

PYQSide

JEE MAIN MECHANICAL PROPERTIES OF SOLIDS — PYQS

Max. Marks: 88

Questions: 22

Section A (MCQ)

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

(take $g = 10 \text{ m/s}^2$ 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]

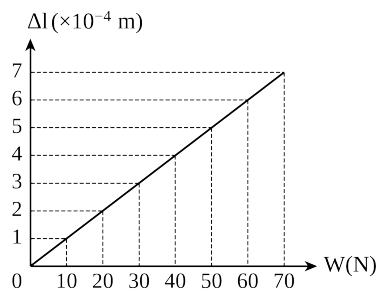
- (1) 1.1 (2) 2.22 (3) 1.21 (4) 4.44

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- Q.3** Figure represents the extension (Δl) 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) 1.0×10^{11} (2) 2.0×10^{10}
(3) 1.0×10^{10} (4) 2.0×10^{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]

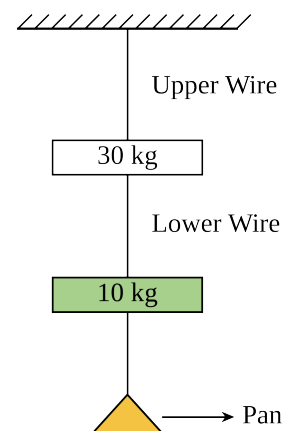
- (1) increases by two times
(2) reduces by half
(3) remains unchanged
(4) becomes one fourth

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- Q.5** Two wires as shown in the figure below, made of steel and have breaking stress of $12 \times 10^8 \text{ N/m}^2$. 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 (ΔV) of water is $6.3 \times 10^7 \text{ N/m}^2$. The percentage decrease in the volume is _____. (Bulk modulus of water = $2.1 \times 10^9 \text{ N/m}^2$.)

[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 $2 \times 10^{10} \text{ N/m}^2$ 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

Scan or tap for the full solution



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 $3.0 \times 10^{-5} \text{ m}^2$ and $4.5 \times 10^{-5} \text{ m}^2$, 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]

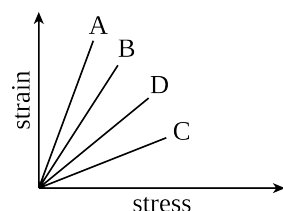
- (1) 2 (2) 1 (3) 4 (4) 5

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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

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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 $P \times 10^{11} \text{ N m}^{-2}$, where the value of P is: (Take $g = 3\pi \text{ m/s}^2$)

[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, $G = 10^{10} \text{ N/m}^2$)

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

- (1) $1/160\pi$ (2) $1/2\pi$ (3) $1/4\pi$ (4) $1/40\pi$

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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 = $2 \times 10^9 \text{ N m}^{-2}$, density of water = 10^3 kg m^{-3} , acceleration due to gravity $g = 10 \text{ m s}^{-2}$.

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

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

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Section B (Numerical)

Q.15 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.16** A copper wire of length 3 m is stretched by 3 mm by applying an external force. The volume of the wire is $600 \times 10^{-6} \text{ m}^3$. The elastic potential energy stored in the wire in stretched condition would be _____ J.

(Given Young modulus of copper = $1.1 \times 10^{11} \text{ N/m}^2$) [JEE Main 2026 (Online) 5th April Evening Shift]

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- Q.17** 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 $\frac{1}{3}$ distance from the top is

$\left(\frac{W}{A} + \frac{2w}{3A}\right)$, 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.18** 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.19** 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 $4 \times 10^9 \text{ N/m}^2$, then shear modulus of material 2 is $x \times 10^9 \text{ N/m}^2$, where value of x is _____.

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

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- Q.20** A steel wire of length 2 m and Young's modulus $2.0 \times 10^{11} \text{ N m}^{-2}$ 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.21** 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.22** The volume contraction of a solid copper cube of edge length 10 cm, when subjected to a hydraulic pressure of $7 \times 10^6 \text{ Pa}$, would be _____ mm^3 . (Given bulk modulus of copper = $1.4 \times 10^{11} \text{ N m}^{-2}$)

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

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ANSWER KEY

Section A (MCQ)

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								
Ans.	2	1	2								

Section B (Numerical)

Ques.	15	16	17	18	19	20	21	22			
Ans.	2	33	3	4	1	25	1	50			