

# Longboard Lab



## In Class

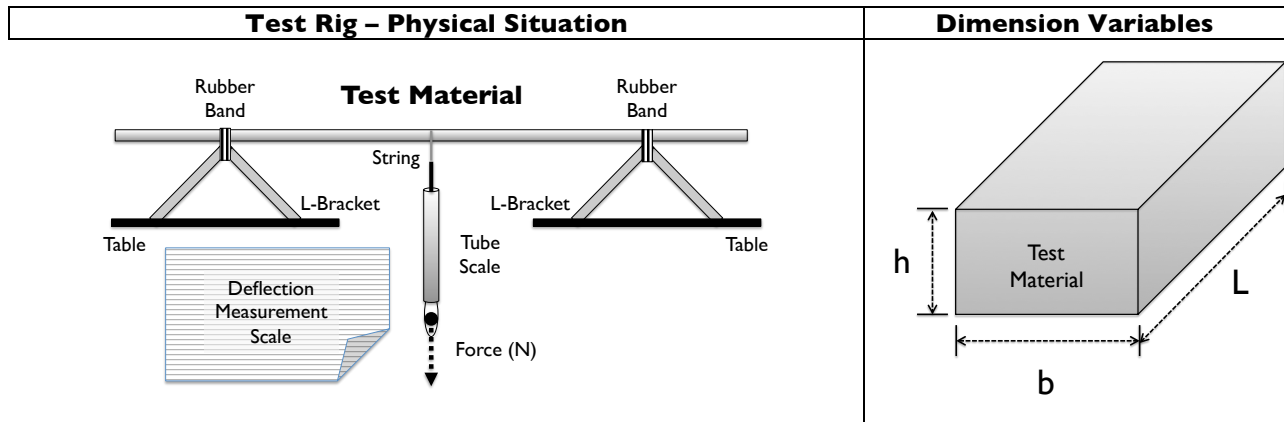
Your Name: (first and last)

Your Lab Teammates: (first and last names)

Your Pod: (circle)

♠ ♥ ♦ ♣

## Test Rig Set-Up:



**Part I:** Determine Young's modulus ( $E$ ) using  $\Delta_y = \frac{PL^3}{48EI}$ , "I" is the Area Moment of Inertia and for a rectangular cross-section is  $I = \frac{1}{12}(bh^3)$ .

**Canadian Maple:** Sample width (b):  m - Sample thickness (h):  m

I = _____ [m <sup>4</sup> ]	M [kg]	P = M*g [N]	Δ [m]	E [N/m <sup>2</sup> ]
L = 1.00 m				
L = 0.80 m				
				E <sub>1,avg</sub> =

**BioBoard:** Sample width (b):  m - Sample thickness (h):  m

I = _____ [m <sup>4</sup> ]	M [kg]	P = M*g [N]	Δ [m]	E [N/m <sup>2</sup> ]
L = 1.00 m				
L = 0.80 m				
				E <sub>2,avg</sub> =

**KrystalKurve:** Sample width (b):  m - Sample thickness (h):  m

I = _____ [m <sup>4</sup> ]	M [kg]	P = M*g [N]	Δ [m]	E [N/m <sup>2</sup> ]
L = 1.00 m				
L = 0.80 m				
				E <sub>3,avg</sub> =

NOTE: (b) and (h) are shown on each test sample in centimeters

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**Part 2:** Determine the stiffness of each test-specimen configuration, where  $stiffness = k = \frac{load (N)}{deflection (m)}$

	Canadian Maple	BioBoard	KrystalKurve
L = 1.00 m			
L = 0.80 m			

### Part 3: Summary of Stiffness

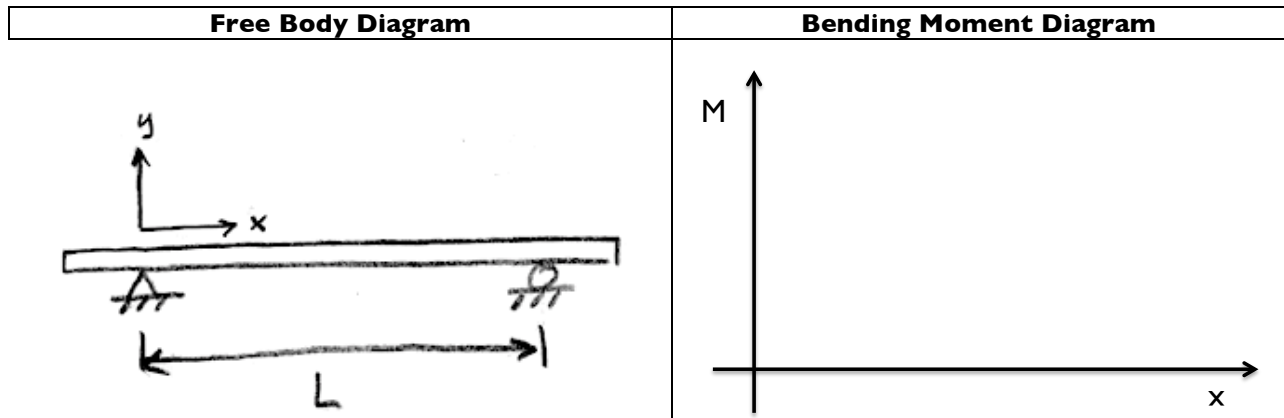
**(3A)** Order the three materials in terms of *material stiffness*, where 3 is most stiff and 1 the least stiff:

\_\_\_ Canadian Maple      \_\_\_ BioBoard      \_\_\_ KrystalKurve

**(3B)** Indicate which of the material-configurations in Part 2 is the most stiff (\*\*\*) and which is least stiff (\*).

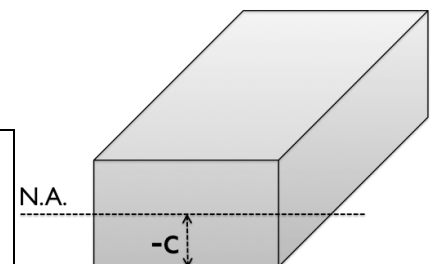
**(3C)** Why might the answers be different materials in (3A) and (3B)?

**Part 4:** Draw the bending moment diagram for a simple beam with the load applied at the center of the beam. Assume the mass of the rider is 100kg (remember to convert to Newtons) and the length of the board is 1m.



**Part 5:** Determine the maximum bending stress for each material.  $\sigma = \frac{-M_b c}{I}$

$\sigma_1 =$	$\sigma_2 =$	$\sigma_3 =$



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## Homework

**Part 6:** Given the maximum allowable deflection  $\Delta_{y,allow}$ , what dimensions would you like your longboard to have? What material did you choose?

Circle Your Choice of Material: **Canadian Maple**    **BioBoard**    **KrystalKurve**

**Design your longboard:** (show dimensions and factors below) (a spreadsheet is available on Coursework to assist in exploring design options)

L [m] =	E [N/m <sup>2</sup> ] =	$\Delta_{max}$ [m] =						
b [m] =	I [m <sup>4</sup> ] =	$\sigma_{max}$ [N/m <sup>2</sup> ] =						
h [m] =	$\Delta_{y,allow} = 0.10$ m $\sigma_{allow} = 50 \times 10^6$ N/m <sup>2</sup>	<table border="0"> <tr> <td>Is <math>\Delta_{max} \leq \Delta_{allow}</math>?</td> <td>yes</td> <td>no</td> </tr> <tr> <td>Is <math>\sigma_{max} \leq \sigma_{allow}</math>?</td> <td>yes</td> <td>no</td> </tr> </table>	Is $\Delta_{max} \leq \Delta_{allow}$ ?	yes	no	Is $\sigma_{max} \leq \sigma_{allow}$ ?	yes	no
Is $\Delta_{max} \leq \Delta_{allow}$ ?	yes	no						
Is $\sigma_{max} \leq \sigma_{allow}$ ?	yes	no						

### Longboard Decks - Industry Standards:

- Length (truck-to-truck): 84.0 cm to 150.0 cm [0.84 m to 1.50 m]
- Width (midpoint): 23.0 cm to 26.0 cm [0.23 m to 0.26 m]
- Depth (thickness): 1.5 cm to 2.0 cm [0.015 m to 0.02 m]
- Max Deflection (deck midpoint): 10 cm [0.10 m]
- Max Rider Mass: 100kg
- Dynamic Load Factor: 3.0

**Part 7:** Using the dimensions defined in Part 6 and the maximum allowable bending stress ( $\sigma_{allow}$ ), what is the stress safety factor of your longboard? Make sure to show calculation.

**Safety Factor (SF)** = \_\_\_\_\_

**OPTIONAL:** (not graded, for enjoyment purposes only)

If you have an idea of what your longboard would look like, please sketch it below:

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