Multiple Choice Questions

Solid State and Their classification

[MHT-CET 2019]

1. Which among the following pairs of compounds is NOT isomorphous ?
   a) $NaNO_3$ and $CaCO_3$
   b) NaF and MgO
   c) K_2SO_4 and K_2SeO_4
   d) NaCl and KCl

2. Which among the following statements is NOT true about amorphous solids ?
   a) Values of physical properties change with direction of measurement.
   b) These are pseudo solids.
   c) These are super cooled liquids.
   d) These behave like fluids.

[MHT-CET 2020]

3. Which among the following is NOT a polar molecular solid ?
   a) H_2S
   b) CH_4
   c) HCl
   d) SO_2

4. Dry ice is an example of
   a) ionic solid
   b) covalent solid
   c) metallic solid
   d) molecular solid

5. Which among the following is an example of amorphous solid ?
   a) Diamond
   b) Camphor
   c) Glass
   d) Magnesium

6. Which among the following is NOT an amorphous solid ?
   a) Tar
   b) Camphor
   c) Butter
   d) Rubber

7. Fullerene is an example of
   a) Covalent solid
   b) Molecular solid
   c) Ionic solid
   d) Metallic solid

[MHT-CET 2021]

8. Which of the following pairs of compounds is isomorphous ?
   a) NaCl, KCl
   b) NaF, $NaNO_3$
   c) $CaCl_2$, $NaNO_3$
   d) $CaCO_3$, $NaNO_3$

9. Which of the following pairs of compounds is isomorphous ?
   a) NaF, $NaNO_3$
   b) NaF, MgO
   c) NaCl, KCl
   d) $CaCl_2$, $BaCl_2$

[MHT-CET 2022]

10. Which of the following is an example of ionic solid ?
    a) Silica
    b) Ice
    c) Sodium metal
    d) Calcium fluoride

11. Which of the following statements is NOT true about polymorphism ?
    a) Fullerene is a polymorphic form of carbon.
    b) Single substance that exists in two or more forms is said to be polymorphous.
    c) NaF and MgO are polymorphous compounds.
    d) Polymorphism occurring in elements is called allotropy.

12. Which among the following statements is NOT true about covalent network solid ?
    a) These are soft in nature.
    b) The atoms in this solid are linked by covalent bonds.
    c) In this solid the constituent particles are atoms.
    d) Covalent solids have high melting points.

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13. Which of the following statements is NOT true about ionic solid ?
   a) Pure ionic solid is good conductor of electricity in solid state.
   b) The constituent particles of ionic solid are cations and anions.
   c) In this constituent particles are held together by electrostatic force of attraction.
   d) Ionic solids are hard and brittle.

14. What type of bonds is present in molecular crystals ?
   a) Ionic bond
   b) Metallic bond
   c) Covalent bond
   d) Various inter molecular forces of attraction

15. Which of the following is an example of covalent network solid ?
   a) Magnesium metal
   b) Benzoic acid
   c) Sodium chloride
   d) Boron nitride

16. Which of the following statements is NOT true about isomorphism ?
   a) Isomorphism occurring in elements is called allotropy.
   b) Isomorphous substances have same crystal structure.
   c) In isomorphous substances the chemical composition has the same atomic ratio.
   d) Compounds like NaF and MgO exhibit isomorphism.

17. Which of the following is not an example of polymorphism exhibited by silica ?
   a) β-Quartz
   b) Cristobalite
   c) α-Quartz
   d) Fullerene

18. Which among the following is an example of molecular solid ?
   a) SiO_2
   b) C_6H_5COOH
   c) SiC
   d) CaF_2

Crystal Lattice and Unit cell, packing of constituent particles

[MHT-CET 2016]

19. In face centred cubic unit cell, what is the volume occupied ?

   a) $\frac{4}{3}\pi r^3$
   b) $\frac{8}{3}\pi r^3$
   c) $\frac{16}{3}\pi r^3$
   d) $\frac{64\,r^3}{3\sqrt{3}}$

[MHT-CET 2019]

20. The percentage of unoccupied volume in simple cubic cell is
   a) 52.40%
   b) 32.00%
   c) 68.04%
   d) 47.60%

21. How many total constituent particles are present in simple cubic unit cell ?
   a) 1
   b) 3
   c) 4
   d) 2

22. In body-centred cubic cell, the space occupied by constituent particles is
   a) 38%
   b) 62%
   c) 74%
   d) 68%

23. If the constituent particles of crystal lattice are of identical size then total particles present in FCC type unit are equal to
   a) 2
   b) 3
   c) 1
   d) 4

24. Arrange following types of unit cells according to their decreasing order of packing efficiency.
   a) bcc > fcc > simple cubic
   b) fcc > bcc > simple cubic
   c) fcc > simple cubic > bcc
   d) simple cubic > bcc > fcc

25. What is the number of atoms present per unit cell of aluminium having edge... 4 Å?
    a) 4
    b) 1
    c) 8
    d) 2

26. The coordination number of the sphere in cubic close packed (ccp) structure...
    a) 8
    b) 4
    c) 6
    d) 12

27. What is the coordination number of cation in ionic compound if the type of hole... by cation is cubic ?
    a) 4
    b) 6
    c) 3
    d) 8

28. What is the coordination number of cation in ionic compound if the type of hole... by cation is octahedral ?
    a) 6
    b) 3
    c) 8
    d) 4

29. How much part of an atom occupies each corner of bcc unit cell ?
    a) 1/8
    b) 1/4
    c) 1/6
    d) 1/2

30. What is the percentage of unoccupied space in fcc unit cell ?
    a) 26%
    b) 32%
    c) 68%
    d) 74%

31. In which among the following crystal structures the edge length of unit cell is eq... twice the radius of one atom ?
    a) End centred orthorhombic
    b) Simple cubic
    c) Body centred cubic
    d) Face centred cubic

32. Atoms of elements A and B crystallize in hcp lattice to form a molecule. Eleme... occupies 2/3 of tetrahedral voids, the formula of molecule is
    a) A_3B_4
    b) A_3B_2
    c) A_4B_3
    d) A_2B_3

33. Which among the following types of unit cells has bond angle equal to $120°$ be... edges 'a' and 'b' ?
    a) Tetragonal
    b) Hexagonal
    c) Orthorhombic
    d) Monoclinic

34. Which of the following formulae is used to find edge length of BCC unit cell ?
    a) $\dfrac{4r}{\sqrt{3}}$
    b) $\dfrac{\sqrt{3}}{4r}$
    c) $\sqrt{\dfrac{4r}{3}}$
    d) $\sqrt{8}\,r$

35. What is the co-ordination number of atoms in BCC crystal lattice ?
    a) 4
    b) 6
    c) 8
    d) 2

36. Identify the type of unit cell that has a particle only at each corner of a cube
    a) Body centered cubic unit cell
    b) Face centered cubic unit cell
    c) Hexagonal close pack
    d) Simple cubic unit cell

37. What is the percentage efficiency of packing in simple cubic cell ?
    a) 47.64%
    b) 52.36%
    c) 28.0%
    d) 74.0%

38. How many particles per unit cell are present in simple cubic structure ?
    a) 1
    b) 2
    c) 3
    d) 4

39. A binary compound of A and B has face centred unit cell. In it atom A occupies... of cube and B occupies centre of faces, the formula of...
    a) AB_3
    b) AB_6

Solid State

40. If 'r'
    is
    a) ...

41. Sodi
    atom
    a) 1.

42. Iden
    parti
    a) H
    c) Si

43. Wha
    a) 1

44. How
    a) 8

45. Iden
    the...
    a) F
    c) S

46. How
    a) 1

47. For...
    a) a

48. The...
    cent
    a) A

49. Wha
    cell
    ...

50. Wha
    a) 1

51. Wha
    a) 4

52. Iden
    a) B
    c) Si

53. Wha
    a) 4

40. If 'r' is the radius of sphere of a simple cubic unit cell then the volume of a particle in it is

a) $\dfrac{\pi a^3}{6}$

b) $\dfrac{16}{3}\pi r^3$

c) $2r$

d) $8r^3$

41. Sodium crystallizes in BCC structure with edge length of unit cell 4.30 A°. Find its atomic radius.

a) 1.86 A°

b) 1.55 A°

c) 5.72 A°

d) 2.22 A°

42. Identify the type of unit cell that has particles at its eight corners and an additional particle at the centre of cube.

a) Hexagonal close pack unit cell

b) Face centred cubic unit cell

c) Simple cubic unit cell

d) Body centred cubic unit cell

43. What is the total number of Bravais lattices present in seven types of crystal system ?

a) 12

b) 7

c) 10

d) 14

44. How many lattice points are present in a face centred cubic unit cell ?

a) 8

b) 17

c) 14

d) 9

45. Identify the type of unit cell that has particles at the centre of each face in addition to the particles at eight corners of a cube.

a) Face centred cubic unit cell

b) Hexagonal unit cell

c) Simple cubic unit cell

d) Body centred cubic unit cell

46. How many particles per unit cell are present in BCC structure ?

a) 1

b) 4

c) 3

d) 2

47. For simple cubic crystal, edge length is expressed as

a) $a = 2r$

b) $a = \dfrac{r}{2}$

c) $a = \sqrt{2}\,r$

d) $a = \dfrac{r}{\sqrt{2}}$

48. The FCC unit cell of a compound contains ions of A at the corner and ions of B at the centre of each face, what is the formula of the compound ?

a) AB_2

b) A_2B

c) AB_3

d) AB

49. What is the volume occupied by particles in BCC structure if 'a' is edge length of unit cell ?

a) $\dfrac{\sqrt{3}\pi a^3}{8}$

b) $\dfrac{\pi a^3}{3\sqrt{2}}$

c) $\dfrac{\pi a^3}{12\sqrt{2}}$

d) $\dfrac{\sqrt{3}\pi a^3}{16}$

[MHT-CET 2022]

50. What is the co-ordination number of a particle in fcc crystal lattice ?

a) 12

b) 4

c) 6

d) 8

51. What is the co-ordination number of hcp crystal lattice ?

a) 4

b) 6

c) 12

d) 8

52. Identify unit cell from following having four particles in it.

a) Base centred cubic

b) Body centred cubic

c) Simple cubic

d) Face centred cubic

53. What is the coordination number of sphere in simple cubic lattice ?

a) 4

b) 6

c) 12

d) 8

87. What is the packing efficiency of FCC crystal structure ?
   a) 68.04%   b) 47.6%   c) 74.0%   d) 52.4%

88. How many number of unit cells are present in 100 g of an element with FCC crystal having density 10 g/cm^3 and edge length 100 pm ?
   a) 4×10^{25} b) 3×10^{25} c) 2×10^{25} d) 1×10^{25}

89. Nickel crystallizes in an FCC type of unit cell, edge length is 0.3524 nm. Calculate the radius of nickel atom.
   a) 0.1624 nm   b) 0.1426 nm   c) 0.2164 nm   d) 0.1246 nm

90. An element crystallizes BCC type of unit cell, the density and edge length of unit cell are 4 g cm^{-3} and 500 pm respectively. What is the atomic mass of the element ?
   a) 100.1   b) 150.0   c) 125.5   d) 250.0

91. An element crystallizes in BCC type having atomic radius 1.33×10^{-8} cm, the edge length of unit cell will be
   a) 4.08×10^{-8} cm   b) 2.17×10^{-8} cm   c) 2.66×10^{-8} cm   d) 5.755×10^{-9} cm

92. Lithium crystallizes into body centered cubic structure. What is the radius of lithium if edge length of its unit cell is 351 pm ?
   a) 75.50 pm   b) 240.80 pm   c) 300.50 pm   d) 151.98 pm

93. The edge length of FCC type unit cell of copper having atomic radius 127.6 pm is equal to
   a) 331 pm   b) 378 pm   c) 295 pm   d) 361 pm

94. An element crystallizes in FCC lattice with cell edge 250 pm. Calculate the density of the element. (At mass = 90.3)
   a) 19.20 g cm^{-3} b) 38.40 g cm^{-3} c) 48.40 g cm^{-3} d) 23.12 g cm^{-3}

95. An element with density 2.8 g cm^{-3} forms FCC unit cell having edge length 4×10^{-8} cm. Calculate molar mass of the element.
   a) 22.0 g mol^{-1} b) 27.0 g mol^{-1} c) 33.0 g mol^{-1} d) 36.0 g mol^{-1}

96. Molar mass of an element is 60.22 g mol^{-1}. What is the mass of FCC type unit cell of the element?
   a) 1.0×10^{-22} g   b) 4.0×10^{-22} g   c) 2.0×10^{-22} g   d) 4.0×10^{-23} g

97. Aluminium crystallizes in a face-centred cubic structure, its atomic radius is 125 pm. What is the edge length of unit cell ?
   a) 335.5 pm   b) 288.6 pm   c) 280 pm   d) 353.5 pm

98. Sodium crystallizes in BCC structure with radius 1.86×10^{-8} cm. Calculate the edge length of unit cell.
   a) 6.20×10^{-8} cm   b) 4.29×10^{-8} cm   c) 3.72×10^{-8} cm   d) 8.05×10^{-8} cm

99. An element crystallizes in BCC type crystal structure with edge length of unit cell 300 pm. Calculate radius of element.
   a) 1.299×10^{-8} cm   b) 6.920×10^{-8} cm   c) 1.440×10^{-8} cm   d) 2.299×10^{-8} cm

100. What is the volume of 1 mole of a crystalline solid having unit cell edge length 16×10^{-8} cm, if its unit cell contains 24 molecules ?
   a) 159.3 cm^3 mol^{-1} b) 404.0 cm^3 mol^{-1} c) 102.7 cm^3 mol^{-1} d) 142.1 cm^3 mol^{-1}

101. Xenon crystallizes in FCC lattice and the edge length of unit cell is 620 pm. What is the radius of Xe atom ?
   a) 536.9 pm   b) 438.5 pm   c) 265.5 pm   d) 219.2 pm

116. What is the density of iron crystal which crystallizes in body centred cubic structure with edge length 287 pm ? (At. mass of Fe = 56 amu)

a) 7.87 g / cm^3 b) 6.07 g / cm^3 c) 7.07 g / cm^3 d) 6.87 g / cm^3

117. Which is the radius of sodium atom if it crystallises in bcc structure with edge length of unit cell 4.29×10^{-8} cm ?

a) 1.61×10^{-8} cm   b) 1.85×10^{-8} cm   c) 32.71×10^{-9} cm   d) 2.30×10^{-8} cm

118. What is the mass of unit cell of gold if it crystallises in FCC structure ?

(At mass of gold = 197 g mol^{-1})

a) 130.85×10^{-23} g   b) 98.14×10^{-23} g   c) 32.71×10^{-23} g   d) 65.42×10^{-23} g

119. Gold crystallizes in fcc structure with edge length 396 pm, find atomic radius of gold.

a) 198 pm   b) 162 pm   c) 714 pm   d) 140 pm

120. Copper chloride crystallizes into FCC type of crystal system. If density of unit cell is 3.4 g cm^{-3}, the edge length of unit cell will be (Given at. mass of Cu = 63, Cl = 36)

a) 9.889 Å   b) 7.426 Å   c) 5.783 Å   d) 3.642 Å

121. An element crystallizes as simple cubic having cell edge length 5 Å. What is the radius of atom of the element ?

a) 261.5 pm   b) 176.8 pm   c) 216.5 pm   d) 250.0 pm

122. The edge length of BCC type of unit cell of an element is 400 pm. Calculate the density of unit cell. (Molar mass of the element = 100 g mol^{-1})

a) 2.144 g cm^{-3} b) 10.378 g cm^{-3} c) 7.289 g cm^{-3} d) 5.189 g cm^{-3}

123. The number of atoms in 100 g of an FCC crystal with density 10 g cm^{-3} and unit cell edge length 200 pm is equal to

a) 1×10^{24} b) 3×10^{24} c) 2×10^{24} d) 5×10^{24}

124. What is the edge length of FCC type of unit cell having density and atomic mass 6.22 g cm^{-3} and 60 g respectively ?

a) 6.83×10^{-7} cm   b) 4.0×10^{-8} cm   c) 3.47×10^{-7} cm   d) 8.0×10^{-8} cm

125. A metallic element crystallizes to BCC type of crystal lattice, having edge length of unit cell 5 Å. Calculate radius of it's atom.

a) 250.0 pm   b) 176.8 pm   c) 261.5 pm   d) 216.5 pm

126. An element (atomic mass = 100 g/mol) having BCC structure has unit cell edge 400 pm. What is the density of the element ?

a) 2.144 g/cm^3 b) 10.376 g/cm^3 c) 7.289 g/cm^3 d) 5.188 g/cm^3

127. A metallic element has a cubic lattice with edge length of unit cell 2 Å. Calculate the number of unit cells in 200 g of the metal, if density of metal is 2.5 g cm^{-3}.

a) 10.0×10^{25} b) 6.25×10^{25} c) 6.40×10^{25} d) 1.0×10^{25}

128. The radius of a sphere in simple cubic lattice is 3 nm. What will be the edge length of unit cell ?

a) 9×10^{-9} m   b) 6×10^{-9} m   c) 3×10^{-9} m   d) 1.5×10^{-8} m

129. Silver crystallizes in face centred cubic structure, if radius of silver atom is 144.5 pm. What is the edge length of unit cell ?

a) 408.6 pm   b) 289.0 pm   c) 428.6 pm   d) 333.7 pm

224. Calculate the density of an element having molar mass 63 g mol^{-1} that forms fcc structure [$a^3 \times N_A = 28$ cm^3 mol^{-1}]
    a) 6.0 g cm^{-3}
    b) 9.0 g cm^{-3}
    c) 5.0 g cm^{-3}
    d) 7.0 g cm^{-3}

225. What is the coordination number of a particle in hcp structure?
    a) 2
    b) 4
    c) 6
    d) 12

226. Calculate the volume occupied by all atoms in bcc unit cell if the volume of unit cell is 1.5×10^{-22} cm^3.
    a) 2.40×10^{-22} cm^3
    b) 3.51×10^{-22} cm^3
    c) 1.56×10^{-22} cm^3
    d) 1.02×10^{-22} cm^3

227. Which from the following statements is NOT true regarding crystalline solid ?
    a) There is a regularity and periodicity in arrangement of constituent particles.
    b) It is isotropic.
    c) It melts at definite temperature.
    d) It has different magnitudes for refractive index in every direction.

228. Find the void volume of bcc unit cell in cm^3 if volume of unit cell is 1.5×10^{-22} cm^3.
    a) 4.8×10^{-23}
    b) 3.6×10^{-23}
    c) 2.4×10^{-23}
    d) 1.2×10^{-23}

229. Calculate the volume of unit cell of an element having molar mass 63.5 mol^{-1} that forms fcc structure [$\rho \times N_A = 5.5 \times 10^{24}$ g cm^{-3} mol^{-1}]
    a) 4.102×10^{-23} cm^3
    b) 5.430×10^{-23} cm^3
    c) 5.014×10^{-23} cm^3
    d) 4.618×10^{-23} cm^3

230. Calculate molar mass of an element having density 8.6 g cm^{-3} if it forms bcc structure [$a^3 \times N_A = 22.0$ cm^3 mol^{-1}]
    a) 106.18 g mol^{-1}
    b) 94.6 g mol^{-1}
    c) 88.25 g mol^{-1}
    d) 80.16 g mol^{-1}

231. Calculate the radius of metal atom if it forms bcc unit cell having edge length 530 pm.
    a) 229.5 pm
    b) 187.4 pm
    c) 459.0 pm
    d) 265.2 pm

232. The density (in g cm^{-3}) of the metal which forms a cubic close packed (ccp) lattice with an axial distance (edge length) equal to 400 pm is _____.
    Use: Atomic mass of metal = 105.6 amu and Avogadro's constant = 6×10^{23} mol^{-1}
    (JEE (Advanced) Paper II - 2025)

Ans: 11.00g cm^{-3}

233. Calculate the number of unit cells in 1 cm^3 volume of metal if, it forms ccp structure **(MHT - CET - 2025)**
    [a = 3.5×10^{-8} cm]
    a) 4.211×10^{22}
    b) 3.281×10^{22}
    c) 1.451×10^{22}
    d) 2.332×10^{22}

234. Which of the following metals exhibits minimum packing efficiency in its cubic system? **(MHT - CET - 2025)**
    a) Polonium
    b) Niobium
    c) Silver
    d) Magnesium

235. Find the total number of tetrahedral and octahedral voids formed in 1 mole of a compound forming hcp structure. **(MHT - CET - 2025)**
    a) 1.204×10^{24}
    b) 1.807×10^{24}
    c) 2.402×10^{24}
    d) 3.012×10^{24}

236. Identify the type of defect from following in stainless steel. **(MHT-CET - 2025)**
    a) Substitutional impurity defect
    b) Interstitial impurity defect
    c) Metal excess defect
    d) Frenkel defect

237. Calculate the total number of tetrahedral and octahedral voids formed in 0.6 mol of a compound if it forms hcp structure. **(MHT-CET - 2025)**
    a) 3.613×10^{24}
    b) 7.226×10^{24}
    c) 1.084×10^{24}
    d) 2.913×10^{24}