PhysicsByAaryan

CSIR NET . GATE . JEST . BARC - Physics

Crystallography - CSIR NET Physics PYQs

Solid State Physics . All PYQs (2015-2025) with answer key

10 questions . Answer key included

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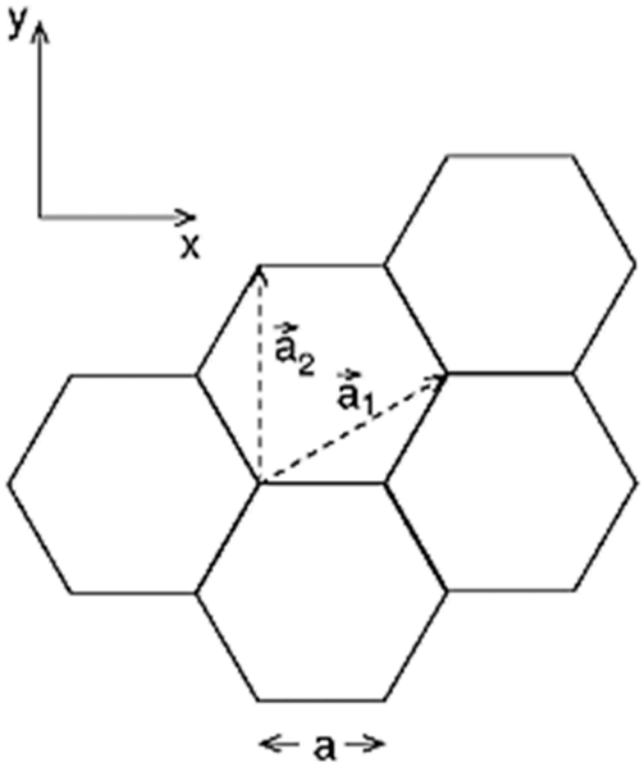
Q1. [Dec 2016] . 5.0 marks

Solid State Physics > Crystallography

CSIR NET	2016 Dec	5M

Consider a hexagonal lattice with basis vectors as shown in the figure below. If the lattice spacing is $a = 1$, the reciprocal lattice vectors are

1. $\left(\frac{4\pi}{3}, 0\right), \left(-\frac{2\pi}{3}, \frac{2\pi}{\sqrt{3}}\right)$
2. $\left(\frac{4\pi}{3}, 0\right), \left(\frac{2\pi}{3}, \frac{2\pi}{\sqrt{3}}\right)$
3. $\left(0, \frac{4\pi}{\sqrt{3}}\right), \left(\pi, \frac{2\pi}{\sqrt{3}}\right)$
4. $\left(\frac{2\pi}{3}, \frac{2\pi}{\sqrt{3}}\right), \left(-2\pi, \frac{2\pi}{\sqrt{3}}\right)$



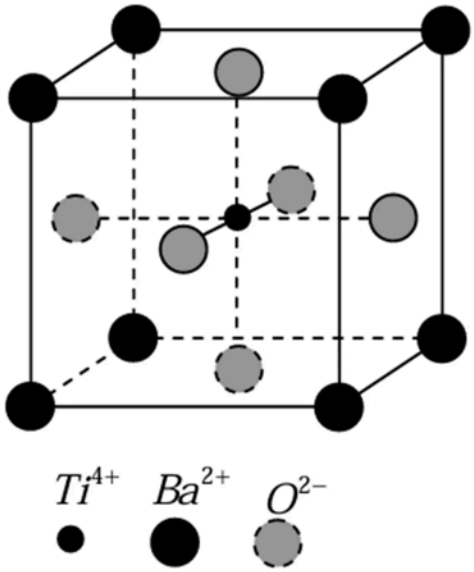
Q2. [Dec 2018] . 5.0 marks

Solid State Physics > Crystallography

CSIR NET	2018 Dec	5M

Barium Titanate ($BaTiO_3$) crystal has a cubic perovskite structure, where the Ba^{2+} ions are at the vertices of a unit cube, the O^{2-} ions are at the centers of the faces while the Ti^{2+} is at the center. The number of optical phonon modes of the crystal is

1. 12
2. 15
3. 5
4. 18



Q3. [June 2018] . 5.0 marks

Solid State Physics > Crystallography

CSIR NET	2018 June	5M

Hard discs of radius R are arranged in a two-dimensional triangular lattice. What is the fractional area occupied by the discs in the closest possible packing?

1. $\frac{\pi\sqrt{3}}{6}$
2. $\frac{\pi}{3\sqrt{2}}$
3. $\frac{\pi\sqrt{2}}{5}$
4. $\frac{2\pi}{7}$

Q4. [June 2019] . 5.0 marks

Solid State Physics > Crystallography

CSIR NET	2019 June	5M

The third-nearest neighbor distance in a BCC (Body Centered Cubic) crystal with lattice constant a_0 is

1. a_0
2. $\frac{3a_0}{2}$
3. $\sqrt{3}a_0$
4. $\sqrt{2}a_0$

Q5. [June 2020] . 5.0 marks

Solid State Physics > Crystallography

CSIR NET	2020 June	5M

A lattice is defined by the unit vectors $\vec{a}_1 = a\hat{i}, \vec{a}_2 = -\frac{a}{2}\hat{i} + \frac{a\sqrt{3}}{2}\hat{j}$ and $\vec{a}_3 = a\hat{k}$, where $a > 0$ is a constant. The spacing between the (100) planes of the lattice is

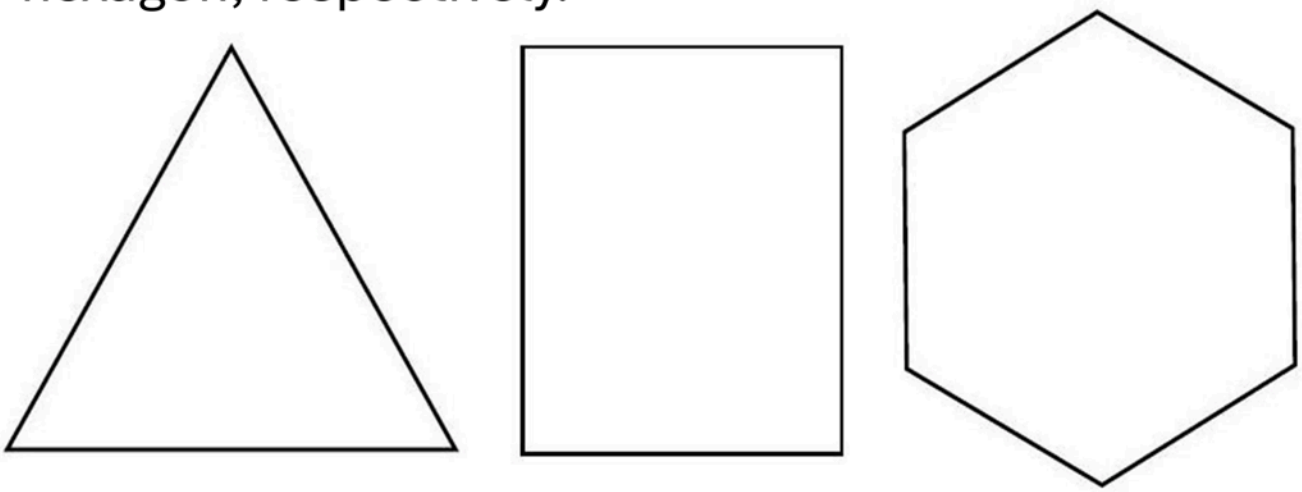
1. $\sqrt{3}a/2$
2. $a/2$
3. a
4. $\sqrt{2}a$

Q6. [June 2022] . 5.0 marks

Solid State Physics > Crystallography

CSIR NET	2022 June	5M

The Figures (i), (ii) and (iii) below represent an equilateral triangle, a rectangle and a regular hexagon, respectively.



(i) (ii) (iii)

Which of these can be primitive unit cells of a Bravais lattice in two dimensions?

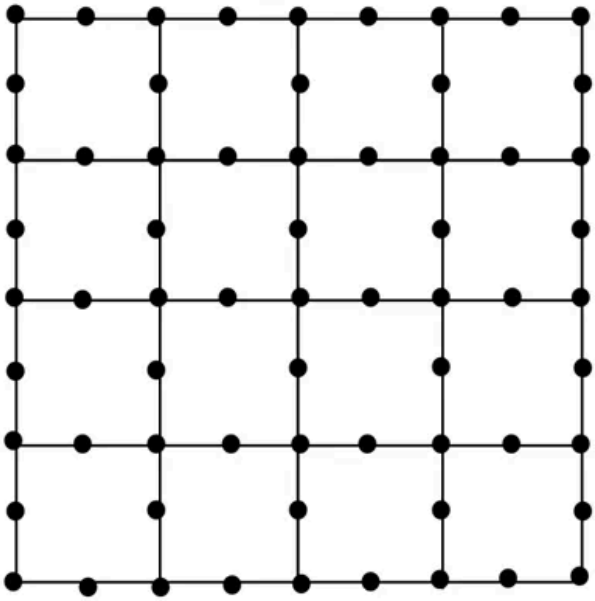
1. only (i) and (iii) but not (ii)
2. only (i) and (ii) but not (iii)
3. only (ii) and (iii) but not (i)
4. All of them

Q7. [Dec 2023] . 5.0 marks

Solid State Physics > Crystallography

CSIR NET	2023 Dec	5 M

In the section of an infinite lattice shown in the figure below, all sites are occupied by identical hard circular discs so that the resulting structure is tightly packed.



The packing fraction is

1. $\frac{3\pi}{4}$
2. $\frac{\pi}{4}$
3. $\frac{3\pi}{16}$
4. $\frac{9\pi}{16}$

Q8. [June 2023] . 5.0 marks

Solid State Physics > Crystallography

CSIR NET	2023 June	5M

A lattice A consists of all points in three-dimensional space with coordinates (n_x, n_y, n_z) where n_x, n_y and n_z are integers with $n_x + n_y + n_z$ being odd integers. In another lattice B, $n_x + n_y + n_z$ are even integers. The lattices A and B are

1. both BCC
2. both FCC
3. BCC and FCC, respectively
4. FCC and BCC, respectively

Q9. [Dec 2024] . 5.0 marks

Solid State Physics > Crystallography

CSIR NET	2024 Dec	5M

The lattice spacing in a simple cubic lattice is given to be 5Å. The number of lattice points per square nanometer in the lattice plane with Miller index (212) is closest to

1. 7.5
2. 3
3. 1.33
4. 0.66

Q10. [June 2024] . 5.0 marks

Solid State Physics > Crystallography

CSIR NET	2024 June	5M

Consider a body-centered tetragonal lattice with lattice constants $a = b = a_0$ and $C = \frac{a_0}{2}$. The number of nearest neighbours, the nearest neighbour distance, the number of next nearest neighbours and the next nearest neighbour distance, respectively, are

1. $6, \frac{1}{2}a_0, 8\frac{\sqrt{3}}{2}a_0$
2. $8, \frac{\sqrt{3}}{2}a_0, 6, a_0$
3. $2, \frac{1}{2}a_0, 8, \frac{3}{4}a_0$
4. $8, a_0, 6, \frac{4}{3}a_0$

Answer Key

10 questions . Subject and topic for quick revision

Q. No	Subject	Topic	Answer
Q1	Solid State Physics	Crystallography	**1**
Q2	Solid State Physics	Crystallography	**1**
Q3	Solid State Physics	Crystallography	**1**
Q4	Solid State Physics	Crystallography	**4**
Q5	Solid State Physics	Crystallography	**1**
Q6	Solid State Physics	Crystallography	**3**
Q7	Solid State Physics	Crystallography	**3**
Q8	Solid State Physics	Crystallography	**2**
Q9	Solid State Physics	Crystallography	**3**
Q10	Solid State Physics	Crystallography	**3**

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