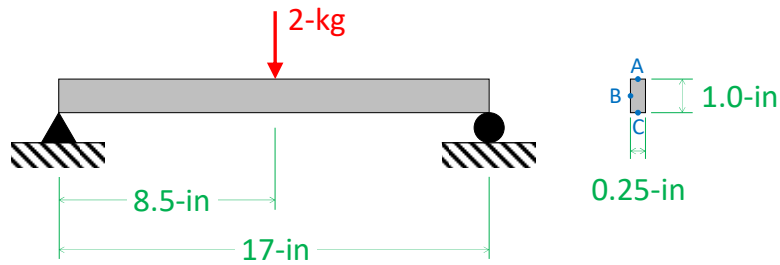**Figure 2 Rectangular Structural Member with 2-kg Load**

1.   Consider a structural member with rectangular cross-section and loaded as shown in Figure 2 and answer this question as an individual.  The strains measured at points A, B, and C would be:

   a.   Equal
   b.   The largest strain would be at A, next largest at B, and smallest at C
   c.   The largest strain would be at C, next largest at B, and smallest at A
   d.   The largest strain would be at B, next largest at A, and smallest at C

2.   After you have answered the question, partner up with 2 other cadets and compare your answers. Make sketches as necessary in the space below. You may change your answer to question 1.

3.   Using the beam testing apparatus set up in your classroom, measure the strains at points A, B, and C, for the beam loaded with 2-kg at mid-span. Record your measurements in Table 1.

**Table 1 Measured Strains: Rectangular Beam with 2-kg Load**

|  | Strain ($\mu\varepsilon = 10^{-6}$ in/in) |
|---|---|
| Point A (top of beam) | |
| Point B (middle of beam) | |
| Point C (bottom of beam) | |

4. As a class, do the following:
   a. Plot the measured strain values along the depth of the cross-section using the figure below.
   b. Use the measured strains to calculate the corresponding stresses at points A, B, and C and plot them along the depth of the cross-section using the figure below (HINT: remember Hooke's Law).
   c. Use the stress-distribution to calculate equivalent concentrated forces and plot them on the figure below (HINT: remember the basic definition of stress).

| Strain $\varepsilon$ | Stress $\sigma$ | Equivalent Force |
| --- | --- | --- |

**Figure 3 Strain and Stress Distributions Through the Beam Depth**

5.  As an individual, calculate the internal moment at mid-span and the associated maximum stress at mid-span. Use this calculated stress to predict the strains at A, B, and C for a 4-kg or 6-kg load in place of the 2-kg load. Record your predictions in Table 2.

**Table 2 Predicted Strains: Rectangular Beam with 4-kg or 6-kg Load (in με)**

|                          | _____-kg Load |
|--------------------------|----------------|
| Point A (top of beam)    |                |
| Point B (middle of beam) |                |
| Point C (bottom of beam) |                |

6.  Compare your predictions with your group members. You may change your predictions if you wish.

7.  Using the same beam testing apparatus, measure the strains at points A, B, and C, for the beam with the rectangular cross-section loaded with 4-kg at mid-span. Record your measurements in Table 3. Apply a 6-kg load at mid-span and record the strain measurements in Table 3. Compare to your predictions.

**Table 3 Measured Strains: Rectangular Beam with 4-kg or 6-kg Load (in με)**

|                          | _____-kg Load |
|--------------------------|----------------|
| Point A (top of beam)    |                |
| Point B (middle of beam) |                |
| Point C (bottom of beam) |                |