

PhysicsByAaryan

CSIR NET . GATE . JEST . BARC - Physics

Lattice vibrations - CSIR NET Physics PYQs

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

6 questions . Answer key included

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Q1. [June 2016] . 5.0 marks

Solid State Physics > Lattice vibrations

CSIR NET	2016 June	5M
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Suppose the frequency of phonons in a onedimensional chain of atoms is proportional to the wavevector. If n is the number density of atoms and c is the speed of the phonons, then the Debye frequency is

1. $2\pi cn$
2. $\sqrt{2}\pi cn$
3. $\sqrt{3}\pi cn$
4. $\pi cn/2$

Q2. [Dec 2018] . 5.0 marks

Solid State Physics > Lattice vibrations

CSIR NET	2018 Dec	5M
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At low temperatures, in the Debye approximation, the contribution of the phonons to the heat capacity of a two dimensional solid is proportional to

1. T^2
2. T^3
3. $T^{1/2}$
4. $T^{3/2}$

Q3. [Dec 2019] . 5.0 marks

Solid State Physics > Lattice vibrations

CSIR NET	2019 Dec	5M
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For T much less than the Debye temperature of copper, the temperature dependence of the specific heat at constant volume of copper, is given by (in the following a and b are positive constants)

1. aT^3

2. $aT + bT^3$

3. $aT^2 + bT^3$

4. $\exp\left(-\frac{a}{k_B T}\right)$

Q4. [June 2021] . 3.5 marks

Solid State Physics > Lattice vibrations

CSIR NET	2021 June	3.5M
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The total number of phonon modes in a solid of volume V is $\int_0^{\omega_D} g(\omega) d\omega = 3N$, is the number of primitive cells, ω_D is the Debye frequency and density of photon modes is $g(\omega) = AV\omega^2$ (with $A > 0$ a constant). If the density of the solid doubles in a phase transition, the Debye temperature θ_D will

1. increase by a factor of $2^{2/3}$
2. increase by a factor of $2^{1/3}$
3. decrease by a factor of $2^{2/3}$
4. decrease by a factor of $2^{1/3}$

Q5. [June 2024] . 5.0 marks

Solid State Physics > Lattice vibrations

CSIR NET	2024 June	5M
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The Debye temperature of a two-dimensional insulator is 150 K . The ratio of the heat required to raise its temperature from 1 K to 2 K and from 2 K to 3 K is

1. 7:19
2. 3:13
3. 1:1
4. 3:5

Q6. [Dec 2025] . 5.0 marks

Solid State Physics > Lattice vibrations

CSIR NET	2025 Dec	5M	SSP
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A cubic sample of edge length L is maintained at a temperature of 4 K . The speed of sound in the material of the sample is 5×10^3 m/s. The minimum value of L required to excite the lowest frequency phonon mode is closest to

1. 10 nm
2. 30 nm
3. 20 nm
4. 5 nm

Answer Key

6 questions . Subject and topic for quick revision

Q. No	Subject	Topic	Answer
Q1	Solid State Physics	Lattice vibrations	1
Q2	Solid State Physics	Lattice vibrations	1
Q3	Solid State Physics	Lattice vibrations	2
Q4	Solid State Physics	Lattice vibrations	2
Q5	Solid State Physics	Lattice vibrations	1
Q6	Solid State Physics	Lattice vibrations	2

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