Beam Modulus of Elasticity

In previous investigations you may have derived a proportionality to describe the deflection of a center-loaded rectangular beam supported on both ends as:
$$∆=\frac{FL^{3}}{4Ebh^{3}}$$

Where *∆* is the beam’s elastic, vertical displacement at mid-span, *F* is the load, *L* is the span length, *b* is the base, and *h* the height. The quantity "4E" may have been left as a single constant or not addressed at all. *E* is the modulus of elasticity which provides a relative sense of the stiffness of a material. In this activity you will be given beams made from a variety of materials and you will experimentally determine the modulus of elasticity for each material.

**MATERIALS**

Vernier data-collection interface
Data analysis software
Vernier Materials and Structures Tester
Rectangular beams made of different materials

**INVESTIGATION Design**

1. List (or describe if not known) the materials and rank them based on your best intuition (without testing) from most flexible to most stiff.

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| --- | --- |
| **Material** | **Ranking** |
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1. Determine your plan for data collection and carry out the investigation. Specify the experiment procedure below:
2. Transfer your predictions from the front of the document to this table and fill in the data for the remaining columns from your experiment.

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| --- | --- | --- | --- | --- |
| **Material** | **Predicted Ranking** | **Measured Modulus of Elasticity (E)** | **Published value for Modulus of Elasticity** | **Actual Ranking** |
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Prepare a short report to include the following:

1. Summarize your findings.
2. Were any of your findings contrary to your predictions? If so, discuss potential reasons or misconceptions. If not, summarize your approach to making your predictions and comment on your results.
3. Compare your values to the values listed in resources. Is the accuracy reasonable? What are the primary sources of error in this system? Defend or discuss your answer.
4. Predict the result of the following experiment:
	1. Fasten the samples (one at a time) to the counter with a clamp so that one end extended beyond the counter by 6 inches.
	2. Apply a downward force on the sample and release it so that it vibrates.
	3. Observe (with all senses possible) the resulting vibration.
	4. Construct a means of using technology to measure what you are observing. Can you create a model from your results?