PHYSICS

BOOKS - RESNICK AND HALLIDAY PHYSICS (HINGLISH)

ELASTICITY

Sample Problem

1. One end of a steel rod of radius R = 9.5 mm and length L = 81 cm is held in a vise. A force of magnitude F = 62 kN is then applied perpendicularly to the end face (uniformly across the area) at the other end, pulling directly away from the vise.

What are the stress on the rod and the elongation ΔL and strain of the rod ?

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2. A table has three legs that are 1.00 m in length and a fourth leg that is longer by d - 0.50 mm, so that the table wobbles slightly. A steel cylinder with mass M = 290 kg is placed on the table (which has a mass much less than M) so that all four legs are compressed but unbuckled and the table is level but no longer wobbles. The legs are wooden cylinders with cross - sectional area $A = 1.0 cm^2$, Young's modulus is $E = 1.3 \times 10^{10} N / m^2$. What are the magnitudes of the forces on the from the floor ?

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3. A smooth uniform string of natural length l, cross-sectional area A and Young's modulus Y is pulled along its length by a force F on a horizontal surface. Find the elastic potential energy stored in the string.

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4. A soild sphere is initially kept in open air, and the pressure exerted on it by air is $1.0 \times 10^5 N/m^2$ (atmospheric pressure). The sphere is lowered into the ocean to a depth where the pressure is 200 times the atmospheric pressure. The volume of the sphere in air is $0.5m^3$. What is the change in the volume once the sphere is submerged ? Given that bulk modulus is $6.1 \times 10^{10} N/m^2$.

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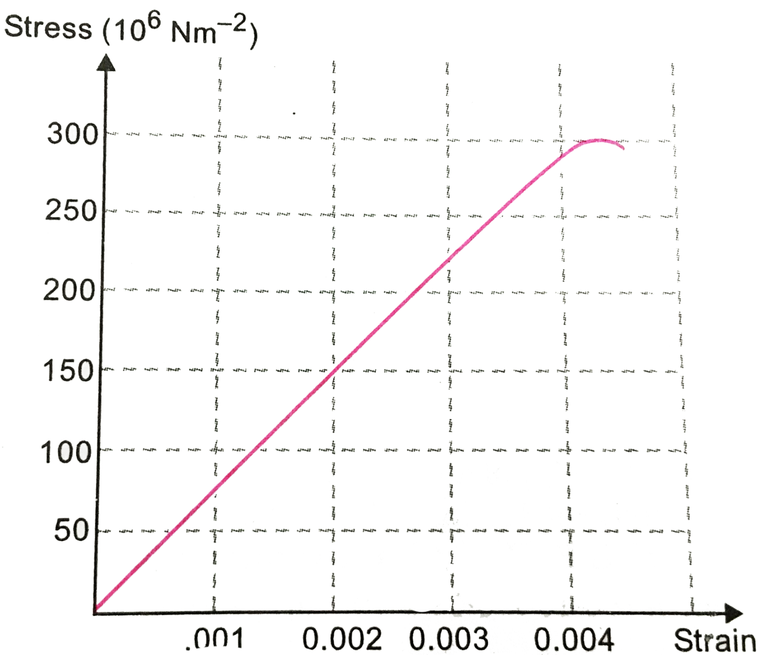
Problems

1. Fig., shows the stress-strain curve for a given materal. What are (a) Young's modulus and (b) approximate yield strength for this material?



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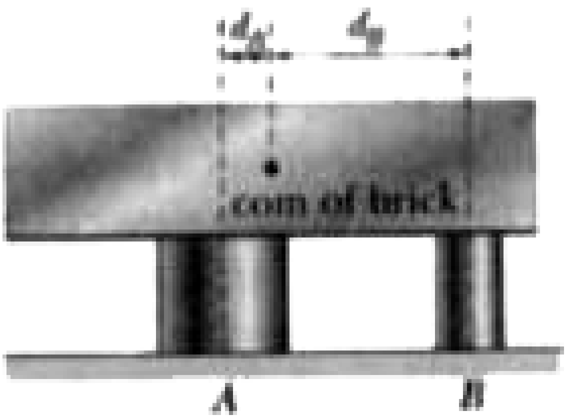
2. In Fig, a lead brick rests horizontally on cylinders A and B. The areas of the top faces of the cylinders are related by $A_A = 2.2A_B$, the Young's moduli of the cylinders are related by $E_A = 2.2E_B$. The cyclinders had identical lengths before the brick was placed on them. What fraction of the brick's mass is supported (a) by cylinder A and (b) by cylinder B ? The horizontal distances between the center of mass of the brick and the centerlines of the cylinders are d_A for cylinder A and d_B for cylinder B. (c) What is the ratio d_A / d_B ?



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3. A 1500 kg load is hung from the free end of a horizontal aluminum rod of length 7.0 cm, diameter 9.6 cm, and negligible mass. The other end of the rod is fixed in place. The shear modulus of aluminium is $3.0 \times 10^{10} N/m^2$. Find (a) the shear stress on the rod and (b) the vertical deflection of the rod's free end.

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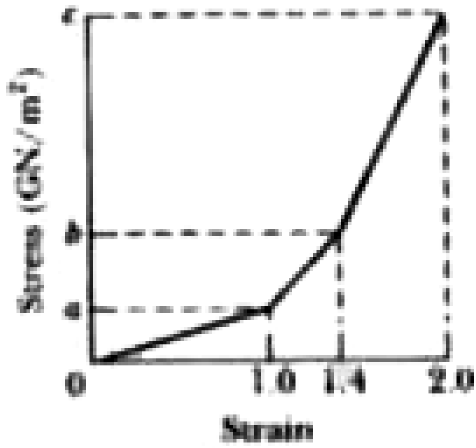
4. Figure shows an approximate plot of stress versus strain for a spider - web thread, out to the point of breaking at a strain of 2.00. The vertical axis scale is set by values $a = 0.10 GN/m^2$, $b = 0.30 GN/m^2$, and $c = 0.85 GN/m^2$. Assume that the thread has an initial length of 0.80 cm, an initial cross - sectional area of $8.0 \times 10^{-12} m^2$, and (during stretching) a constant volume. The strain on the thread is the ratio of the change in the thread's length to that initial length, and the stress on the thread's length to that initial length, and the stress on the thread is the ratio of the collision force to that initial cross - sectional area. Assume that the work done on the thread by the collision force is given by the area under the curve on the graph. Assume also that when the single thread snares a flying insect, the insect's kinetic energy is transferred to the strtching of the thread.

(a) I low much kinetic energy would put the thread on the veger of breaking ? What is the kinetic energy of (b) a fruit fly of mass 6.00 mg and speed 1.70 m/s and (c)a bumble bee of mass 0.388 g and speed 0.420 m/s ? Would (d) the fruit fly and (e) the bumble bee break the thread ?



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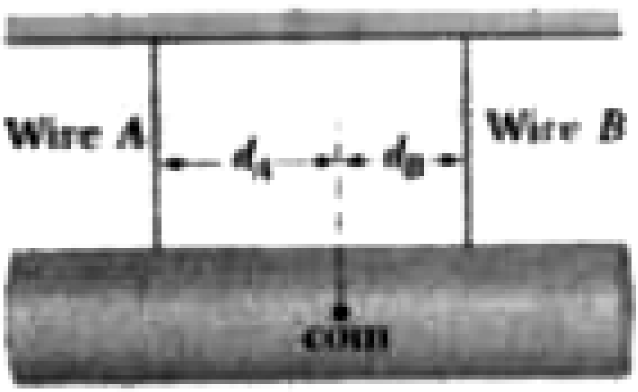
5. In Fig, a 103 kg uniform log hangs by two steel wires, A and B, both of raius 0.600 mm. Initially, wire A 2as 2.50 m long and 2.00 mm shorter than wire B. The log is now horizontal. What are the magnitudes of the forces on it from (a) wire A and (b) wire B ? (c) What is the ratio d_A / d_B ?



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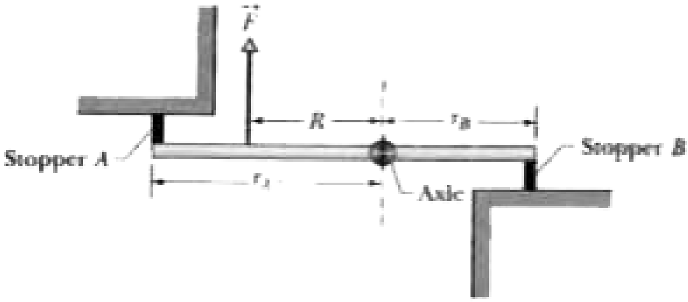
6. Figure is an overhead view of a rigid rod that turns about a vertical axle until the identical rubber stoppers A and B are forced against rigid walls at distances $r_A = 5.0cm$ and $r_B = 2.0cm$ from the axel. Initially the stoppers touch the walls without being compressed. Then force $\overrightarrow{F}$ of magnitude 150 N is applied perpendicular to the rod at a distance R = 5.0 cm from the axle. Find the magnitude of the force compressing (a) stopper A and (b) stopper B.



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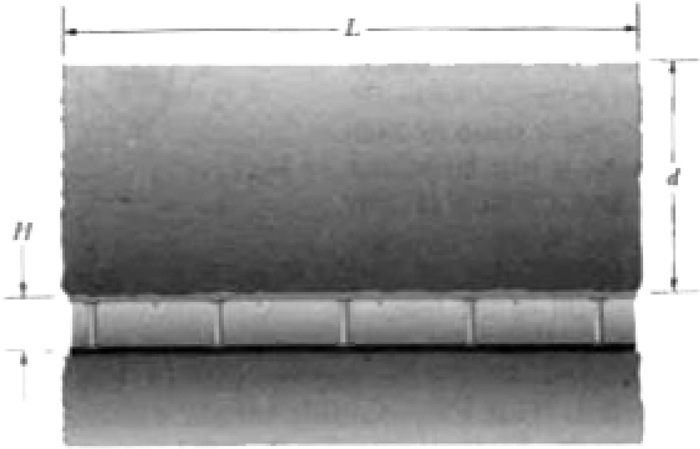
7. A tunnel of length L = 200 m, height H = 7.2 m, and width 6.3 m (with a flat roof) is to be constructed at distance d = 70 m beneath the ground. The tunnel roof is to be supported entirely by square steel columns, each with a cross - sectional area of $960cm^2$. The mass of $1.0cm^3$ of the ground material is 2.8 g.

(a) What is the total weight of the ground material the columns must support ?

(b) How many column are needed to keep the compressive stress on each column at one - half its ultimate strength ?



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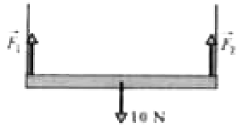
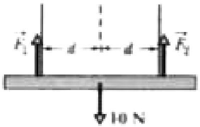
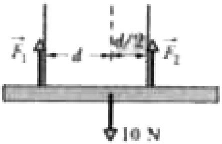
Checkpoint

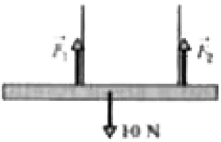
1. A horizontal uniform bar of weight 10 N is to hang from a ceiling by two wires that exert upward forces $\vec{F}_1$ and $\vec{F}_2$ on the bar. The figure shows four arrangements for the wires.

Which arrangements, if any, are indeterminate (so that we cannot solvet for numerical values of $\overrightarrow{F}_1$ and $\overrightarrow{F}_2$) ?

A. 

B. 

C. 

D. 

Answer: D

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Practice Questions

1. If a metal wire is stretched a little beyond its elastic limit (or yield point), and released, it will

A. lose its elastic property completely.

B. not contract.

C. contract, but its final length will be greater than its initial length.

D. contract only up to its length at the elastic limit.

Answer: C

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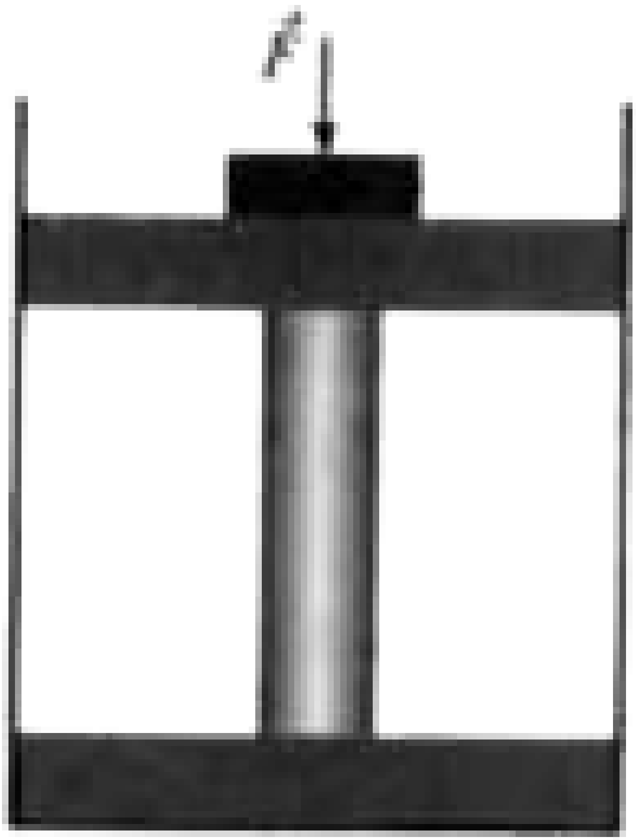
2. A cylinder with a diameter of 0.240 m is placed between the plates of a hydraulic press as illustrated in the figure. A force equal to 4.45×10^5 N is applied to the cylinder. What is the pressure on the end of the cylinder due to the applied force ?



A. 9.84×10^6 Pa

B. 3.13×10^5 Pa

C. 6.18×10^6 Pa

D. 5.34×10^5 Pa

Answer: A

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3. A wire elongates by l mm when a load W is hanged from it. It the wire goes over a pulley and two weights W each are hung at the two ends, the elongation of the wire (in mm) will be

A. $\frac{l}{2}$

B. l

C. 2l

D. zero

Answer: B

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4. A cable stretched by an amount d when it supports a crate of mass M. The cable is replaced by another cable of the same material having the same length and twice the diameter. If the same crate is supported by the thicker cable, by how much will the cable stretch ?

A. $\frac{d}{4}$

B. $\frac{d}{2}$

C. d

D. 2d

Answer: A

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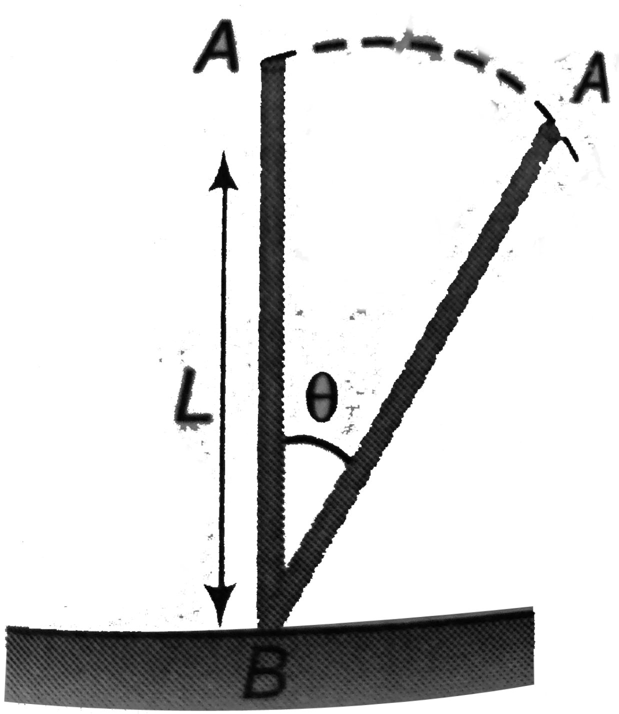
5.



A uniform rod of length L is free to rotate in a vertical plane about a fixed horizontal axis through B. The rod begins rotating from rest. The angular velocity ω at angle θ is given as

A. $\sqrt{\left(\frac{6g}{t}\right)\sin\frac{\theta}{2}}$

B. $\sqrt{\left(\frac{6g}{l}\right)\cos\frac{\theta}{2}}$

C. $\sqrt{\left(\frac{6g}{l}\right)}\sin\theta$

D. $\sqrt{\left(\frac{6g}{l}\right)}\cos\theta$

Answer: C

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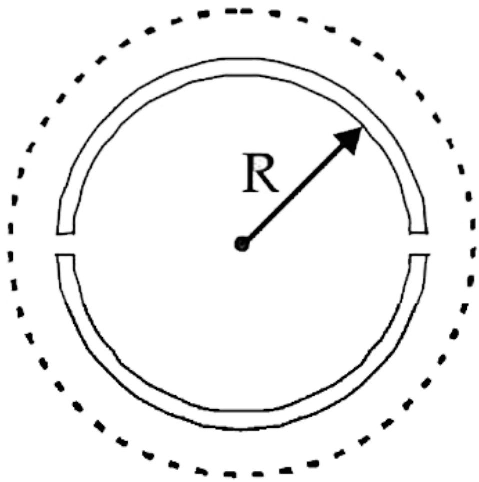
6. A wooden wheel of radius R is made of two semicircular part . The two parts are held together by a ring made of a metal strip of cross sectional area S and length L. L is slightly less than $2\pi R$. To fit the ring on the wheel, it is heated so that its temperature rises by $\Delta T$and it just steps over the wheel. As it cools down to surrounding temperature, it process the semicircle parts together. If the coefficient of linear expansion of the metal is α, and it Young's modulus is Y, the force that one part of the wheel applies on the other part is :



A. $2\pi SY\alpha\Delta T$

B. $SY\alpha\Delta T$

C. $\pi SY\alpha\Delta T$

D. $2SY\alpha\Delta T$

Answer: D

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7. A tow truck is pulling a car out of a ditch by means of steel cable that is 9.1 m long and has a radius of 0.50 cm. When the car just begins to move, the tension in the cable is 890 N. How much has the cable stretched ?

A. $2.6 \times 10^{-6} m$

B. $2.3 \times 10^{-2} m$

C. $1.7 \times 10^{-4} m$

D. $5.2 \times 10^{-4} m$

Answer: D

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8. A rubber cube of side $5cm$ has one side fixed while a tangential force equal to $1800N$ is applied to opposite face. Find the shearing strain and the lateral displacement of the strained face. Modulus of rigidity for rubber is $2.4 \times 10^6 N / m^2$.

A. 0.2160 m

B. 0.0802 m

C. 0.1093 m

D. 0.0147 m

Answer: D

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9. A steel wire of length 20 cm and cross - section $1mm^2$ is tied rigidly at both ends at room temperature $30^\circ C$. If the temperature falls $10^\circ C$, what will be the change in tension ? Given that $Y = 2 \times 10^{11} N/m^2$ and $\alpha = 1.1 \times 10^{-5} /^\circ C$

A. 2.2 N

B. 4.4 N

C. 22 N

D. 44 N

Answer: C

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10. When subjected to a force of compression, the length of a bone decreases by $2.7 \times 10^{-5} m$. When this same bone is subjected to a tensile force of the same magnitude, by how much does it stretch ?

A. $4.6 \times 10^{-5} m$

B. $1.6 \times 10^{-5} m$

C. $3.1 \times 10^{-5} m$

D. $2.0 \times 10^{-5} m$

Answer: B

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11. A uniform rod of mass m. length L, area of cross- sectich A is rotated about an axis passing through one of its ends and perpendicular to its length with constant angular velocity o in a horizontal plane If Y is the Young's modulus of the material of rod, the increase in its length due to rotation of rod is

A. $\frac{m\omega^2 L^2}{AY}$

B. $\frac{m\omega^2 L^2}{2AY}$

C. $\frac{m\omega^2 L^2}{3AY}$

D. $\frac{2m\omega^2 L^2}{AY}$

Answer: B

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12. Between each pair of vertebrae in the spinal column is a cylindrical disc of cartilage. Typically, this disc has a radius of about $3.0 \times 10^{-2} m$ and a thickness of about $7.0 \times 10^{-3} m$. The shear modulus of cartilage is $1.2 \times 10^{7} N/m^{2}$. Suppose a shearing force of magnitude 11 N is applied parallel to the top surface of the disc while the bottom surface remains fixed in place. How far does the top surface move relative to the bottom surface ?

A. $2.0 \times 10^{-5} m$

B. $4.1 \times 10^{-5} m$

C. $2.3 \times 10^{-6} m$

D. $3.5 \times 10^{-6} m$

Answer: C

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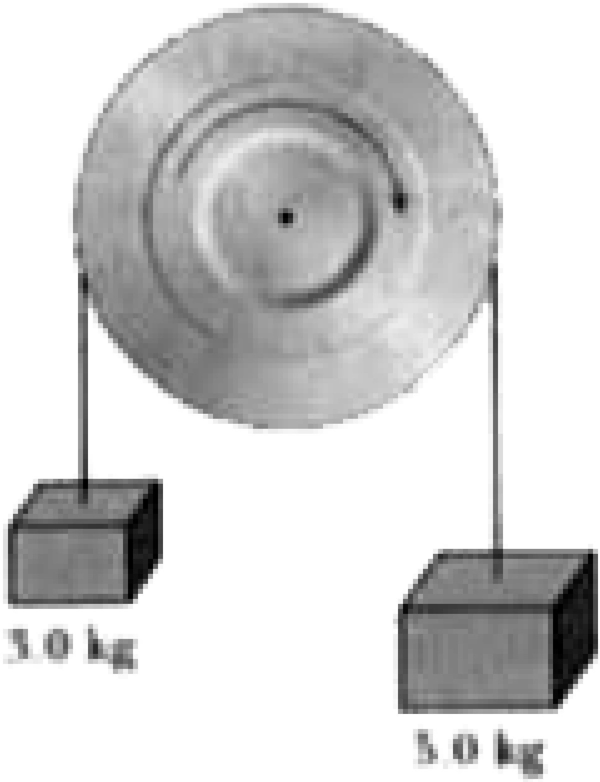
13. The figure shows two creates that are connected by a steel wire that passes over a pulley. The unstretched length of the wire is 1.5 m, and its cross - sectional area is $1.3 \times 10^{-5} m^2$. The pulley is frictionless and massless. When the crates are accelerating, determine the change in length of the wire.

Ignore the mass of the wire.



A. $4.3 \times 10^{-5} m$

B. $3.2 \times 10^{-5} m$

C. $2.1 \times 10^{-5} m$

D. $2.5 \times 10^{-6} m$

Answer: C

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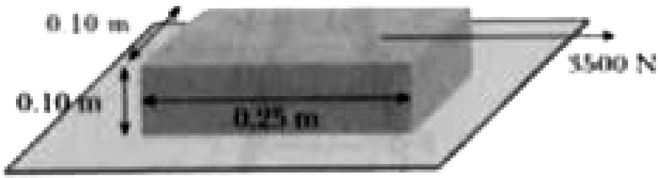
14. The brick shown in the figure is glued to the floor. A 3500 N force is applied to the top surface of the brick as shown. If the brick has a shear modulus of $5.4 \times 10^9 N/m^2$, how far to the right does the top face move relative to the stationary bottom face



A. $5.8 \times 10^{-6} m$

B. $2.6 \times 10^{-6} m$

C. $1.1 \times 10^{-6} m$

D. $6.5 \times 10^{-6} m$

Answer: B

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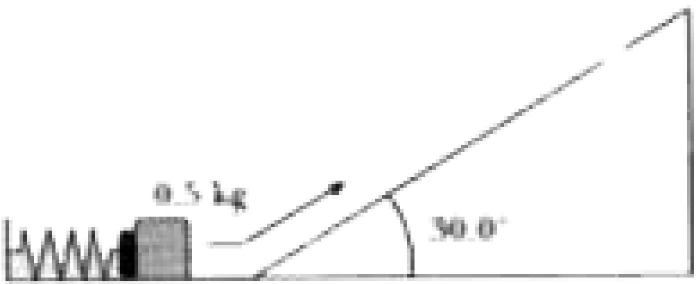
15. A spring with constant k = 78 N/m is at the base of a frictionless, 30.0° inclined plane. A 0.50 kg block is pressed against the spring, compressing it 0.20 m from its equilibrium position. The block is then released. If the block is not attached to the spring, how far up the incline will it travel before it stops ?



A. 0.080 m

B. 0.16 m

C. 0.32m

D. 0.64m

Answer: D

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16. The maximum compressional stress that a bone can withstand is $1.6 \times 10^{8} N / m^{2}$ before it breaks. A thighbone (femur), which is the largest and longest bone in the human body, has a cross - sectional area of $7.7 \times 10^{-4} m^{2}$. What is the maximum compressional force that can be applied to the thighbone ?

A. $2.1 \times 10^{11} N$

B. $1.2 \times 10^{5} N$

C. $4.8 \times 10^{12} N$

D. $3.0 \times 10^{3} N$

Answer: B

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17. The shear modulus of steel is $8.1 \times 10^{10} N/m^2$. A steel nail of radius $7.5 \times 10^{-4} m$ projects 0.040 m horizontally outward from a wall. A man hangs a wet raincoat of weight 28.5 N from the end of the nail.Assuming the wall holds its end of the nail, what is the vertical deflection of the other end of the nail ?

A. $1.8 \times 10^{-3} m$

B. $3.3 \times 10^{-2} m$

C. $7.9 \times 10^{-6} m$

D. $4.2 \times 10^{-4} m$

Answer: C

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18. A gymnast does a one - arm handstand. The humerus, which is the upper arm bone between the elbow and the shoulder joint, may be approximated as a 0.30 - m - long cylinder with an outer radius of $1.0 \times 10^{-2} m$ and a hollow inner core with a radius of $4.0 \times 10^{-3} m$. Excluding the arm, the mass of the gymnast is 63 kg. What is the compressional strain of the humerus ?

A. 4.9×10^{-4}

B. 3.5×10^{-4}

C. 2.5×10^{-4}

D. 6.4×10^{-4}

Answer: C

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19. A solid brass sphere is subjected to a pressure of 1.0×10^5 Pa due to the Earth's atmosphere. On Venus the pressure due to the atmosphere is 9.0×10^6 Pa. By what fraction $\Delta r / r_0$ (including the algebraic sign) does the radius of the sphere change when it is exposed to the atmosphere on Venus ? Assume that the change in radius is very small relative to the initial radius.

A. -4.4×10^{-5}

B. -4.4×10^{-6}

C. $+5.4 \times 10^{-5}$

D. -6.2×10^{-4}

Answer: A

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20. A cylindrically shaped piece of collagen (a substance found in the body in connective tissue) is being stretched by a force that increases from 0 to $3.0 \times 10^{-2} N$. The length and radius of the collagen are, respectively, 2.5 and 0.091 cm, and Young's modulus is $3.1 \times 10^6 N/m^2$. If the strtching obeys Hooke's law, what is the spring constant k for collagen ?

A. $3.5 \times 10^3 N/m$

B. $1.0 \times 10^3 N/m$

C. $3.2 \times 10^2 N/m$

D. $6.4 \times 10^2 N/m$

Answer: C

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21. One end of a piano wire is wrapped around a cylindrical tuing peg and the other end is fixed in place. The tuning peg is turned so as to stretch the wire. The piano wire is made from steel $(Y = 2.0 \times 10^{11} N/m^2)$. It has a radius of 0.80 mm, and an unstrained length of 0.76 m. The radius of the tuning peg is 1.8 mm. Initially, there is not tension in the wire. Find the tension in the wire when the tuning peg its turned through two revolutions.

A. 15,000 N

B. 12,000 N

C. 9200 N

D. 6100 N

Answer: B

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Practice Questions More Than One Correct Choice Type

1. If σ is the breaking stress of a material of density ρ, then the length of the wire of that material that can hang freely without breaking is

A. $\frac{\sigma}{\rho g}$

B. $\frac{\sigma}{2\rho g}$

C. $\frac{2\sigma}{\rho g}$

D. $\frac{\rho}{2\sigma g}$

Answer: A::C

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2. A uniform wire of radius r and length L hanging vertically and fixed at its upper ends, is attached to a weight at its lower end. If Young's modulus for the material of the wire is Y, the extension is

A. inversely proportional to Y.

B. inversely proportional to r^2.

C. directly proportional to L.

D. inversely proportional to r.

Answer: A::B::C

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3. A block is falling in a lake at a depth of 100 m shows 0.2% decrease in its volume at the bottom. What is the bulk modulus of the block ?

A. $4.9 \times 10^{-7} dyn/mm^2$

B. $4.9 \times 10^{8} N/m^2$

C. $4.9 \times 10^{8} dyn/cm^2$

D. $4.9 \times 10^{12} N/cm^2$

Answer: B

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4. The pressure increases by $1.0 \times 10^4 N/m^2$ for every meter of depth beneath the surface of the ocean. At what depth does the volume of a Pyrex glass cube of edge length $1.0 \times 10^{-2} m$ at the ocean's surface decrease by $1.0 \times 10^{-10} m^3$? Bulk modulus of Pyrex glass is $2.6 \times 10^{10} N/m^3$

A. 10.24×10^3 inch

B. 260 m

C. 853 feet

D. 0.161 mile

Answer: A::B::C::D

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5. For the different materials it is given that $Y_1 > Y_2$ and $B_1 < B_2$. Here, Y is Young's modulus of elasticity and B, the Bulk modulus of elasticity. Then we can conclude that

A. 1 is more ductile.

B. 2 is more ductile.

C. 1 is more malleable.

D. 2 is more malleable.

Answer: B::C

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6. Choose the correct statement from the following :

A. Elastic forces are always conservative.

B. Elastic forces are not always conservative.

C. Elastic force are conservative only when Hooke's is obeyed.

D. Elastic forces may be conservative even when Hooke's law is not obeyed.

Answer: B::D

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7. For an ideal liquid :

A. the shear modulus is infinite.

B. the shear modulus is zero

C. the bulk modulus is zero.

D. the bulk modulus is infinite.

Answer: B::D

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8. A copper and a steel wire of the same diameter are connected end to end. A deforming force F is applied to this composite wire, which causes a total elongation of 1 cm. The two wires will have

A. the same stress

B. different stress

C. same strain

D. different strain

Answer: A::D

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Practice Questions Linked Comprehension

1. A $5.0 \times 10^2 N$ object is hung from the end of a cross - sectional area $0.010cm^2$. The wire stretches from its original length of 200.00 cm to 200.50 cm.

What is the stress on the wire ?

A. $5.0 \times 10^2 N / m^2$

B. $1.0 \times 10^6 N / m^2$

C. $1.0 \times 10^8 N / m^2$

D. $5.0 \times 10^8 N / m^2$

Answer: D

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2. A $5.0 \times 10^2 N$ object is hung from the end of a cross - sectional area $0.010 cm^2$. The wire stretches from its original length of 200.00 cm to 200.50 cm.

What is the elongation strain on the wire ?

A. 1.0×10^2

B. 1.0×10^{-2}

C. 5.0×10^2

D. 2.5×10^{-3}

Answer: D

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3. A $5.0 \times 10^2 N$ object is hung from the end of a cross - sectional area $0.010 cm^2$. The wire stretches from its original length of 200.00 cm to 200.50 cm.

Determine the Young's modulud of the wire :

A. $1.0 \times 10^{11} N / m^2$

B. $1.0 \times 10^{9} N / m^2$

C. $2.0 \times 10^{11} N / m^2$

D. $2.0 \times 10^{9} N / m^2$

Answer: C

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4. Using Searle's apparatus while determining the Young's modulus of a wire, a girl is taking measurements of different parameters : Length of the wire, L, is 30 cm, which is measured with a millimeter scale , diameter of the wire, d, is 1 mm, which is measured with a screw gauge. (Least count of the screw gause is 0.01 mm, least count of the spherometer attached to the apparatus frame is 0.005 mm, spherometer attached to the apparatus frame is 0.005 mm , spherometer measured the extension e of the wire , W is the weight of the loads.)

The parameter that should be measured more carefully is

A. load on the hanger

B. length of the wire

C. diameter of the wire

D. extension of the wire

Answer: B

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The load versus extension graph should be (if the extension is in elastic limit)

A. straight line

B. curved line

C. broken line

D. any of the above

Answer: D

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The maximum fractional error in the measurement of Y is

A. $\frac{\Delta W}{W}+\frac{\Delta L}{L}+\frac{\Delta d}{d}+\frac{\Delta l}{l}$

B. $\frac{\Delta W}{W}+\frac{\Delta L}{L}-\frac{2\Delta d}{d}+\frac{\Delta}{l}$

C. $\frac{\Delta W}{W}+\frac{\Delta L}{L}+\frac{2\Delta d}{d}+\frac{\Delta l}{l}$

D. $\frac{\Delta W}{W}-\frac{\Delta L}{L}+\frac{\Delta d}{d}+\frac{\Delta l}{l}$

Answer: C

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Practice Questions Matrix Match

1. Match the statement in Column I with the statements in Column II. One or more than one choice from Column II can match with a statement from Column I.

	Column I		Column II
(a)	If the wire is pulled at its ends by equal and opposite forces of magnitude F so that it undergoes an elongation x, according to Hooke's law, F=-kx, where k is the force constant, Force constant (k) of the wire will depend on	(p)	Young's modulus (Y)
(b)	Let us suspend the wire vertically from a rigid support and attach a mass m at its lower end. If the mass is slightly pulled down and released, it executes SHM of a time period that will depend on	(q)	elongation (x)
(c)	If the given wire is fixed between two rigid supports and its temperature is decreased, then the thermal stress that develops in the wire will depend on	(r)	length (l)
(d)	Work done in stretching the wire to a length $l + x$ will depend on	(s)	area of cross-section (a)

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2. Match the statement in Column I with the statements in Column II. One or more than one choice from Column II can match with a statement from Column I.

	Column I		Column II
(a)	Young's modulus	(p)	$\frac{-\Delta V}{\rho V}$
(b)	Bulk modulus	(q)	$\frac{Fl}{A \Delta l}$
(c)	Compressibility	(r)	$\frac{-\Delta d/d}{\Delta Dl/l}$
(d)	Poisson's ratio	(s)	$\frac{-\rho V}{\Delta V}$

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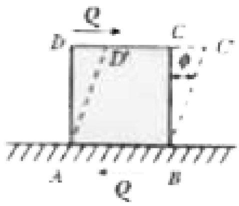
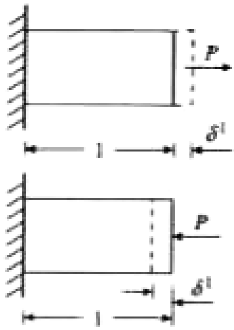
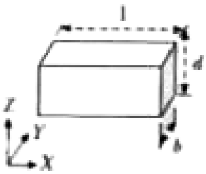
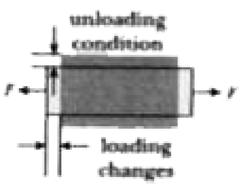
3. In the given table, Young's modulus, bulk modulus, and shear modulus of some materials are listed in Columns I, II and III, respectively.

Column I	Column II	Column III
(I) The ratio of the change in length of the body due to the deformation to its original length in the direction of the force.	(i) 	(J) Distortion in action

Column I	Column II	Column III
(II) The ratio of the change in volume of the body to the deformation to its original volume.	(ii) 	(K) Dilatation
(III) The ratio of the change in length (breadth of a rectangular bar or diameter of a circular bar) of the body due to the deformation to its original length (breadth of a rectangular bar or diameter of a circular bar) in the direction perpendicular to the force.	(iii) 	(L) Tensile or compressive strain
(IV) Strain accompanying a shearing action.	(iv) 	(M) Axial strain

The correct combination that defines the characteristics of linear strain is

A. (I) (iii) (L)

B. (IV) (i) (M)

C. (II) (iv) (K)

D. (I) (ii) (L)

Answer:

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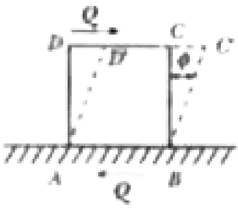
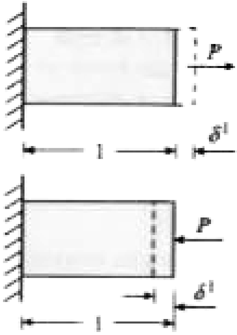
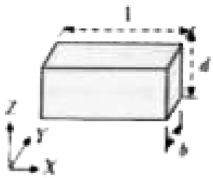
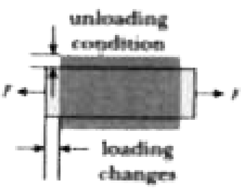
4. In the given table, Young's modulus, bulk modulus, and shear modulus of some materials are listed in Columns I, II and III, respectively.

Column I	Column II	Column III
(I) The ratio of the change in length of the body due to the deformation to its original length in the direction of the force.	(i) 	(J) Distortion in action

Column I	Column II	Column III
(II) The ratio of the change in volume of the body to the deformation to its original volume.	(ii) 	(K) Dilatation
(III) The ratio of the change in length (breadth of a rectangular bar or diameter of a circular bar) of the body due to the deformation to its original length (breadth of a rectangular bar or diameter of a circular bar) in the direction perpendicular to the force.	(iii) 	(L) Tensile or compressive strain
(IV) Strain accompanying a shearing action.	(iv) 	(M) Axial strain

The correct combination that defines the characteristics of lateral strain is

A. (III) (ii) (L)

B. (III) (iv) (M)

C. (II) (iii) (K)

D. (I) (i) (M)

Answer:

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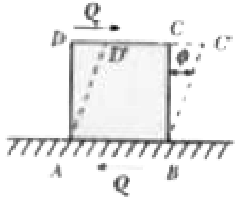
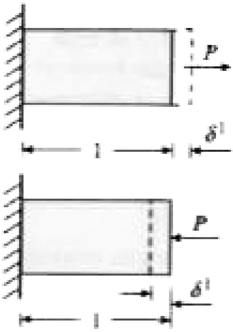
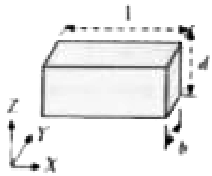
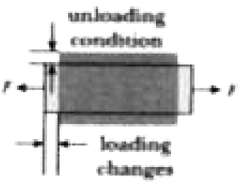
5. In the given table, Young's modulus, bulk modulus, and shear modulus of some materials are listed in Columns I, II and III, respectively.

Column I	Column II	Column III
(I) The ratio of the change in length of the body due to the deformation to its original length in the direction of the force.	**(i)** 	**(J)** Distortion in action

Column I	Column II	Column III
(II) The ratio of the change in volume of the body to the deformation to its original volume.	(ii) 	(K) Dilatation
(III) The ratio of the change in length (breadth of a rectangular bar or diameter of a circular bar) of the body due to the deformation to its original length (breadth of a rectangular bar or diameter of a circular bar) in the direction perpendicular to the force.	(iii) 	(L) Tensile or compressive strain
(IV) Strain accompanying a shearing action.	(iv) 	(M) Axial strain

The correct combination that defines the characteristics volumetric strain is

A. (II) (iii) (K)

B. (I) (i) (K)

C. (III) (iii) (L)

D. (I) (ii) (L)

Answer:

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Practice Questions Integer Type

1. The Leaning Tower of Pisa is 59.1 m high and 7.44 m in diameter. The top of the tower is displaced 4.01 m from the vertical. Treat the tower as a uniform, circulary cylinder. What additional displacement (in m), measured at the top, would bring the tower to the verge of toppling ?

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2. A cylindrical aluminium rod, with an initial length of 0.8000 m and radius 1000.0 μm, is clamped in place at one end and then stretched by a machine pulling parallel to its length at its other end. Assuming that the rod's density (mass per unit volume) does not change, find the force magnitude that is required of the machine to decrease the radius to $999.9 \mu m$ (The yield strength is not exceeded, $E_{\text{aluminium}} = 70 \times 10^9 N/m^2$).

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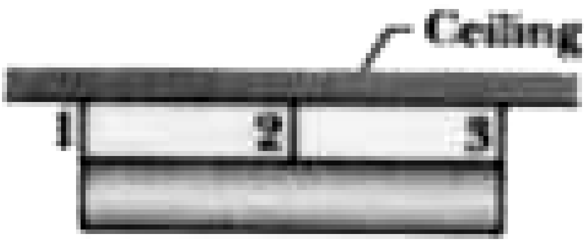
3. Figure shows a 300 kg cylinder that is horizontal. Three steel wires support the cylinder from a ceiling. Wires 1 and 3 are attached at the ends of the cylinder, and wire 2 is attached at the center. The wires each have a cross - sectional area of $2.00 \times 10^{-6} m^2$. Initially (before the cylinder was put in place), wires 1 and 3 were 2.0000 m long and wire 2 was 6.00 mm longer than that. Now (with the cylinder in place), all three wires have been stretched. What is the tension in wire 1 (kN) ? $\left(E_{\text{steel}} = 200 \times 10^9 N / m^2\right)$



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