CUET 2026 May 29 Shift 2 Physics

Question Paper (Memory-Based) with Solutions

Conducted by National Testing Agency (NTA)

General Instructions

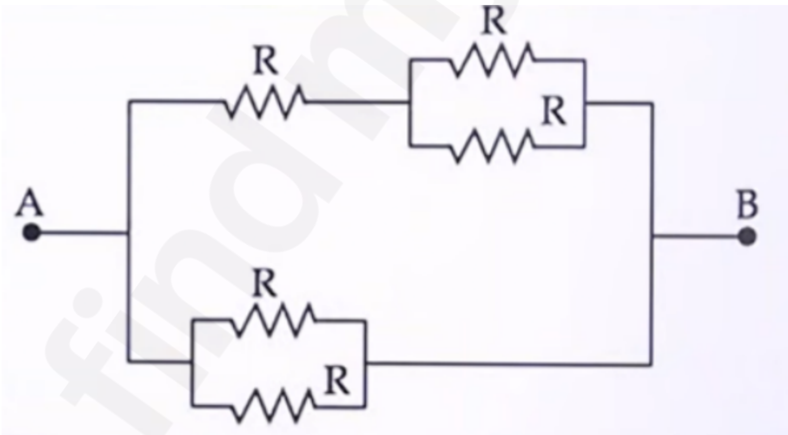
(i) The examination will be conducted in Computer-Based Test (CBT) mode.

(ii) Each question carries +5 marks for correct answer and -1 mark for wrong answer.

(iii) The total number of questions are 50.

(iv) Duration of the exam is 1 hour (60 minutes).

1. Five resistors, each of resistance R, are connected between points A and B as shown in the figure. The equivalent resistance between A and B is:



(A) $\frac{3R}{8}$
(B) $5R$
(C) $\frac{8R}{3}$
(D) $2R$

Correct Answer: (A) $\frac{3R}{8}$

Solution:

Step 1: Simplify the upper branch.

In the upper branch, one resistor R is in series with two resistors R connected in parallel.

The parallel combination is:

$$R_p = \frac{R \cdot R}{R + R} = \frac{R}{2}$$

Therefore, the equivalent resistance of the upper branch is:

$$R_{\text{upper}} = R + \frac{R}{2} = \frac{3R}{2}$$

Step 2: Simplify the lower branch.

The lower branch consists of two resistors R connected in parallel.

Thus,

$$R_{\text{lower}} = \frac{R \cdot R}{R + R} = \frac{R}{2}$$

Step 3: Combine the two branches.

The upper and lower branches are connected in parallel between A and B.

Hence,

$$R_{\text{eq}} = \frac{R_{\text{upper}} R_{\text{lower}}}{R_{\text{upper}} + R_{\text{lower}}}$$

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

$$= \frac{\frac{3R^2}{4}}{2R}$$

$$= \frac{3R}{8}$$

Therefore,

$$\boxed{R_{\text{eq}} = \frac{3R}{8}}$$

Hence, the correct answer is:

$$\boxed{\text{(A)}}$$

Quick Tip: For two equal resistors R in parallel:

$$R \parallel R = \frac{R}{2}$$

A useful strategy for complex resistor networks is:

$$\boxed{\text{Simplify small parallel groups first, then combine series and parallel branches.}}$$

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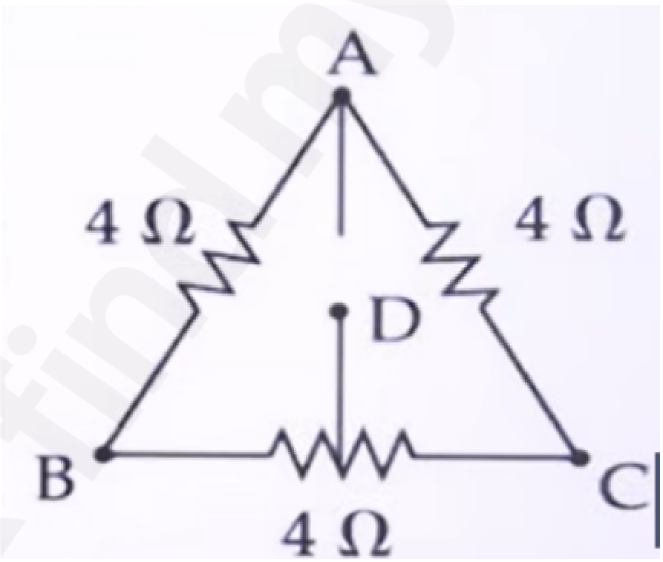
2. In the figure shown, three resistors of $4\,\Omega$ are connected. If point D divides the resistor between B and C into two equal parts, then the equivalent resistance between points A and D is:



(A) $12\,\Omega$

(B) $6\,\Omega$

(C) $3\,\Omega$

(D) $\frac{1}{3}\,\Omega$

Correct Answer: (C) $3\,\Omega$

Solution:

Step 1: Identify the resistance values.
Each side of the triangle has resistance

$$4\,\Omega$$

Since D is the midpoint of the resistor BC,

$$BD = DC = 2\,\Omega$$

Step 2: Find the two paths between A and D.
Path 1:

$$A \to B \to D$$

Resistance along this path:

$$R_1 = 4 + 2 = 6\,\Omega$$

Path 2:

$$A \to C \to D$$

Resistance along this path:

$$R_2 = 4 + 2 = 6\,\Omega$$

Step 3: Combine the two paths.
The two $6\,\Omega$ paths are connected in parallel between A and D.
Therefore,

$$R_{AD} = \frac{6 \times 6}{6 + 6}$$

$$= \frac{36}{12}$$

$$= 3\,\Omega$$

Therefore, the equivalent resistance between A and D is

$$\boxed{3\,\Omega}$$

Hence, the correct answer is:

$$\boxed{\text{(C)}}$$

Quick Tip: Whenever a point divides a resistor into equal parts, first split the resistor accordingly. Here:

$$4\,\Omega \rightarrow 2\,\Omega + 2\,\Omega$$

Then identify all possible paths between the required terminals and reduce the circuit using series and parallel combinations.

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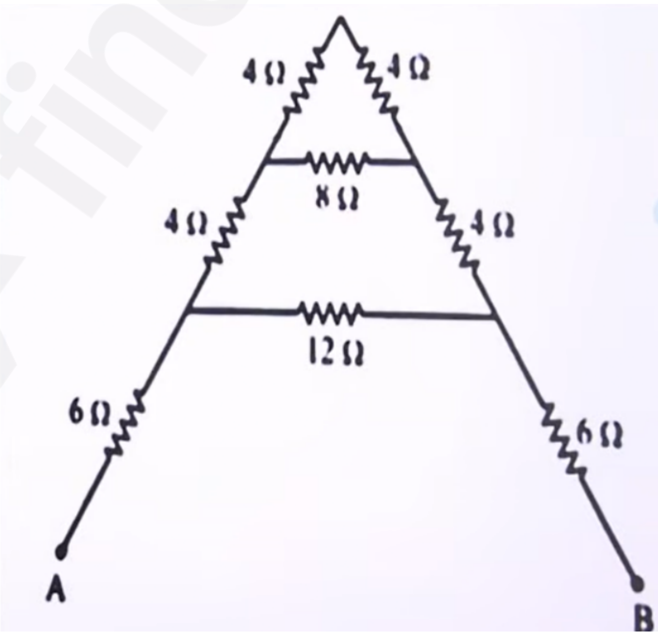
3. For the given mixed combination of resistors, calculate the total resistance between points A and B.



(A) $9\,\Omega$

(B) $18\,\Omega$

(C) $4\,\Omega$

(D) $14\,\Omega$

Correct Answer: (B) $18\,\Omega$

Solution:

Step 1: Analyze the upper triangular section.

Between the two upper junctions, there are two possible paths:

Direct path:

$$8\,\Omega$$

Upper path through the apex:

$$4+4=8\,\Omega$$

Therefore these two $8\,\Omega$ resistances are in parallel.

$$R_{\text{upper}}=8\parallel 8=\frac{8\times 8}{8+8}=4\,\Omega$$

Step 2: Replace the upper section.

The circuit now becomes a rectangle with:

$$4\,\Omega$$

between the upper junctions and

$$12\,\Omega$$

between the lower junctions.

The side resistances are:

$$4\,\Omega$$

on the left and

$$4\,\Omega$$

on the right.

Step 3: Find equivalent resistance between the lower junctions.
One path is directly:

$$12\,\Omega$$

The other path goes through the upper branch:

$$4 + 4 + 4 = 12\,\Omega$$

Hence,

$$R = 12 \parallel 12 = 6\,\Omega$$

Step 4: Include the terminal resistors.
The $6\,\Omega$ resistor from A to the left junction and the $6\,\Omega$ resistor from the right junction to B are in series with the equivalent found above.
Thus,

$$R_{AB} = 6 + 6 + 6$$

$$R_{AB} = 18\,\Omega$$

Therefore,

$$\boxed{R_{AB} = 18\,\Omega}$$

Hence, the correct answer is:

$$\boxed{\text{(B)}}$$

Quick Tip: Whenever a triangular resistor network contains:

$$R \text{ in parallel with } (R_1 + R_2),$$

reduce that section first.

Here:

$$8\Omega \parallel (4\Omega + 4\Omega) = 8\Omega \parallel 8\Omega = 4\Omega$$

After simplification, the remaining network becomes a simple series-parallel combination.

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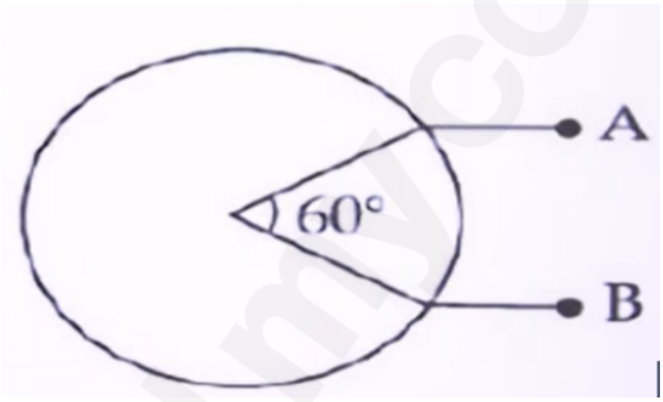
4. A wire of uniform cross-sectional area and resistivity has total resistance $36\,\Omega$ and is bent into a circle as shown in the figure. The equivalent resistance between points A and B is:



(A) $6\,\Omega$

(B) $5\,\Omega$

(C) $30\,\Omega$

(D) $42\,\Omega$

Correct Answer: (B) $5\,\Omega$

Solution:

Step 1: Determine the resistances of the two arcs.

The wire forms a complete circle of total resistance:

$$R = 36\,\Omega$$

The points A and B subtend an angle of

$$60^\circ$$

Therefore, resistance of the smaller arc is:

$$R_1 = 36\left(\frac{60}{360}\right) = 6\,\Omega$$

The remaining arc subtends

$$360^\circ - 60^\circ = 300^\circ$$

Hence,

$$R_2 = 36\left(\frac{300}{360}\right) = 30\,\Omega$$

Step 2: Identify the combination.

The two arcs connect the same points A and B.

Therefore, they are in parallel.

$$R_{AB} = \frac{R_1 R_2}{R_1 + R_2}$$

$$= \frac{(6)(30)}{6+30}$$

$$= \frac{180}{36}$$

$$= 5\,\Omega$$

Step 3: Identify the correct option.

$$\boxed{R_{AB} = 5\,\Omega}$$

Hence, the correct answer is:

$$\boxed{\text{(B)}}$$

Quick Tip: For a circular wire of total resistance R:

$$R_{\text{arc}} = R\left(\frac{\theta}{360^\circ}\right)$$

If two arcs connect the same terminals, they are in parallel.

For an angle θ:

$$R_1 = \frac{\theta}{360^\circ}R, \qquad R_2 = \frac{360^\circ - \theta}{360^\circ}R$$

and

$$R_{\text{eq}} = \frac{R_1 R_2}{R_1 + R_2}$$

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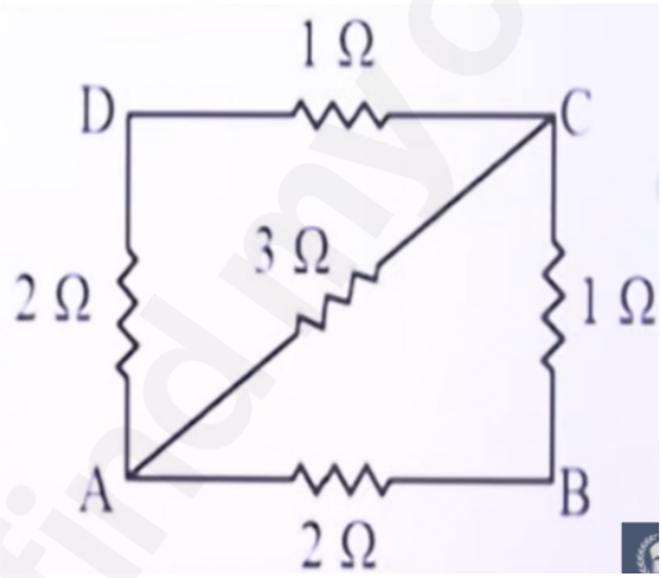
5. The equivalent resistance of the following combination of resistances between A and C is:



(A) $36\,\Omega$

(B) $1\,\Omega$

(C) $27\,\Omega$

(D) $3\,\Omega$

Correct Answer: (B) $1\,\Omega$

Solution:

Step 1: Identify the three paths between A and C.

Upper path:

$$A \to D \to C$$

Resistance:

$$R_1 = 2 + 1 = 3\,\Omega$$

Lower path:

$$A \to B \to C$$

Resistance:

$$R_2 = 2 + 1 = 3\,\Omega$$

Diagonal path:

$$A \to C$$

Resistance:

$$R_3 = 3\,\Omega$$

Step 2: Observe the parallel combination.

All three branches connect directly between the same terminals A and C.

Hence the three $3\,\Omega$ resistors are in parallel.

$$\frac{1}{R_{eq}} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$$

$$\frac{1}{R_{eq}} = 1$$

Therefore,

$$R_{eq} = 1\,\Omega$$

Step 3: Select the correct option.

$$\boxed{R_{eq} = 1\,\Omega}$$

Hence, the correct answer is:

$$\boxed{(B)}$$

Quick Tip: If n equal resistors of resistance R are connected in parallel:

$$R_{eq} = \frac{R}{n}$$

Here,

$$3\Omega \parallel 3\Omega \parallel 3\Omega = \frac{3}{3} = 1\Omega$$

Always look for complete paths joining the same two terminals before simplifying a resistor network.

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6. A straight wire of mass $200\,\text{g}$ and length $1.5\,\text{m}$ carries a current of $2\,\text{A}$. It is suspended in mid-air by a uniform horizontal magnetic field B. The magnitude of B is ($g = 10\,\text{m s}^{-2}$):

(A) $2\,\text{T}$

(B) $1.5\,\text{T}$

(C) $0.55\,\text{T}$

(D) $0.67\,\text{T}$

Correct Answer: (D) $0.67\,\text{T}$

Solution:

Step 1: Apply the condition for suspension.

For the wire to remain suspended in air, the magnetic force must balance its weight.

$$F_B = mg$$

Step 2: Use magnetic force on a current-carrying conductor.

The magnetic force is given by:

$$F_B = BIL\sin\theta$$

For maximum upward force,

$$\theta = 90^\circ$$

Therefore,

$$F_B = BIL$$

Step 3: Substitute the given values.

Mass:

$$m = 200\,\text{g} = 0.2\,\text{kg}$$

Weight:

$$mg = 0.2 \times 10 = 2\,\text{N}$$

Using

$$BIL = mg$$

$$B \times 2 \times 1.5 = 2$$

$$3B = 2$$

$$B = \frac{2}{3}\,\text{T}$$

$$B = 0.67\,\text{T}$$

Therefore,

$$\boxed{B = 0.67\,\text{T}}$$

Hence, the correct answer is:

$$\boxed{\text{(D)}}$$

Quick Tip: For a current-carrying wire suspended by a magnetic field:

$$BIL = mg$$

Hence,

$$\boxed{B = \frac{mg}{IL}}$$

This formula is frequently asked in CUET, JEE Main and NEET Physics examinations.

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7. A straight wire of mass $500\,\text{g}$ and length $7\,\text{m}$ carries a current of $1.4\,\text{A}$. It is suspended in mid-air by a uniform horizontal magnetic field B perpendicular to the length of the wire. The magnitude of the magnetic field is:

(A) $3.5\,\text{T}$

(B) $0.7\,\text{T}$

(C) $0.5\,\text{T}$

(D) $2.5\,\text{T}$

Correct Answer: (C) $0.5\,\text{T}$

Solution:

Step 1: Apply the condition for suspension.

Since the wire is suspended in air, the magnetic force balances its weight.

$$F_B = mg$$

Step 2: Use the magnetic force formula.

Magnetic force on a current-carrying conductor is:

$$F_B = BIL \sin\theta$$

Since the magnetic field is perpendicular to the wire,

$$\theta = 90^\circ$$

and therefore,

$$F_B = BIL$$

Step 3: Substitute the given values.

$$m = 500\,\text{g} = 0.5\,\text{kg}$$

Taking

$$g = 9.8\,\text{m s}^{-2}$$

$$mg = 0.5 \times 9.8 = 4.9\,\text{N}$$

Using

$$BIL = mg$$

$$B \times 1.4 \times 7 = 4.9$$

$$9.8B = 4.9$$

$$B = \frac{4.9}{9.8}$$

$$B = 0.5\,\text{T}$$

Therefore,

$$\boxed{B = 0.5\,\text{T}}$$

Hence, the correct answer is:

$$\boxed{\text{(C)}}$$

Quick Tip: For a wire suspended by magnetic force:

$$BIL = mg$$

Hence,

$$\boxed{B = \frac{mg}{IL}}$$

When the magnetic field is perpendicular to the wire,

$$\sin 90^\circ = 1$$

which gives the maximum magnetic force.

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8. If a straight wire of length 175 cm and mass 250 g is suspended freely in a uniform horizontal magnetic field of 0.7 T, then the current flowing through the wire is:

(A) 20 A

(B) 0.02 A

(C) 2 A

(D) 0.2 A

Correct Answer: (C) 2 A

Solution:

Step 1: Apply the condition for suspension.

For the wire to remain suspended,

$$F_B = mg$$

Step 2: Use the magnetic force formula.

Magnetic force on a current-carrying conductor is:

$$F_B = BIL\sin\theta$$

For maximum upward force,

$$\theta = 90^\circ$$

Thus,

$$BIL = mg$$

Step 3: Substitute the given values.

$$m = 250\,\text{g} = 0.25\,\text{kg}$$

$$L = 175\,\text{cm} = 1.75\,\text{m}$$

$$B = 0.7\,\text{T}$$

Taking

$$g = 9.8\,\text{m s}^{-2}$$

$$I = \frac{mg}{BL}$$

$$I = \frac{0.25 \times 9.8}{0.7 \times 1.75}$$

$$I = \frac{2.45}{1.225}$$

$$I = 2\,\text{A}$$

Therefore,

$$\boxed{I = 2\,\text{A}}$$

Hence, the correct answer is:

$$\boxed{\text{(C)}}$$

Quick Tip: For a wire suspended by magnetic force:

$$BIL = mg$$

Hence,

$$\boxed{I = \frac{mg}{BL}}$$

Always convert:

$$\text{cm} \to \text{m}$$

and

$$\text{g} \to \text{kg}$$

before substitution.

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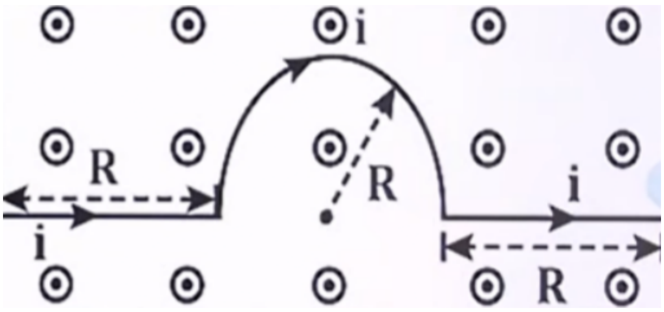
9. A wire carrying current i, bent as shown in the figure, is placed in a uniform magnetic field B directed normally out of the plane of the figure. The force on the wire is:



(A) $4BiR$, directed vertically downward

(B) $3BiR$, directed vertically upward

(C) $Bi(2R + \pi R)$, directed vertically downward

(D) $2BiR$, from P to Q

Correct Answer: (A) $4BiR$, directed vertically downward

Solution:

Step 1: Use the force formula for a wire in a uniform magnetic field.

For a wire carrying current in a uniform magnetic field,

$$\vec{F} = I \int d\vec{l} \times \vec{B}$$

Since $\vec{B}$ is uniform,

$$\vec{F} = I(\vec{L}) \times \vec{B}$$

where $\vec{L}$ is the displacement vector joining the initial and final points of the wire.

Step 2: Find the effective displacement.

The wire consists of:

- Left straight segment of length R
- Semicircular arc of radius R
- Right straight segment of length R

The horizontal displacement between the two end points is

$$R + 2R + R = 4R$$

Thus,

$$L = 4R$$

directed horizontally.

Step 3: Calculate the magnitude of force.

Since $\vec{L}$ lies in the plane of the paper and $\vec{B}$ is perpendicular to the plane,

$$\theta = 90^\circ$$

Therefore,

$$F = BIL\sin 90^\circ$$

$$F = BI(4R)$$

$$F = 4BiR$$

Step 4: Determine the direction.

Current flows from left to right and magnetic field is out of the plane.

Using the right-hand rule:

$$\vec{F} = \vec{L} \times \vec{B}$$

the force acts vertically downward.

Therefore,

$$\boxed{F = 4BiR}$$

directed vertically downward.

Hence, the correct answer is:

$$\boxed{\text{(A)}}$$

Quick Tip: For any shaped wire placed in a **uniform** magnetic field,

$$\boxed{\vec{F} = I\,(\vec{r}_{\text{final}} - \vec{r}_{\text{initial}}) \times \vec{B}}$$

The force depends only on the displacement between the endpoints, not on the actual shape of the wire. This is a very common CUET/JEE conceptual question.

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10. The most exotic diamagnetic materials are superconductors. They exhibit perfect diamagnetism and perfect conductivity. The values of magnetic susceptibility (χ) and relative permeability (μ_r) for such materials are:

(A) $\chi = 1,\ \mu_r = 0$

(B) $\chi = -1,\ \mu_r = 0$

(C) $\chi = 0,\ \mu_r = 1$

(D) $\chi = -1,\ \mu_r = 1$

Correct Answer: (B) $\chi = -1,\ \mu_r = 0$

Solution:

Step 1: Recall the magnetic properties of superconductors.

A superconductor exhibits:

$$\boxed{\text{Perfect diamagnetism}}$$

This phenomenon is known as the

$$\boxed{\text{Meissner Effect}}$$

in which magnetic flux is completely expelled from the interior of the material.

Step 2: Find the magnetic susceptibility.

For a perfect diamagnetic substance,

$$\chi = -1$$

Step 3: Use the relation between permeability and susceptibility.

The relative permeability is related to susceptibility by

$$\mu_r = 1 + \chi$$

Substituting

$$\chi = -1$$

gives

$$\mu_r = 1 - 1$$

$$\mu_r = 0$$

Step 4: Identify the correct option.

Thus,

$$\boxed{\chi = -1, \qquad \mu_r = 0}$$

Hence, the correct answer is:

$$\boxed{\text{(B)}}$$

Quick Tip: For superconductors:

$$\boxed{\chi = -1}$$

$$\boxed{\mu_r = 0}$$

because

$$\mu_r = 1 + \chi$$

The complete expulsion of magnetic field from a superconductor is called the

$$\boxed{\text{Meissner Effect}}$$

which is a favorite CUET/JEE conceptual question.
