

Topic : Solid State

Type of Questions

		M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[9, 9]
Subjective Questions ('-1' negative marking) Q.4 to Q.8	(4 marks, 5 min.)	[20, 25]
Match the Following (no negative marking) Q.9	(8 marks, 10 min.)	[8, 10]

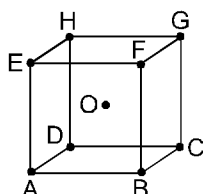
**Integer Answer Type**

Subjective Questions ('-1' negative marking) Q.10	(4 marks, 5 min.)	[4, 5]
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**BooSt YoUr PreVious ConCept**

Single choice Objective ('-1' negative marking) Q.11	(3 marks, 3 min.)	[3, 3]
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- A metallic element has simple cubic arrangement. The number of unit cells in 100 g of this metal (edge length = 288 pm, density = 7.2 g cm<sup>-3</sup>) are  $5.8 \times 10^{23}$ . The total number of atoms in 100 g of the metal is :  
(A)  $5.8 \times 10^{24}$       (B)  $5.8 \times 10^{23}$       (C)  $0.58 \times 10^{23}$       (D)  $58 \times 10^{24}$
- An fcc lattice has lattice parameter  $a = 400$  pm. Calculate the molar volume of the lattice including all the empty space:  
(A) 10.8 mL      (B) 96 mL      (C) 8.6 mL      (D) 9.6 mL
- A body centred cubic arrangement is show :



O is the body centre ; A, B, C, D, ..... , H are the corners. What is the magnitude of the angle AOB?  
(A) 120°      (B) 109° 28'      (C) 104° 31'      (D) 70° 32'

- Radii of A<sup>+</sup> and that of X<sup>-</sup> and Y<sup>-</sup> have been given as:

A <sup>+</sup>	1.00 pm
X <sup>-</sup>	1.00 pm
Y <sup>-</sup>	2.00 pm

Assign structure of AX and AY crystals and also determine volume of the unit cell of AZ and AY crystals.

- A metallic element has cubic lattice. Each edge of the unit cell is 3.0 Å. The density of the metal is 8.5 g/cc. How many unit cells will be present in 50 g of the metal?
- A solid A<sup>+</sup>B<sup>-</sup> has NaCl type close packed structure. Compute the radius of the cation when the radius of anion is 250 pm.  
Can a cation C<sup>+</sup> having a radius of 180 pm be accommodated into the tetrahedral site of the crystal A<sup>+</sup>B<sup>-</sup>?  
Give reason for your answer

7. At 1425°C Fe crystallised in a body-centred cubic lattice whose edge length is 2.93 Å. Assuming the atoms to be packed spheres, calculate :
- the radius of the spheres,
  - the distance between centres of neighbouring spheres,
  - the number of atoms of Fe per unit lattice, and
  - the total volume occupied by an atom of Fe.
8. Metallic gold crystallizes in the face, centered cubic lattice. The length of cubic unit cell is  $a = 4.07\text{Å}$
- What is closest distance between gold atoms
  - What is the distance between next nearest neighbours
  - How many nearest neighbours does each gold atom have
  - How many next nearest neighbours does each gold have
  - What is calculated density of crystalline gold
  - What is packing efficiency of gold ?
9. **Column - I** **Column - II**
- |                              |  |
|------------------------------|--|
| (A) 74% occupancy of space   | (p) cubic close packing of identical spheres.                  |
| (B) Coordination number = 6  | (q) hexagonal close packing of identical spheres.              |
| (C) 68% occupancy of space   | (r) body centred cubic packing of identical spheres.           |
| (D) Coordination number = 12 | (s) simple cubic packing of identical spheres.                 |
|                              | (t) AB AB AB ..... type of close packing of identical spheres. |

### **Integer Answer Type**

10. This section contains 2 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9.
- The coordinate no. of barium ion  $\text{Ba}^{2+}$  in  $\text{Ba F}_2$  is 8. What must be the C.N. of  $\text{F}^-$  ion.
  - The coordination number of each atom in the crystalline structure of Na is

### **BooSt YoUr PreVious ConCept**

11. (a). In the reaction,  $x\text{VO} + y\text{Fe}_2\text{O}_3 \longrightarrow \text{FeO} + \text{V}_2\text{O}_5$ . What is the value of x and y respectively ?
- (A) 1, 1                      (B) 2, 3                      (C) 3, 2                      (D) None of these
- (b). 20 mL of  $\text{H}_2\text{O}_2$  solution is reacted with 80 mL of 0.05 M  $\text{KMnO}_4$  in acidic medium then what is the volume strength of  $\text{H}_2\text{O}_2$  ?
- (A) 2.8                      (B) 5.6                      (C) 11.2                      (D) None of these

# Answer Key

## DPP No. # 44

1. (B)                      2. (D)                      3. (D)
4. AX : bcc structure, volume =  $12.3 \text{ pm}^3$   
AY : octahedral, volume =  $216 \text{ pm}^3$
5.  $2.178 \times 10^{23}$
6. Since the solid  $A^+B^-$  has NaCl type close packed structure, it belongs to a system of coordination number 6. In such case, the ratio of the cation to anion radii is given by
- $$\frac{r_+}{r_-} = 0.414$$
- Since  $r_- = 250 \text{ pm}$   
 $\therefore r_+ = 0.414 \times 250 \text{ pm} = 103.5 \text{ pm} = \text{Radius of the cation}$   
For any tetrahedral site the ratio of cation to anion radii should be between 0.225 and 0.414
- Now  $\frac{r_+}{r_-} = \frac{180 \text{ pm}}{250 \text{ pm}} = 0.72$
- Since this ratio does not fall within the limit, the cation  $C^+$  having a radius of 180 pm cannot be slipped/ accommodated into the tetrahedral site of the crystal  $A^+B^-$ .
7. (a)  $1.268 \text{ \AA}$ , (b)  $2.537 \text{ \AA}$ , (c) 2, (d)  $\frac{4}{3} \pi (1.268)^3 \text{ \AA}^3$ .
8. (a)  $2.878 \text{ \AA}$ , (b) 4.07, (c) 12, (d) 6, (e) 19.4, (f) 0.74                      9. (A - p,q,t) ; (B - s) ; (C - r) ; (D - p,q,t)
10. (i) 4                      (ii) Na crystallizes in bcc structure in which coordination number of each atom is 8.
11. (a) (B)                      (b) (b)

