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Courses » Introduction to Solid State Physics

Announcements **Course** Ask a Question Progress FAQ

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

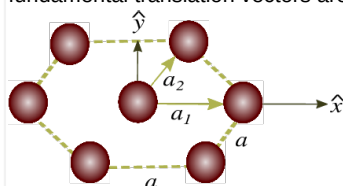
No, the answer is incorrect.

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



$\vec{a}_1 = a\hat{x}, \quad \vec{a}_2 = \frac{a}{2}\hat{x} + \frac{\sqrt{3}a}{2}\hat{y}$

$\vec{a}_1 = a\hat{x}, \quad \vec{a}_2 = a\hat{y}$

$\vec{a}_1 = 0\hat{x}, \quad \vec{a}_2 = 0\hat{y}$

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Bravais Lattice Types Part-2

Introduction to different crystal types Part-1

Introduction to different crystal types Part-2

Indexing crystal planes

Quiz : Assignment 4

Introduction to Solid State Physics : Feedback For Week 4

Assignment 4 solutions

Direct Imaging of Atomic Structure, Diffraction of Waves by Crystals, Reciprocal lattice, Brillouin Zones

Vibrations of Crystals with Monatomic Basis, Acoustic modes

Two Atoms per Primitive Basis, Quantization of Elastic Waves, Phonon Momentum

Bloch's theorem for wavefunction of a particle in a periodic potential, nearly free electron model, origin of energy band gaps, discussion of Bloch wavefunction

Band theory of metals, insulators and semiconductors, Kronig-Penney model, tight binding method of calculating bands, and

ce De $\vec{a}_1 = a\hat{x}, \quad \vec{a}_2 = \frac{a}{2}\hat{x} + \frac{\sqrt{3}a}{2}\hat{y}$

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



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

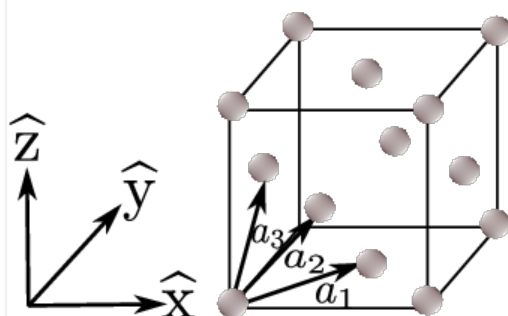
No, the answer is incorrect.

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**



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



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



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



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

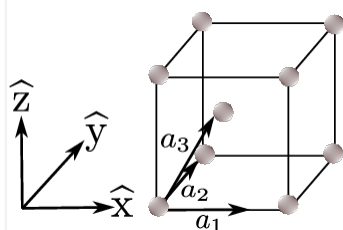
No, the answer is incorrect.

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



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



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



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



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

No, the answer is incorrect.

Score: 0

Accepted Answers:

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

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



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 $APF = \frac{N_{particle} V_{particle}}{V_{unit\ cell}}$ **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



$\frac{\pi}{6}$



$\frac{\pi}{3}$



$\frac{\pi}{2}$



$\frac{\pi}{9}$

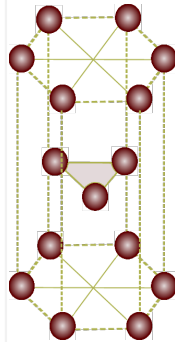
No, the answer is incorrect.

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

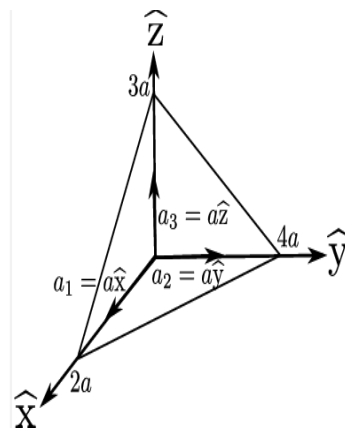
No, the answer is incorrect.

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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