Q1 - Answer = a

Q2 - Problem A - Last name A-K

A 75 cm long steel wire with diameter 0.5 mm is stretched by a force of 1500 N. If Young's modulus for steel is 200 GPa (200 x 10^9 Pa), how much does the wire stretch (in cm)?

A. 9.0

B. 0.7

C. 3 x 10^{-3}

D. **2.9**

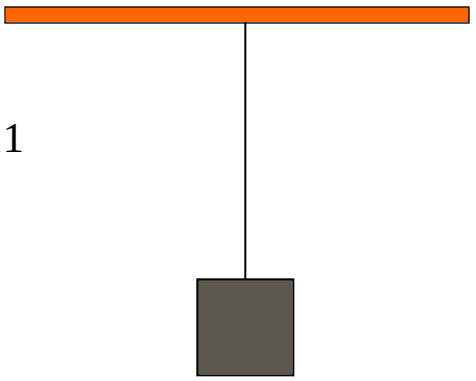
E. 1.25

$\Delta L/L = F/(\pi(d/2)^2)/Y =$

$1500/(\pi(0.25 \times 10^{-3})^2)/2 \times 10^{11}$

$= 0.038;$

$\Delta L = 0.038 \times 75 = 2.9$ cm



Q1 - Answer = a
Q2 - Problem B - Last Name L-Z

- How much force (in N) must be applied to a 1.5 m steel wire of 0.4 mm diameter to make its fractional length change by 2%? Take Y = 200 GPa (200 x 10^9 Pa) for the value of Young's modulus for steel.

A. 160 N

B. **500 N**

C. 5 x 10^4 N

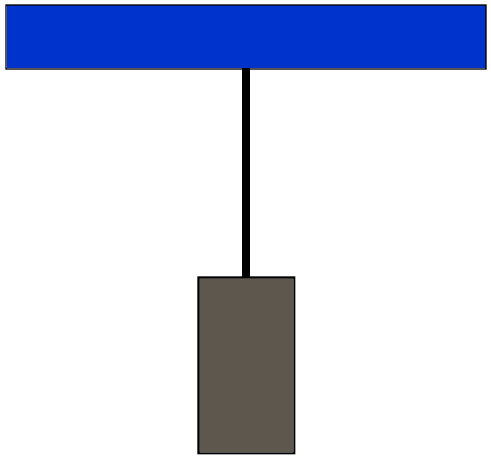
D. 2010 N

E. 2.5 x10^6 N

$F=\Delta L/L\ A\ Y$

$=0.02\ \pi(2x10^{-4})^2 2x10^{11}$

$=500$ N



Q1 - Answer = b

Q2 - Problem A - Last name A-K

The ultimate strength of human bone under compression is 150 MPa (1.5×10^8 Pa). Taking the effective area of the femur to be 3.0 cm^2, what force is required to crush it?

A. 4.5×10^4 N

B. 4.5×10^8 N

C. 1.4×10^4 N

D. 1.1×10^9 N

E. 3.1×10^3 N

$F = F/A \times A = 1.5 \times 10^8 \times 3 \times 10^{-4}$

$= 4.5 \times 10^4$ N

Q1 - Answer = b
Q2 - Problem B - Last Name L-Z

- A weight lifter holds a weight overhead with both arms. If the total effective bone area in both arms is 2.5 cm^2 and if the ultimate strength of bone is 1.1 $x10^8$ Pa, how much weight (in N) can he support before his arms are crushed?

A. 2.7 x 10^8 N

B. 1.3 x 10^3 N

C. 5.4 x 10^4 N

D. 8.6 x 10^4 N

E. **2.8 x 10^4 N**

$F = F/A \times A = 1.1x10^8x2.5x10^{-4}$

$=2.8 \times 10^4$ N

Q1 - Answer = c

Q2 - Problem A - Last name A-K

A 1.5 m long steel wire with diameter 0.5 mm is stretched by a force of 500 N. If Young's modulus for steel is 200 GPa (200 x 10^9 Pa), how much does the wire stretch?

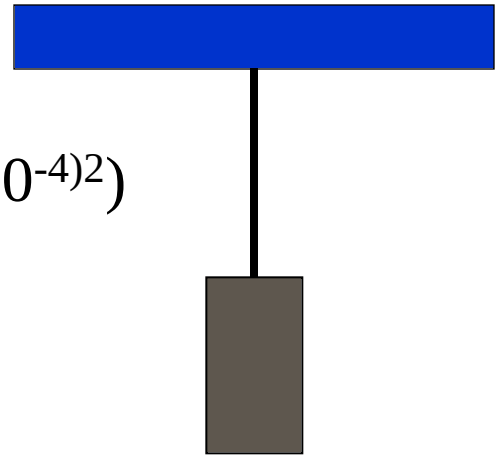
A. 0.9 cm $\Delta L = L/Y \; F/A$

B. 1.3 cm $= 150/2x10^{11}500/(\pi(2.5x10^{-4})^2)$

C. **1.9 cm** $= 1.9$ cm

D. 52 cm

E. 17 cm



Q1 - Answer = c
Q2 - Problem B - Last Name L-Z

- How much force must be applied to a 2 m steel wire of 0.6 mm diameter to make its length change by 3%? Take Y = 200 GPa (200 x 10^9 Pa) for the value of Young's modulus for steel.

A. 850 N

B. 6.8 x 10^4 N

C. 3.4 x 10^3 N

D. **1.7 x 10^3 N**

E. 540 N

$$F = \Delta L/L \times A \times Y$$

$$= (0.03)\pi(3 \times 10^{-4})^2 2 \times 10^{11}$$

$$= 1.7 \times 10^3 \text{ N}$$