non-steady state diffusion

(B) Osmosis

(C) Steady state diffusion

(D) Filter

77. If we increase the temperature, how is the diffusion rate affected?

(A) Diffusion rate increases

(B) Diffusion rate decreases

(C) Diffusion rate decreases drastically

(D) Diffusion rate is not affected

78. How is the diffusion rate affected by concentration difference?

(A) Diffusion rate is not affected

(B) Higher the concentration difference, higher the diffusion rate

(C) Lower the concentration difference, higher the diffusion rate

(D) Higher the concentration difference, lower the diffusion rate

79. How is diffusion rate related to diffusion distance?

(A) Directly related

(B) Inversely related

(C) Not related

(D) Directly related to square of diffusion distance

80. Diffusion is slower for _____

(A) Open crystal structure

(B) Low density materials

(C) Materials with lower melting temperature

(D) Materials with covalent bonding

81. Which of the following relation is stated by Hooke's law?

(A) Stress is directly proportional to strain

(B) Stress is inversely proportional to strain

(C) Stress is directly proportional to square of strain

(D) Stress is inversely proportional to square of strain

82. Which of the following is found out by calculating the area under the stress strain graph?

(A) Toughness

(B) Hardness

(C) Endurance

(D) Strength

83. Which of the following property cannot be determined by a tensile test?

(A) Yield strain

(B) Yield stress

(C) Elastic limit

(D) Limit of proportionality

84. Which type of load is applied in tensile testing?

(A) Axial load

(B) Shear load

(C) Transverse load

(D) Longitudinal load

85. Which of the following factors do not affect the testing?

(A) Temperature

(B) Increase in number of axes for application of load

(C) Fatigue

(D) Pressure

86. Negative screw dislocation is represented by

(A) ⊥ (B)  (C)  (D) ⊤

87. A pair of one cation and one anion missing in a crystal of the type AB is called

(A) Schottky defect (B) Frenkel defect

(C) Pair of vacancies (D) Dislocation.

88. Which of the following is not a point defect?

(A) Interstitial atom (B) Substitutional atom

(C) Edge dislocation (D) None of these are point defects

89. Which of these does not affect diffusion for a case that is described by Fick's first law?

(A) Temperature (B) Concentration

(C) Number of vacancies (D) Time

90. Fick's first law describes diffusion process when

(A) Concentration depends on time space

(B) Concentration varies with time

(C) Concentration independent on space

(D) Concentration depends on space but independent of time

91. Fick's law describes flow of atom caused by

(A) Temperature gradient (B) Concentration gradient

(C) Potential gradient (D) Electric field gradient

92. What is the unit of diffusion coefficient?

(A) mol m^{-2} s^{-1} (B) mol m^{-3}

(C) m^2 s^{-1} (D) KJ mol^{-1}

93. Frankel and Schottky imperfections are

(A) Dislocations in ionic crystals (B) Grain boundaries in covalent crystals

(C) Vacancies in ionic crystals (D) Vacancies in covalent crystals

94. Fick's first law is defined as

(A) $J = -D\frac{dC}{dx}$ (B) $J = -D\frac{d^2C}{dx^2}$

(C) $J = -D^2\frac{dC}{dx}$ (D) J = D2(dx/dt)

95. Specific heat of materials is expressed in terms of _____

(A) W/m (B) J/K

(C) J/kg K (D) m3/kg

96. The **t** vector is parallel to the **b** vector in a dislocation of the type:

(A) Screw (B) Edge

(C) Mixed (D) Tilt

97. Two edge dislocation on same slip plane and the same sign will _____

(A) Exert attractive force

(B) Exert no force

(C) Exert repulsive force

(D) Exert shearing force

98. How many slip system are there in FCC lattice?

(A) 12 (B) 6

(C) 10 (D) 18

99. Slip planes do not occur where _____

(A) Atom density is high

(B) Atom density is low

(C) Atoms are closely placed

(D) direction of slip plane is the same as the translation vector which is the shortest

100. Which law is related to slip plane and slip direction?

(A) Bragg's law (B) Fick's law

(C) Schmid's law (D) Such a law doesn't exist

101. Value of critical resolved shear stress for a given material at a given temperature _____

(A) Increases with time

(B) Decreases with time

(C) Decreases harshly with time

(D) Remains constant

102. Which of the following stresses is required for the slip to occur?

(A) Tensile stress

(B) Compressive stress

(C) Critical resolved shear stress

(D) Slip doesn't occur due to stress

103. How many slip systems are there in BCC lattice?

(A) 36 (B) 48

(C) 24 (D) 18

104. How many slip systems are there in hexagonal closed packed crystal?

(A) 3 (B) 6

(C) 9 (D) 18

105. Which of the following is an alloy of iron?

(A) Vitallium (B) Brass

(C) Invar (D) Solder

106. Which of the following is an alloy of lead?

(A) Vitallium (B) Brass

(C) Invar (D) Solder

107. Which of the following is an alloy of cobalt?

(A) Vitallium (B) Brass

(C) Invar (D) Solder

108. Which of the following is an alloy of copper?

(A) Vitallium (B) Brass

(C) Invar (D) Solder

109. What is sterling silver used for?

(A) casting of firearms

(B) used for making musical instruments

(C) used for making springs

(D) used for joining two metals

110. Which of the following is an alloy of iron and carbon?

(A) Steel (B) Brass

(C) Bronze (D) Solder

111. Which of the following element is added to steel to form stainless steel?

(A) Chromium (B) Copper

(C) Boron (D) Titanium

112. Which of the following alloying element increase hardness?

(A) Silicon (B) Sulphur

(C) Nickel (D) Titanium

113. Which of the metal is alloyed with silver to make sterling silver?

(A) Zinc (B) Copper

(C) Magnesium (D) Aluminum

114. Value of critical resolved shear stress for a given material at a given temperature_____

(A) Increases with time

(B) Decreases with time

(C) Decreases harshly with time

(D) Remains constant

115. What is important for deformation to occur?

(A) point defect (B) slip

(C) surface defect (D) volume defect

116. A polymers has thousands of monomers bounded by _____.

A. adhesive

B. weak bonds

C. physical reaction

D. chemical reaction

117. Polymerization is a process by which _____ are transformed into polymers.

A. atoms

B. elements

C. monomers

D. gases

118. Which polymers cannot be recycled?

A. Thermoplasts

B. Thermosets

C. Elastomers

D. All polymers

119. Which is the unique property of polymer materials?

A. Elasticity

B. Plasticity

C. Visco-elasticity

D. ductility

120. Molecular length of polymer can be estimated using formula ____ .

A. L = length of a mer x number of mers

B. L = number of mers x (C-C bond length)

C. L = 2 x (C-C bond length) x sin (bond angle/2)

D. L = 2 x (C-C bond length) x cos (bond angle/2)

121. The number of _____ present in the polymer is known as degree of polymerization.

A. atoms

B. bonds

C. mers

D. branches

A. Which of the following polymers contains −C−C− linkages only?

A. addition polymers

B. condensation polymers

C. copolymers

D. none of the mentioned

122. Which of the following steps is not involved in addition (chain) polymerization?

A. Initiation

B. chain propagation

C. branching

D. termination

123. During chain propagation the active centers combine with the _____ producing a new radical.

A. atoms

B. initiator

C. monomer

D. terminator

124. Elimination of a small molecule such as water takes place during ____ polymerization.

A. addition polymerization
B. chain polymerization
C. condensation polymerization
D. copolymerization

125. The substance that is so effective, which can suppress the rate as well as degree of polymerization is a _____ .

A. retarder
B. inhibitor
C. promoter
D. none of the mentioned

A. Which of the following reaction is not accompanied by elimination of a byproduct molecule?

A. addition polymerization
B. condensation polymerization
C. both of the mentioned
D. none of the mentioned

126. Which of the following polymer type is not classified on the basis of its application and properties?

A. rubbers
B. plastics
C. fibers
D. synthetic

127. Which one of the following polymers is prepared by condensation polymerization?

A. Teflon
B. Rubber
C. C. Styrene
D. Nylon-6,6

128. Which of the following polymers is not the condensation polymer?
A. proteins
B. nylon
C. polyester
D. polyvinyl chloride

129. Thermoplasts _____ increases with increasing temperature.
A. elasticity
B. plasticity
C. ductility
D. malability

130. Vulcanization is a chemical process to convert natural rubber into durable material via the addition of ____ .
A. carbon
B. sulphur
C. nitrogen
D. oxygen

131. Example for the Diamond crystal structure is
(A) Silicon (B) carbon (C) Germanium (D) All of the these

132. The Crystal type CsCl has basis as
(A) (000) and (½ ½ ½) (B) (¼ ¼ ¼) (C) (222) (D) (012)

133. The number of molecules in the unit cell crystallizing in the sodium chloride structure is
(A) 2 (B) 4 (C) 8 (D) 1.

136. 6.4×10^{-19} joule is approximately
(A) 1 electron volt (B) 4 electron volt (C) 8 electron volt
(D) 1 electron.

137. The number of CsCl molecules in the unit cell is

(A) 2 (B) 4 (C) 1 (D) 3.

138. The structure of NaCl crystal is

(A) BCC (B) FCC (C) SC (D) HCP

139. The structure of CsCl crystal is

(A) BCC (B) FCC (C) SC (D) HCP

140. The structure of ZnS crystal is

(A) BCC (B) FCC (C) SC (D)Tetragonal

141. The structure of diamond crystal is

(A) tetrahydral bonding between C-C (*b*) BCC (C) SC (D) None of these

142. The coordination number in NaCl crystal of different kind atoms is

(A) 8 (*b*) 6 (C) 12 (D) 4

143. The coordination number in CsCl crystal of different kind atoms is

(A) 8 (B) 6 (C) 12 (D) 4

144. The coordination number in ZnS crystal of different kind atoms is

(A) 8 (B) 6 (C) 12 (D) 4

145. The coordination number in diamond crystal of same kind atoms is

(A) 8 (B) 6 (C) 4 (D) 14

146. Not a characteristic property of ceramic material

(A) High temperature stability (B) High mechanical strength

(C) Low elongation (D) Low hardness

147. Ceramics can conduct—

(A) Heat (B)Light (C) Electricity (D) none of above

148. Ceramics bear the properties—

(A) High melting point (B)Soft (C) Tensile (D) None of above

149. Amorphous solids have _____ structure.

(A) Regular (B) Linear (C) Irregular (D) Dendritic

150. The bond between Sodium and chlorine in NaCl structure is

(A) Covalent (B) Vander Waal (C) Ionic (D) Metallic

151. An example of purely crystalline ceramic material is

(A) Window glass (B) NaCl (C) Fixed clay (D) Cement

152. ----is not a ceramic material

(A) Window glass (B) NaCl (C) NH4 (D) Cement

153. The basis for diamond is

(A) (½ ½ ½) (B) (000) and (¼ ¼ ¼) (C) (222) (D) (012)

154. The bond between carbon and carbon in diamond structure is

(A) Covalent (B) Vander waal (C) Metallic (D) Ionic

155. The bond between Zn and S in ZnS structure is

(A) Covalent (B) Vander waal (C) Metallic (D) Ionic

156. Which of the following is false about ceramic structures?

(A) They are made up of two or more different elements

(B) More complex than metal structures

(C) They are electrically neutral

(D) Less complex than metal structures

157. In covalent bond -

(A) The atoms share electrons (B) One of the atoms lends electron

(C) The element possesses strong attractive forces (D) None of these

158. The bond length in diamond structure is equal to----

(A) a(crystal size) (B) ¼ body diagonal of cell

(C) ½ body diagonal of cell (D) none of these

159. System is a group of substances so isolated from its surroundings and subjected to changes in temperature, composition, pressure or volume allowed by the _____ . -1

A. components
B. phases
C. investigator
D. system itself

160. The component of a system must be _____ to describe the experiment.-1

A. less
B. adequate
C. solid
D. liquid

A. How many components are present in unary phase system?-1

A. 1
B. 2

C. 3

D. 4

161. Phase diagrams are maps that give relationships between phases in _____ in a system.-1

A. liquid and solid states

B. liquid and gases states

C. solid and gases states

D. equilibrium

162. The degree of freedom at triple point in unary diagram for water _____.

A. 0

B. 1

C. 2

D. 3

163. What is the temperature at triple point of water?

a) 288 K

b) 273.16 K

c) 298 K

d) 277 K

164. Relative amounts of phases in a region can be deduced using

a) Phase rule

b) Lever rule

c) Either

d) None

165. What are the external parameters that affect the phase structure?

a) Temperature, Pressure

b) Temperature, Composition

c) Pressure, Composition

d) Temperature, Pressure, Composition

166. What is used for determination of Phase amounts?
    a) Tie line and Temperature–Composition Point
    b) Lever line
    c) Temperature–Composition Point
    d) Pressure

167. Following is wrong about a phase diagram.
    a) It gives information on transformation rates.
    b) Relative amount of different phases can be found under given equilibrium conditions.
    c) It indicates the temperature at which different phases start to melt.
    d) Solid solubility limits are depicted by it.

168. It can be noted that the two substances are soluble in each other in the entire range of compositions in both liquid and solid state. This kind of system is known as _____.
    a) Binary phase system
    b) Unary phase system
    c) Multiple phase system
    d) Isomorphous system

169. The Gibbs phase rule is valid under the following conditions.
    a) Constant pressure
    b) Constant temperature
    c) Varying temperature and pressure
    d) Constant temperature and pressure

170. Horizontal arrest in a cooling curve represents:
    a) Continuous cooling
    b) Invariant reaction
    c) Both
    d) Nothing

171. Phase is _____ region of the system.

a) physically-distinct, chemically- homogeneous and mechanically-separable

b) physically- homogeneous, chemically- distinct and mechanically-separable

c) physically- separable, chemically- homogeneous and mechanically-distinct

d) physically-distinct, chemically-separable and mechanically- homogeneous

172. Which of the following remains constant in Unary phase diagrams?

a) Pressure

b) Temperature

c) Composition

d) Both pressure and temperature

173. In a binary isomorphous system which of the following is true?

a) The two metals are completely miscible in each other in liquid as well as solid form

b) The two metals are completely immiscible in each other in liquid as well as solid form

c) The two metals are completely miscible in each other in liquid form only

d) The two metals are completely miscible in each other in solid form only

174. Equilibrium in a system is the state of _____ under any specified combination of composition, pressure, temperature.

a) maximum entropy

b) maximum free energy

c) minimum free energy

d) minimum volume

175. Congruently melting compounds are the compounds which melts_____.

a) with changing their composition

b) without changing their composition

c) with decomposition

d) with tremendous heat

176. The number of components are 2, the number of phases are 3 and degrees of freedom are 0. Then which of the following equilibrium is it?
   a) Invariant
   b) Univariant
   c) Bivariant
   d) Trivariant

177. The first commercial shape memory alloy is
   (A) NiTi (B) NiCd (C) NiC (D) Cryofit

178. ..... is a microsensor that can trigger the operation of a device.
   (A) Actuator (B) LED (C) Transister (D) None of these

179. Smart materials that convert mechanical energy to electrical energy called.....
   (A) Piezoelectrics (B) Shape Memory Alloys (C) Magnetostrictive (D) Shape Memory Polymers

180. Magnetostriction can be defined as the change in dimension of a piece of magnetic material induced by a change in its .....
   (A) Magnetic State (B) Electric State (C) Spin State (D) Angular State

181. Magnetostrictive materials can convert magnetic energy into .....
   (A) Thermal Energy (B) Kinetic Energy (C)Potential Energy (D) Electric Energy

182. The inverse magnetostrictive effect is the change of the magnetic susceptibility of a material when subjected to a .....
   (A)electric potential (B) mechanical stress (C)magnetic force (D) None of these

183. Hydrogels are highly .....
   (A) ductile (B) hard (C) absorbent (D) malleable

184. Dielectric elastomers (DEs) are smart materials that produce large .....
   (A) stress (B) hardness (C) strains (D) None of these

185. Electroactive polymers are polymers that exhibit a change in size or shape when stimulates by an .....
   (A) gravitational field (B) mechanical stress (C) magnetic field (D) electric field

186. Quartz is composed of ..... atoms.

(A) silicon and aluminium (B)iron and oxygen

(C)silicon and iron (D)silicon and oxygen

Short & Long Answers

1. What is a solid solution? Discuss the Hume Rothery's rule for forming a solid solution.
2. Write short notes on substitutional and interstitial solid solution.
3. How are solid solutions classified? Give example for each.
4. Explain single component system. Discuss in detail about one component of iron with neat diagram.
5. What do you mean by Unary system? Draw and explain the Unary phase diagram of pure iron.
6. What is binary phase diagram? Explain in detail about binary isomorphous system and the region present in it.
7. With ideal phase diagram, cooling curves and example, explain the following binary systems. Also name the systems. i) Two components completely soluble in liquid and completely soluble in solid state.
8. Two components completely soluble in liquid and completely in soluble in the solid state.
9. Write the inference of eutectic phase diagram? Draw a typical equilibrium diagram for a eutectic type of system with limited solid solubility and explain its important features.
10. Explain the phase diagram of a system whose solubility is limited and the melting points of the components are comparable.
11. What is a peritectic phase diagram? Draw a typical equilibrium diagram for a peritectic type of system with limited solid solubility and explain its important features.
12. Explain the phase diagram of a system whose solubility is limited and the melting points of the components are vastly different.
13. What do you mean by free energy curves? Explain the construction of phase diagram of completely soluble components from Gibb's energy curves with suitable sketch.
14. Discuss the free energy composition curves for binary and eutectic system.

15. What are the microstructural changes that occur in a binary system?
16. What are homogenous and heterogeneous systems?
17. What is a solid solution? Give example.
18. Differentiate substitutional and interstitial solid solutions with examples.
19. Differentiate between a solid solution and a compound
20. Name and explain the standard rule for formation of substitutional solid *solution.*
21. Define Gibb's Phase rule.
22. What is the difference between the states of phase equilibrium and metastability?
23. In a three component system what is the maximum number of phases that can coexist in equilibrium (taking pressure into account).
24. Write a note on phase diagram.
25. Mention the uses and limitations of phase diagram.
26. What is tie-line rule for phase diagrams?
27. Define lever rule.
28. Mention the use of tie-line rule and lever rule in the binary phase diagram.
29. Define isomorphous system. Give two examples
30. What is liquidus, solidus and solvus line?
31. Write a note on invariant reactions.
32. What is meant by peritectic and peritectoid reactions?
33. Differentiate between Eutectic and Eutectoid phase reactions.
34. State the reactions in the monotectoid and syntactic.
35. What is meant by hypoeutectic alloy and hypereutectic alloy?
36. What is solid solution? Discuss the Hume Rothery's rule for forming solid solution.
37. Write short notes on substitutional and interstitial solid solution.
38. How are solid solutions classified? Give example for each.
39. Explain single component system. Discuss in detail about one component of iron with neat diagram.
40. What do you mean by Unary system? Draw and explain the Unary phase diagram of pure iron.
41. What is binary phase diagram? Explain in detail about binary isomorphous system and the region present in it.
42. With ideal phase diagram, cooling curves and example, explain the following binary systems. Also name the systems. i) Two components completely soluble in liquid and

completely soluble in solid state ii) Two components completely soluble in liquid and completely in soluble in the solid state.

43. What is a eutectic phase diagram? Draw a typical equilibrium diagram for a eutectic type of system with limited solid solubility and explain its important features.
44. Explain the phase diagram of a system whose solubility is limited and the melting points of the components are comparable.
45. What is a peritectic phase diagram? Draw a typical equilibrium diagram for a eutectic type of system with limited solid solubility and explain its important features.
46. Explain the phase diagram of a system whose solubility is limited and the melting points of the components are vastly different.
47. What do you mean by free energy curves? Explain the construction of phase diagram of completely soluble components from Gibb's energy curves with suitable sketch.
48. Discuss the free energy composition curves for binary and eutectic system.
49. What are the microstructural changes that occur in a binary system?
50. Explain in detail about the changes in microstructure due to equilibrium and non - equilibrium cooling with a neat diagram.
51. Explain other invariant reactions. Two metals A and B have melting points at 900°C and 800°C. The alloy forms a eutectic at 600°C of composition 60%B ad 40%A. A and B have unlimited mutual liquid solubilities. Their solid solubilities are as follows: 10%B in A at 600°C and 5% B in A at 0°C, 12% A in B at 600°C and 4% A in B at 0°C. Draw the phase diagram for the series.
52. Find the number of phases, relative amount of the phases and composition of the phases present in the alloy of composition 60% A and 40% B at 200°C.
53. What is tensile test and mention its uses?
54. Define proof stress and ultimate tensile strength.
55. Define ductility.
56. What is meant by resilience and toughness?
57. Explain plastic deformation.
58. Name the four methods of strengthening materials.
59. What is Hall-Petch equation and explain the terms involved in it?
60. Why aluminium and its alloys are more ductile than magnesium and its alloy?
61. Define creep and creep resistance.

62. What is minimum creep rate with respect to creep curve and how it is expressed?
63. Define fracture. What is meant by CRSS?
64. Why ductile fracture is more preferred than brittle fracture?
65. The crack length of a sample of certain material is 4.4μm, and the young's modulus of the material is 60 GPa. The surface energy is 1.32 J/m2 Calculate the fracture strength.
66. What is fatigue?
67. List out the factors that lead to fatigue failure.
68. List the steps of fatigue failure in metals.
69. Explain the term endurance limit in fatigue test.
70. Define hardness.
71. What type on indenter and range of load is used in Vickers and Knoop microhardness test? Explain Brinell number.
72. Discuss the tensile testing of materials. What are the important qualities that can be obtained from the stress-strain curve?
73. What is tensile test? With a neat diagram the construction and working of tensile machine. Explain the various properties obtained from tensile test.
74. Explain the mechanism of plastic deformation of metals by slip and twinning.
75. Distinguish between slip and twinning.
76. Discuss elaborately the four main strengthening methods against plastic yield. Discuss briefly the mechanism of creep.
77. Write a short note on the different stages in a creep curve.
78. Explain creep resistance materials with their properties.
79. What is fracture? Discuss the different types of fracture.
80. Explain Griffith's theory of fracture.
81. Describe fatigue test and the methods of increasing fatigue life.
82. Draw S-N curve for ferrous and non-ferrous metals and explain the procedure used to obtain S-N diagram.
83. Explain brinell hardness test with its advantages and limitations.
84. Write a short note on Rockwell hardness test.
85. Discuss in detail about Vickers micro hardness test with its advantages and is advantages.
86. Discuss in detail about Knoop micro hardness test with its advantages and disadvantages.

87. Distinguish between Vickers micro hardness and Knoop microhardness. List out the differences between ductile and brittle fracture.
88. Ferromagnetism – domain theory – types of energy – hysteresis – hard and soft magnetic materials – ferrites -dielectric materials – types of polarization – Langevin-Debye equation – frequency effects on polarization -dielectric breakdown – insulating materials – Ferroelectric materials - superconducting materials and their properties.
89. What is ferromangnetism?
90. What are the types of energy involved in domain theory?
91. Define hysteresis. What is meant by hysteresis loop and What do you infer from it?
92. Define retentivity and coercivity.
93. Why Ferrites are used as transformer core?
94. Define dielectrics.
95. Define dielectric susceptibility and polarizability of a dielectric.
96. What are different mechanisms of polarization in dielectric?
97. A crystal is subjected to an electrical field of 1000 V/m and the resultant polarisation is 4.3 X 10-8 C/m2. Calculate the relative permittivity of the crystal.
53. Distinguish between active and passive dielectrics.
54. What is mean by relaxation frequency in dielectrics?
55. Differentiate dielectric loss and dielectric breakdown.
56. Explain the important requirements of insulators.
57. List the properties of ferroelectric materials.
58. What is piezoelectricity and pyroelectricity?
59. Name a few uses of dielectrics.
60. Define superconductivity.
61. Mention the condition for the material to behave as a superconductor. 4 Analyzing
62. Define critical temperature and critical field.
63. Calculate the critical current for a wire of lead having a diameter of 1mm at 4.2 K. Critical temperature for lead is 7.18 K and H0 = 6.5 X 104 A/m.
64. Explain ferromagnetic domain theory. Briefly explain different types of energy involved in domain growth.
65. State Weiss theory of ferromagnetism and explain a) domain movement and domain rotation.
66. Discuss the domain structure in ferromagnetic materials. Show how the
67. hysteresis curve is explained on the basis of domain theory.

68. Draw the B-H curve (Hysteresis) for a ferromagnetic material and explain
69. the Retentivity and Coercivity fields in the B-H curve.
70. What is meant by Hysteresis loss? Describe the formation of Hysteresis
71. loop using domain wall movement.
72. Classify the magnetic materials as hard and soft on the basis of Hysteresis loop.
73. What are ferrites? Explain the structure of ferrites, properties and its applications.
74. Discuss about electronic, ionic, orientational and space-charge polarizations with examples in detail.
75. Explain the different types of polarization mechanisms involved in a dielectric material.
76. What is dielectric breakdown? Write in detail about the types and various factors contributing to breakdown in dielectrics.
77. Discuss in detail about the various dielectric breakdown mechanism.
78. What is ferroelectricity? Explain the properties of ferro electric materials.
79. Mention any five applications ferro electric materials.
80. Explain the hysteresis curve exhibited by a ferroelectric material with a
81. suitable sketch. Give examples for ferroelectric materials.
82. Write an essay on different types of superconducting materials, their properties and their applications.
83. Describe the electrical resistance, maximum current and magnetic properties of a superconducting material.
84. Differentiate between Type I and Type II superconductors.
85. What are engineering ceramics.
86. Name two crystal structures of ceramic materials. 2
87. What is a cermet?
88. Ceramics are stronger in compression than in tension. Reason out.
89. What is a composite? Write any two advantages of fibre reinforced composites.
90. What is meant by metal matrix composites? Give one example to each matrix material and reinforcements used.
91. Mention the functions of matrix and fibre in fibre reinforced composites.
92. Define Metallic glasses.
93. What is meant by glass transition temperature?
94. List the merits of metallic glasses as transformer core materials.
95. State any four applications of metallic glasses.

96. What is meant by shape memory effect?
97. What are the two phases of shape memory alloys?
98. What is pseudo elasticity?
99. Mention the advantages and disadvantages of shape memory alloys.
100. What are nanophase materials? Give examples.
101. State few techniques for synthesis of nano phased materials.
102. Explain top down and bottom up approach in nano materials?
103. What is meant by Plasma arching.
104. What is Carbon Nanotube? List out the various forms of CNT.
105. List out and explain the properties and applications of any four type of ceramics.
106. Write a short note on glass ceramics.
107. Give the properties and applications of different ceramics.
108. Give the properties and uses of any one fibre reinforced composite and particle reinforced composite.
109. State the law of mixtures in composites.
110. How are composites classified based on the matrix phase. Compare them based on their properties and applications.
111. What is strengthening mechanism? Explain the strengthening mechanism of fibre reinforced composites.
112. Write a short note about different types of matrix material and reinforced material used to make polymer matrix composites.
113. What are metallic glasses? Describe the preparation, properties and applications of metallic glasses.
114. Describe in detail the development, properties and applications of metallic glasses.
115. What are shape memory alloys (SMA)? Describe the characteristics of SMA and its applications?
116. What are nanomaterials? Explain the properties and applications nanomaterials.
117. Explain in detail the preparation of nano materials by bottom up processes.
118. Describe the method of producing nano materials using a) Pulsed laser deposition. b) Chemical vapour deposition.
119. Differentiate single wall and multiwall carbon nanotubes. Explain three different structure of SWNT.
120. List the properties and applications of CNT.
121. What are the different types of carbon nanotubes and state their properties.