PHYSICAL / INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 42

Total Marks : 46

Max. Time : 50 min.

Topic : Solid State

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.9	(3 marks, 3 min.)	[27, 27]
Fill in the Blanks ('–1' negative marking) Q.10	(3 marks, 3 min.)	[3, 3]
Subjective Questions ('–1' negative marking) Q.11 to Q.14	(4 marks, 5 min.)	[16, 20]

1. The contribution to the until cell by in atom present at the edge centre is :

(A) 1/8 (B) 1/2 (C) 1/4 (D) 1

2. **(a)** In a face centred cubic lattice the number of nearest neighbours for a given lattice point are

(A) 6 (B) 8 (C) 12 (D) 14

(b) How many 'nearest' and 'next nearest' neighbours respectively does potassium have in b.c.c. lattice

(A) 8, 8 (B) 8, 6 (C) 6, 8 (D) 8, 2

3. A metal crystallizes in two cubic phases i.e., FCC and BCC whose unit cell lengths are 3.5Å and 3.0 Å respectively. The ratio of their densities is :

(A) 3.12 (B) 2.04 (C) 1.26 (D) 0.72

4. If a metal has a bcc crystal structure, the coordination number is 8, because :

(A) each atom touches four atoms in the layer above it, four in the layer below it and none in its own layer.

(B) each atom touches four atoms in the layer above it, four in the layer below it and one in its own layer.

(C) two atoms touch four atoms in the layer above them, four in the layer below them, and none in their own layer.

(D) each atom touches eight atoms in the layer above it, eight in the layer below it and none in its own layer.

5. A metal has face centered cubic arrangement. If length of the edge of the cell is x cm and M is its atomic mass, then density will be equal to (N_0 is Avogadro number):

(A) $[(M)/(X^3 \times N_0)]$ g cm^{-3} (B) $[(M \times N_0)\ (X^3)]$ g cm^{-3}

(C) $[(4M)/(X^3 \times N_0)]$ g cm^{-3} (D) $[(M)/(4X^3 \times N_0)]$ gm cm^{-3}

6. **(a)** In a ccp structure, the :

(A) first and third layers are repeated

(B) first and fourth layers are repeated

(C) second and fourth layers are repeated

(D) first, third and sixth layers are repeated.

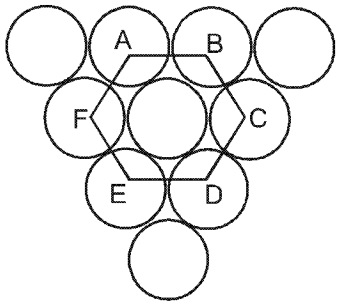
(b) The numbers of tetrahedral and octahedral holes in a ccp array of 100 atoms are respectively

(A) 200 and 100 (B) 100 and 200 (C) 200 and 200 (D) 100 and 100

7. In a face centred cubic arrangement of metallic atoms, what is the relative ratio of the sizes of tetrahedral and octahedral voids?

(A) 0.543 (B) 0.732 (C) 0.414 (D) 0.637

8. The percentage packing efficiency of the two dimensional arrangement of sphere for plane ABCDEF shown below is :



(A) 90.64% (B) 74.05% (C) 68.02% (D) 78.54%

9. A solid has a structure in which 'W' atoms are located at the corners of cubic lattice, 'O' atoms at the centre of edges and 'Na' atoms at the centre of the cube. The formula for the compound is :

(A) $NaWO_2$ (B) NaO_3W (C) Na_2WO_3 (D) $NaWO_4$

10. If the ratio of co-ordination no. P to that of Q be Y : Z, then the formula of the solid is _____.

11. A mineral having formula AB_2 crystallize in the cubic close packed lattice, with the A atoms occupying the lattice points. What is the co-ordination no. of A atoms? of the B atoms? what fraction of tetrahedral sites is occupied by B atoms.

12. Krypton crystallizes with four atoms per unit cell and unit cell is a cube. If the density of krypton is 3.19g/ml,what is the edge length of the unit cell? What is the minimum distance between the two nearest neighbours?

13. Potassium crystallizes in body centred cubic lattice with a unit cell length a = 5.2 Å

(A) What is the distance between nearest neighbours

(B) What is the distance between next nearest neighbours

(C) How many nearest neighbours does each K atom have

(D) How many next nearest neighbours does each K have

(E) What is calculated density of crystalline K.

14. Potassium crystallizes in a body centred cubic lattice. What is the approximate number of until cells in 4.0g of potassium? Atomic mass of potassium = 39.

Answer Key

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1.	(C)	**2.**	**(a)** (C) **(b)** (B)	**3.**	(C)	**4.**	(A)	**5.**	(C)
6.	**(a)** (B) **(b)** (A)	**7.**	(A)	**8.**	(A)	**9.**	(B)		
10.	P_zQ_y	**11.**	8, 4, 100%. It has fluorite (CaF_2) structure.			**12.**	5.6 Å, 3.95Å		
13.	(A) 4.5 Å, (B) 5.2, (C) 8, (D) 6, (E) 0.92 g/mL					**14.**	3.09×10^{22}		

Hints & Solutions

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3. $d = \dfrac{ZM}{a^3N_A}$ $\quad \dfrac{d_1}{d_2} = \dfrac{4}{(3.5)^3} \times \dfrac{(3)^3}{2} = 1.26$

7. $\dfrac{r_{\text{tetrahedra l}}}{r_{\text{octahedral}}} = \dfrac{0.225R}{0.414R} = 0.543.$

11. 8, 4, 100%.
It has fluorite (CaF_2) structure.

12. $d = \dfrac{ZM}{a^3N_A}$ $\quad 3.9 = \dfrac{4 \times 84}{a^3 \times 6.023 \times 10^{23}}$ or $a^3 = 174.9 \times 10^{-24}$

$a = 5.6 \times 10^{-8}$ cm or 5.6 Å

$2r = \dfrac{a}{\sqrt{2}} = \dfrac{5.6}{\sqrt{2}} = 3.95$ Å

13. (A) $2r = \dfrac{\sqrt{3}\,a}{2} = \dfrac{\sqrt{3} \times 5.2}{2} = 4.5$ Å

(B) Distance = a = 5.2 Å
(C) 8
(D) 6

(E) $d = \dfrac{2 \times 39}{(5.2 \times 10^{-8})^3 \times 6.02 \times 10^{23}} = 0.92$ g/ml

14. In bcc unit cell there are 8 atoms at the corners of the cube and one atom at the body centre
$\therefore$ No of atoms per unit = 8 × 1/8 + 1 = 2
No of atoms is 4.0 g of potassium = 4/39 × 6.023 $\times 10^{23}$
$\therefore$ No of unit cells in 4.0 g potassium = 4/39 × 6.023 × 10^{23}/ 2 = 3.09 $\times 10^{22}$