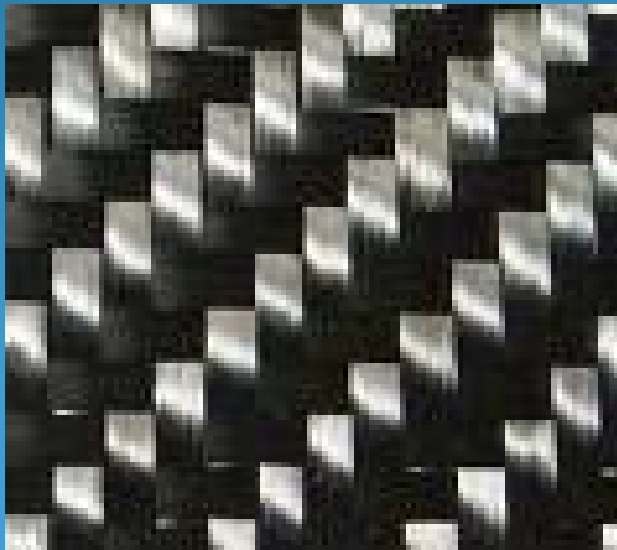


# Lesson Plan for Project #3: Stress and Strain in Composite Materials from a Mathematical and Scientific Standpoint!!!



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# Nobody wants this to happen!!





# Overview:

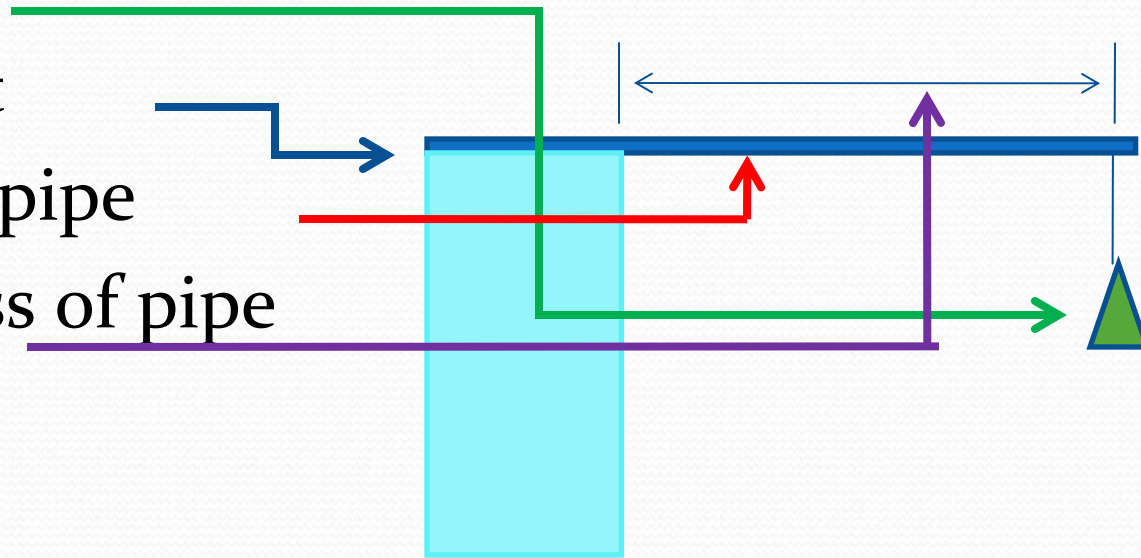
- A: Students develop skills for solving mathematical equations, gather and analyze information.
- C: What is engineering? Students identify the skills needed for a career in engineering and/or research. Understanding that sometimes answers are not known.
- S: How can an engineer help the world? Students identify how different engineering fields attempt to solve problems.



# Day 1: Beam Bending Experiment

***Engage:*** Bend that pipe!!!!

- What variables affect the displacement of a beam??
  - Weight
  - Size of pipe
  - Stiffness of pipe
  - Length



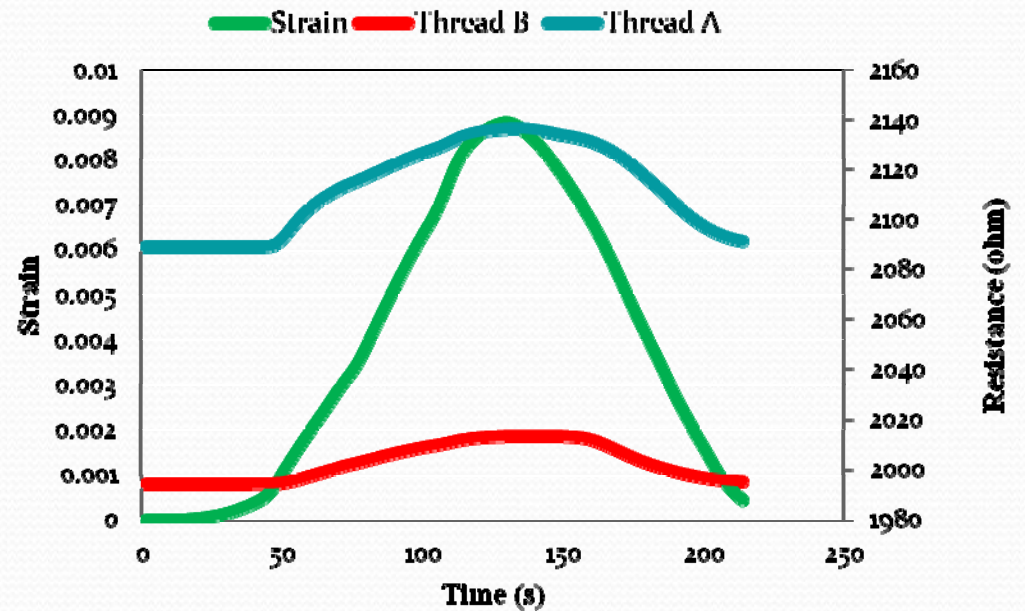
## Day 2: RET Project

**Engage:** RET project and the cool data I collected.

$$I = \frac{w * h^3}{12} \quad M = \frac{p * (l - a)}{4}$$

$$\varepsilon = \frac{M}{I * E} * y \quad \sigma = \frac{M}{I} * y$$

**Resistance, Strain vs. Time**  
(Sample XI, Test 5, Thread A, B)





# Day 3: Students' Experiment Day

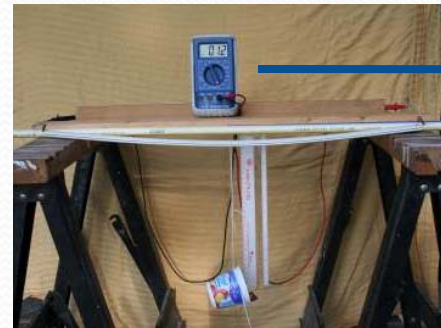
## *Engage:* Self-sensing threads



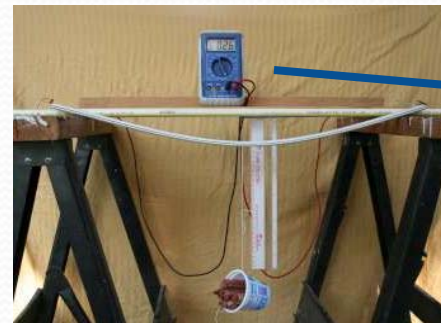
The sample has been glued and clamped



It has displacement as the weight is added.



Look at the change in the resistance! as the weight increased!!



# Assessment:

## Day 1: Beam Bending Experiment

Given a set of data, estimate a function that fits the data.

Using a spreadsheet or calculator, test the function for best fit. Short answers about algebra concepts.

## Day 2: RET Project

Part 1: Given equations, students will solve for a given variable. Trying to keep with the science concept, there will be problems from a science text.

Part 2: Students fill out a lab report with the start of the experiment.

## Day 3: Students' Experiment Day

Sheet filled out by students with experimental data will be collected. Since each group has different materials, they will compare data and find similarities. Using excel again, they will plot a graph of resistance and displacement versus time.



# Scientific Classroom Implementation

## ***Teacher: Day 1-2***

- Warm-up ? What holds us up? Describe how our support system works. (5 min)
- Open section with Bulldog Feud, to assess prior knowledge.
- Intro to the human skeleton PPT with coordinating worksheet

## ***Student: Day 1-2***

- Complete warm-up
- Compete for a prize with teams
- Fill in worksheet while going over chapter data



### ***Teacher: Day 3***

- Warm-up?; What chemicals are an important part of bone, (5 min)
- Begin Lab
- Assign research question:
- Research Osteoporosis: describe the process that occurs in the development of osteoporosis.
- Compare the structure of normal bone to the structure of osteoporotic bone. Describe how normal bone functions.
- Predict how osteoporotic changes will affect the function of bone under stress.

### ***Student: Day 3***

- Record initial data (mass, volume calc density} on bone,
- Put bone in vinegar
- Use microscope to view slides of bone, draw diagram of what is seen at 4x and 10x



### ***Teacher: Day 4***

- Warm-up?: What are stress and strain?
- Introduce the concept of stress and strain and demonstrate how it is tested

### ***Student: Day 4***

- Remove samples from vinegar and rinse with water. Place in hood to dry
- Design of a method to test how much stress, sketch design in lab notebook, begin to build.





### ***Teacher: Days 5-6***

- Warm-up?; What do you think will happen to the decalcified bone under stress, how will that compare to normal bone.
- Remind students of research presentations

### ***Student: Days 5-6***

- Record dry data, draw a diagram of test, test stress/strain
- Enter data into Excel and graph results
- Complete conclusion.



## ***Assessment: Day 7***

- Students will present co teach exercise and be graded on rubric for comprehension.
- Students will be given a series of free body diagrams of different types of bones and be asked to label the forces that act on the bone.
- Predict the location of fractures when different types of bones are put under stress, describe the difference in the location of fractures and the force necessary in diseased bone.





The  
End!