Physics Problem Set 6 - due Mon. May 9 by 6pm (8983576)

Question 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1. Question Details OSColPhys1 5.P.047.WA. [2613400]

Cable A has a radius of 3.48×10^{-3} m while cable B has a radius of 4.90×10^{-3} m. A stretching force of 285 N is applied to cable A. Determine the force that will produce the same stress on cable B as on cable A.

565 N

Supporting Materials

Physical Constants

2. Question Details OSColPhys1 5.P.034.WA. [2613389]

Calculate the force a piano tuner applies to stretch a steel piano wire 8.60 mm, if the wire is originally 0.800 mm in diameter and 1.30 m long. Young's modulus for steel is 210×10^9 N/m^2.

698 N

Supporting Materials

Physical Constants

3. Question Details OSColPhys1 5.P.036.WA. [3081304]

Steel beams are used for load bearing supports in a building. Each beam is 4.0 m long with a cross-sectional area of 7.3×10^{-3} m^2 and supports a load of 5.9×10^4 N. Young's modulus for steel is 210×10^9 N/m^2.

(a) How much compression does each beam undergo along its length?

0.154 mm

(b) Determine the maximum load one of these beams can support without any structural failure if the compressive strength of steel is 1.50×10^8 N/m^2.

1.10e+06 N

Supporting Materials

Physical Constants

4. Question Details OSColPhys1 5.P.037.WA. [2613406]

During a circus act, one performer swings upside down hanging from a trapeze holding another, also upside down, performer by the legs. If the upward force on the lower performer is three times her weight, how much does each of the bones (the femurs) in her upper legs stretch? You may assume each is equivalent to a uniform rod 35.0 cm long and 1.80 cm in radius. Her mass is 59.0 kg. Assume Young's modulus for bone under tension is 16×10^9 N/m^2.

[ ] 1.86e-05 m

Supporting Materials

Physical Constants

5. Question Details OSColPhys1 5.P.039.WA. [2613432]

A tungsten rod and a brass rod have the same length and diameter and are subjected to the same force. If the tungsten rod stretches by 2.80×10^{-6} m, by what amount will the brass rod stretch? Young's modulus for tungsten = 3.60×10^{11} N/m^2; for brass = 9.00×10^{10} N/m^2.

[ ] 1.12e-05 m

Supporting Materials

Physical Constants

6. Question Details OSColPhys1 5.P.042.WA. [2613392]

A 92-kg climber mountain climber stretches her 0.9-cm diameter nylon rope by 1.6 m when she hangs below a rock outcropping. If the original length of the rope is 55 m, what is its Young's modulus?

[ ] 4.87e+08 N/m^2

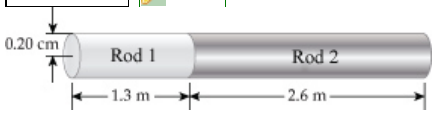
Supporting Materials

Physical Constants

7. Question Details OSColPhys1 5.P.043.Tutorial.WA. [2632679]

A rod has a 1.3-m-long section that is cast iron and a 2.6-m-long section that is aluminum as shown in the diagram below. The diameter of the cylindrical rod is 0.40 cm. $Y_{\text{cast iron}} = 100 \times 10^{10}$ N/m^2 and $Y_{\text{aluminum}} = 7 \times 10^{10}$ N/m^2. How much elongation is produced in the rod when it is subjected to a force of 8.1×10^3 N?

[ ] 2.48 cm



Supporting Materials

Physical Constants

8. Question Details OSColPhys1 5.P.044.WA. [2613412]

An aluminum rod and a tungsten rod have the same length and diameter. They are joined end to end to produce one long rod of length $2L_0$. Determine the effective Young's modulus of this compound rod. The Young's modulus value for aluminum is 7.10×10^{10} N/m^2; for tungsten it is 4.10×10^{11} N/m^2.

[ ] 1.21e+11 N/m^2

Supporting Materials

Physical Constants

9. Question Details OSColPhys1 5.P.048.WA. [2613434]

A disk between vertebrae in the spine is subjected to a shearing force of 650 N. Find its shear deformation taking it to have the shear modulus of $1. \times 10^9$ N/m^2. The disk is equivalent to a solid cylinder 0.700 cm high and 3.60 cm in diameter.

[ ] 4.47e-06 m

Supporting Materials

Physical Constants

10. Question Details OSColPhys1 5.P.050.WA. [2613398]

A 19.0-m tall hollow aluminum flagpole is equivalent in strength to a solid cylinder of aluminum 6.00 cm in diameter. A strong wind bends the pole much as a horizontal force of 900 N exerted at the top would. How far to the side does the top of the pole flex? The shear modulus for aluminum is 25×10^9 N/m^2.

[ ] 0.242 mm

Supporting Materials

Physical Constants

11. Question Details OSColPhys1 5.P.051.WA. [2613413]

A group of teenage friends use a plank 14.0 cm wide and 2.00 cm thick to create a makeshift diving board. They fasten one end of the plank firmly to a cliff leaving 2.00 m of the plank jutting horizontally over the lake below the cliff. When a 77.8-kg boy stands at the edge of the plank, his weight causes that end to drop 4.91 cm. What is the shear modulus of the wooden plank?

[ ] 1.11e+07 N/m^2

Supporting Materials

Physical Constants

12. Question Details OSColPhys1 5.P.054.WA. [2613426]

The top and bottom surfaces of a metal block each have an area of A = 0.028 m^2, and the height of the block is d = 0.15 m. At the top surface of the block, a force F_1 is applied to the right, while at the bottom surface of the block, a force F_2 is applied to the left, causing a shear in the metal block. If $F_1 = F_2 = 32 \times 10^6$ N and the displacement between the two edges due to the shear is 1.30×10^{-3} m, what is the shear modulus of the metal?

[ ] 1.32e+11 N/m^2

Supporting Materials

Physical Constants

13. Question Details OSColPhys1 5.P.055.WA. [2613430]

The pressure on a volume of liquid V = 1.1 m^3 at the surface is approximately equal to the atmospheric pressure $P_{atm} = 1.00 \times 10^5$ N/m^2. If this volume of liquid is now placed at a depth where the pressure is $P = 2.05 \times 10^7$ N/m^2, what will be the change in volume of the liquid? The bulk modulus of the liquid is 7.0×10^{10} N/m^2. (Include the appropriate sign with your answer.)

[ ] -0.000321 m^3

Supporting Materials

Physical Constants

14. Question Details OSColPhys1 5.P.056.WA. [2613437]

A moonshiner makes the error of filling a glass jar to the brim and capping it tightly. The moonshine expands more than the glass when it warms up, in such a way that the volume increases by 0.3% (that is, $\Delta V/V_0 = 3. \times 10^{-3}$) relative to the space available.

(a) Calculate the force exerted by the moonshine per square centimeter if the bulk modulus is 1.6×10^9 N/m^2, assuming the jar does not break.

[ ] 480 N/cm^2

(b) How many atmospheres is this?

[ ] 48

(c) In view of your answer, do you think the jar survives?

- ○ Yes
- ○ No

Supporting Materials

Physical Constants

15. Question Details OSColPhys1 5.P.057.WA. [2613393]

When water freezes, its volume increases by 9.05% (that is, $\Delta V/V_0 = 9.05 \times 10^{-2}$). What force per unit area is water capable of exerting on a container when it freezes? (The bulk modulus of water is 2.2×10^9 N/m^2. Enter the magnitude only.)

N/m^2

Is it surprising that such forces can fracture engine blocks, boulders, and the like?

Supporting Materials

Physical Constants