



CHEMISTRY

BOOKS - DISHA PUBLICATION CHEMISTRY (HINGLISH)

THE SOLID STATE

Jee Main 5 Years At A Glance

1. All of the following share the same crystal structure except

A. RbCl

B. NaCl

C. CsCl

D. LiCl

Answer: D



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

A. $\uparrow \downarrow \downarrow \downarrow \downarrow \uparrow$

B. $\uparrow \uparrow \uparrow \uparrow \uparrow \uparrow$

C. $\uparrow \uparrow \downarrow \uparrow \uparrow \downarrow$

D. $\uparrow \downarrow \uparrow \downarrow \uparrow \downarrow$

Answer: D



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

A. Schottky defect

B. Vacancy defect

C. Frenkel defect

D. Metal deficiency defect

Answer: C



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

A. $2a$

B. $2\sqrt{2}a$

C. $\sqrt{2}a$

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

Answer: D



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5. Sodium metal crystallises in body centred cubic lattice with cell edge 4.29\AA . What is the radius of sodium atom ?

A. 5.27\AA

B. 0.93\AA

C. 1.86\AA

D. 3.22\AA

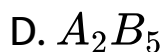
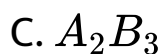
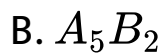
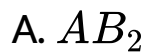
Answer: C



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6. In a face centred cubic lattice, atom A occupies the corner positions and atom B occupies the face centred positions. If one atom of B is missing from

one of the face centred points,, the formula of the compound is :



Answer: D



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

- A. Schottky defect
- B. Frenkel defect
- C. Interstitial position
- D. F-centres

Answer: D



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8. In a monoclinic unit cell the relation of sides and angles are respectively

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

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

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

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

Answer: C



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9. 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: B



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10. $CsCl$ crystallizes in body centred cubic lattice. If

' a ' is its edge length then which of the following expressions is correct ?

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

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

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

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

Answer: C



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11. The correct statement for the molecule, CsI_3 is

A. It is a covalent molecule.

B. It contains Cs^+ and I_3^- ions.

C. It contains Cs^{3+} and I^- ions.

D. It contains Cs^+ , I and lattice I_2 molecule.

Answer: B



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Exercise 1 Concept Builder

1. Solid CH_4 is

- A. ionic solid
- B. covalent solid
- C. molecular solid
- D. does not exist

Answer: C



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2. Which compound will show the highest lattice energy ?

A. KF

B. NaF

C. CsF

D. RbF

Answer: B



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3. An example of a covalent crystalline solid is:

A. Si

B. Al

C. NaF

D. Ar

Answer: A



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4. Which of the following compounds is a good conductor of electricity in solution state?

A. Covalent

B. Molecular

C. Metallic

D. Ionic

Answer: D



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5. A solid with high electrical and thermal conductivity is

A. Si

B. Li

C. NaCl

D. Ice

Answer: B



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6. Solid which do not show the same physical properties in different directions are called:

- A. Pseudo solids
- B. Isotropic solids
- C. Polymorphic solids
- D. Anisotropic solids

Answer: D



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7. Crystals can be classified into ...basic crystal habits

A. 7

B. 4

C. 14

D. 2

Answer: A



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8. In which of the following pairs of structures, tetrahedral as well as octahedral as well as octahedral holes are found?

- A. bcc and fcc
- B. hcp and simple cubic
- C. hcp and ccp
- D. bcc and hcp

Answer: C



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9. How many "nearest" and "next nearest" neighbours, respectively, does potassium have in bcc lattice?

A. 8,8

B. 8,6

C. 6,8

D. 6,6

Answer: B



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10. solid AB crystallises as NaCl structure and the radius of the cation is 0.100nm. The maximum radius of the anion can be :

A. 0.137 nm

B. 0.241 nm

C. 0.274 nm

D. 0.482 nm

Answer: B



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11. In NaCl crystal each Cl^- ion is surrounded by

A. $4Na^+$ ions

B. $6Na^+$ ions

C. $1Na^+$ ions

D. $2Na^+$ ions

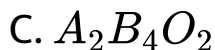
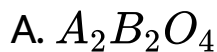
Answer: B



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12. In the spinel structure, oxides, ions are cubical-closest packed whereas $1/8$ th of tetrahedral voids

are occupied by A^{2+} cation and 1/2 of octahedral voids are occupied by B^{3+} cations. The general formula of the compound having spinel structure is:



Answer: B



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13. What would be the effective number of atoms per unit cell in end centred cubic unit cell, if this type of unit cell exist in nature?

A. 1

B. 2

C. 3

D. 4

Answer: B



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14. The effective number of atoms per unit cell in a face centred cube and body centred cube are :

A. 4,2

B. 2,4

C. 14,9

D. 3,2

Answer: A



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15. In the closed packing of atoms A (radius: r_a), the radius of atom B that can be fitted into tetrahedral void is:

A. $0.155r_a$

B. $0.225r_a$

C. $0.414r_a$

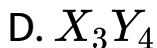
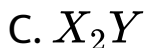
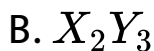
D. $0.732r_a$

Answer: B



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16. In a compound, atoms of element Y form a ccp lattice and those of element X occupy $\frac{2}{3}$ of the tetrahedral voids. The formula of the compound will be:



Answer: A



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17. Which of the following is the incorrect statement?

A. NaCl has 6 : 6 coordination and CsCl has 8: 8 coordination

B. In Na_2O each oxide ion is coordinated by $8Na^+$ ions and each Na^+ ion by 4 oxide ions.

C. NaCl structure transform to CsCl structure on heating

D. NaCl is subjected to high pressure, it transforms into CsCl.

Answer: C



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18. The range of radius ratio (cationic to anionic) for an octahedral arrangement of ions in an ionic solid is

A. 0-0.155

B. 0.155-0.225

C. 0.225-0.414

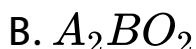
D. 0.414-0.732

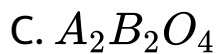
Answer: D



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19. 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 monovalent metal B .The formula of the oxide is





Answer: D



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20. Lattice energy of a solid increases if

A. size of ions are small

B. charges of ions are small

C. ions are neutral

D. none of these

Answer: A



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21. In graphite, electrons are

- A. localised on each carbon atom
- B. spread out between the sheets
- C. localised on every third carbon atom.
- D. present in antibonding orbital

Answer: B



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22. A crystalline solid

- A. changes abruptly from solid to liquid when heated
- B. has no definite melting point
- C. undergoes deformation of its geometry easily
- D. has an irregular 3-dimensional arrangements

Answer: A



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23. Among solid the highest melting point is established by

A. covalent solids

B. ionic solids

C. pseudo solids

D. molecular solids

Answer: A



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24. The major binding force of diamond, silicon and quartz is

- A. electrostatic force
- B. electrical attraction
- C. covalent bond force
- D. non-covalent bond force

Answer: C



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25. Which one of the following forms a molecular solid when solidified?

A. Silicon carbide

B. Calcium fluoride

C. Rock salt

D. Methane

Answer: D



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

- A. thirteen planes of symmetry and nine axis of symmetry
- B. thirteen axis of symmetry and nine planes of symmetry
- C. thirteen axis and thirteen planes of symmetry
- D. nine planes and nine axis of symmetry

Answer: B



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27. Uncharged molecules or atoms are never crystallized in

A. ccp

B. hcp

C. bcc

D. simple cubic

Answer: D



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28. Face-centred cubic packing of uniform spherical units is represented by

A. ABAB.....

B. ABBAAB...

C. ABCABC.....

D. ABCACBABA.....

Answer: C



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29. The number of tetrahedral and octahedral holes in a hexagonal primitive unit cell are respectively:

A. 8,4

B. 6,12

C. 2,1

D. 12,6

Answer: D



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30. 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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31. Among the following which has the highest cation to anion size ratio ?

A. NaF

B. CsI

C. CsF

D. LiF

Answer: C



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

A. 275.1 pm

B. 322.5 pm

C. 241.5 pm

D. 165.7 pm

Answer: C



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

A. 8

B. 6

C. 1

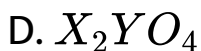
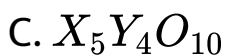
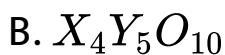
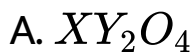
D. 4

Answer: A



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34. In a cubic closed packed structure of mixed oxides the lattice is made up of oxide ions, one eighth of tetrahedral voids are occupied by divalent ions (A^{2+}) while one half of the octahedral voids occupied trivalent ions (B^{3+}). What is the formula of the oxide ?



Answer: B

35. Consider the radii 0.095 nm (Na^+), 0.181 nm (Cl^-), 0.074 nm (Zn^{2+}), 0.184 nm (S^{2-}), 0.068 nm (Ti^{4+}), 0.140 nm (O^{2-}), 0.169 nm (Cs^+) .

Choose the correct option from among the following. (Use radius ratio rules)

A. Na^+ ions are packed in octahedral holes

between the planes of close-packed Cl^- ions

B. Zn^{2+} ions are packed in tetrahedral holes

C. Cs^+ ions are packed in a simple cubic array
of Cl^- ions

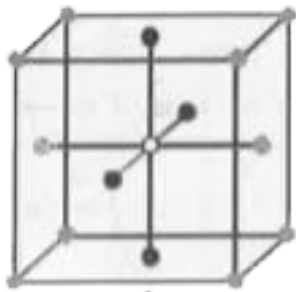
D. All of these

Answer: D

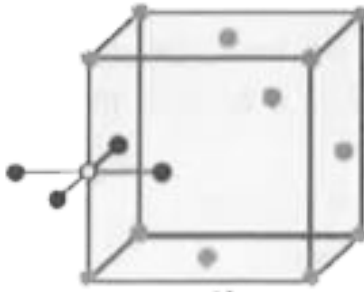


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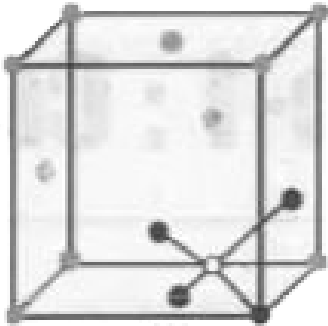
36. Consider the following fcc unit cells choose the correct option



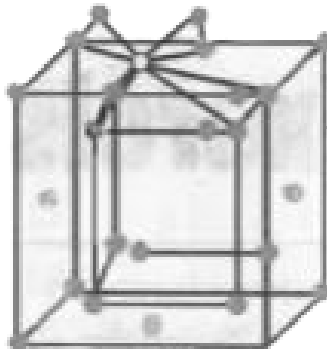
I



II



III



IV

A. I and II represent tetrahedral holes

B. II, III and IV represent tetrahedral holes

C. I and II represent octahedral holes

D. I, II and IV represent octahedral holes

Answer: C



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37. CaS exists in a cubic close packed arrangement of S^{2-} ions in which Ca^{2+} ions occupy $1/2$ of the available tetrahedral holes. How many Ca^{2+} and S^{2-} ions are contained in the unit cell?

- A. 1,1
- B. 2,4
- C. 4,4
- D. 4,2

Answer: C



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

A. 8,4,8, 100%

B. 8,4, 8, 50%

C. 4, 8, 8,50%

D. 4,8, 8, 100%

Answer: D



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39. Polonium crystallizes in a simple cubic structure. The edge of the unit cell is 0.236nm.

What is the radius of the polonium atoms:

A. 0.144 nm

B. 0.156 nm

C. 0.118 nm

D. 0.102 nm

Answer: C



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40. $CsBr$ has bcc structure with edge length 4.3 pm
.The shortest interionic distance in between Cs and
Br is

A. 3.72 pm

B. 1.86 pm

C. 7.44 pm

D. 4.3 pm

Answer: A



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41. In an ionic compound A^+X^- , the radii of A^+ and X^- ions are 1.0pm and 2.0pm, respectively.

The volume of the unit cell of the crystal AX will be:

A. 27pm^3

B. 64pm^3

C. 125pm^3

D. 216pm^3

Answer: D



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42. The coordination number X (---) of each ion in KBr is changed to Y (---) by

- A. X=6 to Y= 8 applying high temperature
- B. X=8 to Y=6 applying high pressure
- C. X=6 to Y= 8 applying high pressure
- D. none of these

Answer: C



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43. Each edge of a cubic unit cell is 400pm long. If atomic mass of the elements is 120 and its density is 6.25g/cm^2 , the crystal lattice is:
(use $N_A = 6 \times 10^{23}$)

- A. Primitive
- B. Body centered
- C. Face centered
- D. End centered

Answer: B



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44. The atomic radius of strontium (Sr) is 215pm and it crystallizes with a cubic. Closest packing . Edge length of the cube is :

A. 430 pm

B. 608.2 pm

C. 496.53 pm

D. none of these

Answer: B



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

A. $2a$

B. $2\sqrt{2}a$

C. $\sqrt{2}a$

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

Answer: D



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46. An element having an atomic radius of 0.14 nm crystallises in a fcc unit cell. What is the length of side of the cell ?

A. 0.56 nm

B. 0.24 nm

C. 0.96 nm

D. 0.4nm

Answer: D



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47. Ammonium chloride crystallizes in a body centred cubic lattice with edge length of unit cell of 390 pm. If the size of chloride ion is 180 pm, the size of ammonium ion would be

A. 174 pm

B. 158 pm

C. 142 pm

D. 126 pm

Answer: B



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

A. 288 pm

B. 398 pm

C. 618 pm

D. 144 pm

Answer: D



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

A. 10.376g/cm^3

B. 5.188g/cm^3

C. 7.289g/cm^3

D. 2.144g/cm^3

Answer: B



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50. If the pressure on a $NaCl$ structure increases, then its coordination number will

- A. Increase
- B. Decrease
- C. Remain same
- D. None of these

Answer: A



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51. An element occurring in the bcc structure has 12.08×10^{23} unit cells. The total number of atoms of the element in these cells will be

A. 24.16×10^{23}

B. 36.18×10^{23}

C. 6.04×10^{23}

D. 12.08×10^{23}

Answer: A



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

A. 1×10^{25}

B. 2×10^{25}

C. 3×10^{25}

D. 4×10^{25}

Answer: D



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

A. 276 pm

B. 138 pm

C. 552 pm

D. 415 pm

Answer: C



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

A. 288 pm

B. 408 pm

C. 144 pm

D. 204 pm

Answer: A



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55. A metal has an fcc lattice. The edge length of the unit cell is 404 pm. The density of the metal is 2.72 g/cm^{-3} . The molar mass of the metal is $(N_A \text{ Avogadro's constant} = 6.2 \times 10^{23} \text{ mol}^{-1})$

A. 30 g mol^{-1}

B. 27 g mol^{-1}

C. 20 g mol^{-1}

D. 40 g mol^{-1}

Answer: B



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56. 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



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57. 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. 127pm

B. 80 pm

C. 108 pm

D. 40 pm

Answer: A



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58. The vacant space in bcc lattice unit cell is

A. 0.26

B. 0.48

C. 0.23

D. 0.32

Answer: D



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59. Non-stoichiometric compound have the properties of:

A. electrical conductance

B. isolation

C. insulation

D. none of these

Answer: D



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60. In Bragg's equation for diffraction of X-rays 'n' represents

A. quantum number

B. an integer

C. Avogadro's numbers

D. moles

Answer: B



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61. Bragg's law is given by the equation:

A. $n\lambda = 2\theta \sin \theta$

B. $n\lambda = 2d \sin \theta$

C. $2n\lambda = d \sin \theta$

$$D. n \frac{\theta}{2} = \frac{d}{2} \sin \theta$$

Answer: B



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62. Each of the following solids show, the Frenkel defect except

A. ZnS

B. AgBr

C. AgI

D. KCl

Answer: D



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63. Schottky defect defines imperfection in the lattice structure of a

A. solid

B. gas

C. liquid

D. plasma

Answer: A



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

- A. p-type semiconductor
- B. n-type semiconductor
- C. insulator
- D. rectifier

Answer: A



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

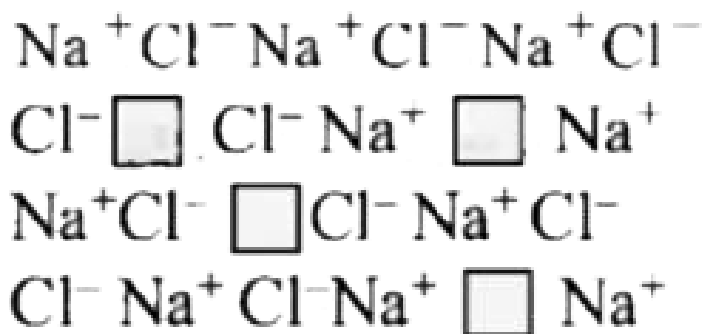
- A. Schottky defect
- B. Frenkel defect
- C. Stoichiometric defect
- D. F-centre

Answer: D



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66. Crystal defect indicated in the diagram below is



- A. Interstitial defect
- B. Schottky defect
- C. Frenkel defect
- D. Frenkel and Schottky defects

Answer: B



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67. Schottky defect is generally observed in :

A. NaCl

B. KCl

C. CsCl

D. All of these

Answer: D



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68. The ratio of inner planar distances of three types of planes (d_{100} , d_{110} , d_{111}) for simple cubic lattice are

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

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

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

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

Answer: A



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

A. 18

B. 12

C. 15

D. 6

Answer: A



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70. Dopping of AgCl crystals with $CdCl_2$ results in:

- A. frenkel defect
- B. schottky defect
- C. substitutional cation vacancy
- D. formation of F-centres

Answer: C



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Exercise 2 Concept Applicator

1. Non-stoichiometric compound have the properties of:

A. electrical conductance

B. isolation

C. insulation

D. None of these

Answer: D



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2. The ability of a substance to exist in two or more crystalline forms is known as:

- A. Amorphism
- B. Isomorphism
- C. Polymorphism
- D. Isomerism

Answer: C



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3. For a cubic geometry the limiting $\frac{r^+}{r^-}$ is:

A. 0.414

B. 0.155

C. 70.731

D. 0.731

Answer: C



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

- A. Simple cubic
- B. Face-centred cubic
- C. Body-centred cubic
- D. None of these

Answer: C



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5. 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. A_6B

C. AB_6

D. A_8B_4

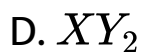
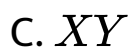
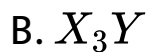
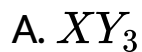
Answer: A



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6. 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



Answer: A



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7. 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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8. A match box exhibits

- A. cubic geometry
- B. monoclinic geometry
- C. orthorhombic geometry
- D. tetragonal geometry

Answer: C



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9. Li' forms a body centered cubic lattice. If the lattice constant is $3.5 \times 10^{-10}m$ and the

experimental density is $5.30 \times 10^3 \text{ kgm}^{-3}$, calculate the percentage occupancy of Li metal.

A. 0.8778

B. 0.9987

C. 0.9778

D. 0.9412

Answer: C



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10. Coordination number of "C" in Be_2C_3 whose structure is correlated with that of CaF_2 is:

A. 2

B. 4

C. 6

D. 8

Answer: D



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11. The fraction of volume occupied by atoms in a primitive cubic unit cell is nearly:

A. 0.48

B. 0.52

C. 0.55

D. 0.68

Answer: B



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12. The fraction of volume occupied by atoms in a body centered cubic unit cell is:

A. 0.32

B. 0.48

C. 0.68

D. 0.74

Answer: C



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13. The fraction of volume occupied by atoms in a face centered cubic unit cell is:

A. 0.32

B. 0.48

C. 0.68

D. 0.74

Answer: D



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14. Molybdenum ($\text{At. mass} = 96 \text{ g/mol}^{-1}$)

crystallizes as bcc crystal. If density of crystal is

10.3 g/cm^3 , then radius of Mo atoms

(use $N_A = 6 \times 10^{23}$):

A. 111 pm

B. 314 pm

C. 135.96 pm

D. none of these

Answer: C



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15. The atomic fraction (d) of tin in bronze (fcc) with a density of 7717kgm^{-3} and a lattice parameter of 3.903\AA is
($Aw_{Cu} = 63.54, Sn = 118.7, 1a\mu = 1.66 \times 10^{-27}\text{kg}$)

A. 0.01

B. 0.05

C. 0.1

D. 3.8

Answer: B



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16. Which one of the following has minimum value of cation/anion ratio ?

A. KCl

B. NaCl

C. CaF_2

D. $MgCl_2$

Answer: C



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17. What is the number of tetrahedral voids per atom in a crystal?

A. 1

B. 2

C. 6

D. 8

Answer: B



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18. Which set of following characteristics for ZnS crystal is correct?

A. Coordination number (4 : 4), ccp, Zn^{++} ion in the alternate tetrahedral voids

B. Coordination number (6:6), hcp, Zn^{++} ion in all tetrahedral voids.

C. Coordination number (6:4), hcp, Zn^{++} ion in all octahedral voids

D. Coordination number (4 : 4), ccp, Zn^{++} ion in all tetrahedral voids.

Answer: A



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19. By X-ray diffraction it is found that nickel (atomic mass = 59g mol^{-1}), crystallizes with ccp. The edge length of the unit cell is 3.5\AA . If density of Ni crystal is 9.0g/cm^3 , then value of Avogadro's number from the data is:

A. 6.05×10^{23}

B. 6.11×10^{23}

C. 6.02×10^{23}

$$D. 6.023 \times 10^{23}$$

Answer: B



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20. CsBr crystallises in a body centered cubic lattice.

The unit cell length is 436.6 pm. Given that the

atomic mass of Cs = 133 and that of Br = 80 amu and

Avogadro number being $6.02 \times 10^{23} \text{ mol}^{-1}$ the

density of CsBr is

A. $0.425 \text{ g} / \text{cm}^3$

B. $8.5 \text{ g} / \text{cm}^3$

C. $4.25\text{g}/\text{cm}^3$

D. $82.5\text{g}/\text{cm}^3$

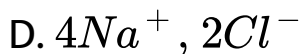
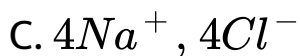
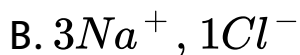
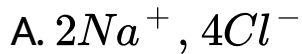
Answer: B



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21. The density of sodium chloride at 25°C is $2.163 \times 10^3 \text{ kg m}^{-3}$. When X-rays from a palladium target having wavelength of 58.1 pm are used, the (200) reflection of sodium chloride occurs at an angle of 5.90° . How many Na^+ and Cl^-

ions are present in the unit cell ? (Molar mass of
 $\text{NaCl} = 58.5 \text{ mol}^{-1} \sin 5.9^\circ = 0.1028$)



Answer: C



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22. Which of the following expression is correct for packing fraction of NaCl if the ions along with face are diagonally removed?

A.
$$\frac{\frac{13}{3}\pi r_-^3 + \frac{16}{3}\pi r_+^3}{8(r_+ + r_-)^3}$$

B.
$$\frac{\frac{13}{3}\pi r_-^3 + \frac{4}{3}\pi r_+^3}{8(r_+ + r_-)^3}$$

C.
$$\frac{\frac{16}{3}\pi r_-^3 + \frac{13}{3}\pi r_+^3}{8(r_+ + r_-)^3}$$

D.
$$\frac{\frac{4}{3}\pi r_-^3 + \frac{13}{3}\pi r_+^3}{8(r_+ + r_-)^3}$$

Answer: A



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23. The angle between the two planes represented by the Miller indices (110) and (111) in a simple cubic lattice is:

A. 30°

B. 45°

C. 60°

D. none

Answer: D



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24. The coordination number of each atom in body centered cubic unit cell is

- A. $(0,0,0)$ and $(1/2,0,0)$
- B. $(0,0,0)$ and $(1/2,1/2, 1/2)$
- C. $(0,0,0)$ and $(0,1/2,0)$
- D. $(0,0,0)$ and $(0,0,1/2)$

Answer: B



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25. The first order reflection of a beam of X-rays of wavelength 1.54 \AA from the (100) face of a crystal of the simple cubic type occurs at an angle of 11.29° . Calculate the length of the unit cell.

A. $3.93 \times 10^{-4} \text{ cm}$

B. $2 \times 10^{-7} \text{ cm}$

C. $3.93 \times 10^{-8} \text{ cm}$

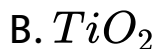
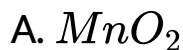
D. $4.0 \times 10^8 \text{ cm}$

Answer: C



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



Answer: A



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

A. 1.24×10^{-17}

B. 2.6×10^{-6}

C. 4.00×10^{-12}

D. 10.24×10^{-13}

Answer: A



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28. When an electron in an excited state of Mo atom falls L to K -shell, an X -ray is emitted. These X -rays are diffracted at angle of 7.75° by planes with a separation of 2.64\AA . What is the difference in energy between K-shell and L -shell in Mo, assuming a first order diffraction? ($\sin 7.75^\circ = 0.1349$)

A. $26.88 \times 10^{-16} J$

B. $25.27 \times 10^{-15} J$

C. $27.88 \times 10^{-16} J$

D. none of these

Answer: C

29. Both NaCl and KCl crystallize with the fcc structure. However, the X-ray powder diffraction pattern of NaCl corresponds to the fcc structure whereas, that of KCl corresponds to simple cubic structure. This is because

A. K^+ and Cl^- are isoelectric.

B. Na^+ and Cl^- are isoelectric.

C. K^+ and Cl^- are disordered in the crystal lattice.

D. KCl has anti-site defects.

Answer: A



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30. Calcium crystallises in a face-centered cubic unit cell with a 0.556 nm and density $1.4848\text{g}/\text{cm}^3$.

Percentage of Schottky defects in the crystal is:

A. 0.03

B. 0.02

C. 0.038

D. 0.04

Answer: D



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