#### **Self Practice Paper (SPP)** In a lattice of X and Y atoms, if X atoms are present at corners and Y atoms at the body centre & one X 1. atom is removed from a corner from each unit cell, then the formula of the compound will be : (1) X<sub>7</sub>Y (2) $X_8 Y_7$ $(3) X_7 Y_8$ (4) $X_7 Y_7$ 2. The vacant space in B.C.C. unit cell is : (1) 32% (2) 10% (3) 23% (4) 46% 3. When NaCl crystal is heated in sodium vapors, then it attains yellow colour. It is due to : (1) electrons trapped in cation vacancies. (2) F-centres, which is electron trapped in anion vacancy created by Cl<sup>-</sup>. (3) F-centres, which is cation trapped in cation vacancy created by Na<sup>+</sup>. (4) interstitial defect caused by external impurity. 4. 1 g of X has atoms arranged in cubic packing so as to give best packing efficiency. The possible arrangement is : (1) simple cubic (2) face centred cubic (3) body certred cubic (4) hexagonal close packing 5. In 3D close packed structures, for every 100 atoms, it contain : (1) 50 octahedral voids (2) 100 tetrohedral voids (3) 200 octohedral voids (4) 100 octahedral voids If x = radius of Na<sup>+</sup> & y = radius of Cl<sup>-</sup> & a is the unit cell edge length for NaCl crystal, then which of the 6. given relation is correct? (4) x + y = $\sqrt{2a}$ (2) 2x + 2y = a(3) x + y = 2a(1) x + y = a7. The co-ordination number of calcium fluoride $(CaF_2)$ type structure is (4) 8 : 4 (1) 1:2 (2) 4 : 4(3) 4:8 8. The lattice of CaF<sub>2</sub> is called fluorite structure. SrCl<sub>2</sub> has fluorite structure. Which of the following statements is true for SrCl<sub>2</sub>? (1) Sr<sup>2+</sup> are at the corners and face centres of the cubic arrangment (2) Sr<sup>2+</sup> are arranged in bcc lattice (3) a<sup>-</sup> are arranged in fcc lattice (4) Cl<sup>-</sup> occupy octahedral holes in the lattice. 9. The most unsymmetrical system is : (3) Triclinic (4) Orthorhombic (1) Cubic (2) Hexagonal 10. Schottky defect occurs mainly in electrovalent compounds where : (1) positive ions and negative ions are of different size (2) positive ions and negative ions are of same size (3) positive ions are small and negative ions are big (4) posiive ions are big and negative ions are small. 11. An ionic compound is expected to have tetrahedral structure if $r_{+}/r_{-}$ lies in the range of : (1) 0.155 to 0.225 (2) 0.732 to 0.414 (3) 0.414 to 0.732 (4) 0.225 to 0.414

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12.	Malleability and ductility of metals can be acounted due to : (1) the capacity of layers of metal ions to slide over the other (2) the interaction of electrons with metal ions in the other (3) the presence of electrostatic forces (4) the crystalline structure of metal									
13.	KCI crystallises in the same type of lattice as does NaCI. Given that $r_{Na}^{+} / r_{CI}^{-} = 0.55$ and $r_{K}^{+} / r_{CI}^{-}$									
	Calculate the ratio of the side of the unit cell of KCI to that of NaCI : (1) 1.123 (2) 0.891 (3) 1.414 (4) 0.414									
14.	A solid compound contains X, Y and Z atoms in a cubic lattice with X atom occupying the corners, Y atoms in the body centred positions and Z atoms at the centres of faces of the unit cell. What is the empirical formula of the compound : (1) $XY/Z$ (2) $XY/Z$ (2) $XY/Z$ (3) $XY/Z$ (4) $Y/Z$									
	(1) / 12-3	(	(0) 12 223	(1), (8, -6						
15.	An example of a face co (1) Zinc	entred cubic lattice is : (2) Sodium	(3) Copper	(4) Caesium chloride						
16.	Which of the following is (1) Cobalt	s NOT ferromagnetic ? (2) Iron	(3) Manganese	(4) Nickel						
17.	In AgBr, there can occu (1) only schottky defect	r (2) only Frenkel defect	t (3) both (1) and (2)	(4) None of these						
18.	In face-centred cubic unit cell, edge length is :									
	(1) $\frac{4}{\sqrt{3}}$ r	(2) $\frac{4}{\sqrt{2}}$ r	(3) 2r	(4) $\frac{\sqrt{3}}{2}$ r						
19.	In an antifluorite structu (1) octahedral voids	re, cations occupy : (2) centre of the cube	(3) tetrahedral voids	(4) corners of the cube						
20.	The number of tetrahed	Iral voids in the unit cell c	of a face-centred cubic la	ttice of similar atoms is : (4) 10						
21.	<ul> <li>A p-type material is electrically</li> <li>(1) positive (2) negative (3) neutral</li> <li>(4) depends upon the concentration of p impurities.</li> </ul>									
22.	The interionic distance for cesium chloride crystal will be :									
	(1) a	(2) a/2	(3) √3 a/2	(4) 2a / √3						
23.	Superconductors are de (1) p-block elements	erived from the compoun (2) lanthanides	ds of : (3) actinides	(4) transition elements						
24.	A substance $A_x B_y$ crystallizes in a face centred cubic (FCC) lattice in which atoms 'A' occupy each corner of the cube and atoms 'B' occupy the centres of each face of the cube. Identify the correct composition of the substance $A_x B_y$ .									
	(1) AB <sub>3</sub>		(2) $A_4B_3$							
	(3) A <sub>3</sub> B		(4) Composition cannot be specified							

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25. The number of atoms in 100 g of a fcc crystal with density = 10.0 g/cm<sup>3</sup> and cell edge equal to 200 pm is equal to :

(1) 
$$5 \times 10^{24}$$
 (2)  $5 \times 10^{25}$  (3)  $6 \times 10^{23}$  (4)  $2 \times 10^{25}$ 

In the sphalerite (ZnS) structure, S<sup>2-</sup> ions form a face-centred cubic lattice. Then Zn<sup>2+</sup> ions are present 26. on the body diagonals at

(1) 
$$\frac{1}{3}$$
 rd of the distance (2)  $\frac{1}{4}$  th of the distance (3)  $\frac{1}{6}$  th of the distance (4)  $\frac{1}{8}$  th of the distance

In a solid, S<sup>2-</sup> ions are packed in fcc lattice. Zn<sup>2+</sup> occupy half of the tetrahedral voids in an alternating 27. arrangement. Now if a plane is cut (as shown) then the cross-section would be :



In a bcc- arrangement which of the marked planes have maximum spatial density of atoms ? 28.



S<sub>1</sub>: Cubic system have four possible type of unit cells. 29.

S<sub>2</sub>: H<sub>2</sub>O is diamagnetic substance and it is weakly attracted in magnetic field.

**S**<sub>3</sub>: Graphite is a covalent solid with vanderwaal's forces as well.

- (4) F F F (1) F F T (2) F T F (3) T F F
- 30. **S**<sub>1</sub> : Distance between Na<sup>+</sup> & Cl<sup>-</sup> in NaCl crystal is more than half of edge length.  $S_2$ : The no. of triagular viods in the given arrangement in the enclosed region is 3.

... **-** - -

 $S_3$ : In ZnS structure, 2 Zn<sup>2+</sup> & 2 S<sup>2-</sup> ions are present in each unit cell.

(1) F F T	(2) F T F	(3) T F F	(4) F F F
Graphite belongs to			

31.	Graphite belongs to	
	(1) cubic system	(2) tetragonal system
	(3) rhombohedral system	(4) hexagonal system

32. Copper crystallises as fcc unit cell. If atomic radius of copper is 1.28 Å, then what is the edge length of the unit cell ? (1) 2.16Å (2) 3.63Å (3) 3.97Å (4) 4.15Å

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33.	If R is the radius of the sphere in the close packed arrangment and r is the radius of the tetrahedral void, then									
	(1) R = 0.225 r	(2) r = 0.225 R	(3) r = 0.414 R	(4) R = 0.414 r						
34.	In a cubic cell, A atoms are present at corners and B atoms are present at body centre, the formula of the compound will be :									
	(1) AB	(2) A <sub>2</sub> B	(3) AB <sub>2</sub>	(4) A <sub>3</sub> B						
35.	<ul> <li>Diamond is hard because :</li> <li>(1) All the four valence electrons are bonded to carbon atoms by covalent bonds</li> <li>(2) It is a giant molecule of fcc lattice</li> <li>(3) It is made up of carbon atoms</li> <li>(4) It cannot be burnt</li> </ul>									
36.	The cubic unit cell of Al(molar mass 27 g mol <sup>-1</sup> ) has an edge length of 405 pm. Its density is 2.7 g cm <sup>-2</sup> . The cubic unit cell is : (1) for a contract $(2)$ had a contract $(2)$ had a contract $(2)$ a contract $(3)$ had a contract $(3)$									
		(2) body centred	(3) primitive	(4) euge centered						
37.	Number of atoms in fcc (1) 1	is : (2) 2	(3) 3	(4) 4						
38.	A particular solid is very its melt is a conductor o (1) metallic	particular solid is very hard and has a very high melting point. In solid state, it is a non conductor and melt is a conductor of electricity. Classify the solid. ) metallic (2) molecular (3) network (4) ionic								
39.	Empty space in ccp latt	ice is : (2) 45%	(3) 00%	(4) 30%						
	(1) 2076	(2) 43 %	(3) 90 %	(4) 50 %						
40.	Which of the following s	shows ferrimagnetism?								
	(1) 110 <sub>2</sub>	(2) $\text{CrO}_2$	(3) MNO	(4) Fe <sub>3</sub> O <sub>4</sub>						
41.	Metallic lustre is explain	ned by :								
	(1) diffusion of metal ior	าร	(2) oscillation of loose electrons							
	(3) excitation of free pro	otons	(4) existence of bcc lattice							
42.	The hardest substance	amongst the following is	:							
	(1) Be <sub>2</sub> C	(2) Graphite	(3) Titanium	(4) SiC						
43.	A semiconductor of Ge (1) trivalent impurity	can be made p-type by a (2) tetravalent impurity	adding : (3) pentavalent impurity	<ul> <li>(4) divalent impurity</li> </ul>						
44.	The range of radius ratio (cationic to anionic) for an octahedral arrangement of ions in an ionic (1) $0 - 0.155$ (2) $0.155 - 0.225$ (3) $0.225 - 0.414$ (4) $0.414 - 0.732$									
45.	The C–C and Si–C inte (1) 77 pm	ratomic distances are 15 (2) 94 pm	64 pm and 188 pm. The a (3) 114 pm	atomic radius of Si is : (4) 111 pm						

	SPP Answers												
1.	(3)	2.	(1)	3.	(2)	4.	(2)	5.	(4)	6.	(2)	7.	(3)
8.	(1)	9.	(3)	10.	(2)	11.	(4)	12.	(1)	13.	(1)	14.	(2)
15.	(3)	16.	(3)	17.	(3)	18.	(2)	19.	(3)	20.	(3)	21.	(3)
22.	(3)	23.	(1)	24.	(1)	25.	(1)	26.	(2)	27.	(2)	28.	(4)
29.	(1)	30.	(4)	31.	(4)	32.	(2)	33.	(2)	34.	(1)	35.	(1)
36.	(1)	37.	(4)	38.	(4)	39.	(1)	40.	(4)	41.	(2)	42.	(4)
43.	(1)	44.	(4)	45.	(4)								

# **SPP Solutions**

- 1. At corner =  $\frac{1}{8}$  (for per atom)  $\Rightarrow X_{1-\frac{1}{8}}$  Y (one X atom removed)  $\Rightarrow X_{7/8} y$  $\Rightarrow x_7 y_8$
- 2. Packing efficiency =  $\frac{2 \times \frac{4}{3} \pi R^3}{\left(\frac{4R}{\sqrt{3}}\right)^3} = \frac{\sqrt{3}\pi}{8} = 68\%$

vacent space = 100 - 68 = 32 %

- **3.** When NaCl crystal is heated in sodium vapors, then it attains yellow colour. It is due to F-centres, which is electron trapped in anion vacancy created by Cl<sup>-</sup>.
- 4. Packing efficiency of ccp is 74% so it best packing is cubic packing.
- 5. In 3D close packed structure for every 100 atoms it contain 100 octahedral voids.
- 6.  $2(r^+ + r^-) = a$  or  $r^+ = x = radius of Na^+$ 2(x + y) = a  $r^- = y = radius of Cl^-$
- 7. C.N. of  $Cu^{2+}$  ion = 8 C.N. of  $F^{-}$  ion = 4  $\therefore$  C.N. of CaF<sub>2</sub> type structure is = 8 : 4
- 8. Sr<sup>2+</sup> are at the corners and face centre of the cubic arrangement.
- 9. Triclinic  $a \neq b \neq c$  $\alpha \neq \beta \neq \gamma$
- **10.** Schottky defect ocure in electrovalent compound which has same bond size positive and negative ion.
- 11. For tetrahedral void  $r_{+}/r_{-}$  range will be 0.225  $\leq \frac{r^{+}}{r^{-}} \leq 0.414$
- **12.** Malleability and ductility is tendency of metal ion layer Slide over the other layer.

13. NaCl and KCl has octahedral structure

$$\frac{r_{Na}^{+}}{r_{C}^{-}} = 0.55 \text{ and } \frac{r_{K}^{+}}{r_{Cl}^{-}} = 0.74$$
  
In octahedral edge length =  $r_{cation} + r_{anion}$ 
$$\frac{r_{Na}^{+} + r_{Cl}^{-}}{r_{Cl}^{-}} = 1.55 \qquad \dots \dots \dots (1)$$
$$\frac{r_{K}^{+} + r_{Cl}^{-}}{r_{Cl}^{-}} = 1.74 \qquad \dots \dots \dots (2)$$

a = edge length of KCl octahedral. a =  $r_{K}^{+} + r_{Cl}^{-}$ b = edge length of NaCl octahedral b =  $r_{Na}^{+} + r_{Cl}^{-}$  $\frac{a}{b} = \frac{r_{K}^{+} + r_{Cl}^{-}}{r_{Na}^{+} + r_{Cl}^{-}} = \frac{1.74}{1.55} = 1.123$ 

- 14. At corner =  $\frac{1}{8} \times (\text{for per atom}) = \frac{X}{8} \times 8$ At body center = 1 × (for per atom) = Y At face center =  $\frac{1}{2} \times (\text{for per atom}) = \frac{Z}{2} \times 6$ Simple ration of all there XYZ<sub>3</sub>
- **15.** Copper has F.C.C. structure.
- **17.** AgBr show schottky and frenkel defect.

a 
$$4r$$
  
 $(4r)^2 = a^2 + a^2$ 

18.

$$a = \frac{4}{\sqrt{2}}r$$

- **19.** In antifluorite structure anion form F.C.C. structure and cation occupy all tetrahedral void.
- 20. In F.C.C. structure tetrahedral void = No. of corner = 8
- 21. p-type material is electrically neutral.
- 22. CsCl have simple cubic structure. In this structure body idagenal of simple cube  $\sqrt{3} a = 2 \times (r_{Cs}^{+} + r_{Cl}^{-})$ So interionic distance =  $2 \times (r_{Cs}^{+} + r_{Cl}^{-})$
- 24. A at corner

$$=\frac{1}{8} \times 8 \times A = A$$

B at face center

$$= \frac{1}{2} \times 6 \times B = 3B$$

$$= AB_{3}$$
25.  $d = \frac{Z \times M}{N_{A}a^{3}}$   
N<sub>A</sub> =  $\frac{4 \times 100}{10 \times (2 \times 10^{-2})^{3}}$  (here : 200 Pm = 2 × 10<sup>-8</sup> cm.) = 5 × 10<sup>24</sup>  
27. S<sup>2</sup>- ion form fcc lattice  
→ Zn<sup>+2</sup> ion ocupy alternate four tetrahedral void i.e.  
→ Over the event of the event cell  
(1) Simple cubic (2) F.C.C. (3) B.C.C  
H<sub>2</sub>O is a paramagnetic substance.  
Graphit is a covalent soid in layer form. In these layer vanderwaal's forces present.  
30. S<sub>1</sub> : edge length = 2 (r<sub>Na</sub><sup>+</sup> + r<sub>C</sub><sup>-1</sup>)  
distance b/w Na<sup>+</sup> and CT is less than edge length  
S<sub>2</sub> : 4 triangular void.  
S<sub>3</sub> : In Zns structure 4zn<sup>+2</sup> and 4s<sup>-2</sup> present in each unit cell.  
31. For graphite a ≠ b ≠ c  
α = β = 90°, y = 120 (hexagonal system)  
32. 4r = a\sqrt{2}  
a =  $\frac{4r}{\sqrt{2}} = \frac{4 \times 128}{\sqrt{2}} \dot{A} = 3.63 \dot{A}$   
33.  $\frac{r}{R} = 0.225$  (R = radius of sphere, r = radius of tetrahedral)  
34. Effective number of atom of element A =  $\frac{1}{8} \times 8 = 1$  per unit cell effective number of atoms  
B = 1 formula = AB.  
35. In Diamond four valence electrons are bonded to other carbon atom by covalent bond.  
36.  $\ell = \frac{Z \times 27}{405^{3} \times 10^{-3} \times 6.023 \times 10^{23}}$   
Z = 4 face center cubic unit cell contain 4 atom.  
37. F.C.C. structure contain four atom.  
38. In solid form free ion is not available but in melting state free ion in available.  
39. Packing effeciency of C.C.P. = 74% free space = 100 - 74 = 26%  
41. Metallic lustre is due to oscillation of loose electron.  
42. SiC is the hardest substance among the following.

**44.** For octahedral void  $0.414 \le \frac{r^+}{r^-} \le 0.732$ 

of element