

PHYSICS · JEE MAIN

Elasticity

Chapter-wise previous year questions, with answer key

65

PYQS

2020–2025

PAPERS

4

TOPICS

Stress and Strain

Elastic Moduli

Elastic Potential Energy

Poisson's Ratio

- 1 Attempt each question on paper first — they're grouped by topic, newest papers first.
- 2 Check yourself against the answer key at the end.
- 3 Got one wrong? Tap “Step-by-step solution” under it for the full working.

Stuck on a question?

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Stress and Strain · 24 PYQs

Q1 JEE Main 2025 · 7 Apr · Shift 1

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?

- (A) 3 : 4 (B) 1 : 12
(C) 1 : 3 (D) 1 : 6

[Step-by-step solution ► prepwiser.in/questions/osfj9jUTDe](https://www.prepwiser.in/questions/osfj9jUTDe)

Q2 JEE Main 2025 · 2 Apr · Shift 2

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.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/1SC5k44kF3](https://www.prepwiser.in/questions/1SC5k44kF3)

Q3 JEE Main 2024 · 5 Apr · Shift 1

The density and breaking stress of a wire are $6 \times 10^4 \text{ kg/m}^3$ and $1.2 \times 10^8 \text{ N/m}^2$ respectively. The wire is suspended from a rigid support on a planet where acceleration due to gravity is $\frac{1}{3}$ rd of the value on the surface of earth. The maximum length of the wire with breaking is _____ m (take, $g = 10 \text{ m/s}^2$).

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/46vp4XoFHZ](https://www.prepwiser.in/questions/46vp4XoFHZ)

Q4 JEE Main 2024 · 4 Apr · Shift 1

An elastic spring under tension of 3N has a length a . Its length is b under tension 2N. For its length $(3a - 2b)$, the value of tension will be _____ N.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/pObiF4ljOd](https://www.prepwiser.in/questions/pObiF4ljOd)

Q5 JEE Main 2024 · 29 Jan · Shift 2

Two metallic wires P and Q have same volume and are made up of same material. If their area of cross sections are in the ratio 4 : 1 and force F_1 is applied to P , an extension of Δl is produced. The force which is required to produce same extension in Q is F_2 .

The value of $\frac{F_1}{F_2}$ is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/PE_TNuTzTT](https://www.prepwiser.in/questions/PE_TNuTzTT)

Q6 JEE Main 2024 · 29 Jan · Shift 2

A wire of length L and radius r is clamped at one end. If its other end is pulled by a force F , its length increases by l . If the radius of the wire and the applied force both are reduced to half of their original values keeping original length constant, the increase in length will become:

- (A) 2 times (B) 4 times
(C) 3 times (D) $\frac{3}{2}$ times

[Step-by-step solution ► prepwiser.in/questions/J3P-6rqwtW](https://www.prepwiser.in/questions/J3P-6rqwtW)

Q7 JEE Main 2024 · 27 Jan · Shift 2

Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : The property of body, by virtue of which it tends to regain its original shape when the external force is removed, is Elasticity.

Reason (R) : The restoring force depends upon the bonded inter atomic and inter molecular force of solid.

In the light of the above statements, choose the correct answer from the options given below :

- (A) (A) is false but (R) is true
- (B) Both (A) and (R) are true but (R) is not the correct explanation of (A)
- (C) Both (A) and (R) are true and (R) is the correct explanation of (A)
- (D) (A) is true but (R) is false

[Step-by-step solution ► prepwisar.in/questions/jumdpDPorV](https://www.prepwisar.in/questions/jumdpDPorV)

Q8 JEE Main 2023 · 11 Apr · Shift 1

The length of a wire becomes l_1 and l_2 when 100N and 120N tensions are applied respectively. If $10l_2 = 11l_1$, the natural length of wire will be $\frac{1}{x}l_1$. Here the value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/xEPmPjCtd](https://www.prepwisar.in/questions/xEPmPjCtd)

Q9 JEE Main 2023 · 10 Apr · Shift 2

Young's moduli of the material of wires A and B are in the ratio of 1 : 4, while its area of cross sections are in the ratio of 1 : 3. If the same amount of load is applied to both the wires, the amount of elongation produced in the wires A and B will be in the ratio of

[Assume length of wires A and B are same]

- (A) 1 : 12
- (B) 1 : 36
- (C) 12 : 1
- (D) 36 : 1

[Step-by-step solution ► prepwisar.in/questions/fTE7GFt4IP](https://www.prepwisar.in/questions/fTE7GFt4IP)

Q10 JEE Main 2023 · 8 Apr · Shift 2

A steel rod of length 1m and cross sectional area 10^{-4}m^2 is heated from 0°C to 200°C without being allowed to extend or bend. The compressive tension produced in the rod is _____ $\times 10^4\text{N}$. (Given Young's modulus of steel = $2 \times 10^{11}\text{Nm}^{-2}$, coefficient of linear expansion = 10^{-5}K^{-1})

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/f1bSOftTCg](https://www.prepwisar.in/questions/f1bSOftTCg)

Q11 JEE Main 2023 · 6 Apr · Shift 2

A metal block of mass m is suspended from a rigid support through a metal wire of diameter 14mm. The tensile stress developed in the wire under equilibrium state is $7 \times 10^5\text{Nm}^{-2}$. The value of mass m is _____ kg. (Take, $g = 9.8\text{ms}^{-2}$ and $\pi = \frac{22}{7}$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/BYn7j1bZoV](https://www.prepwisar.in/questions/BYn7j1bZoV)

Q12 JEE Main 2023 · 31 Jan · Shift 1

A thin rod having a length of 1m and area of cross-section $3 \times 10^{-6} \text{m}^2$ is suspended vertically from one end. The rod is cooled from 210°C to 160°C . After cooling, a mass M is attached at the lower end of the rod such that the length of rod again becomes 1m. Young's modulus and coefficient of linear expansion of the rod are $2 \times 10^{11} \text{Nm}^{-2}$ and $2 \times 10^{-5} \text{K}^{-1}$, respectively. The value of M is _____ kg.

(Take $g = 10 \text{ms}^{-2}$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/FwOb9EavWT](https://www.prepwiser.in/questions/FwOb9EavWT)

Q13 JEE Main 2022 · 29 Jul · Shift 1

If the length of a wire is made double and radius is halved of its respective values. Then, the Young's modulus of the material of the wire will :

- (A) remain same
- (B) become 8 times its initial value
- (C) become $\frac{1}{4}$ of its initial value
- (D) become 4 times its initial value

[Step-by-step solution ► prepwiser.in/questions/IQqshyTJCr](https://www.prepwiser.in/questions/IQqshyTJCr)

Q14 JEE Main 2022 · 28 Jul · Shift 2

A string of area of cross-section 4mm^2 and length 0.5m is connected with a rigid body of mass 2kg. The body is rotated in a vertical circular path of radius 0.5m. The body acquires a speed of 5m/s at the bottom of the circular path. Strain produced in the string when the body is at the bottom of the circle is _____ $\times 10^{-5}$.

(use Young's modulus 10^{11}N/m^2 and $g = 10 \text{m/s}^2$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/j0pUf2dsVy](https://www.prepwiser.in/questions/j0pUf2dsVy)

Q15 JEE Main 2022 · 26 Jul · Shift 2

The area of cross section of the rope used to lift a load by a crane is $2.5 \times 10^{-4} \text{m}^2$. The maximum lifting capacity of the crane is 10 metric tons. To increase the lifting capacity of the crane to 25 metric tons, the required area of cross section of the rope should be :

(take $g = 10 \text{ms}^{-2}$)

- | | |
|--------------------------------------|--------------------------------------|
| (A) $6.25 \times 10^{-4} \text{m}^2$ | (B) $10 \times 10^{-4} \text{m}^2$ |
| (C) $1 \times 10^{-4} \text{m}^2$ | (D) $1.67 \times 10^{-4} \text{m}^2$ |

[Step-by-step solution ► prepwiser.in/questions/-TePpTp98O](https://www.prepwiser.in/questions/-TePpTp98O)

Q16 JEE Main 2022 · 29 Jun · Shift 1

A wire of length L is hanging from a fixed support. The length changes to L_1 and L_2 when masses 1 kg and 2 kg are suspended respectively from its free end. Then the value of L is equal to :

- | | |
|----------------------|---------------------------|
| (A) $\sqrt{L_1 L_2}$ | (B) $\frac{L_1 + L_2}{2}$ |
| (C) $2L_1 - L_2$ | (D) $3L_1 - 2L_2$ |

[Step-by-step solution ► prepwiser.in/questions/TMzMv9JLX4](https://www.prepwiser.in/questions/TMzMv9JLX4)

Q17 JEE Main 2022 · 26 Jun · Shift 1

The elongation of a wire on the surface of the earth is 10^{-4} m. The same wire of same dimensions is elongated by 6×10^{-5} m on another planet. The acceleration due to gravity on the planet will be _____ ms^{-2} . (Take acceleration due to gravity on the surface of earth = 10 ms^{-2})

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/JhIMT6InaH](https://www.prepwisar.in/questions/JhIMT6InaH)

Q18 JEE Main 2021 · 1 Sep · Shift 2

A steel rod with $y = 2.0 \times 10^{11} \text{ Nm}^{-2}$ and $\alpha = 10^{-5} \text{ }^\circ\text{C}^{-1}$ of length 4 m and area of cross-section 10 cm^2 is heated from 0°C to 400°C without being allowed to extend. The tension produced in the rod is $x \times 10^5 \text{ N}$ where the value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/DhaivIFGDZ](https://www.prepwisar.in/questions/DhaivIFGDZ)

Q19 JEE Main 2021 · 31 Aug · Shift 2

Four identical hollow cylindrical columns of mild steel support a big structure of mass $50 \times 10^3 \text{ kg}$. The inner and outer radii of each column are 50 cm and 100 cm respectively. Assuming uniform local distribution, calculate the compression strain of each column. [Use $Y = 2.0 \times 10^{11} \text{ Pa}$, $g = 9.8 \text{ m/s}^2$]

(A) 3.60×10^{-8}

(B) 2.60×10^{-7}

(C) 1.87×10^{-3}

(D) 7.07×10^{-4}

[Step-by-step solution ► prepwisar.in/questions/MpGwqAjoB6](https://www.prepwisar.in/questions/MpGwqAjoB6)

Q20 JEE Main 2021 · 25 Jul · Shift 1

Two wires of same length and radius are joined end to end and loaded. The Young's moduli of the materials of the two wires are Y_1 and Y_2 . The combination behaves as a single wire then its Young's modulus is :

(A) $Y = \frac{2Y_1Y_2}{3(Y_1+Y_2)}$

(B) $Y = \frac{2Y_1Y_2}{Y_1+Y_2}$

(C) $Y = \frac{Y_1Y_2}{2(Y_1+Y_2)}$

(D) $Y = \frac{Y_1Y_2}{Y_1+Y_2}$

[Step-by-step solution ► prepwisar.in/questions/0z_BPNbjs3](https://www.prepwisar.in/questions/0z_BPNbjs3)

Q21 JEE Main 2021 · 20 Jul · Shift 1

The value of tension in a long thin metal wire has been changed from T_1 to T_2 . The lengths of the metal wire at two different values of tension T_1 and T_2 are l_1 and l_2 respectively. The actual length of the metal wire is :

- (A) $\frac{l_1+l_2}{2}$
- (B) $\sqrt{T_1 T_2 l_1 l_2}$
- (C) $\frac{T_1 l_2 - T_2 l_1}{T_1 - T_2}$
- (D) $\frac{T_1 l_1 - T_2 l_2}{T_1 - T_2}$

[Step-by-step solution ► prepwisser.in/questions/Iw95HEtQ5N](https://www.prepwisser.in/questions/Iw95HEtQ5N)

Q22 JEE Main 2021 · 20 Jul · Shift 2

The length of a metal wire is l_1 , when the tension in it is T_1 and is l_2 when the tension is T_2 . The natural length of the wire is :

- (A) $\sqrt{l_1 l_2}$
- (B) $\frac{l_1 T_2 - l_2 T_1}{T_2 - T_1}$
- (C) $\frac{l_1 T_2 + l_2 T_1}{T_2 + T_1}$
- (D) $\frac{l_1 + l_2}{2}$

[Step-by-step solution ► prepwisser.in/questions/lyhuwqShgv](https://www.prepwisser.in/questions/lyhuwqShgv)

Q23 JEE Main 2021 · 18 Mar · Shift 1

Two separate wires A and B are stretched by 2 mm and 4 mm respectively, when they are subjected to a force of 2 N. Assume that both the wires are made up of same material and the radius of wire B is 4 times that of the radius of wire A. The length of the wires A and B are in the ratio of a : b. Then a/b can be expressed as $1/x$ where x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/jzY67aP4tk](https://www.prepwisser.in/questions/jzY67aP4tk)

Q24 JEE Main 2021 · 26 Feb · Shift 2

The length of metallic wire is l_1 when tension in it is T_1 . It is l_2 when the tension is T_2 . The original length of the wire will be :

- (A) $\frac{T_1 l_1 - T_2 l_2}{T_2 - T_1}$
- (B) $\frac{l_1 + l_2}{2}$
- (C) $\frac{T_2 l_1 + T_1 l_2}{T_1 + T_2}$
- (D) $\frac{T_2 l_1 - T_1 l_2}{T_2 - T_1}$

[Step-by-step solution ► prepwisser.in/questions/jF9Qtng9iQ](https://www.prepwisser.in/questions/jF9Qtng9iQ)

Q25 JEE Main 2025 · 8 Apr · Shift 2

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

- (A) 2.5
- (B) 25
- (C) 10
- (D) 5

[Step-by-step solution ► prepwiser.in/questions/-6k5jvmtN_](https://www.prepwiser.in/questions/-6k5jvmtN_)

Q26 JEE Main 2025 · 8 Apr · Shift 2

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 $1 \text{ atm} = 10^5 \text{ Pa}$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/yAd2C74CMh](https://www.prepwiser.in/questions/yAd2C74CMh)

Q27 JEE Main 2025 · 29 Jan · Shift 1

The fractional compression ($\frac{\Delta V}{V}$) 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 $g = 10 \text{ m s}^{-2}$.

- (A) 1.0
- (B) 1.25
- (C) 1.75
- (D) 1.5

[Step-by-step solution ► prepwiser.in/questions/MudEMesvr9](https://www.prepwiser.in/questions/MudEMesvr9)

Q28 JEE Main 2025 · 28 Jan · Shift 2

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 = $1.4 \times 10^{11} \text{ Nm}^{-2}$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/irHPNJTI3C](https://www.prepwiser.in/questions/irHPNJTI3C)

Q29 JEE Main 2025 · 24 Jan · Shift 2

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/CyZP3MN8or](https://www.prepwiser.in/questions/CyZP3MN8or)

Q30 JEE Main 2024 · 9 Apr · Shift 1

Two persons pull a wire towards themselves. Each person exerts a force of 200N on the wire. Young's modulus of the material of wire is $1 \times 10^{11} \text{Nm}^{-2}$. Original length of the wire is 2m and the area of cross section is 2cm^2 . The wire will extend in length by _____ μm .

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/_Mfmaj2jzD](https://www.prepwisar.in/questions/_Mfmaj2jzD)

Q31 JEE Main 2024 · 1 Feb · Shift 1

With rise in temperature, the Young's modulus of elasticity :

(A) changes erratically

(B) increases

(C) decreases

(D) remains unchanged

[Step-by-step solution ► prepwisar.in/questions/R7HrcZNEND](https://www.prepwisar.in/questions/R7HrcZNEND)

Q32 JEE Main 2024 · 31 Jan · Shift 1

The depth below the surface of sea to which a rubber ball be taken so as to decrease its volume by 0.02% is _____ m.

(Take density of sea water = 10^3kgm^{-3} , Bulk modulus of rubber = $9 \times 10^8 \text{Nm}^{-2}$, and $g = 10 \text{ms}^{-2}$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/-PdH--qNFP](https://www.prepwisar.in/questions/-PdH--qNFP)

Q33 JEE Main 2024 · 30 Jan · Shift 1

Young's modulus of material of a wire of length ' L ' and cross-sectional area A is Y . If the length of the wire is doubled and cross-sectional area is halved then Young's modulus will be :

(A) $4Y$

(B) $2Y$

(C) $\frac{Y}{4}$

(D) Y

[Step-by-step solution ► prepwisar.in/questions/3f2MlpIG_Y](https://www.prepwisar.in/questions/3f2MlpIG_Y)

Q34 JEE Main 2024 · 27 Jan · Shift 1

If average depth of an ocean is 4000m and the bulk modulus of water is $2 \times 10^9 \text{Nm}^{-2}$, then fractional compression $\frac{\Delta V}{V}$ of water at the bottom of ocean is $\alpha \times 10^{-2}$. The value of α is _____ (Given, $g = 10 \text{ms}^{-2}$, $\rho = 1000 \text{kgm}^{-3}$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/inLW8wfwKJ](https://www.prepwisar.in/questions/inLW8wfwKJ)

Q35 JEE Main 2023 · 15 Apr · Shift 1

A wire of length ' L ' and radius ' r ' is clamped rigidly at one end. When the other end of the wire is pulled by a force f , its length increases by ' l '. Another wire of same material of length ' $2L$ ' and radius ' $2r$ ' is pulled by a force ' $2f$ '. Then the increase in its length will be :

(A) $2l$

(B) $4l$

(C) l

(D) $l/2$

[Step-by-step solution ► prepwisar.in/questions/nHWXg8qmxt](https://www.prepwisar.in/questions/nHWXg8qmxt)

Q36 JEE Main 2023 · 13 Apr · Shift 1

Under isothermal condition, the pressure of a gas is given by $P = aV^{-3}$, where a is a constant and V is the volume of the gas. The bulk modulus at constant temperature is equal to

- (A) $\frac{P}{2}$ (B) $2P$
(C) $3P$ (D) P

Step-by-step solution ► [prepwiser.in/questions/Tko4ofNmJ9](https://www.prepwiser.in/questions/Tko4ofNmJ9)

Q37 JEE Main 2023 · 6 Apr · Shift 1

A steel rod has a radius of 20mm and a length of 2.0m. A force of 62.8kN stretches it along its length. Young's modulus of steel is $2.0 \times 10^{11} \text{N/m}^2$. The longitudinal strain produced in the wire is _____ $\times 10^{-5}$

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/e0ZVjXUJhb](https://www.prepwiser.in/questions/e0ZVjXUJhb)

Q38 JEE Main 2023 · 1 Feb · Shift 1

A certain pressure 'P' is applied to 1 litre of water and 2 litre of a liquid separately. Water gets compressed to 0.01% whereas the liquid gets compressed to 0.03%. The ratio of Bulk modulus of water to that of the liquid is $\frac{3}{x}$. The value of x is _____.

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/lf4Z9f76cn](https://www.prepwiser.in/questions/lf4Z9f76cn)

Q39 JEE Main 2023 · 1 Feb · Shift 2

The Young's modulus of a steel wire of length 6m and cross-sectional area 3mm^2 , is $2 \times 10^{11} \text{N/m}^2$. The wire is suspended from its support on a given planet. A block of mass 4kg is attached to the free end of the wire. The acceleration due to gravity on the planet is $\frac{1}{4}$ of its value on the earth. The elongation of wire is (Take g on the earth = 10m/s^2):

- (A) 0.1 cm (B) 1 cm
(C) 0.1 mm (D) 1 mm

Step-by-step solution ► [prepwiser.in/questions/8WxsB73qQH](https://www.prepwiser.in/questions/8WxsB73qQH)

Q40 JEE Main 2023 · 31 Jan · Shift 2

Under the same load, wire A having length 5.0m and cross section $2.5 \times 10^{-5} \text{m}^2$ stretches uniformly by the same amount as another wire B of length 6.0m and a cross section of $3.0 \times 10^{-5} \text{m}^2$ stretches. The ratio of the Young's modulus of wire A to that of wire B will be :

- (A) 1 : 2 (B) 1 : 4
(C) 1 : 1 (D) 1 : 10

Step-by-step solution ► [prepwiser.in/questions/637AIXG.qi](https://www.prepwiser.in/questions/637AIXG.qi)

Q41 JEE Main 2023 · 31 Jan · Shift 2

For a solid rod, the Young's modulus of elasticity is $3.2 \times 10^{11} \text{Nm}^{-2}$ and density is $8 \times 10^3 \text{kgm}^{-3}$. The velocity of longitudinal wave in the rod will be.

- (A) $3.65 \times 10^3 \text{ms}^{-1}$ (B) $6.32 \times 10^3 \text{ms}^{-1}$
(C) $18.96 \times 10^3 \text{ms}^{-1}$ (D) $145.75 \times 10^3 \text{ms}^{-1}$

Step-by-step solution ► [prepwiser.in/questions/UMsY5Y3XsF](https://www.prepwiser.in/questions/UMsY5Y3XsF)

Q42 JEE Main 2023 · 30 Jan · Shift 2

A force is applied to a steel wire 'A', rigidly clamped at one end. As a result elongation in the wire is 0.2mm. If same force is applied to another steel wire 'B' of double the length and a diameter 2.4 times that of the wire 'A', the elongation in the wire 'B' will be (wires having uniform circular cross sections)

- (A) 6.9×10^{-2} mm (B) 6.06×10^{-2} mm
(C) 2.77×10^{-2} mm (D) 3.0×10^{-2} mm

[Step-by-step solution ► prepwiser.in/questions/Y5yDYC96s_](https://www.prepwiser.in/questions/Y5yDYC96s_)

Q43 JEE Main 2023 · 30 Jan · Shift 1

Choose the correct relationship between Poisson ratio (σ), bulk modulus (K) and modulus of rigidity (η) of a given solid object :

- (A) $\sigma = \frac{3K+2\eta}{6K+2\eta}$ (B) $\sigma = \frac{3K-2\eta}{6K+2\eta}$
(C) $\sigma = \frac{6K+2\eta}{3K-2\eta}$ (D) $\sigma = \frac{6K-2\eta}{3K-2\eta}$

[Step-by-step solution ► prepwiser.in/questions/6JaS502qIz](https://www.prepwiser.in/questions/6JaS502qIz)

Q44 JEE Main 2023 · 24 Jan · Shift 2

Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R
Assertion A : Steel is used in the construction of buildings and bridges.

Reason R : Steel is more elastic and its elastic limit is high.

In the light of above statements, choose the most appropriate answer from the options given below

- (A) Both A and R are correct and R is the correct explanation of A
(B) A is correct but R is not correct
(C) Both A and R are correct but R is NOT the correct explanation of A
(D) A is not correct but R is correct

[Step-by-step solution ► prepwiser.in/questions/3IZ_p_QCR6](https://www.prepwiser.in/questions/3IZ_p_QCR6)

Q45 JEE Main 2023 · 24 Jan · Shift 1

A 100 m long wire having cross-sectional area $6.25 \times 10^{-4} \text{m}^2$ and Young's modulus is 10^{10}Nm^{-2} is subjected to a load of 250 N, then the elongation in the wire will be :

- (A) $6.25 \times 10^{-6} \text{m}$ (B) $4 \times 10^{-3} \text{m}$
(C) $4 \times 10^{-4} \text{m}$ (D) $6.25 \times 10^{-3} \text{m}$

[Step-by-step solution ► prepwiser.in/questions/p5HQ2liRrq](https://www.prepwiser.in/questions/p5HQ2liRrq)

Q46 JEE Main 2022 · 29 Jul · Shift 2

The speed of a transverse wave passing through a string of length 50cm and mass 10g is 60ms^{-1} . The area of cross-section of the wire is 2.0mm^2 and its Young's modulus is $1.2 \times 10^{11} \text{Nm}^{-2}$. The extension of the wire over its natural length due to its tension will be $x \times 10^{-5} \text{m}$. The value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/C1TZ2iHlwU](https://www.prepwiser.in/questions/C1TZ2iHlwU)

Q47 JEE Main 2022 · 28 Jul · Shift 1

The force required to stretch a wire of cross-section 1cm^2 to double its length will be : (Given Yong's modulus of the wire $= 2 \times 10^{11}\text{N/m}^2$)

(A) $1 \times 10^7\text{N}$

(B) $1.5 \times 10^7\text{N}$

(C) $2 \times 10^7\text{N}$

(D) $2.5 \times 10^7\text{N}$

[Step-by-step solution ► prepwisar.in/questions/Jbg8phhXtW](https://www.prepwisar.in/questions/Jbg8phhXtW)

Q48 JEE Main 2022 · 27 Jul · Shift 2

A steel wire of length

$$3.2\text{m} \left(Y_s = 2.0 \times 10^{11} \text{Nm}^{-2} \right)$$

and a copper wire of length

$$4.4\text{m} \left(Y_c = 1.1 \times 10^{11} \text{Nm}^{-2} \right)$$

, both of radius 1.4mm are connected end to end. When stretched by a load, the net elongation is found to be 1.4mm . The load applied, in Newton, will be: (Given $\pi = \frac{22}{7}$)

(A) 360

(B) 180

(C) 1080

(D) 154

[Step-by-step solution ► prepwisar.in/questions/CtsdMvJlJcg](https://www.prepwisar.in/questions/CtsdMvJlJcg)

Q49 JEE Main 2022 · 26 Jul · Shift 2

A uniform heavy rod of mass 20kg , cross sectional area 0.4m^2 and length 20m is hanging from a fixed support. Neglecting the lateral contraction, the elongation in the rod due to its own weight is $x \times 10^{-9}\text{m}$. The value of x is _____.

(Given, young modulus $Y = 2 \times 10^{11} \text{Nm}^{-2}$ and $g = 10 \text{ms}^{-2}$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/XcK29Uewxp](https://www.prepwisar.in/questions/XcK29Uewxp)

Q50 JEE Main 2022 · 25 Jul · Shift 1

A wire of length L and radius r is clamped rigidly at one end. When the other end of the wire is pulled by a force F , its length increases by 5cm . Another wire of the same material of length $4L$ and radius $4r$ is pulled by a force $4F$ under same conditions. The increase in length of this wire is _____ cm.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/PQgVnu7cUv](https://www.prepwisar.in/questions/PQgVnu7cUv)

Q51 JEE Main 2022 · 24 Jun · Shift 1

The bulk modulus of a liquid is $3 \times 10^{10} \text{Nm}^{-2}$. The pressure required to reduce the volume of liquid by 2% is :

(A) $3 \times 10^8 \text{Nm}^{-2}$

(B) $9 \times 10^8 \text{Nm}^{-2}$

(C) $6 \times 10^8 \text{Nm}^{-2}$

(D) $12 \times 10^8 \text{Nm}^{-2}$

[Step-by-step solution ► prepwisar.in/questions/o0xB2_zAJl](https://www.prepwisar.in/questions/o0xB2_zAJl)

Q52 JEE Main 2021 · 31 Aug · Shift 1

When a rubber ball is taken to a depth of _____m in deep sea, its volume decreases by 0.5%.

(The bulk modulus of rubber = $9.8 \times 10^8 \text{ Nm}^{-2}$, Density of sea water = 10^3 kgm^{-3} , $g = 9.8 \text{ m/s}^2$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/IHQyx1wtPr](https://www.prepwiser.in/questions/IHQyx1wtPr)

Q53 JEE Main 2021 · 17 Mar · Shift 2

An object is located at 2 km beneath the surface of the water. If the fractional compression $\frac{\Delta V}{V}$ is 1.36%, the ratio of hydraulic stress to the corresponding hydraulic strain will be _____. [Given : density of water is 1000 kgm^{-3} and $g = 9.8 \text{ ms}^{-2}$]

- (A) $1.44 \times 10^7 \text{ Nm}^{-2}$
- (B) $1.44 \times 10^9 \text{ Nm}^{-2}$
- (C) $1.96 \times 10^7 \text{ Nm}^{-2}$
- (D) $2.26 \times 10^9 \text{ Nm}^{-2}$

[Step-by-step solution ► prepwiser.in/questions/m5QKEs4_IY](https://www.prepwiser.in/questions/m5QKEs4_IY)

Q54 JEE Main 2021 · 26 Feb · Shift 1

The normal density of a material is ρ and its bulk modulus of elasticity is K . The magnitude of increase in density of material, when a pressure P is applied uniformly on all sides, will be :

- (A) $\frac{\rho K}{P}$
- (B) $\frac{PK}{\rho}$
- (C) $\frac{\rho P}{K}$
- (D) $\frac{K}{\rho P}$

[Step-by-step solution ► prepwiser.in/questions/ie9ZFDwQp2](https://www.prepwiser.in/questions/ie9ZFDwQp2)

Q55 JEE Main 2021 · 24 Feb · Shift 1

If Y , K and η are the values of Young's modulus, bulk modulus and modulus of rigidity of any material respectively. Choose the correct relation for these parameters.

- (A) $Y = \frac{9K\eta}{3K-\eta} \text{ N/m}^2$
- (B) $Y = \frac{9K\eta}{2\eta+3K} \text{ N/m}^2$
- (C) $\eta = \frac{3YK}{9K+Y} \text{ N/m}^2$
- (D) $K = \frac{Y\eta}{9\eta-3Y} \text{ N/m}^2$

[Step-by-step solution ► prepwiser.in/questions/hnNgy4_o93](https://www.prepwiser.in/questions/hnNgy4_o93)

Q56 JEE Main 2020 · 4 Sep · Shift 2

A cube of metal is subjected to a hydrostatic pressure of 4 GPa. The percentage change in the length of the side of the cube is close to :

(Given bulk modulus of metal, $B = 8 \times 10^{10} \text{ Pa}$)

- (A) 0.6
- (B) 20
- (C) 1.67
- (D) 5

[Step-by-step solution ► prepwiser.in/questions/mge_XtL7N0](https://www.prepwiser.in/questions/mge_XtL7N0)

Q57 JEE Main 2020 · 7 Jan · Shift 1

Speed of a transverse wave on a straight wire (mass 6.0 g, length 60 cm and area of cross-section 1.0 mm^2) is 90 ms^{-1} . If the Young's modulus of wire is $16 \times 10^{11} \text{ Nm}^{-2}$, the extension of wire over its natural length is :

(A) 0.03 mm

(B) 0.04 mm

(C) 0.02 mm

(D) 0.01 mm

[Step-by-step solution ► prepwiser.in/questions/ts4G12-04q](https://www.prepwiser.in/questions/ts4G12-04q)

Elastic Potential Energy · 7 PYQs

Q58 JEE Main 2025 · 2 Apr · Shift 1

A steel wire of length 2 m and Young's modulus $2.0 \times 10^{11} \text{ Nm}^{-2}$ is stretched by a force. If Poisson 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).

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/1899gmf30C](https://www.prepwiser.in/questions/1899gmf30C)

Q59 JEE Main 2023 · 13 Apr · Shift 1

The elastic potential energy stored in a steel wire of length 20m stretched through 2cm is 80J. The cross sectional area of the wire is _____ mm^2 .

(Given, $y = 2.0 \times 10^{11} \text{ Nm}^{-2}$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/Es3wg8gI4t](https://www.prepwiser.in/questions/Es3wg8gI4t)

Q60 JEE Main 2023 · 8 Apr · Shift 1

An aluminium rod with Young's modulus $Y = 7.0 \times 10^{10} \text{ N/m}^2$ undergoes elastic strain of 0.04%. The energy per unit volume stored in the rod in SI unit is:

(A) 5600

(B) 2800

(C) 11200

(D) 8400

[Step-by-step solution ► prepwiser.in/questions/tYjpijkha4](https://www.prepwiser.in/questions/tYjpijkha4)

Q61 JEE Main 2021 · 27 Jul · Shift 1

A stone of mass 20 g is projected from a rubber catapult of length 0.1 m and area of cross section 10^{-6} m^2 stretched by an amount 0.04 m. The velocity of the projected stone is _____ m/s.

(Young's modulus of rubber = $0.5 \times 10^9 \text{ N/m}^2$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/QtjLQVxA4M](https://www.prepwiser.in/questions/QtjLQVxA4M)

Q62 JEE Main 2021 · 22 Jul · Shift 2

The area of cross-section of a railway track is 0.01 m^2 . The temperature variation is 10°C . Coefficient of liner expansion of material of track is $10^{-5}/^\circ\text{C}$. The energy stored per meter in the track is _____ J/m.

(Young's modulus of material of track is 10^{11} Nm^{-2})

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/ddtFiM1Aob](https://www.prepwiser.in/questions/ddtFiM1Aob)

Q63 JEE Main 2020 · 6 Sep · Shift 1

If the potential energy between two molecules is given by

$$U = -\frac{A}{r^6} + \frac{B}{r^{12}},$$

then at equilibrium, separation between molecules, and the potential energy are :

(A) $\left(\frac{2B}{A}\right)^{1/6}, -\frac{A^2}{4B}$

(B) $\left(\frac{2B}{A}\right)^{1/6}, -\frac{A^2}{2B}$

(C) $\left(\frac{B}{A}\right)^{1/6}, 0$

(D) $\left(\frac{B}{2A}\right)^{1/6}, -\frac{A^2}{2B}$

[Step-by-step solution ► prepwiser.in/questions/u99o2tq_Gg](https://www.prepwiser.in/questions/u99o2tq_Gg)

Q64 JEE Main 2020 · 9 Jan · Shift 2

Two steel wires having same length are suspended from a ceiling under the same load. If the ratio of their energy stored per unit volume is $1 : 4$, the ratio of their diameters is:

(A) $1 : 2$

(B) $2 : 1$

(C) $1 : \sqrt{2}$

(D) $\sqrt{2} : 1$

[Step-by-step solution ► prepwiser.in/questions/xGgdekginz](https://www.prepwiser.in/questions/xGgdekginz)

Poisson's Ratio · 1 PYQs

Q65 JEE Main 2022 · 26 Jun · Shift 1

An aluminium wire is stretched to make its length, 0.4% larger. The percentage change in resistance is :

(A) 0.4%

(B) 0.2%

(C) 0.8%

(D) 0.6%

[Step-by-step solution ► prepwiser.in/questions/137iKzEgJa](https://www.prepwiser.in/questions/137iKzEgJa)

Answer key — Elasticity

Numbers match the question numbers above. For full working, open the solution link under each question.

1	B	2	1	3	600	4	5	5	16	6	A	7	C	8	2
9	C	10	4	11	11	12	60	13	A	14	30	15	A	16	C
17	6	18	8	19	B	20	B	21	C	22	B	23	32	24	D
25	D	26	4	27	B	28	50	29	43	30	20	31	C	32	18
33	D	34	2	35	C	36	C	37	25	38	1	39	C	40	C
41	B	42	A	43	B	44	A	45	B	46	15	47	C	48	D
49	25	50	5	51	C	52	500	53	B	54	C	55	D	56	C
57	A	58	25	59	40	60	A	61	20	62	5	63	A	64	D
65	C														

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