Name	Natalie Kehoe	**Group Number**	5B
Student Number	n11031808	**Signature**	NKKehoe
Practical Number	Practical Lab 2 (Week 3)		
Task Name	Materials Testing		
Learning Objectives	In this lab, you will be learning to: • Conduct simple tension and compression tests. • Understand failure of materials in tension and compression		
Apparatus	• 1x Vernier Axial Testing Apparatus • 4x Acrylic samples (2x control, 1x wide, 1x long) • 1x HDF sample • 3x Balsa samples (1x control, 1x wide, 1x long) • 1x Vernier Calliper • 1x Ruler		

Preface

Measuring mechanical properties of materials is an essential component of structural design, to ensure the appropriate materials are selected for each structural element.

Your task

The following practical demonstration will be conducted with the guidance of your tutors. You will be sharing the material testing rigs and data collection between groups, there will be one testing rig for every two groups.

Setup

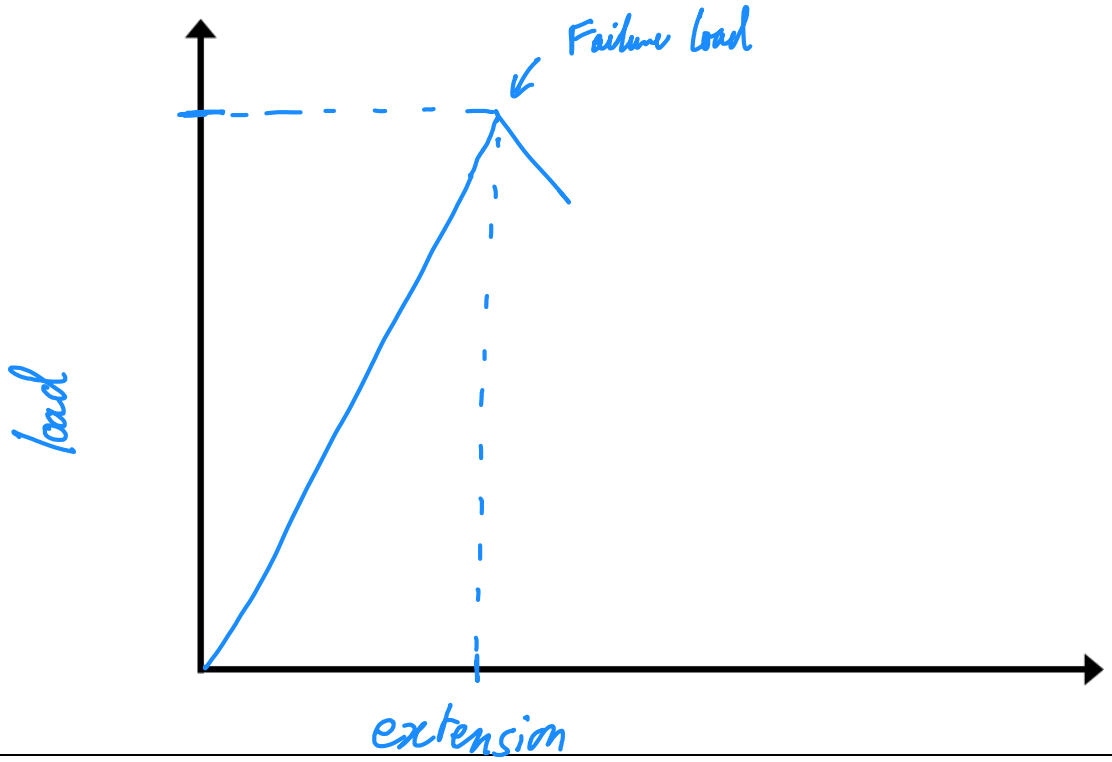
With a ruler and Vernier Calliper, measure the gauge length, width, and depth of the dog bone samples. Record the dimensions in the Tensile and Compression testing tables below.

Tension Testing

1. Load the control Acrylic sample into the materials testing rig. Ensure that the sample is screwed in tightly and appears to be aligned properly.
2. On the LabQuest2 unit, start a new test, and ensure that **load and displacement are zeroed** before the start of the test.
3. Switch to graph view mode on the LabView2 unit. Then slowly rotate the leadscrew. Continue to rotate until the sample fractures.
4. Record down the failure load (N) from the test in the tension results table on the following page.
5. For the first test, also sketch the load-displacement curve for the test (below).
6. Repeat steps 1-5 for the long acrylic sample and the wide acrylic sample.

Acrylic control sample:

Sketch the load-extension curve that appears on the LabQuest2 software, and clearly mark the failure load and extension.



Tension Results

Specimen	Gauge Length (mm)	Width (mm)	Thickness (mm)	Failure Load (N)	Extension (mm)
Acrylic control sample	30	2.7	3	465.9	4.96
Acrylic long sample	60	2.44	3.14	493.9	6.65
Acrylic wide sample	30	4.82	3.03	664.9	4.27
HDF	30	2.39	2.89	235.7	2.38

Compression Testing
Repeat steps 1-5 for the samples in the table below, but in compression mode. Record results in the compression results table.

Compression testing samples will need to be cut 20mm longer than gauge length to fit into compression testing rig.

Compression Results

Specimen	Gauge Length (mm)	Width (mm)	Thickness (mm)	Failure Load (N)
Acrylic control sample	30	3	3	360
Balsa control sample	30	3	3	108
Balsa long sample	60	3	3	67
Balsa wide sample	30	5	5	268

What failure modes did you observe for the tension and compression tests?

Tension Failure Mode: Exceeding UTS

Compression Failure Mode Buckling

From your observations what is the effect of length and width on the failure of specimens in tension?

Longer samples failed earlier than starter samples. Increasing width also increased failure load

From your observations what is the effect of length and width on the failure of specimens in compression?

Increasing length decreased failure load
Increasing width increased failure load

From your observations are members in compression or tension more likely to fail first? Why is this?

Compression, as buckling is related to Young's Modulus and occurs without any plastic deformation

Using the acrylic control sample in tension calculate the Elastic Modulus of the material, ensure you use the correct units?

$\sigma = \frac{F}{A}$ ← (assuming perfectly brittle, $\therefore A = (3 \times 2.7)\text{mm}$, $F = 465.9\text{N}$)

$\therefore \sigma = \frac{465.9}{8.1} = 57.51\ \text{MPa}$ | $\varepsilon = \frac{\Delta l}{l_0} = \frac{4.96}{30} = 0.1653$ | $\therefore E = \frac{\sigma}{\varepsilon} = \frac{57.51}{0.1653} \approx 347.91\ \text{MPa}$