CHEMISTRY

BOOKS - S DINESH & CO CHEMISTRY (HINGLISH)

SOLID STATE

Example

1. Identify the intermolecular forces that must be overcome to cause the melting of the following solids. Also arrange the solids in increasing order of melting points.

(a) NaF (b) HF (c) HCl (d) Cl_2

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2. Identify the type of cyrstalline solid based on the following properties :

(a) Conducts electricity in the molten state but in the solid state.

(b) Very hard with melting point and acts as electrical insulator.

(c) Conducts electricity in the solid state, malleable and ductile.

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3. Out of Xe, CH_3Cl and HF which has :

(i) the smallest dipole-pole forces (ii) the largest hydrogen bond forces (c) the larges dispersion forces?

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4. A cubic solid is made up of two atoms A and B. Atoms A are present at the corners and B at the centre of the body.

What is the formula of the unit cell ?

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

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6. A unit cell consists of a cube in which there are A atoms at the corners and B atoms at the face centres. Two A atoms are missing from the two corners of the unit cell. What is the formula of the compound ?

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7. 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.

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8. Atoms A, B, C and D are present at corners, face centres, body centres and edge centres and respectively in a cubic unit cell. Find the formula of compound.

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9. A mineral containing calcium, oxygen and titanius crystallises in a given cubic unit cell. What is the formula of the mineral?

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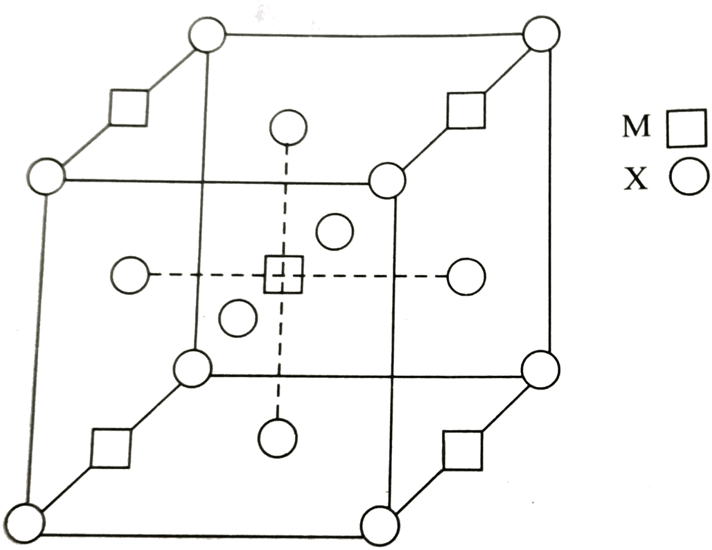
10. A compound M_pX_q has cubic close packing (p) arrangement of X. Its unit cell structure is shown below. The empirical formula of the compound is



a. MX b. MX_2 c. M_2X

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11. 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?

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12. Atoms of elements B from hep 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?

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13. In sapphire, oxide ions are arranged in hexagonal close packing and aluminium ions occupy two-thirds of the octahedral voids. What is the formula of sapphire?

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14. A solid between A and B has the following arrangement of atoms :

(i) Atoms A are arranged in $c.\ c.\ p.$ array.

(ii) Atoms B occupy all the all the octahedral voids and half the tetrahedral voids. What is the formula of the compound ?

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15. In a cubic close packed structure (ccp) of mixed oxides, it is found that lattice has O^{2-} ions and one half of the octahedral voids are occupied by trivalent cations (A^{3+}) and one-eighth of the tetrahedral voids are occupied by divalent cations (B^{2+}). Derive the formula of the mixed oxide.

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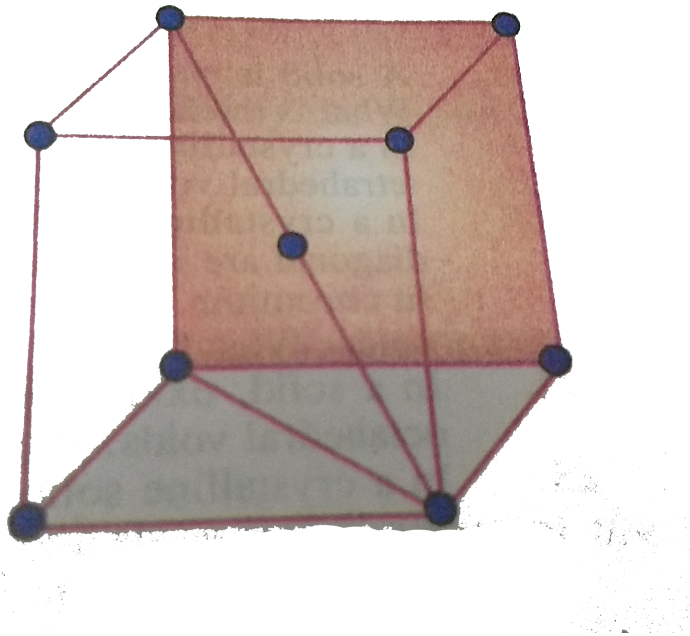
16. Potassium crystallises in a bcc lattice as shown in figure :

(a) What is the distance the nearest neighbours ?

(b) What is the distance between the next nearest neighbours ?

(c) How many nearest neighbours does each potassium atom have ?

(d) How many next nearest neighbours does each potassium atom have ?



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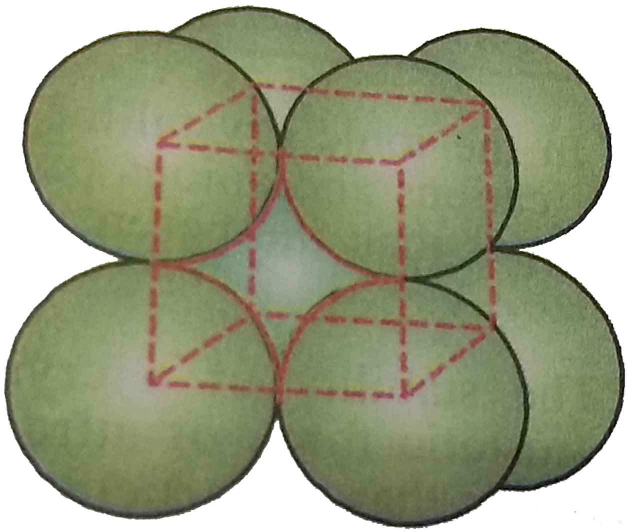
17. The figure exhibits how to calculate the amount of space used by the atoms in a single cubic structure.

(a) What is the volume of the entire cube?

(b) What is the volume of one sphere?

(c) What fraction of any one sphere sticks into the cube rather than outside it?

(d) Given that there are eight spheres in all, how much space will they take up in the cube ?



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18. 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?

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19. 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.

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

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21. 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.

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22. The unit cell edge length of NaF crystal is 4.634Å. If the ionic radius of Na^{+} ion is 95 pm, what is the ionic radius of F^{-} ion, assuming that anion-anion contact and face centred cubic lattice?

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23. The radius of copper atom is 128 pm. It it crystallises in face centred cubic lattice (fcc), what will be the length the edge of the unit cell ?

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24. Sodium crystallises in a body-centred cubic unit cell. (bcc) with edge length 4.29Å. What is the radius of the sodium atom ? What is the length of the body-diagonal of the unit cell?

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25. 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.

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26. Silver metal crystallises in a cubic closed-packed arrangement with the edge of the unit cell having a length, a = 407 pm. What is the radius of silver atom?

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27. Silver crystallises in a face centred cubic unit cell. 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 centred atom is touching the four corner atoms.)

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28. 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?

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29. 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).

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30. 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.

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31. 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 $= 107.9u$).

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32. A face-centred cubic element (atomic mass 60) has a cell edge of 400 pm. What is its density?

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

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34. 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.

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35. 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 = $107.87 g mol^{-1}$, $(N_0 = 6.022 \times 10^{23} mol^{-1})$.

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

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37. An element crystallises in a f.c.c. lattice with edge length of 400 pm. Calculate the density if 200 g of this element contain 2.5×10^{24} atoms.

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38. An element 'x' (Atomic mass = 40 g mol^{-1}) having f.c.c. structure has unit cell edge length of 400 pm. Calculate the density of 'x' and the number of unit cells in 4 g of 'x'

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

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40. 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.

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

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42. The density of lead is 11.35 g cm^{-3} and the metal crystallises with fcc unit cell. Estimate radius of lead atom.

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43. 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 $8.92 gcm^{3}$. Calculate the atomic mass of copper.

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44. A element crystallises in a bcc structure. The edge length of its unit cell is 288 pm. If the density of the crystal is 7.3 g cm^{-3}, what is the atomic mass of the element ?

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45. An element with density 11.2g cm^{-3} forms a fcc lattice with edge length of 4×10^{-8} cm. Calculate the atomic mass of the element.

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46. An element of atomic mass 40 occurs in fcc structure with a cell edge of 540 pm. Calculate the Avogadro's number if density is $1.7 gm / cm^3$.

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

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48. The element chromium crystallises in a body centred cubic lattice whose density is $7.20g/cm^3$. The length of the edge of the unit cell is 288.4 pm. Calculate Avogadro's number (Atomic mas of Cr = 52).

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49. 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

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50. 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 $CaF_2 = 78.0 \text{g mol}^{-1}$)

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51. The density of KBr is 2.73g cm^{-3}. The length of the unit cell is 654 pm. Predict the nature of the unit cell. (Given atomic mass of K = 39, Br = 80)

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52. The density of chormium is 7.2g cm^{-3}. If the unit cell is a cube edge length of 298 pm, determine the type of the unit cell. (Atomic mass of Cr = 52 amu)

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

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54. Methane crystallises in a cubic unit cell with a = 0.598 nm. Calculate the theoretical density of methane assuming Z = 1, 2 and 4. If the density of liquid methane is $0.466 \mathrm{g\ cm}^{-3}$ and assume that density of solid is the same as that of the liquid at a given temperature, predict which type of unit cell result?

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55. A element X with atomic mass 60 g/mol has a density of $6.23 \mathrm{g\,cm}^{-3}$. If the edge length of the unit cell is 400 pm, identify the type of the cubic unit cell. Calculate the radius of the atoms of the element.

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56. Density of copper metal is 8.95g cm^{-3}. If the radius of copper atoms is 127.8pm 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 $N_o = 6.022 \times 10^{23} mol^{-1}$)

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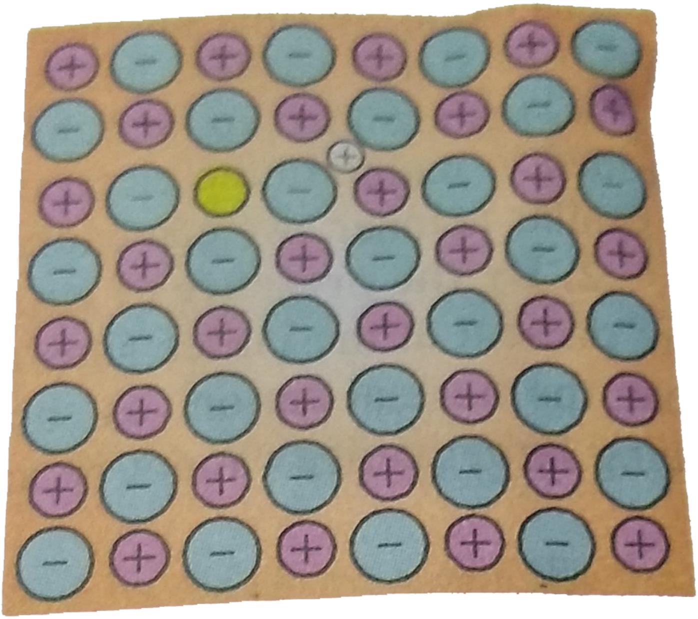
57. Consider the figure of a defective crystal :

(a) Name the defect shown by this diagram.

(b) What is the effect of this defect on the solid

?

(c) Name as ionic compound which can show this type of defect.



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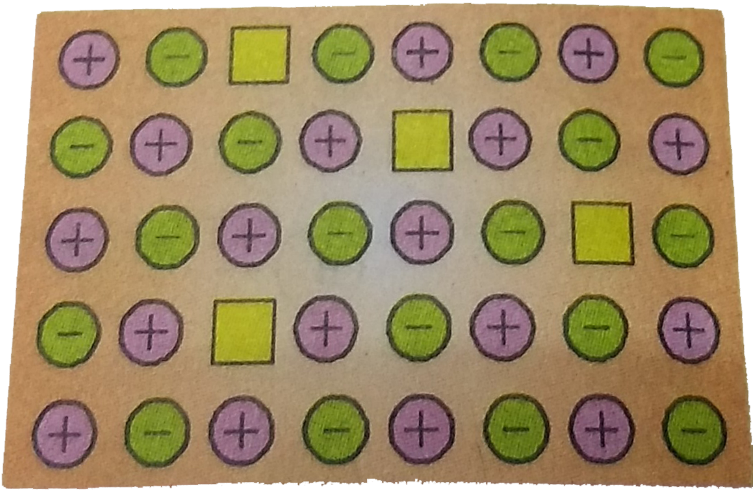
58. Examine the illustration of a portion of the deffective crystal and answer the following question :

(a) What are these type of vacancy defects called ?

(b) How is the density of a crystal affected by these defects ?

(c) Name one ionic compound which can show this type of defect in the crystalline state.

(d) How is the stoichiometry of the compound affected ?



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59. The composition of a sample of Wustite is $Fe_{0.93}O_{1.00}$. What fraction of iron is present in the from of Fe^{2+} ion ?

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60. 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.

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61. The first $-$ order diffraction os $X-$ rays from a certain set of crystal planes occurs an angle of 11.8° from the planes. If the planes are $0.281nm$ apart, what is the wavelength of $X -$ rays?

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62. Calculate the angle at which first order reflection will occur in an X-ray spectrometer when X-rays of wavelength 1.54Å are diffracted by the atoms of a crystal given that interplanar distance is 0.04Å.

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63. What will be the wavelength of the X-rays which give a diffraction angle 2θ equal to 16.80° for a crystal ? The interplanar distance in the crystal is 0.200 nm and only the diffraction of the first order is absorbed.

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N.C.E.R.T

1. Why are solids rigid ?

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2. Why do solids have a definite volume?

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

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4. Why is glass considered a supercooled liquid?

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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?

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6. Classify the following solids in different categories based on the nature of intermolecular forces operating in them: ltbr. Potassium sulphate, tin, benzene, urea, ammonia, water, zinc sulphide,graphite, rubidium , argon, silicon carbide.

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7. A solid substance 'A' is very hard and electrical insulator both in the solid state as well as in molten state. It has also very high melting point. Is the solid metal like silver or network solid like silicon carbide (SiC) ?

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8. Why are ionic solids conducting in the molten state and not in the solid state ?

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

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10. Give the significance of "lattice point."

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11. Name the parameters that characterized a unit cell.

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12. Distinguish between

a. Hexagonal and monoclinic unit cells

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

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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 neighbouring unit cell.

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

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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?

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16. A compound formed by two elements M and N. Element N forms ccp and atoms of M occupy $1/3rd$ of tetrahedral voids. What is the formula of th compound?

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

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18. An element with molar mass $2.7 \times 10^2 kgmol^{-1}$ forms a $2.7 \times 10^3 kg^{-3}$, what is the nature of the cubic unit cell?

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19. 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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20. What type of stoichiometric defect is shown by:

(a) ZnS (b) $AgBr$

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

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

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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?

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

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

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

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

a. Tetra phosphorus decoxide (P_4O_{10})

b. Graphite c. Brass

d. Ammonium phosphate $(NH_4)_3PO_4$

e. Sic f. Rb g. I_2 h. $LiBr$

i. P_4 j. Si k. Plastic

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28. 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?

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

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30. a. "Stability of a crystal is reflected is reflected in the magnitude of its melting points" Comment.

b. Melting points of some compounds are given below water $= 273K$, ethyl alcohol $= 153.7K$, diethyl ether $= 156.8K$, methane $= 90.5K$.

What can you say about the intermolecular forces between the molecules of these compounds?

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31. How will you distinguish between the following pairs of terms?

a. Hexagonal close-packing and cubic close-packing

b. Crystal lattice and unit cell

c. Tetrahedral void octahedral void

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32. 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

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33. Explain

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

b. Ionic solids are hard and brittle.

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34. 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).

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35. Silver crystallises in a face centred cubic lattice with all the atoms at the lattice points. The length of the edge of the unit cell as determined by X-ray diffraction studies is found to be 4.077×10^{-8}cm. The density of silver is $10.5 \mathrm{g\,cm}^{-3}$. Calculate the atomic mass of silver.

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36. A cubic solid is made of two element P and Q Atoms of Q are the corners of the cube P at the body-centre. What is the formula of the compound? What are the coordination number fo P and Q?

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37. Niobium crystallizes in body-centred cubic structure. If the density is $8.55 gcm^{-3}$, calculate the atomic radius of niobium using its atomic mass $93u$.

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38. 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

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39. 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 $8.92 gcm^{3}$.

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40. 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?

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

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42. 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?

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43. 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.

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44. 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

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45. Gold (atoic radius = 0.144 nm) crystallizes in a facelcentred unit cell. What is the length of a side of the cell?

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

a. a condcutor and an insulator

b. a conductor and a semiconductor

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47. Explain the following terms with suitable example:

a. Schottky defect b. Frenkel defect

c. Interstitials d. F-centres

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48. Aluminium crystallizes in a cubic close-packed structre. Its metallic radius is $125p \pm$

a. What is the length of the side of the unit cell?

b. How many unit cell are there in $1.00cm^3$ of aluminium?

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

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50. Example the following with suitable examples:

a. Ferromagnetism b. Paramagnetism

c. Ferrimagnetism d. Antiferromagnetism

e. 12 - 46 and 13 - 15 group compounds

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51. why are liquids and gases categorised as fuids ?

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52. why are solids incompressible ?

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

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

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

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56. why does white Zn0(s) becomes yellow upon heating ?

Watch Video Solution

57. why does the electrical conductivity of semiconductors increse with rise in temperature?

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

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59. 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 ?

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

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61. Explain the structure of neuron with the help of a labelled diagram.

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

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

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64. 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 ?

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65. Frenkel defect is not found in the halides of alkali metals. Assign reason.

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66. What is difference in bahavior between glass and sodium chloride would you expect to observe if you break off a piece of either cube ?

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67. 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?

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68. Schottky defect lowers the density of ionic crystals while Frenkel defect does not. Discuss.

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

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70. Crystals possessing CsCl structure change to NaCl structure upon heating. Give a suitable explanation.

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

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72. 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 $(992^{\circ}C \text{ and } 2642^{\circ}C)$?

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73. The melting point of sodium chloride is more than that of sodium. Justify.

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74. How will you show that glass is super cooled liquid ?

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75. Why is diffusion in solids less as compared to the liquids?

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76. Energy is needed when a solid at its melting point is converted into a liquid. Why ?

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77. Urea has a sharp melting point but glass does not. Explain.

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N.C.E.R.T.

1. Why is latent heat of fusion of solid carbon dioxide less than that of silicon dioxide ?

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2. Cesium chloride is more stable than sodium chloride. Assign reason.

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3. Addition of $CdCl_2$ to the crystals of AgCl will produce Schottky defects but the same is not produced when NaCl crystals are added. Discuss.

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

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

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

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

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8. Assertion : On heating ferromagnetic or ferromagnetic substance , they become paramagnetic

Reason :The electrons change their spin on heating

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9. Gas lighter when pressed produces flame. Explain.

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10. 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

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11. Distinguish between crystal lattice and unit cell.

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12. What is the difference between London dispersion forces and dipole-dipole forces ?

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13. Melting point of quartz, a crystalline allotropic form of SiO_2 is 160°C while sblimation point of sblimation point of CO_2 is $-79^\circ C$. Predict the nature of bonding in the two crystalline solids.

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14. 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?

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15. Melting point of RbBr $(682^\circ C)$ is lesser than that of NaF $(998^\circ C)$. Explain.

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16. How do the electrical conductivity and resistivity of metallic conductors, semi-conductors, and super conductors vary with temperature ?

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QUESTION FROM BOARD EXAMINATION

1. Does Frenkel defect in AgCl crystal change its density ?

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2. Give an example of 12-16 compound ?

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3. What is the packing fraction in face centred cubic lattice ?

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4. What is the formula of the crystalline compound in which the atoms A are present at all the eight corners and atoms B at the centres of all the six faces ?

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5. Arrange simple cubic, body centred cubic and face cented cubic lattic in increasing order of the fraction of the occupied space.

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6. A solid AB has rock salt structure. How many atoms of A and B are present in the unit cell ?

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

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8. What are photo- voltaic compounds ?

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9. What are piezo-electric crystals ?

Watch Video Solution

10. What type of stoichiometric defects are noticed in crystals?

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

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12. What makes alkali metal halides sometimes coloured which are othersise colourless ?

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13. What is the effect of Frenkel defect on the electrical conductivity of crystalline solids ?

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14. What is dislocation in the crystals

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15. How are interstitial solids formed ?

Watch Video Solution

16. At what temperature range most of the metals becomes superconductors

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17. What is the maximum number of atoms in a hcp crystal structure of an element ?

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18. What is the C.N of Ca^{2+} and F^{-} ions in CaF_2 crystal lattice ?

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

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20. How many atoms are present in a cubic unit cell having one atom at each corner and two atoms on each body diagonal ?

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21. How does the density of crystal change due to Schottky defects ?

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22. What is the number of atoms per unit cell in a body centred cubic structure ?

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23. Why is phosphours doped silicon a semi-conductor?

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

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

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26. A compound formed by two elements M and N. Element N forms ccp and atoms of M occupy $1/3rd$ of tetrahedral voids. What is the formula of th compound?

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27. What is the total number of atoms per unit cell in a face centred cubic (fcc) structure ?

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28. What type of substances exhibit antiferromagnetism ?

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29. Why Frenkel defects are not found in pure alkali metal halides?

Watch Video Solution

30. What types of allignments in crystals make them ferromagnetic ?

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31. 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¦.. .

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

Watch Video Solution

33. How do metallic and ionic substances differ in conducting electricity ?

Watch Video Solution

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

Watch Video Solution

35. Write a distinguishing feature of metallic solids.

Watch Video Solution

36. What type of semiconductor results when highly purified silicon is doped with arsenic?

Watch Video Solution

37. Crystalline solids are anisotropc in nature. What does this statement mean ?

Watch Video Solution

38. Distinguish between intrinsic and extrinsic semi-conductors on the basis of energy band diagram.

Watch Video Solution

39. What are semi-conductors ? Describe the two main types of semi- conductors.

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40. 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

41. 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 ?

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42. Classify each of the following as being n-type semi-conductor. Give reason.

(a) Si doped with In (b) Si doped with R.

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43. How many atoms constitute one unit cell of a face-centred cubic crystal?

Watch Video Solution

44. What type of stoichiometric defect is shown by AgCl ?

Watch Video Solution

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

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

Watch Video Solution

47. Why is glass considered a supercooled liquid?

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48. Why does the conductivity of silicon increase upon doping with phosphorus ?

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49. What change occurs when AgCl is doped with $CdCl_2$?

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50. What type of semi-conductor is produced when silicon is doped with boron ?

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

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52. For a value of radius ratio between 0.732-1.0, what is the co-ordination number and geometry of crystal ?

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53. What type of stoichiometric defect is shown by KCl and why ?

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54. Express the relation between atomic radius (r) and edge length (a) in b.c.c. unit cell.

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55. Ionic solids conduct electrical insulator in solid as well as in molten state but not in solid state. Explain

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

Watch Video Solution

57. What is meant by co-ordintion number (C.N.) ?

Watch Video Solution

58. Ionic solids conduct electrical insulator in solid as well as in molten state but not in solid state. Explain

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59. 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).

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60. Discuss briefly the structure of cesium chloride.

Watch Video Solution

61. How is simple cubic unit cell formed ? Calculate the number of atoms in a simple unit cell.

Watch Video Solution

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

Watch Video Solution

63. Define the terms (i) Crystalline solids (ii) Frenkel defects (iii) n-type semi-conductors.

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64. PRIMITIVE AND CENTRED UNIT CELLS

Watch Video Solution

65. Define the terms (i) F-centres (ii) n-type semi-conductors (iii) Ferrimagnetism.

Watch Video Solution

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

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67. For crystal sodium chloride, state

(i) the type of lattice in which it crystallises.

(ii) co-ordination number of each sodium ion and chloride ion in the crystal lattice.

(iii) number of sodium and chloride ions present in a unit cell of sodium chloride.

(iv) the structural arrangement of sodium chloride crystals.

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68. What is unit cell ? Write formula to calculate the density of a unit cell.

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69. (a) Define the terms crystalline and amorphous solids.

(b) Explain Schottky defect with an example.

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70. Sodium crustallises in bcc unit cell. Calculate the approximate no. of unit cells in 9.2 grams of sodium.

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71. The number of atoms per unit cell in a simple cube, face — centred cube and body — centred cube are respectively :

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72. (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 ?

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73. Give reasons :

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

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

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74. (a) If the radius of octahedral void is 'r' and the radius of the atoms in close packing is 'R' what is the relation between 'r' and 'R' ?

(b) A metal crystallises in body centred cubic structure. If 'a' is the edge length of its unit cell, 'r' is the radius of the sphere, what is the relation between 'r' and 'a' ?

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75. Following is the schematic alignment of magnetic moments :

Indetify the type of magnetism. What happens when these substances are heated ?

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

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77. 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.

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78. What are paramagnetisma and ferromagnetism ? What type of substances would make batter permanent magnets, ferromagnetic or ferrimagnetic?

Watch Video Solution

79. What is the number of atoms per unit cell in a body centred cubic structure ?

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80. Differentiate between primitive unit cell and centred unit cells.

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HIGHER ORDER THINKING SKILLS (HOTS) QUESTIONS

1. 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.

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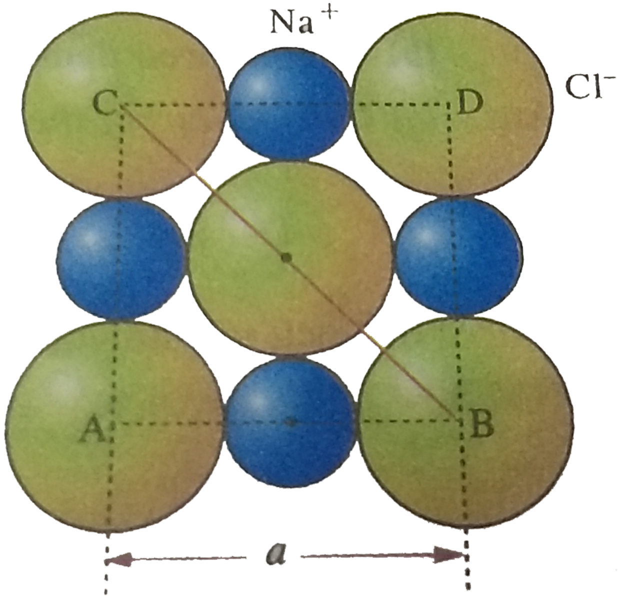
2. Look ato the sodium choride structure in the figure and use it to calculate $\frac{r^{+}}{r^{-}}$



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3. KCl crystallizes int the same type of lattic as done NaCl . Given that $r_{Na^{+}}/r_{Cl^{-}}=0.50$ and $r_{Na^{+}}/r_{K^{+}}=0.70$, Calcualte the ratio of the side of the unit cell for KCl to that for NaCl:

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4. The density of a particular crystal of LiF is $2.65g/\mathrm{cc}$. X-analyses shows that Li^{+} and F^{-} ions are arranged in a cubic array at a spacing of 2.01Å. From this data, apparent Avogadro's constant is $x \times 10^{23}$. Calculate the value of x

(Given atomic mass of Li = 6.939, F = 18.998)

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5. A compount 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.

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6. What fraction of calcium atoms lies on the surface of a cubie crystal that is 1.00 cm in length ? Calcium has fcc lattice with edge length 0.556 nm.

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7. Calcium crystallizesin f unit cell with $0.556nm$. Calculate the density if

a. It contains 0.2% Frenkel defects

b. It contains 0.1% Schottky defects

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PROBLEMS

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

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2. 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?

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3. Is the conductivity of ionic solids due to the presence of ions ?

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4. A solid is a good conductor of electricity. It is alos malleable and ductile. Predict its nature.

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

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6. Give the nature of bonding in the following solids :

(i) ice (ii) iodine (iii) copper (iv) calcium oxide.

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7. What is the nature of the forces present in the noble gas atoms ?

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8. Why is the structure of ice porous ?

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9. Which net work solid is a good conductor of electricity ?

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10. Of the substances Xe, CH_3Cl and HF, which has

(a) Smallest dipole-dipole forces (b) hydrogen bond foces (c) largest dispersion forces ?

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11. In the fcc arrangement of A and B atoms whose A atoms are at corners of the unit cell and B are at the face centres one of the A atom is missing from one corner in each unit cell. What is the simplest formula of the compound?

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12. The number of atoms per unit cell in a simple cube, face $-$ centred cube and body $-$ centred cube are respectively :

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13. A unit cell consists of a cube in which anions (B) are present at each corner and cations (A) at centre of the alternate faces of the unit cell. What is the simplest formula of the compound ?

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14. A unit cell consists of a cube in which the atoms A are occupying the corners while the atoms B are present at the centre of each face. If the atoms A are missing from 2 corners, what is the simplest formuls of the compound ?

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15. 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.

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16. An alloy of copper and gold crystallizes in cubic lattic, in which the $Au-$ atoms occupy the lattice points at the corners of cube and $Cu-$ atoms occupy the centre of each face. The formula of this alloy is :

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17. Sodium crystallises in body centred cubic unit cell. What is the approximate number of unit cells in 4.6 g of sodium ? Given that the atomic mass of sodium is 23 g mol^{-1}.

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18. 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).

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19. An alloy of Cu, Ag and Au is found to have copper constituting the $c.c.p.$ lattice. If Ag atom occupy the edge centres and Au atom is present at body centre, the formula of this alloy is :

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20. A compund is made of two elements P and Q are in p arrangement while atoms P occupy all the tetrahedral voids. What is the formula of the compound?

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21. In a crystalline solid, anions B are arranged in ccp structure. Cations A are equally distributed between octahedral and tetrahedral voids if all the octahedral voids are occupied the formula of the ionic solids will be

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22. In a crystalline solid, atoms of X form fcc packing and atoms of Y occupy all octahedral voids. If all the atoms along one body diagonal are removed, what is the simplest formula of the crystalline lattice solid?

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23. 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?

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24. In a solid ,oxide (O^{2-}) ions are arranged in ccp, cations (A^{3+}) occupy one -sixth of tetrahedral void and cations (B^{3+}) occupy one -third of the octahedral voids . What is the formula of the compound?

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25. In a crystalline solid, having formula AB_2O_4 oxide ions are arranged in cubic close packed lattice while cations A are present in tetrahedral voids and cations B are present in octahedral voids.

(a) What percentage of the tetrahedral voids is occupied by A?

(b) What percentage of the octahedral voids is occupied by B ?

26. a. MgO has the structure of $NaCl$ and $TICI$ has the structure of $CsCl$. What are the coordiantion number of the ions in MgO and $TICI$?

If the closed-packed cations in an XY-type solid have a raidus of 73.2 pm, what would be the maximum and minimum sizes of the anions filling voids?

c. Fe_2O_3 (haematite) forms ccp arrangement of O^{2-} ions with Fe_{3+} ions occupying initerstitial positions. Predict whether fe^{3+} ions are in the OV or TV. Given $r_{Fe^{3+}} = 0.7Å$

and $r_{O^{2-}} = 1.4\text{Å}$

d. A solid XY has $CsCl$-type structure. The edge length of the unit cell is $400 \pm$ Calculate the distance of closest approach between $X^{\oplus}$ and $Y^{\ominus}$ ions.

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

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28. In a face centered lattice of X and Y, X atoms are present at the corners while Y atoms are at face centres.

(a) What is the formula of the compound ?

(b) What would be the formula of the compound if (i) one of the X atoms is missing from a corner in each unit cell

(ii) one of the X atoms at from a corner is replaced by Z atom. (also monovalent) ?

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

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30. If the radius of Br^{-} ion is 0.182 nn, how large can a cation be fit in its tetrahedral holes ?

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31. The ionic radii of Rb^+ and Br^- ions are 147 pm and and 195 pm resectively. Deduce the possible C.N of Rb^+ ions in RbBr

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32. Iron crystallises in a body centred cubic structure. Calculate the radius of ioun atom if edge length of unit cell is 286 pm.

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33. Atomic radius of aluminium is 125 pm. If aluminium has a fcc structure, calculate the edge length of the unit cell.

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34. The radius of chromium atom is 1.25Å. If it crystallises in body centred cubic lattice, calculate the length of the edge of the unit cell.

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35. Polonium crystallises in a simple cubic structure. If the edge length of the unit cel is 336 pm, calculate the atomic radius of polonium.

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36. The length of the edge of the face centred cubic unit cell of aluminium is 400 pm. What is the radius of aluminium atom and the nearest neighbour distance ?

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37. Co-ordination number (CN) of barium ion (Ba^{2+}) in BaF^2 is 8. What is the CN of F^- ion ?

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38. A compound AB crystallises in the b.c.c lattice with unit cell edge length of 390 pm. Calculate

(a) the distance between the oppsitely charged ions in the lattice.

(b) the radius of A^{+} ion if radius of B^{-} ion is 175 pm.

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39. A cubic solid is made of two element P and Q Atoms of Q are the corners of the cube P at the body-centre. What is the formula of the compound? What are the coordination number fo P and Q?

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

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

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42. Silver crystallises in a face centred cubic unit cell. Each side of the unit cell has a length of 400 pm. Calculate radius of the silver atoms (Assume that the atoms just touch each other on the diagonal across the face of the unit cell i.e. each face atom is touching four atoms)

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43. Tungsten crystallises in a body centred cubic unit cell. If the edge of the unit cell is 316.5 pm, what is the radius of tungsten atom ?

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44. A cubic unit cell contains manganese ions at the corners and fluoride ions at the centre of each face.

(a) What is the empirical formula ? (b) What is the C.N. of Mn^{2+} ion ?

(c) Calculate the edge length of the unit cell if the radius of Mn^{2+} ion is 0.65Å and that of F^{-} ion is 1.36Å.

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45. NH_4Cl crystallises in a body centred cubic lattice with a unit cell distance of 387 pm. Calculate

(a) the distance between the oppositely charged ions in the lattice.

(b) the radius of NH_4^+ ion if that of Cl^- ion is 181 pm.

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46. The nearest neighbour silver atoms in silver crystal are 2.87×10^{-10} m apart. What is the density of the silver metal ? Silver crystallises in fcc form. (Atomic mass of Ag = 108)

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47. 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)

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48. A compound having bcc geometry has atomic mass 50. Calculate the density of the unit cell if its edge length is 290 pm.

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49. An element crystallises in a structure having a fcc unit cell of an edge 200 pm. Calculate its density if 400 g of this element contain 48×10^{23} atoms.

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50. Chromium metal crystallizes with a body-centred cubic lattice. The length of the unit cell edge is found to be 287pm. Calculate the atomic radius. What woulds be the density of chromium in gcm^{-3}?

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51. Silver metal crysatllises with a face centred cubic lattice. The length of the unit cell is found to be $4.077 \times 10^{-8} cm$. Calulate the atomic radius and density of silver.

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52. 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.

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53. 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.

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54. 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 ?

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55. KF has NaCl structure. What is the distance between K^{+} and F^{-} in KF, if the density is $2.48 g cm^{-3}$?

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56. An element of atomic number 52 occurs in bcc structure with cell edge length of 288 pm. Calculate the Avodadro's number if density is $7.2gm / cm^3$.

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57. Gold has cubic crystals whose unic cell has edge length of 407.9 pm. Density of gold is 19.3 g cm^{-3}. Calculate the number of atoms per unit cell. Also predict the type of crystal lattice of gold (Atomic mass of gold = 197 amu)

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58. Titanium metal has a density of $4.54 \mathrm{g\ cm}^{-3}$ and an edge length of 412.6 pm. In what cubic unit cell does titanium crystallise ?

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59. 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})

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60. Formula mass of $NaCl$ is $58.45 g mol^{-1}$ and density of its pure form is $2.167 g cm^{-3}$. The average distance between adjacent sodium and chloride ions in the crystal is $2.814 \times 10^{-8} cm$.

Calculate Avogadro constant.

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61. 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})

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62. 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?

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63. Determine the type of cubic lattice to which a crystal belongs if the unit cell edge length is 290 pm and the density of crystal is $7.80gcm^{-3}$. (Molar mass = 56 a.m.u.)

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64. 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.

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65. An element with density 10 g cm^{-3} forms a cubic unit cell with edge length $3 \times 10^{-8} cm$. What is the nature of the cubic unit cell if the atomic mass of the element is 81 g mol^{-1}.

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66. An element crystallizes in f.c.c. lattice with edge length of 400 pm. The density of the element is 7 g cm^{-3}. How many atoms are present in 280 g of the element ?

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67. An element with atomic mass 93 g mol^{-1} has density 11.5 g cm^{-3}. If the edge length of its unit cell is 300 pm, identify the type of unit cell.

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

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69. The metal calcium crystallises in fcc unit cell with a = 600 pm. Calculate the density of the metal if it contains 0.2% Schottky defects.

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70. 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?

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71. 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 $2.16g/\text{cc}$. What type of defect is found in the solid? Calculate the percentage of Na^{+} and Cl^{-} ions that are missing.

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MULTIPLE CHOCIE QUESTION (TYPE-I)

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

A. High temperature

B. Low temperature

C. High thermal energy

D. Weak cohesive forcs.

Answer: B

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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

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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

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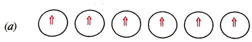
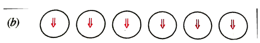
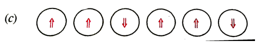
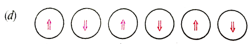
4. Which of the following arrangements shows schematic alignment of magnetic moments of antiferromagnetic substances?

A. 

B. 

C. 

D. 

Answer: D

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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

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6. Which of the following statements is not ture about amophous 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

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

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

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

C. same arragement of constitutent particles in different directions.

D. different arrangement of constituent particles in different directions.

Answer: B

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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

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9. which of the following is a network solid?

A. SO_2 (Solid)

B. I_2

C. Diamond

D. H_2O (ice)

Answer: C

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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

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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

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

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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

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

A. SiO_2

B. $SO_2(s)$

C. MgO

D. CrO_2.

Answer: D

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

A. molecule

B. ion

C. electon

D. atom.

Answer: C

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16. Graphite cannot be classified as :

A. conducting defect

B. network solid

C. covalent solid

D. ionic solid.

Answer: D

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17. Cations are present in the interstitial sites in

....

A. Frenkel defect

B. Schottky defect

C. Vacancy defect

D. Metal deficiency defect.

Answer: A

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

A. some cations move from their lattice site 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

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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-type impurity.

Answer: B

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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

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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

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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: B

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

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

A. The coordination numberr 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 forth layer are exatly, aligned with those of the first layer.

Answer: D

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

A. Cl^- ions form fcc lattice and Na^+ ions occupy all octahedral voids of the unit cell

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

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

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

Answer: A

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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. Dislocationdefects

B. Schottky defects

C. Frenkel defects

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 ture ?

A. Paramagnetic substances are weakly attracted 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

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

A. Bigger ions form the close packed structure

B. Smaller ions occcupy 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 effeciency 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 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

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36. the edge length of the unit cells in terms of the radius of sphere constituting fcc ,bcc and simple cubic unit cells are respectively Ã¢â, Â¦Ã¢â, Â¦Ã¢â, Â¦. .

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

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

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

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

Answer: A

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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.

$$K_{\text{metals}} \cong K_{\text{semiconductors}} > K_{\text{insulators}} = \text{zero}$$

D.

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

Answer: A

Watch Video Solution

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

A. A tetrahedral voids is formed when a sphere of the second layer is present above triangular voids 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 treangular voids in the second layer lie above the triangular voids in the first layer and 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

39. 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 direction of the applied magnetic field

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

D. cancel out each other's magnetic moment.

Answer: C::D

Watch Video Solution

40. Which of the following statements are not true ?

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

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

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

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

Answer: C::D

Watch Video Solution

41. 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 be determined

D. Valence band may remain partially filled.

Answer: A::B::D

Watch Video Solution

42. 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 the positvely 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

Watch Video Solution

43. Which of the following statements are ture about semi-conductors ?

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

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

C. Delocalised electrons increase the conductivity of doped silicon

D. An electron vacancy increases the conductivity of a-type semi-conductor.

Answer: C

View Text Solution

44. 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

45. 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

46. Amorphous solids can also be callled ....

.

A. pseudo solids

B. true solids

C. super cooled liquids

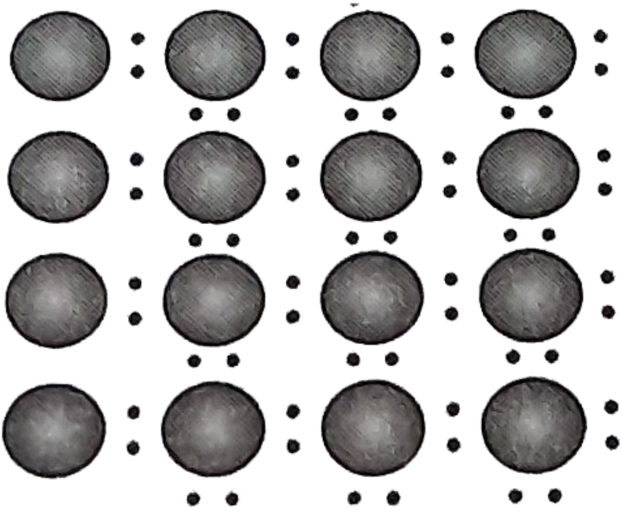
D. super cooled solids.

Answer: A::C

Watch Video Solution

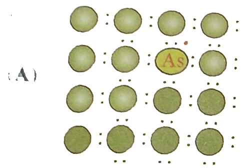
47. A perfect crystal of silicon (fig) is doped with some elements as given in the options , which of these options shows n- type semiconductors

?

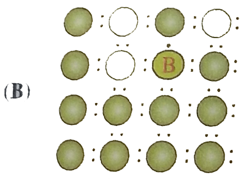


Pure crystal

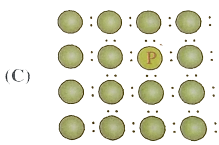
A.

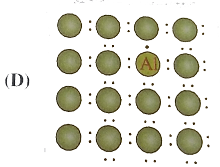


B.



C.



D. 

Answer: A::C

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48. 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 directionof magnetic field and remain as such even after removing magnetic field.

Answer: A::D

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

A. This is a crystalline solid

B. Refractive index is ame in all the directions

C. This has definite heat of fusion

D. This is also called super cooled liquid.

Answer: A::C

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

A. SiC (Silicon carbide)

B. AlN

C. Diamond

D. I_2.

Answer: A::B::C

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

A. hcp

B. bcc

C. simple cubic

D. fcc.

Answer: A::D

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52. Frenkel defect is also known as ....

A. stoichiometric defect

B. dislocation defect

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

D. non-stoichiometric defect.

Answer: A::B

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53. Which of the following defects decrease the density ?

A. Interstitial defect

B. Vacancy defect

C. Frankel defect

D. Schottky defect.

Answer: B::D

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54. match the defects given in column I with the statements in given Column I.

	Column I		Column II
A.	Simple vacancy defect	1.	Shown by non-ionic solids and increases density of the solid
B.	Simple interstitial defect	2.	Shown by ionic solids and decreases density of the solid
C.	Frenkel defect	3.	Shown by non-ionic solids and density of the solid decreases
D.	Schottky defect	4.	Shown by ionic solids and density of the solid remains the same

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55. match the type of unit cell given column I with the features iven in Column II .

	Column I		Column II
A.	Primitive cubic unit cell	1.	Each of the three perpendicular edges compulsorily have the different edge length *i.e.*, $a \neq b \neq c$
B.	Body centred cubic unit cell	2.	Number of atoms per unit cell is one
C.	Face centred cubic unit cell	3.	Each of the three perpendicular edges compulsorily have the same edge length *i.e.*, $a = b = c$
D.	End centred orthorhombic unit cell	4.	In addition to the contribution from the corner atoms the number of atoms present in a unit cell is one
		5.	In addition to the contribution from the corner atoms the number of atoms present in a unit cell is three

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56. match the types of defect given in column I with the statement given in column II.

Column I	Column II
A. Impurity defect	1. NaCl with anionic sites called F-centres
B. Metal excess defect	2. FeO with Fe^{3+}
C. Metal deficiency defect	3. NaCl with Sr^{2+} and some cationic sites vacant

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57. match the items given in column I with the items given in column II.

Column I	Column II
A. Mg in solid state	1. p –type semiconductor
B. $MgCl_2$ in molten state	2. n –type semiconductor
C. Silicon with phosphorus	3. Electrolytic conductors
D. Germanium with boron	4. Electronic conductors

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58. Match the type of packing given in column I with the iterms given in column II.

Column I	Column II
A. Square close packing in two dimensions	1. Triangular voids
B. Hexagonal close packing in two dimensions	2. Pattern of spheres is repeated in every fourth layer
C. Hexagonal close packing in three dimensions	3. Coordination number = 4
D. Cubic close packing in three dimensions	4. Pattern of sphere is repeated in alternate layers

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59. 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 corrent statements and reason is correct explanation for assertion.

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

C. Assertion is corrent statement but reason reason is wrong statement.

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

Answer: A

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60. Assertion :- (A) Graphite is good conductor of electricity however diamond belongs to the category of insulators .

Rason (R) Grapite is soft in anture on the hand diamond is very hard and brittle.

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

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

C. Assertion is corrent statement but reason reason is wrong statement.

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

Answer: B

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

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

Answer: C

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62. 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 corrent statements and reason is correct explanation for assertion.

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

C. Assertion is corrent statement but reason reason is wrong statement.

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

Answer: B

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63. 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 corrent statements and reason is correct explanation for assertion.

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

C. Assertion is corrent statement but reason reason is wrong statement.

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

Answer: C

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ASSIGNMENT

1. Out of crystalline and amorphous solids, which can be cleaved easily ?

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2. Naphthalene belongs to which types of crystalline solids ?

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3. A solid substance is hard and brittle. Its melting point is very high. Predict its nature.

Watch Video Solution

4. How do metallic and ionic substances differ in conducting electricity ?

Watch Video Solution

5. What is the state of hybridisation of carbon atoms in graphite ?

Watch Video Solution

6. Explain

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

b. Ionic solids are hard and brittle.

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7. Polymers belong to which type of solids.

Watch Video Solution

8. What is anisotropy ? Which types of solids exhibit this property ?

Watch Video Solution

9. Give the nature of bonding in the following types of solids.

(i)Copper (ii) water (iii) sodium chloride (iv) graphite.

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10. A substance has its melting point above room temperature under one atmosphere pressure. Predict its nature.

Watch Video Solution

11. Write two points of distinction between crystalline and amorphous solids.

Watch Video Solution

12. How do metallic and ionic substances differ in conducting electricity ?

Watch Video Solution

13. Write a point of distinction between a metallic solid and ionic solid other than the metallic lustre.

Watch Video Solution

14. Ionic solids conduct electricity in the molten state and not in the solid state. Explain.

Watch Video Solution

15. (a) Define the terms crystalline and amorphous solids.

(b) Explain Schottky defect with an example.

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16. Define a unit cell

Watch Video Solution

17. What is co-ordination number ?

Watch Video Solution

18. How manu atoms are present in the unit cell of :

(i) Simple cubic

(ii) bcc

(iii) fcc.

Watch Video Solution

19. Define term space lattice ?

Watch Video Solution

20. Identical spheres are undergoing two-dimensinal packing in squre close packing and hexagonal close packing. Which is correct regarding the spheres?

Watch Video Solution

21. What is the co-ordination number of each sphere in cubic close packing and hexagonal close packing ?

Watch Video Solution

22. What are voids or interstitial sites ?

Watch Video Solution

23. How many voids per point are present in cubic close packed structures of spheres ?

Watch Video Solution

24. How many octahedral tetrahedral voids are per sphere in a unit cell ?

Watch Video Solution

25. Name the three of crystalline solids having the formula AB.

Watch Video Solution

26. What are the coordination number of Zn^{2+} and S^{2-} ions in ZnS?

Watch Video Solution

27. An element occurs in bcc structure. How many atoms are present in its unit cell ?

Watch Video Solution

28. The unit cell of a substance has cations A^+ at the corners of the unit cell and anions B^- in the centre. What is the simplest formula of the substance ?

Watch Video Solution

29. What is the co-ordination number of each sphere in

(i) Hexagonal close packed structure.

(ii) Cubic close packed structure.

(iii) Body centred cubic packed structure.

Watch Video Solution

30. Knowing the edge length of a cubic crystal of an element and its. Density , how will your find the value of Avogadro's number ?

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31. What are interstitial sites ? Discuss tetrahedral and octahedral sites in close packed arrangement :

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32. The number of atoms present per unit cell in simple, fcc and bcc are ...., ..., and ...., respectively.

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

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34. What is the maximum number of atoms in a hcp crystal structure of an element ?

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35. How many atoms can be assigned to its unit cell if an element forms (i) a body centred cubic unit cell (ii) face centred cubic unit cell ?

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36. Distinguish between crystal lattice and unit cell.

Watch Video Solution

37. How is simple cubic unit cell formed ? Calculate the number of atoms in a simple unit cell.

Watch Video Solution

38. What is the number of atoms per unit cell in a body centred cubic structure ?

Watch Video Solution

39. What is radius ratio ? How does it help to predict the structure of ionic compounds ?

Watch Video Solution

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

Watch Video Solution

41. 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.

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42. 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).

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43. For a value of radius ratio between $0.732 - 1.0$, what is the co-ordination number and the geometry of the crystal?

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44. What is the packing efficiency is ccp structure?

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45. How many atoms constitute one unit cell of a face-centred cubic crystal?

Watch Video Solution

46. How will you distinguish between Tetrahedral and Octahedral voids ?

Watch Video Solution

47. Assuming that atoms are touching each other, calcualte the packing efficiency in case of a crystal of simple cubic metal.

Watch Video Solution

48. How is a simple cubic unit cell formed ? Calculate the number of atoms present in it.

Watch Video Solution

49. Distinguish between crystal lattice and unit cell.

Watch Video Solution

50. What is unit cell ? Write formula to calculate the density of a unit cell.

Watch Video Solution

51. In a body centred and face centred arrangement of atoms of an element what will be the number of atoms present in the respective unit cells? Justify your answer with calculations.

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52. What is an ideal crystal ? Name the types of the defects which arise in a crystal.

Watch Video Solution

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

Watch Video Solution

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

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55. Why does Schottky defect decrease the desity of a crystal ?

Watch Video Solution

56. In what way, do Schottky and Frenkel defects differ from each other ?

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57. Why does white zinc oxide on heating become yellow ?

Watch Video Solution

58. Which point defect is observed in a crystal when a vacancy is created by an atom or ion missing from its normal position ?

Watch Video Solution

59. What are non-stoichiometric compounds ?

Watch Video Solution

60. Does Frenkel defect in AgCl crystal change its density ?

Watch Video Solution

61. What are impurity defects ? Explain.

Watch Video Solution

62. What do yor understand by doping ?

Watch Video Solution

63. What are metal excess defects in crystals ? How are these caused ?

Watch Video Solution

64. What will happen when a small amount of phosphorus is addded to pure crystal of silicon ?

Watch Video Solution

65. What is the effect of Frenkel defect on the electrical conductivity of crystalline solids ?

Watch Video Solution

66. Why does KCl turn violet on heating in the potassium vapours ?

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

69. How will you show that non-stoichiometic solium chloride is yellow ?

Watch Video Solution

70. What are non-stoichiometry defects in crystals ? Explain.

Watch Video Solution

71. Explain Scottky defect.

Watch Video Solution

72. What is the effect of Schottky defect on the density of crystal ?

Watch Video Solution

73. Write notes on :

(i) Frenkel defects

(ii) Schottky defect.

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74. Explain on brief Schottky defect.

Watch Video Solution

75. What is the point defect due to the presence of foreign atom ? ltbRgt Explain with suitable example.

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76. ELECTRONIC AND LINE IMPERFECTIONS

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77. Explain Frenkel defect in ionic crystals. What type of compounds exhibit this defect ?

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78. Why is phosphours doped silicon a semi-conductor?

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79. Explain the conductivity of n-type semi-conductors.

Watch Video Solution

80. Schottky defect lowers the density of ionic crystals while Frenkel defect does not. Discuss.

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81. Write the difference between Frenkel and Schottky defects.

Watch Video Solution

82. Explain the following :

(i) How does density of crystals change due to

Schottky defect ?

(ii) How is conductivity of covalenet solids increased by introducing impurities ?

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83. Explan how Schottky defect occurs.

Watch Video Solution

84. Explain Frenkel defects in crystals.

Watch Video Solution

85. Write the difference between Frenkel and Schottky defects.

Watch Video Solution

86. Write two points of distinction between Schottky and Frenkel defects.

Watch Video Solution

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

Watch Video Solution

88. Which point defect in the crystals increases the density of the solid ?

Watch Video Solution

89. Which point defect decreases the density of crystals ?

Watch Video Solution

90. What are F-centres in ionic crystals ? Why are crystals having F-centres are paramagnetic in nature.

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91. What change occurs when AgCl is doped with $CdCl_2$?

Watch Video Solution

92. What type of non-stoichiometric point defect is responsible for the pink colour of LiCl ?

Watch Video Solution

93. What type of stoichiometric defect is shown by NaCl ? Explain.

Watch Video Solution

94. Define the terms (i) Crystalline solids (ii) Frenkel defects (iii) n-type semi-conductors.

Watch Video Solution

95. Why does sodium chloride on heating with sodium vapours acquire yellow colour ?

Watch Video Solution

96. What is the effect of temperature and pressure on ionic compounds having NaCl or CsCl type structure ?

Watch Video Solution

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

Watch Video Solution

98. Write the three types of solids on the basis of their ability to conduct electric current.

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99. Although pure silicon is an insulator, then how does it behave as semi-conductor on heating ?

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100. Ferromagnetic Substances

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101. Assertion : On heating ferromagnetic or ferromagnetic substance , they become paramagnetic

Reason :The electrons change their spin on heating

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102. With the help of electron spins, clearly distinguish between Ferromagnetic, Antiferromagnetic and Ferrimagnetic substances.

Watch Video Solution

103. What do you understand by paramagnetism and diamagnetism ?

Watch Video Solution

104. why does the electrical conductivity of semiconductors increse with rise in temperature?

Watch Video Solution

105. How are n-type and p-type semiconductors formed ? Give one example in each case.

Watch Video Solution

106. What types of semi-conductors will be formed when silicon is doped with Indium ?

Watch Video Solution

107. What are piezoelectric crystals ? Give their important uses.

Watch Video Solution

108. How will you account for the fact that silicon is an insulator but silicond doped with phosphorus acts as semi-conductor ?

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109. Give one example of 1315 compounds.

Watch Video Solution

110. Define the term doping. Pure silicon is an insulator. Silicon doped with phosphorus is a semiconductor. Silicon doped with gallium is also a semi-conductor. What is difference between the two types of semi-conductors ?

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111. What is the magnetic nature of super-conductors?

Watch Video Solution

112. How does the electrical conductivity of super- conductors vary with temperature ?

Watch Video Solution

113. What types of crystals show pyroelectricity ?

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114. What is super conductivity ?

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115. Give one example of peizoelectric substance.

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116. FERROMAGNETIC SUBSTANCES

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117. Explain superconductivity.

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118. At what temperature range most of the metals becomes superconductors

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119. Define piezoelectricity.

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120. How does electrical cocductivity of semi-conductors vary with temperature ?

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

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

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123. Example the following with suitable examples:

a. Ferromagnetism b. Paramagnetism

c. Ferrimagnetism d. Antiferromagnetism

e. 12 - 46 and 13 - 15 group compounds

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124. Explain with suitable examples the following :

(a) n-type and p-type semi-conductors

(b) F-centres

(c) Ferromagnetism.

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125. Explain the following terms with suitable examples :

(i) Schottky defect

(ii) Ferromagnetism.

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

Watch Video Solution

127. What is doping?

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128. What type of semi-conductor is produced when silicon is doped with boron ?

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129. On the basis of the nature of ionic solids, compare Frenkel defect with Schottky defect.

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130. Define conductors, semi-conductors and insulators.

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131. Discuss briefly the structure of CsCl.

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132. ELECTRICAL PROPERTIES- BAND THEORY

Watch Video Solution

133. Define Frenkel and Schottky defects with examples.

Watch Video Solution

134. What are semi-conductors ? How are they formed ?

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multiple choice

1. Most crystals show good cleavage because their atoms, ions and molecules are :

A. weakly bonded together

B. strongly bonded together

C. spherically symmetrical

D. arranged in planes

Answer: D

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2. On doping Ge with a little of In or Ga one gets

A. n-type semi - conductor

B. n-type semi - conductor

C. insulator

D. rectifer

Answer: B

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3. When electrons are trapped into the crystalline anion vacancy the defect is known as

A. Schottky defect

B. Frenkel defect

C. Stoichiometric defect

D. F- centres

Answer: D

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4. If we mix a pentavalent impurity in the crystal lattice of germinium the type of semiconductor formed will be:

A. p-type

B. n-type

C. both (a) and (b)

D. None of the two

Answer: B

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5. Which of the following is a ferroelectric compound?

A. $BaTiO_3$

B. $K_4[Fe(CN)_6]$

C. Pb_2O_3

D. None of these

Answer: A

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6. The intermetallic compounds $LiAg$ crystallises in cubic lattice in which both lithium and silver have coordination number of eight ,the crystal class is

A. simple cubic

B. Body centred cubic

C. Face centred cubic

D. None of these

Answer: B

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7. In the crystals of which of the following ionic compounds would you expect maximum distance between the centres of the cations and anion?

A. LiF

B. CsF

C. CsI

D. LiI

Answer: C

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8. Schottky defect to crystals is observed when

A. unequal number of cations and anions is missing from the crystal lattice

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

C. an ion leaves its normal site and occupies an interstitial site

D. density of the crystal is increased.

Answer: B

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9. A compound formed by elements A and B crystallises in a cubic structure where A atoms are present at the corners of a cube and the B atoms are present at the face centres.The formula of the compound is

A. AB_3

B. AB

C. A_3B

D. A_2B_2

Answer: A

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10. When molten zinc is cooled to solid state, it assumes hcp structure. Then the number of nearest neighbours of zine atom will be

A. 4

B. 6

C. 8

D. 12

Answer: D

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11. What is the co-ordination number of sodium in Na_2O ?

A. 6

B. 4

C. 8

D. 2

Answer: B

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12. A compound formed by elements X and Y crystallises in a cubic structure in which the X atoms are at the corners of a cube and the Y

atoms are at the face centres.The formula of the compound is

A. XY_3

B. X_3Y

C. XY

D. XY_2

Answer: A

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13. The crystal system of a compound with unit cell dimensions $a = 0.387, b = 0.387$ and $c = 0.504$ and $\alpha = \beta = 90^\circ$ and $\gamma = 120^\circ$ is

A. Cubic

B. Hexagonal

C. Orthorhombic

D. Rombohedral

Answer: B

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14. In a face centred cubic lattice unit cell is shared equally by how many unit cells?

A. 2

B. 4

C. 6

D. 8

Answer: C

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15. If $'Z'$ is the number of atoms in the unit cell that represents the closet packing sequence......$ABCABC$..... The number of tetrahedral voids in the unit cell is equal

A. Z

B. 2Z

C. $Z/2$

D. $Z/4$

Answer: B

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16. The appearance of colour in solid alkali metal halides is generally due to

A. interstitial positions

B. F-centres

C. Schottky defect

D. Frenkel defect

Answer: B

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

A. $4.25g / cm^3$

B. $42.5g / cm^3$

C. $0.425g / cm^3$

D. $8.25g / cm^3$

Answer: A

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18. The Ca^{2+} and F^{-} ions arc located in CaF_2 crystal respectively at face centred cubic lattice points and in

A. tetrahedral voids

B. half of tetrahedral voids

C. octahedral voids

D. half of octahedral voids

Answer: A

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19. A particular solid is very hard and has a very high melting point.In solid state it is nonconductor and its melt is a conductor of electricity. Classify the solid.

A. metallic

B. molecular

C. network

D. ionic

Answer: D

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20. 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. $6.022 \times 10^{16}\ \text{mol}^{-1}$

B. $6.022 \times 10^{17}\text{mol}^{-1}$

C. $6.022 \times 10^{14}\text{mol}^{-1}$

D. $6.022 \times 10^{15}\text{mol}^{-1}$

Answer: B

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

A. 34%

B. 28%

C. 30%

D. 32%

Answer: D

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22. Which of the following statements is not correct ?

A. The number of carbon atoms in the unit cell of diamond is 4

B. The number of Bravais lattics in which a crystal can be catagorized is 14

C. The fraction of the total volume occupied by the atoms in a primitive cell is 0.48

D. Molecular solids are generally volatile

Answer: C

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

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

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

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

Answer: C

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24. Lithium forms body centred cube structure .The length of the side of its unirt cell is 351 pm Atomic radius of the lithium will be

A. $151.8pm$

B. $75.6pm$

C. $300.5pm$

D. $240.8pm$

Answer: A

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25. Copper crystallises in fcc with a unit cell length of 361 pm. What is the radius of copper atom?

A. 157

B. 181

C. 108

D. 128

Answer: D

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26. Total no. of voids in 0.5 mole of a compound forming hexagonal closed packed structure are :

A. 6.022×10^{23}

B. 3.011×10^{23}

C. 9.033×10^{23}

D. 4.516×10^{23}

Answer: C

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27. AB crystallizes in a body centred cubic lattice with edge length a equal to $387pm$ .The distance between two oppositely charged ions in the lattice is :

A. 335 pm

B. 250 pm

C. 200 pm

D. 300 pm

Answer: A

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

A. 275.1pm

B. 322.5pm

C. 241.5pm

D. 165.7pm

Answer: C

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29. 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

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30. Structure of a mixed oxide is cubic close packed 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 monvalent metal B. The formula of the oxide is :

A. ABO_2

B. A_2BO_2

C. $A_2B_3O_4$

D. AB_2O_2

Answer: D

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31. The number of carbon atoms per unit cell of diamond unit cell is

A. 1

B. 4

C. 8

D. 12

Answer: C

Watch Video Solution

32. 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. 40g mol^{-1}

B. 30g mol^{-1}

C. 26g mol^{-1}

D. 20g mol^{-1}

Answer: C

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

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

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

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

Answer: C

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34. Density of a crystal is given by the formula

A. $\frac{a^3 M}{Z N_A}$

B. $\dfrac{N_A M}{Za^3}$

C. $\dfrac{a^3 N_A}{ZM}$

D. $\dfrac{ZM}{a^3 N_A}$

Answer: D

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35. Copper crystallises in fcc with a unit cell length of 361 pm. What is the radius of copper atom?

A. 157

B. 181

C. 108

D. 128

Answer: D

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36. Lithium has a bcc structure .its density is $530 Kgm^{-1}$ and its atomic mass is $6.94 gmol^{-1}$

. 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

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37. 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

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38. Which is the incorrect statement?

A. $Fe_{0.98}O$ has non stoichiometric metal deficiency defect

B. Density decrease in case of crystals with Schottly's defect

C. NaCl(s) is inculator, silicon is semiconductor, silve is conductor, quartz is piezo electric crystal

D. Frenkel defect is favoured in those ionic compouds in which sizes of cation and anions are almost equal

Answer: D

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39. Iron exhibits bcc structure at room temperatutre .Above $900^{\circ}C$ .it transitions to fcc structure .The ratio of density of ions at room temperature to that at $900^{\circ}C$(assuming molar mass and atomic , radii of ion remain s

constant with temperature) is

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

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

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

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

Answer: C

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40. A substance has a face centred cubic crystal with a density 1.984 g cm^{-3} and edge length 630 pm. Calculate the molar mass of the substance

A. $98.63g \quad \text{mol}^{-1}$

B. $85.50g \quad \text{mol}^{-1}$

C. $74.70g \quad \text{mol}^{-1}$

D. $63.45g \quad \text{mol}^{-1}$

Answer: C

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41. What colour is observed when ZnO is heated ?

A. Yellow

B. Violet

C. Green

D. Blue

Answer: B

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42. f-centre is

A. anion vacancy occupied by unpaired electron

B. anion vacancy occupied by paired electrons

C. anion vacancy occupied by electron

D. anion present in interstitial slite

Answer: A

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43. The melting point of $RbBr$ is $682^{\circ} C$, while that of NaF is $988^{\circ} C$. The principla reason that melting point of NaF is much higher than that of $RbBr$ is that :

A. the two crystals are not isomorphous

B. the molar mass of NaF is smaller than that of RbBr

C. the bond in RbBr has more covalent character than the bond in NaF

D. the internuclear distance $(r_c + r_a)$ is greater for RbBr than for NaF.

Answer: D

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44. Ferrous oxide has cubes structure and each edge of the unit cell is 5.0Å .Assuming of the oxide as $4.0g/cm^3$ then the number of Fe^{2+} and O^2 inos present in each unit cell will be

A. two Fe^{2+} and four O^{2-}

B. three Fe^{2+} and three O^{2-}

C. four Fe^{2+} and two O^{2-}

D. four Fe^{2+} and four O^{2-}

Answer: D

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45. Calculate the density of flourine nucleus supposing that the shape of the nucleus is spherical and its radius is 5×10^{-13}. (Mass of F=19 amu)

A. $6.02 \times 10^{3} g \text{ cm}^{-3}$

B. $5 \times 10^{4} g \text{ cm}^{-3}$

C. $6.02 \times 10^{3} g \text{ cm}^{-3}$

D. $5 \times 10^{13} g \text{ cm}^{-3}$

Answer: C

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46. A mineral MX_2 crystallizes in ccp of M^{2+} ions whereas X^- ions occupy the tetrahedral voids. The number of cations and anions per unit cell, the coordination number of cation and percent of tetrahedral voids occupied are :

A. $4, 8, 8, 100\ \%$

B. $4, 8, 8, 50\ \%$

C. $8, 4, 8, 50\ \%$

D. $8, 4, 8, 100\ \%$

Answer: A

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47. A solid AB has NaCl type statement for ionic solids in which positive and negative ions are held by strong electrostatic attractive forces ?

A. $190.2pm$

B. $540.13pm$

C. $525pm$

D. $78.12pm$

Answer: A

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48. Which of the following statement are correct for the ionic solids in which positive and negative ions are held by strong electrostatic attractive forces ?

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 r_+/r_- ratio lies between $0.225 \text{ to} 0.414$

D. In ZnS type structure, anions have ccp arrangement and cations occupy alternate tetrahedral voids. The coordination number of Zn^{2+} and S^{2-} respectively are 4 and 4

Answer: C

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Select the correct

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

A. Interstitial defect

B. Vacancy defect

C. Frenkel defect

D. Schottky defect

Answer: C

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2. Which has hcp crystal structure ?

A. $NaCl$

B. $CsCl$

C. Zn

D. $RbCl$

Answer: C

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3. 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

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4. A solid solution of $CdBr_2$ in AgBr contains

A. Schottky defects

B. Frenkel defects

C. Colour Centres

D. Frenkel as well as Schottky defects

Answer: D

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5. In a ccp structure, the :

A. first and third layers are repeated

B. first and fourth layers are repeated

C. second and fourth layers are repeated

D. first, third and sixth layers repeated

Answer: B

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6. In a face centered cubic arrangement of A and B atoms whose A atoms are at the corner of the unit cell and B atoms at the face centers. One of the B atoms missing from one of the face in unit cell. The simplest formula of compounding is:

A. A_7B_3

B. AB_3

C. A_7B_{24}

D. A_8B_{21}

Answer: C

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7. The unit cell of a binary compound of A and B has ccp structure with A atoms occupying the corners and B atoms occupying the centres of each face of the unit cell. If during crystallisation of the alloy, in the unit cell two atoms of A are missing, the overall composition per unit cell is :

A. AB_6

B. AB_4

C. AB_8

D. A_6B_{24}

Answer: B

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8. Tetragonal crystal system has the following unit cell dimensions :

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

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

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

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

Answer: D

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9. For an ionic crystal of the formula AX and cooradition number 6, the value of radius ratio will be

A. greater than 0.73

B. between 0.73 and 0.41

C. between 0.41 and 0.22

D. less than 0.22

Answer: B

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10. In a covalent solid the lattice points are occupied by

A. atoms

B. ions

C. molecules

D. electrons

Answer: A

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11. Which of the following describes the hexagonal close packed arrangement of spheres ?

A. ABCABA

B. ABCABC

C. ABABA

D. ABBABB

Answer: C

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12. In the crystals structures of sodium chloride, the arrangement of Cl^{-} ions is

A. fcc

B. bcc

C. Both fcc and bcc

D. None of these

Answer: A

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

A. $NaWO_2$

B. $NaWO_3$

C. Na_2WO_3

D. $NaWO_4$

Answer: B

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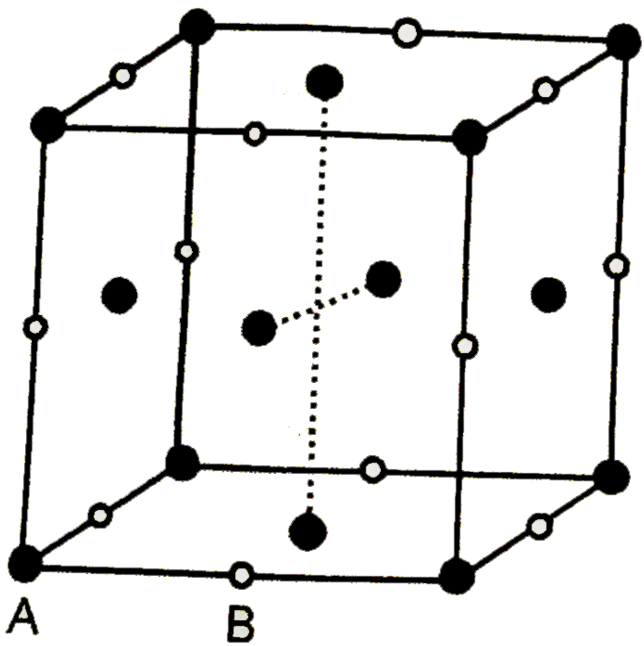
14. For a solid with the structure shown in Fig, the coordination number of the points of the points A and , respectively are



A. 6, 8

B. 8, 8

C. 6, 6

D. 4, 6

Answer: C

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15. The total number of lattic arrangements in different crystal system is

A. 7

B. 3

C. 10

D. 14

Answer: D

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16. A solid crystal is composed of X, Y and Z atoms. Y atoms are occupying 50% of octahedral voids, whereas X atoms are occupying the 100% tetrahedral voids while Z atoms occupy CCP arrangement. The formula of the compound is:

A. $X_8Y_2Z_4$

B. $X_5Y_{10}Z_8$

C. X_4YZ_2

D. $X_{10}Y_4Z_2$

Answer: A

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17. Which of the following unit cells is the most unsymmetrical ?

A. Triclinic

B. Orthorhombic

C. Monoclinic

D. Hexagonal

Answer: A

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18. At very low temperature, oxygen (O_2) freezes and forms a crystalline solid. Which term best describes the solid ?

A. Covalent netword crystals

B. Molecular crystals

C. Metallic crystals

D. Ionic crystals

Answer: B

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19. Which has Frenkel defect ?

A. Sodium chloride

B. Graphite

C. Silver bromide

D. Diamond

Answer: C

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20. To get n-type doped semiconductor, impurity to be added to silicon should have the following number of valence electrons

A. 2

B. 5

C. 3

D. 1

Answer: B

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

A. 6×10^{20}

B. 3×10^{22}

C. 1.5×10^{23}

D. 0.5×10^{24}

Answer: C

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22. The edge length of a face centred unit cubic cell is 508 pm. If the radius of cation is 110 pm, the radius of anion will be

A. 288 pm

B. 144 pm

C. 618 pm

D. 398 pm

Answer: B

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23. Na and Mg crystallize in bcc- and fcc-type crystals, the ratio of number of atoms present in the unit cell of their respective crystal is

A. 4 and 2

B. 9 and 14

C. 14 and 9

D. 2 and 4

Answer: D

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24. How many unit cell are present in a cubic-shaped ideal crystal of $NaCl$ of mass $1.0g$?

A. 2.57×10^{21}

B. 5.14×10^{21}

C. 1.28×10^{21}

D. 1.71×10^{21}

Answer: A

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25. Which type of crystal defect is indicated by the diagram given below ?

$Na^+ Cl^- Na^+ Cl^- Na^+ Cl^-$

$Cl^- Cl^- Na^+ Na^+$

$Na^+ Cl^- Cl^- Na^+ Cl^-$

$Cl^- Na^+ Cl^- Na^+ Na^+$

A. Interstitial defects

B. Schottky defect

C. Frenkel defect

D. Both Frenkel & Schottky defects

Answer: B

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26. An ionic compound has a unit cell consisting of A ions at the corners of a cube and B ions on the centers of the faces of the cube .The empirical formula for this compound would be

A. AB

B. A_2B

C. AB_3

D. A_3B

Answer: C

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27. The volume of atom present in a face-centred cubic unit cell of a metal (r is atomic radius) is

A. $20/3\pi r^3$

B. $24/3\pi r^3$

C. $12/3\pi r^3$

D. $16/3\pi r^3$

Answer: D

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28. The non- stoichiometric compound $Fe_{0.94}O$ is formed when $x\ \%$ of Fe^{2+} ions are replaced by as many $2/3Fe^{3+}$ ions The value of x is:

A. 18

B. 12

C. 13

D. 6

Answer: A

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29. Al (atomic mass =27) crystallises in a cubic system with edge length (a) equal to 4Å its density is $2.7g/cm^3$ The type of the unit cell is:

A. Simple

B. Face centred

C. Body centred

D. None of these

Answer: B

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30. A binary solid (A^+B^+) has a rock sell structure .If the edge length is $400 \pm$ and radius of cation is 75 pm the radius of amion attion is

A. 100 pm

B. 125 pm

C. 250 pm

D. 325 pm

Answer: B

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31. 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_3Y_4

B. X_4Y_4

C. X_2Y_3

D. X_2Y.

Answer: B

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32. Copper crystallises in fcc with a unit cell length of 361 pm. What is the radius of copper atom?

A. 108 pm

B. 128 pm

C. 157 pm

D. 181 pm

Answer: B

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33. 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. 288 pm

B. 398 pm

C. 618 pm

D. 144 pm

Answer: D

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34. The crystal with metal deficiency defect is:

A. NaCl

B. FeO

C. KCl

D. ZnO

Answer: B

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35. The relation between atomic radius and edge length 'a' of a body centred cubic unit cell :

A. $r = a/2$

B. $r = \sqrt{a/2}$

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

D. $r = \frac{3a}{2}$

Answer: C

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36. 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. A_2B

B. AB_2

C. A_2B_3

D. A_2B_5

Answer: D

Watch Video Solution

37. Lithium forms body centred cube structure .The length of the side of its unirt cell is 351 pm Atomic radius of the lithium will be

A. 75 pm

B. 300 pm

C. 240 pm

D. 152 pm

Answer: D

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38. In a face centred cubic lattice unit cell is shared equally by how many unit cells?

A. 6

B. 4

C. 4

D. 8

Answer: D

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39. Which of the following metals has different geometry compared to those of the others ?

A. Fe

B. Co

C. Ni

D. Cu

Answer: A

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

A. Frenkel

B. Schottky

C. Linear

D. Impurity

Answer: B

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

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

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

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

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

Answer: C

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42. A crystalline solid XY_3 has ccp arrangement for its element Y. The element X occupies :

A. 66% of tetrahedral holes

B. 33% of tetrahedral holes

C. 66% of octahedral holes

D. 33% of octahedral holes

Answer: D

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43. In a crystalline solid, having formula AB_2O_4 oxide ions are arranged in cubic close packed lattice while cations A are present in tetrahedral voids and cations B are present in octahedral voids.

(a) What percentage of the tetrahedral voids is occupied by A?

(b) What percentage of the octahedral voids is occupied by B ?

A. 45.5% , 13.0%

B. 50% , 12.5%

C. 13.0% , 45.5%

D. 12.5% , 50%

Answer: D

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44. Sodium metal crystllizes in a body centred cubic lattice with a unit cell edge of 4.29Å. The radius of sodium atom is approximately

A. 5.72Å

B. 0.93Å

C. 1.86Å

D. 3.22Å

Answer: C

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45. The unit cell with crystallographic dimensions,

$a \neq b \neq c, \alpha = \gamma = 90^\circ$ and $\beta \neq 90^\circ$ is :

A. monoclinic

B. tetragonal

C. triclinic

D. orthorhombic

Answer: A

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46. Pure silicon doped with phosphorus is:

A. Amorphous

B. n-type semi conductor

C. p-type semi-conductor

D. insulator

Answer: B

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47. An example of covalent solid is:

A. MgO

B. Mg

C. SiC

D. CaF_2

Answer: C

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48. Suppose the mass of a single Ag atoms is 'm' Ag metal crystallises in fcc lattice with unit cell edge length 'a' The density of Ag metal in terms of 'a' and 'm' is:

A. $\frac{4m}{a^3}$

B. $\frac{2m}{a^3}$

C. $\frac{m}{a^3}$

D. $\frac{m}{2a^3}$

Answer: A

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49. A metal oxide has empirical formula $M_{0.96}O_{1.00}$ What will be the percentage of M^{2+} ion in the crystal ?

A. 90.67

B. 91.67

C. 8.33

D. 9.33

Answer: B

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50. An element crystallising in body centred cubic lattice has edge length of 500 pm. If the density is 4 g cm^{-3}, the atomic mass of the element $\left(\mathrm{in\ g\ mol}^{-1}\right)$ is (consider $N_A = 6 \times 10^{23}$)

A. 100

B. 250

C. 125

D. 150

Answer: D

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51. The contibution of the particle present at the edge centre of a particular unit cell is :

A. $1/2$

B. $1/4$

C. 1

D. $1/8$

Answer: B

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52. Which of the following compounds is metallic and paramagnetic ?

A. T_iO_2

B. CrO_2

C. VO_2

D. MnO_2

Answer: B

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53. 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. $2\sqrt{2a}$

B. $\sqrt{2}a$

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

D. $2a$

Answer: C

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54. Which of the following statement regarding defects in solids is/are correct?

A. Schottky defect has no effect on the physical properties of solids

B. Frenkel defect is a dislocation defect

C. Frenkel defect is usually favoured by a very small difference in the sizes of cation and anions

D. Trapping of proton in the lattice leads to the formation of F-centres.

Answer: B

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55. Which type of defect has the presence of cations in the interstitial sites ?

A. Vacancy defect

B. Frenkel defect

C. Metal defeiciency effect

D. Schottky defect

Answer: B

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

A. (a) 

B. 

C. 

D. 

Answer: D

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57. Edge length of cube is 300 pm. Its body diagonal would be:

A. 600 pm

B. 423 pm

C. 519.6pm

D. 450.5pm

Answer: C

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58. What is the C.N of Ca^{2+} and F^{-} ions in CaF_2 crystal lattice ?

A. C.N of $Ca^{2+} = 4$ and $F^{-} = 8$

B. C.N of $Ca^{2+} = 6$ and $F^{-} = 6$

C. C.N of $Ca^{2+} = 8$ and $F^{-} = 8$

D. C.N of $Ca^{2+} = 8$ and $F^{-} = 4$

Answer: D

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59. A compound X formed by elements X and Y crystallises in a cubic structure, where X atoms are present at the corners of a cube and Y atoms are at the centres of the body. The formula of compound is:

A. XY

B. XY_2

C. X_2Y_3

D. XY_3

Answer: A

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comprehension

1. The regular three dimensional arrangement of points in a crystal is known as crystal lattice and the smallest repeating pattern in the lattice is called unit cell. The unit cells are characterised by the edge lengths a, b, c and the angles between them α, β and γ respectively. Based on this, there are seven crystal systems. In a cubic unit cell:

$a=b=c$ and $\alpha=\beta=\gamma=90^{\circ}$ The number of points in simple, body centred and face centred cubic cells are 1,2 and 4 respectively In both the hcp and ccp of spheres, the number of tetrahedral voids per sphere is two while the octahedral voids is one.

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

A. 1 part

B. $1/2$ part

C. $1/4$ part

D. $1/8$ part

Answer: B

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2. The regular three dimensional arrangement of points in a crystal is known as crystal lattice and the smallest repeating pattern in the lattice is called unit cell. The unit cells are characterised by the edge lengths a, b, c and the angles between them α, β and γ respectively. Based on this, there are seven crystal systems. In a cubic unit cell:

$a = b = c$ and $\alpha = \beta = \gamma = 90^\circ$ The number of points in simple, body centred and face centred cubic cells are 1,2 and 4 respectively In both the hcp and ccp of spheres, the number of tetrahedral voids per sphere is two while the octahedral voids is one.

A double triangular void surrounded by three spheres above and three spheres below is called

A. triangular void

B. tetrahedral void

C. octahedral void

D. trigonal bipyramidal void

Answer: C

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3. The regular three dimensional arrangement of points in a crystal is known as crystal lattice and the smallest repeating pattern in the lattice is called unit cell. The unit cells are characterised by the edge lengths a, b, c and the angles between them α, β and γ respectively. Based on this, there are seven crystal systems. In a cubic unit cell:

$a = b = c$ and $\alpha = \beta = \gamma = 90^\circ$ The number of points in simple, body centred and face centred cubic cells are 1,2 and 4 respectively In both the hcp and ccp of spheres, the number of tetrahedral voids per sphere is two while the octahedral voids is one.

The C.N of cation occuppying an octahedral vois is:

A. 4

B. 6

C. 8

D. 12

Answer: B

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4. In an ideal crystal, the entropy of the constituents at absolute zero temperature (0K) is zero. However, the crystals generally suffer from certain defects also called imperfections They may be both electronic and atomic in nature. The atomic imperfections may be stoichiometric (Schottky and Frenkel defects) or non-stoichiometric (metal excees and metal deficiency defects). In addition to these, there are impurity defects which are caused by the addition of certain impurities of metals and this is known as dopping. The dopping leads to semi conductors which may be either n-type or p-type in nature.

Ionic solids with Schottky defects contain in their structure

A. Equal number of cation and anion vacancies

B. Anion vacancies and interstitial anions

C. Cation vacancies

D. Cation vacancies and interstitial cations

Answer: A

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5. In an ideal crystal, the entropy of the constituents at absolute zero temperature (0K) is zero. However, the crystals generally suffer from certain defects also called imperfections They may be both electronic and atomic in nature. The atomic imperfections may be stoichiometric (Schottky and Frenkel defects) or non-stoichiometric (metal excees and metal deficiency defects). In addition to these, there are impurity defects which are caused by the addition of certain impurities of metals and this is known as dopping. The dopping leads to semi conductors which may be either n-type or p-type in nature.

Which of the following is correct ?

A. Schottky defect lowers the density of crystals

B. Frenkel defect increases the dielectric constant of crystals

C. Stoichiometric defects make crystals good conductors of electricity

D. All the three are correct

Answer: D

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6. In an ideal crystal, the entropy of the constituents at absolute zero temperature (0K) is zero. However, the crystals generally suffer from certain defects also called imperfections They may be both electronic and atomic in nature. The atomic imperfections may be stoichiometric (Schottky and Frenkel defects) or non-stoichiometric (metal excees and metal deficiency defects). In addition to these, there are impurity defects which are caused by the addition of certain impurities of metals and this is known as dopping. The dopping leads to semi conductors which may be either n-type or p-type in nature.

Silicon doped with arsenic is

A. p-type semi - conductor

B. n-type semi-conductor

C. like a metallic conductor

D. an insulator

Answer: B

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7. In an ideal crystal, the entropy of the constituents at absolute zero temperature (0K) is zero. However, the crystals generally suffer from certain defects also called imperfections They may be both electronic and atomic in nature. The atomic imperfections may be stoichiometric (Schottky and Frenkel defects) or non-stoichiometric (metal excees and metal deficiency defects). In addition to these, there are impurity defects which are caused by the addition of certain impurities of metals and this is known as dopping. The dopping leads to semi conductors which may be either n-type or p-type in nature.

Zinc oxide (ZnO) is white when cold and yellow when hot. It is due to the development of :

A. Frenkel defect

B. Schottky defect

C. Metal excees defect

D. Metal deficiency defect

Answer: C

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8. In an ideal crystal, the entropy of the constituents at absolute zero temperature (0K) is zero. However, the crystals generally suffer from certain defects also called imperfections They may be both electronic and atomic in nature. The atomic imperfections may be stoichiometric (Schottky and Frenkel defects) or non-stoichiometric (metal excees and metal deficiency defects). In addition to these, there are impurity defects which are caused by the addition of certain impurities of metals and this is known as dopping. The dopping leads to semi conductors which may be either n-type or p-type in nature.

In stoichiometric defects, the ratio of positive and negative ions as indicated by chemical formula of the compound:

A. decreases

B. increases

C. remains same

D. cannot be predicted

Answer: C

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9. In an ideal crystal, the entropy of the constituents at absolute zero temperature (0K) is zero. However, the crystals generally suffer from certain defects also called imperfections They may be both electronic and atomic in nature. The atomic imperfections may be stoichiometric (Schottky and Frenkel defects) or non-stoichiometric (metal excees and metal deficiency defects). In addition to these, there are impurity defects which are caused by the addition of certain impurities of metals and this is known as dopping. The dopping leads to semi conductors which may be either n-type or p-type in nature.

Which is the correct statement regarding F-centres ?

A. Electrons are held in the voids of the crystals

B. F-centres impart colour to the crystals

C. Conductivity of crystals increases due to F-centres

D. All the three statements are correct

Answer: D

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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 space-cilling 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 number of atom in this hcp unit cell is

A. 4

B. 6

C. 12

D. 17

Answer: B

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11. 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 space-cilling 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. $24\sqrt{2}r^3$

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

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

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

Answer: A

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12. 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 space-cilling 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 empty space in this hcp unit cell is

A. 74%

B. 97.6%

C. 32%

D. 26%

Answer: D

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13. Packing refers to the arrangement of constituent units in such a way that the forces of attraction among the constituent particles is the maximum and the contituents occupy the maximum available space. In two dimensions, there are hexagonal close packing and cubic close packing. In three dimentions, there are hexagonal, cubic as well as body centred close packings.

The empty space left in hcp packing is:

A. 26%

B. 74%

C. 52.4%

D. 80%

Answer: A

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14. Packing refers to the arrangement of constituent units in such a way that the forces of attraction among the constituent particles is the maximum and the contituents occupy the maximum available space. In two dimensions, there are hexagonal close packing and cubic close packing. In three dimentions, there are hexagonal, cubic as well as body centred close packings.

The pattern of successive layers in ccp arrangement is:

A. ABABAB...

B. ABABC ABABC...

C. ABCABCABC...

D. AB BA AB BA...

Answer: C

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15. Packing refers to the arrangement of constituent units in such a way that the forces of attraction among the constituent particles is the maximum and the contituents occupy the maximum available space. In two dimensions, there are hexagonal close packing and cubic close packing. In three dimentions, there are hexagonal, cubic as well as body centred close packings.

The space occupied by spheres in bcc arrangement is:

A. 74 %

B. 70%

C. 68%

D. 60.4%

Answer: C

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16. Packing refers to the arrangement of constituent units in such a way that the forces of attraction among the constituent particles is the maximum and the contituents occupy the maximum available space. In two dimensions, there are hexagonal close packing and cubic close packing. In three dimentions, there are hexagonal, cubic as well as body centred close packings.

A certain oxide of a metal M crystallises in such a way that O^{2-} ions occupy hcp arrangement following ABAB... pattern. The metal ions however occupy $2/3$ rd of the octahedral voids. The formula of the compound is :

A. M_2O_3

B. M_3O

C. $M_{8/3}O_3$

D. MO_2

Answer: A

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Straight objective

1. The material used in solar cells contains

A. Cs

B. Si

C. Sn

D. Ti

Answer: B

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2. In the calcum fluaride structure, the coordination bumber of the cations and anions are respectively ,

A. 6 and 6

B. 8 and 4

C. 4 and 4

D. 4 and 8

Answer: B

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3. 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?

A. $74\ \%$

B. $26\ \%$

C. $50\ \%$

D. none of these

Answer: B

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4. The cordination number of a metal crystallising in a hexagonal close-packed structure is:

A. 12

B. 4

C. 8

D. 6

Answer: A

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5. 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

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6. A substance A_xB_y crystallises in a face centred cubic (fcc) lattice in which atoms 'A' occupy each corner of the cube and atoms 'B' occupy the centres of each face of the cube identify the correct formula of the compound.

A. AB_3

B. A_4B_3

C. A_3B

D. Formula cannot be specified

Answer: A

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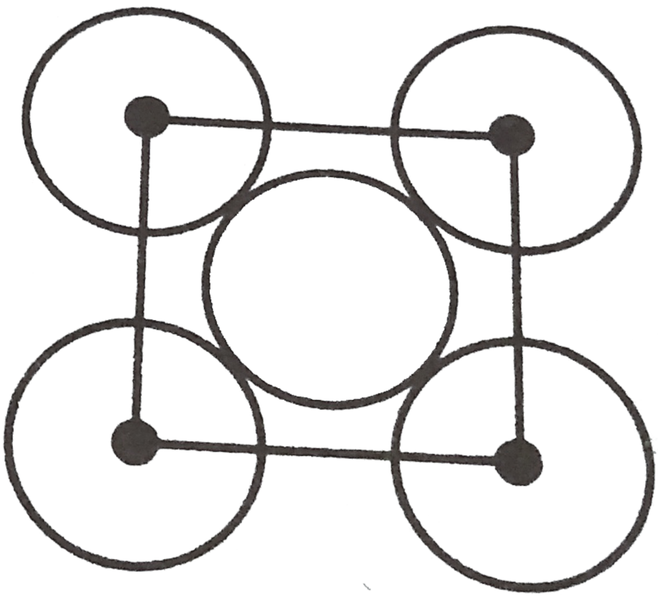
7. The packing efficiency of the two dimensional square unit cell shown below is:



A. 39.27%

B. 68.02%

C. 74.05%

D. 78.54%

Answer: D

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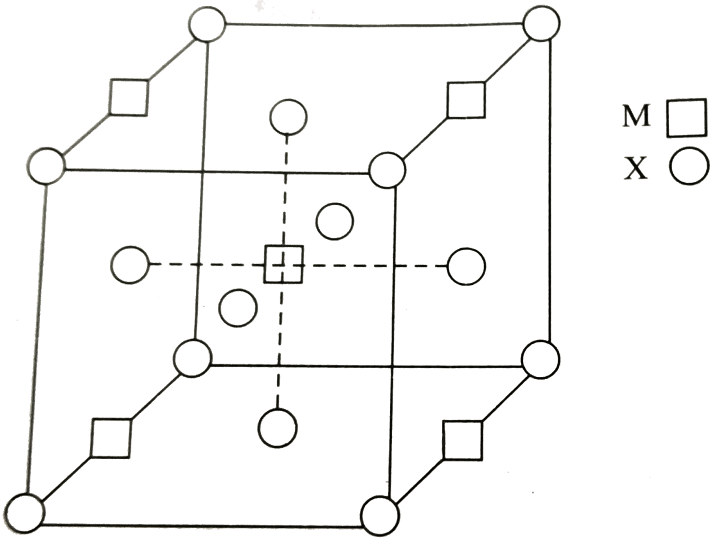
8. A compound M_pX_q has cubic close packing (p) arrangement of X. Its unit cell structure is shown below. The empirical formula of the compound is



a. MX b. MX_2 c. M_2X

A. MX

B. MX_2

C. M_2X

D. M_5X_{14}

Answer: B

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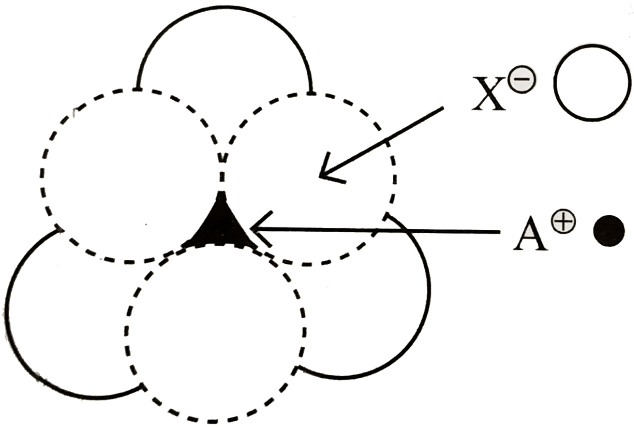
9. The arrangement of $X^{\ominus}$ ions around $A^{\oplus}$ ion in solid AX is given in the figure (not drawn to scale). If the radius of $X^{\ominus}$ is $250 \pm$, the radius of $A^{\oplus}$ is



A. 104 pm

B. 125 pm

C. 183 pm

D. 57 pm

Answer: A

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10. In the closest packing of atoms

A. Coordination number of particles placed in tetrahedral voids is smaller than octahedral voids.

B. Size of tetrahedral void is larger than that of octahedral void

C. Size of voids depend upon size of atoms of atoms and tetrahedral void is smaller than octahedral void

D. Radius ratio for tetrahedral voids is smaller than octahedral void

Answer: A::C::D

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11. Incorrect option (s) about NaCl structure is/are

A. 4 corners are shared

B. 12 edges are shared

C. 6 corners and 2 edges are shared

D. 3 edges and 3 faces are shared

Answer: A::C::D

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12. CsCl structure is interchanged into NaCl structure. This can be done because

A. Temperature is increased

B. Pressure is decreased

C. Temperature is decreased

D. Pressure is increased

Answer: A::B

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13. Which of the following statements are correct ?

A. In a body- centred cubic unit cell, the C.N is 12

B. The C.N. of each type of ion in CsCl is 8

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

D. $r_{Na^+} = 95\text{pm}, r_{Cl^-} = 181\text{pm}$, then the edge length of the unit cell of NaCl is 552pm

Answer: B::C::D

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14. Glasses and plastics are

A. amorphous solids

B. super cooled liquids

C. isotropic

D. ferromagnetic

Answer: A::B

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15. Which is true ? If radius ratio r^{+} / r^{-}

A. is $0.732 \text{to} 0.414$ co-ordination number is 6

and is octahedral

B. is above 0.732 , co-ordination number is 8

and is cubic

C. is $0.225 \text{to} 0.155$ co-ordination number is 3

and is triangular

D. is $0.732 \quad \text{to} \quad 0.878,$ co-ordination number

is 8 and is cubic

Answer: A::B::C

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16. Which is true

A. Piezoelectricity is due to net - dipole movement

B. Some electric current is produced on heating polar crystals, this is pyro electricity

C. Ferroelectricity is due to allignment of dipole in the same direction

D. Ferrielectricity is due to alligment of dipole in the same direction

Answer: A::B::C

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17. Which of the following are not the characteristics of crystalline solids ?

A. They are isotropic

B. They exhibit polymorphism

C. After melting, they become non - crystalline

D. They donot have thermodynamic defects

Answer: A::D

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18. Choose the correct statements out of the following

A. Quartz is a three dimensional silicate

B. There is no effect of density on the solid having Frenkel defect

C. Group 14 elements doped with group 13 elements produce n-type semi conductors

D. Ferrimagnetic substances possess large magnetic moment

Answer: A::B

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19. Which of the following statements are correct ?

A. The co-ordination number of each type of ions in CsCl crystals is 8

B. A metal which crystallises in bcc structure has co-ordination number of 12

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

D. The length of a unit cell in NaCl is 552pm

$$(r_{Na^+} = 95\text{pm} r_{Cl^-} = 181\text{pm})$$

Answer: A::C::D

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20. The corrent statement regarding defects is solids in solids is

A. Frenkel defect is usually favoured by a very small difference in the sizes of cation and anion

B. Frenkel defect is a dislocation defect

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

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

Answer: B::C

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21. Diamond is:

A. a covalent solid

B. non-conductor

C. a lubricant

D. sp^3 hybridised

Answer: A::B::C

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22. Select the correct statements (s)

A. Under high pressure, the co-ordination no. increases from $6:6 \text{to} 8:8$

B. Under high pressure, the co-ordination no.decreases from $8:8 \text{ to } 6:6$

C. At high temperature, co-ordinate no. decreases

D. At 760 K, CsCl structure changes into NaCl structure

Answer: A::C::D

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23. What is true about a bcc unit cell?

A. Number of atoms in the unit cell is 2

B. In addition to atoms at the centre of the body, in the unit cell there are eight different corners

C. $1/8$ atom at each corner of the unit cell

D. None of the above

Answer: A::B::C

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24. Which of the following statements is (are) correct ?

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

B. A metal that crystallizes in bcc structure has a 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 unit cell in NaCl is 552pm

$(r_{Na^+} = 95\text{pm}, r_{Cl^-} = 181\text{pm})$

Answer: A::C::D

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25. Which of the following statements is/are consistent with the properties of a molecular solid ?

A. A low melting solid

B. A compound which conducts electricity when molten

C. A solid which is a non - conductor of electricity

D. A solid formed by the combination of two non-metallic elements

Answer: A::C::D

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

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

B. The efficiency of 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

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A.R

1. Statement : Schottky defect is generally shown by the compounds with high co – ordination no.

Explanation : Equal no. of cations and anions are missing from the lattice sites in Schottky defect.

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: B

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2. Assertion (A) : $CsCl$ crystal, the coordination number of $Cs^{\oplus}$ ion is 8.

Reason (R) : $Cl^{\ominus}$ ion in $CsCl$ adopt b type of packing,

A. If both assertion and reason are correct and reason is correct explanation for

assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: C

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3. Assertion (A) : Covalent crystals have higher melting point.

Reason (R) : Covalent bonds are stronger than ionic bonds.

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: C

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4. Assertion: Hexagonal close packing in more light than cubic close packing.

Reason: Hexagonal close packing has C.N of 12 whereas cubic close packing has C.N. of 8.

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: D

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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 correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: B

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6. Statement I: In any ionic solid $[MX]$ with Schottky defect, the number of positive and negative ions are same.

Statement II: An equal number of cation and anion vacancies is present.

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

assertion

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: A

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7. Assertion: In sodium crystal, the co-ordination number of Na^+ ion is six

Reason: Sodium atom is smaller in size than chlorine atom

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: B

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8. Assertion: Crystalline solids are anisotropic.

Reason: Cystalline solids are not as closely packed as ionic solids.

A. If both assertion and reason are correct and reason is correct explanation for

assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: C

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9. 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 correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: D

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10. Assertion: In a close packing of spheres, a tetrahedral void is surrounded by four spheres whereas an octahedral void is surrounded by six spheres.

Reason: A tetrahedral void has a tetrahedral shape while an octahedral void has an octahedral shape

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: C

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11. Assertion :In $NaCI$crystal each Na^{+} ion is tourching $6CI^{-}$ ion but these CI^{-} ion do not touch each other

Reason:The radius ratio is greater than 0.414 required forexact fitting

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: B

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12. Statement : Due to Frenkel defect the density of the crystalline solid remains same.

Explanation : In Frenkel defect, no cations or anions leave the lattice.

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: A

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13. Assertion : On heating ferromagnetic or ferromagnetic substance , they become paramagnetic

Reason :The electrons change their spin on heating

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

assertion

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: A

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14. Assertion (A) : The electrical conductivity of a semiconductor increases with increase in temperature.

Reason (R) : With increase in temperature, large number of electrons from the valence band can jump to the conduction band.

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: A

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15. Assertion (A) : Group-13-doped crystals of Si are called p-type semiconductors.

Reason (R) : Positive holes are reasponsible for the semiconducting properties.

A. If both assertion and reason are correct and reason is correct explanation for

assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: A

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16. Assertion (A) : Graphite is an example of tetragonal crystal system.

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

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: D

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17. Band gap in germanium is small.

The energy spread of each germanium atomic energy level is infinitesimally small.

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: B

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18. STATEMENT -1 : In NaCl structure , Na^{+} ion occupy octahedral holes and Cl^{-} ions occupy ccp.

STATEMENT -2 : The distance of the nearest neighours in NaCl structure is $a/2$ where a is the edge length of the cube .

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: A

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19. Assertion: In the body centred cubic structure of CsCl the arrangement of Cl^- ions is primitive

Reason: In CsCl, the Cs^+ ion remains at the body centred position and Cl^- ions at the corners.

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: A

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20. Assertion: Diamond has a ccp arrangement in which corners, face centres and alternate tetrahedral holes are occupied by C atoms

Reason: In diamond, C atoms at corners are sp^3 hybridised but at the face centres these are sp^2 hybridised

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: C

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21. Assertion: Metals are generally good conductors of electricity

Reason: Electrical conductivity of metals is due to Schottky type of defects

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: C

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22. Assertion: p-type semiconductors are good conductors of electricity due to metal excees defects

Reason: f-centres are created due to metal excess defects

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: D

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23. Assertion: Increase in dielectric constant is observed for crystals having Frenkel defect

Reason: Similarly charged cations come closer in the crystal lattice

A. If both assertion and reason are correct and reason is correct explanation for

assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: A

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24. Assertion: Every 4th layer is identical to first layer in ccp pattern of three dimension arrangement

Reason: ABCABC.... Arrangement is present in ccp

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: A

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25. Assertion: bcc and hcp have same packing efficiency

Reason: Both have same number of atoms per unit cell and same arrangement

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: D

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26. Assertion : The number of tetrahedral voids is double the number of octahedral voids

Reason : The size of the tetrhedral voids is half of that of the ochedral void

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: C

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27. Assertion: Metal dificiency defect can be seen in FeO.

Reason: Li compound (LiCl) has pink colour due to F-centre

A. If both assertion and reason are correct and reason is correct explanation for assertion

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

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: B

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Integer

1. What is the co-ordination number of sodium in Na_2O ?

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2. Al (Atomic mass =27) crystallises in a cubic system with edge length (a) equal to 4Å its density is $2.7gcm^{-3}$ Calculate the number of aluminium atoms present per unit cell

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3. The number of atoms per unit cell in a simple cube, face $-$ centred cube and body $-$ centred cube are respectively :

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4. What is the C.N of Cl^- ions in NaCl crystals ?

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5. In a simple or primitive unit cell, what is the number of atoms per unit cell ?

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6. Calculate the number of atoms in a cubic-shared unit cell having one atom on each corner and two atoms one each diagonal.

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7. A cubic solid is made of two element P and Q Atoms of Q are the corners of the cube P at the body-centre. What is the formula of the compound? What are the coordination number fo P and Q?

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

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9. What is the total no of planes of symmetry in a cube ?

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10. What is the number of unit cells in 936 amu of sodium chloride ?

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11. In hcp arrangement the C.N. of atoms in the middle layer is......

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

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13. 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 $8 g cm^{-3}$, then the number of atoms present in 256g of the crystal is $N \times 10^{24}$. The value of N is

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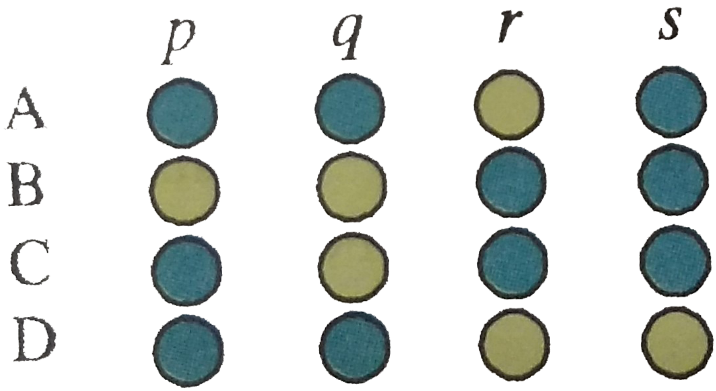
Matrix

1. Match the statements (A,B, C, D) in Column I with statements (p, q, r, s) in Column II The answer to the question have to be property bubbled

	Column I	Column II
(A)	Ice	(p) Tetrahedral
(B)	Nitre	(q) Hydrogen bonded
(C)	Diamond	(r) High melting
(D)	Ammonia	(s) Crystalline solid



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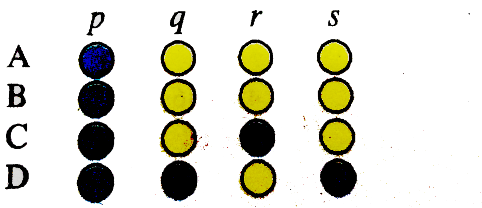
2. Match the following columns

Column I		Column II	
(A)	Cubic close packing	(p)	C.N. = 12
(B)	Hexagonal close packing	(q)	74% occupancy
(C)	Simple cubic	(r)	Primitive
(D)	Face centred cubic	(s)	Non-primitive.



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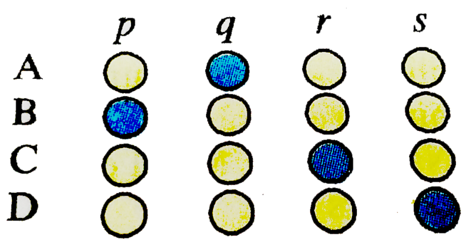
3. Match the following columns

Column I	Column II
(A) Ferromagnetic	(p) $BaTiO_3$
(B) Ferroelectricity	(q) CrO_2
(C) Antiferroelectricity	(r) $PbZrO_3$
(D) Ferrimagnetic	(s) Fe_3O_4



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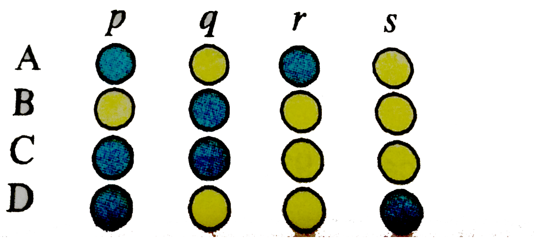
4. Match the following columns

10.

Column I	Column II
(A) NaCl	(p) Schottky defect
(B) ZnS	(q) Frenkel defect
(C) AgBr	(r) Develops yellow colour on heating due to F-centre
(D) KCl	(s) Develops blue/ yellow colour on heating due to F-centre



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Brain storming

1. 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

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2. At what angle for the first - order diffraction, spacing between two planes respectively is λ and $\frac{\lambda}{2}$?

A. $0^\circ, 90^\circ$

B. $90^\circ, 0^\circ$

C. $30^\circ, 90^\circ$

D. $90^\circ, 30^\circ$

Answer: C

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3. It is stated that ZnS does not crystallise in the NaCl structure it is due to:

A. The r^{+}/r^{-} ratio is 0.402 too low to avoid anion anion contact as in the NaCl stucture

B. ZnS is water insoluble, NaCl is water soluble

C. ZnS is water soluble, NaCl is water insoluble

D. Zn belongs to d-block, Na belongs to s-block

Answer: A

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4. In solid ammonia, each NH_3 molecule has six other NH_3 molecules as nearest neighbours. ΔH sublimation of NH_3 at the melting point is $30.8 kJ mol^{-1}$, and the estimated ΔH sublimation in the absence of hydrogen bonding is $14.4 kJ mol^{-1}$. the strength of a hydrogen bond is NH_3 is

A. $5.47 kJ \text{ mol}^{-1}$

B. $10.93 kJ \text{ mol}^{-1}$

C. $16.40 kJ \text{ mol}^{-1}$

D. $-16.4 kJ \text{ mol}^{-1}$

Answer: A

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5. The density of KBr is $2.75 gcm^{-3}$. 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. Unit cell is fcc

B. Z=4

C. There are four constituents in the unit cell

D. There are 8 lines at the corners and 6 ions at the centres of the faces

Answer: A::B::C::D

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6. In a cubic packed structure of mixed oxides the lattice is made up of oxide ions. One fifth of tetrahedral voids are occupied by divalent (X^{2+}) ions, while one - half of the octahedral voids are occupied by trivalent ions (Y^{3+}) then the formula of the oxide is:

A. XY_2O_4

B. X_2YO_4

C. $X_4Y_5O_{10}$

D. X_3YZ

Answer: C

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7. If there elements X, Y & Z crystallize in cubic solid latice with X atoms at corners, Y atoms at cube centre & Z-atoms at the edges, then the formula of the compound is

A. XYZ

B. XY_3Z

C. XYZ_3

D. X_3YZ

Answer: C

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8. The limiting radius ratios of the complexes $\left[Ni(CN)_4\right]^{2-}$ and $\left[NiCl_4\right]^{2-}$ are respectively

A. $0.225 - 0.414, 0.225 - 0.414$

B. $0.414 - 0.732, 0.414 - 0.732$

C. $0.225 - 0.414, 0.414 - 0.732$

D. $0.414 - 0.732, 0.225 - 0.414$

Answer: A

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9. KCl crystallises in the same type of lattice as does NaCl Given that $r_{Na^+} / r_{Cl^-} = 0.55$ and

$r_{K^+}/r_{Cl^-} = 0.74$, the ratio of the side of unit cell for KCl to that of NaCl is

A. 1.122

B. 0.891

C. 1.414

D. 0.414

Answer: A

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10. 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

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