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# JEE MAIN MECHANICAL PROPERTIES OF SOLIDS — PYQS

**Max. Marks:** 96 **Questions:** 24

## Section A (MCQ) — 15 questions

**Q.1** A lift of mass 1600 kg is supported by thick iron wire. If the maximum stress which the wire can withstand is $4 \times 10^8$ N/m$^2$ and its radius is 4 mm, then maximum acceleration the lift can take is _____ m/s$^2$.
(take g = 10 m/s$^2$ and $\pi$ = 3.14)

[JEE Main 2026 (Online) 6th April Morning Shift]

(1) 2.56 (2) 3.89 (3) 4.32 (4) 5.16

Scan or tap for the full solution

**Q.2** The two wires A and B of equal cross-section but of different materials are joined together. The ratio of Young's modulus of wire A and wire B is 20/11. When the joined wire is kept under certain tension the elongations in the wires A and B are equal. If the length of wire A is 2.2 m, then the length of wire B is _____ m.

[JEE Main 2026 (Online) 6th April Morning Shift]

(1) 1.1 (2) 2.22 (3) 1.21 (4) 4.44

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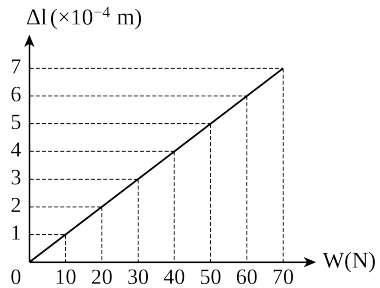
**Q.3** Figure represents the extension ($\Delta l$) of a wire of length 1 meter, suspended from the ceiling of the room at one end with a load W connected to the other end. If the cross-sectional area of the wire is $10^{-5}$ m$^2$ then the Young's modulus of the wire is _____ N/m$^2$.

[JEE Main 2026 (Online) 6th April Evening Shift]




(1) $1.0 \times 10^{11}$ (2) $2.0 \times 10^{10}$
(3) $1.0 \times 10^{10}$ (4) $2.0 \times 10^{11}$

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**Q.4** The Young's modulus of steel wire of radius r and length L is Y.
If the radius r and length L of the wire are doubled then the value of Y

[JEE Main 2026 (Online) 5th April Morning Shift]

(1) increases by two times
(2) reduces by half
(3) remains unchanged
(4) becomes one fourth

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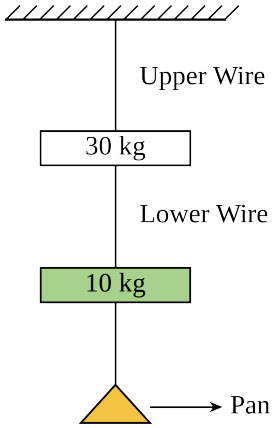
**Q.5** Two wires as shown in the figure below, made of steel and have breaking stress of $12 \times 10^8$ N/m$^2$. Area of cross-section of upper wire is 0.008 cm$^2$ and of lower wire is 0.004 cm$^2$. The maximum mass that can be added to pan without breaking any wire is _____ kg.

[JEE Main 2026 (Online) 5th April Morning Shift]




(1) 56 (2) 38 (3) 96 (4) 5.6

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**Q.6** The increase in the pressure required to decrease the volume ($\Delta V$) of water is $6.3 \times 10^7$ N/m$^2$. The percentage decrease in the volume is _____.
(Bulk modulus of water = $2.1 \times 10^9$ N/m$^2$.)

[JEE Main 2026 (Online) 4th April Morning Shift]

(1) 2 % (2) 3 % (3) 6 % (4) 4 %

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**Q.7** A string A of length 0.314 m and Young's modulus $2 \times 10^{10}$ N/m$^2$ is connected to another string B of length and Young's modulus both twice of those of A. This series combination of strings is then suspended from a rigid support and its free end is fixed to a load of mass 0.8 kg. The net change in length of the combination is _____ mm.
(radius of both the strings is 0.2 mm and acceleration due to gravity = 10 m/s$^2$)
(Mass of both strings is to be neglected as compared to the mass of load)

[JEE Main 2026 (Online) 4th April Morning Shift]

(1) 3 (2) 2 (3) 1.9 (4) 1

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**Q.8** A metal string A is suspended from a rigid support and its free end is attached to a block of mass M. Second block having mass 2M is suspended at the bottom of the first block using a string B. The area of cross sections of strings A and B are same. The ratio of lengths of strings of A to B is 2 and the ratio of their Young's moduli $(Y_A/Y_B)$ is 0.5. The ratio of elongations in A to B is _____.

[JEE Main 2026 (Online) 4th April Evening Shift]

(1) 1 (2) 4 (3) 8 (4) 6

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**Q.9** Two wires A and B made of different materials of lengths 6.0 cm and 5.4 cm, respectively and area of cross sections $3.0 \times 10^{-5}$ m$^2$ and $4.5 \times 10^{-5}$ m$^2$, respectively are stretched by the same magnitude under a given load. The ratio of the Young's modulus of A to that of B is x:3. The value of x is ____

[JEE Main 2026 (Online) 28th January Morning Shift]

(1) 2 (2) 1 (3) 4 (4) 5

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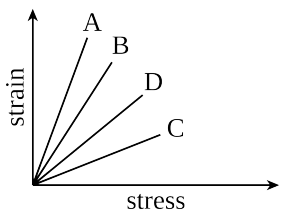
**Q.10** The strain-stress plot for materials A, B, C and D is shown in the figure. Which material has the largest Young's modulus ?

[JEE Main 2026 (Online) 23rd January Morning Shift]




(1) B (2) A (3) D (4) C

Scan or tap for the full solution

**Q.11** A 3 m long wire of radius 3 mm shows an extension of 0.1 mm when loaded vertically by a mass of 50 kg in an experiment to determine Young's modulus. The value of Young's modulus of the wire as per this experiment is $P \times 10^{11}$ N m$^{-2}$, where the value of P is: (Take g = 3π m/s$^2$)

[JEE Main 2025 (Online) 8th April Evening Shift]

(1) 2.5 (2) 25 (3) 10 (4) 5

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**Q.12** Two wires A and B are made of same material having ratio of lengths $\frac{L_A}{L_B} = \frac{1}{3}$ and their diameters ratio $\frac{d_A}{d_B} = 2$. If both the wires are stretched using same force, what would be the ratio of their respective elongations?

[JEE Main 2025 (Online) 7th April Morning Shift]

(1) 3:4 (2) 1:12 (3) 1:3 (4) 1:6

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**Q.13** A cylindrical rod of length 1 m and radius 4 cm is mounted vertically. It is subjected to a shear force of $10^5$ N at the top. Considering infinitesimally small displacement in the upper edge, the angular displacement θ of the rod axis from its original position would be : (shear modulus, G = $10^{10}$ N/m$^2$)

[JEE Main 2025 (Online) 4th April Evening Shift]

(1) 1/160π (2) 1/2π (3) 1/4π (4) 1/40π

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**Q.14** The fractional compression $\left(\frac{\Delta V}{V}\right)$ of water at the depth of 2.5 km below the sea level is _____ %. Given, the Bulk modulus of water = $2 \times 10^9$ N m$^{-2}$, density of water = $10^3$ kg m$^{-3}$, acceleration due to gravity g = 10 m s$^{-2}$.

[JEE Main 2025 (Online) 29th January Morning Shift]

(1) 1.0 (2) 1.25 (3) 1.75 (4) 1.5

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**Q.15** A massless spring gets elongated by amount $x_1$ under a tension of 5 N. Its elongation is $x_2$ under the tension of 7 N. For the elongation of $(5x_1 - 2x_2)$, the tension in the spring will be,

[JEE Main 2025 (Online) 23rd January Evening Shift]

(1) 20 N (2) 39 N (3) 11 N (4) 15 N

Scan or tap for the full solution

## Section B (Numerical) — 9 questions

**Q.16** A cube has side length 5 cm and modulus of rigidity $10^5$ N/m$^2$. The displacement produced by a force of 10 N in the upper face of cube is _____ mm.

[JEE Main 2026 (Online) 5th April Morning Shift]

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**Q.17** A copper wire of length 3 m is stretched by 3 mm by applying an external force. The volume of the wire is $600 \times 10^{-6}$ m$^3$. The elastic potential energy stored in the wire in stretched condition would be _____ J.
(Given Young modulus of copper = $1.1 \times 10^{11}$ N/m$^2$) [JEE Main 2026 (Online) 5th April Evening Shift]

Scan or tap for the full solution

**Q.18** A uniform wire of length l of weight w is suspended from the roof with a weight of W at the other end. The stress in the wire at $\frac{l}{3}$ distance from the top is $\left(\frac{W}{A}+\frac{2}{\gamma}\frac{w}{A}\right)$, where A is the cross sectional area of the wire. The value of γ is _____.

[JEE Main 2026 (Online) 2nd April Morning Shift]

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**Q.19** A sample of a liquid is kept at 1 atm. It is compressed to 5 atm which leads to a change of volume of 0.8 cm$^3$. If the bulk modulus of the liquid is 2 GPa, the initial volume of the liquid was _____ litre.
(Take 1 atm = $10^5$ Pa)

[JEE Main 2025 (Online) 8th April Evening Shift]

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**Q.20** Two slabs with square cross section of different materials (1, 2) with equal sides (l) and thickness $d_1$ and $d_2$ such that $d_2 = 2d_1$ and $l > d_2$. Considering lower edges of these slabs are fixed to the floor, we apply equal shearing force on the narrow faces. The angle of deformation is $\theta_2 = 2\theta_1$. If the shear modulus of material 1 is $4 \times 10^9$ N/m$^2$, then shear modulus of material 2 is $x \times 10^9$ N/m$^2$, where value of x is _____.

[JEE Main 2025 (Online) 4th April Morning Shift]

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**Q.21** A steel wire of length 2 m and Young's modulus $2.0 \times 10^{11}$ N m$^{-2}$ is stretched by a force. If Poisson's ratio and transverse strain for the wire are 0.2 and $10^{-3}$ respectively, then the elastic potential energy density of the wire is _____ $\times 10^5$ (in SI units).

[JEE Main 2025 (Online) 2nd April Morning Shift]

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**Q.22** The length of a light string is 1.4 m when the tension on it is 5 N. If the tension increases to 7 N, the length of the string is 1.56 m. The original length of the string is _____ m.

[JEE Main 2025 (Online) 2nd April Evening Shift]

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**Q.23** The volume contraction of a solid copper cube of edge length 10 cm, when subjected to a hydraulic pressure of $7 \times 10^6$ Pa, would be _____ mm$^3$.
(Given bulk modulus of copper = $1.4 \times 10^{11}$ N m$^{-2}$)

[JEE Main 2025 (Online) 28th January Evening Shift]

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**Q.24** The increase in pressure required to decrease the volume of a water sample by 0.2% is P $\times 10^5$ Nm$^{-2}$. Bulk modulus of water is $2.15 \times 10^9$ Nm$^{-2}$. The value of P is _____.

[JEE Main 2025 (Online) 24th January Evening Shift]

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## ANSWER KEY

### Section A (MCQ) — 15 questions

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | **1** | **3** | **3** | **3** | **2** | **2** | **2** | **4** | **4** | **4** | **4** |
| Ques. | 12 | 13 | 14 | 15 | | | | | | | |
| Ans. | **2** | **1** | **2** | **3** | | | | | | | |

### Section B (Numerical) — 9 questions

| Ques. | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | **2** | **33** | **3** | **4** | **1** | **25** | **1** | **50** | **43** | | |