



The 3-point and 4-point bending tests are useful in studying the changes in bending moment and second moment of area in materials. While tensile, compressive and other forms of mechanical



### 3. Results:

<b>Material</b>	<b>Elastic Modulus</b>	<b>Flexural Stress and Strain</b>	<b>Bending Moment</b>	<b>Second Moment of Area</b>
<b>Example:</b> <b>PLA</b> <b>Cross-section area: XXX</b>				

## 4. Discussion:

*Question time!*

**Question 1:**

What was interesting about each sample? How do they compare to each other?

(Hints: deflection length, elastic modulus, brittle / ductile behaviour)

**Question 2:**

How does the different cross-section profiles effect the stiffness?

## 5. *Acknowledgements*

This project builds on the open source 3 point bending test platform created by Stefan Hermann of CNC kitchen. You can download the original files at the link below and check out his YouTube channel for some awesome material science videos relating to 3d printing!

Original files at: <https://www.thingiverse.com/thing:3142077>

<https://www.youtube.com/watch?v=te0Wwf7Dxi4&feature=youtu.be>

## Example for teachers:

*I-beams* are great for unidirectional loading parallel along the I direction. The flanges (horizontal section) resist bending moment while the web (vertical section) resists shear forces. The combination of both, overall, increases the stiffness of the beam. However, I-beams are weak against torsional forces (twisting). This makes I-beams great for horizontal loading.

*Hollow beams* (hollow rectangular / circular sections) have uniform geometry along 2 axes of the cross-section, allowing these beams to have high resistance to torsion. This makes hollow beams great as columns.

*Other shapes, I, C and T* are also used as supports in structures. With different geometries, the stress profile changes in these beams and they provide strengths in various applications. These shapes are more commonly observed in non-metal beams, i.e. composite and concrete.