EXERCISE-I

Type of solid and their properties

1. Which one of the following is a good conductor of electricity
(A) Diamond
(B) Graphite
(C) Silicon
(D) Amorphous carbon

2. A crystalline solid
(A) Changes abruptly from solid to liquid when heated
(B) Has no definite melting point
(C) Undergoes deformation of its geometry easily
(D) Has an irregular 3-dimensional arrangements

3. Diamond is an example of
(A) Solid with hydrogen bonding
(B) Electrovalent solid
(C) Covalent solid
(D) Glass

4. The solid NaCl is a bad conductor of electricity since
(A) In solid NaCl there are no ions
(B) Solid NaCl is covalent
(C) In solid NaCl there is no velocity of ions
(D) In solid NaCl there are no electrons

5. The existence of a substance in more than one solid modifications is known as **or** Any compound having more than two crystal structures is called
(A) Polymorphism
(B) Isomorphism
(C) Allotropy
(D) Enantiomorphism

6. Which is not a property of solids
(A) Solids are always crystalline in nature
(B) Solids have high density and low compressibility
(C) The diffusion of solids is very slow
(D) Solids have definite volume

7. Which solid will have the weakest intermolecular forces
(A) Ice (B) Phosphorus
(C) Naphthalene (D) Sodium fluoride

8. Dulong and Petit's law is valid only for
(A) Metals (B) Non-metals
(C) Gaseous elements (D) Solid elements

9. Which of the following is an example of metallic crystal solid
(A) C (B) Si
(C) W (D) AgCl

10. Under which category iodine crystals are placed among the following
(A) Ionic crystal (B) Metallic crystal
(C) Molecular crystal (D) Covalent crystal

11. Crystalline solids are
(A) Glass (B) Rubber
(C) Plastic (D) Sugar

12. Davy and Faraday proved that
(A) Diamond is a form of carbon
(B) The bond lengths of carbon containing compounds are always equal
(C) The strength of graphite is minimum compared to platinum
(D) Graphite is very hard

13. Which one of the following metal oxides is antiferromagnetic in nature
(A) MnO_2 (B) TiO_2
(C) VO_2 (D) CrO_2

14. In graphite, carbon atoms are joined together due to

(A) Ionic bonding

(B) Vander Waal's forces

(C) Metallic bonding

(D) Covalent bonding

15. Which of the following is not correct for ionic crystals

(A) They possess high melting point and boiling point

(B) All are electrolyte

(C) Exhibit the property of isomorphism

(D) Exhibit directional properties of the bond

16. Which of the following is a molecular crystal

(A) SiC (B) NaCl

(C) Graphite (D) Ice

17. Quartz is a crystalline variety of

(A) Silica

(B) Sodium silicate

(C) Silicon carbide

(D) Silicon

18. Which type of solid crystals will conduct heat and electricity

(A) Ionic (B) Covalent

(C) Metallic (D) Molecular

19. Which of the following is an example of covalent crystal solid

(A) Si (B) NaF

(C) Al (D) Ar

20. Which of the following is an example of ionic crystal solid

(A) Diamond (B) LiF

(C) Li (D) Silicon

Crystallography and Lattice

21. For cubic coordination the value of radius ratio is

(A) 0.732 – 1.000 (B) 0.225 – 0.414

(C) 0.000 – 0.225 (D) 0.414 – 0.732

22. How many space lattices are obtainable from the different crystal systems

(A) 7 (B) 14

(C) 32 (D) 230

23. Example of unit cell with crystallographic dimensions $a \neq b \neq c$, $\alpha = \gamma = 90^{o}$, $\beta \neq 90^{o}$ is

(A) Calcite

(B) Graphite

(C) Rhombic sulphur

(D) Monoclinic sulphur

24. In a face-centered cubic lattice, a unit cell is shared equally by how many unit cells

(A) 8 (B) 4

(C) 2 (D) 6

25. The maximum radius of sphere that can be fitted in the octahedral hole of cubical closed packing of sphere of radius r is

(A) 0.732 r (B) 0.414 r

(C) 0.225 r (D) 0.155 r

26. The unit cell of a NaCl lattice

(A) Is body centred cube

(B) Has $3Na^{+}$ ions

(C) Has 4NaCl units

(D) Is electrically charged

27. For tetrahedral coordination number, the radius ratio $\frac{r_{c^+}}{r_{a^-}}$ is

(A) 0.732 – 1.000 (B) 0.414 – 0.732

(C) 0.225 – 0.414 (D) 0.155 – 0.225

28. What type of lattice is found in potassium chloride crystal

(A) Face centred cubic

(B) Body centred cubic

(C) Simple cubic

(D) Simple tetragonal

29. The three dimensional graph of lattice points which sets the pattern for the whole lattice is called

(A) Space lattice

(B) Simple lattice

(C) Unit cell

(D) Crystal lattice

30. Crystals can be classified into ..... basic crystal habits

(A) 3 (B) 7

(C) 14 (D) 4

31. Bravais lattices are of

(A) 8 types (B) 12 types

(C) 14 types (D) 9 types

32. The structure of TlCl is similar to CsCl. What would be the radius ratio in TlCl

(A) 0.155 – 0.225

(B) 0.225 – 0.414

(C) 0.414 – 0.732

(D) 0.732 – 1.000

33. Structure similar to zinc blende is found in

(A) AgCl (B) NaCl

(C) CuCl (D) TlCl

34. The structure of Na_2O crystal is

(A) CsCl type (B) NaCl type

(C) ZnS type (D) Antifluorite

35. Structure of *ZnS* is

(A) Body centred cubic

(B) Face centred cubic

(C) Simple cube

(D) Fluorite structure

Crystal packing

36. Na and Mg crystallize in *BCC* and *FCC* type crystals respectively, then the number of atoms of Na and Mg present in the unit cell of their respective crystal is

(A) 4 and 2 (B) 9 and 14

(C) 14 and 9 (D) 2 and 4

37. An AB_2 type structure is found in

(A) NaCl (B) Al_2O_3

(C) CaF_2 (D) N_2O

38. Potassium crystallizes with a

(A) Face-centred cubic lattice

(B) Body-centred cubic lattice

(C) Simple cubic lattice

(D) Orthorhombic lattice

39. If the number of atoms per unit in a crystal is 2, the structure of crystal is

(A) Octahedral

(B) Body centred cubic *bcc*

(C) Face centred cubic fcc

(D) simple cubic

40. The intermetallic compound LiAg crystallizes in cubic lattice in which both lithium and silver have coordination number of eight. The crystal class is

(A) Simple cube

(B) Body-centred cube

(C) Face-centred cube

(D) None of these

41. The number of octahedral sites per sphere in a *fcc* structure is

(A) 8 (B) 4

(C) 2 (D) 1

42. Hexagonal close packed arrangement of ions is described as

(A) ABC ABA (B) ABC ABC

(C) ABABA (D) ABBAB

43. An example of a body cube is

(A) Sodium (B) Magnesium

(C) Zinc (D) Copper

44. An example of fluorite structure is

(A) NaF (B) SrF_2

(C) $AlCl_3$ (D) SiF_4

45. In which of the following crystals alternate tetrahedral voids are occupied?

(A) *NaCl* (B) *ZnS*

(C) CaF_2 (D) Na_2O

46. The vacant space in the *bcc* unit cell is

(A) 32% (B) 23%

(C) 26% (D) None of these

47. The number of octahedral voids in a unit cell of a cubical closest packed structure is

(A) 1 (B) 2

(C) 4 (D) 8

48. In the closest packed structure of a metallic lattice, the number of nearest neighbours of a metallic atom is

(A) Twelve (B) Four

(C) Eight (D) Six

49. In the rock salt structure, the number of formula units per unit cell is equal to

(A) 1 (B) 2

(C) 3 (D) 4

50. Hexagonal close packing is found in crystal lattice of

(A) Na (B) Mg

(C) Al (D) None of these

Mathematical analysis of cubic system and Bragg's equation

51. The number of spheres contained (i) in one body centred cubic unit cell and (ii) in one face centred cubic unit cell, is

(A) In (i) 2 and in (ii) 4

(B) In (i) 3 and in (ii) 2

(C) In (i) 4 and in (ii) 2

(D) In (i) 2 and in (ii) 3

52. CsBr crystal has bcc structure. It has an edge length of 4.3 Å. The shortest interionic distance between Cs^+ and Br^- ions is

(A) 1.86 Å (B) 3.72 Å

(C) 4.3 Å (D) 7.44 Å

53. In octahedral holes (voids)

(A) A simple triangular void surrounded by four spheres

(B) A bi-triangular void surrounded by four spheres

(C) A bi-triangular void surrounded by six spheres

(D) A bi-triangular void surrounded by eight spheres

54. Bragg's law is given by the equation

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

(C) $2n\lambda = d \sin\theta$ (D) $n\frac{\theta}{2} = \frac{d}{2}\sin\theta$

55. The number of atoms in 100 g of an fcc crystal with density $d = 10\ g/cm^3$ and cell edge equal to 100 pm, is equal to

(A) 4×10^{25} (B) 3×10^{25}

(C) 2×10^{25} (D) 1×10^{25}

56. In the crystals of which of the following ionic compounds would you expect maximum distance between centres of cations and anions

(A) LiF (B) CsF

(C) CsI (D) LiI

57. The number of unit cells in 58.5g of NaCl is nearly

(A) 6×10^{20} (B) 3×10^{22}

(C) 1.5×10^{23} (D) 0.5×10^{24}

58. How many unit cells are present in a cube-shaped ideal crystal of *NaCl* of mass 1.00 *g* [Atomic masses: Na = 23, Cl = 35.5]

(A) 2.57×10^{21} unit cells

(B) 5.14×10^{21} unit cells

(C) 1.28×10^{21} unit cells

(D) 1.71×10^{21} unit cells

59. In the Bragg's equation for diffraction of *X*-rays, *n* represents for

(A) Quantum number (B) An integer

(C) Avogadro's numbers (D) Moles

60. In a face centred cubic cell, an atom at the face contributes to the unit cell

(A) 1/4 part (B) 1/8 part

(C) 1 part (D) 1/2 part

61. The number of atoms/molecules contained in one face centred cubic unit cell of a monoatomic substance is

(A) 1 (B) 2

(C) 4 (D) 6

62. The number of atoms/molecules contained in one body centered cubic unit cell is

(A) 1 (B) 2

(C) 4 (D) 6

63. It the distance between Na^+ and Cl^- ions in sodium chloride crystal is X pm, the length of the edge of the unit cell is

(A) 4X pm (B) X/4 pm

(C) X/2 pm (D) 2X pm

64. The edge of unit cell of FCC Xe crystal is 620 pm . The radius of Xe atom is

(A) 219.25 Pm (B) 235.16 Pm

(C) 189.37 Pm (D) 209.87 Pm

65. In orthorhombic, the value of a, b and c are respectively 4.2Å, 8.6Å and 8.3Å . given the molecular mass of the solute is $155\,gm\,mol^{-1}$ and that of density is $3.3\,gm/cc$, the number of formula units per unit cell is

(A) 2 (B) 3

(C) 4 (D) 6

Crystal structure and Coordination number

66. In a solid '*AB*' having the NaCl structure, '*A*' atoms occupy the corners of the cubic unit cell. If all the face-centered atoms along one of the axes are removed, then the resultant stoichiometry of the solid is

(A) AB_2 (B) A_2B

(C) A_4B_3 (D) A_3B_4

67. In solid CsCl each Cl is closely packed with how many Cs

(A) 8 (B) 6

(C) 10 (D) 2

68. In A^+B^- ionic compound, radii of A^+ and B^- ions are 180 pm and 187 pm respectively. The crystal structure of this compound will be

(A) NaCl type

(B) CsCl type

(C) ZnS type

(D) Similar to diamond

69. In which of the following substances the carbon atom is arranged in a regular tetrahedral structure

(A) Diamond (B) Benzene

(C) Graphite (D) Carbon black

70. The coordination number of a metal crystallizing in a hexagonal close packed structure is

(A) 4 (B) 12

(C) 8 (D) 6

71. The structure of MgO is similar to NaCl. What would be the coordination number of magnesium

(A) 2 (B) 4

(C) 6 (D) 8

72. How many chloride ions are there around sodium ion in sodium chloride crystal

(A) 3 (B) 8

(C) 4 (D) 6

73. Most crystals show good cleavage because their atoms, ions or molecules are

(A) Weakly bonded together

(B) Strongly bonded together

(C) Spherically symmetrical

(D) Arranged in planes

74. An example of a non-stoichiometric compound is

(A) Al_2O_3 (B) Fe_3O_4

(C) NiO_2 (D) PbO

75. If the radius ratio is in the range of $0.731-1$, then the coordination number will be

(A) 2 (B) 4

(C) 6 (D) 8

76. In NaCl lattice the coordination number of Cl^- ion is

(A) 2 (B) 4

(C) 6 (D) 8

77. In zinc blende structure the coordination number of Zn^{2+} ion is

(A) 2 (B) 4

(C) 6 (D) 8

78. Coordination number of Na^+ ion in rock salt is

(A) 12 (B) 4

(C) 8 (D) 6

79. The number of Cl^- ions around one Na^+ in NaCl crystal lattice is

(A) 12 (B) 4

(C) 8 (D) 6

80. The number of atoms present in unit cell of a monoatomic substance of simple cubic lattice is

(A) 6 (B) 3

(C) 2 (D) 1

Defects in crystal

81. In the laboratory, sodium chloride is made by burning the sodium in the atmosphere of chlorine which is yellow in colour. The cause of yellow colour is

(A) Presence of Na^+ ions in the crystal lattice

(B) Presence of Cl^- ions in the crystal lattice

(C) Presence of electron in the crystal lattice

(D) Presence of face centered cubic crystal lattice

82. Frenkel defect is caused due to

(A) An ion missing from the normal lattice site creating a vacancy

(B) An extra positive ion occupying an interstitial position in the lattice

(C) An extra negative ion occupying an interstitial position in the lattice

(D) The shift of a positive ion from its normal lattice site to an interstitial site

83. Which one of the following has Frenkel defect

(A) Sodium chloride (B) Graphite

(C) Silver bromide (D) Diamond

84. Schottky defect generally appears in

(A) NaCl (B) KCl

(C) CsCl (D) All of these

85. Schottky defect in crystals is observed when

(A) Density of crystal is increased

(B) Unequal number of cations and anions are missing from the lattice

(C) An ion leaves its normal site and occupies an interstitial site

(D) Equal number of cations and anions are missing from the lattice

86. In AgBr crystal, the ion size lies in the order $Ag^{+} << Br^{-}$. The AgBr crystal should have the following characteristics

(A) Defectless (perfect) crystal

(B) Schottky defect only

(C) Frenkel defect only

(D) Both Schottky and Frenkel defects

87. Frenkel and Schottky defects are

(A) Nucleus defects

(B) Non-crystal defects

(C) Crystal defects

(D) None of these

88. Which one of the following is the most correct statement

(A) Brass is an interstitial alloy, while steel is a substitutional alloy

(B) Brass is a substitutional alloy, while steel is an interstitial alloy

(C) Brass and steel are both substitutional alloys

(D) Brass and steel are both interstitial alloys

89. The flame colours of metal ions are due to

(A) Frenkel defect

(B) Schottky defect

(C) Metal deficiency defect

(D) Metal excess defect

90. Which one of the following crystals does not exhibit Frenkel defect

(A) *AgBr* (B) *AgCl*

(C) *KBr* (D) *ZnS*