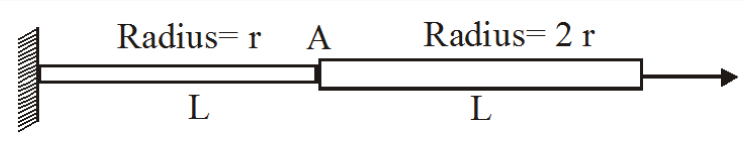
# Elasticity

Total Questions: 28

**Q1.** **Question ID: 1434366** | Type: **SC**

Two steel wires of same length but radii r and 2r are connected together end to end and tied to a wall as shown. The force stretches the combination by 10 mm. How far does the midpoint A move ?




**A.** 6 mm

**B.** 8 mm

**C.** 2 mm

**D.** 4 mm

**Q2.** **Question ID: 1493359** | Type: **SC**

The dimensions of four wires of the same material are given below. In which wire increase in length will be maximum for a given force :

**A.** Length 100 cm, diameter 1 mm

**B.** Length 200 cm, diameter 2 mm

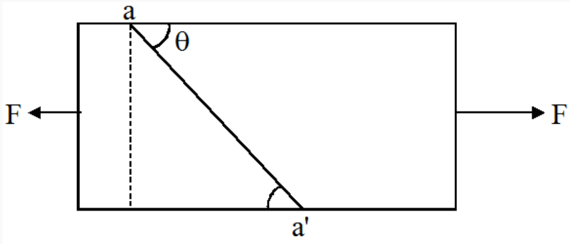
**C.** Length 300 cm, diameter 3 mm

**D.** Length 50 cm, diameter 0.5 mm

**Q3.** **Question ID: 1524631** | Type: **SB**

Consider a long steel bar under a tensile stress due to forces $\vec{F}$ acting at the edges along the length of the bar (Fig.). Consider a plane making an angle θ with the length. What are the tensile and shearing stresses on this plane ?

(a) For what angle is the tensile stress a maximum ?




(b) For what angle is the shearing stress a maximum ?

**Q4.** **Question ID: 1525750** | Type: **SC**

A wire suspended vertically from one of its ends is stretched by attaching a weight of 200 N to the lower ends. The weight stretches the wire by 1mm. Then the elastic energy stored in the wire is-

**A.** 0.2 J

**B.** 10 J

**C.** 20 J

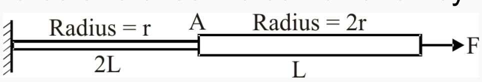
**D.** 0.1 J

**Q5.** **Question ID: 2545982** | Type: **ID**

A thin wire of area of cross-section $A = 10^{-2}\ m^2$ is used to make a ring of radius $r = 10^{-1}$ m. This ring is placed on a smooth horizontal floor & is given angular velocity ω = 2 rad/s about its centre. Find out stress in the ring (mass per unit length of wire λ = 1 kg/m)

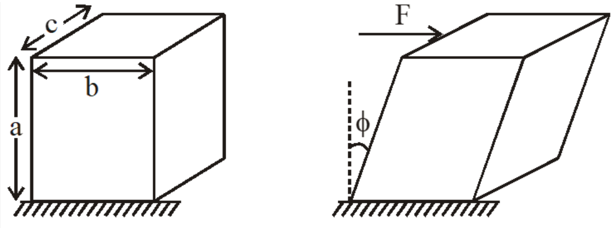
**Q6.** **Question ID: 2755907** | Type: **IM**

Two steel wires of radii r and 2r are connected together end to end and tied to a wall as shown. The force stretches the combination by $\frac{27}{4}$ mm. How far does the junction point A move. (in mm)




**Q7.** **Question ID: 3185060** | Type: **SC**

A cuboidal block of sides *a, b* and *c* is fixed on ground. The top is pushed by a horizontal force *F* as shown. The angle ϕ by which the block deforms is : (η is modulus of rigidity)




**A.** $\frac{F}{ab\eta}$

**B.** $\frac{F}{ac\eta}$

**C.** $\frac{F}{bc\eta}$

**D.** $\frac{F}{\sqrt{b^2+c^2}\,\eta}$

**Q8.** **Question ID: 3185084** | Type: **SC**

A cylindrical wire of radius 1 *mm*, length 1 *m*, Young's modulus = $2 \times 10^{11}$ $N/m^2$, Poisson's ratio μ = π/10 is stretched by a force of 100 *N*. Its radius will become

**A.** 0.99998 *mm*

**B.** 0.99999 *mm*

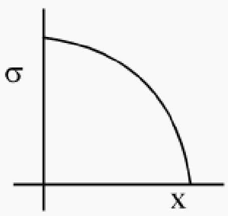
**C.** 0.99997 *mm*

**D.** 0.99995 *mm*

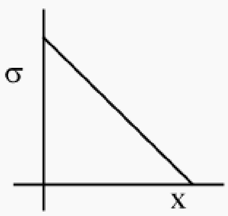
**Q9.** **Question ID: 3185836** | Type: **SC**

A uniform rod rotating in gravity free region with certain constant angular velocity. The variation of tensile stress with distance *x* from axis of rotation is best represented by which of the following graphs.

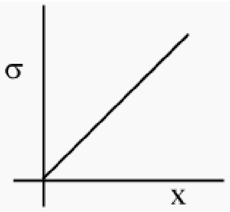
**A.**



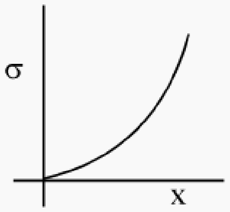

**B.**



**C.**

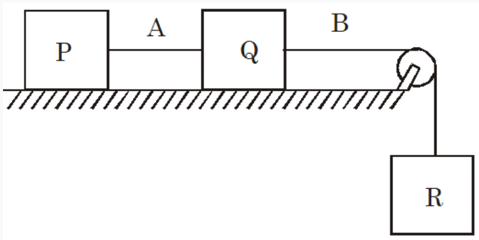



**D.**

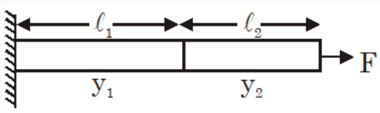



**Q10.** **Question ID: 3561435** | Type: **SB**

Each of the three blocks P, Q and R shown in figure has a mass of 3 kg. Each of the wires A and B has cross-sectional area 0.005 $cm^2$ and Young's modulus $2 \times 10^{11}$ $N/m^2$. Neglect friction. Find the longitudinal strain developed in each of the wires. Take g = 10 $m/s^2$.




**Q11.** **Question ID: 3561538** | Type: **SB**

Find the  (i) Net elongation of composite rod approximately. ($x \times 10^{-11}$ m) then x =

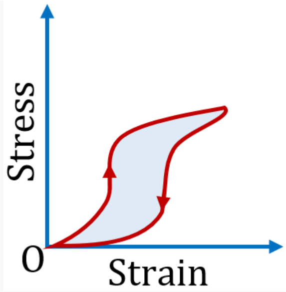
(ii) $Y_{eq}$ of the composite rod ( $x \times 10^{11}$ N /$m^2$)

(assume A = area of cross section of each rod), then x =

$\ell_1 = \ell_2 = 1$m, F = 2N/$m^2$ , A =1sq.$m^2$

$y_1 = 2 \times 10^{11}$ N/$m^2$ , $y_2 = 3 \times 10^{11}$ N /$m^2$

**Q12.** **Question ID: 4141306** | Type: **SC**

The diagram shows a stress-strain graph for a rubber band. 

Consider of the following statements.

I. It will be easier to compress this rubber than expand it.
II. Rubber does not return to its original length after it is stretched.
III. The rubber band will get heated if it is stretched and released.
Which of these can be deduced from the graph

**A.** III only

**B.** II and III

**C.** I and III

**D.** I only

**Q13.** **Question ID: 4141325** | Type: **SC**

A 100 $m$ long wire having cross-sectional area $6.25 \times 10^{-4}$ $m^2$ 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.** $6.25 \times 10^{-3}$ $m$

**B.** $4 \times 10^{-4}$ $m$

**C.** $6.25 \times 10^{-6}$ $m$

**D.** $4 \times 10^{-3}$ $m$

**Q14.** **Question ID: 4141428** | Type: **SC**

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

**A.** 5600

**B.** 8400

**C.** 2800

**D.** 11200

**Q15.** **Question ID: 4141461** | Type: **SC**

The length of wire becomes $l_1$ and $l_2$ when 100$N$ and 120 $N$ 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 _____.

**A.** 2

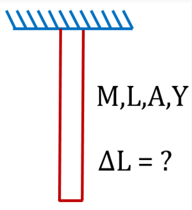
**B.** 5

**C.** 8

**D.** 10

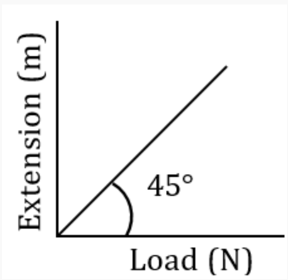
**Q16.** **Question ID: 4145151** | Type: **SB**

Let a rope of mass $M$ and length $L$ and young's modulus of elasticity $Y$ and cross-sectional area $A$ is hung vertically. Calculate the increase in length.




**Q17.** **Question ID: 4190106** | Type: **IS**

As shown in the figure, in an experiment to determine Young's modulus of a wire, the extension- load curve is plotted. The curve is a straight line passing through the origin and makes an angle of 45°with the load axis. The length of wire is 62.8 $cm$ and its diameter is 4 mm. The Young's modulus is found to be $x \times 10^4$ $Nm^{-2}$.




The value of $x$ is _____.

**Q18.** **Question ID: 4190130** | Type: **IS**

One end of a metal wire is fixed to a ceiling and a load of 2 kg hangs from the other end. A similar wire is attached to the bottom of the load and another load of 1 kg hangs from this lower wire. Then the ratio of longitudinal strain of upper wire to that of the lower wire will be____.
[Area of cross section of wire = 0.005 $cm^2$, $Y = 2 \times 10^{11}$ $Nm^{-2}$ and $g = 10$ $ms^{-2}$]

**Q19.** **Question ID: 4190151** | Type: **SC**

A force is applied to a steel wire '$A$', rigidly clamped at one end. As a result elongation in the wire is 0.2 mm. 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.** $6.06 \times 10^{-2}$ mm

**B.** $2.77 \times 10^{-2}$ mm

**C.** $3.0 \times 10^{-2}$ mm

**D.** $6.9 \times 10^{-2}$ mm

**Q20.** **Question ID: 4190195** | Type: **SC**

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 '2$L$' and radius '2$r$' is pulled by a force '2$f$'. Then the increase in its length will be :

**A.** 2l

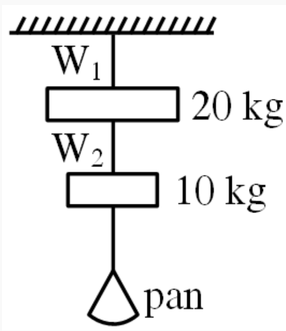
**B.** l

**C.** 4 l

**D.** l / 2

**Q21.** **Question ID: 4190215** | Type: **IM**

Wires $W_1$ and $W_2$ are made of same material having the breaking stress of $1.25 \times 10^9$ N/m$^2$. $W_1$ and $W_2$ have cross-sectional area of $8 \times 10^{-7}$ $m^2$ and $4 \times 10^{-7}$ $m^2$, respectively. Masses of 20 kg and 10 kg hang from them as shown in the figure. The maximum mass that can be placed in the pan without breaking the wires is ____ kg. (Use g = 10 $m/s^2$)




**Q22.** **Question ID: 4190229** | Type: **SC**

An object of mass $m$ is suspended at the end of a massless wire of length $L$ and area of cross-section, $A$. Young modulus of the material of the wire is $Y$. If the mass is pulled down slightly its frequency of oscillation along the vertical direction is:

**A.** $f = \frac{1}{2\pi}\sqrt{\frac{YA}{mL}}$

**B.** $f = \frac{1}{2\pi}\sqrt{\frac{YL}{mA}}$

**C.** $f = \frac{1}{2\pi}\sqrt{\frac{mA}{YL}}$

**D.** $f = \frac{1}{2\pi}\sqrt{\frac{mL}{YA}}$

**Q23. Question ID: 4190245** | Type: **SC**

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

**A.** 5600

**B.** 8400

**C.** 2800

**D.** 11200

**Q24. Question ID: 4190263** | Type: **SC**

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.** $\frac{\ell_1 + \ell_2}{2}$

**B.** $\frac{T_2\ell_1 + T_1\ell_2}{T_1 + T_2}$

**C.** $\frac{T_2\ell_1 - T_1\ell_2}{T_2 - T_1}$

**D.** $\frac{T_1\ell_1 - T_2\ell_2}{T_2 - T_1}$

**Q25. Question ID: 4190281** | Type: **SC**

A solid sphere of radius $r$ made of a soft material of bulk modulus $K$ is surrounded by a liquid in a cylindrical container. A massless piston of area a floats on the surface of the liquid, covering entire cross section of cylindrical container. When a mass *m* is placed on the surface of the piston to compress the liquid, the fractional decrement in the radius of the sphere, $\left(\frac{dr}{r}\right)$, is :

**A.** $\frac{Ka}{3mg}$

**B.** $\frac{mg}{3Ka}$

**C.** $\frac{mg}{3Ka}$

**D.** $\frac{Ka}{mg}$

**Q26.** **Question ID: 457020** | Type: **SC**

A rope of diameter 2cm breaks if tension in it exceeds 500 N. The maximum tension that may be given to similar rope of diameter 4cm is :-

**A.** 500 N

**B.** 250 N

**C.** 1000 N

**D.** 2000 N

**Q27.** **Question ID: 698270** | Type: **SC**

Two rods A and B of lengths $\ell_A$ and $\ell_B$ have coefficients of linear expansion $\alpha_A : \alpha_B = 1 : 4$. If the difference between the lengths of the two rods is to be independent of temperature, $\ell_A : \ell_B$ should be :-

**A.** 1 : 16

**B.** 1 : 4

**C.** 1 : 2

**D.** 4 : 1

**Q28.** **Question ID: 729680** | Type: **SC**

A liquid with coefficient of volume expansion γ is filled in a container of a material having the coefficient of linear expansion α. If the liquid overflows on heating, then :-

**A.** $\gamma = 3\alpha$

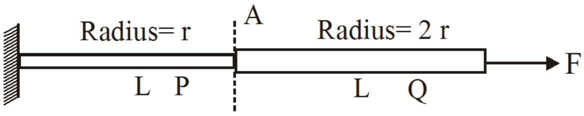
**B.** $\gamma > 3\alpha$

**C.** $\gamma < 3\alpha$

**D.** $\gamma = 3\alpha^3$

Solutions

Q1. Answer: B




Solution:

$\Delta L_P + \Delta L_Q = \Delta L_{Total} = 10mm$

$Y = \frac{F/A}{\Delta L/L} = \frac{FL}{A\Delta L}$

$\Rightarrow \Delta L = \frac{FL}{AY}$

$\Delta L_{Total} = \Delta L_P + \Delta L_Q$

$= \frac{FL}{4\pi r^2 Y} + \frac{FL}{\pi r^2 Y} = 10mm$

$\therefore \frac{5}{4} \cdot \frac{FL}{\pi r^2 Y} = 10mm$

$\Rightarrow \frac{FL}{\pi r^2 Y} = 8mm$

So, $\Delta L_P = \frac{FL}{\pi r^2 Y} = 8mm$ = shift in A

Q2. Answer: D

Solution: $\Delta l \propto \frac{l}{D^2}$

Q3. Answer: N/A

Solution: Ans. (a) $\theta = \frac{\pi}{2}$ (b) $\theta = \pi/4$.

$T.S = \frac{F\sin^2\theta}{A}$

$S.S = \frac{F}{2A}\sin 2\theta$

$T.S_{max} = \frac{F}{A}\ ;\ \left(\theta = \frac{\pi}{2}\right)$

$S.S_{max} = \frac{F}{2A},\ \left(\theta = \frac{\pi}{4}\right)$

Q4. Answer: D

Solution: Elastic energy stored in wire = $\frac{1}{2}(mg)x = \frac{1}{2}(200)\left(10^{-3}\right)J$ = 0.1 J

Q5. Answer: N/A

Solution: $Td\theta = \lambda r d\theta \omega^2 r$

$T = \lambda r^2 \omega^2$

Stress = $\frac{T}{A} = \frac{\lambda r^2 \omega^2}{A} = 4$

Q6. Answer: N/A

Solution:

Q7. Answer: C

Solution: Modulus of rigidity (η) = $\frac{(F/bc)}{\phi}$

$\Rightarrow \phi = \frac{F}{bc\eta}$

Q8. Answer: D

Solution: $\mu = \frac{\Delta r/r}{\Delta \ell/\ell} \Rightarrow \frac{\Delta r}{r} = -\left(\frac{\pi}{10}\right) \times \frac{\Delta \ell}{\ell}$

$\frac{\Delta \ell}{\ell} = \frac{F}{AY}$

$\Delta r = -5 \times 10^{-5}\ mm$

$r_f - r_i = -5 \times 10^{-5}$

$r_f = r_i - 0.00005$

$= 1 - 0.00005$

$= 0.99995\ mm$

Q9. Answer: A

Solution: $\sigma \propto T \propto (L^2 - x^2)$

Q10. Answer: N/A

Solution: The block R will descend vertically and the blocks P and Q will move on the frictionless horizontal table. Let the common magnitude of the acceleration be a. Let the tensions in the wires A and B be $T_A$ and $T_B$ respectively.

Writing the equations of motion of the blocks P, Q and R, we get,

$T_A = (3kg)a$ ......(i)

$T_B - T_A = (3kg)a$ .....(ii)

and $(3kg)g - T_B = (3kg)a$ .....(iii)

By (i) and (ii),

$T_B = 2T_A$.

By (i) and (iii),

$T_A + T_B = (3kg)g = 30$ N.

or, $3T_A = 30N$

or, $T_A = 10$ N and $T_B = 20$ N.

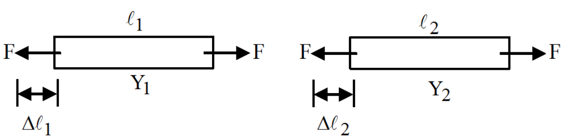
Longitudinal strain = $\frac{\text{Longitudinal stress}}{\text{Young's modulus}}$

Strain in wire A = $\frac{10N/0.005cm^2}{2 \times 10^{11} N/m^2} = 10^{-4}$

and strain in wire B = $\frac{20N/0.005cm^2}{2 \times 10^{11} N/m^2} = 2 \times 10^{-4}$

Q11. Answer: N/A

Solution: (1) F.B.D of the figure




$\Delta \ell_1 = \frac{F\ell_1}{AY_1}$ $\Delta \ell_2 = \frac{F\ell_2}{AY_2}$

Net elongation $\Delta \ell = \Delta \ell_1 + \Delta \ell_2$

$= \frac{F\ell_1}{AY_1} + \frac{F\ell_2}{AY_2} = \frac{F}{A}\left(\frac{\ell_1}{Y_1} + \frac{\ell_2}{Y_2}\right)$

Now substituting the values = $\frac{2}{1}\left(\frac{1}{2 \times 10^{11}} + \frac{1}{3 \times 10^{11}}\right)$

$= 2\left(\frac{3+2}{6 \times 10^{11}}\right)$

$= \frac{10}{6 \times 10^{11}} = 1.67 \times 10^{-11}$ m

Hence x = 1.67

(2) Now using the same $(\Delta\ell)_{eq.} = \Delta\ell_1 + \Delta\ell_2$

$$\frac{F.2\ell}{AY} = \frac{F\ell}{AY_1} + \frac{F\ell}{AY_2}$$

$$= \frac{2}{Y} = \frac{1}{Y_1} + \frac{1}{Y_2}$$

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

$$Y = \frac{2 \times 2 \times 10^{11} \times 3 \times 10^{11}}{5 \times 10^{11}}$$

$Y = 2.4 \times 10^{11}$

Hence x = 2.4

Q12. Answer: A

Solution: **Ans. (A)**

**Sol.** The area enclosed between deformation and restoration curve gives us the mechanical energy dissipated per unit volume of the given material.

Q13. Answer: D

Solution: Elongation in wire $\delta = \frac{F\ell}{AY}$

$$\delta = \frac{250 \times 100}{6.25 \times 10^{-4} \times 10^{10}}$$

$\delta = 4 \times 10^{-3}$ m

Q14. Answer: A

Solution: **Ans. (A)**

**Sol.** $Y = 7 \times 10^{10}\,N/m^2$

Strain $= \frac{0.04}{100}$

Energy $= \frac{1}{2}\left(\frac{YA}{l}\right)\Delta x^2$

Energy $= \frac{1}{2}YA\left(\frac{\Delta x}{l}\right)^2 \times l$

$$\frac{E}{V} = \frac{1}{2} \times Y \times \text{strain}^2$$

$$= \frac{1}{2} \times 7 \times 10^{10} \times \frac{0.04 \times 0.04}{10^4} = 56 \times 10^2$$

Q15. Answer: A

Solution: **Ans. (A)**

**Sol.** Let the original length be '$\ell_0$'

When $T_1 = 100\,N$, Extension = $\ell_1 - \ell_0$

When $T_2 = 120\,N$, Extension = $\ell_2 - \ell_0$

Then $100 = K(\ell_1 - \ell_0)$ …(1)

And $120 = K(\ell_2 - \ell_0)$ …(2)

$$\frac{1}{2} \Rightarrow \frac{5}{6} = \frac{\ell_1 - \ell_0}{\ell_2 - \ell_0}$$

$$5\ell_2 - 5\ell_0 = 6\ell_1 - 6\ell_0$$

$$\ell_0 = 6\ell_1 - 5\ell_2$$

$$\ell_0 = 6\ell_1 - 5\left(\frac{11\ell_1}{10}\right)$$

$\ell_0 = 6\ell_1 - \frac{11\ell_1}{2}$

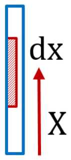
$\ell_0 = \frac{\ell_1}{2}$

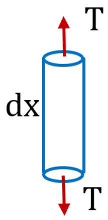
$\therefore x = 2$

Q16. Answer: N/A

Solution: **Ans.** $\Delta L = \frac{3MgL}{2AY}$

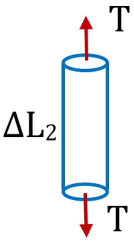
**Sol.**

$\Rightarrow$ 


$T = \frac{M}{L}xg + Mg$

$\Delta L = \frac{FL}{AY}$




$\int dL = \int \frac{\left(\frac{M}{L}xg + Mg\right)}{AY}dx \Rightarrow \Delta L = \frac{Mg}{AY}\int\left(\frac{x}{L}+1\right)dx$

$\Delta L = \frac{Mg}{AY}\left(\int_0^L \frac{x}{L}dx + \int_0^L 1dx\right) \Rightarrow \Delta L = \frac{Mg}{AY}\left[\frac{L}{2}+L\right]$

$\Delta L = \frac{Mg}{AY} \times \frac{3L}{2}$

Q17. Answer: N/A

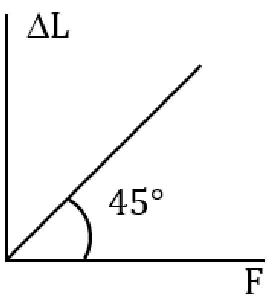
Solution: From graph :

$F = \Delta L$

$Y = \frac{FL}{A\Delta L}$

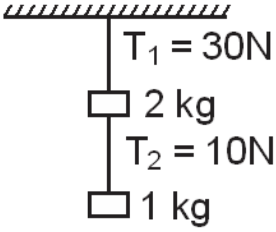
$Y = \frac{L}{A}$

$Y = \frac{62.8 \times 10^{-2}}{\pi\left(2 \times 10^{-3}\right)^2}$




$Y = 5 \times 10^4 N/m^2$

Q18. Answer: N/A




Solution:

$\Delta L = \frac{FL}{AY}$

$\frac{\Delta L}{L} = \frac{F}{AY}$

$\frac{\frac{\Delta L_1}{L_1}}{\frac{\Delta L_2}{L_2}} = \frac{F_1}{F_2} = \frac{30}{10} = 3$

Q19. Answer: D

Solution: $Y = \frac{F/A}{\frac{\Delta \ell}{\ell}}$

$\Rightarrow \quad F = \frac{YA}{\ell}\Delta \ell$

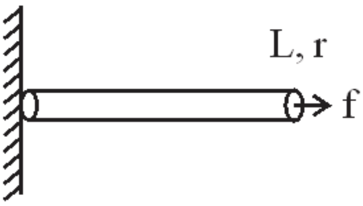
$\left(\frac{A\Delta \ell}{\ell}\right)_1 = \left(\frac{A\Delta \ell}{\ell}\right)_2$

$\Rightarrow \quad \frac{\Delta \ell_2}{\Delta \ell_1} = \frac{A_1}{A_2} \times \frac{\ell_2}{\ell_1}$

$\Rightarrow \quad \frac{\Delta \ell_2}{0.2} = \frac{1}{2.4 \times 2.4} \times \frac{2}{1}$

$\Rightarrow \quad \Delta \ell_2 = 6.9 \times 10^{-2}$ mm

Q20. Answer: B

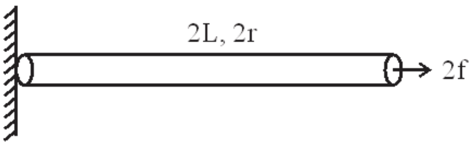



Solution:

$\frac{f}{\pi r^2} = Y\frac{\ell}{L}$

$\frac{2f}{\pi (2r)^2} = Y\frac{\ell'}{2L}$

$\Rightarrow \frac{2}{1} = \frac{2\ell'}{\ell} \Rightarrow \ell' = \ell$




Q21. Answer: N/A

Solution: $B.S_1 = \frac{T_{1\,max}}{8 \times 10^{-7}} \Rightarrow T_{1\,max} = 8 \times 1.25 \times 100$

$= 1000$ N

$B.S_2 = \frac{T_{2\,max}}{4 \times 10^{-7}} \Rightarrow T_{2\,max} = 4 \times 1.25 \times 100$

$= 500\ N$

$m = \frac{500 - 100}{10} = 40\ Kg$

Q22. Answer: A

Solution: An elastic wire can be treated as a spring with

$k = \frac{YA}{\ell}$

$T = 2\pi\sqrt{\frac{m}{k}}$

$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}} = \frac{1}{2\pi}\sqrt{\frac{YA}{m\ell}}$

Q23. Answer: A

Solution: $Y = 7 \times 10^{10}\ N/m^2$

Strain $= \frac{0.04}{100}$

Energy $= \frac{1}{2}\left(\frac{YA}{l}\right)\Delta x^2$

Energy $= \frac{1}{2}YA\left(\frac{\Delta x}{l}\right)^2 \times l$

$\frac{E}{V} = \frac{1}{2} \times Y \times \text{strain}^2$

$= \frac{1}{2} \times 7 \times 10^{10} \times \frac{0.04 \times 0.04}{10^4} = 56 \times 10^2$

Q24. Answer: C

Solution: Assuming Hooke's law to be valid.

$T \propto (\Delta l)$

$T = k(\Delta l)$

Let, $l_0$ = natural length (original length)

$\Rightarrow T = k(l - l_0)$

so, $T_1 = k(l_1 - l_0)$ & $T_2 = k(l_2 - l_0)$

$\Rightarrow \frac{T_1}{T_2} = \frac{\ell_1 - \ell_0}{\ell_2 - \ell_0} \Rightarrow \ell_0 = \frac{T_2\ell_1 - T_1\ell_2}{T_2 - T_1}$

Q25. Answer: B

Solution: [Bulk Modulus = $\frac{\text{volumetric stress}}{\text{volumetric strain}}$]

$K = \frac{mg}{a\left(\frac{dV}{V}\right)}$

$\frac{dV}{V} = \frac{mg}{Ka}$ .....(i)

volume of sphere → $V = \frac{4}{3}\pi R^3$

Fractional change in volume

$\frac{dV}{V} = \frac{3dr}{r}$ ....(2)

U sing eq. (i) & (ii) $\frac{3dr}{r} = \frac{mg}{Ka}$

$\frac{dr}{r} = \frac{mg}{3Ka}$

Q26. Answer: D

Solution: $T = Y \times \frac{\Delta\ell}{\ell} \times \frac{\lambda d^2}{4}$

$T \propto d^2$

$\frac{T_2}{T_1} = \frac{d_2^2}{d_1^2}$

$T_1 = 500N \quad d_1 = 2cm \qquad d_2 = 4cm$

$$\frac{T_2}{500} = \frac{4^2}{2^2}$$

$T_2 = 2000\ N$

Q27. Answer: D

Solution: $(\ell_A)_f - (\ell_B)_f = \ell_A - \ell_B$

$\ell_A(1 + \alpha_A \Delta T) - \ell_B(1 + \alpha_B \Delta T) = \ell_A - \ell_B$

$\ell_A \alpha_A \Delta T - \ell_B \alpha_B \Delta T = 0$

$$\frac{\ell_A}{\ell_B} = \frac{\alpha_B}{\alpha_A} = \frac{4}{1}$$

$\ell_A : \ell_B = 4 : 1$

Q28. Answer: B

Solution: $\gamma > 3\alpha$