# Stress, Strain and Hooke's Law Problem Set

*You will need to SHOW ALL WORK. Useful constants that you will need to know are in a table below. (assume given constants have 3 SF's). Please also note the relationships we've just discussed given below.*

| Material | Young's Modules, E (Pa) |
|---|---|
| Steel | $200 \times 10^9$ |
| Cast Iron | $100 \times 10^9$ |
| Concrete | $20.0 \times 10^9$ |

$$F = m * a \qquad \sigma = \frac{F}{A} \qquad \varepsilon = \frac{\Delta l}{l_0} \qquad \sigma = E * \varepsilon \qquad F = -k * \Delta x$$

1. A 3340 N ball is supported vertically by a 1.90 cm diameter steel cable. Assuming the cable has a length of 10.3 m, determine the stress and the strain in the cable.

2. Consider an iron rod with a cross-sectional area of 3.81 $cm^2$ that has a force of 66,700 N applied to it. Find the stress in the rod.

3. A concrete post with a 50.8 cm diameter is supporting a compressive load of 8910 Newtons. Determine the stress the post is bearing.

4. The concrete post in the previous problem has an initial height of 0.55 m. How much shorter is the post once the load is applied (in mm)?

5. A construction crane with a 1.90 cm diameter cable has a maximum functioning stress of 138 MPa. Find the maximum load that the crane can endure.

6. Consider Hooke's Law as a simple proportionality where F is directly proportional to delta x. Therefore, we know the force stretching a spring is directly proportional to the distance the spring stretches. If 223 N stretches a spring 12.7 cm, how much stretch can we expect to result from a of 534 N?

7. The figure below shows a column of fatty tissue, determine the strain in each of the three regions.