NEET REVISION SERIES

SOLID STATE

Revise Most Important Questions to Crack NEET 2020

Q-1 - 15278234

Sodium metal crystallises in body centred cubic lattic with cell edge 4.29 .What is the radius of sodium atom ?

(A) 1.86

(B) 3.22

(C) 5.72

(D) 0.93

CORRECT ANSWER: A

Q-2 - 15278237

Experimentally it was found that a metal oxide in formula $M_{0.98}O$. Metal M is present as M^{2+} and M^{3+} in its oxide ,Fraction of the metal which exists as M^{3+} would be

(A) $7.01\ \%$

(B) $4.08\ \%$

(C) $6.05\ \%$

(D) $5.08\ \%$

CORRECT ANSWER: B

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Q-3 - 15278254

Statement I: In any ionic solid $[MX]$ with Schottky defect, the

number of positive and negative ions are same.

Statement II: An equal number of cation and anion vacancies is present.

CORRECT ANSWER: A

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Q-4 - 23682064

The unit cell with parameters $\alpha = \beta = \gamma = 90$ and $a = b \neq c$ is :-

(A) cubic

(B) triclinic

(C) Hexagonal

(D) Tetragonal

CORRECT ANSWER: D

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Q-5 - 12658798

An element crystallises in fee lattice having edge length 350

Maximum raduis of the atoms which can be placed in the internal site without distoring the structure is

(A) 58.55 pm

(B) 117 pm

(C) 51.23 pm

(D) 83 pm

CORRECT ANSWER: C

SOLUTION:

For fcc stracture

$\left(\frac{r_+}{r_-}\right) = 0.414$ for octahedral void

$= 0.225$ for tetrabeederal void

Thus maximum packing can be octabodral void

$r_+ = 0.414r$

Also $r_- = \frac{a}{2\sqrt{2}}$

$\therefore r_+ = 0.414\frac{a}{2\sqrt{2}}$

$= 0.414 \times \frac{350}{2\sqrt{2}}$

$= \frac{144.9}{2\sqrt{2}} = 51.23$

pm

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Q-6 - 11883681

In the above question, if an external magnetic field is applied, then the answer is :

(A) (A)

(B) (B)

(C) (C)

(D) (D)

SOLUTION:

— do —

Q-7 - 11883683

Which of the following materials is not ferromagnetic ?

(A) Iron

(B) Cobalt

(C) Nickel

(D) Copper

CORRECT ANSWER: D

SOLUTION:

Ferromagnetism is due to spontaneous alignment of unpaired electrons dipoles. Cu has only one unpaired electrons.

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Q-8 - 11883712

In a $f.\ c.\ c.$ arrangement of A and B atoms, where A atoms are at the corners of the unit cell and B atoms at the face $-$ centres, one of the A atom is missing from one corner in each unit cell. The formula of compound is :

(A) $A_{24}B_7$

(B) A_7B_{24}

(C) A_7B_{28}

(D) $A_{28}B_7$

CORRECT ANSWER: B

SOLUTION:

No. of atom A from the corner of unit cell $= \frac{7}{8}$

No. of atom B from the face of unit cell $= 3$

Thus $A:B::\frac{7}{8}:\frac{3}{1}$

or $A:B::7:24$

$\therefore$ Formula is A_7B_{24}

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Q-9 - 11883715

The density of KBr is $2.75gcm^{-3}$ length of the unit cell is $654pm$

. $K = 39, Br = 80$, then what is true about the predicted nature of the solide ?

(A) Solid has face $-$ centred cubic system with co $-$ ordination number $= 6$

(B) Solid has simple cubic system with co $-$ ordinatiion number $= 4$

(C) Solid has face $-$ centred cubic system with co $-$ ordination number $= 1$

(D) none of these

CORRECT ANSWER: A

SOLUTION:

KBr have $f.\,c.\,c.$ structure with co $-$ ordination number $6:6$

Q-10 - 11883738

The corrent statement regarding defects is solids in solids is

(A) Frenkel defect is usually favoured by a very small difference in the sezes of cation and anion.

(B) Frenkel defect is a dislocation defect.

(C) trapping of an electron in the lattice leads to the formation of $F-$ centre

(D) Schottky defects have no effect on the physical properties of solids.

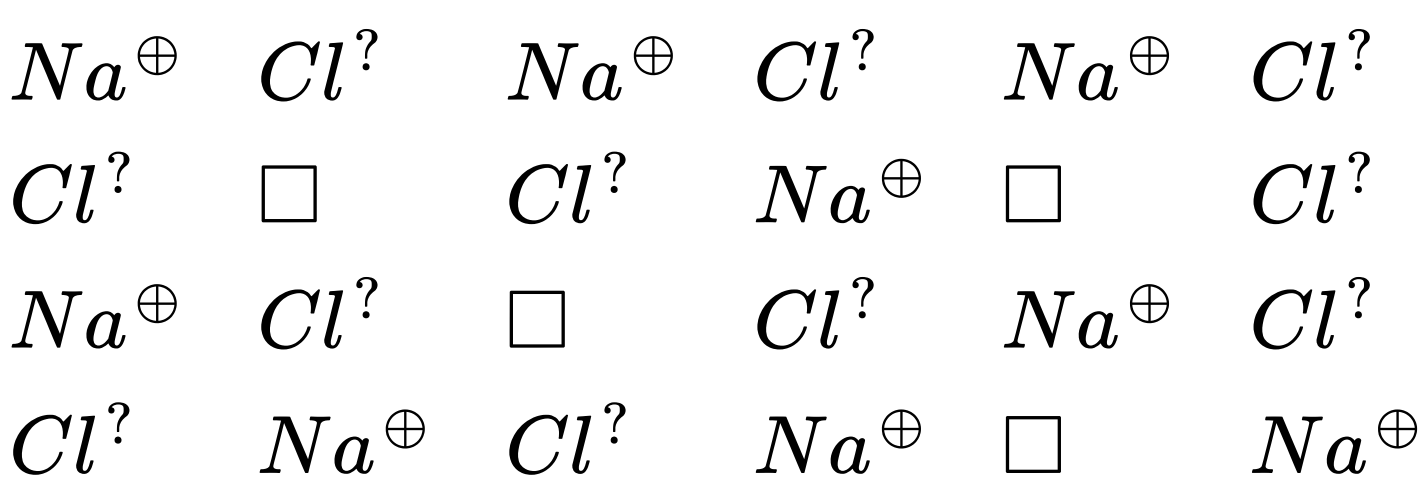
CORRECT ANSWER: B,C

SOLUTION:

b,c

Q-11 - 11883756

What type of crystal defect is indicated in the diagram given below



(A) Frenkel and Schottky defects

(B) Schottky defect

(C) Interstitial defect

(D) Frenkel defect

CORRECT ANSWER: B

SOLUTION:

These defect are produced when one $+ve$ and one

$-ve$ ion are missing from their respective position

removed.

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Q-12 - 11883757

An ionic compound has a unit cell consisting of A ions at the corners of a cube and B ions on the centers of the faces of the cube .The empirical formula for this compound would be

(A) AB

(B) A_2B

(C) A_3B

(D) AB_3

CORRECT ANSWER: D

SOLUTION:

A at the corners, thus $A = \frac{8}{8} = 1$

B at the centre, thus $B = \frac{1}{2} \times 6 = 3$

Thus, formula is AB_3.

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Q-13 - 11883759

In a compound atoms of element Y form ccp lattice and those of element X occupy $2/3^{rd}$ of tetrahedral voids .The formula of the compound will be

(A) X_4Y_3

(B) X_2Y_3

(C) X_2Y

(D) X_3Y_4

CORRECT ANSWER: A

SOLUTION:

No. of atoms of $Y = 4$ (for $c.\ c.\ p$)

No. of atoms of $X = \dfrac{2}{3} \times 8 = \dfrac{16}{3}$ (for $f.\ c.\ c.$)

$\therefore$ Formula of compound will be X_4Y_3.

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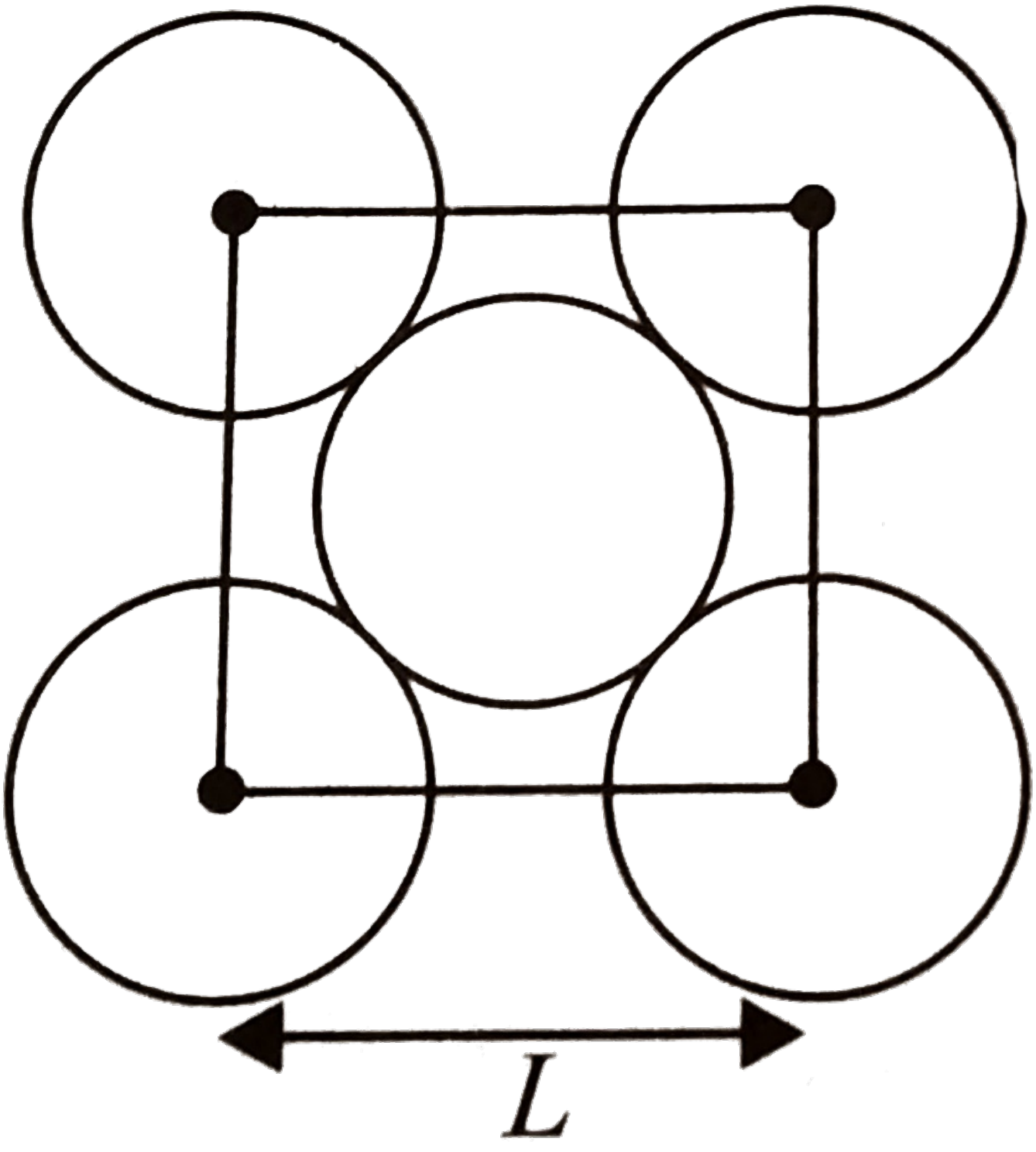
Q-14 - 11883773

The packing efficiency of a two-dimensional square unit cell shown below is



(A) 32.97 %

(B) 68.02 %

(C) 74.05 %

(D) 78.54 %

CORRECT ANSWER: D

SOLUTION:

Number of particles in one unit cell

$$= 1 + 4 \times \frac{1}{4} = 2$$

If radius of particle is r then total are a covered by

particles $= 2\pi r^2$

Total area of unit cell $= L^2 (\text{ or } a^2)$

Bur, $a = 2\sqrt{2}r$

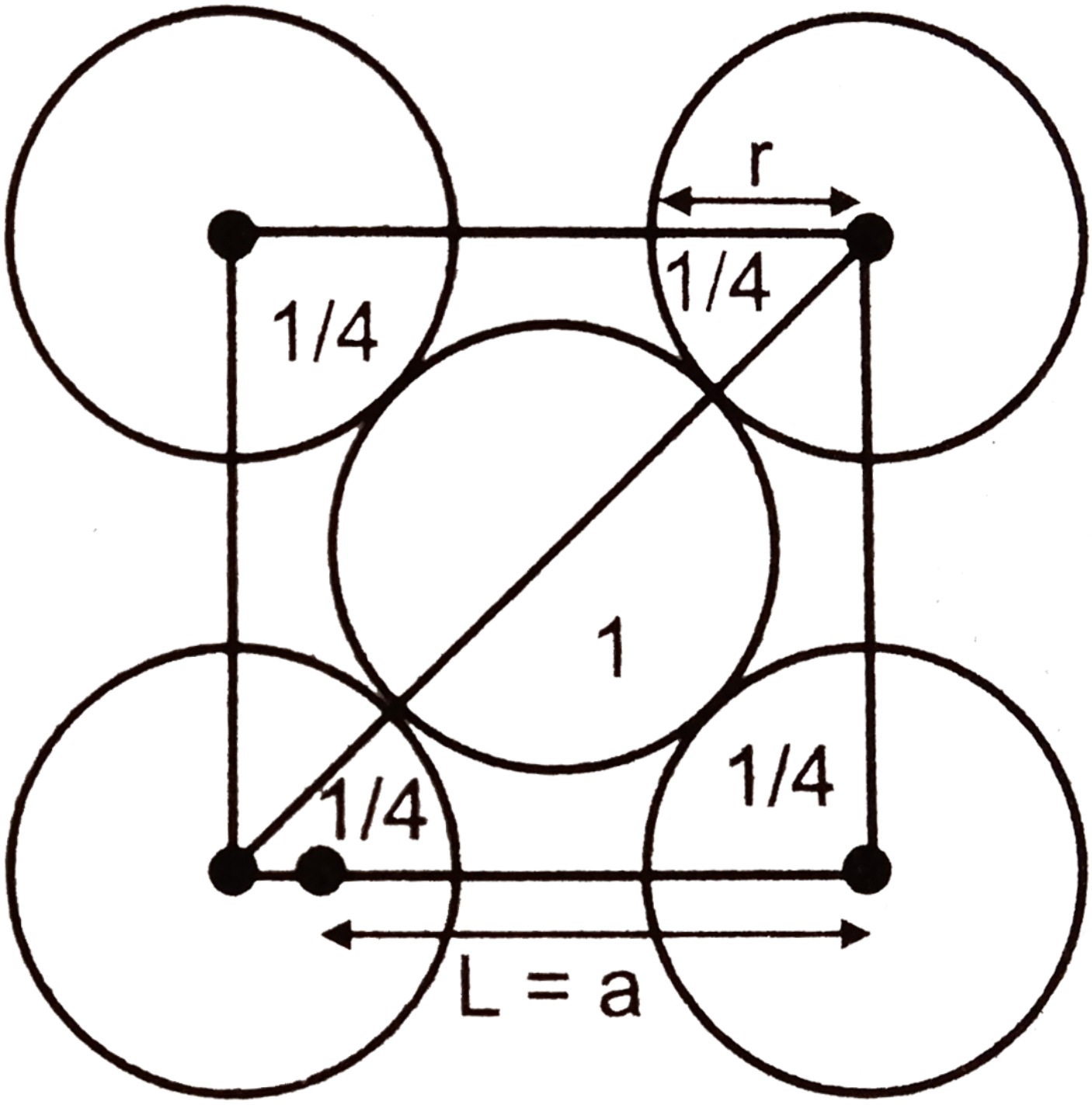
and Packing efficiency

$$= \frac{\text{Area covered by particle}}{\text{Total area}}$$

$$= \frac{2\pi r^2}{\left(2\sqrt{2}\right)^2} = \frac{\pi}{4}$$

$$\Rightarrow \frac{22}{7 \times 4} \times 100$$

$$= 78.54\,\%$$



Q-15 - 11883836

In a closed packed structure of mixed oxides, the lattice is composed of mixed oxides ions. One-eighth of tetrahedral voids are occupied by divalent cation $\left(A^{2+}\right)$ while one-half of octahedral voids are occupied by trivalent cations $\left(B^{3+}\right)$. The fromula of mixed oxide is

CORRECT ANSWER: AB;

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Q-16 - 11883840

An ionic solid $A^{\oplus}B^{?}$ crystallizes as an bcc structure. The distance between cation and anion in the lattice is $338 \pm$. The edge length of cell is

CORRECT ANSWER: $390.3PM$;

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Q-17 - 12658808

Percentage of free space in cubic close packed struchure and in body centred structure are respectively.

(A) $48\ \%$ and $26\ \%$

(B) $30\ \%\ \ \text{and}\ \ 26\ \%$

(C) $26\ \%\ \ \text{and}\ \ 32\ \%$

(D) $32\ \%\ \ \text{and}\ \ 48\ \%$

CORRECT ANSWER: A

SOLUTION:

In ccp (or fcc) and bcc , packing density is

$74\ \%\ \ \text{and}\ \ 68\ \%$ respectively .Thus free space is

$26\ \%\ \ \text{and}\ \ 12\ \%$ respectively.

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Q-18 - 12658813

An elementoccurring in the bcc structure has 12.08×10^{23} unit cells .The total number of atoms of the element in these cells will be

(A) 24.16×10^{23}

(B) 36.18×10^{23}

(C) 6.04×10^{23}

(D) 12.08×10^{23}

CORRECT ANSWER: A

SOLUTION:

There are two atoms is a has unit cell

So number of atoms in 12.08×10^{23} unit cells

$= 2 \times 12.08 \times 10^{23}$

$= 24.16 \times 10^{23}$

atom

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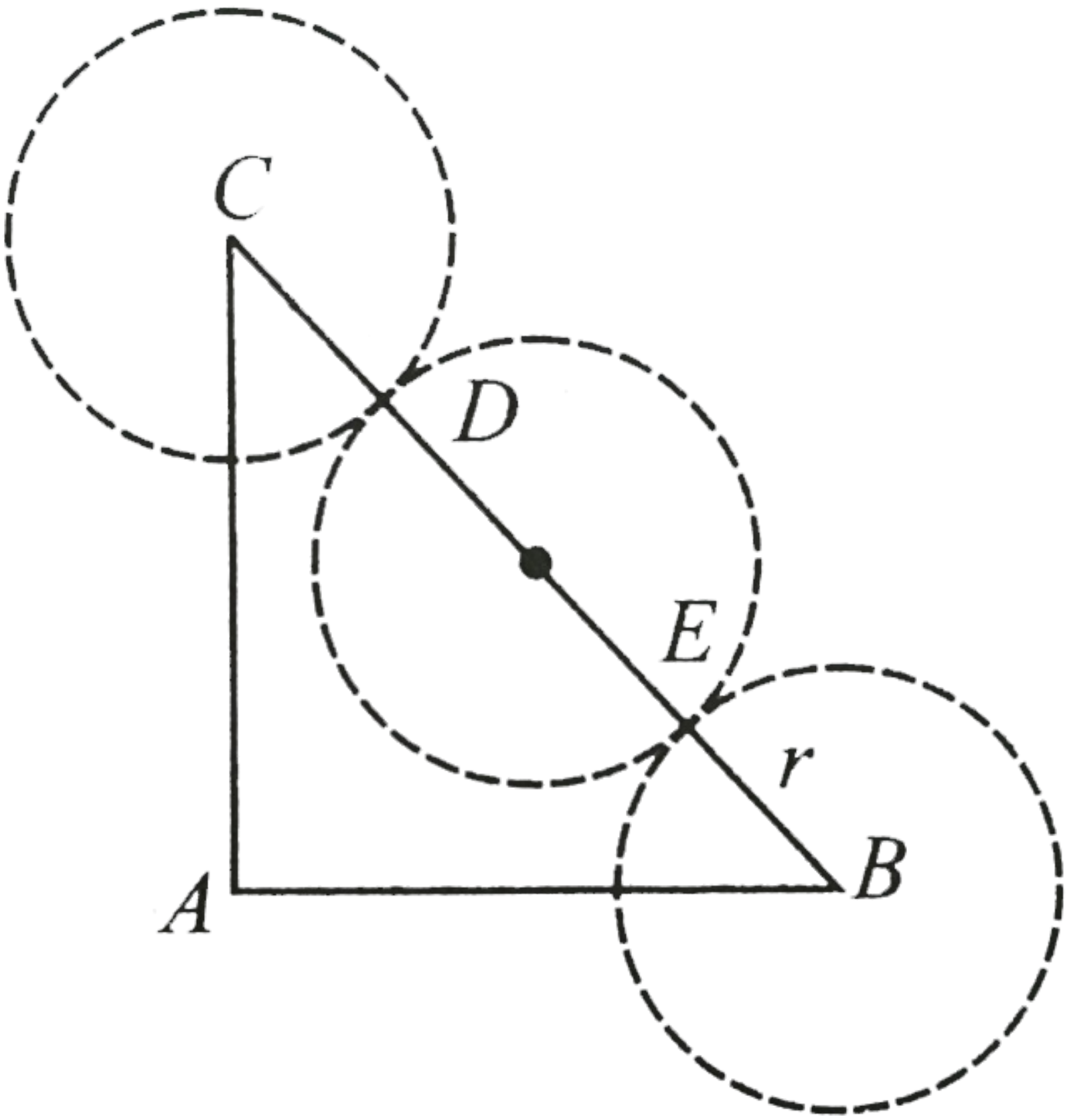
Q-19 - 12658827

Stracture of unit cell is described in the given figure fraction of the

unit cell is



(A) 0.521

(B) 0.907

(C) 0.093

(D) 0.745

CORRECT ANSWER: B

SOLUTION:

$$\text{Packing faction} = \frac{\text{Area occupied by circles}}{\text{area of unit cell}}$$

Let edge length $= l$

l

Thus, radius (r) $= \frac{}{2}$ from figure it is clear

parallelegram has one complete circle

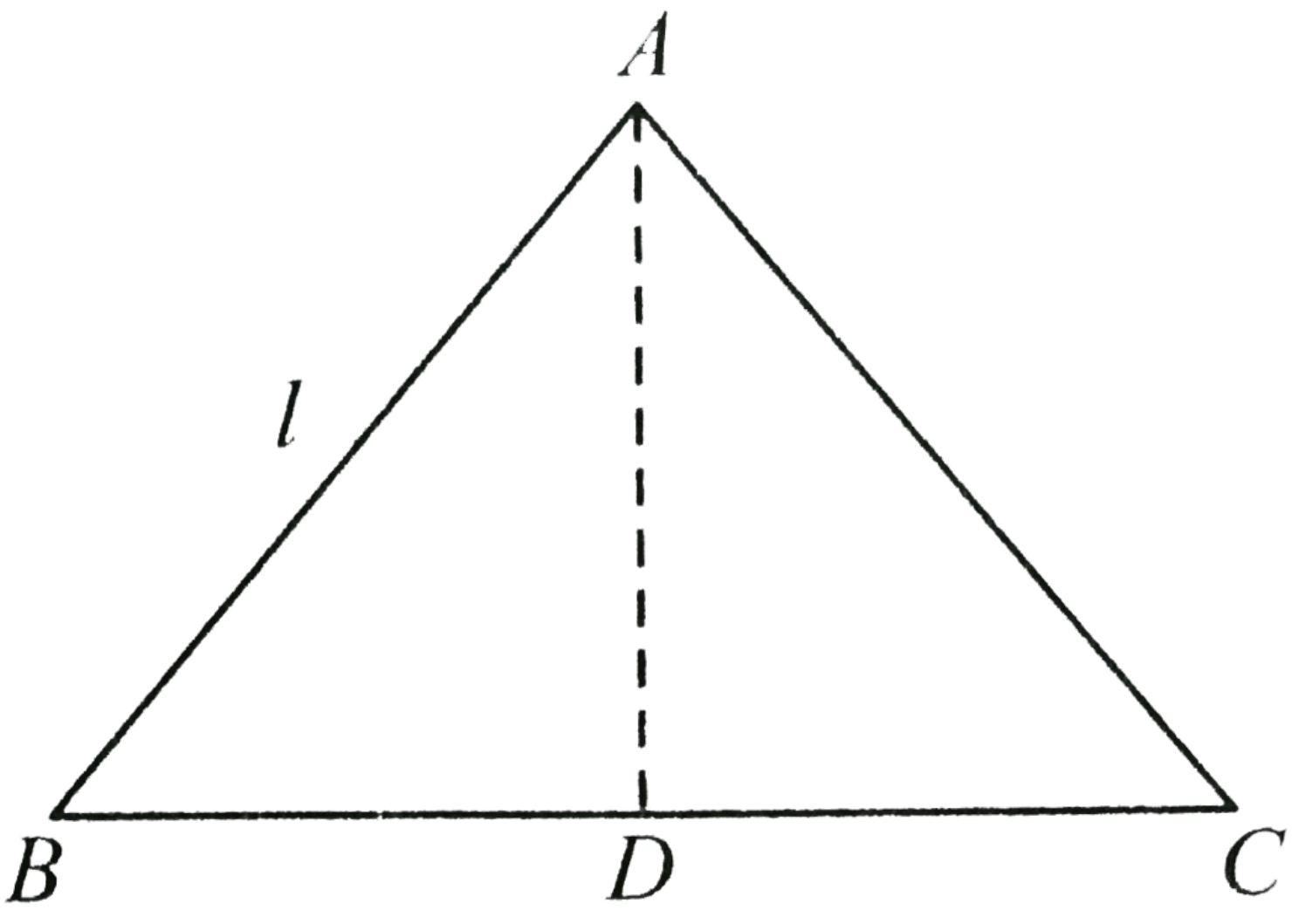
Thus area of circuit $= \pi r^2 = \pi\left(\frac{1}{2}\right)^2$

Area of parallelagram $= 2(areaof\Delta ABC)$

Area of

$$\Delta ABC = \frac{1}{2}BC$$

$\times AD$



$$AD^2 = AB^2 - BD^2$$

$$= l^2 - \frac{l^2}{4} = \frac{3l^2}{4}$$

$$AD = \sqrt{3}\left(\frac{1}{2}\right)$$

Area of

$$\Delta ABC$$

$$= \frac{1}{2}\left(1 + \sqrt{3}\frac{1}{2}\right) =$$

$$= \sqrt{3}\frac{l^2}{4}$$

Area of parallelogram = 2 + Area of ΔABC

$$= 2\sqrt{3}\frac{l^2}{4} = \sqrt{3}\frac{l^2}{2}$$

Packing fraction

$$\frac{\pi l 4}{\sqrt{3} l^2 / 2} = \frac{\pi}{2\sqrt{3}}$$

$$= 0.907$$

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Q-20 - 12658839

In the crystal lattice of diamond carbon atoms adopt

(A) fcc arrangement along with occupancy of $50\ \%$ lertabedral holes

(B) fcc arrangement along with occupancy of $25\ \%$ lertabedral holes

(C) fcc arrangement along with occupancy of $25\ \%$ octabedral holes

(D) bcc arrangement

CORRECT ANSWER: A

SOLUTION:

Only two terahedral holes are occupied dimond

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Q-21 - 35611549

In a CCP lattice of X and Y,X atoms are present at the corners while Y atoms are at face centers. Then the formula of the compound would be if one of the X atoms from a corner is replaced by Z atoms (also monovalent) ?

(A) $X_7Y_{24}Z_2$

(B) $X_7Y_{24}Z$

(C) $X_{24}Y_7Z$

(D) $XY_{24}Z$

CORRECT ANSWER: B

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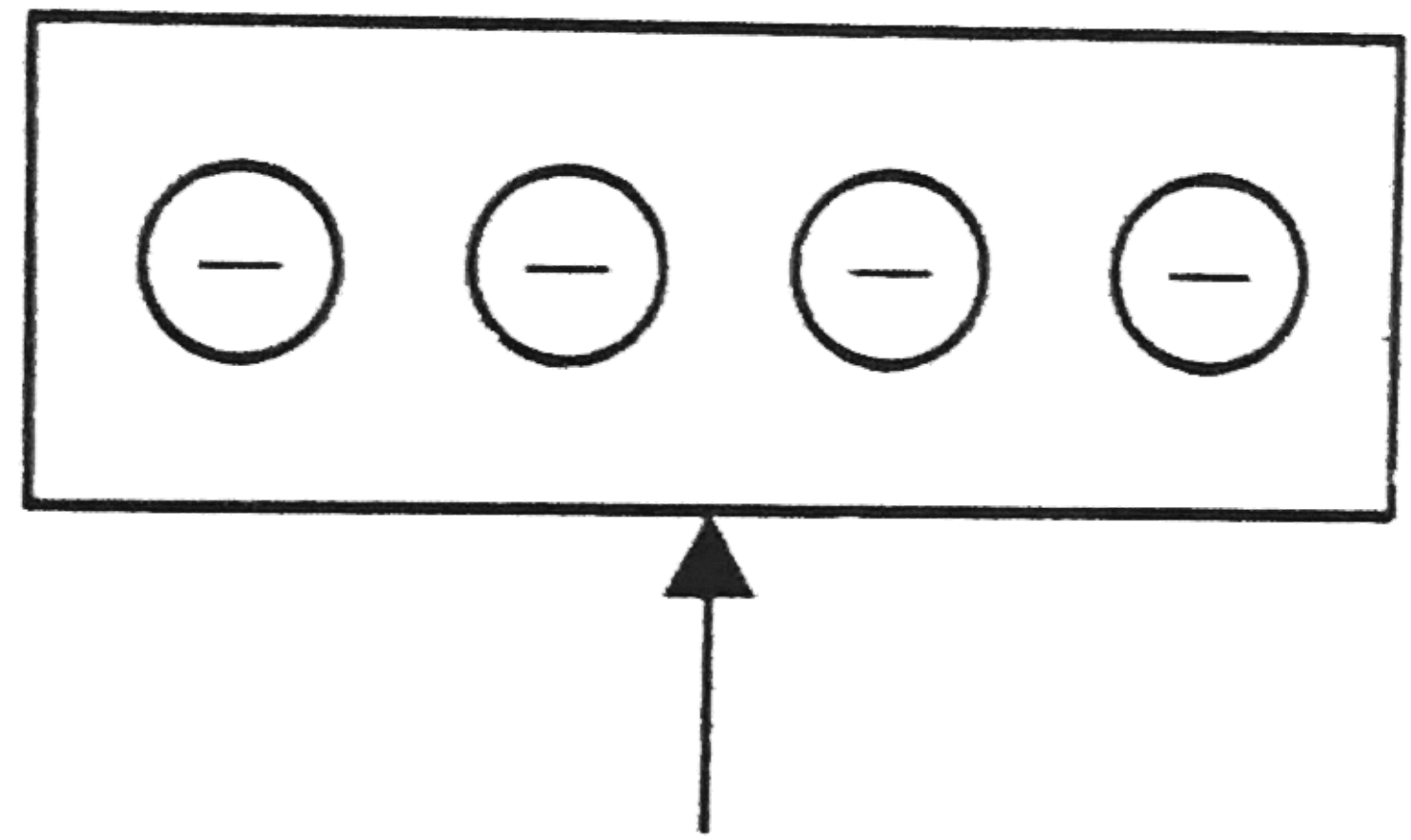
Q-22 - 12658958

For silicon , given



Wavelength of light that excite an electron from the valence to the condiction band in silicon is

(A) $1022nm$

(B) $1039nm$

(C) 1022 pm

(D) 872 pm

CORRECT ANSWER: B

SOLUTION:

$$E_g = 115kJmol^{-1}$$

$$= \frac{115 \times 10^3}{6.02 \times 10^{23}} = \text{ per electron}$$

$$E_g = hv = \frac{hc}{\lambda}$$

$$\therefore \lambda = \frac{hc}{E_g}$$

$$= \frac{6.02 \times 10^{-36} Js \times 3 \times 10^8 ms^{-1} \times 6.02 \times 10^{23}}{115 \times 10^3 J}$$

$$= 1039 \times 10^{-8} m$$

$$= 1039 nm$$

Q-23 - 12658960

In the laboratory , sodium choride is made by burning the sodium in the atmosphere of cholrine which is yellow in colour .The cause of yellow colour is

(A) Presence of Na^+ ions in the crystal lattice

(B) Presence of Cl^- ions in the crystal lattice

(C) Presence of electron in the crystal lattice

(D) Presence of face centered cubic crystal lattice

CORRECT ANSWER: C

SOLUTION:

Yellow colour on heating $NaCI$ in the presence of Na is due to presence of electron in ation vacancies (f-centres).

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Q-24 - 23585065

If NaCl is doped with $10^{-4} mol\ \%$ of $SrCl_2$ the concentration of cation vacancies will be $\left(N_A = 6.02 \times 10^{23} mol^{-1}\right)$

(A) $6.02 \times 10^{23} mol^{-1}$

(B) $6.02 \times 10^{15} mol^{-1}$

(C) $6.02 \times 10^{16} mol^{-1}$

(D) $6.02 \times 10^{17} mol^{-1}$

CORRECT ANSWER: D

SOLUTION:

For each Sr^{2+} ion introduced, one vacancy is created because $2Na^{+}$ ions are removed and one of the two

vacant sites is occupied by Sr^{2+}. Doping with 10^{-4}

mol % $SrCl_2$ means 100 moles of NaCl are doped with

10^{-4} mole of $SrCl_2$.

$\therefore SrCl_2$

$\text{droped per mole of}$

$NaCl = 10^{-4}/100$

=

$10^{-6}\text{mole} = 10^{-6}$

$\times \left(6.02\right.$

$\times 10^{23}$

$\left.\right) Sr^{2+} Sr^{2+} ions$

$\therefore$ concentration of cation vacancies $= 6.02 \times 10^{17} m$

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Q-25 - 35611571

NaCl shows Schottky defects and AgCl Frenkel defects. Their

electrical conductivity is due to

(A) motion of ions and not the motion of electrons

(B) motion of electrons and not the motion of ions

(C) lower co-ordination number of NaCl

(D) higher co-ordination number of AgCl

CORRECT ANSWER: A

Q-26 - 12658985

Which substance shown antiferromagnetism?

(A) ZnO_2

(B) CdO

(C) CrO_2

(D) MnO_3

CORRECT ANSWER: D

SOLUTION:

Substances which are expected to be paramagnetic in ferromagnetic on the basic of unpaired electron but actually they posses zero net magnitude moment are called aniferomagnites

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Q-27 - 12658983

In Bragg's X-rays diffraction studies , 100 pm has second - order diffraction at glancing angle of 30 Its interplanar spacing will be

(A) 200 pm

(B) 150 pm

(C) 100 pm

(D) 144 pm

CORRECT ANSWER: A

SOLUTION:

$$n\lambda = 2d\sin\theta$$
$$2 \times 100 - 2 \times d \times \frac{1}{2}$$
$$d = 200 \text{ pm}$$

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Q-28 - 23584957

The pyknometric density of sodium chloride crystal is $2.165 \times 10^3 kg \quad m^{-3}$while its X-ray density is $2.178 \times 10^3 kg \quad m^{-3}$. The fraction of unoccupied sites in sodium chloride crystal is

(A) 5.96×10^{-3}

(B) 5.96

(C) 5.96×10^{-2}

(D) 5.96×10^{-1}

CORRECT ANSWER: A

SOLUTION:

Pyknometric density = Observed density

$= 2.165 \times 10^{3} kg$

m^{-3}

X-ray density = Calculated density

=$2.178 \times 10^{3} kg \quad m^{-3}$

Decrease in density

$= \left(2.178 \times 10^{3}\right.$

$\left. - 2.165 \times 10^{3}\right) kg$

m^{-3}

=

$$\left(0.013 \times 10^{3}\right) kg$$

$$m^{-3} = 13 kg \quad m^{-3}$$

Fraction of unoccupied sites

$$= \frac{\text{Decrease in density}}{\text{Calculated density}}$$

=

$$\frac{13 kg \quad m^{-3}}{2.178 \times 10^{3} kg \quad m^{-3}}$$

$$= 5.96 \times 10^{-3}$$

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Q-29 - 12659108

The edge length of a cube is 400 pm .its body diagonal would be

(A) 693 pm

(B) 566 pm

(C) 600 pm

(D) 500 pm

CORRECT ANSWER: A

SOLUTION:

Since in body cernter cubic , the body diagram $= \sqrt{3}a$

$= \sqrt{3} \times 400\text{pm}$

$= 692.82\text{pm}$

$= 693$ pm

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Q-30 - 12659059

In closest packing of A type of atoms (radius r_A) the radius of atom B that can be fitted into octabedral voids is

(A) $0.155r_A$

(B) $0.125r_A$

(C) $0.414r_A$

(D) $0.732r_A$

CORRECT ANSWER: C

SOLUTION:

For octahedral void

$$\frac{r_B}{r_A} = 0.414 \text{ or } , r_B$$

$$= 0.414r_A$$

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Q-31 - 52403436

Ferrous oxide has a cubic structure and each edge of the unit cell is $5.0A$. Assuming density of the oxide as $4.0g - cm^{-1}cm^{-3}$ then the number of Fe^{2+} and O^{2-} ions present in each unit cell will be

(A) Four Fe^{2+} and four O^{2-}

(B) Two Fe^{2+} and four O^{2-}

(C) Four Fe^{3+} and two O^{2-}

(D) Three Fe^{2+} and three O^{2-}

CORRECT ANSWER: A

SOLUTION:

Let the units of ferrous oxide in a unit cell =n, molecular

weight of ferrous oxide

$(FeO) = 56 + 16$

$= 72 g \mathrm{mol}^{-1}$

,

weight of n units $= \dfrac{72 \times n}{6.023 \times 10^{23}}$

Volume of one unit $= (\text{length of corner})^3$

$= \left(5A\right)^3 = 125$

$\times 10^{-24} Cm^3$

Density

$$= \frac{\text{wt. of cell}}{\text{volume}}, 4.09$$

$$= \frac{72 \times n}{6.023 \times 10^{23} \times 125 \times 10^{-24}}$$

$$n = \frac{3079.2 \times 10^{-1}}{72}$$

$$= 42.7 \times 10^{-1}$$

$$= 4.27 = 4$$

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Q-32 - 52374102

Iron exhibits bcc structure at room temperature. Above $900C$, it transforms to fcc structure. The ratio of density of iron at room temperature to that at $900C$ (assuming molar mass and atomic radii of iron remains constant with temperature) is

(A) $\frac{3\sqrt{3}}{4\sqrt{2}}$

(B) $\frac{4\sqrt{3}}{3\sqrt{2}}$

(C) $\frac{\sqrt{3}}{\sqrt{2}}$

(D) $\frac{1}{2}$

CORRECT ANSWER: A

SOLUTION:

Density of unit cell

$$d = \frac{Z \times M}{N_A \times a^3}$$

where, Z=Number of atoms per unit cell

M=Molar mass

a^3=Volume of unit cell [a=edge length]

N_A=Avogadro's number $= 6.022 \times 10^{23}$

For bcc, Z=2, radius (r) $= \frac{\sqrt{3}a}{4}$

$$a = \frac{4r}{\sqrt{3}}$$

For fcc, $Z = 4, r = \frac{a}{2\sqrt{2}}$

$$\Rightarrow a = 2\sqrt{2}r$$

According to question

$$\frac{d_{\text{room temp.}}}{D_{900C}}$$

$$= \frac{\left(\frac{ZM}{N_A a^3}\right)_{bcc}}{\left(\frac{ZM}{N_A a^3}\right)_{fcc}}$$

On substituting the given values , we get

$$\frac{d_{\text{room temp.}}}{d_{900C}}$$

$$= \frac{2 \times M}{N_A \times \left(\frac{4r}{\sqrt{3}}\right)^3}$$

$$/ \frac{4 \times M}{N_A \times \left(2\sqrt{2}r\right)^3}$$

[$\because$ Given, M and r of iron remains constant with

temperature]

$$= \frac{2 \times 3\sqrt{3}}{64r^3}$$

$$\times \frac{16\sqrt{2}r^3}{4}$$

$$\frac{d_{bcc}}{d_{fcc}} = \frac{3}{4}\sqrt{\frac{3}{2}}$$

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Q-33 - 52403300

To get n-type semiconductor, the impurity to be added to silicon should have which of the following number of valence electrons.

(A) 1

(B) 2

(C) 3

(D) 5

CORRECT ANSWER: D

SOLUTION:

For n-type, impurity added to silicon should have more than 4 valence electrons.

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Q-34 - 52403467

When electrons are trapped into the crystal in anion vacancy. The defect is known as

(A) Schottky defect

(B) Frenkel defects decrease the density of crystalline solids

(C) Stoichiometric defect

(D) F-centres.

CORRECT ANSWER: D

SOLUTION:

F-centres are the sites where anions are missing and instead electrons are present, they are responsible for colour.

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Q-35 - 12658948

How many energy levels are prent in $3s$ conduction hand of a single crystal of sodium weighing $25.6mg$?

(A) 7.01×10^{20}

(B) 7.01×10^{23}

(C) 6.02×10^{23}

(D) 6.68×10^{20}

CORRECT ANSWER: D

SOLUTION:

$25.6mg = \frac{25.6}{23}$

$\times 10^{-3}$

mol

$= \frac{0.0256}{23} N_0$ sodium atoms

Electrons in 3 s orbital in one sodium atom (conduction

band) = 1.

Thus total conduction bands (energy levels) $\frac{0.0256}{23} N_0$

$= 6.68 \times 10^{20}$

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Q-36 - 12658889

An element $X(At, wt = 80g/mol)$ having fcc structure, calculate

the number of unit cells in $8gofX$

(A) $0.4 \times N_A$

(B) $0.1 \times N_A$

(C) $4 \times N_A$

(D) $N_A / 40$

CORRECT ANSWER: D

SOLUTION:

Effective an of atoms in a unit cell $= 4$

No, of atoms $= \frac{8}{80} \times N_A$

No of unit cells $= \frac{N_A}{10} \times \frac{1}{4} = \frac{N_A}{40}$

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Q-37 - 12658876

What is the formula of a magnetic oxide of cobalt used in recording tapes that crystallises with cobalt atoms occupying one - eight of the

tetrabedral holes and one- half of the octahedral holes in a closest packed array of oxide inos ?

(A) Co_2O_3

(B) CoO_2

(C) Co_3O_4

(D) CoO

CORRECT ANSWER: B

SOLUTION:

Tetrahedral holes $= 8$ Octabadral holes $= 4$

Cobalt atoms = $\frac{8}{8} = 1$

Oside ions = $\frac{4}{2} = 2$

Thus, formula is CaO_2.

Q-38 - 12658868

Select the corrent statement (s)

(a) The $C.\ N.$ of cation occupying a tetrahedral hole is 4

(b) The $C.\ N.$ of cation occupying an octabedral hole is 6

(c) In schottky defects, density of the lattice decreases

(A) a,b

(B) b,c

(C) a,b,c

(D) a,c

CORRECT ANSWER: C

SOLUTION:

Since terthadral holes are surrounded by a nearest neighours so, the $C.\ N$ of cation occupying tetrahedral

hole is 4 since octahedral holes is surrounded by six nearest neighource so, $C.N$ of cation accopying outahedral is 6 In schotily defecty defects a parts of anion and cation so density of lattice decreases

Q-39 - 16009343

For an ionic solid of the general formula AB and coordination number 6, the value of ther radius ratio will be:

(A) less than 0.025

(B) in between 0.025 and 0.414

(C) between 0.414 and 0.732

(D) greater than 0.732

Q-40 - 52403433

A solid has a strcture in which 'W' atoms are located at the corners of a 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) $NaWO_3$

(C) Na_2WO_3

(D) $NaWO_4$

CORRECT ANSWER: B

SOLUTION:

In a unit cell, W atoms at the corner $= \frac{1}{8} \times 8 = 1$

O atoms at the centre of edges $= \frac{1}{4} \times 12 = 3$

Na atoms at the centre of the cube=1

$W:O:Na = 1:3:1$, hence formula =$NaWO_3$

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Q-41 - 52403517

In a solid 'AB' having the NaCl structure 'A' atoms occupy the corners of the cubic unit cell. If all the face-centred atoms along one of the axes are removed, then the resultant stoichiometry of the solid is

(A) AB_2

(B) A_2B

(C) A_4B_3

(D) A_3B_4

CORRECT ANSWER: D

SOLUTION:

Effective number of 'A' atoms

$$= \left(8 \times \frac{1}{8}\right)$$

$$+ \left(4 \times \frac{1}{2}\right) = 3$$

Effective number of 'B' atoms

$$= \left(12 \times \frac{1}{4}\right) + 1$$

$$= 4$$

$\therefore$ Formula of the solid=A_3B_4

Q-42 - 52403322

If 'a' stands for the edge length of the cubic systems: simple cubic, body centred cubic and face centred cubic, then the ratio of radii of the spheres in these systems will be respectively.

(A) $\frac{1}{2}a : \frac{\sqrt{3}}{2}a : \frac{\sqrt{2}}{2}a$

(B) $1a : \sqrt{2}a : \sqrt{2}a$

(C) $\frac{1}{2}a : \frac{\sqrt{3}}{4}a : \frac{1}{2\sqrt{2}}a$

(D) $\frac{1}{2}a : \sqrt{3}a : \frac{1}{\sqrt{2}}a$

CORRECT ANSWER: C

SOLUTION:

SC a=2r

BCC $\sqrt{3}$ a=4r

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

$\frac{a}{2} : \frac{\sqrt{3a}}{4} : \frac{\sqrt{2a}}{4}$.

In the calcium fluoride structure, the coodination number of the cation and the anion are, respectively,

(A) 6 and 6

(B) 8 and 4

(C) 4 and 4

(D) 4 and 8

CORRECT ANSWER: B

SOLUTION:

In fluorite-type stucture, $CN = (8:4)$ (factual statement).

In a tetragonal crystal

(A)

$a = b = c, \alpha = \beta = 90^\circ \neq \gamma$

(B)

$\alpha = \beta = \gamma = 90^\circ, a = b \neq c$

(C)

$\alpha = \beta = \gamma = 90^\circ, a \neq b \neq c$

(D)

$\alpha = \beta = 90^\circ, \gamma = 120^\circ, a = b \neq c$

CORRECT ANSWER: B

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Q-45 - 11042993

The material used in solar cells contains

(A) Cs

(B) Si

(C) Sn

(D) Ti

CORRECT ANSWER: B

SOLUTION:

SiO_2 is used in solar cells.

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Q-46 - 11043006

The edge length of unit cell of a metal $(Mw = 24)$ having cubic structure is 4.53. If the density of metal is $1.74gcm^{-3}$, the radius of

metal is $\left(N_A = 6 \times 10^{23}\right)$

(A) 180 pm

(B) 160 pm

(C) 140 pm

(D) 190 pm

CORRECT ANSWER: B

SOLUTION:

$$\rho = \frac{Z_{eff} \times Mw}{. a^3 \times N_A}$$

$$1.74 gcm^{-3}$$

$$= \frac{Z_{eff} \times 24}{\left(4.53 \times 10^8\right)^3 cm^3 \times 6 \times 10^{23} \text{atoms}}$$

$\therefore Z_{eff} = 4$ (fcc structure)

For fcc, the radius of atom is.

$$r = \frac{a}{2\sqrt{2}} = \frac{4.53}{2\sqrt{2}}$$

$$= 1.60 = 160\text{pm}$$

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Q-47 - 11043008

If R is the radius of the octahedral voids and r is the radius of the atom in close packing, then r / R is equal to

(A) 2.41

(B) 4.76

(C) 3.22

(D) 9.1

CORRECT ANSWER: A

SOLUTION:

For OV,

$$\frac{R}{r}\text{ (i.e., }\frac{r_{\oplus}}{r_{?}}\text{ or }\frac{r_{\text{void}}}{r_{?}}\text{)}=0.414$$

$$\therefore \frac{r}{R}=\frac{1}{0.414}$$

$$=2.41$$

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Q-48 - 11043012

An elemental crystal has density of $8570kgm^{-3}$. The packing efficiency is 0.67. If the closest distance between neighbouring atoms is 2.86. The mass of one atom is $\left(1a\mu=1.66\times10^{-27}\right)kg\right)$

(A) 186 amu

(B) 93 amu

(C) 46.5 amu

(D) 43 amu

CORRECT ANSWER: B

SOLUTION:

Let the volume of unit cell $= V$

Volume occupied by atoms $= 0.68V$

Volume occupied by atoms $= 0.68V$

Thus,

$$Z_{eff}\left(\frac{4}{3}\pi r^3\right) = 0.68V$$

Also, $2r = 2.86 \Rightarrow 1.43$

$$\rho\frac{Z_{eff} \times Aw}{a^3 \times N_A}\left(A\frac{w}{N_A}\right.$$

$=$

Mass of an atom in amu)

Applying another fourmula of ρ.

(Refer Section 1.13, alternative method)

ρ

$$= \frac{Z_{eff} \times \text{Mass in amu} \times 1.66 \times 10^{-27} kg}{V}$$

$8570kgm^{-3}$

$$= \frac{0.68 \times m \times 1.66 \times 10^{-27}kg}{\frac{4}{3}\pi(1.43)^3 \times 10^{-30}}$$

$\therefore m \Rightarrow 93a\mu$

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Q-49 - 11043025

A molecule $A_2B(Mw = 166.4)$ occupies triclinic lattice with $a = 5, b = 8$, and $c = 4$,. If the density of AB_2 is $5.2gcm^{-3}$, the number of molecules present in one unit cell is

(A) 2

(B) 3

(C) 4

(D) 5

CORRECT ANSWER: B

SOLUTION:

Volume of unit cell

$$= a \times b \times c = 5 \times 10^{-8} \times 8 \times 10^{-8} \times 4 \times 10^{-8}$$

$$= 1.6 \times 10^{-22} cm^3$$

Mass of unit cell $= 1.6 \times 10^{-22} cm^3$

Mass of unit cell

$$= 1.6 \times 10^{-22} \times 5.2$$

$$= 8.32 \times 10^{-22} g$$

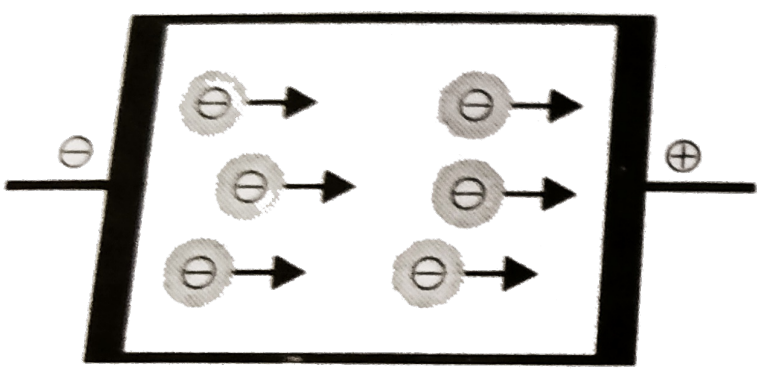
Number of molecules in one unit cell

$$= \frac{8.32 \times 10^{-22} g}{166.4 g mol^{-1}}$$

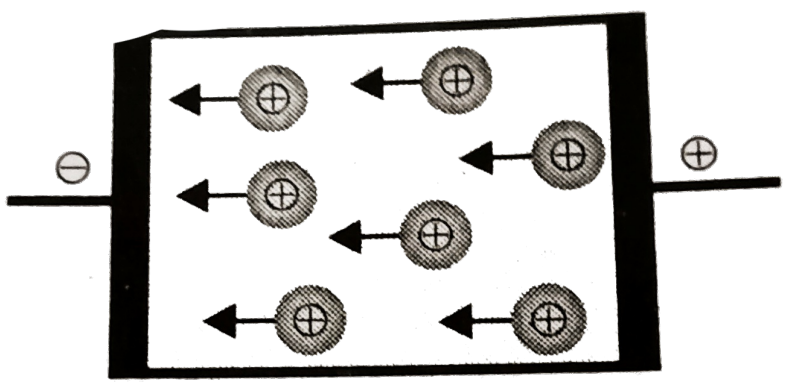
$$= 3$$

Q-50 - 11043059

What are types of following semiconductors I and II.



(I)



(II)

(A)

$I \Rightarrow p-type, II \Rightarrow n-type$

(B)

$I \Rightarrow n-type, II \Rightarrow p-type$

(C) Both n-type

(D) Both p-type

CORRECT ANSWER: B

SOLUTION:

See text.

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Q-51 - 11043053

When molten zinc is cooled to solid state, it assumes *hcp* structure.

Then the number of nearest neighbours of zine atom will be

(A) 4

(B) 6

(C) 8

(D) 12

CORRECT ANSWER: D

SOLUTION:

hcp has 12 nearest neighbours.

Q-52 - 12659011

With which one of the following element silicon should be depend so as to give p- type semiconductor?

(A) As

(B) Se

(C) B

(D) Ge

CORRECT ANSWER: C

SOLUTION:

Silicon should be doped with group 13 element to give a

p- type semiconductor

Q-53 - 12978509

AB crystallizes in a body centred cubic lattice with edge length a equal to $387pm$ .The distance between two oppositely charged ions in the lattice is :

(A) $300pm$

(B) $335pm$

(C) $250pm$

(D) $200pm$

CORRECT ANSWER: 2

SOLUTION:

For a body centred unit cell, we have

$4r = \sqrt{3}a$

or $r = \frac{\sqrt{3}}{4}a$

The distance between two oppositely charged ions in the

lattice is

$2r = 2\left(\frac{\sqrt{3}}{4}a\right)$

$= \frac{\sqrt{3}}{2}a$

$= \frac{\sqrt{3}}{2}(387pm)$

$$= \frac{1.732}{2}(387pm)$$
$$= 335pm$$

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Q-54 - 12659008

Assertion : The octahedral viods have double the size of the tetrabedral voids in a crystal

Reason: The number of tetrahedral voids is double the number of octabehedral voids is a crystal

(A) If both assertion and reason are true and the reason is the correct explanation of the assertion

(B) If both assertion and reason are true but reason is not the correct explanation of the assertion

(C) If assertion is true bur reason is false

(D) If assertion is false bur reason is true

CORRECT ANSWER: D

SOLUTION:

Correct assertion Octadudral void are large in size than tetrahedral voids but not double in size. Reason is correct.

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Q-55 - 12658994

Assertion :Bragg's equation has no solution, if $n = 2$ and $\lambda > d$

Reason : Bragg's equation is $n\lambda = 2d\sin\theta$

(A) If both assertion and reason are true and the reason is the correct explanation of the assertion

(B) If both assertion and reason are true but reason is not the correct explanation of the assertion

(C) If assertion is true bur reason is false

(D) If assertion is false bur reason is true

CORRECT ANSWER: A

SOLUTION:

If $n = 2$ and$\lambda > d$then $\sin\theta > 1$ which is not possible

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Q-56 - 12658995

Assertion : Na_2O adopes structure similar to that of CaF_2 but positions and negative ions are reversed

Reason : The structure ofNa_2O is also called spinal structure

(A) If both assertion and reason are true and the reason is the correct explanation of the assertion

(B) If both assertion and reason are true but reason is

not the correct explanation of the assertion

(C) If assertion is true bur reason is false

(D) If assertion is false bur reason is true

CORRECT ANSWER: C

SOLUTION:

Na_2O structure is also known as antiflourite structure

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Q-57 - 32522158

Assertion : An important feature of fluorite structure is that cations being large ib size occupy FCC lattice points, the formula unit AB_2 (A cation, B anion)

Reason: There are 6 cations and 12 anions per FCC unit cell of the flucrite structure

(A) Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

(B) Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1

(C) Statement-1 is True, Statement-2 is False.

(D) Statement-1 is False, Statement-2 is True.

CORRECT ANSWER: C

SOLUTION:

Based on Fluorite structure of CaF_2

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Q-58 - 52403466

Certain crystals produce electric signals on application of pressure.

This phenomenon is called

(A) Pyroelectricity

(B) Ferroelectricity

(C) Peizoelectricity

(D) Ferrielectricity.

CORRECT ANSWER: C

SOLUTION:

When polar crystal is subjected to a mechanical stress, electricity is produced - a case of piezoelectricity. Reversely. If electric field is applied, mechanical stress is developed Piezoelectric crystal acts asa mechanical electrical transductor.

Assertion : ZnO becomes yellow when it is beated

Reason: $NaCI$ becomes yellow when heater in the presence of Na vapours due to anion vacancy

(A) If both assertion and reason are true and the reason is the correct explanation of the assertion

(B) If both assertion and reason are true but reason is not the correct explanation of the assertion

(C) If assertion is true bur reason is false

(D) If assertion is false bur reason is true

CORRECT ANSWER: B

SOLUTION:

Zinc oxide losses oxygen reversible at hight temperature and turn yellow

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Q-60 - 69095692

Assertion. Triclinic system is the most unsymmetrical system

Reason. No axial angle is equal to 90 in triclinic system

(A) If both assertion and reason are true, and reason is the true explanation of the assertion.

(B) If both assertion and reason are true, but reason is not the true explanation of the assertion.

(C) If assertion is true , but reason is false

(D) If both assertion and reason are false.

CORRECT ANSWER: B

SOLUTION:

Correct explanation . Axial angles are not equal to each

other.