CHEMISTRY

BOOKS - R G PUBLICATION

THE SOLID STATE

Exercise

1. Which point defect lowers the density of a crystal?

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2. What is semiconductor? Mention the two main types of semiconductor.

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3. Mention the type of semiconductor, (n-type or p-type) when silicon doped with phosphorus.

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4. Which point defect lowers the density of a crystal?

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5. For one mole close packed spheres, how many octahedral and tetrahedral voids are present?

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6. Mention the number of atoms in a b.c.c unit cell.

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7. A compound forms hexagonal close packed (hcp) structure. What is the total number of voids in 0.5 mol of it? How many of these are tetrahedral void?

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8. State whether true or false

In Schoottky defect, in order to maintain electroneutrality , the number of missing cations and anions are equal.

9. How many atoms can be assigned to its unit cell if an element forms a body centred cubic (bcc) cell and a face centred cubic (fcc) cell? Show by calculation.

10. How many lattice points are there in one unit cell of each of the following lattice? Face-centred cubic

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11. A compound forms hexagonal close packed (hcp) structure. What is the total number of voids in 0.5 mol of it? How many of these are tetrahedral void?

12. Copper crystallises into a fcc lattice. Its edge length is $3.61 \times 10^{-8} cm$. Claculate the density of copper. (at mass of copper = 63.5u, $N_A = 6.022 \times 10^{23} mol^{-1}$).

13. Sodium crystallizes in a body-centred cubic (bcc) unit cell. Calculate the approximate

number of unit cells in 9.2g of sodium. (Atomic mass of Na = 23u).

14. Gold metal crystallizes in a face-centred cubic cell (fcc). Determine the density of gold. (Atomic mass of gold = 197u, atomic radius of 0.144 nm, $N_A = 6.012 \times 10^{23} mol^{-1}$).

15. X-ray diffraction sutdies show that coper crystallises in a fcc lattice with edge length of 3.608×10^{-8}cm. If density of copper is $8.92 gcm^{-3}$ calculate the atomic mass of copper.

16. Explain the following terms with suitable examples: Frenkel defect

17. Explain the following with suitable examples: Ferromagnetism

18. Atoms of element X form hcp lattice and those of element Y form occupy 2/3rd of the tetrahedral voids. Determine the formula of the compound formed by the elements X and Y?

19. Mention the type of semiconductor, (n-type or p-type) when silicon doped with phosphorus.

20. Calculate atomic radiusa of elementary silver which crystallises in facecentered cubic laatice with unit cell edge length $4.086 \times 10^{-10} m$.

21. Aluminium crystallises as face-centered cubic lattice and it has a density of $2.7 \times 10^3 kgm^{-3}$. Calculate edge length of the unit cell. Given atomic mass of aluminium equal to 27.0 amu.

22. Atoms of element X form hcp lattice and those of element Y form occupy 2/3rd of the

tetrahedral voids. Determine the formula of the compound formed by the elements X and Y?

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23. What are semiconductors? How electrical conductivity of semiconductors vary with temperature? Give one example of intrinsic semiconductor.

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24. What type of substance would make better permanent magnets, ferromagnetic or ferrimagnetic. Justify you answer.

25. Most crystals show good cleavage because their atoms ions or molecules.

A. Weakly bonded together.

B. Strongly bonded together

C. Spherically symmetrical

D. Arranged in planes.

Answer:

26. The effective mode of packing of identical atoms in one layer is-

A. Square close packing pattern.

B. Hexagonal close packing pattern

C. Both (i) and (ii) (i)

D. None of the two.

Answer:

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27. The available space occupied by spheres of equal size in three dimensions in both hcp and ccp arrangement is

A. 0.74

B. 0.7

C. 0.68

D. 0.604

Answer:

28. The tetrahedral viods formed by ccp arrangemnt of Cl ions in NaCl structure are.

A. Occupied by Na^+ ions

B. Occupied by Cl^- ions

C. Occupied by either Na^+ and Cl^- .

D. Vacant

Answer:

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29. SiC is an example of.

A. Molecular solid

B. Ionic solid.

C. Metallic solid

D. Covalent solid.

Answer:

30. In solids, the constituent particle are arranged in.

A. Definite pattern in one direction.

B. Definite geometrical configuration.

C. Random disordered arrangement

D. None of the these.

Answer:

31. The interstitial hole is called tetrahedral because.

A. It is formed by four spheres.

B. It is tetrahedral in shape

C. It is formed by four spheres the centres

of which form a regular tetrahedron

D. None of the above three.

Answer:

32. A compound formed by elements A and B

crystallises in the cubic structure where A

atoms are at the corners of the cube and B

atoms at the centre of the cube. What is the formula of the compound?

A. AB

B. AB_2

C. A_2B

D. AB_4

Answer:

33. If the number of octahedral voids in N then the number of tetrahedral voids is-

A. $4N$

B. $\dfrac{N}{2}$

C. $2N$

D. None of these

Answer:

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34. When $ZnCO_3$ is heated it becomes yellow. The phenomenon is due to.

A. Metal deficiency defect

B. Schottky defect.

C. Metal excess defect

D. Frankel detect.

Answer:

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35. Mention two important characteristics of solid.

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36. Define the term amorphous solid.

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37. Crystalline solids are 'anisotropic' comment.

38. Why is glass considered a super cooled liquid?

39. Ionic solids conduct electricity in molten state but not in solid state. Explain.

40. Which factors are responsible for conductivity of metal?

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41. Give one example of each from polar molecular solid and metallic solid.

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42. Name the arrangement of crystal system.

43. Give the significance of a 'lattice point'.

44. How many sphere are surrounded by a tetrahedral and octahedral void?

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

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46. State the difference between Schottky and Frenkel defects.

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47. What are F-centres?

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48. What type of defect can arise when a solid is heated? Which physical property is affected by it and in what way?

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49. What is doping?

50. Which point defects in the crystal unit increases the density of solid?

51. On heating a crystal of KCl in potassium vapours, the crystal start exhibiting a violet colour. Why?

52. A compound is formed by two elements M and N. The elements N forms ccp and atoms of element M occupy $1/3rd$ of tetrahedral voids. What is the formula of the compound.

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53. What type of stoichiometric defect is shown by NaCl?

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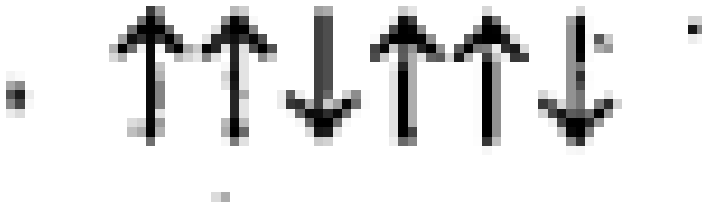**54.** Why does presence of excess of lithium makes LiCl crystal pink?

55. Classify each of the following as being either a p-type or an n-type semiconductor B doped with Si.

56. What type of magnetism is shown in the following alignment of magnetic moment.

↑↑↓↑↑↓

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57. What type of defect is obtained when AgCl is doped with $CdCl_2$?

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

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59. What are p-type semi-conductor?

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60. Some of the glass objects recovered from ancient monuments look milky instead of

being transparent.

61. How solids are catagorised? Given one example of each.

62. What is crystal lattice? Write two characteristics of crystal lattice.

63. A compound is formed by two types of ions viz. A (as cation) & B (as anion). B ions make ccp and A ions occupy the all the tetrahedral voids. Write the formula of the compound.

64. Show that in ccp and hcp structure the packing efficiency is 74%.

65. 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?

66. Explain the phenomenon "When molten NaCl is crystallised with $SrCl_2$".

**67.** In terms of band theory, what is the difference between a conductor and a semiconductor.

68. Ferric oxide crystallises 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.

69. Name and write two characteristics of the following two crystal defects mentioned in the figure.
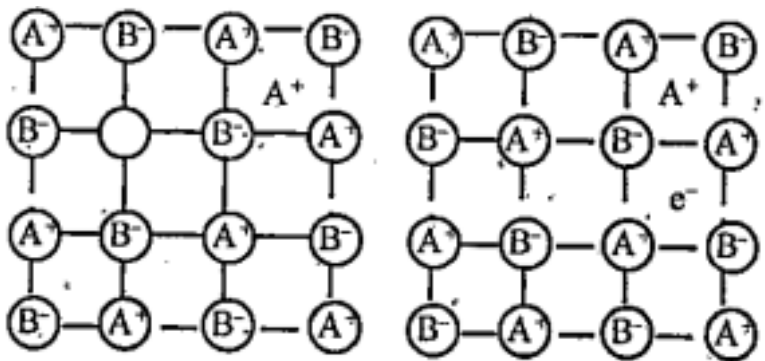
70. An element with molar mass $2.7 \times 10^{-2} kgmol^{-1}$ forms a cubic unit cell with edge length 405pm. If its density is $2.7 \times 103kgm^{-3}$, what is the nature of the cubic unit celL?

71. An element crystallizes in a fcc unit cell with an edge length 200pm. Calculate the

density if 200g of this element contains 24×10^{23} atoms?

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72. Aluminium crystallises in a cubic close-packed structure. Its metallic radius is 125 pm. What is the length of the side of the unit cell?

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73. A metal crystallizes in bcc unit cell. If the edge of the unit cell is 300pm, what is the radius of the atom?

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74. Why a salt of zinc becomes yellow on heating? Explain.

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75. The density of Copper metal is $8.95g/cm^3$. If the radius of Copper atoms be 127.8pm. What is the nature of the unit cell?

76. A metal crystallizes in a fcc unit cell with edge length equal to 0.5nm. Calculate the density of the metal if it contains 0.1% schottky defects.

77. An element has a bcc structure with a cell edge of 299pm. The density of the element is $7.2g/cm^3$. How many atoms are present in 208g of the element?

78. Write two differences between n-type semi conductor and p-type semi conductor.

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

80. From analysis it is found that iron oxide has the formula $Fe_{0.95}O_{1.00}$. What fractions of iron exist as Fe^{2+} & Fe^{3+} ions.

81. An element crystallises in a structure having a f.c.c. unit cell with an edge length 100pm. Calculate its density if 100g of this element contains `24xx10^(23) atoms.

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82. Classify the following as being either a p-Type or n-Type semiconductor. Ge doped with In

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83. Classify each of the following as being either a p-type or an n-type semiconductor B doped with Si.

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

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85. What do you mean by non-stoichiometric defect? How this defect is classified? Give example of each class.

86. Explain the following with suitable examples: 12-16 and 13-15 group compounds.

87. Explain the following with suitable examples: 12-16 and 13-15 group compounds.

88. What are ferro and anti ferro magnetism? Give examples.

89. In the cubic crystal of CsCl (density = $3.97 gcm^{-3}$), the eight corners are occupied by Cl^- with a Cs^+ at the centre and vice versa. Calculate the distance between the neighbouring Cs^+ and Cl^- ions. What is the radius ratio of the two atoms? (At wt. of Cs=133.0 & Cl = 35.5)

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90. Calculate the efficiency of packing in case of a metal crystal for body-centred cubic