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THE SOLID STATE

Single Correct Answer Type

1. Schottky defect generally appears in
    a) NaCl   b) KCl   c) CsCl   d) All of these
2. Which arrangement of electrons leads ferromagnetism?
    a) ↑↑↑↑   b) ↑↓↑↓   c) ↑↑↑↓↓   d) None of these
3. The crystal are bounded by plane faces (f), straight edges (e) and interfacial angel (c). The relationship between these is :
    a) $f + c = e + 2$ b) $f + e = c + 2$ c) $c + e = f + 2$ d) None of these
4. The melting point of RbBr is 682°C, while that of NaF is 988°C. The principle reason that melting point of NaF is much higher than that of RbBr is that :
    a) The two crystals are not isomorphous
    b) The molar mass of NaF is smaller than that of RbBr
    c) The internuclear distance $r_c + r_a$ is greater for RbBr than for NaF
    d) The bond is RbBr has more covalent character than the bond in NaF.
5. If a crystal lattice of a compound, each corner of a cube is enjoyed by sodium, each edge of a cube has oxygen and centre of a cube is enjoyed by tungsten (W), then give its formula
    a) Na_2WO_4 b) $NaWO_3$ c) Na_3WO_3 d) Na_2WO_3
6. In antifluorite structure, the negative ions:
    a) Occupy tetrahedral voids
    b) Occupy octahedral voids
    c) Are arranged in ccp
    d) Are arranged in hcp
7. An insulator oxide is :
    a) CuO   b) C_OO c) Fe_2O_3 d) All of these
8. A solid with high electrical and thermal conductivity from the following is :
    a) Si   b) Li   c) NaCl   d) ice
9. The radius ratio $\left(\frac{r_+}{r_-}\right)$ of an ionic solid (A^+B^-) is 0.69. What is the coordination number of B^-?
    a) 6   b) 8   c) 2   d) 10
10. The axial angles in triclinic crystal system are
    a) $\alpha = \beta = \gamma = 90°$ b) $\alpha = \gamma = 90°, \beta \neq 90°$ c) $\alpha \neq \beta \neq \gamma \neq 90°$ d) $\alpha = \beta = \gamma \neq 90°$
11. In NaCl crystal each Cl^- ion is surrounded by
    a) 4 Na^+ ions   b) 6 Na^+ ions   c) 1 Na^+ ion   d) 2 Na^+ ions
12. For an ionic crystal of the general formula A^+B^- and co-ordination number 6, the radius ration will be :
    a) Greater than 0.73
    b) Between 0.73 and 0.41
    c) Between 0.41 and 0.22
    d) Less than 0.22
13. The ratio of cations to anion in a octahedral close packing is :
    a) 0.414   b) 0.225   c) 0.02   d) None of these
14. Electrons in a paramagnetic compound are
    a) Shared   b) Unpaired   c) Donated   d) Paired
15. Crystals which are good conductor of electricity and heat are known as :

a) Ionic crystals   b) Covalent crystals   c) Metallic crystals   d) Molecular crystal

16. An element has bcc structure having unit cells 12.08×10^{23}. The number of atoms in these cells is :

a) 12.08×10^{23} b) 24.16×10^{23} c) 48.38×10^{23} d) 12.08×10^{22}

17. Among the following types of voids, which one is the largest void?

a) Triangular   b) Cubic   c) Tetrahedral   d) Octahedral

18. The crystalline structure of NaCl is

a) Hexagonal close packing   b) Face centred cubic

c) Square planar   d) Body centred cubic

19. Metals have conductivity of the order of $(\text{ohm}^{-1}\, \text{cm}^{-1})$:

a) 10^{12} b) 10^{8} c) 10^{2} d) 10^{-6}

20. Of the elements Sr, Zr, Mo, Cd and Sb, all of which are in V period, the paramagnetics are:

a) Se, Cd and Sb   b) Zr, Mo and Cd   c) Sr, Zr and Cd   d) Zr, Mo and Sb

21. The radius ratio of CsCl is 0.93. The expected lattice structure is

a) Tetrahedral   b) Square planar   c) Octahedral   d) Body centred cubic

22. Which one of the following defects in the crystals lowers its density?

a) Frenkel defect   b) Schottky defect   c) F-centres   d) Interstitial defect

23. The yellow colour of ZnO and conducting nature produced in heating is due to:

a) Metal excess defects due to interstitial cation

b) Extra positive ions present in an interstitial site

c) Trapped electrons

d) All of the above

24. A metal has bcc structure and the edge length of its unit cell is 3.04 Å. The volume of the unit cell in cm^3 will be

a) $1.6 \times 10^{-21}\, \text{cm}^3$ b) $2.81 \times 10^{-23}\, \text{cm}^3$ c) $6.02 \times 10^{-23}\, \text{cm}^3$ d) $6.6 \times 10^{-24}\, \text{cm}^3$

25. The edge length of a face centred cubic cell of an ionic substance is 508 pm. If the radius of the cation is 110 pm, the radius of the anions is

a) 288 pm   b) 398 pm   c) 618 pm   d) 144 pm

26. An ionic compound is expected to have tetrahedral structure if r_+/r_- lies in the range of

a) 0.414 to 0.732   b) 0.225 to 0.414   c) 0.155 to 0.225   d) 0.732 to 1

27. The interparticle forces in solid hydrogen are :

a) Hydrogen bonds   b) Covalent bonds   c) Co-ordinate bonds   d) Van der Waals' forces

28. If Z is the number of atoms in the unit cell that represents the closest packing sequence $-ABC\ ABC-$, the number of tetrahedral voids in the unit cell is equal to :

a) Z   b) 2Z   c) $\dfrac{Z}{2}$ d) $\dfrac{Z}{4}$

29. Quartz is an example of :

a) Chain silicate   b) Infinite sheet silicate   c) Framework silicate   d) Cyclic silicate

30. For AX ionic crystal to exist in bcc structure, the ratio of radii $\left(\dfrac{r_{\text{cation}}}{r_{\text{anions}}}\right)$ should be

a) Between 0.41 and 0.73   b) Greater then 0.73

c) Less than 0.41   d) Equal to 1.0

31. Which crystal is expected to be soft and have low melting point?

a) Covalent   b) Metallic   c) Molecular   d) Ionic

32. The elements commonly used for making transistors are

a) C and Si   b) Ga and In   c) P and As   d) Si and Ge

33. Silver (atomic weight $= 108\, \text{g mol}^{-1}$) has a density of $10.5\, \text{g cm}^{-3}$. The number of silver atoms on a surface of area $10^{-12}\, \text{m}^2$ can be expressed in scientific notation as $y \times 10^{x}$. The value of x is

a) 3   b) 5   c) 7   d) 9

34. The first order reflection $(n = 1)$ from a crystal of the X-ray from a copper anode tube $(\lambda = 1.54\, \text{Å})$ occurs at an angle of $45°$. What is the distance between the set of plane causing the diffraction?

a) 0.1089 nm   b) 0.1089 m   c) 0.905 Å   d) 1.089×10^{-9}m

35. What is the number of tetrahedral voids per atom in a crystal?
    a) 1   b) 2   c) 6   d) 8

36. Iodine is a
    a) Electrovalent solid   b) Atomic solid   c) Molecular solid   d) Covalent solid

37. In CsCl type structure the coordination number of Cs^+ and Cl^- are
    a) 6, 6   b) 6, 8   c) 8, 8   d) 8, 6

38. Structure of a mixed oxide is cubic close-packed (c.c.p). The cubic unit cell of mixed oxide is composed of oxide ions. One fourth of the tetrahedral voids are occupied by divalent metal A and the octahedral voids are occupied by a monovalent metal B. The formula of the oxide is :
    a) $AB\,O_2$ b) A_2BO_2 c) $A_2B_3O_4$ d) AB_2O_2

39. The example of orthosilicate is :
    a) $MgCaSi_2O_6$ b) Mg_2SiO_4 c) $Fe_2O_3SiO_2$ d) $Ba_3Al_2Si_6O_8$

40. A compound CuCl has face centred cubic structure. Its density is 3.4 g cm^{-3}. The length of unit cell is :
    a) 5.783Å   b) 6.783Å   c) 7.783Å   d) 8.783Å

41. The orthorhombic, the value of a, b and c are respectively 4.2 Å, $6.8A$ Å and 8.3 Å. Given the molecular mass of the solute is 155 g mol^{-1} and that of density is 3.3g/cc, the number of formula units per unit cell is
    a) 2   b) 3   c) 4   d) 6

42. Which one of the following is a covalent crystal?
    a) Rock salt   b) Ice   c) Quartz   d) Dry ice

43. LiF is a/an :
    a) Ionic crystal   b) Metallic crystal   c) Covalent crystal   d) Molecular crystals

44. A binary solid (A^+B^-) has a rock salt structure. If the edge length is 400 pm and radius of cation is 75 pm the radius of anion is :
    a) 100 pm   b) 125 pm   c) 250 pm   d) 325 pm

45. The limiting radius ratio for tetrahedral shape is
    a) 0 to 0.155   b) 0.255 to 0.414   c) 0.155 to 0.225   d) 0.414 to 0.732

46. A metallic element has a cubic lattice. Each edge of the unit of cell is 2Å. The density of the metal is 2.5 g cm^{-3}. The unit cells in 200 g of metal are
    a) 1×10^{24} b) 1×10^{20} c) 1×10^{22} d) 1×10^{25}

47. Potassium has a bcc structure with nearest neighbour distance 4.52 Å. Its atomic weight is 39. Its density will be :
    a) 454 kg m^{-3} b) 804 kg m^{-3} c) 852 kg m^{-3} d) 910 kg m^{-3}

48. Lithium forms body centred cube structure. The length of the side of its unit cell is 351 pm. Atomic radius of the lithium will be :
    a) 300 pm   b) 240 pm   c) 152 pm   d) 75 pm

49. Bragg's equation is :
    a) $n\lambda = 2\theta \sin\theta$ b) $n\lambda = 2d \sin\theta$ c) $2n\lambda = d \sin\theta$ d) $\lambda = (2d/n) \sin\theta$

50. The intermetallic compound LiAg has a cubic crystalline structure in which each Li atom has 8 nearest neighbor silver atoms and $vice-versa$. What is the type of unit cell?
    a) Body centred cubic
    b) Face centred cubic
    c) Simple cubic for either Li atoms alone or Ag atoms alone
    d) None of the above

51. In the face centred cubic lattice, atom A occupies the corner positions and atom B occupies the face centre positions. If one atom of B is missing from one of the face centred points, the formula of the compound is
    a) A_2B b) AB_2 c) A_2B_2 d) A_2B_5

52. Which compound has highest lattice energy?
    a) LiBr   b) LiCl   c) LiI   d) LiF

53. In a face centred cubic cell, an atom at the face centre is shared by :
    a) 4 unit cells   b) 2 unit cells   c) 1 unit cell   d) 6 unit cells

54. Extremely pure samples of Ge and Si are non-conductors, but their conductivity increases suddenly on introducing ....in their crystal lattice.
    a) As   b) B   c) Both (a) and (b)   d) None of these

55. Iodine crystals are :
    a) Metallic solid   b) Ionic solid   c) Molecular solid   d) Covalent solid

56. Which of the following statements about amorphous solids is incorrect?
    a) They melt over a range of temperature   b) They are anisotropic
    c) There is no orderly arrangement of particles   d) They are rigid and incompressible

57. The number of atoms present in a simple cubic unit cell are :
    a) 4   b) 3   c) 2   d) 1

58. An AB_2 type structure is found in :
    a) NaCl   b) CaF_2 c) Al_2O_3 d) N_2O

59. A cubic crystal possesses in all ......elements of symmetry.
    a) 9   b) 13   c) 1   d) 23

60. A solid compound contains X, Y and Z atoms in a cubic lattice with X atom occupying the corners. Y atoms in the body centred positions and Z atoms at the centres of faces of the unit cell. What is the empirical formula of the compound?
    a) XY_2Z_3 b) XYZ_3 c) $X_2Y_2Z_3$ d) X_8YZ_6

61. The oxide which shows transition from metal to insulation, *i.e*, semiconductors are :
    a) V_2O_3 b) VO_2 c) Ti_2O_3 d) All of these

62. Edge length of a cube is 400 pm. Its body diagonal would be :
    a) 600 pm   b) 566 pm   c) 693 pm   d) 500 pm

63. Crystals can be classified into .... Basic crystal habits.
    a) 7   b) 4   c) 14   d) 3

64. The unit cell with crystallographic dimensions $a = b \neq c$; $\alpha = \beta = \gamma = 90^0$ is :
    a) Cubic   b) Tetragonal   c) Monoclinic   d) Hexagonal

65. The number of octahedral void(s) per atom present in a cubic close-packed structure is :
    a) 2   b) 4   c) 1   d) 3

66. The hardness of metals increases with increase in number of ......involved in metallic bonding.
    a) Atoms   b) Molecules   c) Electrons   d) All of these

67. The substance which possesses zero resistance as 0 K :
    a) Conductor   b) Super conductor   c) Insulator   d) Semiconductor

68. Sodium metal crystallises at room temperature in a body centred cubic lattice with a cell edge $a = 4.29$ Å. The radius of sodium atom is
    a) 1.40   b) 2.65   c) 1.85   d) 2.15

69. The oxide which shows metallic conduction:
    a) ReO_3 b) VO c) CrO_2 d) All of these

70. The number of hexagonal faces that are present in a truncated octahedron is
    a) 2   b) 4   c) 6   d) 8

71. Which of the following statement is true?
    a) Some complex metal oxides behave as superconductor   b) Zinc oxide can act as superconductor
    c) An impurity of tetravalent germanium in trivalent gallium creates electron deficiency   d) A Frenkel defect is formed when an ion is displaced from its lattice site to an interstitial site

72. Schottky defect defines imperfection in the lattice structure of a :
    a) Solid   b) Gas   c) Liquid   d) Plasma

73. When electrons are trapped into the crystal in anion vacancy, the defect is known as :

a) Schottky defect   b) Frenkel defect   c) Stoichiometric defect   d) F-centres

74. Which of the following has highest value of energy gap?
    a) Aluminum   b) Silver   c) Germanium   d) Diamond

75. If 'a' stands for the edge length of the cubic systems : simple cubic, body-centred cubic and face-centered, then the ratio of radii of the spheres in these systems will be respectively,
    a) $\frac{1}{2}a : \sqrt{3}\,a : \frac{1}{\sqrt{2}}\,a$ b) $\frac{1}{2}a : \frac{\sqrt{3}}{2}\,a : \frac{\sqrt{2}}{2}\,a$ c) $\frac{1}{2}a : \sqrt{3}a : \sqrt{2}a$ d) $\frac{1}{2}a : \frac{\sqrt{3}}{4}\,a : \frac{1}{2\sqrt{2}}\,a$

76. In a face centred cubic lattice the number of nearest neighbours for a given lattice point are :
    a) 6   b) 8   c) 12   d) 14

77. Percentage of free space in cubic close packed structure and in body centred packed structure are respectively
    a) 30% and 26%   b) 26% and 32%   c) 32% and 48%   d) 48% and 26%

78. Lithium borohydride crystallizes in an orthorhombic system with 4 molecule per unit cell. The unit cell dimensions are $a = 6.8$ Å, $b = 4.4$ Å and $c = 7.2$ Å. If the molar mass is 21.76, then the density of crystals is :
    a) 0.6708 g cm^{-3} b) 1.6708 g cm^{-3} c) 2.6708 g cm^{-3} d) None of these

79. Total volume of atoms present in a face centred cubic unit cell of a metal is (r=atomic radius)
    a) $\frac{20}{3}\pi r^3$ b) $\frac{24}{3}\pi r^3$ c) $\frac{12}{3}\pi r^3$ d) $\frac{16}{3}\pi r^3$

80. Which has no rotation of symmetry?
    a) Hexagonal   b) Orthorhombic   c) Cubic   d) Triclinic

81. The unit cell with dimensions $\alpha = \beta = \gamma = 90°, a = b \neq c$ is
    a) Cubic   b) Triclinic   c) Hexagonal   d) Tetragonal

82. A fcc element (atomic mass = 60) has a cell edge of 400 pm. Its density is :
    a) 6.23 g cm^{-3} b) 6.43 g cm^{-3} c) 6.53 g cm^{-3} d) 6.63 g cm^{-3}

83. For a crystal system $a = b = c$ and $\alpha = \beta = \gamma \neq 90°$
    a) Tetragonal   b) Hexagonal   c) Rhombohedral   d) Monoclinic

84. The number of atoms (n) contained within a cubic cell is :
    a) 1   b) 2   c) 3   d) 4

85. All the substances becomes diamagnetic at :
    a) 4 K   b) 10 K   c) 20 K   d) 25 K

86. The co-ordination number of Ca^{2+} ion in fluorite crystal is :
    a) 2   b) 8   c) 6   d) 4

87. What is the structure of NaCl?
    a) BCC   b) FCC   c) Interpenetrating fcc   d) None of these

88. Which of the following statements is not correct?
    a) Molecular solids are generally volatile
    b) The number of carbon atoms in an unit cell of diamond is 4
    c) The number of Bravais lattices in which a crystal can be categorized is 14
    d) The fraction of the total volume occupied by the atoms in a primitive cell is 0.48.

89. Which is the wrong statement regarding a crystal containing Schottky defect?
    a) Electrical neutrality of the crystal is maintained
    b) Entropy of the crystal increases
    c) The density of the overall crystal remains the same
    d) The density of the overall crystal reduces

90. How many 'nearest' and 'next nearest' neighbours respectively potassium have in bcc lattice?
    a) 8, 8   b) 8, 6   c) 6, 8   d) 8, 2

91. Ferrimagnetic is converted into paramagnetic at :

a) 300 K b) 400 K c) 600 K d) 850 K

92. A match box exhibits :
    a) Cubic geometry
    b) Monoclinic geometry
    c) Orthorhombic geometry
    d) Tetragonal geometry

93. The oxide that possesses electrical conductivity :
    a) V_2O_5 b) CrO_2 c) NiO d) MnO

94. The arrangement $ABC\ ABC$......is referred to as,
    a) Octahedral close packing
    b) Hexagonal close packing
    c) Tetrahedral close packing
    d) Cubic close packing

95. The lattice points of a crystal of hydrogen iodide are occupied by
    a) HI molecules b) H atoms and I atoms
    c) H^+ cations and I^- anions d) H_2 molecules and I_2 molecules

96. A metal crystallises in a bcc lattice. Its unit cell edge length is about 300 pm and its molar mass about 50 g mol^{-1}. What would be the density of the metal(in g cm^{-3})?
    a) 3.1 b) 6.2 c) 9.3 d) 12.4

97. The radius of the Na^+ is 95 pm and that of Cl^- ion is 181 pm. Predict the co-ordination number of Na^+ :
    a) 4 b) 6 c) 8 d) Unpredictable

98. How many unit cells are present in a cube shaped ideal crystal of NaCl of mass 1.00g?
    [Atomic masses : Na = 23, Cl = 35.5]
    a) 2.57×10^{21} b) 5.14×10^{21} c) 1.28×10^{21} d) 1.71×10^{21}

99. For a covalent solid, the units which occupy lattice points are :
    a) Atoms b) Ions c) Molecules d) Electrons

100. The metal surfaces are excellent reflectors because of absorption and re-emission of light by :
    a) Protons in atom b) Electrons in atom c) Neutrons in atom d) None of these

101. The fraction of total volume occupies by the atoms present in a simple cube is :
    a) $\dfrac{\pi}{3\sqrt{2}}$ b) $\dfrac{\pi}{4\sqrt{2}}$ c) $\dfrac{\pi}{4}$ d) $\dfrac{\pi}{6}$

102. If we mix a pentavalent impurity in a crystal lattice of germanium, what type of semiconductor formation will occur?
    a) $p-$type b) $n-$type c) Both (a) and (b) d) None of the two

103. A metal crystallizes with a face-centered cubic lattice. The edge of the unit cell is 408 pm. The diameter of the metal atom is :
    a) 144 pm b) 204 pm c) 288 pm d) 408 pm

104. Metallic crystalline solids :
    a) Have low melting point and boiling point
    b) Are bad conductors
    c) Are good conductors of heat and electricity
    d) Only conduct heat

105. Most crystals show good cleavage because their atoms, ions and molecules are:
    a) Weakly bonded together
    b) Strongly bonded together
    c) Spherically symmetrical
    d) Arranged in planes

106. The structure of MgO is similar to NaCl. The co-ordination number of Mg is :
   a) 2 b) 6 c) 4 d) 8

107. If NaCl is dopped with 10^{-4} mole % of $SrCl_2$ the concentration of cation vacancies will be:
a) 6.02 x 10^{16} mol^{-1} b) 6.02 x 10^{17} mol^{-1} c) 6.02 x 10^{14} mol^{-1} d) 6.02 x 10^{15} mol^{-1}

108. What type of crystal defect is indicated in the diagram below?

Na^+, Cl^-, Na^+, Cl^-, Na^+, Cl^-

Cl^- ☐ Cl^- Na^+ ☐ Na^+

Na^+ Cl^- ☐ Cl^-, Na^+ Cl^-

Cl^- Na^+ Cl^- Na^+ ☐ Na^+

a) Frenkel defect   b) Schottky defect
c) Interstitial defect   d) Frenkel and Schottky defects

109. An ion leaves its regular site occupy a position in the space between the lattice sites is called
a) Frenkel defect   b) Schottky defect   c) Impurity defect   d) Vacancy defect

110. Schottky defects occurs mainly in electrovalent compounds where
a) Positive ions and negative ions are of different size
b) Positive ions and negative ions are of same size
c) Positive ions are small and negative ions are big
d) Positive ions are big and negative ions are small

111. Sodium metal crystallizes in a body centred cubic lattice with the cell edge $a = 4.29$ Å. The radius of sodium atom is :
a) 1.8574 Å   b) 2.8574 Å   c) 3.8574 Å   d) None of these

112. The cation-anion bond have the largest amount of covalent character for:
a) NaBr   b) SrS   c) CdS   d) BaO

113. In a cubic close packing of spheres in three dimensions, the co-ordination number of each sphere is :
a) 6   b) 9   c) 3   d) 12

114. In a cubic structure of diamond which is made from X and Y, where X atoms are at the corners of the cube and Y at the face centres of the cube. The molecular formula of the compound is
a) X_2Y b) X_3Y c) XY_2 d) XY_3

115. Which of the following statements is not correct?
a) The units of surface tension are dynes Cm^{-1}
b) The units of viscosity coefficient of a liquid are 'poise '
c) CsCl crystallizes in body centred cubic type of lattice
d) The coordination number of S^{2-} in ZnS is 6

116. The ability of a given substance to assume two or more crystalline structure is called
a) Amorphism   b) Isomorphism   c) Polymorphism   d) Isomerism

117. With which one of the following element silicon should be doped so as to give p-type semiconductor?
a) As   b) Se   c) B   d) Ge

118. If the radius of K^+ and F^- are 133 pm and 136 pm respectively, the distance between K^+ and F^- in KF is
a) 269 pm   b) 134.5 pm   c) 136 pm   d) 3 pm

119. Copper crystallises in fcc with a unit cell length of 361 pm. What is the radius of copper atom?
a) 108 pm   b) 127 pm   c) 157 pm   d) 181 pm

120. Which species is paramagnetic?
a) NO   b) Fe^{3+} c) Fe^{2+} d) All are correct

121. Density of a crystal remains unchanged as a result of
a) Ionic defect   b) Schottky defect   c) Frenkel defect   d) Crystal defect

122. A metallic element crystallises into lattice containing a sequence of layers of $ABABABAB$ .... Any packing of spheres leaves out void in the lattice. The empty space in percentage by volume in this lattice is :
a) 26%   b) 32%   c) 20%   d) 30%

123. For a solid with the following structure, the co-ordination number of the point B is :
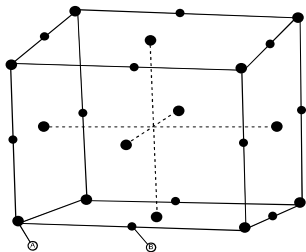
   a) 3   b) 4   c) 5   d) 6

124. The phenomenon in which crystals on subjecting to a pressure or mechanical stress produce electricity is called :

   a) Pyro-electricity   b) Piezo-electric effect   c) Ferro-electricity   d) Ferri-electricity

125. Which arrangement of electron decides ferrimagnetism?

   a) ↑↑↑↑↑   b) ↑↓↑↓   c) ↑↑↑↓↓   d) None of these

126. The 8 : 8 type of packing is present in

   a) MgF_2 b) CsCl   c) KCl   d) NaCl

127. Which is not the correct statement for ionic solids in which positive and negative ions are held by strong electrostatic attractive forces?

   a) The radius r^+/r^- increases as coordination number increases

   b) As the difference in size of ions increases, coordination number increases

   c) When coordination number is eight, the r^+/r^- ratio lies between 0.225 to 0.414

   d) In ionic solid of the type AX (ZnS, Wurtzite), the coordination number of Zn^{2+} and S^{2-} respectively are 4 and 4

128. Which set of characteristics of ZnS crystal is correct?

   a) Coordination number (4 : 4): ccp; Zn^{2+} ion in the alternate tetrahedral voids

   b) Coordination number (6 : 6); hcp; Zn^{2+} ion in all tetrahedral voids

   c) Coordination number (6 : 4); hcp; Zn^{2+} ion in all octahedral voids

   d) Coordination number (4 : 4); ccp; Zn^{2+} ion in all tetrahedral voids

129. NaCl structure consists of :

   a) Na and Cl atoms

   b) Na^+ and Cl atoms

   c) Na atoms and Cl^- ions

   d) Na^+ and Cl^- ions

130. A solid metal has ccp or fcc structure. The relation of side of cube (a) and radius of atom (r) will be

   a) $a = 2r$ b) $a = 2\sqrt{2}r$ c) $a = \dfrac{4}{\sqrt{3}}r$ d) $a = \sqrt{\dfrac{3}{2}}r$

131. A solid X melts slightly above 273 K and is a poor conductor of heat and electricity. To which of the following categories does it belong?

   a) Ionic solid   b) Covalent solid   c) Metallic   d) Molecular

132. Lubricating properties of graphite are diminished in presence of :

   a) High pressure   b) Low pressure   c) Vacuum   d) None of these

133. Lithium metal crystallises in a body centred cubic crystal. If the length of the side of the unit cell of lithium is 351 pm, the atomic radius of the lithium will be :

   a) 300.5 pm   b) 240.8 pm   c) 151.8 pm   d) 75.5 pm

134. Close packing is maximum in the crystal lattice of :

   a) Simple cubic   b) Face centred   c) Body centred   d) None of these

135. The radii of Na^+ and Cl^- ions are 95 pm and 181 pm respectively. The edge length of NaCl unit cell is

   a) 276 pm   b) 138 pm   c) 552 pm   d) 415 pm

136. The ionic radii of Rb^+ and I^- are 1.46 Å and 2.16 Å. The most probable type of structure exhibited by it is
     a) CsCl type   b) ZnS type   c) NaCl type   d) CaF_2 type

137. Which one is diamagnetic?
     a) ClO_3 b) Cu^{2+} c) F^- d) Ni^{2+}

138. The statement that "All crystals of the same substance possess the same elements of symmetry" is known
     as :
     a) Hauy's law of rationality of indices
     b) The law of constancy of interfacial angles
     c) The law of constancy of symmetry
     d) None of the above

139. A solid AB has NaCl type structure with edge length 580.4 pm. The radius of A^+ is 100 pm. What is the
     radius of B^- ?
     a) 190.2   b) 540.13   c) 525   d) 78.12

140. In a face centred cubic arrangement off A and B atoms whose A atoms are at the corner of the unit cell and
     B atoms at the face centres. One of the A atom is missing from one corner in unit cell. The simplest formula
     of compound is :
     a) A_7B_3 b) AB_3 c) A_7B_{24} d) $A_{7/8}B_3$

141. Which one of the following is a covalent crystal?
     a) Rock salt   b) Ice   c) Quartz   d) Dry ice

142. The coordination number of Al in the crystalline state of $AlCl_3$ is
     a) 2   b) 4   c) 6   d) 8

143. In crystal structure of rock salt (NaCl), the arrangement of Cl ion is :
     a) Fcc   b) Bcc   c) Both (a) and (b)   d) None of these

144. In which of the following crystals alternate tetrahedral voids are occupied?
     a) NaCl   b) Zns   c) CaF_2 d) Na_2O

145. A compound of 'A' and 'B' crystallises in a cubic lattice in which 'A' atoms occupy the lattice points at the
     corners of the cube. The 'B' atoms occupy the centre of each face of the cube. The probable empirical
     formula of the compound is
     a) AB_2 b) A_3B c) AB d) AB_3

146. Amorphous solids:
     a) Possess sharp melting points
     b) Undergo clean cleavage when cut with knife
     c) Do not undergo clean cleavage when cut with knife
     d) Possess orderly arrangement over long distances

147. For which crystal anion-anion contact is valid?
     a) NaF   b) NaI   c) CsBr   d) KCl

148. The crystal system of a compound with unit cell dimensions $a = 0.387, b = 0.387,$ and $c = 0.504$ nm and
     $\alpha = \beta = 90°$ and $\gamma = 120°$ is :
     a) Cubic   b) Hexagonal   c) Orthorhombic   d) Rhombohedral

149. Possible number of different type of crystal lattice present in all types of crystals, is
     a) 23   b) 7   c) 230   d) 14

150. Doping of silicon (Si) with boron (B) leads to
     a) n –type semiconductor   b) p –type semiconductor
     c) Metal   d) Insulator

151. AB crystallises in a bcc lattice with edge length $'a'$ equal to 387 pm. The distance between two oppositely
     charged ions in the lattice is :
     a) 335 pm   b) 250 pm   c) 200 pm   d) 300 pm

152. The packing efficiency of the two dimensional square unit cell shown below is
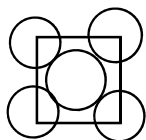
a) 39.27%   b) 68.02%   c) 74.05%   d) 78.54%

153. Which is an example of ferroelectric compound?

a) Quartz   b) $PbCrO_4$ c) Barium titanate   d) None of these

154. An increase in the charge of the positive ions that occupy lattice positions brings in a /an ....in metallic bonding.

a) increase

b) Decrease

c) Neither increase nor decrease

d) Either increase or decrease

155. In a crystal, the atoms are located at the position of ....potential energy.

a) Zero   b) Infinite   c) Minimum   d) Maximum

156. Solids are characterised by their properties :

a) Incompressibility   b) Mechanical strength   c) Crystalling nature   d) All of these

157. Arrangement of sulphide ions in zinc blende is

a) Simple cubic   b) hcp   c) bcc   d) fcc

158. ZnS is :

a) Ionic crystal   b) Covalent crystal   c) Metallic crystal   d) Van der Walls' crystal

159. Which substance shows antiferromagnetism?

a) ZrO_2 b) CdO   c) CrO_2 d) Mn_2O_3

160. The appearance of colour in solid alkali metal halide is generally due to:

a) Frenkel defect   b) Interstitial position   c) F-centres   d) Schottky defect

161. In a cubic close packing of spheres in three dimensions, the co-ordination number of each sphere is :

a) 6   b) 9   c) 3   d) 12

162. High thermal conductivity of metals is due to transfer of heat through :

a) Molecule collisions   b) Electronic collisions   c) Atomic collisions   d) All of these

163. A solid having definite geometrical shape with flat faces and sharp edges is :

a) Amorphous solid   b) Crystalline solid   c) Isotropic solid   d) None of these

164. If the positions of Na^+ and Cl^- are interchanges in NaCl, the crystal lattice with respect to Na^+ and Cl^- is :

a) Both fcc   b) Both bcc   c) Fcc and bcc   d) Bcc and fcc

165. Which kind of defect is shown by the given crystal?

K^+ Cl^-K^+ Cl^-K^+ Cl^-

Cl^- □ Cl^-K^+□ K^+

K^+Cl^- □ $Cl^-K^+Cl^-$

$Cl^-K^+Cl^-K^+$ □ K^+

a) Schottky defect   b) Frenkel defect

c) Schottky and Frenkel defects   d) Substitution disorder

166. An alloy of copper, silver and gold is found to have copper constituting the ccp lattice. If silver atoms occupy the edge centres and gold is present at body centre, the alloy has a formula

a) Cu Ag Au   b) $Cu_4 Ag_2 Au$ c) $Cu_4 Ag_3 Au$ d) $Cu_4 Ag_4 Au$

167. The structure of CsCl crystal is :

a) Body centred cubic lattice

b) Face centred cubic lattice

c) Octahedral lattice

d) None of the abve

168. The pure crystalline substance on being heated gradually first forms a turbid liquid at constant

temperature and still at higher temperature turbidity completely disappears. The behavior is a characteristic of substance forming :

a) Allotropic crystal   b) Liquid crystals   c) Isomeric crystals   d) Isomorphous crystals

169. Molecular crystals exist in :

a) Crystalline state   b) Amorphous state   c) Non-crystalline state   d) All of these

170. The unit cell with the structure below refers to......crystal system.
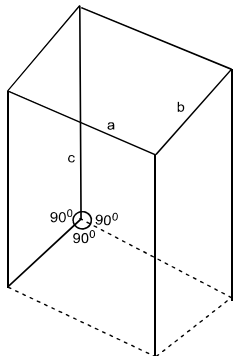
a) Cubic   b) Orthorhombic   c) Tetragonal   d) Trigonal

171. CsBr crystallises in a body centred cubic lattice. The unit cell length is 436.6 pm. Given that the atomic mass of Cs = 133 and that of Br = 80 amu and Avogadro number being 6.02×10^{23} mol^{-1}, the density of CsBr is :

a) 8.25 g/cm^3 b) 4.25 g/cm^3 c) 42.5 g/cm^3 d) 0.425 g/cm^3

172. 8 : 8 co-ordination of CsCl is found to change into 6 : 6 co-ordination on :

a) Applying pressure

b) Increasing temperature

c) Both (a) and (b)

d) None of these

173. Which element is used for making a transistor?

a) Sn   b) Sb   c) Si   d) Mg

174. KCl crystallises in the same type of lattice as dose NaCl. Given that $r_{Na^+}/r_{Cl^-} = 0.55$ and $r_{K^+}/r_{Cl^-} = 0.74$. Calculate the ratio of the side of the unit cell for KCl to that of NaCl.

a) 1.123   b) 0.0891   c) 1.414   d) 0.414

175. The number of atoms (n) contained within a fcc cell is:

a) 1   b) 2   c) 3   d) 4

176. For a crystal, the angle of diffraction $(2.\theta)$ is 90°and the second order line has a d value of 2.28 Å. The wavelength $(in \text{ Å})$ of X-rays used for Bragg's diffraction is

a) 1.612   b) 2.00   c) 2.28   d) 4.00

177. Wax is an example of :

a) Ionic crystal   b) Covalent crystal   c) Molecular crystal   d) Metallic crystal

178. A binary solid (A^+B^-) has a zinc blende structure with B^- ions constituting the lattice and A^+ ions occupying 25% tetrahedral holes. The formula of solid is :

a) AB b) A_2B c) AB_2 d) AB_4

179. The radius of Ag^+ ion is 126 pm while that of I^- ion is 216 pm. The co-ordination number of Ag in AgI is :

a) 2   b) 4   c) 6   d) 8

180. The statement that, "It is possible to choose along the three co-ordinate axes unit distance a, b, c not necessarily of the same length, such that the ratio of there intercepts of any plane in the crystal is given by in $ma : nb : pc$ where m, n, p are either integral whole numbers including infinity or fraction of whole number" is known as :

a) Hauy's law of rationality of indices

b) The law of constancy of interfacial angles

    c) The law of constancy of symmetry

    d) None of the above

181. Number of atoms in the unit cell of Na(bcc type crystal) and Mg(fcc type crystal) are respectively

    a) 4,4   b) 4,2   c) 2,4   d) 1,1

182. Schottky defect is noticed in :

    a) NaCl   b) KCl   c) CsCl   d) All of these

183. Which one is called pseudo solid?

    a) CaF_2 b) Glass   c) NaCl   d) All of these

184. A solid having no definite shape is called :

    a) Amorphous solid   b) Crystalline solid   c) Anisotropic   d) None of these

185. The phenomenon in which polar crystals on heating produce electricity is called :

    a) Pyro-electricity   b) Piezo-electricity   c) Ferro-electricity   d) Ferri-electricity

186. CaF_2 possesses :

    a) Face centred cubic

    b) Body centred cubic

    c) Simple cubic

    d) Hexagonal closed packing

187. The three states of matter are solid, liquid and gas, which of the following statements are correct about them?

    a) Gases and liquids have viscosity as a common property

    b) The molecules in all the three states possess random translational motion

    c) Gases cannot be converted into solids without passing through the liquid phase

    d) Solids and liquids have vapour pressure as a common property

188. Which is ferromagnetic?

    a) Ni   b) Co   c) CrO_3 d) All of these

189. Solid CO_2 is an example of :

    a) Molecular crystal   b) Covalent crystal   c) Metallic crystal   d) Ionic crystal

190. A solid is made of two elements X and Z. The atoms Z are in ccp arrangement while the atom X occupy all the tetrahedral sites. What is the formula of the compound?

    a) XZ b) XZ_2 c) X_2Z d) X_2Z_3

191. A cubic crystal possesses :

    a) 9 plane of symmetry   b) 13 axis of symmetry   c) 1 centre of symmetry   d) All of these

192. A substance A_XB_Y crystallises in a face centred cubic (fcc) lattice in which atoms $'A'$ occupy each corner of the cube and atoms $'B'$ occupy the centres of each face of the cube. Identify the correct composition of the substance A_XB_Y :

    a) AB_3

    b) A_4B_3

    c) A_3B

    d) Composition cannot be specified

193. Which crystal has the largest lattice energy?

    a) KCl   b) MgO   c) LiBr   d) NaF

194. A crystal may have one or more planes and one or more axes of symmetry but it possesses

    a) Two centres of symmetry

    b) One centre of symmetry

    c) No centre of symmetry

    d) None of the above

195. In an antifluorite structure, cations occupy

    a) Octahedral voids   b) Centre of cube   c) Tetrahedral voids   d) Corners of cube

196. In a crystal some ions are missing from normal sites. This is an example of :

a) F-centres   b) Interstitial defect   c) Frenkel defect   d) Schottky defect

197. The number of atoms (n) contained within a body centred cubic cell is:

     a) 1   b) 2   c) 3   d) 4

198. The density of KCl is 1.9893 g cm^{-3} and the length of a side unit cell is 6.29082 Å as determined by X-rays diffraction. The value of Avogadro's number calculated from these data is :

     a) 6.017×10^{23} b) 6.023×10^{23} c) 6.03×10^{23} d) 6.017×10^{19}

199. Which species is diamagnetic ?

     a) Ca^{2+} b) Hg_2Cl_2 c) Sb^{3+} d) All of these

200. Graphite is a soft solid lubricant extremely difficult to melt. The reason for this anomalous behaviour is that graphite :

     a) Is a non-crystalline substance

     b) Is an allotropic form of diamond

     c) Has molecules of variable molecular masses like polymers

     d) Has carbon atoms arranged in large plates of rings of strongly bound carbon atoms with weak interpolate bonds

201. Ionic solids with Schottky defects contain in their structure :

     a) Equal number of cations and anion vacancies

     b) Interstitial anions and anion vacancies

     c) Cation vacancies only

     d) Cation vacancies and interstitial cations

202. Na_2SeO_4 and Na_2SO_4 show :

     a) Isomorphism   b) Polymorphism   c) Allotropism   d) Ferromagnetism

203. The number of molecules of NaCl in an unit cell of its crystal is :

     a) 2   b) 4   c) 6   d) 8

204. A compound $MpXq$ has cubic close packing (ccp) arrangement of X. Its unit cell structure is shown in figure. The empirical formula of the compound is :
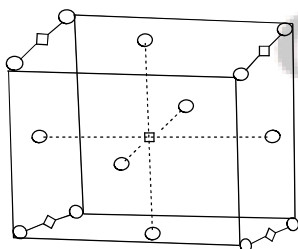

     a) MX b) MX_2 c) M_2X d) M_5X_{14}

205. Which one is correct about ferrites?

     a) These possess formula AB_2O_4 (where A is divalent and B is trivalent cation)

     b) These possess spinel structure

     c) $MgAl_2O_4$ is a ferrite

     d) All of the above

206. If 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

207. The ratio of cations to anion in a closed pack tetrahedral is :

     a) 0.414   b) 0.225   c) 0.02   d) None of these

208. The pyknometric density of sodium chloride crystal is 2.165×10^3 kg m^{-3} while is X-ray density is 2.178×10^3 kg m^{-3}. The fraction of the unoccupied sites in sodium chloride crystal is :

     a) 5.96   b) 5.96×10^{-2} c) 5.96×10^{-1} d) 5.96×10^{-3}

209. A compound alloy of gold and Cu crystallises in a cubic lattice in which the gold atoms occupy the lattice points at the corners of a cube and the copper atoms occupy the centres of each of the cube faces. What is
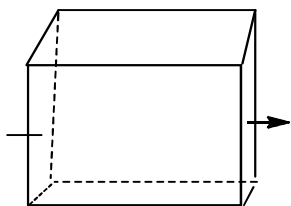
the empirical formula of this compound?

a) $AuCu_3$ b) Au_3Cu c) Au_2Cu_3 d) $AuCu$

210. In a solid lattice, the cation has left a lattice site and is located at an interstitial position, the lattice defect is

a) Frenkel defect   b) Schottky defect   c) F-centre defect   d) Valency defect

211. The unit cell cube length for LiCl (just like NaCl structure) is 5.14 Å , Assuming anion-anion contact, the ionic radius for chloride ion is:

a) 1.815 Å   b) 2.8 Å   c) 3.8 Å   d) 4.815 Å

212. Which arrangement of electrons leads to anti-ferromagnetism?

a) ↑↑↑↑   b) ↑↓↑↓   c) Both (a) and (b)   d) None of these

213. Which of the following will show anisotropy?

a) Glass   b) $BaCl_2$ c) Wood   d) Paper

214. Silicon dioxide is an example of :

a) Metallic crystal   b) Ionic crystal   c) Covalent crystal   d) None of these

215. The number of atoms contained in a fcc unit cell of a monoatomic substance is

a) 1   b) 2   c) 4   d) 6

216. Ionic solids are characterised by :

a) Good conductivity in solid state

b) High vapour pressure

c) Low melting point

d) Solubility in polar solvents

217. The mass of a unit cell of CsCl corresponds to :

a) $8Cs^+$ and Cl^- b) $1Cs^+$ and $6Cl^-$ c) $1Cs^+$ and $1Cl^-$ d) $4Cs^+$ and Cl^-

218. Coordination number of Zn in ZnS (zinc blende) is

a) 6   b) 4   c) 8   d) 12

219. At room temperature, sodium crystallizes in a body centered cubic lattice with $a = 4.24$ Å. the theoretical density of sodium (At. wt. of Na $= 23$) is :

a) 1.002 g cm^{-3} b) 2.002 g cm^{-3} c) 3.002 g cm^{-3} d) None of these

220. Copper crystallises in fcc lattice with a unit cell edge of 361 pm. The radius of copper atom is

a) 181 pm   b) 108 pm   c) 128 pm   d) 157 pm

221. How many number of atoms are there in a cube based unit cell having one atom on each corner and two atoms on each body diagonal of cube

a) 8   b) 6   c) 4   d) 9

222. When light strikes a photographic (AgBr) paper, silver atoms move in through these defects to :

a) Form –ve images

b) Form tiny clumps of silver atoms

c) Form a colour image

d) None of the above

223. Graphite is a

a) Molecular solid   b) Covalent solid   c) Ionic solid   d) Metallic solid

224. Which is covalent solid?

a) Fe_2O_3 b) Diamond   c) Graphite   d) All of these

225. The co-ordination number of Na in Na_2O is :

a) 6   b) 4   c) 8   d) 2

226. The coordination number of Na^+ in NaCl is

a) 6   b) 8   c) 4   d) 1

227. Number of atoms per unit cell of bcc is

a) 1   b) 2   c) 8   d) 4

228. What is the coordination number of body centred cube?

a) 8   b) 6   c) 4   d) 12

229. Which of the following statements are true?
    a) Piezo-electricity is due to net dipole moment
    b) Ferro-electricity is due to alignment of dipoles in same direction
    c) Pyro-electricity is due to heating polar crystals
    d) All of the above

230. A solid has a bcc structure. If the distance of closest approach between the two atoms is 1.73Å. The edge length of the cell is :
    a) 200 pm   b) $\sqrt{3}/\sqrt{2}\ PM$ c) 142.2 pm   d) $\sqrt{2}$ pm

231. The number of octahedral sites in a cubical close pack array of N sphere is :
    a) $N/2$ b) $2N$ c) $4N$ d) N

232. A solid A^+B^- has the B^- ions arranged as below. If the A^+ ions occupy half of the tetrahedral sites in the structure. The formula of solid is :
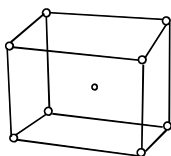
    a) AB b) AB_2 c) A_2B d) A_3B_4

233. Crystalline solids have :
    a) Short range order
    b) Long range order
    c) Anisotropic distribution
    d) No order

234. The statement that, "The crystals of same substance can have different shapes depending upon the number and size of faces but the angle between the corresponding faces remains constant" is known as :
    a) Hauy's law of rationality of indices
    b) The law of constancy of interfacial angles
    c) The law of constancy of symmetry
    d) None of the above

235. Frenkel defect is noticed in :
    a) AgBr   b) ZnS   c) AgI   d) All of these

236. A fcc unit cell of aluminium contains the equivalent of how may atoms?
    a) 1   b) 2   c) 3   d) 4

237. The maximum proportion of available volume that can be filled by hard spheres in diamond is
    a) 0.52   b) 0.34   c) 0.32   d) 0.68

238. The resistance of mercury becomes almost zero at :
    a) 4 K   b) 10 K   c) 20 K   d) 25 K

239. The cubic unit cell of Al (molar mass 27 g mol^{-1})has an edge length of 405 pm. Its density is 2.7 g cm^{-3}. The cubic unit cell is
    a) Face centred   b) Body centred   c) Primitive   d) Edge centred

240. Maximum ferromagnetism is found in :
    a) Fe   b) Ni   c) Co   d) None of these

241. How many tetrahedral holes are occupied in diamond?
    a) 25%   b) 50%   c) 75%   d) 100%

242. The flame colours of metal ions are due to
    a) Frenkel defect   b) Schottky defect
    c) Metal deficiency defect   d) Metal excess defect

243. Which of the following statements is correct?
    a) Silicon doped with boron is an n −type semiconductor

b) Silicon doped with arsenic is a p −type semiconductor

c) Metals are good conductors of electricity

d) Electrical conductivity of semiconductors decreases with increasing temperature

244. A compound is formed by elements A and B. This crystallises in the cubic structure where the A atoms are at the corners of the cube and B atoms are at the body centres. The simplest formula of the compound is

a) AB b) A_6B c) A_8B_4 d) AB_6

245. Which pairs shows isomorphism

a) $KNO_3, NaNO_3$ b) Cr_2O_3, FeO c) Both (a) and (b) d) None of these

246. The elements of symmetry in a crystal are :

a) Plane of symmetry b) Axis of symmetry c) Centre of symmetry d) All of these

247. How many octahedral and tetrahedral holes are present per unit cell in a face centred cubic arrangement of atoms?

a) 8, 4 b) 1, 2 c) 4, 8 d) 2, 1

248. A solid has structure in which 'W' atoms are located at the corners of a cubic lattice 'O' atoms at the centre of edge and Na atoms at the centre of cube. The formula for the compound is

a) Na_2WO_3 b) Na_2WO_2 c) $NaWO_2$ d) $NaWO_3$

249. Which do not form amalgam with Hg?

a) Pt b) Fe c) Both (a) and (b) d) None of these

250. A crystal of Fe_3O_4 is :

a) Paramagnetic b) Diamagnetic c) Ferromagnetic d) Ferromagnetic

251. A solid XY has NaCl structure. If radius of X^+ is 100 pm. What is the radius of Y^- ion?

a) 120 pm b) 136.6 to 241.6 pm c) 136.6 pm d) 241.6 pm

252. An element (atomic mass = 100 g/mol) having bcc structure has unit cell edge 400 pm. Then density of the element is :

a) 10.376 g/cm^3 b) 5.188 g/cm^3 c) 7.289 g/cm^3 d) 2.144 g/cm^3

253. The ratio of closed packed atoms to tetrahedral holes in cubic close packing is:

a) 1 : 1 b) 1 : 2 c) 1 : 3 d) 2 : 1

254. TiO_2 is well known example of :

a) Triclinic system b) Tetragonal system c) Monoclinic system d) None of these

255. In a simple cubic cell, each atom on a corner is shared by :

a) 2 unit cells b) 1 unit cell c) 8 unit cells d) 4 unit cells

256. The vacant space in body centred cubic (bcc) lattice unit cell is about:

a) 32% b) 10% c) 23% d) 46%

257. Percentage of free space in a body-centred cubic unit cell is :

a) 32% b) 34% c) 28% d) 30%

258. In a compound, atoms of element Y form ccp lattice and those of element X occupy 2/3rd of tetrahedral voids. The formula of the compound will be

a) X_4Y_3 b) X_2Y_3 c) X_2Y d) X_3Y_4

259. In NaCl unit cell, all the ions lying along the axis as shown in the figure are removed. Then the number of Na^+ and Cl^- ions remaining in the unit cell are

a) 4 and 4 b) 3 and 3 c) 1 and 1 d) 4 and 3