CHEMISTRY

JEE MAIN AND ADVANCED

THE SOLID STATE

Example

1. 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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2. The number of atoms in a cubic based unit cell having one atom on each corner and two atoms on each body diagonal is

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3. Potassium crystallizes in a body centred cubic lattice. How many unit cells are present in 2g potassium ? (At. Mass of K=39)

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4. 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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5. 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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6. A unit cell consists of a cube in which X atoms at the corners and Y atoms are at the face centres. If two atoms are missing from two corners of the unit cell , what is the formula of the compound ?

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7. A solid is made of two elements X and Y. Atoms X are in fcc arrangement and Y atoms occupy all the octahedral sites and alternate

tetrahedral sites. What is the formula of compound ?

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

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9. 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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10. 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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11. In a solid AB, A atoms have a ccp arrangement and B atoms occupy all the octahedral sites. If all the face-centred atoms along one of the axes passing through body centres are removed, then what will be the resultant stoichiometry of compound ?

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12. Br^- ions form a close packed structure. If the radius of Br^- ions is 195 pm, calculate the radius of the cation that just fits into the tetrahedral hole. Can a cation A^+ having a radius of 82 pm be shipped into be octahedral hole of the crystal A^+Br^- ?

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13. 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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14. 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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15. KF and NaCl struture. If the distance between K^+ and F^- is 269 pm, find the denisty of KF ($N_A = 6.02 \times 10^{23} \text{mol}^{-1}$ a atomic mass of copper = 63.5

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16. 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?

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

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

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

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19. Iron oxide has formula $Fe_{0.94}O$. What fraction of Fe exists as Fe^{+3} ?

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

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21. 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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22. If the atoms touching one of the 2-fold, 3-fold and 4-fold axis of symmetry are removed , then formula of compound is _____

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23. if the atoms touching one of the reactangular planes of symmetry and one of the 4-fold axis of symmetry are removed , then formula of compound is _____

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24. In a CCP structure, calculate the minimum distance two tetrahedral voids.

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25. Find out of 1st,2nd and 3rd coordination number for an atom located at the corner in a simple cubic unit cell

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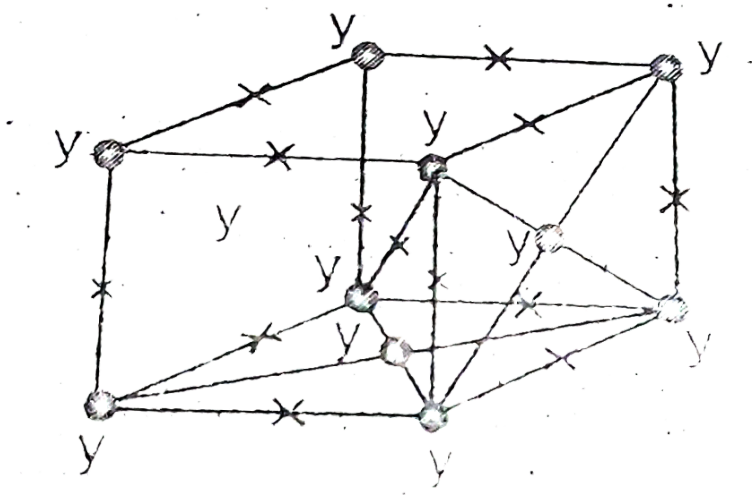
26. In a CCP structure of compound XY, X atoms are present at octahedral voids. Calculate the number of nearest neighbours upto 6th C.N. for an X atom located at body centre.



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27. A cubic solid has two different atoms P & Q. Atoms P are present at comers and Q at the centre of the cube. What is the formal of unit cell ?

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30. A compound is made up of two elements A & B, having cubic structure. Atoms A occupy corners as well as face centre whereas atoms B occupy edge centre as well as body centre. What is formula of the compound ?

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31. A compound representing alloy of gold and copper crystallises in a cubic lattice in which gold atoms occupy the lattice points at the corners of a cube and copper atoms occupy the centres of each of the cubic faces. Find formula of compound.

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tetrahedral sites. What is the formula of compound ?

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

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Try Yourself

1. why are solids incompressible ?

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2. Classify the following solids into amorphous or crystalline solids.

Bakelite, Platinum , Camphor , Oxalic acid , Melamine formaldehyde, Alum , Neoprene, Sugar , Solid CO_2 , Polythene.

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3. Thermal conductivity of a solid has different values along different directions. What kind of solid is this ? Also comment on its melting point .

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4. Classify the following solids into four categories based on intermolecular forces of interaction.

Caesium chloride, Solid carbon disulphide , Bronze ,Neon ,Boron nitride, Washing soda , Carborundum , Corrudum , Solid NH_3, Solid camphor , Silver , Silica

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5. Three elements P, Q and R crystallize in a cubic solid lattice. The P atoms occupy the

corners. Q atoms the cube centres and R atoms the edges. The formula of the compound is

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

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

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

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10. 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:

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11. In a crystalline solid, anions B are arranged in ccp structure. Cations A are equally distributed between octahedral and

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

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15. 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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16. A compound AB crystallizes in bcc lattice with unit edge length of 380 pm. Calculate (i)The distance between oppositely charged

ions in the lattice.

(ii)Radius of A^+ if radius of B is 175 pm

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17. 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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18. 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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19. Formula mass of $NaCl$ is $58.45gmol^{-1}$ and density of its pure form is $2.167gcm^{-3}$. 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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20. An element occurs in bcc structure with edge length of 288 pm. Its density is $7.2 g / cm^3$ Calculate atomic mass of element.

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21. Thallium chloride TlCl crystallises in either a simple cubic lattice or fcc lattice of Cl^- ions with Tl^+ ions in voids. If the density of solid is $7\mathrm{g/cm}^3$ and edge length of unit cell is 3.85×10^{-8} cm. What is the geometry of unit cell ? (At. number of Tl=204.37 & Cl=35.5)

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22. An element with atomic mass 60 having fcc structure has a density of $6.23\mathrm{g/cm}^3$.What is

the edge length of unit cell ?

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23. 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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24. 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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25. Atoms A,B,C and D are present at corners, face centres , body-centres and edge-centres respectively, in a cubic unit cell.if two atoms from corners and two from face-centres are

removed, then what is the formula of compound ?

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26. Which types of Bravais lattice is not present in cubic crystal system ?

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27. Name the type of crystal systems of NaCl and Borax.

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28. A cubic unit cell has eight edge-centres. (true/false)

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29. Atoms A,B,C, D are present at corners , face-centres , body-centres and edge-centres respectively

(a)If the atoms touching all the rectangular

planes of symmetry are removed, then what is the formula of the compound ?

(b)If body centre is at origin and the atoms present in (or touching) first octant are removed, then what is the formula of the compound ?

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30. Atoms A,B,C and D are present at edge centres, body-centre, corners and face-centres respectively. if body centred atom touching to

surface spheres. if touching spheres are removed then find the formula of the compound.

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31. In a HCP unit-cell, if total number of atoms per unit cell gets halved, then what is the percentage void in unit cell ?

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32. Total number of T-voids and O-voids in HCP and CCP structures are different . (True/False)

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"exist" as Ni^{2+} and Ni^{3+} ions?

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Assignment Section A Objective

1. Amorphous substances show

(A) short and long range order

(B) short range order

(C) long range order(D) have no sharp $M.P$

A. I & III

B. II & III

C. III & IV

D. II & IV

Answer: D

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2. Malleability and ductility of metals can be accounted due to

A. The capacity of layers of metal ions to slide over the other

B. The crystalline structure in metal

C. Presence of electrostatic with metal ions

D. Interaction of electrons with metal ions.

Answer: A

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3. Which of the following do not match

A. Plastic : amorphous solid

B. Graphite : Metallic solid

C. P_4O_{10} : Molecular solid

D. SiC-covalent solid

Answer: B

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4. In which of the following pairs, both the crystals are not of the same type ?

A. Ice , Solid CO_2

B. NaCl , BaO

C. Mg,Ar

D. SiC, diamond

Answer: C

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5. Among solids highest mp is observed for

A. Covalent solids

B. Ionic solids

C. Pseudo solids

D. Molecular solids

Answer: A

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

A. They posses high mp and bp ?

B. All are electrolyte

C. Exhibit the property of isomorphism

D. Exhibit directional properties of the bond

Answer: D

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7. The ability of a substance to exist in two or more crstaline forms knows as:

A. Amorphism

B. isomorphism

C. Polymorphism

D. isomerism

Answer: C

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8. In which of the following pairs both the solids belong to same type ?

A. SiC, AlN

B. CaF_2, Ca

C. Graphite , Ice

D. Solid CO_2 , ZnS

Answer: A

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9. In graphics carbon atoms are joined togather due to

A. Ionic bonding

B. vander Waals forces

C. metallic bonding

D. Covalent bonding

Answer: D

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10. How many formula units are there in the unit cell of sodium chloride ?

A. 2

B. 4

C. 6

D. 8

Answer: B

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11. In a tetragonal crystal

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

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

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

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

Answer: B

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12. The most unsysmmetrical and symmeterical systems are, respectively:

A. Tetragonal, cubic

B. Triclinic, cubic

C. Rhombohedral, hexagonal

D. Orthorhombic, cubic

Answer: B

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13. Which of the following systems do not give correct discription of axial lengths and axial angles ?

A. Hexagonal a=b $\neq$ c

$$\alpha = \beta = 90^\circ, \gamma = 120^\circ$$

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

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

D. Cubic a=b=c $\alpha = \beta = \gamma = 90^\circ$

Answer: C

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

A. $32\ \%$

B. $34\ \%$

C. $28\ \%$

D. $30\ \%$

Answer: A

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15. 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_3

C. x_2y_3

D. x_2y

Answer: B

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16. A solid compound contains X,Y and Z atoms in a cubic lattice with X atoms occupying the corners ,Yatoms in the body centred position and Z atoms at the centre of the faces of the unit cell .What is the empirical formula of the compound?

A. xy_2z_3

B. $x_2y_2z_3$

C. xyz_3

D. xyz

Answer: C

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

A. 12

B. 4

C. 8

D. 6

Answer: A

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

A. 8

B. 4

C. 2

D. 6

Answer: D

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19. The simplest unit of three dimensional arrangement of lattice points which sets the pattern for whole lattice is callled

A. Space lattice

B. Simple lattice

C. Unit cell

D. Crystal lattice

Answer: C

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20. 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. Rhombohedral

Answer: B

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21. 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. N

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

C. 2N

D. 4N

Answer: C

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22. In an ionic compound XY_2O_4 oxide ions are arranged in ccp. Cations X are present in octahedral voids.Cations Y are equally distributed between octahedral voids occupied is

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

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

C. $\frac{1}{8}$

D. $\frac{1}{6}$

Answer: A

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

A. octahedral

B. Body centred cubic

C. Face centred cubic (fcc)

D. Simple cubic

Answer: B

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24. Which of the following is ferromagnetic compound ?

A. $BaTiO_3$

B. $K_4Fe(CN)_6$

C. $Pb_2^- O_3$

D. Al_2C_3

Answer: A

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

A. $\frac{20}{3}\pi r^3$

B. $\frac{24}{3}\pi r^3$

C. $\frac{12}{3}\pi r^3$

D. $\frac{16}{3}\pi r^3$

Answer: D

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26. The intermetallic compound $LiAg$ crystallizes in cubic lattice in which both

lithium and silver have coordination number of 8. The crystal class is

A. bcc

B. Simple lattice

C. fcc

D. hcp

Answer: A

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

A. $1:1$

B. $1:2$

C. $1:3$

D. $2:1$

Answer: B

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

A. 4 and 2

B. 9 and 14

C. 14 and 9

D. 2 and 4

Answer: D

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29. The edge of unit of $FCCXe$ crystal is 620 pm .The radius of Xe atom is

A. 213.25 pm

B. 235.16 pm

C. 189.37 pm

D. 209.87 pm

Answer: A

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30. The number of atoms in $100gan f$ crystal with density $d = 10g/cm^3$ and the edge equal to 100 pm is equal to

A. 4×10^{25}

B. 3×10^{25}

C. 2×10^{25}

D. 1×10^{25}

Answer: A

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31. The interatomic distance for bcc crystal is

A. a

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

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

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

Answer: C

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32. The cubic unit cell of a metal (molar mass= 63.55 mol^{-1}) has an edge length of 362pm. Its density is $8.92 gcm^{-3}$. The type of unit cell is

A. Primitive

B. Face centred

C. Body centred

D. End centred

Answer: B

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33. $CsBr$ 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. 8.25g/cm^3

B. 0.425g/cm^3

C. 4.25g/cm^3

D. 0.825g/cm^3

Answer: C

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34. 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. Lil

Answer: C

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35. Lithium metal crystallizes in a body centred cubic crystals. If the length of the side of the unit cell of lithium is $351pm$ the atomic radius of the lithium will be

A. 240.8 pm

B. 151.9 pm

C. 75.5 pm

D. 300.5 pm

Answer: B

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36. Coordinating number of Na^+ in $NaCl$ is

A. 6

B. 8

C. 4

D. 1

Answer: A

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37. Body -centred cubic lattice has a corrdination number of

A. 4

B. 6

C. 12

D. 8

Answer: D

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38. 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. 8

C. 6

D. 12

Answer: D

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39. 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. $A_{3/4}B_3$

Answer: B

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40. Which of the following unit cell is not possible for monoclinic crystals ?

A. Primitive

B. End centre

C. face centre

D. All of these

Answer: C

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41. Which defect causes decreases in the density of crystal?

A. Frenkel

B. Schottky

C. Interstitial

D. F-centre

Answer: B

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42. Schottky defect occurs mainly in electrovalent compounds where

A. Positive ions have large sizes

B. Negative ions have small sizes

C. Positive and negative ions are of similar size

D. Positive ions are big and negative ions are small

Answer: C

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43. Which one of the following is the correct statement ?

A. Brass is an interstitial alloy , while steel is a substitutional alloy

B. Brass is a substitutional alloy, while steel is an interstitial alloy

C. Brass and steel are both substitutional alloys

D. Brass and steel are both interstitial alloys

Answer: B

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

A. Frenkel defect

B. Interstitial defect

C. F-centres

D. Schottky defect

Answer: C

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45. Doping silicon with boron produces a -

A. Insulator

B. metal

C. n-type semiconductor

D. p-type semiconductor

Answer: D

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46. What type of crystal defect is indicated in the diagram given below :

Na^+	Cl^-	Na^+	Cl^-	Na^+	Cl^-
Cl^-	$\square$	Cl^-	Na^+	$\square$	Cl^-
Na^+	Cl^-	$\square$	Cl^-	Na^+	Cl^-
Cl^-	Na^+	Cl^-	Na^+	$\square$	N^+

A. Interstitial defect

B. Schottky defect

C. Frenkel defect

D. Frenkel and Schottky defect

Answer: B

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

A. 5.96×10^{-3}

B. 5.96

C. 5.96×10^{-2}

D. 5.96×10^{-1}

Answer: A

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48. The non-stoichiometric compound $Fe_{0.94}O$ is formed when some Fe^{+2} ions are replaced

by Fe^{+3} ions. What is the percentage of Fe^{+3} ions in this ionic lattice ?

A. $18\ \%$

B. $25\ \%$

C. $13\ \%$

D. $6\ \%$

Answer: C

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

A. 2

B. 6

C. 3

D. 1

Answer: B

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50. A binary solid $\left(A^{+}B^{+}\right)$ 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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Assignment Section B Objective

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. Schottky defect

C. Valency defect

D. Frenkel defect

Answer: D

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2. In Zinc blende structure, Zn^{+2} ions are present in alternate tetrahedral voids and S^{-2} in ccp. The coordination number of Zn^{+2} and S^{-2} are respectively

A. 8,8

B. 4,4

C. 4,8

D. 8,4

Answer: B

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3. Which one of the following statements is incorrect ?

A. Crystalline solids have sharp melting and boiling points

B. FCC possesses closest packing of atoms in it

C. Increase in pressure in ionic solids may decrease coordination number

D. NaCl has 6:6 coordination number

Answer: C

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4. An element (At. Mass =50 g/mol) having fcc structure has unit cell edge length 400 pm. The density of element is

A. 5.188 g/cc

B. 10.376 g/cc

C. 2.56 g/cc

D. 1.2 g/cc

Answer: A

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5. 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. 144 pm

B. 288 pm

C. 398 pm

D. 618 pm

Answer: A

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6. 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

A. AB

B. AB_2

C. A_2B

D. A_2B_3

Answer: C

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7. A TV in fcc is formed by atoms at

A. 3 corners + 1 face centre

B. 3 face centres + 1 corner

C. 2 face centres + 2 corners

D. 2 face centres + 1 corner + 1 body centre

Answer: B

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8. Which of the following has highest number of formula units per unit cell ?

A. NaCl type structure

B. Na_2O type structure

C. CaF_2 type structure

D. All have same number of formula unit

Answer: D

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9. Which defect causes decreases in the density of crystal?

A. Schottky defect

B. Frenkel defect

C. Interstitial defect

D. Metal excess defect

Answer: A

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10. The number of atoms in $100gan f$ crystal with density $d = 10g/cm^3$ and the edge equal to 100 pm is equal to

A. 4×10^{25}

B. 2×10^{25}

C. 8×10^{25}

D. 1×10^{25}

Answer: B

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11. Element x,y and z crystallize in primitive , face centered and body centered unit cell respectively. What would be the correct order of metallic radii of each unit cell is ?

A. $r_x > r_z > r_y$

B. $r_y > r_z > r_x$

C. $r_x > r_y > r_z$

D. $r_y > r_x > r_z$

Answer: A

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12. Zinc sulphide exists in two different structural forms as zinc blende (FCC) and Wurtzite (HCP). What will be the coordination number of cation and anion in both the structures ?

A. 6 :6 are both

B. 4 : 4 for both

C. 4 :4 and 6 :6 respectively

D. 6:6 and 4:4 respectively

Answer: B

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13. F-Centres are:

A. fcc center

B. Metal deficiency defect

C. Anion vacancy defect

D. Face center

Answer: C

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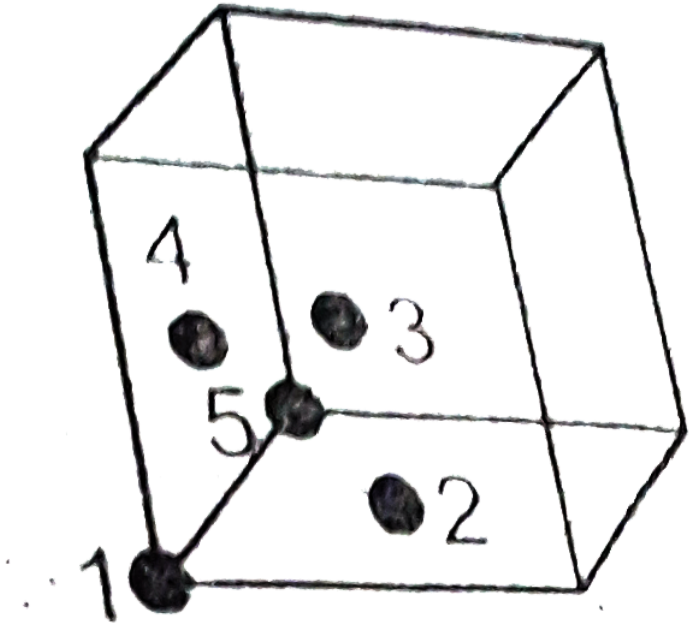
14. Tetrahedral voids is surrounded by four atoms. Which atoms in the given figure are around the tetrahedral voids ?



A. 2,3,4 and 5

B. 1,3,4,5

C. 1,2,3,4

D. 2,4,5

Answer: C

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15. Which of the following is a covalent solid ?

A. Dry ice

B. P_4O_{10}

C. SiC

D. NaCl

Answer: C

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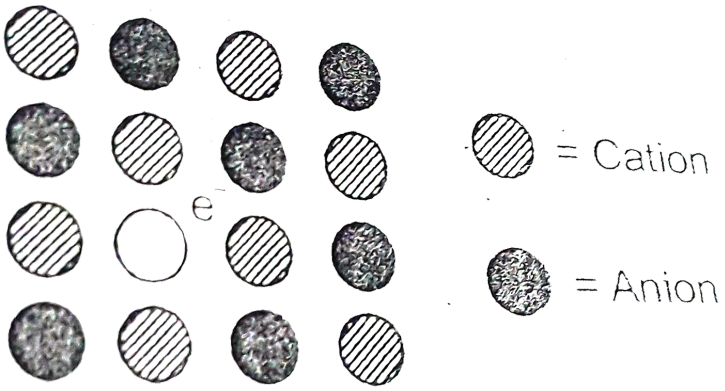
16. What type of defects are represented by given figure ?



A. Frenkel defect

B. metal excess defect

C. Cation deficiency defect

D. Interstitial defect

Answer: B

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17. If the unit cell edge length of NaCl crystal is 600 pm, then the density will be

A. $2.165\ \mathrm{g/cm^3}$

B. $1.79\ \mathrm{g/cm^3}$

C. $3.247\ \mathrm{g/cm^3}$

D. $1.74\ \mathrm{g/cm^3}$

Answer: B

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18. Quartz on strong heating followed by rapid cooling gives glass which is an amorphous solid because

A. Glass is a super cooled liquid

B. Glass does not have a sharp melting point

C. Silicate tetrahedral unit are shifted in randomly arranged pattern

D. Glass is a silicate of sodium

Answer: C

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19. 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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20. Lithium crystallizes in a body centred cubic lattice. How many next-nearest neighbours does each Li have?

A. 8

B. 6

C. 12

D. 4

Answer: B

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21. The ionic radii of Rb^+ and I^- are 1.46 and 2.16Å. The most probable type of structure exhibited by it is:

A. CsCl type

B. NaCl type

C. ZnS type

D. CaF_2 type

Answer: B

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22. In an ionic compound XY_2O_4 oxide ions are arranged in ccp. Cations X are present in octahedral voids.Cations Y are equally

distributed between octahedral voids occupied is

A. $\frac{1}{4}$

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

C. $\frac{1}{8}$

D. $\frac{1}{6}$

Answer: B

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23. 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?

A. $96\ \%$

B. $4\ \%$

C. $98\ \%$

D. $2\ \%$

Answer: B

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24. 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.

A. 1.295

B. 1.259

C. 2.195

D. 2.591

Answer: B

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25. In diamond , the C.N. of carbon and number of carbon atoms per unit cell respectively are

A. 4,8

B. 4,6

C. 6,4

D. 6,6

Answer: A

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26. If the total number of atoms per unit cell in an hcp structure and a bcc structure gets halved, then ratio of percentage voids in hcp and bcc structures is

A. $\frac{34}{27}$

B. $\frac{21}{22}$

C. $\frac{22}{21}$

D. $\frac{37}{34}$

Answer: B

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27. In ionic solids AB and CD , radius -ratios are x and y respectively. If x +y=0.75 and x-y=0.25 then cations in AB and CD are respectively in

A. T-voids, O-voids

B. O-voids , T-voids

C. T-voids, T-voids

D. O-voids , O-voids

Answer: B

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Assignment Section C Objective

1. Which of the following is correctly matched ?

A. In HCP unit cell - No of effective atoms =6

B. In ABC ABC type packing - No of effective atoms =12

C. In FCC unit cell - No of effective atoms =12

D. In primitive unit cell - No of effective atoms =1

Answer: A::D

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2. Which of the following is/are pseudo solid ?

A. KCl

B. $BaCl_2.2H_2O$

C. Rubber

D. Coke

Answer: C::D

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3. Which of the following is/are correct for fluorite structure (CaF_2) ?

A. Ca^{2+} ions are in ccp with fcc unit cell and F^- ions occupy all the tetrahedral voids

B. Ca^{2+} ion is surrounded by $4F^-$ ions

C. Mass of one unit cell = mass of $4Ca^{2+}$ + Mass of $4F^-$

D. C.N. of F^- =4 , C.No . Ca^{2+} =8

Answer: A::D

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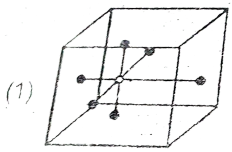
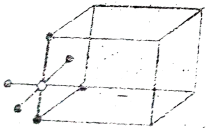
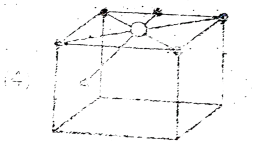
4. Which of the following represent octahedral void ?

A. 

B.

C. 

D. 

Answer: A::C

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5. Which of the following is/are true statement(s)?

A. On rising pressure coordination no. changes from 8:8 to 6:6

B. On rising temperature coordination no. changes from 8:8 to 6:6

C. Compounds with metal deficiency defect may behave as a p-type semiconductor

D. Compounds with metal excess defect may behave as a p-type semiconductor

Answer: B::C

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6. CsCl has bcc structure . If atomic mass of Cs and Cl atom is 133 and 35.5 amu respectively , what would be correct about its unit cell ?

A. Number of formula unit (z) =1

B. Number of formula unit (z) =2

C. Mass of unit cell= $370\ \mathrm{g\ mol^{-1}}$

D. Mass of unit cell= $168.5\ \mathrm{g\ mol^{-1}}$

Answer: A::D

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7. Fe_3O_4 has inverse spinel structure. What is not true about this solid ?

A. Fe^{3+} ions are equally distributed between octahedral and tetrahedral voids

B. Tetrahedral voids are equally distributed between Fe^{2+} and Fe^{3+} ions

C. No. of $O^{-2} > Fe^{+3} > Fe^{+2}$

D. Coordination no. of Fe^{3+} =8 through out the unit cell

Answer: B::D

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8. The density of KBr is $2.75gcm^{-3}$. The length of the unit cell is 654 pm. Atomic mass of $K = 39$, $Br = 80$. Then what is true about the predicted nature of the solid?

A. Unit cell is fcc type

B. No. of formula units =4

C. Solid has bcc type

D. No. of formula units =2

Answer: A::B

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9. In fluorite structure of AB_2

A. On subjecting to strong heating it changes to antifluorite structure

B. Interchanging the position of positive and negative ion changes to antifluorite structure

C. Coordination number of A=8 and B=4

D. Coordination number of A=4 and B=8

Answer: B::C

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10. Which of the following defects doesn't disturb stoichiometry of solid ?

A. Schottky defect

B. metal excess defect

C. Non-stoichiometric defects

D. Frenkel defect

Answer: A::D

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11. For hcp lattice which statements will be correct ?

A. Coordination number of hcp =12

B. Volume of unit cell unoccupied =74%

C. It contains both tetrahedral and octahedral voids

D. This is more effective packing than ccp

Answer: A::C

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12. Which of the following is/are true statement(s)?

A. KO_2 is orange coloured because of F-centres

B. KCl is violet on heating with K-metal vapour because of F-centers

C. Crystals with defects are better conductor of electricity

D. CsCl also shows F-centre defect

Answer: B::C

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13. What will be the distance between two nearest neighbours in primitive , fcc and bcc unit cell ?

A. For primitive , d=a

B. For fcc, d=0.707 a

C. For bcc, d=1.732 a

D. For bcc , d=1.414 a

Answer: A::B

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14. In the closest packing of atoms

A. Coordination number of particles placed in of 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 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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15. In which operations , the formula of NaCl remains same ?

A. On passing one body-diagonal plane in unit cell and all the ions are removed

touching body-diagonal plane

B. On passing one reactangular plane in unit cell and all the ions are removed touching rectangular plane

C. On passing tetrad axis in unit-cell and all the ions are removed touching the tetrad axis

D. On passing body-diagonal line in unit cell and all the ions are removed touching the body diagonal line

Answer: A::B::C

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16. 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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17. All spinel structures do not have

A. CCP array of anions

B. Simple cubic structure

C. BCC array of anions

D. HCP array of anions

Answer: B::C::D

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Assignment Section D Linked Comprehension

1. NaCl is a AB type of solid . Its crystalline structure is known as rock salt structure in which r_{Na}^{+} and r_{Cl}^{-} are 95 and 181 pm respectively , where Cl^{-} is present at the lattice point of face centered cubic unit cell Na^{+} ions are located in void and those compounds which have same crystalline structure also have same coordination system

in which Na^+ and Cl^- ions are surrounded by certain number of opposite ions respectively. Under high pressure coordination number changes to 8 :8 type from 6 :6 type.

On Subjecting NaCl under high pressure it changes

A. From NaCl to CsCl

B. From NaCl and ZnS

C. NaCl remains NaCl

D. It cause Shottky defect

Answer: C

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2. NaCl is a AB type of solid . Its crystalline structure is known as rock salt structure in which r_{Na}^{+} and r_{Cl}^{-} are 95 and 181 pm respectively , where Cl^{-} is present at the lattice point of face centered cubic unit cell Na^{+} ions are located in void and those compounds which have same crystalline structure also have same coordination system in which Na^{+} and Cl^{-} ions are surrounded by certain number of opposite ions

respectively. Under high pressure coordination number changes to 8 :8 type from 6 :6 type.

LiCl adopts rock salt crystalline structure in which edge length is 5.40 Å. What would be the radii of Li^+ ?

A. 0.89 Å

B. 2.7 Å

C. 1.78 Å

D. 0.98 Å

Answer: A

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3. NaCl is a AB type of solid . Its crystalline structure is known as rock salt structure in which r_{Na}^{+} and r_{Cl}^{-} are 95 and 181 pm respectively , where Cl^{-} is present at the lattice point of face centered cubic unit cell Na^{+} ions are located in void and those compounds which have same crystalline structure also have same coordination system in which Na^{+} and Cl^{-} ions are surrounded by certain number of opposite ions

respectively. Under high pressure coordination number changes to 8 :8 type from 6 :6 type.

In rock salt type structure of AB solid , what would be the maximum radius of 'X' that can displace A^+ if radius of B^- is 100 pm ?

A. 41.4 pm

B. 73.2 Å

C. 41.4 Å

D. 73.2 pm

Answer: D

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4. NaCl is a AB type of solid . Its crystalline structure is known as rock salt structure in which r_{Na}^{+} and r_{Cl}^{-} are 95 and 181 pm respectively , where Cl^{-} is present at the lattice point of face centered cubic unit cell Na^{+} ions are located in void and those compounds which have same crystalline structure also have same coordination system in which Na^{+} and Cl^{-} ions are surrounded by certain number of opposite ions

respectively. Under high pressure coordination number changes to 8 :8 type from 6 :6 type.

If the atomic mass of Li and Cl are 7 and 35.5 amu respectively , then what would be number of LiCl molecule in cubic of LiCl with length x height x breadth = 1 x 1 x 1=1 cm^3 ?

A. Nearly 2.5×10^{22}

B. Nearly 4×10^{20}

C. Nearly 12×10^{30}

D. Nearly 14×10^{23}

Answer: A

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5. NaCl is a AB type of solid . Its crystalline structure is known as rock salt structure in which r_{Na}^{+} and r_{Cl}^{-} are 95 and 181 pm respectively , where Cl^{-} is present at the lattice point of face centered cubic unit cell Na^{+} ions are located in void and those compounds which have same crystalline structure also have same coordination system in which Na^{+} and Cl^{-} ions are surrounded by certain number of opposite ions

respectively. Under high pressure coordination number changes to 8 :8 type from 6 :6 type. What is the number of second nearest neighbours of Na^+ in NaCl crystal ?

A. 6

B. 12

C. 8

D. 4

Answer: B

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6. Magnesium and Titanium form a crystalline oxide in which Mg appears at the eight corners , oxygen appears at face centres and titanium appears at the centre of cube. The atomic mass of magnesium , titanium and oxygen is 24, 45.9 and 16 amu respectively. A similar compound is formed by calcium with titanium and oxygen .

What would be the formula of substance (oxide) ?

A. Mg_2TiO_3

B. $MgTiO_3$

C. $MgTiO_4$

D. Mg_2TiO_4

Answer: B

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7. Magnesium and Titanium form a crystalline oxide in which Mg appears at the eight corners , oxygen appears at face centres and titanium appears at the centre of cube. The

atomic mass of magnesium , titanium and oxygen is 24, 45.9 and 16 amu respectively. A similar compound is formed by calcium with titanium and oxygen .

What would be the number of nearest neighbours for Ti ?

A. 8

B. 6

C. 12

D. 4

Answer: B

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8. Magnesium and Titanium form a crystalline oxide in which Mg appears at the eight corners , oxygen appears at face centres and titanium appears at the centre of cube. The atomic mass of magnesium , titanium and oxygen is 24, 45.9 and 16 amu respectively. A similar compound is formed by calcium with titanium and oxygen .

What type of crystalline structure does $MgTiO_3$ have ?

A. Spinel

B. Wurtzite

C. Antifluorite

D. pervoskite

Answer: D

 Watch Video Solution

9. Magnesium and Titanium form a crystalline oxide in which Mg appears at the eight corners , oxygen appears at face centres and

titanium appears at the centre of cube. The atomic mass of magnesium , titanium and oxygen is 24, 45.9 and 16 amu respectively. A similar compound is formed by calcium with titanium and oxygen .

What would be the molar mass of unit cell of $MgTiO_3$?

A. Nearly 118g mol^{-1}

B. 236 g mol^{-1}

C. 59 g mol^{-1}

D. None of these

Answer: A

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Assignment Section E Assertion Reason

1. Statement-1 :Schottky type of defect is shown by crystals with high co-ordination numbers .

Statement-2 :In Schottky defect , equal number of cations and anions are missing from their lattice sites

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

B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation for statement-1

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

Answer: B

 Watch Video Solution

2. Statement-1:Na_2O adopts structure similar to that of CaF_2 but positions of positive and negative ions are reversed.

Statement-2:The structure of Na_2O is also known as antifluorite structure.

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

B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation for statement-1

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

Answer: B

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3. Assertion: Metals are generally good conductors of electricity

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

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

B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation for statement-1

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

Answer: C

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4. Statement-1: Molecular solids have higher melting point than covalent solids

Statement-2:In molecular solids the lattice points are occupied by molecules.

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

B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation for statement-1

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

Answer: D

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5. Statement-1:Amorphous solids are isotropic

Statement-2:Amorphous solids show physical properties like mechanical strength, electrical conductivity refractive index etc. same in all directions .

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

B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation for statement-1

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

Answer: A

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6. 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. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation for statement-1

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

Answer: B

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7. Statement-1:For NaCl structure, Cl^- ions occupy corners and face centre and Na^+ ions occupy edge centres and body centre.

Statement-2:The radius ratio of NaCl structure varies from 0.414 to 0.732

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

B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation

for statement-1

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

Answer: C

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8. Statement-1:For a CsCl unit cell $r_{Cs}^{+} + r_{Cl}^{-} = \frac{\sqrt{3}}{2}a$ where a is edge-length

Statement-2: CsCl structure has FCC type unit-cell

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

B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation for statement-1

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

Answer: C

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9. Statement-1:The coordination number of a cation present in an O void is 6

Statement-2:O-voids are formed due to overlapping of two trigonal voids of adjacent layers.

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

B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation for statement-1

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

Answer: A

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10. Statement-1:p-type semiconductor are formed due to metal excess defect.

Statement-2: F-centres are created due to metal excess defect.

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

B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation for statement-1

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

Answer: D

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Assignment Section F Matrix Match

1. Match the following

Column-I		Column-II	
(A)	ZnS	(p)	Zinc blende structure
(B)	Hexogonal closed packing	(q)	Body centered cubic
(C)	Cubic closed	(r)	Coordination no. = 12
(D)	ABAB.... pattern	(s)	Wurtzite structure

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Assignment Section G Integer

1. What is the total no of planes of symmetry in a cube ?

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2. How many aluminium ions are present per unit cell of corundum (Al_2O_3) ?

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3. Calculate the number of formula units of NaCl per unit cell of NaCl. Given : (i)Internuclear distance of adjacent ions = 0.282 nm

(ii)Density of solid NaCl= $2.17 \times 10^3 \mathrm{kg/m}^3$

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4. Solid spheres of diameter 10 cm are arranged in a Square packing , with side of the

square packing, with side of the square as 50 cm. If 'n' is the number of spheres whose centre either lie inside or on the side of the square, then find the value of $\sqrt{n}$.

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5. In a B.C.C. unit-cell of compound AB, A is located at cubical void. Calculate the ratio of the 4th C.N. and 3rd C.N. of A

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6. Atoms A,B,C and D are present at corners , face centres, body-centre and edge-centres respectively. If atoms touching one of the 2-fold axis, 3-fold axis and 4-fold axis are removed, then total number of atoms remaining per unit cell is $x + \frac{1}{4}$. Find x .

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Assignment Section H Multiple True False

1. Statement-1: In fluorite structure, $\frac{r^+}{r^-} > 1$

Statement-2: There are 4 unoccupied octahedral positions in a unit cell of CaF_2

Statement-3:There are 4 unoccupied tetrahedral positions in a unit cell of CaF_2.

A. T F F

B. T F T

C. F F F

D. T T F

Answer: A

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2. Statement -1:There are 6 atoms of Mg for unit cell of its crytal.

Statement-2: Mg forms HCP lattice.

Statement-3: Packing fraction of Mg crystal is 0.74.

A. T T T

B. F F T

C. T F T

D. T T F

Answer: A

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3. Statement-1:In a hexagonal close packing , third layer is identical to first layer.

Statement-2: In a primitive unit-cell, the third nearest neighbours of an atom located at a corner are at the other end of face-diagonal.

Statement-3: If the radius of cation is nearly

equal to radius of anions, then most favourable arrangement is BCC.

A. T T T

B. F F T

C. T F T

D. T T F

Answer: C

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Assignment Section I Subjective

1. What would be the edge length of that fcc unit cell in which an atom with maximum diameter 117.1 pm can be placed in between its interstitial sites without changing its structure ?

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2. For a unit cell of edge length 10 Å, atomic mass of that element is 150 g and density is $1 gcm^{-3}$.Find out the atomic radius .

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3. In an oxide of iron, oxygen forms hcp and iron occupies two out of every three octahedal voids. Find out the formula of unit cell and formula of compound .

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4. Iron adopts two different crystalline allotropic forms one at 1183 K and other one

below 1183 K, which differ in structural units as bcc and fcc are known as α and γ forms.. What would be the ratio of densities of these two forms (γ and α) ? Assume inter atomic distance remains same.

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5. If the density of crystalline CsCl is nearly $4 \mathrm{g\ cm}^{-3}$. Calculate

(a)The volume of unit cell effectively occupied by one molecule of CsCl if atomic mass of

Cs=133 and Cl=35.5

(b)Calculate the smallest Cs-Cs interionic distance

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6. Lithium borohydride crystallizes in an orthorhombic system with 4 molecule per unit cell. The unit cell dimensions are $a = 6.8\text{Å}, b = 4.4\text{Å}$ and $c = 7.2\text{Å}$. If the molar mass is 21.76, calculate density of crystal.

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7. The density of KCl is $1.9892 \mathrm{g\,cm^{-3}}$. If atomic mass of K and Cl are 39 and 35.5 amu respectively, find the inter ionic distance of KCl, If KCl has Fcc structure

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8. With the help of given values of ionic radii answer the following questions :

Cations	Li^+	Na^+	K^+	Cs^+	Mg^{2+}	Ca^{2+}
Ionic radii (pm)	60	95	133	160	65	99
Anions	F^-	Cl^-	Br^-	I^-	O^{2-}	S^{2-}
Ionic radii (pm)	135	181	195	216	140	184

(a)What would be coordination number of Mg in MgO ?

(b)What type of unit cell is given by CsBr ?

(c)Can we substitute Cl^- from Nacl by Br^- and I^- ions without changing the coordination system ?

(d)What type of voids are present in Na_2S ?

(e)What would be the maximum radii of that ion which can fit into site occupied by F^- in KF ?

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9. Calculate the closest distance between two gold atoms (edge length =1.414 Å) in a face-centered cubic lattice of gold

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10. In a BCC lattice of a metal edge-length is 300 pm and its molar mass is 50 g/mol, calculate the density of metal lattice.

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Assignment Section J Aakash Challengers

1. Potassium crystallizes in bcc unit cell with distance nearest neighbours of 4.52 Å, if its atomic mass = 39 amu.

(a)What would be edge length of unit cell ?

(b)What would be the density of K metal ?

(c) How many nearest neighbouring atoms does each potassium atom has ?

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2. An element occurs in BCC with edge length 300 pm. The density of solid is $7.2\,\mathrm{g\,cm^{-3}}$. Find out

(a)Number of atoms in foil of $27cm^2$ area and 1 cm thickness.

(b)Number of unit cells in the foil .

(c)Number of atoms in a foil of 100 g.

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3. Calculate the ratio of minimum distances between two T-voids and two alternate T-voids in a cubic unit -cell.

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4. KF crystallizes in the rock salt type structure. If the radius of K^+ ion is 132 pm and that of F^- ion is 135 pm.

(i)What is the shortest distance between K^+ and F^- ions ?

(ii)What is the edge length of the unit cell ?

(iii)What is closest K-K distance ?

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5. AB crystallizes in a rock salt structure. The nearest distance between A and B is $Y^{1/3}$ nm, where Y is a constant. The molecular mass of AB is $6.023\ \mathrm{Y\ g/mol}^{-1}$ .Determine the density in kgm^{-3}.

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6. Four solids W,X , Y and Z are given . All have a metallic lustre. The solids could be gold, lead sulphide , mica (which is quartz or SiO_2) and iodine . The results of the investigation are :

(a)W is a good electrical conductor . X,Y and Z are poor electrical conductors

(b)When the solids are hit with a hammer, W flattens out , X shaltters into many pieces, Y is smashed into a powder and Z is not affected .

(c)When the solids are heated with a Bunsen burner, Y melts with some sublimation, but X, W and Z do not melt.

(d)In treatment with $7MHNO_3$, X dissolves and there is no effect on W,Y or Z

On the basis of these test results, identify the solids

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7. Tungsten has a body centered cubic lattice and each lattice point is occupied by one atom. Calculate the radius of metallic tungsten if density of tungsten is $19.30\ \mathrm{g\ cm^{-3}}$ and atomic weight is 183.9 g.

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8. KCI crystallizes in the same type of lacttice as does $NaCl$. Given that

$\frac{r_{Na^{\oplus}}}{r_{Cl^{\Theta}}} = 0.5$ and $\frac{r_{Na^{\oplus}}}{r_{K^{\oplus}}} = 0.7$

Calculate (a) the ratio of side of the unit cell for KCl to that for $NaCl$, and (b) the ratio of density of $NaCl$ to that KCl.

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9. Potassium crystallizes in a body centred cubic lattice . What is the approximate number of unit cells in 4.0 gm of potassium ? (Atomic mass of potassium =39)

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10. An element A (Atomic weight =100) having b.c.c. structures has unit cell edge length 400 pm. Calculate the density of A. number of unit cells and number of atoms in 10 g of A.

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Exercise

1. Which one of the following property is attributed to amorphous solid ?

A. Isotropy

B. Anisotropy

C. Sharp melting point

D. Long range order

Answer: A

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2. Which of the following is a covalent solid ?

A. $CO_2(s)$

B. $H_2O(s)$

C. Diamond

D. NaCl(s)

Answer: C

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3. Which of the following is the incorrect match ?

A. Molecular solid (polar) : Dry Ice

B. Ionic solid : CaF_2

C. Metallic solid : Ag

D. Network solid : SiO_2

Answer: A

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4. Which of the following covalent solid is the conductor of electricity ?

A. SiC

B. AlN

C. Diamond

D. Graphite

Answer: D

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5. Which of the following is the characteristic of a crystalline solid ?

A. Sharp melting point

B. Short - range order

C. Irregular arrangement

D. Indefinite heat fusion

Answer: A

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6. Which of the following is an example of hydrogen bonded solid ?

A. Water

B. $CO_2(s)$

C. $H_2O(s)$

D. $SO_2(s)$

Answer: C

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7. 'Glass' is an example of

A. Pseudo solid

B. True solid

C. Super cooled liquid

D. Both (1) & (3)

Answer: D

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

A. Molecular

B. Ionic

C. Metallic

D. Covalent

Answer: C

 Watch Video Solution

9. Which of the following set of solids contains only ionic solids ?

A. NaCl, MgO & ZnS

B. CaF_2, ZnS, SiO_2

C. MgO, SiO_2, KCl

D. SiO_2, SiC, AlN

Answer: A

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10. When constituent particles are present only on the corner of a unit cell, it is called

A. Primitive unit cell

B. FCC unit cell

C. BCC unit cell

D. All of these

Answer: A

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11. The number of tetrahedral voids present on each body diagonal ccp unit cell is

A. 1

B. 2

C. 3

D. 4

Answer: B

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12. Octahedral void at edge center in ccp arrangement is equally distributed amongst

A. 8 unit cells

B. 6 unit cells

C. 4 unit cells

D. 2 unit cells

Answer: C

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13. Total number of octahedral voids present per unit cell of ccp unit cell is

A. 8

B. 9

C. 12

D. 4

Answer: D

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14. The co-ordination number in 3D-hexagonal close packing is

A. 8

B. 12

C. 6

D. 9

Answer: B

 Watch Video Solution

15. The efficiency of packing in simple cubic unit cell is

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

B. $\frac{\sqrt{3}\pi}{8}$

C. $\frac{\sqrt{2}\pi}{6}$

D. $\frac{\pi}{16}$

Answer: A

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16. 'A' has fcc arrangement, 'B' is present in $2/3^{rd}$ of tetrahedral voids. The formula of the compound will be

A. A_2B_3

B. A_4B_3

C. A_3B_4

D. A_3B_2

Answer: C

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17. Gold crystallises in ccp structure. The number of voids present in 197 g of gold will be [Au = 197]

A. $197 \times N_A$

B. $2N_A$

C. $3N_A$

D. $4 \times 197N_A$

Answer: C

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18. The correct relation for radius of atom and edge - length in case of fcc arrangement is

A. $r = \frac{a}{2}$

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

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

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

Answer: C

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19. The type of void present at the centre of the ccp unit cell is

A. Trigonal void

B. Tetrahedral void

C. Octahedral void

D. All of these

Answer: C

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20. The ratio of atoms present per unit cell in bcc to that present in fcc is

A. $1:2$

B. $2:3$

C. $1:4$

D. $2:5$

Answer: A

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21. Stoichiometric defect is also known as

A. Intrinsic defect

B. Impurity defect

C. Thermodynamic defect

D. Both (1) & (3)

Answer: D

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22. Which one of the following compounds can show Frenkel defect ?

A. ZnS

B. AgCl

C. Agl

D. All of these

Answer: D

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23. In NaCl there are _____ schottky pairs per cm^3 at room temperature

A. 10^{22}

B. 10^{16}

C. 10^{6}

D. 10^{12}

Answer: C

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24. Which of the following compounds is likely to show both Frenkel and Schottky defects in its cyrstalline form ?

A. AgBr

B. NaCl

C. CsCl

D. ZnS

Answer: A

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25. The anionic sites occupied by electrons are called

A. X-center

B. Y-center

C. S-center

D. F-center

Answer: D

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26. The solids which are good conductor of electricity should have conductivities in the order of

A. $10^{7}\Omega^{-1}m^{-1}$

B. $10^{-20}\Omega^{-1}m^{-1}$

C. $10^{-6}\Omega^{-1}m^{-1}$

D. $10^{4}\Omega^{-1}m^{-1}$

Answer: A

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27. Identify the antiferromagnetic substance

A. MnO

B. Fe_3O_4

C. CrO_2

D. NaCl

Answer: A

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28. n-type semiconductor is

A. $-$ vely charged

B. $+$ vely charged

C. Either - vely or + vely charged

D. Neutral

Answer: D

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29. Which of the following substance is diamagnetic ?

A. Fe_3O_4

B. $MgFe_2O_4$

C. $ZnFe_2O_4$

D. NaCl

Answer: D

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30. Metal excess defect arises due to

A. Anionic vacancies

B. The presence of extra cations at interstitial sites

C. Cationic vacancies

D. Both (1) & (2)

Answer: D

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Assignment Section A Objective Type Question

1. Which of the following crystal is represented by $a \neq b \neq c$ and $\alpha \neq \beta \neq \gamma \neq 90^\circ$?

A. Orthorhombic

B. Monoclinic

C. Triclinic

D. Tetragonal

Answer: C

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2. Copper belongs to a crystal system represented by the crystal dimensions as

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

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

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

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

Answer: A

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3. What is the relation between diamond and graphite ?

A. Polymorphous

B. Isomer

C. Isotope

D. Isomorphous

Answer: A

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4. Maximum possible numbers of two dimensional and three dimensional lattices are respectively

A. 5 and 14

B. 7 and 14

C. 14 and 4

D. 5 and 13

Answer: A

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5. A compound formed by element A and B crystallize in the cubic structure where A atoms are at the corners of a cube and B atoms are at the centre of the body. The formula of the compounds is

A. AB

B. AB_2

C. A_2B_3

D. AB_3

Answer: A

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6. A solid with formula ABC_3 would probably have

A. A at body centre, B at face centres and C at corners of the cube

B. A at corners of cube, B at body centre C at face centre

C. A at corners of hexagon, B at centres of the hexagon and C inside the hexagonal

unit cell

D. A at corner, B at face centre, C at body centre

Answer: B

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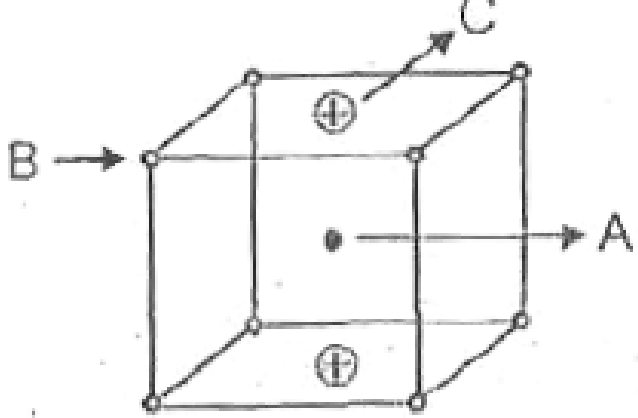
7. A solid ABC has A, B and C arranged as below. The formula of solid is



A. ABC

B. AB_2C_2

C. A_2BC

D. AB_8C_2

Answer: A

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

A. Cu_4Ag_2Au

B. Cu_4Ag_4Au

C. Cu_ACu_3Au

D. CuAgAu

Answer: C

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9. In a face centred cubic arrangement of A and B atoms whose A atoms are at the corner of the unit cell and B atoms at the face centres. Once of the A atom is missing from one corner in unit cell. The simplest formula of compound is

A. A_7B_3

B. AB_3

C. A_7B_{24}

D. $A_{7/8}B_3$

Answer: C

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10. In any ionic crystal A has formed cubical close packing and B atoms are present at every tetrahedral voids. If any sample of crystal

contain 'N' number of B atoms then number of A atoms in that sample is

A. N

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

C. 2 N

D. $\sqrt{2}N$

Answer: B

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11. A binary solid A^+B^- has a structure with B^- ions constituting the lattice and A^+ ions occupying 25% tetrahedral holes. Formula of the solid is

A. A_2B

B. AB

C. AB_2

D. AB_4

Answer: C

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

A. AB

B. AB_2

C. A_2B

D. A_2B_3

Answer: C

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13. In a cubic close packed structure of mixed oxides, the lattice is made up of oxide ions, one eight of tetrahedral voids are occupied by divalent $\left(X^{2+}\right)$ ions, while one - half of the octahedral voids are occupied by trivalent ions $\left(Y^{3+}\right)$, then the formula of the oxide is

A. XY_2O_4

B. X_2YO_4

C. $X_4Y_5O_{10}$

D. $X_5Y_4O_{10}$

Answer: A

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14. Titanium crystallizes in a face centred cubic lattice. It reacts with carbon or hydrogen interstitially by allowing atoms of these elements to occupy holes in the host lattice.

Hydrogen occupies tetrahedral holes but carbon occupies octahedral holes the formula of titanium carbide and hydride are

A. TiC_2, TiH_4

B. TiC, TiH_2

C. Ti_3C, TiH_2

D. TiC_2, TiH

Answer: B

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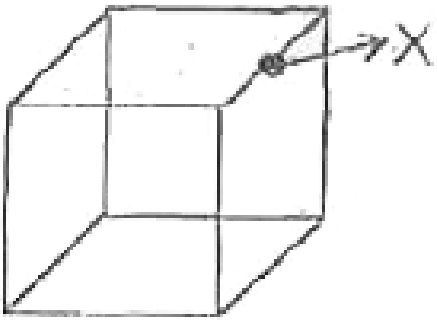
15. The site labelled as 'X' in fcc arrangement is



A. Face with $\frac{1}{4}$ contribution

B. Edge with $\frac{1}{4}$ contribution

C. Corner with $\frac{1}{4}$ contribution

D. Tetrahedral void with $\frac{1}{8}$ contribution

Answer: B

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16. A unit cell is obtained by closed packing layers of atoms in ABAB ..... pattern. The total number of tetrahedral and octahedral voids in the unit cell are respectively

A. 6, 12

B. 8, 4

C. 4, 8

D. 12, 6

Answer: D

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17. In certain solid, the oxide ions are arranged in ccp. Cations A occupy $\frac{1}{6}$ of the tetrahedral voids and cations B occupy one third of the octahedral voids. The probable formula of the compound is

A. ABO_3

B. AB_2O_3

C. A_2BO_3

D. $A_2B_2O_3$

Answer: A

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18. A solid has a structure in which A atoms are located at the cube corners of the unit cell, B atoms are located at the cube edges of unit cell and the C atoms at the body centre. Formula of the compound

A. CAB_3

B. C_2AB_3

C. CA_3B

D. C_2A_3B

Answer: A

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19. If a is the length of unit cell, then which one is correct relationship ?

A. For simple cubic lattice. Radius of metal atoms $= \frac{a}{2}$

B. For bcc lattice. Radius of metal atom $= \frac{\sqrt{3}a}{4}$

C. For fcc lattice, Radius of metal atom $= \frac{a}{2\sqrt{2}}$

D. All of these

Answer: D

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20. For face centered cubic structure edge length 'a' can be related with radius 'r' as

A. $a = r \times \sqrt{2}$

B. a = r

C. $a = 2\sqrt{2}r$

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

Answer: C

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21. A crystalline solid AB adopts sodium chloride type structure with edge length of the unit cell as 745 pm and formula mass of 74.5 g The density of the crystalline compound is

A. $2.16gcm^{-3}$

B. $0.99gcm^{-3}$

C. $1.88gcm^{-3}$

D. $1.197gcm^{-3}$

Answer: D

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22. If radius of an octahedral void is r and atomic radius of atoms assuming cubical close pacting is R. Then the relation between r and R is

A. r = 2R

B. r = 1.414 R

C. r = 0.414 R

D. $r = \frac{R}{\sqrt{2}}$

Answer: C

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23. Polonium adopts cubic structure with edge length of cube being 0.336 nm. The distance of the body diagonal is

A. 0.336 nm

B. 0.291 nm

C. 0.582 nm

D. 0.481 nm

Answer: C

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24. CsCl has bcc structure with Cs^+ at the centre and Cl^- ion at each corner. If r_{Cs^+} is 1.69Å and r_{Cl^-} is 1.81Å what is the edge length of the cube?

A. 3.50Å

B. 4.04Å

C. 2.02Å

D. 1.01Å

Answer: B

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25. 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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26. For tetrahedral co-ordination the radius ratio $\left(r^{+}/r^{-}\right)$should be

A. $0.414-0.732$

B. $0.732 - 1.0$

C. $0.156 - 0.225$

D. $0.225 - 0.414$

Answer: D

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

A. 4

B. 6

C. 8

D. Unpredictable

Answer: B

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28. Lithium metal has a body centred cubic structure. Its density is $0.53gcm^{-3}$ and its

molar mass is $6.94 g mol^{-1}$. Calculate the edge length of a unit cell of Lithium metal

A. 153.6 pm

B. 351.6 pm

C. 527.4 pm

D. 263.7 pm

Answer: B

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29. What is the volume of a face centred cubic unit cell, when its density is $2.0gcm^{-3}$ and the molar mass of the substance is 60.23 g mol^{-1} ?

A. $4 \times 10^{-22}cm^3$

B. $2 \times 10^{-22}cm^3$

C. $44 \times 10^{-22}cm^3$

D. $22 \times 10^{-22}cm^3$

Answer: B

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30. The number of octahedral sites in a cubical close pack array of N spheres is

A. N/2

B. 2 N

C. 4 N

D. N

Answer: D

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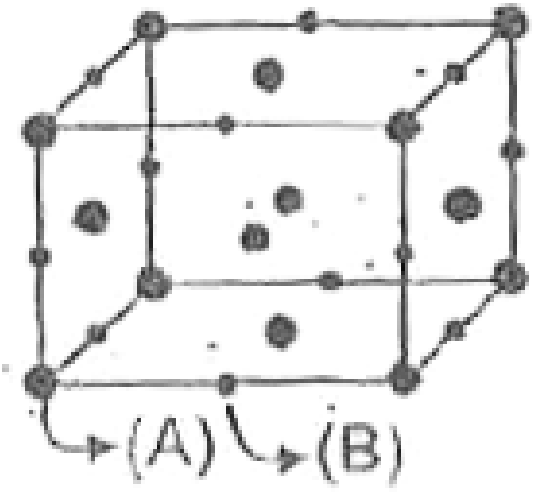
31. For a solid with the following structure, the coordination number of the point B is



A. 3

B. 4

C. 5

D. 6

Answer: D

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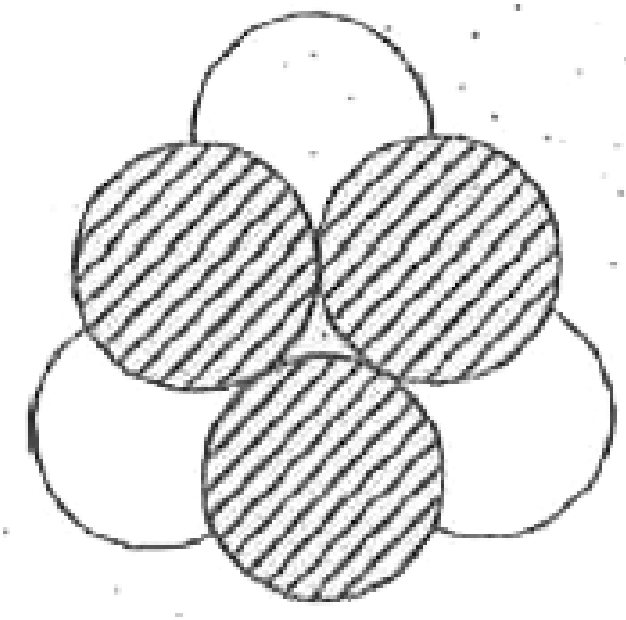
32. The empty space between the shaded balls and hollow balls as shown in the diagram is

called



A. Hexagonal void

B. Ociahedral void

C. Tetrahedral void

D. Double triangle void

Answer: B

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33. A mineral having the formula AB_2, crystallises in the cubic close -packed lattice, with the A atom occupying the lattice points. The co-ordination number of the A atoms is x, that of B atoms is y. Report your answer $(x - y)$

A. 4, 8

B. 4, 4

C. 8, 8

D. 8, 4

Answer: D

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34. KF has NaCl type of structure. The edge length of its unit cell has been found to be 537.6 pm. The distance between K^+F^- in KF is

A. 26.88 pm

B. 268.8 pm

C. 2688 pm

D. Unpredictable

Answer: B

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35. Which of the following features is false regarding the structure of CsCl ?

A. It has bcc arrangements

B. For each ion coordination number is 8

C. For each ion coordination number is 6

D. The radius ratio (r_+/r_-) is 0.93

Answer: C

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36. Which type of solids will have the highest melting point ?

A. Ionic crystals

B. Network covalent solid

C. Molecular solids

D. Metallic crystals

Answer: B

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37. The mass of unit cell of Na_2O is

A. Twice the formula mass of Na_2O

B. Four times the formula mass of Na_2O

C. Six times the formula mass of Na_2O

D. Thrice the formula mass of Na_2O

Answer: B

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38. In normal spinel structure there is a closed packed array of O^{2-} ions. The trivalent cations are present in

A. 75 % of octahedral voids

B. 50 % of octachedral voids

C. 12.5 % of tetrahedral voids

D. 25 % of octahedral voids

Answer: B

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39. The C - C and Si - C interatomic distances are 154 pm and 188 pm. The atomic radius of Si is

A. 77 pm

B. 94 pm

C. 114 pm

D. 111 pm

Answer: D

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40. What is the coordination number of Rb^+ in RbBr unit cell if ionic radii of Rb^+ and Br^- ions being 148 and 195 respectively ?

A. 6

B. 4

C. 8

D. 12

Answer: C

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41. A crystalline solid AB has NaCl type structure with radius of B^- ion is 250 pm. Which of the following cation can be made to

slip into tetrahedral site of crystals of A^+B^-

?

A. P^+ (radius = 180 pm)

B. $Q^+ =$ (radius = 56 pm)

C. $R^+ =$ (radius = 200 pm)

D. $S^+ =$ (radius = 150 pm)

Answer: B

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42. Number of formula units in unit cell of MgO (rock salt), ZnS (zinc blende) and Pt (fcc) respectively

A. $4, 3, 2$

B. $4, 3, 4$

C. $4, 4, 4$

D. $4, 3, 1$

Answer: C

Watch Video Solution

43. An element crystallises in a b.c.c. lattice. Nearest and next nearest neighbours are respectively

A. 8, 8

B. 8, 6

C. 6, 8

D. 6, 6

Answer: B

 Watch Video Solution

44. The total number of elements of symmetry in a cubic crystal is

A. 9

B. 23

C. 10

D. 14

Answer: B

Watch Video Solution

45. A crystal may have one or more planes and one or more axes of symmetry but it has:

A. Two centres of symmetry

B. Only one centre of symmetry

C. No centre of symmetry

D. Three centres of symmetry

Answer: B

Watch Video Solution

46. Which of the following statement is correct ?

A. On increasing temperature the coordination number of solid remains unchanged

B. On increasing pressure the coordination number of solid increases

C. On increasing temperature the coordination number of solid increases

D. On increasing pressure the coordination number of solid decreases

Answer: B

Watch Video Solution

47. Pyroelectric crystals feeble electric current

A. On deformation

B. On dissolving in a solvent

C. On heating

D. On sublimation

Answer: C

 Watch Video Solution

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

A. Zinc oxides is a stoichiometric compound

B. Zinc oxide is a covalent compound

C. Zinc oxide shows metal excessive defect

D. It shows metal deficiency defect

Answer: C

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49. F - centres in an ionic crystals are

A. Lattice sites containing electrons

B. Interstitial sites containing electrons

C. Lattice sites that are vacant

D. Interstitial sites containing cations

Answer: A

Watch Video Solution

50. When an element of group 14 is doped with an element of group 15

A. p - type of semi - conductors are formed

B. n - type of semi - conductors are formed

C. Zeolites are formed

D. Electrolytes are formed

Answer: B

Watch Video Solution

51. Antiferromagnetic property is given as

A. ↑ ↑ ↑ ↑

B. ↑ ↑ ↓ ↑

C. ↑ ↓ ↑ ↓

D. ↓ ↓ ↓ ↓

Answer: C

Watch Video Solution

52. Substances which are magnetic but having less magnetic moment than theoretically calculated value are called

A. Ferromagnetic

B. Ferrimagnetic

C. Antiferromagnetic

D. Diamagnetic

Answer: B

Watch Video Solution

53. In antiferromagnetism

A. Alignments of magnetic moments is additive

B. Alignments of magnetic moments in one direction is compensated by alignments in the opposite directions

C. Alignments of magnetic moments does not take place

D. Alignments of magnetic moments varies with the nature of the material

Answer: B

Watch Video Solution

54. Which is true about Piezoelectric crystals ?

A. They produce an electric current on heating

B. They produce an electric current when a mechanical stress is applied

C. They are insulators

D. They are magnetic in nature

Answer: B

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55. When a crystal having rock salt type geometry is heated in the presence of it's metal vapour then defect in it will be

A. Stoichiometric defect

B. Metal excess defect

C. Anion excess defect

D. Frenkel defect

Answer: B

 Watch Video Solution

56. The mass percentage of Fe^{3+} ion present in $Fe_{0.93}, O_{1.00}$ is

A. $15\ \%$

B. $5.5\ \%$

C. $10.0\ \%$

D. $11.5\ \%$

Answer: D

Watch Video Solution

57. If 1 mole of NaCl is doped with 10^{-3} mole of $SrCl_2$. What is the number of cationic vacancies per mole of NaCl ?

A. 10^{-3}mole^{-1}

B. $6.02 \times 10^{18}\text{mole}^{-1}$

C. 10^{50}mole^{-1}

D. $6.02 \times 10^{20}\text{mole}^{-1}$

Answer: D

Watch Video Solution

58. Which of the following is incorrect statement about the Bragg's equation $n\lambda = 2d\sin\theta$?

A. n, represents order of reflection

B. λ, represents wavelength of UV - rays used

C. θ, represents angle of incidence

D. d, represents distance between two parallel planes

Answer: B

Watch Video Solution

Assignment Section B Objective Type Question

1. In crystalline solids, which of the following element of symmetry is not present ?

A. Axis of symmetry

B. Angle of symmetry

C. Centre of symmetry

D. Plane of symmetry

Answer: B

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2. Amorphous solids have

A. Orderly arrangement of atoms

B. Repeating unit of unit cell

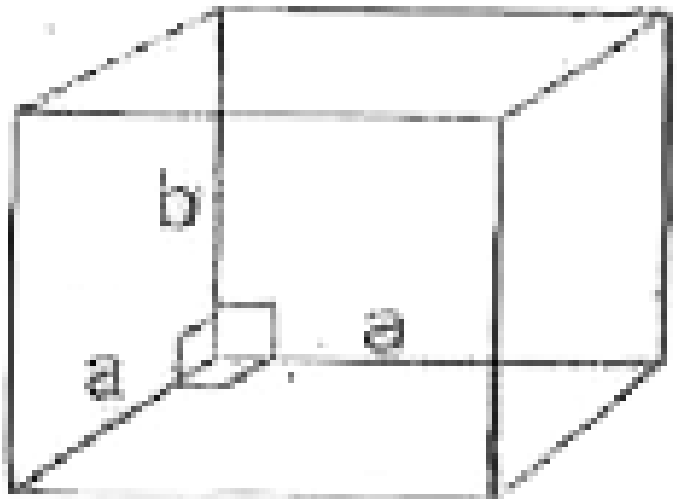
C. Long range of melting point

D. Anisotropy

Answer: C

Watch Video Solution

3. The type of crystal system shown is



A. Cubic

B. Orthorhombic

C. Monoclinic

D. Tetragonal

Answer: D

 Watch Video Solution

4. In a unit cell, atoms A, B, C and D are present at comers, face centres, body - centre and edge - centre respectively in a cubic unit cell. The total number of atoms present per unit cell is

A. 4

B. 8

C. 15

D. 27

Answer: B

 Watch Video Solution

5. In a unit cell, atoms A, B, C and D are present at half of total corners, all face - centres, body -

centre and one third of all edge - centres respectively. Then formula of unit cell is

A. AB_3CD_3

B. ABCD

C. $AB_6C_2D_4$

D. $AB_6C_2D_2$

Answer: D

Watch Video Solution

6. In a unit cell, atoms A, B, C and D are present at corners, face - centres, body - centre and edge - centres respectively. If atoms touching one of the plane passing through two diagonally opposite edges are removed, then formula of compound is

A. $ABCD_2$

B. ABD_2

C. AB_2D_2

D. AB_4D_5

Answer: D

Watch Video Solution

7. In a CsCl structure, if edge length is a, then distance between one Cs atom and one Cl atoms is

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

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

C. $a\sqrt{2}$

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

Answer: A

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8. The correct statement about, CCP structure is

A. Packing fraction = 26%

B. Coordination number = 6

C. Unit cell is face centred cubic

D. AB - AB type of packing

Answer: C

Watch Video Solution

9. In a NaCl structure, if positions of Na atoms and Cl - atoms are interchanged, then in the new unit cell

A. Na atoms is present at body centre

B. Cl atom is present at face centre

C. Na atom is present in tetrahedral voids

D. Cl atoms is present in octahedral voids

Answer: D

 Watch Video Solution

10. If radius of a metal atom (A) is 5pm and radius of an electronegative atom (B) is 20 pm, then in the unit cell

A. A in octahedral voids, B in FCC unit

B. A in FCC unit, B in tetrahedral void

C. A in BCC unit, B in cubic void

D. A in tetrahedral void, B in FCC unit

Answer: D

 Watch Video Solution

11. A metal can be crystallized in both BCC and FCC unit cells whose edge lengths are 2 pm and 4 pm respectively. Then ratio of densities of FCC and BCC unit cells is

A. $\frac{1}{4}$

B. 4

C. $\frac{1}{16}$

D. 16

Answer: A

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12. In a unit cell containing X^{2+}, Y^{3+} and Z^{2-} where X^{2+} occupies 1/8 th of tetrahedral voids, Y^{3+} occupies 1/2 of octanhedral voids and Z^{2-} forms ccp structure. Then formula of compound is

A. X_2Y_4Z

B. XY_2Z_4

C. XY_3Z_4

D. X_4YZ_2

Answer: B

 Watch Video Solution

13. On rising temperature and decreasing pressure in CsCl solid

A. C.N. of metal ion increases from 6 to 8

B. Number of formula unit per unit cell (Z) changes from one to four

C. Density of unit cell is increased

D. $\frac{r_+}{r_-}$ (radius ratio) is increased

Answer: B

Watch Video Solution

14. In a ccp type structure, if half of atoms are removed, then percentage void in unit cell is approximately

A. $54\ \%$

B. $46.25\ \%$

C. $63\ \%$

D. $37\ \%$

Answer: A

 Watch Video Solution

15. In a BCC unit cell, if half of the atoms per unit cell are removed, then percentage void is

A. $68\ \%$

B. $32\ \%$

C. $34\ \%$

D. $66\ \%$

Answer: D

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16. Number of atoms per unit cell, if atoms are present at the corner of unit cell and 2 atoms at each body diagonal

A. 9

B. 10

C. 6

D. 4

Answer: A

Watch Video Solution

17. Number of unit cells in 10 g NaCl

A. $\frac{1.5}{58.5} \times 10^{24}$

B. $\frac{2.5}{58.5} \times 10^{23}$

C. $\frac{5.6}{58.5} \times 10^{20}$

D. $\frac{5.6}{58.5} \times 10^{21}$

Answer: A

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18. Some of the molecular solid upon heating produces small amount of electricity, hence solid is

A. Piezoelectric

B. Pyroelectric

C. Ferrielectric

D. Ferroelectric

Answer: B

Watch Video Solution

19. NaCl becomes paramagnetic at high temperature due to

A. Formation of F - centre

B. Molent state

C. Change in oxidation state

D. Conversion of Na^+ to Na

Answer: A

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20. How many Cs^+ ions occupy the second nearest neighbour location of a Cs^+ ion in the structure CsCl (8:8 coordination) ?

A. 8

B. 6

C. 16

D. 10

Answer: B

 Watch Video Solution

21. The ratio of number of rectangular plane and diagonal plane in a cubic unit cell

A. $1:2$

B. $3:1$

C. $2:3$

D. $3:4$

Answer: A

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

A. 6,6

B. 8,4

C. 4,4

D. 4,8

Answer: B

Watch Video Solution

23. which of the following defects decrase the density decrease the density ?

A. Schottky defect

B. Frenkel defect

C. F - centre

D. Impurity defect

Answer: D

Watch Video Solution

24. Glass is a

A. Micro - crystalline solid

B. Super cooled liquid

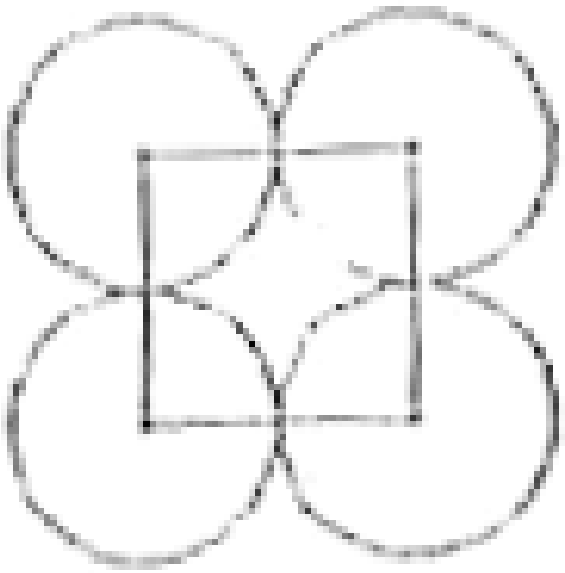
C. Gel

D. Polymeric mixture

Answer: B

Watch Video Solution

25. The packing efficiency of the 2D square unit cell shown below is



A. $39.27\ \%$

B. $68.02\ \%$

C. $74.05\ \%$

D. $78.54\ \%$

Answer: D

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Assignment Section C Previous Years Question

1. Which is the incorrect statement ?

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

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

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

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

Answer: A::D

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2. 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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3. Lithium has a bcc structure .Its density is $530 kgm^{-3}$ 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. 264 pm

B. 154 pm

C. 352 pm

D. 527 pm

Answer: C

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4. The ionic radii of A^+ and B^- ions are $0.98 \times 10^{-10} m$ and $1.81 \times 10^{-10} m$.The coordination number of each ion in AB is :

A. 2

B. 6

C. 4

D. 8

Answer: B

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5. The vacant space in bcc lattice unit cell is

A. $23\ \%$

B. $32\ \%$

C. $26\ \%$

D. $48\ \%$

Answer: B

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6. The correct statement regarding defects in crystalling solids.

A. Frenkel defect is a dislocation defect

B. Frenkel defect is found in halides of alkaline metals

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

D. Frenkel defects decrease the density of crystalline solids

Answer: A

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

A. 108 pm

B. 40 pm

C. 127 pm

D. 80 pm

Answer: C

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

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

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

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

Answer: D

Watch Video Solution

9. A metal has an fcc latticed.The edge length of the unit cell is 404 pm .The density of the metal is $2.72g/cm^{-3}$ .The molar mass of the

metal is

$(N_A$ Avogadro's constant $= 6.2 \times 10^{23} mol^{-1})$

A. $30 gmol^{-1}$

B. $27 gmol^{-1}$

C. $20 gmol^{-1}$

D. $40 gmol^{-1}$

Answer: B

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

A. 8

B. 6

C. 1

D. 4

Answer: A

 Watch Video Solution

11. a metal crystallizes with a face-centered cubic lattice.The edge of the unit cell is 408 pm. The diameter of the metal atom is :

A. 144 pm

B. 204 pm

C. 288 pm

D. 408 pm

Answer: C

Watch Video Solution

12. The total number of octahedral void (s) per atom present in a cubic close packed structure is

A. 2

B. 4

C. 1

D. 3

Answer: C

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13. Structure of a mixed oxide is cubic closed - packed (ccp) .The cubic unit cell of mixed oxide is composed of oxide ions .One fourth of the tetrahedral voids are occupied by divalent metal A and the octahedral voids are occupied by a monovelent metal B .The formula of the oxide is

A. ABO_2

B. A_2BO_2

C. $A_2B_3O_4$

D. AB_2O_2

Answer: D

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

A. 241.5 pm

B. 165.7 pm

C. 275.1 pm

D. 322.5 pm

Answer: A

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15. 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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16. Among the following which has the highest cation to anion size ratio ?

A. CsI

B. CsF

C. LiF

D. NaF

Answer: B

 Watch Video Solution

17. Lithium metal crystallizes in a body centred cubic crystals. If the length of the side of the

unit cell of lithium is $351pm$ the atomic radius of the lithium will be

A. 152 pm

B. 75 pm

C. 300 pm

D. 240 pm

Answer: A

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18. Copper crystallises in face-centred cubic lattice with a unit cell length of 361 pm. What is the radius of copper atom in pm?

A. 157

B. 181

C. 108

D. 128

Answer: D

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19. If a stands for the edge length of the cubic system : simple cubic, body $-$ centred cubic anf face $-$ centred cubic, then the ratio of radii of the spheres in these systems will be respectively:

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

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

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

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

Answer: B

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20. The percentage of free space in a body centred cubic unit cell is

A. $28\ \%$

B. $30\ \%$

C. $32\ \%$

D. $34\ \%$

Answer: C

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21. With Which one of the following elements silicon should be doped so as to give p-type of semiconductor?

A. Boron

B. Germanium

C. Arsenic

D. Selenium

Answer: A

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22. Which of the following statements is not correct ?

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

B. The fraction of the total volume occupied by the atoms in a primitive cell is 0.52

C. Molecular solids are generally volatile

D. The number of carbon atoms in a unit cell of diamond is 4

Answer: D

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

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

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

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

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

Answer: B

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

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

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

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

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

Answer: D

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25. CsBr crystallises in a body centred cubic lattice. The unit cell length is 436 pm. Given that the atomic mass of Cs = 133 and that of Br

= 80 amu and Avagadro number being $6.02 \times 10^{23} mol^{-1}$ the density of CsBr is

A. $42.5 g / cm^3$

B. $0.425 g / cm^3$

C. $8.53 g / cm^3$

D. $4.25 g / cm^3$

Answer: D

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

A. F - centres

B. Schottky defect

C. Frenkel defect

D. Interstitial positions

Answer: A

 Watch Video Solution

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

A. 8

B. 4

C. 2

D. 6

Answer: D

Watch Video Solution

28. Ionic solids with Schottky defects contain in their structure

A. Cation vacancies only

B. Cation vacancies and interstital cations

C. Equal number of cation and anion vacancies

D. Anion vacancies and interstitial anions

Answer: C

 Watch Video Solution

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

A. 2×10^{25}

B. 1×10^{25}

C. 4×10^{25}

D. 3×10^{25}

Answer: C

Watch Video Solution

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

A. $7.289gm/cm^3$

B. $2.144gm/cm^3$

C. $10.376gm/cm^3$

D. $5.188gm/cm^3$

Answer: D

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

A. n-type semiconductor

B. p-type semiconductor

C. Both (1) & (2)

D. None of these

Answer: A

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32. The intermetallic compound $LiAg$ crystallizes in cubic lattice in which both lithium and silver have coordination number of 8. The crystal class is

A. Face - centred cube

B. Simple cube

C. Body - centred cube

D. None of these

Answer: B

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33. Schottky defect in a crystal is observed when

A. Density of the crystal is increased

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

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

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

Answer: D

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

A. 144 pm

B. 398 pm

C. 288 pm

D. 618 pm

Answer: A

 Watch Video Solution

35. The second order Bragg diffraction of X-rays with $\lambda = 1.0\text{Å}$ from a set of parallel planes in a metal occurs at an angle 60°. The

distance between the scattering planes in the crystals is

A. 2.00Å

B. 1.00Å

C. 0.575Å

D. 1.15Å

Answer: D

Watch Video Solution

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

A. CsI

B. CsF

C. LiF

D. LiI

Answer: A

Watch Video Solution

Watch Video Solution

37. A compound formed by elements A and B crystallizes in cubic structure, where A atoms are at the corners of a cube and B atoms are at the face $-$ centre. What is the formula of the compound ?

A. AB

B. AB_3

C. A_2B_2

D. A_2B_3

Answer: B

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38. Coordination number in ABAB ... type arrangement is

A. 6

B. 8

C. 12

D. 4

Answer: C

Watch Video Solution

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

A. 5.96

B. 5.96×10^{-2}

C. 5.96×10^{-1}

D. 5.96×10^{-3}

Answer: D

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40. 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

Watch Video Solution

41. 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

Watch Video Solution

Assignment Section D Assertion Reason Type Question

1. A : In NaCl structure, the interionic distance is a/2 (a = Unit cell edge length).

R : NaCl forms face centered cubic unit cell.

A. both Assertion & Reason are true and the reason is the correct explanation of the assertion

B. both Assertion & Reason are true but the reason is not the correct explanation of the assertion

C. Assertion is true statement but Reason is false

D. both Assertion and Reason are false statements

Answer: B

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2. A : The co - ordination number of CaF_2 is 8 : 4.

R : Ca^{2+} ions occupy ccp lattice while F^-

ions occupy 50% octahedral voids and 50% tetrachedral voids.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: C

 Watch Video Solution

3. A : The number of spheres are equal to the number of octahedral voids as well as tetrahedral void.

R : Octahedral void and tetrahedral void has equal size.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: D

Watch Video Solution

4. A : In Schottky defect, density of crystal decreases.

R : Equal number of cations and anions are missing in Schottky defect.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: A

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5. A : If a tetrad axis is passed through the unit cell of NaCl and all ions removed which are touching to tetrad axis then the formula of NaCl becomes Na_3Cl_4.

R : Only one Na^+ is removed not the Cl^-.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation

of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: D

Watch Video Solution

6. A : A particle at the corner of CCP unit cell has $\frac{1}{8}th$ of its contribution to the unit cell.

R : In any space lattice the corner of the unit cell is always shared by the eight unit cell.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: C

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7. A : Glass belongs to the category of covalent network solid.

R : Unit cell of glass is hexagonal.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: D

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8. A : NaCl shows Schottky defect at room temperature.

R : NaCl shows F centre at high temperature.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: B

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9. A : Fe_3O_4 is ferrimagnetic at room temperature but becomes paramagnetic at 850 K.

R : The magnetic moment in Fe_3O_4 are aligned equally in parallel and antiparallel directions which on heating randomise.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: C

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10. A : In molecular solids the lattice points are occupied by the atoms or molecules.

R : Molecular solids are generally sublime.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: B

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11. A : Silicon is insulator at 0 K but semiconductor at room temperature.

R : Conductivity of silicon at room temperature is due to electronic defect.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: A

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12. A : Amorphous solids are isotropic.

R : Amorphous solids are not rigid.

A. If both Assertion & Reason are true and the reason is the correct explanation of

the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: B

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13. A : In NaCl coordination number of Cl^- ion is 6 but in CsCl coordination number of Cl^- ion is 8.

R : Ionic radii changes with type of lattice.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation

of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: C

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14. A : All crystals of same substance possess the same elements of symmetry.

R : The size of crystal of same substance may vary depending upon the conditions of crystallisation.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation

of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: B

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15. A : AgBr shows both Schottky and Frenkel defect.

R : AgBr is a crystalline solid.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: B

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16. A : Number of carbon atoms per unit cell in diamond is 8.

R : The structure of diamond is similar to ZnS.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: A

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17. A : The coordination number of ionic compound depends upon radius ratio.

R : Higher the coordination number higher will be stability.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: B

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18. A : Number of rectangular plane in a cubic crystal is 3.

R : Rectangular planes passes through corner to corner of unit cell.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: C

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19. A : ccp is more efficient than hcp.

R : Packing fraction is different in both cases.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: D

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20. A : Coordination number of both Na^+ and Cl^- NaCl is 6.

R : Second coordination number of Cl^- in the NaCl unit is 12.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: B

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