CHEMISTRY

BOOKS - PRADEEP CHEMISTRY (HINGLISH)

STATES OF MATTER: SOLID MATTER

Problem

1. Calculate the number of atoms per unit cell present in simple, fcc and bcc unit cells.

Watch Video Solution

2. A compound formed by elements A and B has a cubic structure in which A atoms are at the corner of the cube and B atoms are at the face centres. Derive the fomula of the compound.

Watch Video Solution

3. A cubic solid is made up iof two elements X and Y . Atoms Y are present at the corners of the cube and atoms X at the body centre. What is the formula of the compound ? What are the coordination number of X and Y ?

Watch Video Solution

4. An ionic compand made up of atoms A and B has a face- centred cubic arrangement in which atoms A are at the cornere and atoms B are at the face-centres. If one of the atoms is missing from the corrner, what is the simplest formula of the compound ?

Watch Video Solution

5. Calculate the number of unit cells in 8.1 g of aluminium if it crystallizes in a face-centred cubic (f.c.c.) structure. (atomic mass of Al=27g mol^{-1})

Watch Video Solution

6. A solid $A^{+}B^{-}$ has NaCl type close packed structure .If the anion has a radius of 241.5 pm , what should be the ideal radius of the cation ? Can a cation C^{+} having radius of 50 pm be fitted into the tetrahedral hole of the crystal $A^{+}B^{-}$?

Watch Video Solution

7. A compound is formed by two elements X and Y. Atoms of the element Y (as anion) make ccp and those of element X (as cation) occupy all the octahedral voids. What is the formula of the compound?

Watch Video Solution

8. Atoms of elements B from hcp lattice and those of element A occupy two-thirds of tetrahedral voids. What is the formula of the compound formed by elements A and B?

Watch Video Solution

9. In a crystalline solid anions B are arranged in cubic close packing. Cation A are equally distributed between octahedral and tetrahedral voids. If all the octahedral voids are occupied, the formula for the solid is

Watch Video Solution

10. In the mineral, spinel, having the formula $MgAl_2O_4$ oxide ions ar arranged , in the cubic close packing, Mg^{2+} ions occupy the tetrahedrel voids while Al^{3+} ions occupy the octahedral voids.

(i) What precnetage of tetrahedral voids is occupied by Mg^{2+} ions ?

(ii) What precentage of octahedral voids is occupied by Al^{3+} ions ?

Watch Video Solution

11. What is the percent by mass of titanium in rutile, a mineral that contain Titanium and oxygen, if structure can be described as a closet packed array of oxide ions, with titanium in one half of the octahedral holes. What is the oxidation number of titanium ?

Watch Video Solution

12. Calculate the approximate number of unit cells present in 1 g of ideal NaCl crstabls.

Watch Video Solution

13. Two ions $A^{\oplus}$ and B^{Θ} have radii 88 and 200 pm, respectively. In the close-packed crystal of compound AB, predict coodination number of $A^{\oplus}$.

Watch Video Solution

14. Br^{-} ions form a close packed structure. If the radius of Br^{-} ions is 195 pm, calculate the radius of

the cation that just fits into the tetrahedral hole. Can a cation A^+ having a radius of 82 pm be shipped into be octahedral hole of the crystal A^+Br^- ?

Watch Video Solution

15. Xenon crystallizes in the face-centred cubic lattice and the edge of the unit cell is 620 pm. What is the nearest neighbour distance and what is the redius of xenon atom?

Watch Video Solution

16. $CsCl$ has bcc arrangement and its unit cell edge length is 400 pm. Calculate the interionic distance in $CsCl$.

Watch Video Solution

17. Sodium metal crystallises in body centred cubic lattic with the cell edge, 4.29 Å . What is the radius of radius of sodium atom ? What is the length of the body dioganl of the unit cell ?

Watch Video Solution

18. In face - centred cubic (fcc) crystal lattice, edge length is 400 pm. Find the diameter of the greatest sphere which can be fitted into the interstital void without distortion of the lattice.

Watch Video Solution

19. Silver froms ccp lattice and X-ray studies of its crystals show that the edge length of its unit cell is 408.6 pm. Calculate the density of silver (atomic mass $= 107.9u$).

Watch Video Solution

20. Sodium has a bcc structure with nearest neighbour distance of 365.9 pm. Calculate its density. (Atomic mass of sodium $= 23$)

Watch Video Solution

21. Gold (atomic mass = 197 u) has atomic radius = 0.144 nm. It crystallises in face centred unit cell. Calculate the density of gold. (No = $6.022 \times 10^{23} mol^{-1}$)

Watch Video Solution

22. Gold has a close-packed structure which can be viewed as-spheres occupying 0.74 of the total volume. If the density of gold is 19.3 g/cc, calculate the apparent radius of a gold ion in the solid

Watch Video Solution

23. $CsCl$ has cubic structure. Its density is $3.99gcm^{-3}$. What is the distance between $Cs^{\oplus}$ and Cl^{Θ} ions?

(Atomic mass of $Cs = 133$)

Watch Video Solution

24. The density of aluminium is $2700 kgm^{-3}$, Aluminium crytallises in face - centred cubic lattic. Calculate the radius of aluminium atom in meters (Atomic mass of Al = 27)

Watch Video Solution

25. The edge length of unit cell of a metal having molecular weight 75 g/mol is 5Å which crystallises in cubic lattice. If the density is 2 g/c.c., then the radius of the metal atom in pm is

Watch Video Solution

26. Calculate the value of Avogadro's number from the following data:

Density of $NaCl = 2.165 gcm^{-3}$

Distance between $Na^{\oplus}$ and $Cl^{\ominus}$ in $NaCl = 281$ pm

Watch Video Solution

27. The density of KCl is $1.9893 gcm^{-3}$ and the length of a side unit cell is 6.29082Å as determined by $X-$ ray diffraction. Calculation the value of Avogadro's number.

Watch Video Solution

28. An element has a bcc structure with a celledge of 288 pm. The density of the element is $7.2 g cm^{-3}$. How many atins are present in $208 g$ of the element?

Watch Video Solution

29. X-rays diffraction studies show that copper crystallizes in an fcc unit cell with cell edge of $3.608 \times 10^{-8} cm$. In a separte experiment, copper is determined to have a density of $8.92 g cm^{3}$. Calculate the atomic mass of copper.

Watch Video Solution

30. An element crystallizes into a structure which may be describes by a cubic type of unit cell having one atom on each corner of the cube and two atoms on one of its diagonals. If the volume of this unit cell is $24 \times 10^{-24} cm^3$ and density of element is $7.2 gcm^{-3}$. Calculate the number of atoms present in $200g$ of element.

Watch Video Solution

31. Density of Li is $0.53 \mathrm{g\,cm}^{-3}$. The edge length of Li is 3.5Å. Find the number of Li atoms in a unit cell

$(N_0 = 06.023 \times 10^{23}, M = 6.94)$.

Watch Video Solution

32. The density of KBr is $2.75 gcm^{-3}$, The length of edge of the unit cell is 654 pm. Predict, the type of cubic lattice to which unit cell of KBr belongs $\left(N_0 = 6.023 \times 10^{23} \text{ mol}^{-1}\right.$, At mass : K = 29 , Br = 80)

Watch Video Solution

33. Density of copper metal is $8.95 \mathrm{g\,cm}^{-3}$. If the radius of copper atoms is $127.8 \mathrm{pm}$ predict the nature of its unit cell whether simple cubic, faced centred or body centred cubic. (Given atomic mass of Cu = 63.54 g mol^{-1} and $N_o = 6.022 \times 10^{23} mol^{-1}$)

Watch Video Solution

34. If NaCl is doped with 10^{-3} mol % $SrCl_2$, what is the concentration of cation vacancies ?

Watch Video Solution

35. If Al^{3+} replaces Na^{+} at the edge centre of $NaCl$ lattice ,then the cation vacancies in 1 mole of $NaCl$ will be

Watch Video Solution

36. The composition of a sample of Wustite is $Fe_{0.93}O_{1.00}$. What percentage of the iron is present in the form of $Fe(III)$?

Watch Video Solution

Curiosity

1. Why is glass of window panes of very old builidings found to be thicker at the bottom than as the top and why is it milky ?

Watch Video Solution

2. What ar optical fibers ? What are their advatages over ordinary glass like that of window panes ?

Watch Video Solution

3. What are diodes and transistors ? For what purpose are they generally used ?

Watch Video Solution

Advanced Problems

1. A bcc lattice is made up of hollow spheres of X. Spheres of solid 'Y' are present in hollow spheres of X. The radius of 'Y' is half of the radius of 'X' . Calculate the ratio of the total volume of spheres of 'X' unoccupied by Y in a unit cell and volume of the unit cell ?

Watch Video Solution

2. The density of solid argon is $1.65g/mL$ at $-233^{\circ}C$. If the argon atom is assumed to be sphere of radius $1.54 \times 10^{-8}cm$, what percentage of solid argon is apparentaly empty space ? $(At. Wt. of Ar = 40)$

Watch Video Solution

3. In the cubic crystal of $CsCl(d = 3.97gcm^{-3})$, the eight corners are occupied by $Cl^{\ominus}$ with a $Cs^{\oplus}$ at the centre and vice versa. Calculate the distance between the neighbouring $Cs^{\oplus}$ and $Cl^{\ominus}$ ions.

What is the radius of the two ions? (Aw of $Cs = 132.91$ and $Cl = 35.45$)

Watch Video Solution

4. A compound AB has a rock type structure with $A:B = 1:1$. The formula weight of AB is $6.023Y amu$ and the closed $A - B$ distance is $Y^{1/3} nm$.

(i) Find the density of lattice.

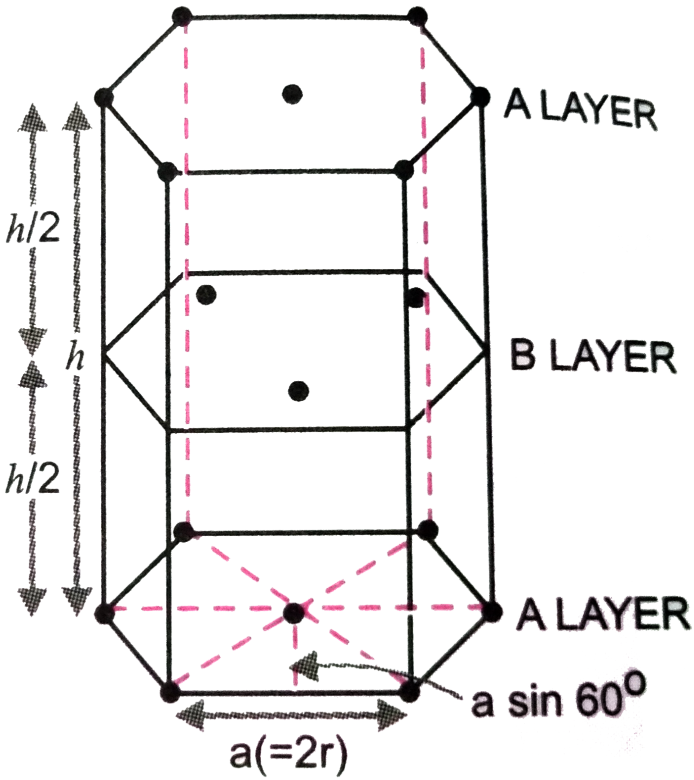
(ii) If the density of lattice is found to be $20 kgm^{-3}$, then predict the type of defect.

Watch Video Solution

5. An element crystallises in $f.c.c.$ lattice having edge length $400pm$. Calculate the maximum diameter, which can be placed in interstitial sites without disturbing the structure.

Watch Video Solution

6. A metallic element crystallizes into a lattice containing sequence of layers of ABABAB ..... Any packing of spheres leaves out voids in the lattice. What percentage by volume of this lattice is empty space ?



Watch Video Solution

7. Calculate the distance between (111) planes in a crystal of calcium. Repeat the calculation for (222) planes. Which palnes are closer ? (a = 0.556 nm)

Watch Video Solution

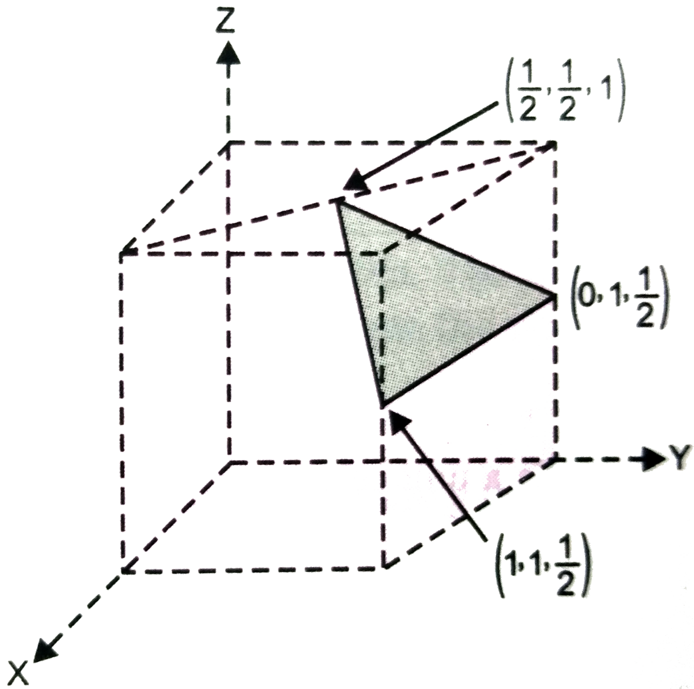
8. Determines the Miller indices of the shaded plane.

Coordinates of the corners of the plane

Watch Video Solution

9. The coordinates of the three corners of a shaded face on a cubic unit cell are $\left(\frac{1}{2}, \frac{1}{2}, 1\right), \left(0, 1, \frac{1}{2}\right)$ and $\left(1, 1, \frac{1}{2}\right)$. Determine

the Miller indices of the plane.



Watch Video Solution

10. The density of sodium chloride at $25^{\circ} C \text{is} 2.163 \times 10^{3} \text{ kg m}^{-3}$ When X -rays rom a palladium target having waveleth of 58.1 pm are used, the (200) reflection of sodium chloride occurs at an angle of 5.90° . How many Na^{+} and Cl^{-} ions are present in the unit cell ? (Molar mass of NaCl = 58.5 $\text{mol}^{-1}\sin 5.9^{\circ} = 0.1028\Big)$

Watch Video Solution

11. What fraction (n/N) of the lattice sites are vacant at 298 K for a crystal in which the energy required to make a defect is 1 eV.$\left(1eV = 1.602 \times 10^{-19}J\right)$

Watch Video Solution

12. Metallic magnesium has a hexagonal close packed structure and a density of $1.74 g/cm^3$. Assuming magnesium atoms to be spherical, calculate the volume of each atom and atomic radius of Mg atom (Atomic mass of Mg =24)

Watch Video Solution

13. Calculate the packing fraction and density of diamond if a=3.57 Å. Diamond crystallizes in fcc lattice with some more carbon atoms in alternate tetrahedral voids.

Watch Video Solution

14. Calculate the packing effeciency of a fcc crystal in which all the tetrahedral and octahedral voids are occupied by the largest spheres without disturibing the lattice.

Watch Video Solution

15. X-ray diffraction studies show that edge length of a unit cell of NaCl is 0.56 nm. Density of NaCl was found to be $2.16 g / \mathrm{cc}$. What type of defect is found in the solid? Calculate the percentage of Na^{+} and Cl^{-} ions that are missing.

Watch Video Solution

16. A reflaction from (111) planes of a cubic crystal was observed ad at a glancing angle of 11.2° when X -rays of wavelength 154 pm were used. What is the length of the side of the unit cell ? $(\sin 11.2^{\circ} = 0.1944)$

Watch Video Solution

17. When an electron in an excited state of Mo atom falls L to K -shell, an X -ray is emitted. These X -rays are diffranted at angle of 7.75° by planes with a sepration of 2.64Å . What is the difference in energy between K-shelll and L -shell in Mo, assuming a first order diffraction ? `(sin 7.75^(@) = 0.1349)

Watch Video Solution

Problems For Practice

1. A compound formed by element X and Y crystallizes in the cubic structure when Y atoms are at the corners of the cube and X atoms are at the alternate faces. What is the formula of the compound?

Watch Video Solution

2. Calculate the number of atoms in a cubic based unit cell having one atome on each corner and two atoms on each body diagonal.

Watch Video Solution

3. A compound made up of elements A and B crystallizes in the cubic structures. Atoms A are present on the corners as well as face centres whereas atoms B are present on the edge centres centres as well as body centre. What is the formula of the compound? Draw the structure of its unit cell.

Watch Video Solution

4. If three elements P, Q and R crystallise in a cubic unit cell with P atoms at the corners, Q atoms at the cubic centre and R atoms at the centre of each face of the cube, then write the formula of the compound.

Watch Video Solution

5. Sodium crystallises in b.c.c unit cell. Calculate the approximate number of unit cells in 9.2 g of solium (Atomic mass of Na = 23u).

Watch Video Solution

6. Calculate the approximate number of unit cells present in 1 g of gold. Given that gold cyrstallises in a face centred cubic lathce (Given atomic mass of gold = 197 u).

Watch Video Solution

7. A solid AB has $NaCl$ structure. If the radius of the cation A is 100 pm, what is the radius of anion B?

Watch Video Solution

8. A solid AB has NaCl structure. If the radius of cation A^+ is 170 pm, calculate the maximum possible radius of the anion.

Watch Video Solution

9. What is the formula of a compound in which the element Y forms ccp lattice and atoms X occupy 1/3rd of tetrahedral voids ?

Watch Video Solution

10. In corundum, oxide ions are arranged in hexagonal close packing and aluminium ionsa occpy tow-third of the octaheral voids. What is the formula of corrundum ? .

Watch Video Solution

11. In solid, oxide ions are arranged in ccp. One sixth of the tetrahedral voids are occupied by the cations (A) while one third of the octahedral voids, are occupied by the cations (B). What is the formula of the compound ?

Watch Video Solution

12. A solid is made up of two elements P and Q , Atoms Q are in ccp arrangement while atoms P occupy all the tetrahdral sites. What is the formual of the compound ?

Watch Video Solution

13. In chromium (III) chloride $CeCl_3$ chloride ions have cubic close packed arrangement and Cr (III) ions present in the octahedral voids. What fraction of the octahedral void is occupied ? What fraction of the total number of voids is occupied?

Watch Video Solution

14. what is the formula of a compound in which element P forms ccp lattice and atoms of Q occupy 2/3rd of tetrahedral voids ?

Watch Video Solution

15. If the radii of Mg^{2+}, $Cs^{\oplus}$, O^{2-}, S^{2-}, and CI^{Θ} ions are $0.65, 1.69, 1.40, 1.84,$ and 1.81Å, respectively, calculate the coordination number of the cation in the crystals of MgS, MgO, and C_sCI.

Watch Video Solution

16. Predict the structure of MgO crystal and the co-ordination number of the cation in which the radii of the cation and anion are 65 pm and 140 pm respectively.

Watch Video Solution

17. Predict the close packed structure of an ionic compound $A^{+}B^{-}$ in which the radius of the cation = 148 pm and radius of anion=195 pm. What is the coordination number of the cation ?

Watch Video Solution

Watch Video Solution

18. If the close-packed cations in an AB-type solid gave a radius of 75 pm. What would be the maximum and minimum sizes of the anions filling the voids?

Watch Video Solution

19. A solid $A^{\oplus}B^{\ominus}$ has $NaCl$-type close-packed structure. If the anion has a radius of 250 pm, what should be the ideal radius for the cation? Can a cation $C^{\oplus}$ having radius of 180 pm be slipped into the tetrahedral site of the crystal $A^{\oplus}B^{\ominus}$? Give reason for your answer.

Watch Video Solution

20. If the radius of an atom of an elements is 75 pm and the lattice type is body-centred cubic, what is the edge length of the unit cell?

Watch Video Solution

21. The radius of an atom of an element is 500 pm. If it crystallizes as a face-centred cubic lattice, what is the length of the side of the unit cell?

Watch Video Solution

22. A solid AB has $CsCl$-type structure. The edge length of the unit cell is 404 pm. Calculate the distance of closest approach between $A^{\oplus}$ and $B^{\ominus}$ ions.

Watch Video Solution

23. what is the radius of sodium atom if it crystaliizes in bcc structure with the cell edge of 400

pm?

Watch Video Solution

24. Gold crystallizes in a face centered cubic lattice. If the length of the edge of the unit cell is 407 pm, calculate the density of gold as well as its atomic radius assuming it to be spherical. Atomic mass of gold = 197 amu.

Watch Video Solution

25. Silver metal crystallises with a face centred cubic lattice. The length of the unit cell is found to be 3.0×10^{-8}cm. Calculate atomic radius and density of silver.

Molar mass of Ag $= 108 g mol^{-1}, N_A = 6.02 \times 10^{23} mol^{-1}$).

Watch Video Solution

26. Niobium crystallises in body-centred cubic structure. If the atomic radius is 143.1 pm, calculate the density of Niobium. (Atomic mass = 93u).

Watch Video Solution

27. The effective radius of an iron atom is 1.42Å. It has a rock-salt structure. Calculate its density (Fe = 56)

Watch Video Solution

28. The edge length of NaCl unit cell is 564 pm. What is the density of NaCl in g/cm^3?

Watch Video Solution

29. The compound CuCl has ZnS structure and the edge length of the unit cell is 500 pm. Calculate its density (Atomic mass of Cu = 63, Cl = 35.5)

Watch Video Solution

30. KF and NaCl struture. If the distance between K^{+} and F^{-} is 269 pm, find the denisty of KF ($N_A = 6.02 \times 10^{23} \text{mol}^{-1}$ a atomic mass of copper = 63.5

Watch Video Solution

31. Copper crystal has a face-centred cubic lattice structure. Atomic radius of copper atom is 128 pm. Calculate the density of copper. Atomic mass of copper=63.5

Watch Video Solution

32. Copper crystallises into a fee lattice. Its edge length is 3.62×10^{-8} cm. Calculate the density of copper (atomic mass of Cu=63-5 u, $N_A = 6 - 022 \times 10^{23} mol^{-1}$).

Watch Video Solution

33. Calculate the density of silver which crystallises in face-centred cubic from. The distance between nearest metal atoms is 287 pm (Molar mass of Ag = $107.87 gmol^{-1}$, $(N_0 = 6.022 \times 10^{23} mol^{-1})$.

Watch Video Solution

34. The compound CuCl has Zns structure. Its density is 3.4 g cm^{-3}. What is the length of the edge of the unit cell ?

Watch Video Solution

35. The density of a face centred cubic element (atomic mass = 60.2 amu) is 6.25 gm cm^{-3}, calculate the edge length of the unit cell.

Watch Video Solution

36. The density of lead is $11.35 gcm^{-3}$ and the metal crystallizes with fee unit cell. Estimate the radius of lead atom. (At. Mass of lead $= 207 gmol^{-1}$ and $NA = 6.02 \times 10^{23} mol^{-1}$)

Watch Video Solution

37. What is the distance between Na^{+} and Cl^{-} ions in NaCl crystal if density is 2.165g cm^{-3} ? NaCl crystallises in fcc lattice.

Watch Video Solution

38. Lead (II) sulphide crystal has NaCl structure. What is the distance betweeen Pd^{2+} and S^{2-} in PhS if its density is $12.7gcm^{-3}$? (At .mass of Pb = 207)

Watch Video Solution

39. KBr has fcc struture. The density of KBr is 2.75 g cm^{-3}. Find the distance between K^{+} and Br^{-}, (At mass of Br = 80.0)

Watch Video Solution

40. Calculate the value of Avogadro's number from the following data : Density of KF = 2.48 g cm^{-3}. Distance between K^{+} and F^{-} KF = 269 pm. (Atomic masses : K = 39 and F = 19 amu)

Watch Video Solution

41. Calculate the Avogadro's number from the following data of AB when AB has NaCl type stucture.

Density of AB = $2.48 \text{ g cm}^{-3}, M = 58$

Distnace between $A^{+}a \ne dB^{-}$ AB = 269 pm.

Watch Video Solution

42. Iron has body centred cubic cell with a cell edge of 286.5 pm. The density of iron is 7.87 g cm^{-3}. Use this information to calculate Avogadro's number. (Atomic mass of Fe = 56 mol^{-3})

Watch Video Solution

43. The well know mineral flourite is chemically calcium fluoride. It is a well known fact that in one unit cell of this mineral, there are four Ca^{2+} ions and eight F^{-} ions and Ca^{2+} ions are arranged in f.c.c. lattice. The F^{-} ions fill all the tetrahedral holes in the face centred cubic lattice of Ca^{2+} ions. The edge length of the unit cell is 5.46×10^{-8} cm. The density of the solid is 3.18g cm^{-3}. Use this information to calculate Avogadro's number (Molar mass of $CaF_2 = 78.0 \text{g mol}^{-1}$)

Watch Video Solution

44. As element cystallises in BCC structure. The edge length of its unit cell is 288 pm. It the density of the crystals is $7.2gcm^{-3}$, what is the atomic mass of the element ?

(b) How many atoms of the element are presnet in 100g ?

Watch Video Solution

45. An element with density $11.2gcm^{-3}$ forms a f. c. c. lattice with edge length of 4×10^{-8} cm. Calculate the atomic mass of the element. (Given : $N_A = 6.022 \times 10^{23} mol^{-1}$

Watch Video Solution

46. An element (density $=6.8 gcm^{-3}$) occurs in bcc structure with cell edge of 290pm .Calculate the number of atoms present in $200g$ of the element:-

Watch Video Solution

47. Tungsten has a density of 19.35 g cm^{-3} and the length of the side of the unit cell is 316 pm. The unit cell is a body centred unit cell. How many atoms does 50 grams of the element contain?

Watch Video Solution

48. Sodium crystallises in a cubic lattice and the edge length of the unit cell is 430 pm. Calculate the number of atoms in the unit cell. (Atomic mass Na = 23 amu, Density of Na = 0.9623 g cm^{-3})

Watch Video Solution

49. An element with molor mass $27 g mol^{-1}$ forms a cubic unit cell with edge length $4.05 \times 10^{-8} cm$. If its density is $2.7 g cm^{-3}$, what is the nature of the unit cell?

Watch Video Solution

Watch Video Solution

50. Use the data given below to find the type of cubic lattice to which the crystal of iron belongs

a/pm=286 , ρ / gcm^{-3}=7.86

Watch Video Solution

51. Thallium chloride (TICI) crystallizes in a cubic lattice whose edge length is found to be 385 pm. If the density of the solid is found to be $7.0 \ \mathrm{g\,cm}^{-3}$, predict the type of lattice to which the crystals of TICI belong .

(Atomic mass of TI = 204, Cl = 35.5)

Watch Video Solution

52. Iron (II) oxide has a cubic structure and each unit cell has side 5 Å . If the density of the oxide is 4 g cm^{-3} Calculate the number of Fe^{2+} and O^{2+} ions presnent in each unit cell (Molar mass of FeO = 72 g mol^{-1}

$N_A = 6.02 \times 10^{23} \text{mol}^{-1}$)

Watch Video Solution

53. An element has atomic mass $93 gmol^{-1}$ and density $11.5 gcm^{-3}$. If the edge length of its unit cell

is 300 pm, identify the type of unit cell.

Watch Video Solution

54. An element crystallizes in a f.c.c. lattice with cell edge of 250 pm. Calculate the density if 300 g of this element contain 2×10^{24} atoms.

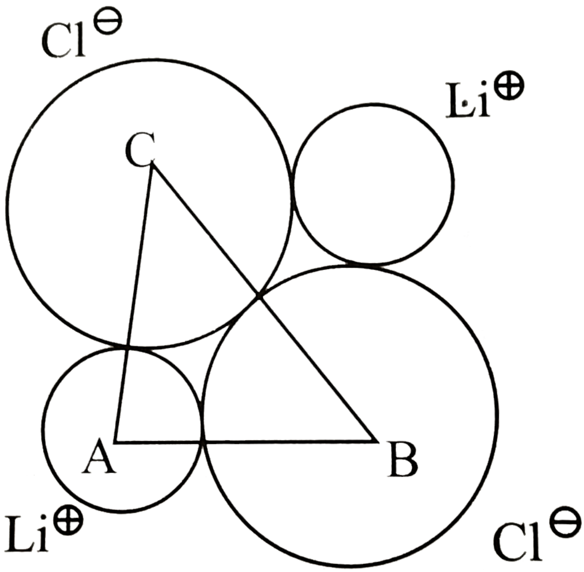
Watch Video Solution

55. A crystal of lead (II) sulphide has NaCl strcuture . In this crystal the shortest distance between a Pb^{2+}

ion and S^{2-} ion is 297 pm . What is the volume the of unit cell in lead sulphide ?

Watch Video Solution

56. The unit cube length for $LiCl$ ($NaCl$ structure) is 5.14Å. Assuming anion-anion contact, calculate the ionic radius for chloride ion.



Watch Video Solution

57. A compound AB crystallises in bcc lattice with the unit cell edge length of 380 pm. Calculate (i) the distance between oppositely charged ions in the lattice ,(ii) radius of B^{-} if the radius of A^{+} is 190 pm

Watch Video Solution

58. An element A crystallises in fcc structure. 200 g of this element has 4.12×10^{24} atoms. If the density of A is $7.2 \mathrm{g\,cm}^{-3}$, calculate the edge length of the unit cell.

Watch Video Solution

59. A metal (atomic mass = 50) has a body centred cubic crystal structure. If the density of the metal is 5.96 g cm^{-3}, calculate the volume of the unit cell.

Watch Video Solution

60. Aluminium metal forms a cubic face centred closed packed crystal structure. Its atomic radius is 125×10^{-12}m.

(a) Calculate the length of the side of the unit cell.

(b) How many unit cells are there in $1.0m^3$ of aluminium?

Watch Video Solution

61. A uni-univalent ionic crystal AX is composed of the following radii (arbitrary units) :

A^+	A^-
1.0	2.0

Assuming that ions are hard spheres , predict giving reasons whether the crystal will have sodium chloride cesium chloride structure. Calculate the volume of the unit cell.

Watch Video Solution

62. An element 'X' (At mass = 40g mol^{-1}) having fcc structure, has unit cell length of 400 pm. Calculate

the density of 'X' and the number of unit cells in 4 g in 'X' $\left(N_A = 6.022 \times 10^{23} \text{mol}^{-1}\right)$

Watch Video Solution

63. Analysis shows that a metal oxide has the empirical formula $M_{0.96}O_{1.00}$. Calculate the percentage of M^{2+} and M^{3+} ions in the sample.

Watch Video Solution

Test Your Grip Multiple Choice

1. The property of crystalline solid is not

A. anisotropic

B. isotropic

C. hard

D. dense

Answer: b

Watch Video Solution

2. Wax is an example of -

A. ionic crystal

B. covalent crystal

C. molecular crystal

D. amorphous solid

Answer: c

Watch Video Solution

3. Which of the following is a molecular crystal?

A. Rock salt

B. Quartz

C. Dry ice

D. Diamond

Answer: c

Watch Video Solution

4. In a tetragonal crystal

A. a=b=c,$\alpha = \beta = 90^\circ \neq \gamma$

B. $\alpha = \beta = \gamma = 90^\circ, a = b \neq c$

C. $\alpha = \beta = \gamma = 90^\circ, a \neq b \neq c$

D. $\alpha = \beta = 90^\circ, \gamma = 120^\circ, a = b \neq c$

Answer: b

Watch Video Solution

5. An example of a face centred cubic lattice is

A. Zinc

B. Sodium

C. Copper

D. Caesium chloride

Answer: c

Watch Video Solution

6. Percentage of free space in cubic close packed structure and in body centered packed structure are responsive:

A. 32% and 48%

B. 48% and 26%

C. 30% and 26%

D. 26% and 32%

Answer: d

Watch Video Solution

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

A. X_2Y

B. X_3Y_4

C. X_4Y_3

D. X_2Y_3

Answer:

Watch Video Solution

8. The number of octahedral sites per sphere in fcc structure is

A. 8

B. 4

C. 2

D. 1

Answer: d

Watch Video Solution

9. A solid AB has NaCl type structure for ionic solids in which positive and negative ions are held by strong electrostatic attractive forces. The edge length is 580.4 pm and radius of cation is 100 pm them find out the radius of anion.

A. The radius ratio 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, $\frac{r_{+}}{r_{-}}$ 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

Answer: c

Watch Video Solution

10. The crystal lattice of NaCl is

A. Face-centred cubic lattice

B. Body-centred cubic lattice

C. Simple cubic lattice

D. Hexagonal close packing

Answer: a

Watch Video Solution

11. What is the coordination number of sodium in sodium oxide (Na_2O)?

A. 6

B. 4

C. 8

D. 2

Answer: c

Watch Video Solution

12. In crystal structure of NaCl, total number of Cl^{-} ions in a unit cell is

A. 6

B. 4

C. 8

D. 2

Answer: b

Watch Video Solution

13. Which of the following fcc structure contain cations in alternate tetrahedral voids?

A. NaCl

B. ZnS

C. Na_2O

D. CaF_2

Answer: b

Watch Video Solution

14. Which of the following defects is present in KCl crystals ?

A. Frenkel

B. Schottky

C. Linear

D. Impurity

Answer: b

Watch Video Solution

15. In a solid lattice the cation has left a lattice sirte and is located at an interstital position , the lattice defect is

A. n-type

B. p-type

C. Frenkel defect

D. Schottky defect

Answer: c

Watch Video Solution

16. Which of the following is ferromagnetic?

A. Calcium metal

B. Iron metal

C. Sodium metal

D. Zinc metal

Answer: b

Watch Video Solution

17. 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 anion is

A. 618 pm

B. 144 pm

C. 288 pm

D. 398 pm

Answer: b

Watch Video Solution

Test Your Grip Fill In Blanks

1. The constituent particles of a solid posses .... Motion .

Watch Video Solution

2. If electrical conductivity is found to be same in all directions though a solid, the substance is ____ solid and this property is called _______\

Watch Video Solution

3. In a photovoltaic cell, the material the converts sunlight into electricity is _______

Watch Video Solution

4. The forces operating between non-polar molecules like He, H_2, CH_2 etc.When present as crystalline solids are called _______ (a type of van der waals forces

Watch Video Solution

5. For two- dimensional hexagonal lattice, the unit cell is _____

Watch Video Solution

6. The most unsymmetrical system is

Watch Video Solution

7. The fourteen types of space lattices are collectively called ....

Watch Video Solution

8. The coordination number of a tetrahedral void is ......,while that of an octahedral void is ....

Watch Video Solution

9. AB AB .... Type of packing is called ...... whereas ABCABC.......typeof packing is called ......

Watch Video Solution

10. The coordination number of each sphere in hexagonal close packing is .... While that of body - centred cubic packing is.....

Watch Video Solution

11. The empty space in the hexogonal close packing is........% while that in the body-centred cubic packing is ....%

Watch Video Solution

12. The packing fraction of a simple unit cell is ________.

Watch Video Solution

13. An octahedral void is ______times larger than a tetrahedral void.

Watch Video Solution

14. In the uint cell of a cubic close-packed struture, total number of voids is .... Whereas in the unit cell of a hexagonal close-packed stucture, total number is voids is ......

Watch Video Solution

15. The pair of compounds having the same general formula.

Watch Video Solution

16. Most of the ferrites have ...... structure.

Watch Video Solution

17. Spinel is the mineral with the formula........

Watch Video Solution

18. In an ionic compound $A^{+}B^{-}$, radius of A^{+} 88 pm while that of B^{-} is 200 pm. The coordination number A^{+} will be ______

Watch Video Solution

19. In a face-centred cubic crystal, the neighbour distance is ...... times the edge of the crystal.

Watch Video Solution

20. In a body centred cubic crystal of an element, the ratio of edge of the unit cell to the radius of the atom is _______.

Watch Video Solution

21. The mass of a unit cell of an element is the product of the atomic mass of the element and .... divided further by......

Watch Video Solution

22. The coordination number of Cl^{+} ion in NaCl struture is...... whereas that in CsCl structure is ....

Watch Video Solution

23. In fluorite (CaF_2), Ca^{2+} ions form the .... Struture whereas F^{-} ions are present in the ....

voids.

Watch Video Solution

24. In NaCl, Cl^{-} ions are present in the .... Structure whereae Cl^{-} ions ar present in the .... Voids.

Watch Video Solution

25. In ZnS , S^{2-} ions form .... Structure while Zn^{2+} ions are present in .... Voids.

Watch Video Solution

26. ZnS exists in two forms called .... And ....

Watch Video Solution

27. Zinc blede has .... Arrangement of S^{2-} ions whereas wurtzite has .... Arrangement of S^{2-} ions.

Watch Video Solution

28. Wurtzite has ...... formula units per unit celll wherease zinc blende has .... Formula units per unit celll.

Watch Video Solution

29. Due to Frenkel defect, the density of the crystal, ... Wherease due to schottky defect, it ......

Watch Video Solution

30. NaCl crystals have some yellow colour. This is due to the presence of ....

Watch Video Solution

31. The process of adding impurities to a crystalline substance so as to change its properties like conductivity etc. is called.....

Watch Video Solution

32. If arsenic is added as impurity to silicon, the type of semiconductor obtained is called .....

Watch Video Solution

33. If aluminium is added as imourity to silicon, the type of semiconductor formed is called......

Watch Video Solution

34. Frenkel defect is shown by crystals having _________ coordination number and __________difference in the size of the cations and the anions.

Watch Video Solution

35. Semiconductors posses conducitivity in the range .... To.......

Watch Video Solution

36. The band formed atomic orbitals of lower energy is called..... While that formed from atomic orbitals of higher energy is called.....

Watch Video Solution

37. If there is a large energy gap between the filled valance band and empty conduction band, the subtance acts as........

Watch Video Solution

38. The electrical conductivity of semiconductors .... With increase of temperature.

Watch Video Solution

39. Pure substances which show conducitivity similar to that of silicon and germanium are called .... conductors.

Watch Video Solution

40. As regards magnetic behaviour , TiO_2 is ....

Watch Video Solution

Watch Video Solution

41. Substances which show permanent magnetism even in the absence of magnetic field are called....

Watch Video Solution

42. Antiferromagnetic subtance have..... Magnetic moment.

Watch Video Solution

43. Magnetite is ....as regards magnetic behaviour .

Watch Video Solution

44. the electricity produced in a polar crystals when mechanical stress is applied on then is called....

Watch Video Solution

45. In terms of dielectric properties, barium titanate is......

Watch Video Solution

46. The characteristic temperature of a ferromagnetic substance above which is shows no ferromagnetism is known as........

Watch Video Solution

Conceptual

1. In terms of intermolecular forces, explain why do some substances exist as solids ?

Watch Video Solution

2. Why is glass considered a supercooled liquid?

Watch Video Solution

3. How the sturctue of amorphous silica (quartz glass) differ from quartz?

Watch Video Solution

4. In CaF_2 crystal, Ca^{2+} ions are present in FCC arrangment . Calculate the number of F^- ions in the unit cell.

Watch Video Solution

5. Do all the metals possess a close-packed struture ? Name the different structures exhibited and give their packing fractions.

Watch Video Solution

6. A $NaCl$ crystal is found to have $CsCl$ structure. How it happened?

Watch Video Solution

7. AgI crystallises in a cubic close-packed ZnS structure. What fraction of tetrahedral sites is occupied by Ag^{+} ions ?

Watch Video Solution

8. Write the coordination numbers of cations and anions in the following ionic compounds :

(a) Zinc blende (b) Fluortie

Watch Video Solution

9. In each of the compounds : NaCl, ZnS and CaF_2 , Write (i) ions occupying the voids (ii) types of voids occupied (iii) fraction of voids occupied.

Watch Video Solution

10. KF has ccp structure. Calculate the radius of the unit cell if the edge length of the unit cell is 400 pm. How many F^- ions and octahedral voids are there in the unit cell ?

Watch Video Solution

11. A metal crystallizes into two cubic phases, face-centred cubic and body-centred cubic, which have unit cell lengths 3.5 and $3.0A$, respectively. Calculate the ration of densities of fcc and bcc.

Watch Video Solution

12. Analyses shows that FeO has a non-stoichiometric composition with formula $Fe_{0.95}O_{1.00}$. Give reason.

Watch Video Solution

13. Why the defects of the crystalline solids are called thermodynamic defects?

Watch Video Solution

14. Why stoichiometric defects are also called intrinsic defects?

Watch Video Solution

15. Why is Frenkel defect not found in pure alkali metal halides ?

Watch Video Solution

16. $CaCl_2$ will introduce schottky defect if added to AgCl crystal. Explain.

Watch Video Solution

17. Why LiCl acquires pick colour when heated in Li vapours ?

Watch Video Solution

18. Give reason :

(a) Why is Frenkel defect found in AgCl ?

(b) What is the difference between silicon doped with phosphorus and doped with gallium semi-conductors ?

Watch Video Solution

19. Examine the given defective crystal

$$\begin{matrix} A^+ & B^- & A^+ & B^- & A^+ \\ B^- & O & B^- & A^+ & B^- \\ A^+ & B^- & A^+ & O & A^+ \\ B^- & A^+ & B^- & A^+ & B^- \end{matrix}$$

Answer the following question :

(i) What type of stoichimetic defect is shown by the crystal ?

(ii) How is the density of the crystal affected by this defect ?

(iii) What type of ionic substances show such defect ?

Watch Video Solution

20. Examine the given defective crystal

$$\begin{array}{ccccc} X^+ & Y^- & X^+ & Y^- & X^+ \\ Y^- & Z^{2+} & Y^- & X^+ & Y^- \\ X^+ & Y^- & O & Y^- & X^+ \\ Y^- & X^+ & Y^- & X^+ & Y^- \end{array}$$

(i) Write the term used for this of defect .

(ii) What is the result when XY crystal is doped with divalent (Z^{2+}) impurtiy ?

Watch Video Solution

21. What is the difference between anti-ferromgnetic and ferrimagnetic substances ? What is the cause of the difference ?

Watch Video Solution

22. What type of magnetism is shown by a substance if magnetic moments of domains are arranged in same direction?

Watch Video Solution

23. Out of SiO_2 (s) , NaCl (s) and Br_2 (l) which is the best electrical conductor ?

Watch Video Solution

24. Calculate the co − ordination number of an atom in :

(i) A primitive cubic unit cell,

(ii) A body $-$ centred cubic unit cell.

(iii) A face $-$ centred cubic unit cell.

Watch Video Solution

25. Give reasons :

(i) In stoichiometric dfects. NaCl exhibits Schottky defect and not Frenkel defect.

(iii) Ferrimagnetic substances show better magnetism than antiferromagnetic substances.

Watch Video Solution

Ncert

1. Why are solids rigid ?

Watch Video Solution

2. Why do solids have a definite volume?

Watch Video Solution

3. Classify the following as amorphous or crystalline solids: polyurethane, naphtalene, benzoic acid, teflon, potassium nitrate, cellophane, polyvinyl chloride, fibre glass, copper.

Watch Video Solution

4. Why is glass considered a supercooled liquid?

Watch Video Solution

5. The refractive index of a solid is observed to have the same value along all direction. Comment on the nature of this solid. Would it show cleavage property?

Watch Video Solution

6. Classify the following solids in different categories based on the nature of intermolecular forces operating in them :

Potassium sulphate, tin, benzene, urea, ammonia, water, zinc sulphide, graphite, rubidium, argon, silicon carbide.

Watch Video Solution

7. Solid A is very hard electrical insulator in solid as well as in molten state and melts at an extremely high temperature. What type of solid is it?

Watch Video Solution

8. Ionic solids conduct electricity in the molten state but not is the solid state. Explain.

Watch Video Solution

9. What type of solids are electrical conductors, malleable or ductile?

Watch Video Solution

10. Give the significance of "lattice point."

Watch Video Solution

11. Name the parameters that characterized a unit cell.

Watch Video Solution

12. Distinguish between

a. Hexagonal and monoclinic unit cells

(b) Face-entred and end-centred unit cells

Watch Video Solution

13. Explain how much portin of an atom located at (a) corner and (b) body centre of a cubic unit cell is part of its neighouring unit cell.

Watch Video Solution

14. What is the two-dimensional coordination number of a molecule in square close-packed layer?

Watch Video Solution

15. A compound is formed hexagonal close-packed structure. What is the total number of voids in 0.5

mol of it? How many of these are tetrahedral voids?

Watch Video Solution

16. A comound is formed by two elements M and N. The element N froms ccp and atoms of M occupy 1/3rd of tetrahedral voids. What is the formula of the compound ?

Watch Video Solution

17. Which of the following lattices has the highest packing efficency (a) simple cubic, (b) body-centred cubic, and (c) hexagonal close-packed lattice?

Watch Video Solution

18. An element with molar mass 2.7×10^{-2} kg per mole forms a cubic unit cell with edge length 405 pm. If its density is 2.7×10^{3} , what is the nature of the cubic unit cell ?

Watch Video Solution

19. What type of defect can arise when a solid is heated?

Which physical property is affected by it and in what way?

Watch Video Solution

20. What type of stoichiometric defect is shown by:

(a) ZnS (b) $AgBr$

Watch Video Solution

21. Explain how vacancies are introduced in an ionic solid when a cation of higher valence is added as an impurity in it.

Watch Video Solution

22. Ionic solids, which have anioninc vacancies due to metal excess defect, developed colour. Explain with the help of a suitalbe example.

Watch Video Solution

23. A group-14 element is to be converted into n-type semiconductor by doping it with a suitalbe impurity. To which group this impurity belong?

Watch Video Solution

24. What type of substances would make better permanent magnets, ferromagnetic or ferrimagnetic? Justify your answer.

Watch Video Solution

25. What makes a glass different from a solid such as quartz? Under what conditions could quartz be converted into glass?

Watch Video Solution

26. Classify each of the following solids as ionic, metallic, molecular, network (covalent) or amorphous

(i) Tetraphosphorus decoxide (P_4O_{10}) , (ii) Ammonium phosphate, $(NH_4)_3PO_4$, (iii)SiC , (iv)I_2 , (v) P_4 , (vi) Plastics ,(vii) Graphite ,(viii) Brass ,(ix) Rb , (x) LiBr ,(xi) Si

Watch Video Solution

27. What is meant by the term "coordination number"?

b. What is the coordination number of atoms:

i. in a cubic-packed structure?

ii. In a body-centreds structure?

Watch Video Solution

28. How can you determine the atoic mass of an unknown metal if you know its density and the dimension of its unit cell ? Explain.

Watch Video Solution

29. (a) 'Stability of a crystal is reflected in the magnitude of its melting point'. Comment.

(b) The melting points of some compounds are given below : Water = 273 K, Ethyl alcohol = 155.7 K, Diethyl ether = 156.8 K, Methane = 90.5 K. What can you say about the intermolecular forces between these molecules ?

Watch Video Solution

30. How will you distinguish between the following pairs of terms

(i) Hexagonal close packing and cubic close packing

(ii) Crystal lattice and unit cell (iii) Tetrahedral void and octadedral void.

Watch Video Solution

31. How many lattice points are there in one unit cell of each of the following lattice?

a. Face-centred cubic

b. Face-centred tetragonal

c. Body-centred

Watch Video Solution

32. Explain

a. The basic of sumilarities and differences between metallic and ionic crystals.

b. Ionic solids are hard and brittle.

Watch Video Solution

33. Calculate the efficiency of packing in case of a metal crystal for

a. Simple cubic

b. Body-centred cubic

c. Face-centred cubic (with the assumptions that atoms are touching each other).

Watch Video Solution

34. Silver crystallises in fcc latice. If edge length of the unit cell is $4.077 \times 10^{-8} cm$, then calculate the radius of silver atom.

Watch Video Solution

35. A cubic solid is made up of two elements X and Y . Atoms Y are present at the corners of the cube and atoms X at the body centre. What is the formula of the compound ?

Watch Video Solution

36. Niobium crystallizes in body-centred cubic structure. If the density is $8.55 g cm^{-3}$, calculate the

atomic radius of niobium using its atomic mass $93u$.

Watch Video Solution

37. If the radius of the octaheral void is r and the radius of the atoms in close-packing is R, derive relation between r and R

Watch Video Solution

38. Copper crystallizer into an fcc lattice with edge length $3.61 \times 10^{8} cm$, Show that the calculated density in in agreement with its measured value of $8.92gcm^3$.

Watch Video Solution

39. Analysis shows that nickel oxide has the formula $Ni_{0.98}O_{1.00}$. What fractions of nickel "exist" as Ni^{2+} and Ni^{3+} ions?

Watch Video Solution

40. What is a 'semiconductor' ? Describe the two main types of semiconductors and contrast their condcution mechanisms.

Watch Video Solution

41. Non-stoichiometric cuprous oxide. Cu_2O can be perpared in laboratory. In this oxide, copper-to-oxygen ratio is slightly less than 2 : 1. can you account for the fact that this substance is a p-type semiconductors?

Watch Video Solution

42. Ferric oxide crystalliizes in a hexagonal close-packed array of oxide ions with two out of every three octahedral holes occupied by ferric ions. Derive the formula of the ferric oxide.

Watch Video Solution

43. Classify each of the following as being either a p-type or an n-type semiconductor

a. Ge doped with In

b. B doped with Si

Watch Video Solution

44. Gold (atomic radius = 0.144nm) crystallises in a face centred unit cell. What is the length of the side of the cell ?

Watch Video Solution

45. In terms of band theory, what is the difference between

a. a condcutor and an insulator

b. a conductor and a semiconductor

Watch Video Solution

46. Explain the following terms with suitable example:

a. Schottky defect b. Frenkel defect

c. Interstitials d. F-centres

Watch Video Solution

47. Aluminium crystallises in a cubic close packed structure. Its metallic radius is 125 pm.

(i) What is the length of the side of the unit cell ?

(ii) How many unit cells are there in 1.00cm^3 of aluminium ?

Watch Video Solution

48. If NaCl is doped with 10^{-3} mol percent of $SrCI_2$, what is the concentration of cation vacancy?

Watch Video Solution

49. Example the following with suitable examples:

a. Ferromagnetism b. Paramagnetism

c. Ferrimagnetism d. Antiferromagnetism

e. 12 - 46 and 13 - 15 group compounds

Watch Video Solution

Ncert Exercise

1. Define the term "amorphous". Give a few example of amorphous solids.

Watch Video Solution

Ncert Exemplar Problems Multiple Choice I

1. which of the following favours the existenence of a substance in the solid state ?

A. High temperatue

B. Low temperature

C. High thermal energy

D. Weak cohesive forces

Answer: b

Watch Video Solution

2. which of the following is not a characteristic of a crystalline solid ?

A. Definite and characteristic heat of fusion

B. Isotropic nature

C. A regular periodically repeated pattern of arrangement of constituent particles in the entire crystal

D. A true solid

Answer: b

Watch Video Solution

3. Which of the following is an amorphous solid

A. Graphite (C)

B. Quartz glass (SiO_2)

C. Chrome alum

D. Silicon carbide (SiC)

Answer: B

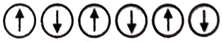
Watch Video Solution

4. Which of the following arrangements shows schematic alignment of magnetic moments of antiferromagnetic substances?

A. 

B. 

C. (c) 

D. (d) 

Answer: d

Watch Video Solution

5. which of the following is true about the value of refractive index of quartz glass ?

A. Same in all directions

B. Different in different directions

C. Cannot be measured

D. Always zero

Answer: a

Watch Video Solution

6. Which of the following statement is not true about amorphous solids?

A. On heating they may become crystalline at certain temperature

B. They may become crystalline on keeping for long time

C. Amorphous solids can be moulded by heating

D. They are anisotropic in nature

Answer: d

Watch Video Solution

7. The sharp melting point of crystalline solids is due to ....

A. a regular arrangement of constituent particles observed over a short distance in the crystal lattice.

B. a regular arrangement of constituent particles observed over a long distance in the crystal lattice.

C. same arrangement of constituent particles in different directions

D. different arrangement of constituent particles in different directions

Answer: b

Watch Video Solution

8. Iodine molecules are held in the crystal lattice by:

A. London forces

B. dipole -dipole interactions

C. covalent bonds

D. coulombic forces

Answer: a

Watch Video Solution

9. which of the following is a network solid?

A. SO_2 (Solid)

B. I_2

C. Diamond

D. H_2O (Ice)

Answer: c

Watch Video Solution

10. which of the following solids is not an electrical conductor ?

(a) Mg(s) (b) TiO(s) (c) $I_2(s)$ (d) $H_2O(s)$

A. (A) only

B. (B) only

C. (C) and (D)

D. (B) , (C) and (D)

Answer: c

Watch Video Solution

11. which of the following is not the characteristic of ionic solids?

A. Very low value of electrical conductivity in the molten state.

B. Brittle nature .

C. Very strong forces of interactions

D. Anisotropic nature

Answer: a

Watch Video Solution

12. Graphite is a good conductor of electricity due to the presence of :

A. lone pair of electrons

B. free valence electrons

C. cations

D. anions

Answer: b

Watch Video Solution

13. which of the following oxides behaves as conductor or insulator depending upon temperature ?

A. TiO

B. SiO_2

C. TIO_3

D. MgO

Answer: c

Watch Video Solution

14. Which of the following oxides shows electrical properties like metals?

A. SiO_2

B. MgO

C. $SO_2(s)$

D. CrO_2

Answer: d

Watch Video Solution

15. The lattice site in a pure crystal cannot be occupied by :

A. molecule

B. ion

C. electron

D. atom

Answer: c

Watch Video Solution

16. Graphite cannot be classified as :

A. conducting solid

B. network solid

C. covalent solid

D. ionic solid

Answer: d

Watch Video Solution

17. Cations are present in the interstitial sites in ....

A. Frenkel defect

B. Schottky defect

C. Vacancy defect

D. Metal deficiency defect

Answer: a

Watch Video Solution

18. Schottky defect is observed in crystals when ....

A. some cations move from their lattice sites to interstitial sites

B. equal number of cations and anions are missing from the lattice.

C. some lattice sites are occupied by electrons

D. some impurity is present in the lattice.

Answer: b

Watch Video Solution

19. which of the following is true about the change the charge acquired by p- type semiconductors ?

A. positive

B. neutral

C. negative

D. depends on concentration of p impurity

Answer: b

Watch Video Solution

20. To get a n- type semiconductor from silicon , it should be doped with a sustance with valencyÃ¢â‚¬Â¦Ã¢â‚¬Â¦Ã¢â‚¬Â¦.. .

A. 2

B. 1

C. 3

D. 5

Answer: d

Watch Video Solution

21. The total of tetrahedral voids in the face centred unit cell is ....

A. 6

B. 8

C. 10

D. 12

Answer: b

Watch Video Solution

22. Which of the following point defects are shown by AgBr (s) crystals ?

(a) Schottky defect

(b) Frenkel defect

(c) metal ecxess defect

(d) Metal deficiency defect

A. (A) and (B)

B. (C) and (D)

C. (A) and (C)

D. (B) and (D)

Answer: a

Watch Video Solution

23. In which pair most efficient packing is present?

A. hcp and bcc

B. hcp and ccp

C. bcc and ccp

D. bcc and simple cubic cell

Answer: d

Watch Video Solution

24. The percentage of empty space in a body centred cubic arrangement is :

A. 74

B. 68

C. 32

D. 26

Answer: c

Watch Video Solution

25. which of the following statemets is not true about the hexagonal close packing ?

A. The coordination number is 12

B. It has 74% packing efficiency

C. Tetrahedral voids of the second layer are covered by the spheres of the third layer

D. In this arrangement spheres of the fourth layer are exactly aligned with those of the first layer.

Answer: d

Watch Video Solution

26. in which of the following structures coordination number for cations and anions in the packed structure will be same ?

A. Cl^{-} ion from fcc lattice and Na^{+} ions occupy all octahedral voids of the unit cell

B. Ca^{2+} ions from fcc lattice and F^{-} ions occupy all the eight tetrahedral voids of the unit cell

C. O^{2-} ions from fcc lattice and Na^{+} ions occupy all the eight tetrahedral voids of the unit cell

D. S^{2-} ions from fcc lattice and Zn^{2+} ions go into alternate tetrahedral voids of the unit cell

Answer: a

Watch Video Solution

27. What is the coordination number in a square close packed structures in two dimensions?

A. 2

B. 3

C. 4

D. 6

Answer: c

Watch Video Solution

28. which kind of defects are introduced by doping ?

A. Dislocation defect

B. Schottky defect

C. Frenkel defect

D. Electronic defects

Answer: d

Watch Video Solution

29. silicon doped with electron rich impurity forms ....

A. p-type semiconductor

B. n-type semiconductor

C. intrinsic semiconductor

D. insulator

Answer: b

Watch Video Solution

30. Which of the following statements is not true ?

A. Paramagnetic substances are weakly attacted by magnetic field

B. Ferromagnetic substances cannot be magnetised permanently

C. The domains in antiferromagnetic substances are oppositely oriented with respect to each other

D. Pairing of electrons cancels their magnetic moment in the diamagnetic substances .

Answer: b

Watch Video Solution

31. which of the following is not true about the ionic solids ?

A. Bigger ions from the close packed structure

B. Smaller ions occupy either the tetrahedral or the octahedral voids depending upon their size

C. Occupation of all the voids is not necessary

D. The fraction of octahedral or tetrahedral voids occupied depends upon the radii of the ions occupying the voids .

Answer: d

Watch Video Solution

32. A ferromagnetic substance becomes a permanent magnet when it is placed in a magnetic field because___

A. all the domains get oriented in the direction of magnetic field

B. all the domains get oriented in the direction opposite to the direction of magnetic field

C. domains get oriented randomly

D. domains are not affected by magnetic field

Answer: a

Watch Video Solution

33. The correct order of the packing efficiency in different types of unit cells is____________

A. fcc lt bcc lt simple cubic

B. fcc gt bcc gt simple cubic

C. fcc lt bcc gt simple cubic

D. bcc lt fcc gt simple cubic

Answer: b

Watch Video Solution

34. which of the follwing defects is also known as dislocation defect ?

A. Frenkel defect

B. Schottky defect

C. Non-stoichiometric defect

D. Simple interstitial defect

Answer: a

Watch Video Solution

35. In the cubic close close packing, the unit cell has....

A. 4 tetrahedral voids each of which is shared by four adjacent unit cells.

B. 4 tetrahedral voids within the unit cell

C. 8 tetrahedral voids each of the which is shared by four adjacent unit cells.

D. 8 tetrahedral voids within the unit cells.

Answer: d

Watch Video Solution

36. The edge lengths of the unit cells in terms of the radius of spheres constituting fcc, bcc and simple cubic unit cell respectively

A. $2\sqrt{2}r, \frac{4r}{\sqrt{3}}, 2r$

B. $\frac{4r}{\sqrt{3}}, 2\sqrt{2}r, 2r$

C. $2r, 2\sqrt{2r}, \frac{4r}{\sqrt{3}}$

D. $2r, \frac{4r}{\sqrt{3}}, 2\sqrt{2}r$

Answer: a

Watch Video Solution

37. which of the following represents correct order of conductivity in solids ?

A. $K_{\text{metals}} > \; > K_{\text{insulators}} < K_{\text{semiconductors}}$

B. $K_{\text{metals}} < \; < K_{\text{insulators}} < K_{\text{semiconductors}}$

C. $K_{\text{metals}}, K_{\text{semiconductors}} > K_{\text{insulators}} = zero$

D. $K_{\text{metals}} < K_{\text{semiconductors}} > K_{\text{insulators}} \neq zero$

Answer: a

Watch Video Solution

Ncert Exemplar Problems Multiple Choice Ii

1. Which of the following is not true about the voids formed in 3 dimensional hexagonal close packed structure?

A. A tetrahedral void is formed when a sphere of the second layer is present above triangular void in the first layer

B. All the triangular voids are not covered by the spheres of the second layer.

C. Tetrahedral voids are formed when the triangular voids in the second layer lie above the triangular shapes of these voids do not overlap

D. Octahedral voids are formed when the triangular voids in the second layer exactly overlap with similar voids in the first layer.

Answer: c,d

Watch Video Solution

2. the value of magnetic moment is zero in the case of antiferromagnetic substaence because the domains ....

A. get oriented in the direction of the applied magnetic field

B. get oriented opposite to the direction of the applied magnetic field

C. are oppositely orientedwith respect to each other without the application of magnetic field

D. cancel out each other's magnetic moment.

Answer: c,d

Watch Video Solution

3. Which of the following statements are not true ?

A. Vacancy defect results in a decrease in the density of the substances

B. Interstitial defect results in an increase in the density of the substances

C. Impurity defect has no effect on the density of the substances

D. Frenkel defect results in an increase in the density of the substance

Answer: c,d

Watch Video Solution

4. Which of the following statements are true about metals ?

A. Valence band overlaps with conduction band

B. The gap between valence band and conduction band is negligible

C. The gap between valence band and conduction band cannot de determined

D. Valence band may remain partially filled .

Answer: a,b,d

Watch Video Solution

5. under the influence of electric field , which of the following statement is true about the movement of electrons and holes in p- type semiconducter ?

A. Electron will move towards are positively charged plate through electron holes

B. Holes will appear to be moving towards the negatively charged plate

C. Both electrons and holes appear to move towards the positively charged plate

D. Movement of electrons is not related to the movement of holes

Answer: a,b

Watch Video Solution

6. Which of the following statements are true about semiconductors?

A. Silicon doped with electron rich impurity is a p-type semiconductor

B. Silicon doped with an electron rich impurity is an n-type semiconductor

C. Delocalised electrons increase the conductivity of doped silicon

D. An electron vacancy increases the conductivity of n-type semiconductor

Answer: b,c

Watch Video Solution

7. An excess of potassium ions makes KCL crystals appear violet or lilac in colour since ....

A. some of the anionic sites are occupied by an unpaired electron

B. some of the anionic sites are occupied by a pair of electrons

C. there are vacancies at some anionic sites

D. F-centres are created which impart colour to the crystals

Answer: a,d

Watch Video Solution

8. the number of tetrahedral voids per unit cell in NaCl crystal is ....

A. 4

B. 8

C. twice the number of octahedral voids

D. four times the number of octahedral voids .

Answer: b,c

Watch Video Solution

9. Amorphous solids can also be callled ....

A. pseudo solids

B. true solids

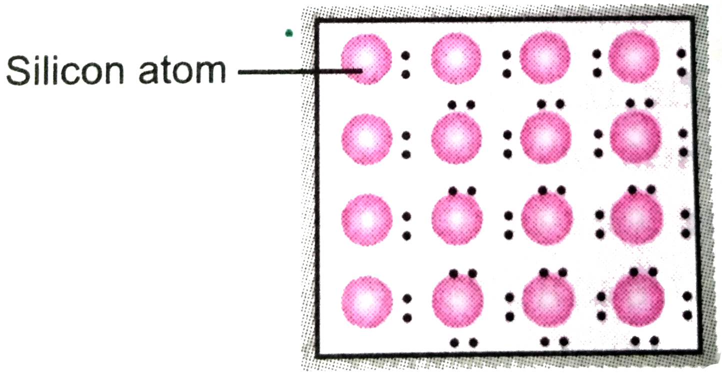
C. super cooled liquids

D. super cooled solids

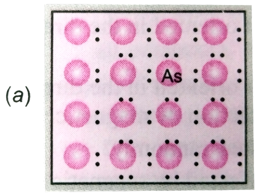
Answer: a,c

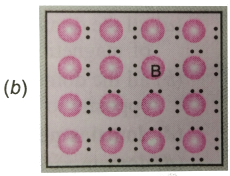
Watch Video Solution

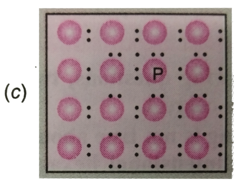
10. A perfect crystal of silicon is doped with some elements as given in the options . Which of the these options show n-type semiconductors ?



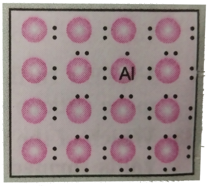
Pure crystal

A. 

B. 

C. 

(d)

D. 

Answer: a,c

Watch Video Solution

11. Which of the following statements are correct ?

A. Ferrimagnetic substances lose ferrimagnetism on heating and become paramagnetic

B. Ferrimagnetic substances do not lose ferrimagnetism on heating and remain ferrimagnetic

C. Antiferromagnetic substances have domain structures similar to ferromagnetic substances and their magnetic moments are not cancelled by each other

D. In ferromagnetic substances , all the domains get oriented in the direction of magnetic field and remain as such even after removing magnetic field

Answer: a,d

Watch Video Solution

12. Which of the following features are not shown by quartz glass ?

A. This is a crystalline solid

B. Refractive index is same in all the directions

C. This has definite heat of fusion

D. This is also called super cooled liquid

Answer: a,c

Watch Video Solution

13. Which of the following cannot be regarded as molecular solid ?

A. SiC (Silicon carbide)

B. AIN

C. Diamond

D. I_2

Answer: a,b,c

Watch Video Solution

14. In which of the following arrangements, Octahedral voids are formed ?

A. hcp

B. bcc

C. simple cubic

D. fcc

Answer: a,d

Watch Video Solution

15. Frenkel defect is also known as ....

A. stoichiometric defect

B. dislocation defect

C. impurity defect

D. non-stoichiometric effect

Answer: a,b

Watch Video Solution

16. Which of the following defects decrease the density ?

A. Interstitial defect

B. Vacancy defect

C. Frenkel defect

D. Schottky defect

Answer: b,d

Watch Video Solution

Ncert Exemplar Problems Short Answer

1. why are liquids and gases categorised as fuids ?

Watch Video Solution

2. Why are solids incompressible ?

Watch Video Solution

3. Inspite of long range order in the arrangement of particles why are the crystals usually not perfect ?

Watch Video Solution

4. Why common salt $(NaCl)$ sometimes appear yellow?

Watch Video Solution

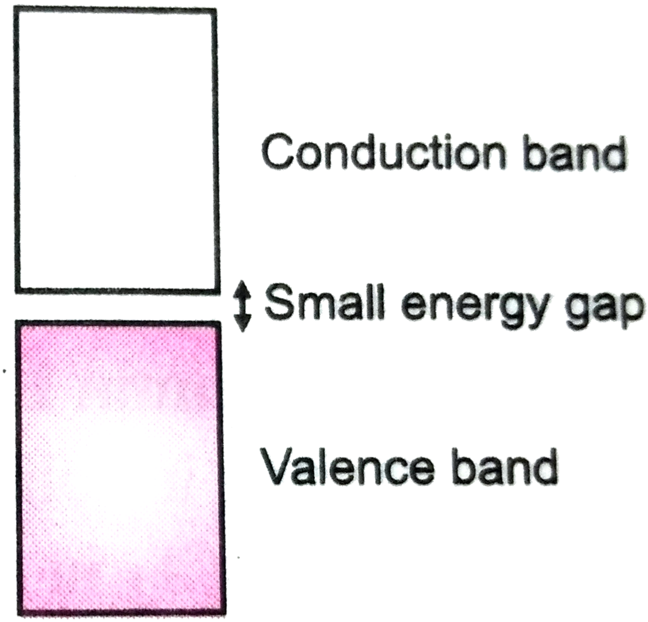
5. why is $Fe0(s)$ not formed in stoichiometric compostion ?

Watch Video Solution

6. why does white ZnO(s) becomes yellow upon heating ?

Watch Video Solution

7. Why does the electrical conductivity of semiconductors increase with rise in temperature ?



Watch Video Solution

8. Expalin why does conductivity of germainum crystals increase on doping with galium ?

Watch Video Solution

9. In a compound, nitrogen atoms (N) make cubic close packed lattice and metal atoms (M) occupy one-third of the tetrahedral voids present. Determine the formula of the compound formed by M and N ?

Watch Video Solution

10. Under which situations can an amorphous substance change to crystaline form?

Watch Video Solution

Ncert Exemplar Problems Matching

1. Match the defects given in Column I with the statements in given Column II.

Column I	Column II
(i) Simple vacancy defect	(a) shown by non-ionic solids and increases density of the solid.
(ii) Simple interstitial defect	(b) shown by ionic solids and decreases density of the solid.
(iii) Frenkel defect	(c) shown by non-ionic solids and density of the solid decreases
(iv) Schottky defect	(d) shown by ionic solids and density of the solid remains the same.

Watch Video Solution

2. Match the items given in Column I with the items given in Column II.

Column I	Column II
(i) Mg in solid state	(a) p-Type semiconductor
(ii) $MgCl_2$ in molten state	(b) n-Type semiconductor
(iii) Silicon with phosphorus	(c) Electrolytic conductors
(iv) Germanium with boron	(d) Electronic conductors

Watch Video Solution

3. Match the type of packing given in Column I with the items given in Column II.

Column I	Column II
(i) Square close packing in two dimensions	(a) Triangular voids
(ii) Hexagonal close packing in two dimensions	(b) Pattern of spheres is repeated in every fourth layer
(iii) Hexagonal close packing in three dimensions	(c) Coordination number 4
(iv) Cubic close packing in three dimensions	(d) Pattern of sphere is repeated in alternate layers.

Watch Video Solution

Ncert Exemplar Problems Assertion And Reason

1. Assertion :- (a) the total number of atoms present in a simple cubic unit cell is one .

Reasn :-(R) simple cubic cell has atoms at its corners

, each of which is shered between eight adjecent adjeacent unit cells.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion

C. Assertion is correct statement but reason is wrong statement

D. Assertion is wrong statement but reason is correct statement.

Answer: a

Watch Video Solution

2. Assertion (A): Graphite is a good conductor of electricity, however, diamond belongs to the category of insulators.

Reason (R): Graphite is soft in nature, on the other hand diamond is very hard and brittle.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.
B. Assertion and reason both are correct statements but reason is not correct explanation for assertion
C. Assertion is correct statement but reason is wrong statement
D. Assertion is wrong statement but reason is correct statement.

Answer: b

Watch Video Solution

3. Assertion :- (A) total number of octahedral voids present in unit cell of cubic close of each packing including the one that is present at the body centre . Is four .

Reason :- (R) Besides the body centre there is one octahedral void present at the centre of each of the six faces of the unit cell and each of which is shared between two adjeccent units cells.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion

C. Assertion is correct statement but reason is wrong statement

D. Assertion is wrong statement but reason is correct statement.

Answer: c

Watch Video Solution

4. Assertion : The packing efficiency is maximum for the fcc structure.

Reason : The cordination number is 12 in fcc structure.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion

C. Assertion is correct statement but reason is wrong statement

D. Assertion is wrong statement but reason is correct statement.

Answer: b

Watch Video Solution

5. Assertion :-(A) semiconductors are solids with conductivites in the intermediate range from $10^{-6} - 10^{4} ohm^{-1} m^{-1}$

Reason :-(R) internmediate conductivity in semiconductor Is due to partially filled valence band

.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.
B. Assertion and reason both are correct statements but reason is not correct explanation for assertion
C. Assertion is correct statement but reason is wrong statement

D. Assertion is wrong statement but reason is correct statement.

Answer: c

Watch Video Solution

Ncert Exemplar Problems Long Answer

1. with the help of a labelled diagram show that there are four octahedral voids per unit cell in cubic close packed structure .

Watch Video Solution

2. Show that in a cubic close packed structure, eight tetrahedral voids are present per unit cell.

Watch Video Solution

3. How does the doping increase the conductivity of semiconductor ?

Watch Video Solution

4. A sample of ferrous oxide has actual formula $Fe_{0.93}O_{1..00}$. In this sample what fraction of metal ions are Fe^{2+} ions? What type of non-stoichiometric defect is present in this sample ?

Watch Video Solution

Additional Questions Very Short Answer

1. Crystalline solids are anisotropic in nature. What does this statement mean ?

Watch Video Solution

2. How can a substance be made amorphous?

Watch Video Solution

3. Why is glass considered a supercooled liquid?

Watch Video Solution

4. What is photovoltaic cell ?

Watch Video Solution

5. What type of crystalline solid is graphite ?

Watch Video Solution

6. Classify the following into ionic, molecular,cvalent and metallic crystals.

Bronze, Dry ice, Nitre and Diamond

Watch Video Solution

7. Classify the following substances into ionic, covalent, molecular or metallic :

MgO, SO_2, I_2, H_2O (ice) , SiO_2 (quartz), brass.

Watch Video Solution

8. What type of solid is silicon carbide, SiC?

Watch Video Solution

9. Write a feature which will distinguish a metallic solid from an ionic solid.

Watch Video Solution

10. What type of interactions hold together the molecules in a polar crystalline solid ?

Watch Video Solution

11. Write any two differences between amorphous solids and crystalline solids.

Watch Video Solution

12. In NaCl crystal the Cl^{-} ions are in f.c.c. arrangement. Calculate the number of Cl^{-} ions in unit cell.

Watch Video Solution

13. How many atoms can be assigned to its unit cell if an element forms (i) a body centred cubic cell and

ii) face centred cubic cell ?

Watch Video Solution

14. A metallic crystal cystallizes into a lattice containing a sequence of layers $ABABAB....$ Any packing of spheres leaves out voids in the lattice. What percentage by volume of this lattice is empty spece?

Watch Video Solution

15. Give packing efficiency and coordination number of the following crystal structures :

(a)body centred cubic (b)cubic close packing

Watch Video Solution

16. What is the C.N. of octahedral void ?

Watch Video Solution

17. In a crystal of zinc sulphide , zinc occupies tetrahedral voids . What is the coordination number of zinc ?

Watch Video Solution

18. How may octahedral voids are present in 1 mole of a compound having cubic close packed structure ?

Watch Video Solution

19. Arrange the following accroding to their packing fraction:

simple cubic, face-centred cubic , body -centred cubic.

Watch Video Solution

20. Write the coordination number of each ion in the following crystals :

(i)NaCl (ii)CsCl (iii)ZnS (iv)Na_2O

Watch Video Solution

21. A solid substance AB has a rock salt geometry . What is the coordination number of A and B ? How many atoms of A and B are present in the unit cell ?

Watch Video Solution

22. How will you convert CsCl structure into NaCl structure ?

Watch Video Solution

23. MgO has a structure of NaCl and TiCl has the structure of CsCl. What are the coordination number of ions in each (MgO and TiCl)

Watch Video Solution

24. Name a compound having body centred cubic unit cell crystal lattice

Watch Video Solution

25. A compound AB_2 possesses the CaF_2 type crystal structure. The co-ordination number of A^{2+} and B^{-} ions is the crystal will be:

Watch Video Solution

26. Define coordination number of a metal ion in an ionic crystal

Watch Video Solution

27. What is the coordination number of

(i)sodium in sodium oxide (Na_2O) ?

(ii)oxide ion in sodium oxide (Na_2O) ?

(iii)calcium in calcium fluoride (CaF_2) ?

(iv)zinc in zinc blende (ZnS) ?

Watch Video Solution

28. What is the effect of pressure on NaCl type crystals ?

Watch Video Solution

29. What type of structures are exhibited by (a) $BaCl_2$, (b) Na_2O

Watch Video Solution

30. The radius of the Na^+ is 95 pm and that of Cl ion is 181 pm Predict the coordination number of Na^+ ?

Watch Video Solution

31. Silver crystallises with face - centred cubic unit cells .each side of the unit cell has a length of 409 pm . What is the radius of an atom of silver ? (Assume that each face atom is touching the four corner atoms.)

Watch Video Solution

32. Write expression for molar mass, M (in kg mol^{-1}) of a body-centred cubic crystal of an ionic compound if it has an edge length of 'a' metre and a density of 'd' kg m^{-3}

Watch Video Solution

33. Why stoichiometric defects are also called intrinsic defects?

Watch Video Solution

34. What are interstitials in a crystal ?

Watch Video Solution

35. Schottky defect.

Watch Video Solution

36. Explain the term 'Dislocations ' in relation to crystals

Watch Video Solution

37. Give the name of one solid which shows both Schottky and Frenkel defects?

Watch Video Solution

38. What are non-stoichiometric compounds ?

Watch Video Solution

39. In Frenkel defect

Watch Video Solution

40. What other elements may be added to silicon to make electrons available for conduction of an electric current?

Watch Video Solution

41. Why does Frenkel defect not change the density of AgCl crystals ?

Watch Video Solution

42. Mention one property which is caused due to the presence of F-centre in a solid

Watch Video Solution

43. Name the compound that can be added to $AgCl$ so as to produce cation vacancies.

Watch Video Solution

44. What are point defects ? Describe Schottky defects in crystals.

Watch Video Solution

45. When NaCl crystal is doped with $MgCl_2$,the nature of defect produced is

Watch Video Solution

46. Why is potassium chloride sometimes violet instead of pure white ?

Watch Video Solution

Watch Video Solution

47. What is the difference between 13-15 and 12-16 compounds ?

Watch Video Solution

48. f-centre is

Watch Video Solution

49. Name the non-stoichiometric point defect responsible for the colour of alkali metals halides.

Watch Video Solution

50. Name the type of defect that occurs in the crystals of zinc sulphide.

Watch Video Solution

51. Which point defect in crystals does not alter the density of the relevant solid ?

Watch Video Solution

52. Which point defect in crystals of a solid decreases the density of the solid?

Watch Video Solution

53. Which stoichiometric defect in crystals increses the density a solid?

Watch Video Solution

54. intrinsic and extrinsic semiconductor

Watch Video Solution

55. What type of semi-conductors is produced when silicon is doped with arsenic?

Watch Video Solution

56. How do paramagnetic substances differ from ferromagnetic ?

Watch Video Solution

57. What happens when a ferromagnetic or anti-ferromagnetic or a ferrimagnetic solid is heated ?

Watch Video Solution

58. Ferromagnetic subtances make permanent magnets. Give reason.

Watch Video Solution

59. What happens when ferrimagnetic Fe_3O_4 is heated to 850 K and why ?

Watch Video Solution

60. What happens when ferromagnetic substance is heated to high temperature?

Watch Video Solution

61. What type of substances exhibit antiferromagnetism ?

Watch Video Solution

62. How is electrical conductivity caused in (a) semiconductors, (b) metals, and (c) inoic compounds?

Watch Video Solution

63. How do the electrical conductivity and resistivity of the following classes of materials vary with temperature ?

Semiconductors, metallic conductors, superconductors.

Watch Video Solution

64. How may the conductivity of an intrinsic semiconductor be increased ?

Watch Video Solution

65. What is energy gap in band theory ? Compare its size in conductors, semiconductors insulators

Watch Video Solution

66. What type of substances would make better permanent magnets, ferromagnetic or ferrimagnetic? Justify your answer.

Watch Video Solution

67. What is a semiconductor ? Mention the two main types of semiconductor.

Watch Video Solution

68. Define superconductivity of a substance .

Watch Video Solution

Additional Questions Short Answer

1. (a)Write two difference between crystalline solids and amorphous solids ?

(b)Draw a diagram for anisotropic behaviour of crystalline solids .

Watch Video Solution

2. Why are crystalline solids anisotropic ?

Watch Video Solution

3. On the basis of nature of bonding, how can the solids be classified into different types ?

Watch Video Solution

4. Classify the following solids on bonding considerations :

CO_2, MgO, Al , H_2 , Si , Gd, Pb, AgCl

Watch Video Solution

5. Explain with the help of diagrams the structrual differences between three types of cubic crystals.

Watch Video Solution

6. Define body-centred cubic cell and Face-centred cubic cell

Watch Video Solution

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

Watch Video Solution

8. The number of close neighbours in a body-centred cubic unti cell of monoatomic substance is,

Watch Video Solution

9. Calculate the packing efficiency of a metal crystal for a simple cubic lattice.

Watch Video Solution

10. Name the ions which form the close-packed structure (along with the type of packing) and the ions which fill the voids (along with the types of voids) in the compounds : (i)NaCl (ii)ZnS (iii)CaF_2

Watch Video Solution

11. Explain what happens to the structure of CsCl when (i)it is heated to about 760 K. (ii)pressure is applied on it.

Watch Video Solution

12. Draw the structure of NaCl and represent the coordination numbers of Na^{+} and Cl^{-} ions in the diagram.

Watch Video Solution

13. Draw the structure of CsCl and represent the coordination numbers of Cs^{+} and Cl^{-} ions in the diagram.

Watch Video Solution

14. What is the difference in the structures of zinc blende and wurtzite ?

Watch Video Solution

15. Define radius-ratio . What is the coordination number if the radius ratio of the compound is 0.52 ?

Watch Video Solution

16. Define radius ratio. What is the value of radius ratio for octahedral geometry ?

Watch Video Solution

17. For a face-centred cubic crystal of an element , prove that radius (r) of the atoms is related to the edge (a) as $r = a/2\sqrt{2}$

Watch Video Solution

18. For a body-centred cubic, crystal of an element , derive the relationship between radius (r) of the atoms and edge (a).

Watch Video Solution

19. Derive an expression for the calculation of density of the cubic crystal of an element whose edge is 'a' pm and atomic mass is M.

Watch Video Solution

20. Explain how can you determine the atomic mass of an unknown metal if you know its mass density and the dimensions of unit cell of its crystal.

Watch Video Solution

21. What are point defects ? Describe Schottky defects in crystals.

Watch Video Solution

22. Write the difference between Frenkel and Schottky defects.

Watch Video Solution

23. Frenkel and Schottky defects are:

Watch Video Solution

24. What are interstitials ? Explain with suitable examples

Watch Video Solution

25. Briefly explain what you understand by 'F-centre' ?

Watch Video Solution

26. Pure silicon is an insulator . Silicon doped with phosphorus is a semiconductor. Silicon doped with gallium is also a semiconductor. What is the difference between the two doped silicon semiconductors ?

Watch Video Solution

27. Explain Schottky defect in Stoichiometric crystals. What are the consequences of Schottky and Frenkel defects in crystals ?

Watch Video Solution

28. What do you understand by imperfections in ionic crystals? Name the types of imperfections which generally occur in ionic crystals

Watch Video Solution

29. Explain the term 'Doping'

Watch Video Solution

30. State the difference between Schottky and Frenkel defects ? Which of these two changes the density of the solid and why ?

Watch Video Solution

31. How would you account for the following ?

(i) Frenkel defects are not found in alkali metal halides.

(ii)Schottky defects lower the density of related solids.

(iii)Impurity doped silicon is a semiconductor.

Watch Video Solution

32. What is a semiconductor? Describe the two main types of semiconductor and contrast their conduction mechanism.

Watch Video Solution

33. What is doping ? What are n-type and p-type semiconductors ?

Watch Video Solution

34. Solids can be classified into three types on the basis of their electrical conductivities.

(i)Name three types of solids classified on the basis of electrical conductivities .

(ii)How will you explain such classification based on band theory ?

Watch Video Solution

35. Explain ferromagnetism with suitable examples.

Watch Video Solution

36. Account for the following :

(i)Silicon is an insulator but silicon doped with phosphorus acts as a semi-conductor.

(ii)Some of the glass objects recovered from ancient monuments look milky instead of being transparent.

Watch Video Solution

37. Difference between Diagmagnetism, Paramagnetism , Ferromagnetism

Watch Video Solution

38. Explain superconductivity.

Watch Video Solution

39. Explain each of the following with a suitable example :

(i)Paramagnetism , (ii)Piezoelectric effect , (iii)Frenkel defect in crystals.

Watch Video Solution

40. Define the following terms in relation to crystalline solids :

(i) Unit cell , (ii)Coordination number

Watch Video Solution

41. (a) What type of semiconductor is obtained when silicon is doped with boron ?

(b) What type of magnetism is shown in the following alignment of magnetic moments?

$\uparrow \uparrow \uparrow \uparrow \uparrow \uparrow$

(c) What type of point defect is produced when AgCl is doped with $CdCl_2$?

Watch Video Solution

42. (a) Based on the nature of intermolecular forces, classify the following solids:

Silicon carbide, Argon

(b) ZnO turns yellow on heating. Why?

(c) What is meant by groups 12-16 compounds? Give an example.

Watch Video Solution

43. (a) Based on the nature of the intermolecular foces, classify solids benzene and silver.

(b) AgCl shows frenkel defect while NaCl does not. Give reason.

(c) What type of semi-conductor is formed when Ge is doped with Al ?

Watch Video Solution

44. (a) Based on the nature of intermolecular forces, classify the following solids:

Sodium sulphat, Hydrogen

(b) What happens when $CdCl_2$ is doped with $AgCl$?

(c) why do ferrimagnetic substances show better magnetism than antiferromagnetic substances?

Watch Video Solution

Additional Questions Long Answer

1. What are amorphous solids ? Give their important properties and uses.

Watch Video Solution

2. What is space lattice and unic cell ? What do you understand by simple, face centred and body centred unit cells?

Watch Video Solution

3. Briefly explain how the packing of the constituent particles in a crystal takes place.

Watch Video Solution

4. Knowing the radii of the cation and anion of an ionic compound, how can you predict the structure of the compound ?

Watch Video Solution

5. Derive the following relationships for cubic crystals of an element :

(i) For FCC, $r = a/2\sqrt{2}$

(ii) For BCC, $r = \sqrt{3}a/4$

Watch Video Solution

6. Derive an expression for density of a cubic crystal from the edge of the cubic crystal of an element in terms of SI units.

Watch Video Solution

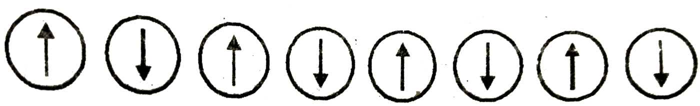
7. What is point defects. Describe two types of point defects.

Watch Video Solution

8. Define different types of magnetic materials and give one example in each case.

Watch Video Solution

9. (i) (a) Following is the schematic alignment of magnetic moments :

(a) 

What type of magnetism is shown by this substance ?

(b) What type of stoichiometric defect is shown by

(i) KCl (ii) AgCl ?

(ii) An element with density $11.2gcm^{-3}$ forms a fcc lattice with length of $4 \times d10^{-8}$ cm. Calculate the atomic mass of the element. $\left(N_A = 6.02 \times 10^{23} mol^{-1}\right)$.

Watch Video Solution

Analytical Question

1. Why ureas has a sharp melting point but glass does not ?

Watch Video Solution

2. The mineral haematite, Fe_2O_3 consists of a cubic close packed array of oxide ions with Fe^{3+} ions occupying intersitial positions. Predict whether the iron ions are in the octahdral or tetrahedral holes. Radius of Fe^{3+} = 0.65Å .

Watch Video Solution

3. Zine oxide is white but it turns yellow on heating . Explain.

Watch Video Solution

4. Why does zinc oxide exhibit enhanced electrical conducity on heating ?

Watch Video Solution

5. The electrical conductivity of a metal decreases with rise in temperature while that of semi-conductor increases. Justify.

Watch Video Solution

6. The ions of NaF and MgO have the same number of electrons and inter nuclear distances are about the same (235 pm and 215 pm). Why are then the melting points of NaF and MgO so different $(992^{\circ}C$ and $2642^{\circ}C)$?

Watch Video Solution

7. Diamond and solid rhombic sulphur both are covalent solids but the latter has very low melting point than the former. Explain why ?

Watch Video Solution

8. NaCl and CsCl have similar formular . Then why they have differnet strutures ?

Watch Video Solution

9. Why is coordination number of 12 not found in Ionic crystals ?

Watch Video Solution

10. Analyses shows that FeO has a non-stoichiometric composition with formula $Fe_{0.95}O_{1.00}$. Give reason.

Watch Video Solution

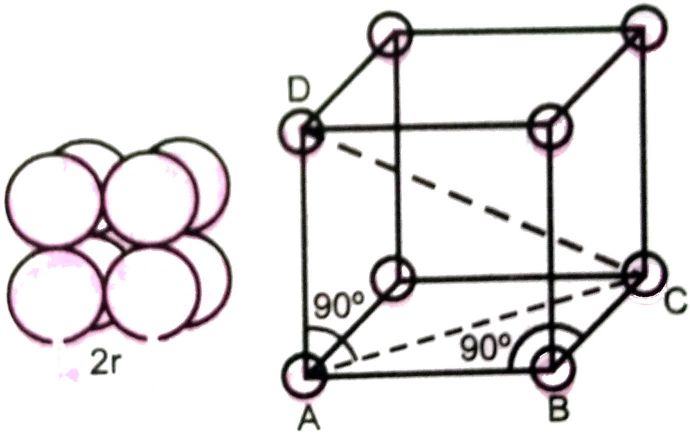
11. ZnO crystals on heating acquires the formuls $Zn(1+x)O$.

Or

There is an increase in conductivity when silicon doped with phosphorus. Give reason.

Watch Video Solution

12. If the atoms of an element have the radius r, then in a primitive cubic unit cell, calculate (a)the length of the face diagonal . (b)the length of the body diagonal.



View Text Solution

13. Out of NaCl and CsCl , which one is more stable and why ?

Watch Video Solution

14. In a crystal, Frenkel defect is not shown by alkali metal halides but silver halides show. Why ?

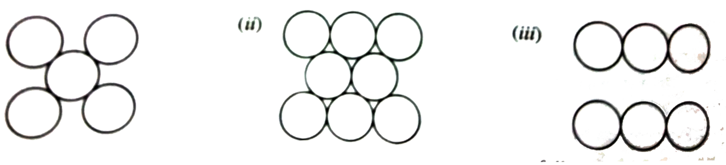
Watch Video Solution

15. What is the arrangement of atoms in the lattice structure of diamond and give contribution of each C atom ?

Watch Video Solution

16. The figures given below show the location of atoms in three crystallographic planes in a fcc lattice. Draw the unit cell for the corresponding structure and identify these planes in your diagram.

(i) (ii) (iii)



View Text Solution

17. r_{Na^+} and r_{Cl^-} represent radius of Na^+ and Cl^- ions respectively. If 'n' is the number of NaCl units per cell then give the eqution you will use to obtain molar volume.

Watch Video Solution

Analytical Problems

1. Lithium borohydride $(LiBH)_4$ crystallizes in an orthorohombic system having 4 molecules per unit cell. The unit cell dimensions are : $a = 6.81 \text{Å}$ and $c = 7.17 \text{Å}$. Calculate the density of the crystal (At. Mass of $Li = 7, B = 11, H = 1u$).

Watch Video Solution

2. If the crystallises in zinc blende structure with I^- ions at lattice points. What fraction of tetrahedral voids is occupied by Ag^+ ions ?

Watch Video Solution

3. A compound consisting of the monovalent ions A^{+}, B^{-} crystallizes in the body-centred cubic lattice. (i)What is the formula of the compound ? (ii)If one of A^{+} ions from the corner is replaced by a monovalent ions C^{+}, what would be the simplest formula of the resulting compound ?

Watch Video Solution

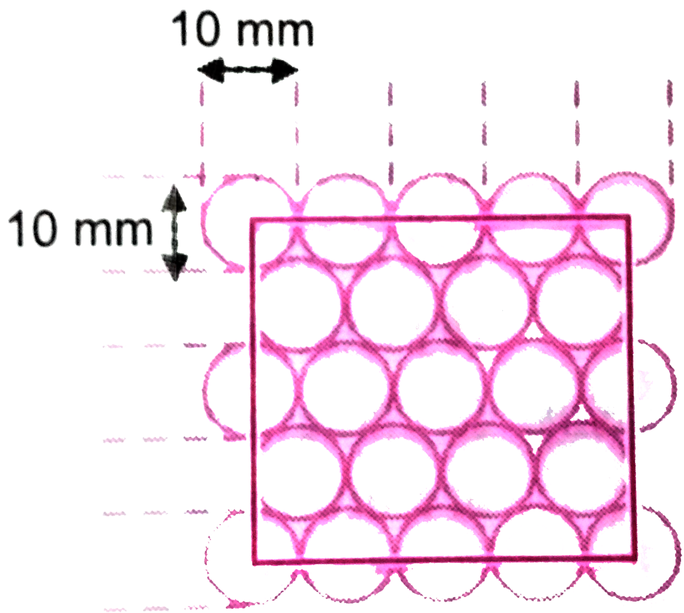
4. Calcium metal crystallizes in a face-centred cubic lattice with edge length of 0.556 nm. Calculate the density of the metal if it contains (i)0.5% Frenkel defects (ii)0.2% Schottky defects.

Watch Video Solution

5. There is a collection of crystalline substances in a hexagonal closed packing. If the density of matter is $2.6g/cm^3$, what would be the average density of matter in collection? What fraction of space is actually unoccupied ?

Watch Video Solution

6. You are given marbles of diameter 10 mm.They are to be placed such that their centres are lying in a square bound by four lines each of length 40 mm. What will be the arrangement of marbles in a plane so that maximum number of marbles can be placed inside the area ? Sketch the diagram and derive an expression for the number of marbles per unit area .



View Text Solution

7. Lithium iodide crystal has a face-centred cubic unit cell. If the edge length of the unit cell is 620 pm, determine the ionic radius of I^{-} ion.

Watch Video Solution

8. When heated above $916^{\circ}C$, iron changes, its crystal structure from body centred cubic to cubic closed packed structure. Assuming that the metallic radius of an atom does not change, calculate the ratio of the density of the bcc crystal to that of ccp crystal.

Watch Video Solution

9. A metal crystallizes into two cubic phases, face-centred cubic and body-centred cubic, which have unit cell lengths 3.5 and $3.0A$, respectively. Calculate the ration of densities of fcc and bcc.

Watch Video Solution

10. In diamond lattice, all lattice points and alternate tetrahedral voids are occupied by carbon atoms. If diamond crystallizes in fcc form with edge length 'a' , find out (a)number of next nearest neighbours in diamond lattice (b)distance between the next nearest neighbours.

Watch Video Solution

11. Using X -rays of wavelength 154.1 pm and staring from the glancing angle, the reflection fro sliver crystal was found to occur at $\theta = 22.20^\circ$. Calculate the spacing between the planes of Ag atoms that gave rise to the above reflection.

$(\sin 22.20^\circ = 0.3778)$

Watch Video Solution

Competition Focus I Multiple Choice

1. Which of the following exists as covalent crystals in the solid state?

A. Phosphorus

B. Iodine

C. Silicon

D. Sulphur

Answer: C

Watch Video Solution

2. Which of the following statements about amorphous solid 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

Answer: B

Watch Video Solution

3. 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. 5.14×10^{21}

B. 1.28×10^{21}

C. 1.71×10^{21}

D. 2.57×10^{21}

Answer: D

Watch Video Solution

4. In a face centred cubic lattice, atom A occupies the corner positions and atom B occupies the face centred positions. If one atom of B is missin from one of the face centred points,, the formula of the compound is :

A. AB_2

B. A_2B_3

C. A_2B_5

D. A_2B

Answer: C

Watch Video Solution

5. The vacant space in bcc lattice unit cell is :

A. 23%

B. 32%

C. 26%

D. 48%

Answer: B

Watch Video Solution

6. If spheres of radius 'r' are arranged in ccp fashion (ABC ABC...) , the vertical distance between any two consecutive A layers is

A. $4r\sqrt{\frac{2}{3}}$

B. $4r\sqrt{\frac{3}{2}}$

C. 6 r

D. $r\sqrt{6}$

Answer: A

View Text Solution

7. The pyknometric density of sodium chloride crystal is $2.165 \times 10^3 kgm^{-3}$ while its X ray density is $2.178 \times 10^3 kgm^{-3}$ the fraction of unoccupied sites in $NaCl$ crystal is

A. 5.96

B. 5.96×10^{-2}

C. 5.96×10^{-1}

D. 5.96×10^{-3}

Answer: D

Watch Video Solution

8. The fraction of total volume occupied by the atom present in a simple cubic is

A. $\frac{\pi}{4}$

B. $\frac{\pi}{6}$

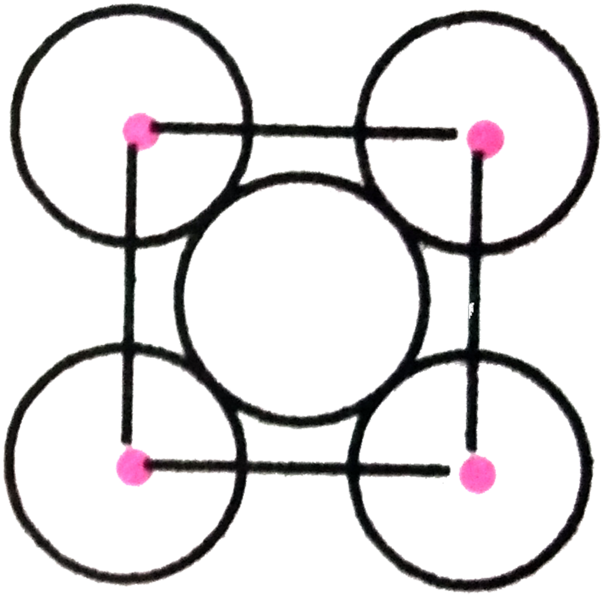
C. $\frac{\pi}{\sqrt{3\sqrt{2}}}$

D. $\frac{\pi}{\sqrt{4\sqrt{2}}}$

Answer: B

Watch Video Solution

9. The packing efficiency of the two-dimensional square unit cell



A. $39.27\ \%$

B. $68.02\ \%$

C. $74.05\ \%$

D. $78.54\ \%$

Answer: D

View Text Solution

10. In a solid AB having the $NaCl$ structure, A atom occupies the corners of the cubic unit cell. If all the face-centred atoms along one of the axes are removed, then the resultant stoichiometry of the solid is

A. AB_2

B. A_2B

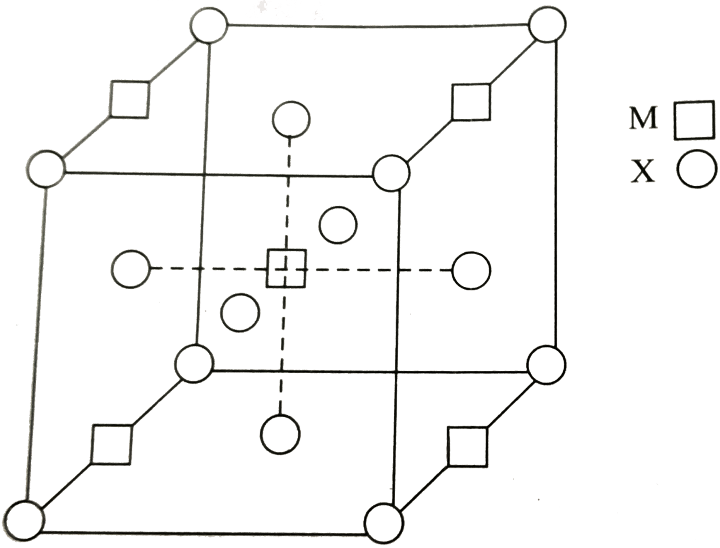
C. A_4B_3

D. A_3B_4

Answer: D

Watch Video Solution

11. A compound M_pX_q has cubic close packing (p) arrangement of X. Its unit cell structure is shown below. The empirical formula of the compound is



a. MX b. MX_2 c. M_2X

A. MX

B. MX_2

C. M_2X

D. M_5X_{14}

Answer: B

Watch Video Solution

12. Perovskite is mineral containing calcium, oxygen and titanium, in which oxygen atoms are at the face centres, calcium atoms are at the corners and titanium atoms at the centre of the cube. Oxidation number of titanium in the mineral is

A. $+2$

B. $+3$

C. $+4$

D. $+1$

Answer: C

Watch Video Solution

13. Calculate the number of tetrahedral voids in the unit cell of a face-centred cubic lattice of similar atoms.

A. 4

B. 6

C. 8

D. 12

Answer: C

Watch Video Solution

14. Structure of a mixed oxide is cubic closed - packed (ccp) .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 monovelent metal B .The formula of the oxide is

A. $A_2B_3O_4$

B. AB_2O_2

C. ABO_2

D. A_2BO_2

Answer: B

Watch Video Solution

15. If the unit cell of a mineral has cubic close packed (ccp) array of oxygen atoms with m fraction of octahedral holes occupied by aluminium ions and n fraction of tetrahedral holes occupied by magnesiums ions, m and n respectively, are

A. $\frac{1}{2}, \frac{1}{8}$

B. $1, \frac{1}{4}$

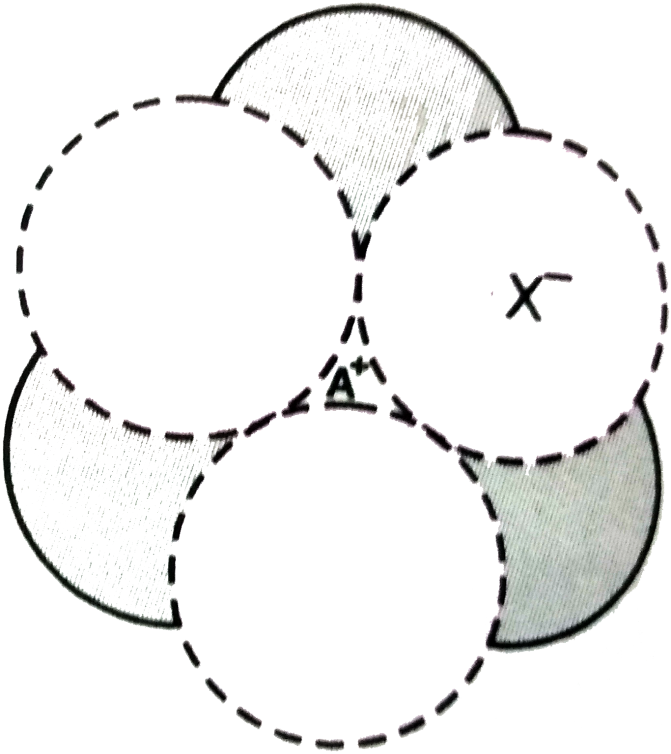
C. $\frac{1}{2}, \frac{1}{2}$

D. $\frac{1}{4}, \frac{1}{8}$

Answer: A

Watch Video Solution

16. The arrangement of X^- ions around A^+ ion in solid AX. If the radius of X^- is 250 pm, the radius of A^+ is



A. 104 pm

B. 125 pm

C. 183 pm

D. 57 pm

Answer: A

View Text Solution

17. A metal crystallises in a face centred cubic structure. If the edge length of its unit cell is 'a' the closest approach between two atoms in metallic crystal will be

A. $\sqrt{2}a$

B. $\frac{a}{\sqrt{2}}$

C. 2a

D. $2\sqrt{2}a$

Answer: B

Watch Video Solution

18. In calcium, fluoride having the florite structures. The coordination number for calcium ion $\left(Ca^{2+}\right)$ and fluoride ion $\left(F^{-}\right)$ are

A. 4 and 2

B. 6 and 6

C. 8 and 4

D. 4 and 8

Answer: C

Watch Video Solution

19. In an ionic compound $A^{+}X^{-}$, the radii of A^{+} and X^{-} ions ar 1.0pm and 2.0om, respectively. The volume of the unit cell of the crystal AX will be:

A. 27 pm^3

B. 64 pm^3

C. 125 pm^3

D. 216 pm^3

Answer: D

Watch Video Solution

20. A solid compound XY has $NaCl$ structure. If the radius of the cation is 100 pm, the radius of the anion $\left(Y^{-}\right)$ will be

A. 275.1

B. 322.5 pm

C. 241.5 pm

D. 165.7 pm

Answer: C

Watch Video Solution

21. The ionic radii of A^{+} and B^{-} ions are 0.92×10^{-10} m and 1.81×10^{-10} m . The coordination number of each ion in AB is

A. 2

B. 6

C. 4

D. 8

Answer: B

Watch Video Solution

22. 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. 288 pm

B. 408 pm

C. 144 pm

D. 204 pm

Answer: A

Watch Video Solution

23. Sodium metal crystallises in body centred cubic lattic with cell edge 4.29Å .What is the radius of sodium atom ?

A. 5.72 Å

B. 0.93 Å

C. 1.86 Å

D. 3.22 Å

Answer: C

Watch Video Solution

24. A given metal crystalline out with a cubic structure having edge length of 361 pm .if there are four metal atoms in one unit cell, what is the radius of metal atom?

A. 80 pm

B. 108 pm

C. 40 pm

D. 127 pm

Answer: D

Watch Video Solution

25. The edge length of a face-centred cubic unit cell is $508 \pm$. If the radius of the cation is $110 \pm$ the radius of the anion is

A. 144 pm

B. 288 pm

C. 618 pm

D. 398 pm

Answer: A

Watch Video Solution

26. $CsCl$crystallizes in body centred cubic lattice. If $'a'$ is its edge length then which of the following expressions is correct ?

A. $r_{Cs^+} + r_{Cl^-} = \sqrt{3}a$

B. $r_{Cs^+} + r_{Cl^-} = 3a$

C. $r_{Cs^+} + r_{Cl^-} = \frac{3\text{a}}{2}$

D. $r_{Cs^{+}} + r_{Cl^{-}} = \frac{\sqrt{3}}{2}a$

Answer: D

Watch Video Solution

27. If a is the length of the side of a cube, the distance between the body centred atom and one corner atom in the cube will be:

A. $2\sqrt{3}a$

B. $\frac{4}{\sqrt{3}}a$

C. $\frac{\sqrt{3}}{4}a$

D. $\frac{\sqrt{3}}{2}a$

Answer: D

Watch Video Solution

28. The edge length of a cube is 400 pm .its body diagonal would be

A. 500 pm

B. 600 pm

C. 566 pm

D. 693 pm

Answer: D

Watch Video Solution

29. If $'a'$ stands for the edge length of the cubic systems: simple cubic,body centred cubic and face centred cubic then the ratio of radii of the spheres inthese systems will be respectively,

A. $\frac{1}{2}a : \frac{\sqrt{3}}{4}a : \frac{1}{2\sqrt{2}}a$

B. $\frac{1}{2}a : \sqrt{3}a : \frac{1}{\sqrt{2}}a$

C. $\frac{1}{2}a : \frac{\sqrt{3}}{2} : \frac{\sqrt{2}}{2}a$

D. $1a : \sqrt{3}a : \sqrt{2}a$

Answer: A

Watch Video Solution

30. A metal has a fcc lattice.The edge length of the unit cell is 404 pm ,the density of the metal is $2.72 gcm^{-3}$. The molar mass of the metal is $(N_A,$ Avorgadro's constant $= 6.02 \times 10^{23} mol^{-1})$

A. 40 g mol^{-1}

B. 30 g mol^{-1}

C. 27 g mol^{-1}

D. 20 g mol^{-1}

Answer: C

Watch Video Solution

31. The number of atoms is 100 g of a fcc crystal with density = 10.0 g / cm^3 and cell edge equal to 200 pm is equal to

A. 5×10^{24}

B. 5×10^{25}

C. 6×10^{23}

D. 2×10^{25}

Answer: A

Watch Video Solution

32. Ice crystallises in hexagonal lattice having volume of unit cell is $132 \times 10^{-24} cm^3$.If density is 0.92g cm^3at a given temperature, then number of water molecules per unit cell is

A. 1

B. 2

C. 3

D. 4

Answer: D

Watch Video Solution

33. if the edge length of a NaH unit cell is 488 pm, what is the length of Na-H bond if it crystallises in the fcc structure ?

A. 122 pm

B. 244 pm

C. 488 pm

D. 976 pm

Answer: B

Watch Video Solution

34. Lithium has a bcc structure .Its density is $530 kg m^{-3}$ and its atomic mass is $6.94 g mol^{-1}$ .Calculate the edge length of a unit cell of lithium metal $\left(N_A = 6.02 \times 10^{23} mol^{-1}\right)$

A. 527 pm

B. 264 pm

C. 154 pm

D. 352 pm

Answer: D

Watch Video Solution

35. Iron exhibits b structure at roomj temperature. Above $9000^{\circ}C$, it transformers to f structure. The ratio of density of iron at room temperature to that at $900^{\circ}C$ (assuming molar mass and atomic radius of iron remains constant with temperature) is

A. $\dfrac{\sqrt{3}}{\sqrt{2}}$

B. $\dfrac{4\sqrt{3}}{3\sqrt{2}}$

C. $\dfrac{3\sqrt{3}}{4\sqrt{2}}$

D. $\frac{1}{2}$

Answer: D

Watch Video Solution

36. The correct statement regarding defects in crystalling solids.

A. Frenkel defect is a dislocation defect

B. Frenkel defect is found in halids of alkaline metals

C. Schottky defects have no effect on the density of crystalline solids

D. Frenkel defects decrease the density of crystalline solids

Answer: A

Watch Video Solution

37. If $NaCl$ is doped with $10^{-4} mol\,\%$ of $SrCl_2$ the concentration of cation vacancies will be $(N_A = 6.02 \times 10^{23} mol^{-1})$

A. $6.02 \times 10^{14} \text{mol}^{-1}$

B. $6.02 \times 10^{15} \text{mol}^{-1}$

C. $6.02 \times 10^{16} \text{mol}^{-1}$

D. $6.02 \times 10^{17} \text{mol}^{-1}$

Answer: D

Watch Video Solution

38. The crystal with metal deficiency defect is:

A. NaCl

B. FeO

C. KCl

D. ZnO

Answer: B

Watch Video Solution

39. Experimentally it was found that a metal oxide has formula $M_{0.98}O$. Metal M present as M^{2+} and M^{3+} in its oxide. Fraction of the metal which exists as M^{3+} would be:

(a) 7.01% (b) 4.08% (c) 6.05%

[Hint: $M_{0.98}O$ — $\underset{x}{M}\underset{x \text{ mole}}{O}$, $\underset{y}{M_2}\underset{\frac{3}{2}y \text{ mole}}{O_3}$: $\frac{x+y}{x+\frac{3y}{2}} = 0.98$]

A. 5.08%

B. 7.01%

C. 4.08%

D. 6.05%

Answer: C

Watch Video Solution

40. Which type of 'defect' has the pressence of cations in the interstitial sites?

A. Schottky defects

B. Vacancy defect

C. Frenkel defect

D. Metal deficiency defect

Answer: C

Watch Video Solution

41. The substances,Which are repelled by a magnet,are termed as

A. O_2

B. H_2O

C. CrO_2

D. Fe_3O_4

Answer: B

Watch Video Solution

42. Which of the following metal oxides is anti-ferromagnetic in nature?

A. MnO_2

B. TiO_2

C. VO_2

D. CrO_2

Answer: A

Watch Video Solution

43. The energy gaps (E_g) between valence band and conduction band for diamond, silicon and germanium are in the order

A.

$$E_g(\text{diamond}) \text{ gt } E_g(\text{silicon}) \text{ gt } E_g(\text{germanium})$$

B.

$$E_g(\text{diamond}) \text{ lt } \ E_g(\text{silicon}) \text{ lt } \ E_g(\text{germanium})$$

C.

$$E_g(\text{diamond}) = \ E_g(\text{silicon}) = \ E_g(\text{germanium})$$

D.

$$E_g(\text{diamond}) \text{ gt } \ E_g(\text{germanium}) \text{ gt } \ E_g(\text{silicon})$$

Answer: A

Watch Video Solution

44. Which of the following compounds is metallic and ferromagnetic ?

A. CrO_2

B. VO_2

C. MnO_2

D. TiO_2

Answer: A

Watch Video Solution

45. For which crystal anion-anion contact is valid ?

A. NaF

B. NaI

C. CsBr

D. KCl

Answer: B

Watch Video Solution

46. Each rubidium halide crystallising in the NaCl-type lattice has a unit cell length 0.30Å greater than that for corresponding potassium salt $\left(r_{k+} = 1.33\text{Å}\right)$ of the same halogen. Hence, ionic radius of Rb^{+} is

A. 1.03 Å

B. 1.18 Å

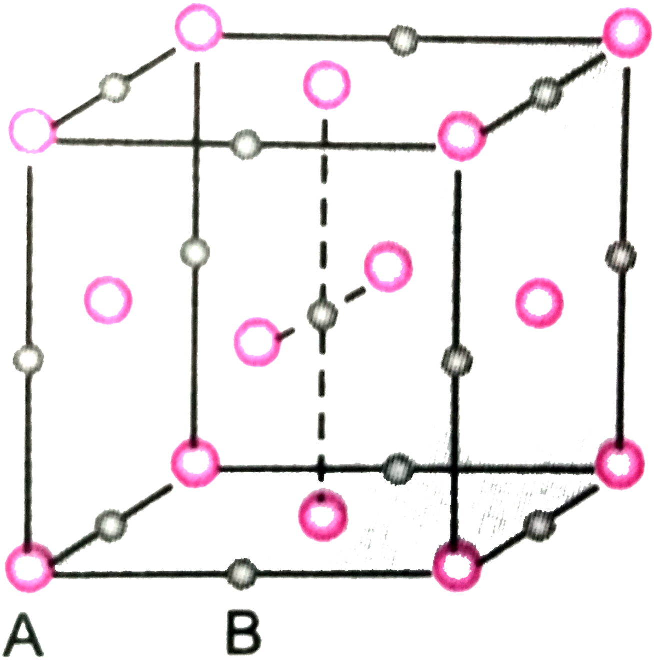
C. 1.48 Å

D. 1.63 Å

Answer: C

Watch Video Solution

47. For a solid with the adjoining structure, the coordination number of the points A and B respectively are



A. 6,8

B. 8,8

C. 6,6

D. 4,6

Answer: C

View Text Solution

48. If the positions of Na^{+} and Cl^{-} are interchanged in NaCl, having fcc arrangement of Cl^{-} ions then in the unit cell of NaCl

A. Na^{+} ions will decrease by 1 while Cl^{-} ions will increase by 1

B. Na^{+} ions will increase by 1 while Cl^{-} ions will decrease by 1

C. Number of Na^{+} and Cl^{-} ions will remain the same

D. The crystal structure of NaCl wil change

Answer: B

Watch Video Solution

49. Which of the following statements is not correct ?

A. The fraction of the total volume unoccupied by the atoms in a primitive cell is 0.48

B. Molecular solids are generally volatile

C. The number of carbon atoms in a unit cell of Diamond is 4

D. The number of Bravais lattices in which a crystal can be categorized is 14.

Answer: C

Watch Video Solution

50. KCl crystallises in the same type of lattices as does 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 of KCl to that of NaCl.

A. 1.123

B. 0.891

C. 1.414

D. 0.414

Answer: A

Watch Video Solution

51. Which has no rotaition of symmetry ?

A. Hexagonal

B. Orthorhombic

C. Cubic

D. Triclinic

Answer: D

Watch Video Solution

52. Which is the incorrect statement ?

A. $FeO_{0.98}$ has non-stoichiometric metal deficiency defect

B. Density decreases in case of crystals with Schottky's defect

C. NaCl(s) is insulator , silicon is semiconductor, silver is conductor , quartz is piezoelectric crystal

D. Frenkel defect is favoured in those ionic compounds in which the sizes of cations and anions are almost equal

Answer: A,D

Watch Video Solution

1. Which of the following statements are not true ?

A. An element with BCC structure has two atoms per unit cell.

B. An ionic compound A^+B^- with BCC structure has one AB formula unit per unit cell.

C. The shape of the octahedral void is octahedral

D. The edge length of the crystal A^+B^- is equal to the distance between A^+ and B^- ions.

Answer: C,D

View Text Solution

2. Which of the following are not true about hexagonal close packing ?

A. It has a coordination number of 6.

B. It has 26% empty space

C. It is ABCABC.... Type of arrangement

D. It is as closely packed as body centred cubic packing.

Answer: A,C,D

Watch Video Solution

3. Which of the following are true ?

A. In NaCl crystals , Na^{+} ions are present in all the octahedral voids

B. In ZnS (zinc blende) , Zn^{2+} ions are present in alternate tetrahedral voids .

C. In CaF_2, F^{-} ions occupy all the tetrahedral voids

D. In Na_2O, O^{2-} ions occupy half the octahedral voids.

Answer: A,B,C

Watch Video Solution

4. Crystal systems in which no two axial lengths are equal are

A. Tetragonal

B. Orthorhombic

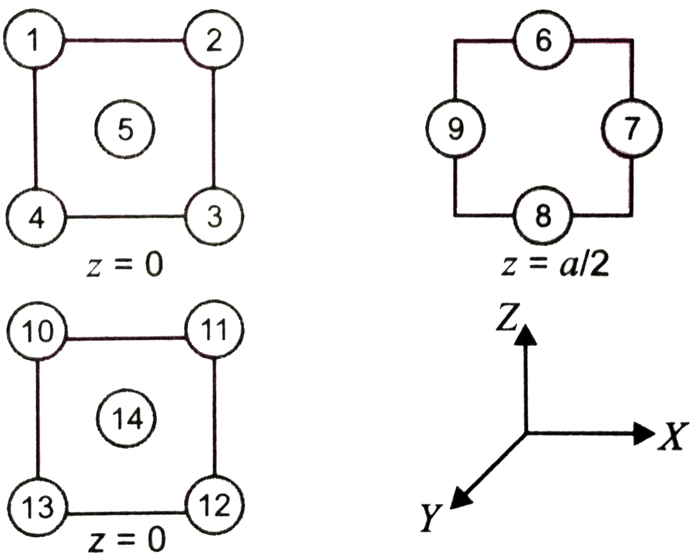
C. Monoclinic

D. Triclinic

Answer: B,C,D

Watch Video Solution

5. A metal has cubic close packed (ccp) arrangement , the layer sequence of which is shown below :



A face diagonal passes through the centre of atom 4 and the centre (s) of which other atoms ?

A. 1

B. 2,5

C. 8,12

D. 9,10

Answer: B,C,D

Watch Video Solution

6. The density of KBr is $2.75gcm^{-3}$. The length of the unit cell is 654 pm. Atomic mass of

$K = 39, Br = 80$. Then what is true about the predicted nature of the solid?

A. It has $4K^{+}$ and $4Br^{-}$ ions per unit cell

B. It is face-centred

C. It has rock-salt type structure

D. It can have Schottky defects

Answer: A,B,C,D

Watch Video Solution

7. Which of the following statements are correct ?

A. The coordination number of each type of ion in CsCl crystal is 8

B. A metal that crystallizes in bcc structure has coordination number of 12

C. A unit cell of an ionic crystal shares some of its ions with other unit cells.

D. The length of the edge of unit cell of NaCl is 552 pm (r_{Na^+} =95 pm, r_{Cl^-} =181 pm)

Answer: A,C,D

Watch Video Solution

8. The correct statement(s) regarding defects in solids is (are)

A. Frenkel defects are usually favoured by a very small differences in the sizes of the cation and anion

B. Frenkel defect is a dislocation defect

C. Trapping of an electron in the lattice leads to the formation of F-centre

D. Schottky defects have no effect on the physical properties of solids

Answer: B,C

Watch Video Solution

9. With respect to graphite and diamond, which of the following statement(s) given below is (are) correct ?

A. Graphite is harder than diamond

B. Graphite has higher electrical conductivity than diamond

C. Graphite has higher thermal conductivity than diamond

D. Graphite has higher C-C bond order than diamond

Answer: B,D

Watch Video Solution

10. The correct statement (s) for cubic close packed (ccp) three dimensional structure is (are)

A. The number of neighbours of an atom present in the topmost layer is 12

B. The efficiency of the atom packing is 74%

C. The number of octahedral and tetrahedral voids per atom are 1 and 2 respectively

D. The unit cell edge length is $2\sqrt{2}$ times the radius of the atom

Answer: B,C,D

Watch Video Solution

Competition Focus Iii Multiple Choice

1. By X-ray studies, the packing atoms, in a crystal of gold is found to be in layers such that starting from any layer, every fourth layer is found to be exactly idenctical. The density of gold is found to be $19.4 gcm^{-3}$ and its atomic mass is 197 a.m.u.

The coordination number of gold atom in the crystal is

A. 4

B. 6

C. 8

D. 12

Answer: D

Watch Video Solution

2. By X-ray studies, the packing atoms, in a crystal of gold is found to be in layers such that starting from any layer, every fourth layer is found to be exactly idenctical. The density of gold is found to be $19.4 gcm^{-3}$ and its atomic mass is 197 a.m.u.

The fraction occupied by gold atoms in the crystal is

A. 0.52

B. 0.68

C. 0.74

D. 1

Answer: C

Watch Video Solution

3. By X-ray studies, the packing of atoms in a crystal of gold is found to be in layers such that starting from any layer, every fourth layer is found to be exactly identical . The density of gold is found to be $19.4gcm^{-3}$ and its atomic mass is 197 a.m.u.

The approximate number of unit cells present in 1 g of gold is

A. 3.06×10^{21}

B. 1.53×10^{21}

C. 3.82×10^{20}

D. 7.64×10^{20}

Answer: D

View Text Solution

4. By X-ray studies, the packing atoms, in a crystal of gold is found to be in layers such that starting from any layer, every fourth layer is found to be exactly idenctical. The density of gold is found to be $19.4gcm^{-3}$ and its atomic mass is 197 a.m.u. The length of the edge of the unit cell will be

A. 407 pm

B. 189 pm

C. 814 pm

D. 204 pm

Answer: A

Watch Video Solution

5. By X-ray studies, the packing atoms, in a crystal of gold is found to be in layers such that starting from any layer, every fourth layer is found to be exactly idenctical. The density of gold is found to be $19.4gcm^{-3}$ and its atomic mass is 197 a.m.u.

Assuming gold atom to be spherical , its radius will be

A. 203.5 pm

B. 143.9 pm

C. 176.2 pm

D. 287.8 pm

Answer: B

Watch Video Solution

6. No crystal is found to be prefect at room temperature. The defects present in the crystals can be stoichimetric or non-stoichiometric. Due to non-stoichimetric defects, the formula of the ionic compound is different from the ideal formula. For example , the ideal formula of ferrous oxide should be FeO but actually in one sample , it was found to be $Fe_{0.93}$O. This is because the crystal may have some ferric ions in place of ferrous ions. These defects change the propeties of the crystals. In some cases, defects are introduced to have crystals of desired properties as required in the field of electronics. Doping of elments of Group 14 with those of Group 13 or 15 is most common. In ionic compounds, usually impurities are introduced in which the cation has higher valency than the cation of the parent crystal, e.g, $SrCl_2$ into NaCl.

which one of the following doping will produces p-type semicomductor ?

A. Silicon doped with arsenic

B. Germanium doped with phosphorus

C. Germanium doped with aluminium

D. Silicon doped with phosphorus

Answer: C

Watch Video Solution

7. No crystal is found to be prefect at room temperature. The defects present in the crystals can be stoichimetric or non-stoichiometric. Due to non-stoichimetric defects, the formula of the ionic compound is different from the ideal formula. For example , the ideal formula of ferrous oxide should be FeO but actually in one sample , it was found to be $Fe_{0.93}$O. This is because the crystal may have some ferric ions in place of ferrous ions. These defects change the propeties of the crystals. In some cases, defects are introduced to have crystals of desired properties as required in the field of electronics. Doping of elments of Group 14 with those of Group 13 or 15 is most common. In ionic compounds, usually impurities are introduced in which the cation has higher valency than the cation of the parent crystal, e.g, $SrCl_2$ into NaCl.

which one of the following defects does not affect the density of the crystal ?

A. Schottky defects

B. Interstitial defect

C. Frenkel defect

D. Both in (b) and (c)

Answer: C

Watch Video Solution

8. No crystal is found to be prefect at room temperature . The defects present in the crystals can be stoichiometric or non-stoichiometric. Due to non-stoichiometric defects, the formula of the ionic compound is different from the ideal formula. For example , the ideal formula of ferrous oxide should be FeO but actually in one sample , it was found to be $Fe_{0.93}O$. This is because the crystal may have some ferric ions in place of ferrous ions. These defects change the properties of the crystals. In some cases , defects are introduced to have crystals of desired properties as required in the field of electronics . Doping of elements of Group 14 with those of Group 13 or 15 is most common. In ionic compounds , usually impurities are introduced in which the cation has higher valency than the cation of the parent crystal , e.g. of $SrCl_2$ into NaCl

NaCl was doped with 10^{-3} mol % $SrCl_2$. The concentration of cation vacancies is

A. $6.02 \times 10^{18} \text{mol}^{-1}$

B. $6.02 \times 10^{15} \text{mol}^{-1}$

C. $6.02 \times 10^{21} \text{mol}^{-1}$

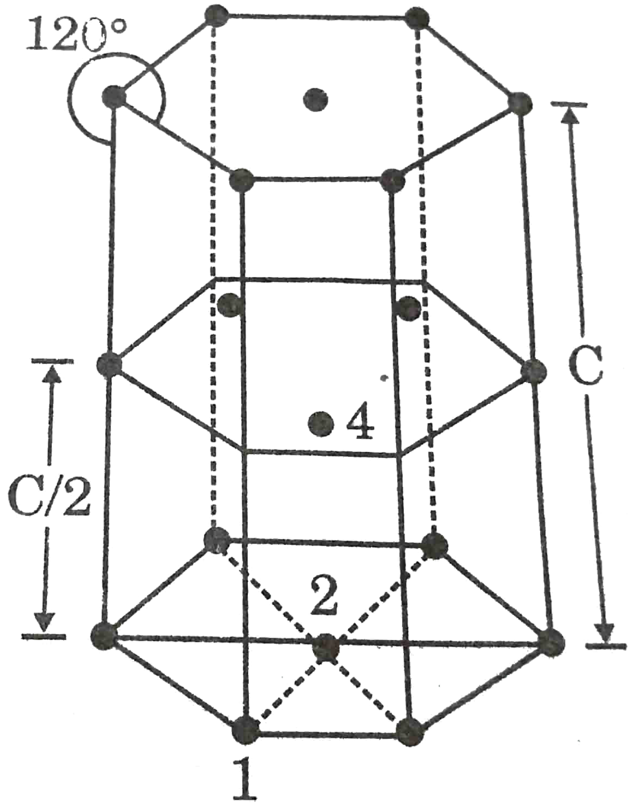
D. $6.02 \times 10^{12} \text{mol}^{-1}$

Answer: C

Watch Video Solution

9. In hexagonal system of crystals, a frequently encountered arrangement of atoms is described as a hexagonal prism. Here, the top and bottom of the cell are regular hexagons and three atoms are sandwiched in between them. A space -filling model of this structure, called hexagonal close-packed (HCP), is consituted of a sphere on a flat surface surrouneded in the same plane by six identical spheres as closely possible. Three sphere are then palces over the first layer so that they touch each other and represent second layer is covered with

third layer that is identical to the bottom layer in relative position. Assume radius of enery sphere to be r.



The number of atoms in the HPC unit cell is :

A. 4

B. 6

C. 12

D. 17

Answer: B

Watch Video Solution

10. In a hexaonal system system of cycstals, a frequently encountered arrangement of atoms is described as a hexagonal prism. Here, the top and bottom of the cell are refular hexagons, and three atoms are sandwiched in between them. A spacecilling model of this structure, called hexagonal close-paked is constituted of a sphere on a flat surface surrounded in the same plane by six identical spheres as closely as possible. Three spherres are then placed overt the first layer so that they toych each other and represent the second layer so that they toych each other and present the second layer. Each one of the three spheres touches three spheres of the bottom layer. Finally, the second layer is convered with a third layer identical to the bottom layer in relative position. Assume the radius of every sphere to be r.

The voume of this hcp unit cell is

A. $24\sqrt{3}r^3$

B. $16\sqrt{2}r^3$

C. $12\sqrt{2}r^3$

D. $\frac{64}{3\sqrt{3}}r^3$

Answer: A

Watch Video Solution

11. In hexogonal systems of crystals, a frequently encountered arrangement of atoms is described as a hexagonal prism. Here, the top and bottom of the cell are regular hexongonas and three atoms are sandwiched inbetween them. A space filling model of this structure called haxagonal closed packed (HCP) is constituted of a sphere on a flat surface surrounded in the same plane by six identical spheres as closely as possible . Three spheres are then placed over the first layer so that they touch each other and represent the second layer. Finally, the second layer is covered with a third layer that is identical to the bottom layer that is identical to the bottom layer in relative position. Assume radius of every sphere to be 'r'.

The empty space in this HCP unit cell is

A. 74%

B. 47.6%

C. 32%

D. 26%

Answer: D

Watch Video Solution

Competition Focus Matching

1.

	Column I (Crystal system)		Column II (Axial ratio)
(A)	Tetragonal	(p)	$a \neq b \neq c, \alpha = \beta = \gamma = 90^\circ$
(B)	Rhombic	(q)	$a = b \neq c, \alpha = \beta = \gamma = 90^\circ$
(C)	Monoclinic	(r)	$a \neq b \neq c, \alpha \neq \beta \neq \gamma \neq 90^\circ$
(D)	Triclinic	(s)	$a \neq b \neq c, \alpha = \gamma = 90^\circ \neq \beta$

Watch Video Solution

2.

Compound		Magnetic property	
(A)	NaCl	(p)	Ferrimagnetic
(B)	MnO	(q)	Paramagnetic
(C)	$CrCl_3$	(r)	Ferromagnetic
(D)	CrO_2	(s)	Diamagnetic
(E)	$MgFe_2O_4$	(t)	Antiferromagnetic

View Text Solution

Competition Focus Integer

1. A cubic unit cell has one atom on each corner and one atom on each body diagonal. The number of atoms in the unit cell is

Watch Video Solution

2. In hexagonal close packing , the difference in the number of tetrahedral and octahedral voids per unit cell is

Watch Video Solution

3. NH_4^+ and Br^- ions have ionic of 143 pm and 196 pm respecitvely. The coordination number of NH_4^+ ion in NH_4Br is

Watch Video Solution

4. Iron (II) oxide has a cubic strcuture and each unit cell has side 5 Å. If the density of the oxide is 4 g cm^{-3}, the number of oxide ions present in each unit cell is (Molar mass of FeO = $72\text{g mol}^{-1}, N_A = 6.02 \times 10^{23}\text{mol}^{-1}$

Watch Video Solution

5. Al^{3+} ions replace Na^{+} ions at the edge centres of NaCl lattice. The number of vacancies in one mole NaCl is found to be x x 10^{23}. The value of x approximately is

Watch Video Solution

6. The oxide $Tl_nCa_2Ba_2Cu_3O_{10}$ is found to be superconductor at 125 K. The value of n is

Watch Video Solution

7. The coordination number of Al in the crystalline state of $AlCl_3$ is _____.

Watch Video Solution

8. The number of hexagonal faces that are present in a truncated octahedron is

Watch Video Solution

9. A crystalline solid of a pure substance has a face-centred cubic structure with a cell edge of 400 pm. If the density of the substance in the crystal is $8gcm^{-3}$, then the number of atoms present in 256g of the crystal is $N \times 10^{24}$. The value of N is

Watch Video Solution

Competition Focus Numerical

1. Consider an ionic solid MX with NaCl structure. Construct a new structure (Z) whose unit cell is constructed from the unit cell of MX following the sequential instructions given below. Neglect the charge balance. 1.Remove all the anions (X) except the central one 2.Replace all the face centered cations (M) by anions (X) 3.Remove all the corner cations (M) 4.Replace the central anion (X) with cation (M)

The value of $\left(\frac{\text{number of anion s}}{\text{number of cation s}}\right)$ in z is _______.

Watch Video Solution

Competition Focus Assertion Reason

1. Statement -1 : Covalent crystals have the highest melting point .

Statement 2: Covalent bonds are stronge than ionic bonds.

A. Statement 1 is True , Statement-2 is True , Statement-2 is a correct explanation for statement-1

B. Statement 1 is True , Statement-2 is True , Statement-2 is NOT a correct explanation of

Statement-1

C. Statement-1 is True , Statement-2 is False

D. Statement -1 is False , Statement -2 is True

Answer: C

Watch Video Solution

2. Statement -1 : In NaCl crystal , all the octahdefral voids are occupied by Na^{+} ions.

Statement-2 : The number of octahedral voids is equal to the number of Cl^{-} ions in the packing .

A. Statement 1 is True , Statement-2 is True , Statement-2 is a correct explanation for statement-1

B. Statement 1 is True , Statement-2 is True , Statement-2 is NOT a correct explanation of Statement-1

C. Statement-1 is True , Statement-2 is False

D. Statement -1 is False , Statement -2 is True

Answer: B

Watch Video Solution

3. Assertion : The octahedral viods have double the size of the tetrabedral voids in a crystal

Reason: The number of tetrahedral voids is double the number of octabehedral voids is a crystal

A. Statement 1 is True , Statement-2 is True , Statement-2 is a correct explanation for statement-1

B. Statement 1 is True , Statement-2 is True , Statement-2 is NOT a correct explanation of Statement-1

C. Statement-1 is True , Statement-2 is False

D. Statement -1 is False , Statement -2 is True

Answer: D

Watch Video Solution

4. Statement 1: In any ionic solid [MX] withschotty defects, the number of positive and negative ions are same

Statement 2: Equals number of cation and anion vacancies are present .

A. Statement 1 is True , Statement-2 is True , Statement-2 is a correct explanation for statement-1

B. Statement 1 is True , Statement-2 is True , Statement-2 is NOT a correct explanation of Statement-1

C. Statement-1 is True , Statement-2 is False

D. Statement -1 is False , Statement -2 is True

Answer: A

Watch Video Solution

5. Assertion: Triclinic system is the most unsymmetrical system.

Reason: No axial angle is equal to 90° in triclinic system

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true , but reason is false

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

6. Assertion . Graphite is an example to hexogonal crystal system.

Reason . For a tetragonal system, $a = b \neq c, \alpha = \beta = 90^\circ, \gamma = 120^\circ$

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true , but reason is false

D. If both assertion and reason are false.

Answer: D

Watch Video Solution

7. Assertion : $CsCI$ has body - centred cunic arrangement

Reason: $CsCI$ has one and $8CI^-$ ion is its unit cell

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true , but reason is false

D. If both assertion and reason are false.

Answer: C

Watch Video Solution

8. Assertion . Hexagonal close packing is equally closely packed than cubic close packing .

Reason. Hexagonal close packing has a corrdination number of 12 whereas cubic close packing has a coordination number of 8.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true , but reason is false

D. If both assertion and reason are false.

Answer: D

Watch Video Solution

9. Assertion (A) : Zinc blende and wurtzite both have f arrangement of S^{2-} ions.

Reason (R) : A unit cell of both has four formula units of ZnS.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true , but reason is false

D. If both assertion and reason are false.

Answer: D

Watch Video Solution

10. Assertion: In a crystal, the size of the cation is larger in a tetrahedral hole than in an octahedral hole.

Reason: Cations occupy more space than atoms in crystal packing

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true , but reason is false

D. If both assertion and reason are false.

Answer: D

Watch Video Solution

11. Assertion. In a unit cell of NaCl, all Cl^{-} ions as will they touch each other.

Reason. Radius ratio r_{+} / r_{-} in NaCl is 0.414.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true , but reason is false

D. If both assertion and reason are false.

Answer: D

Watch Video Solution

12. Assertion:If the length of the unit cell of $LICI$ having $NaCI$ structure is 5.14Å, the ionic radius of CI^- ion is $.82\text{Å}$

Rason : Anion- anion contact is retaned in$LiCI$ structure because anion constitute the lattice

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true , but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

13. Assertion. The sum of the radii of Na^+ and Cl^- ions in NaCl cystal is 281 pm Hence, edge of the unit cell is 281 pm.

Reason. Edge of the unit cell is the distance between the centres of Na^+ and Cl^- ions touching each other.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true , but reason is false

D. If both assertion and reason are false.

Answer: D

Watch Video Solution

14. Assertion (A) : Frenkel defects are shown by AgX

.

Reason (R) : $Ag^{\oplus}$ ions have small size.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true , but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

15. Assertion. No compound has both Schottky and Frenkel defects.

Reason. Both defects change the density of the soild .

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true , but reason is false

D. If both assertion and reason are false.

Answer: D

Watch Video Solution

16. Assertion. When 1.0 mol of NaCl is doped with 10^{-3} mol $SrCl_2$, the number of cationic sites remaining vacant is 10^{-3}

Reason. Each $SrCl_2$ unit produces two cation vacancies.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true , but reason is false

D. If both assertion and reason are false.

Answer: D

Watch Video Solution

17. Assertion (A) : Antiferromagnetic substances on heating to high temperature become paramagnetic.

Reason (R) : On heating, the randomization of spins occurs.

A. If both assertion and reason are true, and reason is the true explanation of the assertion.

B. If both assertion and reason are true, but reason is not the true explanation of the assertion.

C. If assertion is true , but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution