
I. Multiple Choice Questions (Type-I)

1. Which of the following conditions favours the existence of a substance in the solid state?

- (i) High temperature
- (ii) Low temperature
- (iii) High thermal energy
- (iv) Weak cohesive forces

Solution:

Option (ii) is the answer.

2. Which of the following is not a characteristic of a crystalline solid?

- (i) Definite and characteristic heat of fusion.
- (ii) Isotropic nature.
- (iii) A regular periodically repeated pattern of arrangement of constituent particles in the entire crystal.
- (iv) A true solid

Solution:

Option (ii) is the answer.

3. Which of the following is an amorphous solid?

- (i) Graphite (C)
- (ii) Quartz glass (SiO₂)
- (iii) Chrome alum
- (iv) Silicon carbide (SiC)

Solution:

Option (ii) is the answer.

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

- (a) 
- (b) 
- (c) 
- (d) 

Solution:

Option (iv) is the answer.

5. Which of the following is true about the value of the refractive index of quartz glass?

- (i) Same in all directions
- (ii) Different in different directions
- (iii) Cannot be measured
- (iv) Always zero

Solution:

Option (i) is the answer

6. Which of the following statement is not true about amorphous solids?

- (i) On heating, they may become crystalline at a certain temperature.
- (ii) They may become crystalline on keeping for a long time.
- (iii) Amorphous solids can be moulded by heating.
- (iv) They are anisotropic.

Solution:

Option (iv) is the answer.

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

- (i) a regular arrangement of constituent particles observed over a short distance in the crystal lattice.
- (ii) a regular arrangement of constituent particles observed over a long distance in the crystal lattice.
- (iii) the same arrangement of constituent particles in different directions.
- (iv) a different arrangement of constituent particles in different directions.

Solution:

Option (ii) is the answer.

8. Iodine molecules are held in the crystals lattice by _____.

- (i) london forces
- (ii) dipole-dipole interactions
- (iii) covalent bonds
- (iv) coulombic forces

Solution:

Option (i) is the answer.

9. Which of the following is a network solid?

- (i) SO₂ (Solid)
- (ii) I₂
- (iii) Diamond
- (iv) H₂O (Ice)

Solution:

Option (iii) is the answer.

10. Which of the following solids is not an electrical conductor?

- (A) Mg (s) (B) TiO (s) (C) I₂
- (s) (D) H₂O (s)
- (i) (A) only
- (ii) (B) Only
- (iii) (C) and (D)
- (iv) (B), (C) and (D)

Solution:

Option (iii) is the answer.

11. Which of the following is not the characteristic of ionic solids?

- (i) A very low value of electrical conductivity in the molten state.
- (ii) Brittle nature.
- (iii) Very strong forces of interactions.
- (iv) Anisotropic nature.

Solution:

Option (i) is the answer.

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

- (i) lone pair of electrons
- (ii) free valence electrons
- (iii) cations
- (iv) anions

Solution:

Option (ii) is the answer.

13. Which of the following oxides behaves as conductor or insulator depending upon temperature?

- (i) TiO
- (ii) SiO₂

(iii) TiO_3

(iv) MgO

Solution:

Option (iii) is the answer.

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

(i) SiO_2

(ii) MgO

(iii) $\text{SO}_2(\text{s})$

(iv) CrO_2

Solution:

Option (iv) is the answer.

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

(i) molecule

(ii) ion

(iii) electron

(iv) atom

Solution:

Option (iii) is the answer.

16. Graphite cannot be classified as _____.

(i) conducting solid

(ii) network solid

(iii) covalent solid

(iv) ionic solid

Solution:

Option (iv) is the answer.

17. Cations are present in the interstitial sites in _____.

(i) Frenkel defect

(ii) Schottky defect

(iii) Vacancy defect

(iv) Metal deficiency defect

Solution:

Option (i) is the answer.

18. Schottky defect is observed in crystals when _____.

(i) some cations move from their lattice site to interstitial sites.

(ii) the equal number of cations and anions are missing from the lattice.

(iii) some lattice sites are occupied by electrons.

(iv) some impurity is present in the lattice.

Solution:

Option (ii) is the answer.

19. Which of the following is true about the charge acquired by p-type

semiconductors?

- (i) positive
- (ii) neutral
- (iii) negative
- (iv) depends on the concentration of p impurity

Solution:

Option (ii) is the answer

20. To get a n-type semiconductor from silicon, it should be doped with a substance with valence _____.

- (i) 2
- (ii) 1
- (iii) 3
- (iv) 5

Solution:

Option (iv) is the answer.

21. The total number of tetrahedral voids in the face-centred unit cell is _____.

- (i) 6
- (ii) 8
- (iii) 10
- (iv) 12

Solution:

Option (ii) is the answer

22. Which of the following point defects are shown by AgBr(s) crystals?

- (A) Schottky defect (B) Frenkel defect
(C) Metal excess defect (D) Metal deficiency defect

- (i) (A) and (B)
- (ii) (C) and (D)
- (iii) (A) and (C)
- (iv) (B) and (D)

Solution:

Option (i) is the answer.

23. In which pair most efficient packing is present?

- (i) hcp and bcc
- (ii) hcp and ccp
- (iii) bcc and up
- (iv) bcc and simple cubic cell

Solution:

Option (ii) is the answer.

24. The percentage of empty space in a body centred cubic arrangement is _____.

- (i) 74

(ii) 68

(iii) 32

(iv) 26

Solution;

Option (iii) is the answer.

25. Which of the following statement is not true about the hexagonal close packing?

(i) The coordination number is 12.

(ii) It has 74% packing efficiency.

(iii) Tetrahedral voids of the second layer are covered by the spheres of the third layer.

(iv) In this arrangement spheres of the fourth layer are exactly aligned with those of the first layer.

Solution:

Option (iv) is the answer.

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

(i) Cl⁻ ion form fcc lattice and Na⁺ ions occupy all octahedral voids of the unit cell.

(ii) Ca²⁺ ions form fcc lattice and F⁻ ions occupy all the eight tetrahedral voids of the unit cell.

(iii) O²⁻ ions form fcc lattice and Na⁺ ions occupy all the eight tetrahedral voids of the unit cell.

(iv) S²⁻ ions form fcc lattice and Zn²⁺ ions go into alternate tetrahedral voids of the unit cell.

Solution:

Option (i) is the answer.

27. What is the coordination number in a square close-packed structure in two dimensions?

(i) 2

(ii) 3

(iii) 4

(iv) 6

Solution:

Option (iii) is the answer.

28. Which kind of defects are introduced by doping?

(i) Dislocation defect

(ii) Schottky defect

(iii) Frenkel defects

(iv) Electronic defects

Solution:

Option (iv) is the answer.

29. Silicon doped with electron rich impurity forms _____.

(i) p-type semiconductor

- (ii) n-type semiconductor
- (iii) intrinsic semiconductor
- (iv) insulator

Solution:

Option (ii) is the answer.

30. Which of the following statements is not true?

- (i) Paramagnetic substances are weakly attracted by the magnetic field.
- (ii) Ferromagnetic substances cannot be magnetised permanently.
- (iii) The domains in antiferromagnetic substances are oppositely oriented with respect to each other.
- (iv) The pairing of electrons cancels their magnetic moment in the diamagnetic substances.

Solution:

Option (ii) is the answer.

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

- (i) Bigger ions form the close-packed structure.
- (ii) Smaller ions occupy either the tetrahedral or the octahedral voids depending upon their size.
- (iii) Occupation of all the voids is not necessary.
- (iv) The fraction of octahedral or tetrahedral voids occupied depends upon the radii of the ions occupying the voids.

Solution:

Option (iv) is the answer.

32. A ferromagnetic substance becomes a permanent magnet when it is placed in a magnetic field because _____.

- (i) all the domains get oriented in the direction of the magnetic field.
- (ii) all the domains get oriented in the direction opposite to the direction of the magnetic field.
- (iii) domains get oriented randomly.
- (iv) domains are not affected by the magnetic field.

Solution:

Option (i) is the answer.

33. The correct order of the packing efficiency in different types of unit cells is _____.

- (i) fcc < bcc < simple cubic
- (ii) fcc > bcc > simple cubic
- (iii) fcc < bcc > simple cubic
- (iv) bcc < fcc > simple cubic

Solution:

Option (ii) is the answer.

34. Which of the following defects is also known as dislocation defect?

- (i) Frenkel defect

- (ii) Schottky defect
- (iii) Non-stoichiometric defect
- (iv) Simple interstitial defect

Solution:

Option (i) is the answer.

35. In the cubic close packing, the unit cell has _____.
- (i) 4 tetrahedral voids each of which is shared by four adjacent unit cells.
 - (ii) 4 tetrahedral voids within the unit cell.
 - (iii) 8 tetrahedral voids each of them which are shared by four adjacent unit cells.
 - (iv) 8 tetrahedral voids within the unit cells.

Solution:

Option (iv) is the answer.

36. The edge lengths of the unit cells in terms of the radius of spheres constituting fcc, bcc and simple cubic unit cell are respectively _____

- (i) $2\sqrt{2}r$, $4r/\sqrt{3}$, $2r$
- (ii) $4r/\sqrt{3}$, $2\sqrt{2}r$, $2r$
- (iii) $2r$, $2\sqrt{2}r$, $4r/\sqrt{3}$
- (iv) $2r$, $4r/\sqrt{3}$, $2\sqrt{2}r$

Solution:

Option (i) is the answer.

37. Which of the following represents correct order of conductivity in solids?

- (i) $\kappa \text{ metals} \gg \kappa \text{ insulators} < \kappa \text{ semiconductors}$
- (ii) $\kappa \text{ metals} \ll \kappa \text{ insulators} < \kappa \text{ semiconductors}$
- (iii) $\kappa \text{ metals} \kappa \text{ semiconductors} > \kappa \text{ insulators} = \text{zero}$
- (iv) $\kappa \text{ metals} < \kappa \text{ semiconductors} > \kappa \text{ insulators} \neq \text{zero}$

Solution:

Option (i) is the answer.

II. Multiple Choice Questions (Type-II)

Note: In the following questions two or more options may be correct.

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

- (i) A tetrahedral void is formed when a sphere of the second layer is present above triangular void in the first layer.
- (ii) All the triangular voids are not covered by the spheres of the second layer.
- (iii) Tetrahedral voids are formed when the triangular voids in the second layer lie above the triangular voids in the first layer and the triangular shapes of these voids do not overlap.
- (iv) Octahedral voids are formed when the triangular voids in the second layer exactly overlap with similar voids in the first layer

Solution:

Option (iii) and (iv) are the answers.

39. The value of the magnetic moment is zero in the case of antiferromagnetic substances because the domains _____.

- (i) get oriented in the direction of the applied magnetic field.**
- (ii) get oriented opposite to the direction of the applied magnetic field.**
- (iii) are oppositely oriented with respect to each other without the application of the magnetic field.**
- (iv) cancel out each other's magnetic moment.**

Solution:

Option (iii) and (iv) are the answers.

40. Which of the following statements are not true?

- (i) Vacancy defect results in a decrease in the density of the substance.**
- (ii) Interstitial defects increase the density of the substance.**
- (iii) Impurity defect does not affect the density of the substance.**
- (iv) Frankel defect results in an increase in the density of the substance.**

Solution:

Option (iii) and (iv) are the answers.

41. Which of the following statements are true about metals?

- (i) Valence band overlaps with conduction band.**
- (ii) The gap between the valence band and the conduction band is negligible.**
- (iii) The gap between the valence band and the conduction band cannot be determined.**
- (iv) Valence band may remain partially filled.**

Solution:

Option (i), (ii) and (iv) are the answers.

42. Under the influence of the electric field, which of the following statements is true about the movement of electrons and holes in a p-type semiconductor?

- (i) The electron will move towards the positively charged plate through electron holes.**
- (ii) Holes will appear to be moving towards the negatively charged plate.**
- (iii) Both electrons and holes appear to move towards the positively charged plate.**
- (iv) Movement of electrons is not related to the movement of holes.**

Solution:

Option (i) and (ii) are the answers.

43. Which of the following statements are true about semiconductors?

- (i) Silicon doped with an electron-rich impurity is a p-type semiconductor.**
- (ii) Silicon doped with an electron-rich impurity is an n-type semiconductor.**
- (iii) Delocalised electrons increase the conductivity of doped silicon.**
- (iv) An electron vacancy increases the conductivity of the n-type semiconductor.**

Solution:

Option (ii) and (iii) are the answers.

44. An excess of potassium ions makes KCl crystals appear violet or lilac in colour since _____.

- (i) some of the anionic sites are occupied by an unpaired electron.
- (ii) some of the anionic sites are occupied by a pair of electrons.
- (iii) there are vacancies at some anionic sites.
- (iv) F-centres are created which impart colour to the crystals.

Solution:

Option (i) and (iv) are the answers.

45. The number of tetrahedral voids per unit cell in NaCl crystal is _____.

- (i) 4
- (ii) 8
- (iii) twice the number of octahedral voids.
- (iv) four times the number of octahedral voids.

Solution:

Option (ii) and (iii) are the answers.

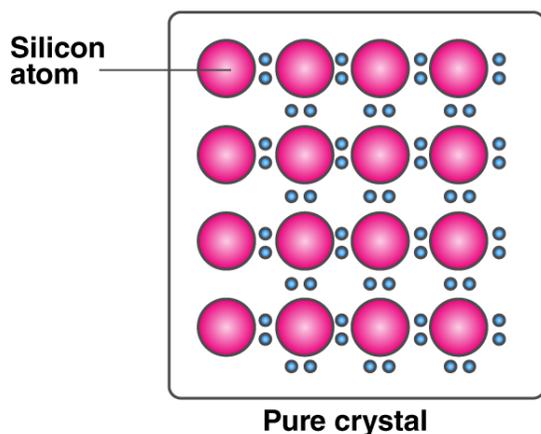
46. Amorphous solid can also be called _____.

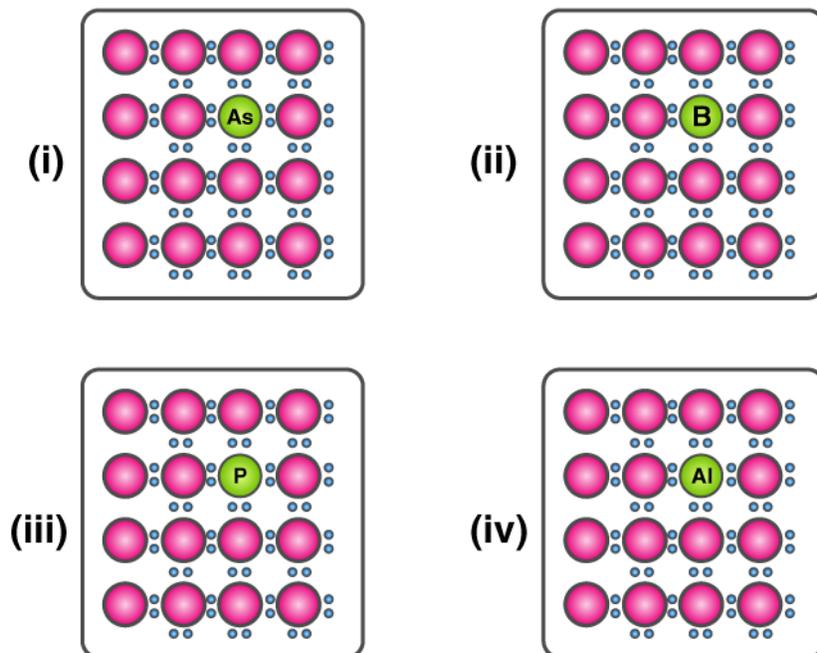
- (i) pseudo solids
- (ii) true solids
- (iii) supercooled liquids
- (iv) supercooled solids

Solution:

Option (i) and (iii) are the answers.

47. A perfect crystal of silicon (Fig. 1.1) is doped with some elements as given in the options. Which of these options show n-type semiconductors?




Solution:

Option (i) and (iii) are the answers.

48. Which of the following statements are correct?

- (i) Ferrimagnetic substances lose ferrimagnetism on heating and become paramagnetic.
- (ii) Ferrimagnetic substances do not lose ferrimagnetism on heating and remain ferrimagnetic.
- (iii) Antiferromagnetic substances have domain structures similar to ferromagnetic substances and their magnetic moments are not cancelled by each other.
- (iv) In ferromagnetic substances, all the domains get oriented in the direction of the magnetic field and remain as such even after removing magnetic field.

Solution:

Option (i) and (iv) are the answers.

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

- (i) This is a crystalline solid.
- (ii) Refractive index is the same in all the directions.
- (iii) This has a definite heat of fusion.
- (iv) This is also called supercooled liquid.

Solution:

Option (i) and (iii) are the answers.

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

- (i) SiC (Silicon carbide)
- (ii) AlN
- (iii) Diamond
- (iv) I₂

Solution:

Option (i), (ii) and (iii) are the answers.

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

- (i) hcp
- (ii) bcc
- (iii) simple cubic
- (iv) fcc

Solution:

Option (i) and (iv) are the answers.

52. Frenkel defect is also known as _____.

- (i) stoichiometric defect
- (ii) dislocation defect
- (iii) impurity defect
- (iv) non-stoichiometric defect

Solution:

Option (i) and (ii) are the answers.

53. Which of the following defects decrease the density?

- (i) Interstitial defect
- (ii) Vacancy defect
- (iii) Frankel defect
- (iv) Schottky defect

Solution:

Option (ii) and (iv) are the answers.

III. Short Answer Type

54. Why are liquids and gases categorised as fluids?

Solution:

They both have the property to flow. The molecules of liquid and gases can move fast from one to another. That is why they are categorized as fluids.

55. Why are solids incompressible?

Solution:

Solids are incompressible because their intermolecular distance between the molecules is very less. There will be a large repulsive force between the electron clouds.

56. Despite long-range order in the arrangement of particles why are the crystals usually not perfect?

Solution:

The crystallization process will be faster so that the particle may not get enough time to arrange in perfect order. That is why crystals have the long-range arrangement of particles but not perfect.

57. Why does table salt, NaCl, sometimes appear yellow?

Solution:

This is due to the metal excess defect. The unpaired electrons get trapped in anion vacancies. When the electrons absorb energy, it gets excited and falls on the crystals. Thus the colour becomes yellow.

58. Why is FeO (s) not formed in stoichiometric composition?

Solution:

The composition of Fe²⁺ and O²⁻ ions is not 1:1 it is 0.95:1. This can be obtained if and only if a small number of Fe²⁺ ions are replaced by two-third of Fe³⁺ in OH sites

59. Why does white ZnO (s) become yellow upon heating?

Solution:

When ZnO is heated, it gives Zn²⁺ electrons. The excess Zn ions get trapped in the interstitial site and vacant sites also. The yellow colour is due to this electron and electrical conductivity in crystals.

60. Why does the electrical conductivity of semiconductors increase with a rise in temperature?

Solution:

The energy gap between the valence band and conduction band is small, at room temperature they do not conduct electricity but raised the electrons to get enough amount of energy to excite from valence band to conduction band. This is called thermodynamic conduction in intrinsic semiconductors