Solid State

1. Type of Solids, Crystal & its Properties

Q 1. In amorphous solid, regular arrangement of constituent species are present
(A) in small region
(B) in complete solid
(C) No where inside solid
(D) None of these

Q 2. Which of the following is not properties of crystalline solid
(A) formation of crystal
(B) sharp melting point
(C) Isotropic material
(D) All of these

Q 3. Which of the following is not a characteristic of a crystalline solid? **[NCERT Examplar]**
(A) Definite and characteristic heat of fusion
(B) Isotropic nature
(C) A regular periodically repeated pattern of arrangement of constituent particles in the entire crystal
(D) A true solid

Q 4. Which of the following is true about refractive index of quartz glass? **[NCERT Examplar]**
(A) Same in all directions
(B) Different in different directions
(C) Cannot be measured
(D) Always zero

Q 5. The sharp melting point of crystalline solids is due to **[NCERT Examplar]**
(A) a regular arrangement of constituent particles observed over a short distance in the crystal lattice
(B) a regular arrangement of constituent particles observed over a long distance in the crystal lattice
(C) same arrangement of constituent particles in different directions
(D) different arrangement of constituent particles in different directions

Q 6. Solid A is a very hard electrical insulator in solid as well as in molten state and melts at extremely high temperature. What type of solid is it? **[NCERT Solved]**

Q 7. Which of the following is/are amorphous solids?
I. KCl
II. Barium chloride dehydrate
III. Rubber
IV. Solid cake left after distillation of coal tar
(A) I, III (B) II, III
(C) III, IV (D) Only III

Q 8. Classify each of the following solids as ionic, metallic, molecular, network (covalent) or amorphous
(a) Tetra phosphorous decaoxide (P_4O_{10})
(b) Graphite (c) Brass
(d) Ammonium phosphate $(NH_4)_3PO_4$
(e) SiC (f) Rb
(g) I_2 (h) LiBr
(i) P_4 (j) Si
(k) Plastic

Q 9. Which of the following is a network solid ? **[NCERT Examplar]**
(A) $SO_2(solid)$ (B) I_2
(C) Diamond (D) $H_2O(ice)$

Q 10. Which of the following solids is not an electrical conductor? **[NCERT Examplar]**
1. Mg (s) 2. TiO (s)
3. $I_2(s)$ 4. $H_2O(s)$
(A) Only 1 (B) Only 2
(C) 3 and 4 (D) 2,3 and 4

Q 11. The ability of a substance to assume in two or more crystalline structure is called **[CBSE PMT 90]**
(A) isomersim (B) polymorphism
(C) isomorphism (D) amorphism

Q 12. In 2-D solid, no. of different type of crystals are
(A) 2 (B) 3
(C) 7 (D) 5

Q 13. Which of the following is property of crystal structure?
(A) definite geometrical shape
(B) sharp edge
(C) Flat face

(D) All of these

Q 14. In 3-D unit cell, no. of parameters that–define unit cell is
(A) 3 (B) 6
(C) 7 (D) None of these

Q 15. In 2-D & 3-D unit cell, no. of lattice structure possible are respectively
(A) 2,4 (B) 3,4
(C) 4,4 (D) 4,2

Q 16. Which of the property of unit cell is always fixed
(A) unit cell intercepts (B) Interfacial angles
(C) Both A and B (D) None of these

Q 17. In a cubic unit cell, no. of plane of symmetry is
(A) 3 (B) 6
(C) 9 (D) 12

Q 18. In a cubic unit cell, no, of 2-fold axis of symmetry is
(A) 6 (B) 9
(C) 10 (D) 13

Q 19. In a cubic unit cell, total no. of element of symmetry is
(A) 21 (B) 18
(C) 20 (D) 23

Q 20. In hexagonal unit cell, the x-fold axis of symmetry is present & hence x is
(A) 3 (B) 6
(C) 5 (D) None of these

2. Bravius Lattice, Unit Cell Properties

Q 1. In 2-D hexagon unit cell
(A) $a = b, \alpha = 60°$ (B) $a = b, \alpha = 120°$
(C) $a \neq b, \alpha = 60°$ (D) $a \neq b, \alpha = 120°$

Q 2. The unit cell with crystallographic dimensions $a = b \neq c, \alpha = \beta = \gamma = 90°$ is
(A) Cubic (B) Tetragonal
(C) Monoclinic (D) Hexagonal

Q 3. The 3-D unit cell with $a \neq b \neq c, \alpha = \beta = 90°$, $Y \neq 90°$ is
(A) Triclinic (B) Hexagonal
(C) Monoclinic (D) Rhombohedral

Q 4. The most symmetric crystal among given unit cells is
(A) orthorhombic (B) Rhombohedral
(C) Tetragonal (D) Hexagonal

Q 5. For orthorhombic system, axial ratios are $a \neq b \neq c$, & axial angles are **[CBSE AIPMT 91]**
(A) $\alpha = \beta = \gamma \neq 90^o$ (B) $\alpha = \beta = \gamma = 90^o$
(C) $\alpha = \gamma = 90^o, \beta \neq 90^o$ (D) $\alpha \neq \beta \neq \gamma \neq 90^o$

Q 6. The crystal system of a compound with unit cell dimensions a = 0.387, b = 0.387 & c = 0.504 nm and $\alpha = \beta = 90^0$ & $\gamma = 120^0$ is **[AIIMS 2004]**
(A) Cubic (B) Hexagonal
(C) orthorhombic (D) Rhombohedral

Q 7. In hexagonal unit cell, Bravius lattice present are
(A) Primitive & body centered
(B) Primitive & face centered
(C) Primitive
(D) Primitive & end face centered

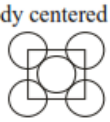
Q 8. In monoclinic unit cell which bravius lattice does not exist
(A) Primitive (B) Body centered
(C) End face centered (D) None of these

Q 9. Match the crystal systems/unit cells metioned in column I with their characteristic features mentioned in column II.

Column-I
(A) Simple cubic and face – centred cubic
(B) Cubic and rhomohedral
(C) Cubic and tetragonal
(D) Hexagonal and monoclinic

Column –II
(P) cell parameters $a = b = c$ & $\alpha = \beta = \gamma$
(Q) are two crystal systems
(R) only two crystallographic angles of 90°
(S) belong to the same crystal system 1

Q 10. The rank of body centered 2-D unit cell square is



(A) 1 (B) 2
(C) 3 (D) 4

Q 11. The rank of body centered 2-D unit cell hexagon is

(A) 1 (B) 2
(C) 3 (D) 4

Q 12. How many atoms are provided by the edge atom of a cube to the unit cell ?
(A) 1/2 (B) 1/4
(C) 1/8 (D) 1

Q 13. How much is the contribution in a unit cell of a particle at corner of a simple cube ?
(A) 1 (B) 1/2
(C) 1/4 (D) 1/8

Q 14. An atom at the face centre of a face –centered cubic cell is shared by
(A) 4 unit cells (B) 2 unit cells
(C) 1 unit cell (D) 6 unit cells

Q 15. Which of the following cubic lattices has the maximum number of atoms per unit cell?
(A) simple cubic
(B) body – centered cubic
(C) face – centered cubic
(D) all have the same number of atoms

Q 16. In hexagonal 3-D unit cell, atoms at edge centre is contributed to
(A) 2 unit cell (B) 3 unit cell
(C) 4 unit cell (D) 6 unit cell

Q 17. Solid has a structure in which W atoms are located at the corners of a cubic lattice, O atom at the centre of the edges & Na atom at centre of the cubic lattice. The formula for the compound is
(A) $NaWO_2$ (B) $NaWO_3$
(C) Na_2WO_3 (D) $NaWO_4$

Q 18. Three elements P,Q and R crystallize in a cubic solid lattice. The P atoms occupy the corners, Q atoms the face centres and R atoms the edge centres. The formula of the compound is
(A) PQR (B) PQR_2
(C) PQ_3R_3 (D) PQ_3R

Q 19. A face – centered cubic arrangement has 'A' and 'B' atoms. 'A' atoms are at the corners of the unit cell and 'B' atoms are at the face centers. One of the 'A' atom is missing from one corner in the unit cell. The formula of the compound is
(A) A_7B_3 (B) AB_2
(C) AB_3 (D) A_7B_{24}

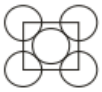
Q 20. In a face centred cubic arrangement of A and B atoms whose A atoms are at the corner of the unit cell and B atoms at the face centres. One of the B atoms is missing from one of the faces in the unit cell. The simplest formula of compound is
(A) AB_3 (B) A_8B_5
(C) A_2B_5 (D) $AB_{2/5}$

Q 21. The lattice site in a pure crystal cannot be occupied by ….. **[NCERT Examplar]**
(A) molecule (B) ion
(C) electron (D) atom

3. Type of Cubic Unit cell

Q 1. The co-ordination no. of primitive square 2-D arrangement is
(A) 4 (B) 6 (C) 8 (D) 12

Q 2. The co-ordination no. of body centered hexagonal 2-D arrangement



(A) 4 (B) 6 (C) 8 (D) 12

Q 3. The packing fraction of following 2-D unit cell is
(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{6}$
(C) $\frac{\pi}{4}$ (D) None of these

Q 4. The packing fraction of following 2-D unit cell is

(A) $\frac{\pi}{2\sqrt{3}}$ (B) $\frac{\pi}{3\sqrt{3}}$
(C) $\frac{\pi}{4}$ (D) $\frac{\pi}{6}$

Q 5. In simple cubic unit cell, Nearest neighbours & next nearest neighbours of the element are respectively
(A) 6,8 (B) 6,6
(C) 6,12 (D) None of these

Q 6. An element crystallizes in a 'bcc' lattice. Nearest neighbours and next neighbours of the element are respectively
(A) 8,8 (B) 8,6
(C) 6,8 (D) 6,6

Q 7. In fcc cubic unit cell, Nearest neighbours & next nearest neighbor of the element are respectively
(A) 12,12 (B) 12,6
(C) 12,24 (D) 12,8

Q 8. The fraction of total volume occupied by the atoms present in a simple cube is
(A) $\frac{\pi}{3\sqrt{2}}$ (B) $\frac{\pi}{4\sqrt{2}}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{6}$

Q 9. Fraction of total volume occupied by atoms in a body centered cubic cell is
(A) $\frac{\pi}{2}$ (B) $\frac{\sqrt{3}\pi}{8}$
(C) $\frac{\sqrt{2}\pi}{6}$ (D) $\frac{\pi}{6}$

Q 10. The void fraction of CCP lattice is approximately
(A) 32% (B) 26%
(C) 28% (D) 46%

Q 11. Total volume of atoms present in a face-centred cubic unit cell of a metal is (r is atomic radius)
(A) $\frac{20}{3}\pi r^3$ (B) $\frac{24}{3}\pi r^3$
(C) $\frac{12}{3}\pi r^3$ (D) $\frac{16}{3}\pi r^3$

Q 12. In BCC lattice, relation between a (edge length) & r (radius of atom)
(A) $4r = \sqrt{2}a$ (B) $4r = 3\sqrt{3}a$
(C) $4r = \sqrt{3}a$ (D) None of these

Q 13. The maximum co-ordination no. in any lattice is
(A) 12 (B) 16
(C) 24 (D) 20

Q 14. A solid has a B.C.C. structure . If the distance of closest approach between the two atoms is 1.73Å. The edge length of the cell is (approx)
(A) 200 pm (B) $\frac{\sqrt{3}}{\sqrt{2}}$ pm
(C) 142.2 pm (D) $\sqrt{2}$pm

Q 15. The edge lengths of unit cells in terms of radius of spheres present in FCC, BCC & simple cubic unit cells are respectively. **[NCERT Examplar]**
(A) $2\sqrt{2}r, \frac{4\pi}{\sqrt{3}}, 2r$ (B) $\frac{4r}{\sqrt{3}}, 2\sqrt{2}r, 2r$
(C) $2r, 2\sqrt{2}r, \frac{4r}{\sqrt{3}}$ (D) $2r, \frac{4r}{\sqrt{3}}, 2\sqrt{2}r$

Q 16. Gold (atomic radius = 0.144 nm) crystallizes in a face – centred unit cell. What is the length of a side of the cell ? **[NCERT]**

4. HCP lattice, Density of Solids

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

Q 1. The number of atoms in this HCP unit cell is
(A) 4 (B) 6
(C) 12 (D) 17

Q 2. The volume of this HCP unit cell is
(A) $24\sqrt{2}r^3$ (B) $16\sqrt{2}r^3$
(C) $12\sqrt{2}r^3$ (D) $\frac{64}{3\sqrt{3}}r^3$

Q 3. The empty space in this HCP unit cell is
(A) 74% (B) 47.6%
(C) 32% (D) 26%

Q 4. The distance between two consecutive layer is hcp lattice is

(A) $2r\sqrt{\frac{2}{3}}$ (B) $r\sqrt{\frac{2}{3}}$

(C) $2r\sqrt{\frac{3}{2}}$ (D) $r\sqrt{\frac{3}{2}}$

Q 5. At room temperature, sodium crystallizes in a body centered cubic lattice with edge length a = 4.24 A°. The theoretical density of sodium (At. Wt. of Na = 23) will be

(A) 1.002g cm^{-3} (B) 2.002g cm^{-3}

(C) 3.002g cm^{-3} (D) None of these

Q 6. The number of atoms in 100 gm of an fcc crystal with density $d = 10\text{gm cm}^{-3}$ and cell edge as 200 pm is equal to

(A) 3×10^{25} (B) 5×10^{24}

(C) 1×10^{25} (D) 2×10^{25}

Q 7. The cubic unit cell of aluminium (atomic mass 27) has an edge length of 400 pm. Its density is 2.8 g cm^{-3}. The unit cell is

(A) primitive (B) face – centered

(C) body – centered (D) end – centered

Q 8. An element (atomic mass = 100 g/mol) having bcc structure has unit cell edge 400 pm. Then, density of the elements is

(A) 10.376g/cm^3 (B) 5.188g/cm^3

(C) 7.289g/cm^3 (D) 2.144g/cm^3

Q 9. CsBr crystallizes in a body centred cubic lattice (Br at corners and Cs at body centre). The unit cell length is 400 pm. Given that the atomic mass of Cs = 133 amu and that of Br= 80 amu and Avogadro number being $6.02\times10^{23}\text{mol}^{-1}$, the density of CsBr is

(A) 5.52g/cm^3 (B) 55.2g/cm^3

(C) 0.552g/cm^3 (D) 11.04g/cm^3

Q 10. The pyknometric density of sodium chloride is 2.165 x 10^3 Kg/m^3 while –ray density is 2.178 x 10^3 Kg/m^3. The fraction of unoccupied sites in NaCl crystal is **[CBSE PMT 2003]**

(A) 5.96×10^{-1} (B) 5.96×10^{-3}

(C) 5.96 (D) 5.96×10^{-2}

Q 11. The maximum no. of marbles of diameter 10 mm that can be kept inside square of edge length 40 mm is

(A) 16 (B) 12

(C) 18 (D) 24

Q 12. The maximum no. of marbles of diameter 10 mm that can be kept inside square of edge length 50 mm is

(A) 25 (B) 30

(C) 36 (D) 28

Q 13. The maximum no. of marbles diameter 10 mm that can be kept inside Rhombic structure of angle 60° is

(A) 8 (B) 9

(C) 12 (D) None of these

Q 14. An element has BCC structure with a cell edge of 288pm. The density of the element is 7.2 g/cc. How many atoms are present in 208 g of the element? **[NCERT Solved]**

Q 15. An element with molar mass 2.7×10^{-2} Kg/mol forms a cubic unit cell with edge length 405 pm. If its density is $2.7\times10^3\text{kg/m}^3$, What is the nature of the cubic unit cell? **[NCERT Solved]**

Q 16. Silver crystallizes in FCC lattice. If edge length of the cell is 4.07×10^{-8} cm & density is 10.5 g/cc, calculate atomic mass of silver. **[NCERT]**

Q 17. Niobium crystallizes in body- centred cubic structure. If density is 8.55 g cm^{-3}, calculate atomic radius of niobium using its atomic mass 93 u. **[NCERT]**

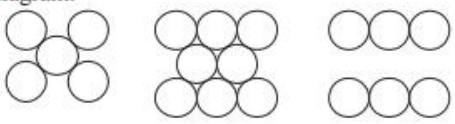
Q 18. Copper crystallizes into a FCC lattice with edge length $3.61\times10^{-8}\text{cm}$. Show that the calculated density is in agreement with its measured value of 8.92 g/cc. **[NCERT]**

Q 19. Aluminium crystallizes in a cubic close- packed structure. Its metallic radius is 125 pm **[NCERT]**
(i) What is the length of the side of the unit cell ?
(ii) How many unit cells are in 1.00 cc of Al?

Q 20. The edge length of unit cell of a metal having atomic weight 75 g/mol is 5Å which crystallizes

in cubic lattice. If the density is 2 g/cc then find the radius of metal atom. $\left(N_A = 6\times10^{23}\right)$. Give the answer in pm.

Q 21. The figures given below show the location of atoms in three crystallographic planes in a fcc lattice. Draw the unit cell for the corresponding structures and identify these panes in your diagram.



5. Closest Packed Structure, Tetrahedral & Octahedral Voids

Q 1. Which one of the following schemes of ordering belongs to cubic closed packed structure
(A) ABCABC (B) ABACABAC
(C) ABBAABBA (D) ABCBCABCBC

Q 2. The number of octahedral and tetrahedral sites in a cubical close packed array of N spheres respectively is
(A) N and 2N (B) N/2 and N
(C) 2N and N (D) 4N and 2N

Q 3. How many octahedral sites per sphere are there in a cubic close – packed structure ?
(A) four (B) two
(C) one (D) six

Q 4. Hexagonal closest- packed structure and a cubic closest-packed structure for a given element would be expected to have
(A) the same coordination number
(B) the same packing fraction
(C) both (A) and (B)
(D) none of these

Q 5. At body centre of FCC lattice, which type of void is present ?
(A) Tetrahedral void (B) octahedral void
(C) Body centered void (D) Face center void

Q 6. Tetrahedral voids are present in FCC structure at
(A) body centre of minicube of side length a/2
(B) body centre of FCC lattice
(C) edge centre of FCC lattice
(D) None of these

Q 7. 3 sphere of the first layer & 3 of the second layer enclose a site at the centre in a close packing arrangement, this site is called **[AIIMS 2015]**
(A) Interstitial void (B) tetrahedral void
(C) Octahedral void (D) Cubic Void

Q 8. An alloy of copper, silver and gold is found to have copper constituting the C.C.P. 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_4Ag_3Au (D) CuAgAu

Q 9. If the anions (A) Form hexagonal closest packing and cations (C) occupy only 2/3 octahedral voids in it, then the general formula of the compound is
(A) CA (B) CA_2
(C) C_2A_3 (D) C_3A_2

Q 10. In metal oxide, the oxide ions are arranged at corners as well as centre of each face and metal ions occupy $\frac{2}{3}$ of octahedral voids, the formula of oxide is
(A) M_2O_3 (B) MO
(C) M_2O (D) MO_2

Q 11. In a close packed structure of mixed oxides, the lattice is composed of oxide ions, one eighth of tetrahedral voids are occupied by divalent cations $\left(A^{2+}\right)$ while one half of octahedral voids are occupied by trivalent cations $\left(B^{3+}\right)$. The formula of oxide
(A) AB_2O_4 (B) ABO_2
(C) A_2BO_2 (D) $A_2B_2O_2$

Q 12. A solid is made of two elements P & Q. Atoms P are in ccp arrangement and atoms Q occupy all the octahedral voids and half of the tetrahedral voids, then the simplest formula of the compound is
(A) PQ_2 (B) P_2Q

(C) PQ (D) P_2Q_2

Q 13. Diamond exists in FCC unit cell with 50% tetrahedral sites also occupied. The effective number of carbon atoms in a unit cell of diamond is
(A) 4 (B) 6
(C) 8 (D) 12

Q 14. 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. One of the B atoms is missing from one of the faces in the unit cell. The simplest formula of compound is
(A) AB_3 (B) A_6B_5
(C) A_2B_5 (D) $AB_{2/5}$

Q 15. A compound is formed by two elements X and Y. Atoms of the element Y (as anions) make ccp and those of the element X (as cations) occupy all the octahedral voids. What is the formula of the compound? **[NCERT Solved]**

Q 16. Atoms of element B form hcp lattice and those of the element A occupy $2/3^{rd}$ of tetrahedral voids. What is the formula of the compound formed by the elements A and B? **[NCERT Solved]**

Q 17. A cubic solid is made of two elements P and Q. Atoms of Q are at the corners of the cube and P at the body centre. What is the formula of the compound? What are the coordination numbers of P and Q ? **[NCERT]**

Q 18. **Assertion (A)**: Total number of octahedral voids present in unit cell of cubic close packing including the one that is present at the body centre, is four
Reason (R): Besides the body centre there is one octahedral void present at the centre of each of the six faces of the unit cell and each of which is shared between two adjacent unit cells.
[NCERT Examplar]
(A) Assertion and reason both are correct statements and Reason is correct explanation for Assertion
(B) Assertion and Reason both are correct statements but Reason is not correct explanation for Assertion
(C) Assertion is correct statement but Reason is wrong statement
(D) Assertion is wrong statement but reason is correct statement

Q 19. Which of the following statement is not true about the hexagonal close packing?
[NCERT Examplar]
(A) The coordination number is 12
(B) It has 74% packing efficiency
(C) Tetrahedral voids of the second layer are covered by the spheres of the third layer
(D) In this arrangement spheres of the fourth layer are exactly aligned with those of the first layer

Q 20. Iron oxide crystallizes 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 Iron oxide. **[NCERT]**

6. Radius Ratio & Type of Voids

Q 1. Which statement is not correct?
(A) host atoms always form the lattice structure
(B) foreign atoms are present in the void formed
(C) cations are always present in void formed
(D) All are correct

Q 2. Which of the following pair of voids have same range of radius ratio for which the atom can occupy that particular void
(A) Tetrahedral & square planar
(B) Square planar & octahedral
(C) Square planar & Body centered
(D) Triangular void & Tetrahedral

Q 3. Octahedral void & square planar voids are formed by following no of atoms respectively
(A) 6,4 (B) 8,4
(C) 4,6 (D) 6,6

Q 4. If the radius of an octahedral void is r and radius of the atom in close packing is R, then
(A) r = 0.732 R (B) R = 0.414r
(C) r = 0.414 R (D) R = 0.732 r

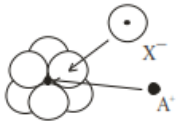
Q 5. In the closest packing of atoms A (radius : r_a), the radius of atom B that can be fitted into tetrahedral voids is

(A) $0.155r_a$ (B) $0.225r_a$
(C) $0.414\ r_a$ (D) $0.732r_a$

Q 6. For an ionic crystal of the general formula AX and coordination number 6, the value of radius ratio will be
(A) greater than 0.732
(B) in between 0.414 and 0.732
(C) in between 0.225 and 0.414
(D) Less than 0.225

Q 7. KCl crystallizes in the same type of lattice as NaCl does. Given that $\frac{r_{Na^+}}{r_{Cl^-}} = 0.6$ and $\frac{r_{Na^+}}{r_{K^+}} = 0.9$. What is the ratio of the side of the unit cell for KCl to that for NaCl ?
(A) 1.04 (B) 2
(C) 5.01 (D) 2.5

Q 8. The arrangement of X- ions around A^+ ion in solid AX is given in the figure (not drawn to scale). If the radius of X^- is 250 pm, the radius of A^+ is



(A) 104 pm (B) 125 pm
(C) 183 pm (D) 57 pm

Q 9. Cesium chloride forms a body centered cubic lattice. Cesium and chloride ions are in contact along the body diagonal of the unit cell. The length of the side of the unit cell is 412 pm and Cl^- ion has a radius of 181 pm. Calculate the radius of Cs^+ ion.
(A) 121.2 pm (B) 251.5 pm
(C) 175.8 pm (D) None of these

Q 10. Packing fraction of AB structure when A^+ is present in octahedral void & B^+ form FCC lattice is
(A) 0.74 (B) 0.793
(C) 0.815 (D) 0.68

Q 11. Packing fraction of CD structure in has D^- from simple cubic lattice & C^+ are present at body centred void (in limiting case) is
(A) 0.68 (B) 0.85
(C) 0.73 (D) 0.55

Q 12. If the radius of the octahedral void is r and radius of the atoms in closepacking is R, derive relation between r and R. **[NCERT]**

7. Type of Ionic Solids

Q 1. In NaCl structure, the no. of NaCl units present in one unit cell is
(A) 4 (B) 6
(C) 8 (D) 1

Q 2. The $\frac{r^+}{r^-}$ range in NaCl structure is
(A) [0.414,0.732) (B) [0.732,0.999)
(C) [0.225,0.414) (D) [0.225,0.732)

Q 3. A solid XY has NaCl structure. If radius of X^+ is 100 pm. What is the radius of Y^- ion ?
(A) 120 pm (B) 136.6 to 241.6 pm
(C) 136.6 pm (D) 241.6 pm

Q 4. 6:6 of NaCl coordination changes to 8:8 coordination of
(A) applying high pressure
(B) increasing temperature
(C) both
(D) no effect of changing pressure and temperature on coordination

Q 5. Among NaCl & CsCl structure, which are is more stable ?
(A) CsCl (B) NaCl
(C) Both are equally stable
(D) Depends on pressure & temperature

Q 6. CsBr has bcc structure with edge length 4.3Å. The shortest inter ionic distance in between Cs^+ and Br^- (in Å) is
(A) 3.72 (B) 1.86
(C) 7.44 (D) 4.3

Q 7. LiBr, NaBr, KBr and RbBr have the same crystal structure (cubic). Which of the following is a simple cubic, whereas all others are fcc arrangement for Br^- ?
(A) LiBr (B) NaBr
(C) KBr (D) RbBr

Q 8. In zinc blende structure, the distance of closest approach between two anions is equal to
(A) half the edge length
(B) half the face diagonal
(C) 3/4th of body diagonal
(D) body diagonal

Q 9. In cubic ZnS lattice, if the radii of Zn^{2+} and S^{2-} ions are 0.38 Å, the lattice parameter (edge length, a) of cubic ZnS is
(A) 11.87 Å (B) 5.94Å
(C) 5.14Å (D) 2.97Å

Q 10. In fluorite structure (CaF_2)
(A) Ca^{++} ions are CCP & F^- ions are present in all the tetrahedral voids
(B) Ca^{++} ions are CCP & F^- ions are present in all the octahedral voids
(C) Ca^{++} ions are CCP & F^- ions are present in all the octahedral voids and half of thetrahedral voids
(D) None

Q 11. The ratio of coordination number of cation and anion in Fluorite CaF_2 and CsCl are respectively
(A) 8:4 and 6:3 (B) 6:3 and 4:4
(C) 8:4 and 8:8 (D) 4:2 and 2:4

Q 12. In fluorite structure, $\frac{r^+}{r^-}$ bewlong to
(A) $(0.414, 0.225]$ (B) $[0.414, 0.732)$
(C) $[0.225, 0.414)$ (D) $\left(\frac{1}{0.414}, \frac{1}{0.225}\right]$

Q 13. Which of the following ionic solid has Anti-fluorite st
(A) Na_2S (B) Li_2O
(C) K_2Se (D) All of these

Q 14. BeO has structure similar to
(A) Zinc blende structure
(B) Cosiom halide structure
(C) Wurztite structure
(D) Rock salt structure

Q 15. If AgI crystallizes in Zinc Blende structurewith I^- ions at lattice points. What fraction of tetrahedral voids is occupied by Ag^+ ions **[AIIMS 2009]**
(A) 25 % (B) 50 %
(C) 100 % (D) 75 %

Q 16. In $AlCl_3$ (HCP) structure, Co-ordination no. of Al^{3+} is
(A) 4 (B) 6
(C) 8 (D) 12

Q 17. In Fe_2O_3, O^{2-} ion form hCp structure, then % of octahedral void occupied by Fe is
(A) 33.33% (B) 50%
(C) 66.67 % (D) None

Q 18. In $CaTiO_3$ (pervoskite) structure , Ca^{2+} form simple cubic, O^{2-} ion at all face centre & Ti^{4+} prescut at body centre in
(A) Tetrahedral void (B) Body centered void
(C) Face cartered void (D) Octahedral void

Q 19. In spinel $(MgAl_2O_4)$ structure, O^{2-} ion form CCP lattice Mg^{2+} are present at tetrahedral void & Al^{3+} are present at octahedral void. The fractional of tetrahedral & octahedral voids occupied are respectively
(A) $\frac{1}{4}, \frac{1}{4}$ (B) $\frac{1}{8}, \frac{1}{2}$
(C) $\frac{1}{4}, \frac{1}{2}$ (D) $\frac{1}{8}, \frac{1}{2}$

Q 20. In which of the following structures coordination number for cations and anions in the packed structure will be same? **[NCERT Examplar]**
(A) Cl^- ions form fcc lattice and Na^+ ions occupy all octahedral voids of the unit cell
(B) Ca^{2+} ions form fcc lattice and F^- ions occupy all the eight tetrahedral voids of the unit cell

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

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

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

8. Defect in Solids

Q 1. In stoichiometric defect in ioinic solid
(A) cation & anion remain same
(B) cation – Anion ratio does not charge
(C) Cation – Anion charge ratio does not change
(D) No. of cations & no. of anions are equal.

Q 2. Schottky defect is observed in crystals when … **[NCERT Examplar]**
(A) Some cations move from their lattice site to interstitial sites
(B) equal number of cations and anions are missing from the lattice
(C) some lattice sites are occupied by electrons
(D) some impurity is present in the lattice

Q 3. Which of the following point defects are shown by AgBr(s) crystals ? **[NCERT Examplar]**
(1) Schottky defect
(2) Frenkel defect
(3) Metal excess defect
(4) Metal deficiency defect
(A) 1 and 2 (B) 3 and 4
(C) 1 and 3 (D) 2 and 4

Q 4. Which of the following will show schottky defect by greatest extent?
(A) CaF_2 (B) ZnS
(C) AgCl (D) CsCl

Q 5. In a crystal both ions are missing from normal sites in equal number. This is an example of
(A) F-centres (B) Interstitial defect
(C) Frqenkel defect (D) Schottky defect

Q 6. ZnO shows, which of the following defects
(A) Metal deficiency defect (B) Schottky defect
(C) Metal excess defect (D) Frenkel defect

Q 7. Schottky defect in crystals is observed when
(A) unequal number of cations and anions are missing from the lattice
(B) equal number of cations and anions are missing from the lattice
(C) an ion leaves its normal site and occupies an interstitial site
(D) density of the crystal is increased

Q 8. When NaCl is dopped with $MgCl_2$ the nature of defect produced is
(A) interstitial defect (B) Frenkel defect
(C) Schottky deffect (D) none of these

Q 9. **Assertion (A)** No compounds have both schottky and Frenkel defect.
Reason (R) Both defects changes the density of the solid **[AIIMS 2008]**
(A) Assertion and reason both are correct statements and Reason is correct explanation for Assertion
(B) Assertion and Reason both are correct statements but Reason is not correct explanation for Assertion
(C) Assertion is correct statement but Reason is wrong statement
(D) Assertion is wrong statement & reason is also wrong statement

Q 10. Due to Frankel defect, the density of the ionic Solid is
(A) Decreases (B) Increases
(C) Doesn't change (D) Change

Q 11. Due to F- centres present, solid becomes
(A) colourful (B) Conductive
(C) Paramagnetic (D) All of these

Q 12. In formation of F-centres, density of solid
(A) increases (B) decreases
(C) doesn't change (D) can't predict

Q 13. In metal deficiency defect density of solid
(A) decreases (B) Increases
(C) remain constant (D) None of these

Q 14. The composition of a sample of wustite is $Fe_{0.93}O_{1.00}$. The percentage of Fe (III) ions present in the sample is about
(A) 10 % (B) 15%
(C) 20% (D) 25%

Q 15. Metal deficiency defect due to pressure of extra anion in the lattice is not possible because

(A) Cations are smaller in size
(B) Anion increases density of solid
(C) Anions are larger in size
(D) ionic neutrality will be not maintained

Q 16. What type of defect can arise when a solid is heated ? Which physical property is affected by it and in what way? **[NCERT Solved]**

Q 17. 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 ? **[NCERT]**

Q 18. Calculate the Conc. per mole of cation vacancies if NaCl is doped with 10^{-3} mole % of $SrCl_2$.

Q 19. If NaCl structure is doped with 10^{-4} mole % $AlCl_3$, what is the conc. of cationic vacancy.

Q 20. Silver (at.wt. = 108) has a density of 10.5 g/cc. The number of silver atoms on a surface area of $10^{-12}m^2$ can be expressed in scientific notations as $Y \times 10^x$. The value of x is

9. Metallic Bonding & Magnetic Properties

Q 1. Insulators have conductivity range in
(A) 10^{-20} to 10^{-10} $\Omega^{-1}m^{-1}$
(B) 10^4 to $10^6 \Omega^{-1}m^{-1}$
(C) 10^{-6} to $10^4 \Omega^{-1}m^{-1}$
(D) None of these

Q 2. Assertion (A) Semiconductors are solids with conductivities in the intermediate range from $10^{-6} - 10^4$ $ohm^{-1}m^{-1}$
Reason (R) Intermediate conductivity in semiconductor is due to partially filled valence band **[NCERT Examplar]**
(A) Assertion and reason both are correct statements and Reason is correct explanation for Assertion
(B) Assertion and Reason both are correct statements but Reason is not correct explanation for Assertion
(C) Assertion is correct statement but Reason is wrong statement
(D) Assertion is wrong statement but reason is correct statement

Q 3. Metals are good conductor because
(A) valence bond & conduction band overlap each other
(B) Conduction band has laver charge than valence bond
(C) Valence bond has laver energy than conduction band
(D) None of these

Q 4. Valence band consists of
(A) bonding molecular orbitals
(B) Antibonding molecular orbitals
(C) Any molecular orbitals
(D) None of these

Q 5. The energy gap between the valence band and conduction band for diamond, silicon and germanium are in the order **[AIIMS 2006]**
(A) diamond > Silicon > Germanium
(B) diamond > silicon < Germanium
(C) diamond = Silicon = Germanium
(D) diamond > Germanium > Silicon

Q 6. In semiconductor, doping increases conductivity because
(A) Energy gap between valence band & conduction band decreases
(B) no. of current carrying particles increases
(C) becomes conductor
(D) No. of current carrying particles decreases

Q 7. In n-type semiconductor formation with Si, which element should Q 4. In semiconductor, doping increases conductivity because
(A) Energy gap between valence band & conduction band decreases
(B) no. of current carrying particles increases
(C) becomes conductor
(D) No. of current carrying particles decreases
be doped
(A) B (B) Ge
(C) P (D) C

Q 8. In p-type semiconductor, the current carrying particles have
(A) –ve charge (B) +ve charge
(C) zero charge (D) None of these

Q 9. In p-type semiconductor, holes have
(A) –ve charge (B) +ve charge
(C) zero charge (D) None of these

Q 10. In p- type semiconductor formation, which type of element is used in doping ?
(A) supervalent (B) Subvalent
(C) Same valency (D) None of these

Q 11. To get a n-type semiconductor from silicon, it should be doped with a substance with valency **[NCERT Examplar]**
(A) 2 (B) 1
(C) 3 (D) 5

Q 12. Non –stoichiometric cuprous oxide, Cu_2O can be prepared in laboratory. In this oxide, copper to oxygen ratio is slightly less than 2:1. Can you account for the fact that this substance is a p-type semiconductor ? **[NCERT]**

Q 13. Which of the following species is diamagnetic
(A) O_2 (B) H_2O
(C) CrO_2 (D) $FeCl_3$

Q 14. Which of the following substance is ferromagnetic ?
(A) Fe (B) CrO_2
(C) Ni (D) All of these

Q 15. Which of the following substance is antiferromegnetic ?
(A) CrO_2 (B) Gadolinium
(C) MnO (D) PbO_2

Q 16. Which of the following substance have ferromagnetic character ?
(A) FeO (B) Fe_2O_3
(C) Fe_3O_4 (D) $MgFe_2O_4$

Q 17. In anti ferromagnetic substance domains are oriented in opposite direction in
(A) unequal no (B) equal no
(C) domains are not oriented
(D) domins are oriented in arbitrary direction

Q 18. Which of the following arrangements shows schematic alignment of magnetic moments of antiferromagnetic substances? **[NCERT Examplar]**
(A) ↑ ↑ ↑ ↑ ↑ ↑
(B) ↓ ↓ ↓ ↓ ↓ ↓
(C) ↑ ↑ ↓ ↑ ↑ ↓
(D) ↑ ↓ ↑ ↓ ↑ ↓

Q 19. Which of the following oxides behaves as conductor or insulator depending upon temperature? **[NCERT Examplar]**
(A) TiO (B) SiO_2
(C) TiO_3 (D) MgO

Q 20. Which of the following statements is not true? **[NCERT Examplar]**
(A) Paramagnetic substances are weakly attracted by magnetic field
(B) Ferromagnetic substances cannot be magnetized permanently
(C) The domains in antiferromagnetic substances are oppositely oriented with respect to each other

Answer Key

1. Type of Solids, Crystal & its Properties

(1). A (2). C (3). B
(4). A (5). B (6). Crystalline Solid
(7). C
(8). (a) Molecular Solid (b) Covalent Solid
(c) Metallic Solid (d) Ionic Solid
(e) Covalent Solid (f) Metallic Solid
(g) Molecular Solid (h) Ionic Solid
(i) Molecular Solid (j) Covalent Solid
(k) Molecular Solid
(9). C (10). C (11). B
(12). D (13). D (14). B
(15). A (16). B (17). C
(18). C (19). D (20). B

2. Bravius Lattice, Unit Cell Properties

(1). A (2). B (3). C
(4). B (5). B (6). B
(7). C (8). B
(9). A – P, Q; B – P, Q; C – Q; D – Q, R
(10). B (11). C (12). B
(13). D (14). B (15). C
(16). B (17). B (18). C
(19). D (20). C (21). C

3. Type of Cubic Unit cell

(1). A (2). B (3). C
(4). B (5). C (6). B
(7). B (8). D (9). B
(10). B (11). C (12). A
(13). D (14). A (15). A
(16). 0.407 nm

4. HCP lattice, Density of Solids

(1). B (2). A (3). D
(4). A (5). A (6). B
(7). B (8). B (9). A
(10). B (11). C (12). D
(13). B (14). 10.5 g/cc
(15). FCC (16). 107 g/mol
(17). 330.4 pm (18). 8.96 g/cc
(19). 354 pm, 2.25×10^{22} (20). 250 pm
(21). Face Plane, Body Plane, Face Diagonal Plane

5. Closest Packed Structure, Tetrahedral & Octahedral Voids

(1). A (2). A (3). C
(4). C (5). B (6). A
(7). C (8). C (9). C
(10). A (11). A (12).A
(13). C (14). C (15). XY
(16). A_4B_3 (17). C.N. = 8 (18). C
(19). D (20). Fe_2O_3

6. Radius Ratio & Type of Voids

(1). C (2). B (3). A
(4). C (5). B (6). B
(7). A (8). A (9). C
(10). B (11). C (12). r = 0.414R

7. Type of Ionic Solids

(1). A (2). A (3). B
(4). A (5). A (6). A
(7). D (8). B (9). B
(10). A (11). C (12). D
(13). D (14). A (15). B
(16). B (17). C (18). D
(19). B (20). A

8. Defect in Solids

(1). C (2). B (3). A
(4). D (5). D (6). C
(7). B (8). C (9). D
(10). D (11). D (12). B
(13). D (14). B (15). C
(16). Vacancy defect (17). 96 % Ni^{2+}
(18). 6.02×10^{18} (19). 1.204×10^{18}
(20).7

9. Metallic Bonding & Magnetic Properties

(1). A (2). C (3). A
(4). A (5). A (6). B
(7). C (8). A (9). C
(10). B (11). D (12). Yes
(13). B (14). D (15). C
(16). C,D (17). B (18). D
(19). C (20). B