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NPTEL

reviewer4@nptel.iitm.ac.in ▾

Courses » Introduction to Solid State Physics

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Unit 5 - Introduction to crystal structure and their classifications

Register for Certification exam

Course outline

How to access the portal

Introduction to Drude's free electron theory of metals, electrical conductivity Ohm's law and Hall effect

Introduction to Sommerfeld's model

Specific heat of an electron gas and the behaviour of thermal conductivity of a solid and relationship with electrical conductivity

Introduction to crystal structure and their classifications

- Introduction to crystals and bonding in

Assignment 4

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-02-27, 23:59 IST.

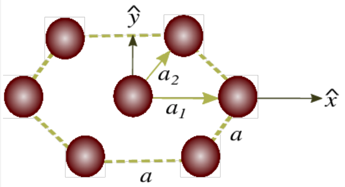
1) A crystal is describe by *1 point*

- A Bravais lattice of points and a basis of atoms
- A simple lattice of points and a basis of atoms
- A simple lattice of atoms and a basis of points
- Only a basis of atoms

No, the answer is incorrect.
Score: 0

Accepted Answers:
A Bravais lattice of points and a basis of atoms

2) For the hexagonal 2D Bravais lattice shown below with lattice constant a, the fundamental translation vectors are *1 point*



- $\vec{a_1} = a\hat{x}, \quad \vec{a_2} = \frac{a}{2}\hat{x} + \frac{\sqrt{3}a}{2}\hat{y}$
- $\vec{a_1} = a\hat{x}, \quad \vec{a_2} = a\hat{y}$
- $\vec{a_1} = 0\hat{x}, \quad \vec{a_2} = 0\hat{y}$

$\vec{a_1} = a\hat{x}, \quad \vec{a_2} = \frac{a}{2}\hat{x} + \frac{\sqrt{3}a}{2}\hat{y}$

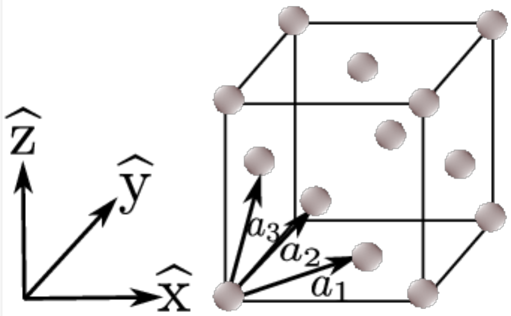
3) The area of the primitive cell formed by $\vec{a_1}, \vec{a_2}$ in above question is *1 point*

- $2a^2$
- $\sqrt{3}a^2$
- a^2
- $\frac{\sqrt{3}}{2}a^2$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{\sqrt{3}}{2}a^2$

4) For a FCC structure, the primitive lattice vector (expressed in terms of $\hat{x}, \hat{y}$ and $\hat{z}$) is *1 point*

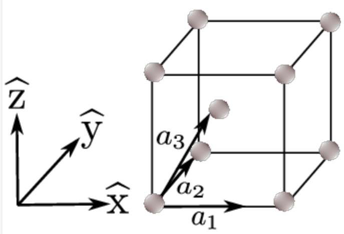


- $a_1 = \frac{a}{2}(\hat{x} + \hat{y}), a_2 = \frac{a}{2}(\hat{y} + \hat{z}), a_3 = \frac{a}{2}(\hat{x} + \hat{z})$
- $a_1 = \frac{a}{2}(-\hat{x} + \hat{y}), a_2 = \frac{a}{2}(\hat{y} + \hat{z}), a_3 = \frac{a}{2}(-\hat{x} + \hat{z})$
- $a_1 = \frac{a}{2}(\hat{x} - \hat{y}), a_2 = \frac{a}{2}(-\hat{y} + \hat{z}), a_3 = \frac{a}{2}(\hat{x} + \hat{z})$
- $a_1 = \frac{a}{2}(\hat{x} + \hat{y}), a_2 = \frac{a}{2}(\hat{y} - \hat{z}), a_3 = \frac{a}{2}(\hat{x} - \hat{z})$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$a_1 = \frac{a}{2}(\hat{x} + \hat{y}), a_2 = \frac{a}{2}(\hat{y} + \hat{z}), a_3 = \frac{a}{2}(\hat{x} + \hat{z})$

5) For a body centered cubic lattice a possible set of primitive lattice vectors are shown. Then in terms of $\hat{x}, \hat{y}$ and $\hat{z}$ they are *1 point*



semi-classical dynamics of a particle in a band

Introductory Semiconductor Physics

Magnetism in materials

Superconductivity

Solutions of Assignments

$a_1 = a\widehat{x}, a_2 = a\hat{y}, a_3 = \frac{a}{2}(\widehat{x} + \hat{y} + \hat{z})$

$a_1 = \dfrac{a}{2}(\widehat{x} + \hat{y} + \hat{z}), a_2 = a\hat{y}, a_3 = \frac{a}{2}\widehat{x}$

$a_1 = a(\hat{y} + \hat{z}), a_2 = \frac{a}{2}(\widehat{x} + \hat{z}), a_3 = \frac{a}{2}\widehat{x}$

$a_1 = \frac{a}{2}(-\widehat{x} + \hat{y}), a_2 = a\hat{y}, a_3 = \frac{a}{2}(\widehat{x} + \hat{y} + \hat{z})$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$a_1 = a\widehat{x}, a_2 = a\hat{y}, a_3 = \frac{a}{2}(\widehat{x} + \hat{y} + \hat{z})$

6) If coordination number represents the number of nearest neighbouring lattice points then for the FCC lattice the coordination number is ***1 point***

- 12
- 4
- 8
- 6

No, the answer is incorrect.
Score: 0

Accepted Answers:
12

7) Atomic packing factor (APF) is the fraction of volume in a crystal structure that is occupied by constituent particles $APF = \dfrac{N_{particle}V_{particle}}{V_{unit\ cell}}$ ***1 point***

where,
$N_{particle}$: : number of particles in unit cell

$V_{particle}$: : volume of each particle in unit cell

$V_{unit\ cell}$: : volume of a unit cell

and each particle in the structure is taken as a sphere. Then, the APF for a simple cube is

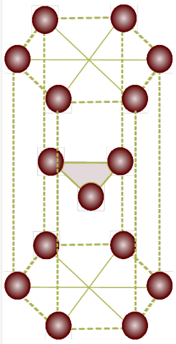
- $\dfrac{\pi}{6}$
- $\dfrac{\pi}{3}$
- $\dfrac{\pi}{2}$
- $\dfrac{\pi}{9}$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$\frac{\pi}{6}$

8) Shown below is the HCP unit cell structure. The number of atom per unit cell of HCP is ***1 point***



- 6
- 5
- 4
- 3

No, the answer is incorrect.
Score: 0

Accepted Answers:
6

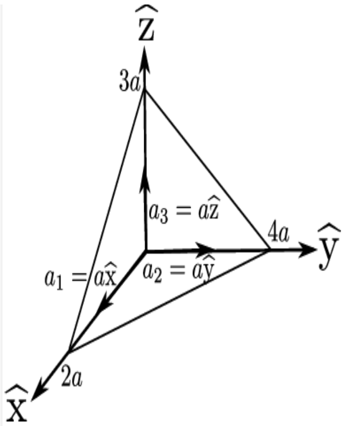
9) Volume of a HCP unit cell is, ***1 point***

- $\frac{\sqrt{3}}{2}a^2c$
- a^2c
- $\frac{1}{2}a^2c$
- a^3

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{\sqrt{3}}{2}a^2c$

10)The Miller's indices (h,k,l) for the plane shown is ***1 point***



- (h,k,l)=(6,3,4)
- (h,k,l)=(2,4,3)
- (h,k,l)=(3,6,4)
- (h,k,l)=(4,2,3)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(h,k,l)=(6,3,4)

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