

STUDENT FEEDBACK FORM (HARRISON FREERICKSON-DILLON)

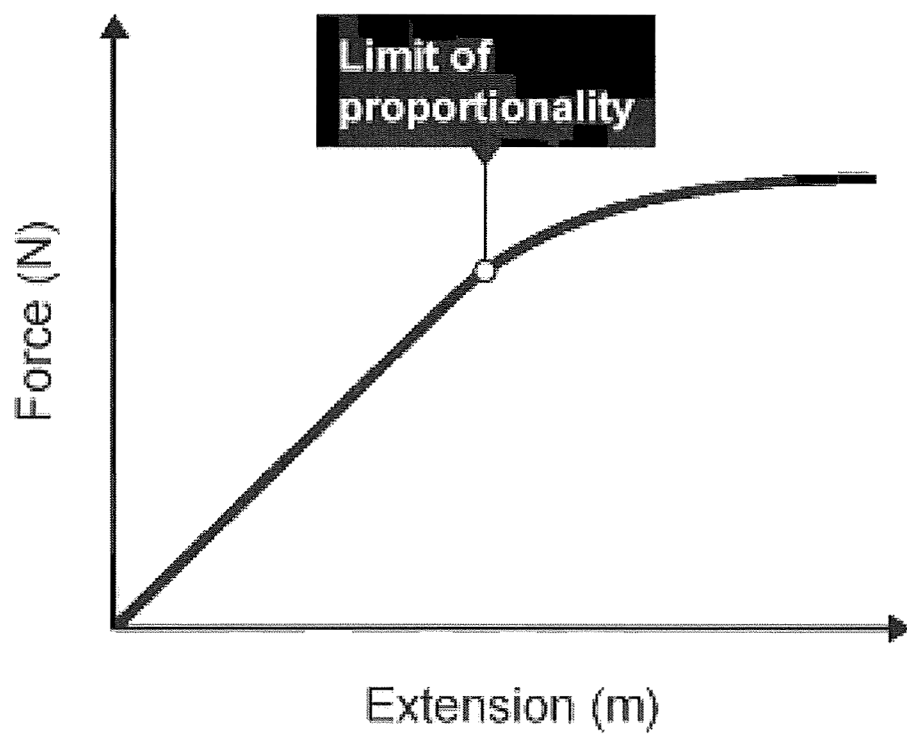
This section details the *extent* to which the assessment criteria are demonstrated by you, which in turn determines your mark. The marks available for each category of skill are shown. Lecturers will use the space provided to comment on the achievement of the task(s), including those areas in which you have performed well and areas that would benefit from development/improvement.

Generic Assessment Criteria	Marks available	Marks awarded
1. Engagement with Literature Skills		
Limited engagement with suitable range of literature but some good points were raised. Generally, your work needed more depth and scope. Without a detailed literature review, you left yourself with too little to discuss. This is something you will need to improve upon next time. Try to ensure you present your research in coherent and structured manner. You need to plan out your work beforehand.	20	7
2. Knowledge and Understanding Skills		
Knowledge of the basic underlying concepts and principles is accurate with some good understanding of the field of study. However, your research needed further depth and scope. Tended to the descriptive, be more critical in your tone. Errors in terminology noted and some confusion was evident.	30	14
3. Cognitive and Intellectual Skills		
A reasonable attempt at the evaluation of the underlying concepts and principles. You did interpret the data correctly, and you demonstrated an ability to use evidence to support the argument. Structural issues noted throughout which prevented a coherent approach.	20	10
4. Practical Application Skills		
Appropriate application of basic methods, materials, tools, and/or techniques. Appreciation of the context of the application. Good set of calculations, and reasonable values of E and G obtained but the presentation of data was poor. Beam stress was not included. I would have liked to have seen more on the practical application of the work covered. Also, further reference to expected values of E and G would have helped.	15	9
5. Transferable Skills for Life and Professional Practice		
Work is too descriptive with grammatical errors noted. Contents page needed to be developed. Referencing was included but only to a limited extent. Summary was not fully developed. This is important and it needs to include the main aims, the results and the conclusions. Remember to use the correct tense and person throughout. Also, always ensure that appropriate technical language is always used.	15	6

Assessment Mark (Assessment marks are subject to ratification at the Exam Board. These comments and marks are to give feedback on module work and are for guidance only until they are confirmed.)	Late Submission Penalties (tick if appropriate)	%	46
	Up to 1 week late (40% Max)		
	Over 1 week late (0%)		

Investigation into elastic constants

Harrison Frederickson-Dillon



Summary

This report will explain the results from two unidentical tests that have been completed, both of these tests were carried out so that the elasticity of the materials could be worked out. Test one was used to work out the modulus of elasticity of an aluminium beam, ~~then~~ test two was completed to work out the modulus of rigidity when the force (torque) is applied to the beam. All the results and graphs can be seen below

↳ to determine G for Brass and steel.

“The importance of mechanical testing in ensuring the safety, reliability, and performance of materials remains as vital as ever”

(Discover Engineering, 2024)

↑
No need for a reference
here

Contents

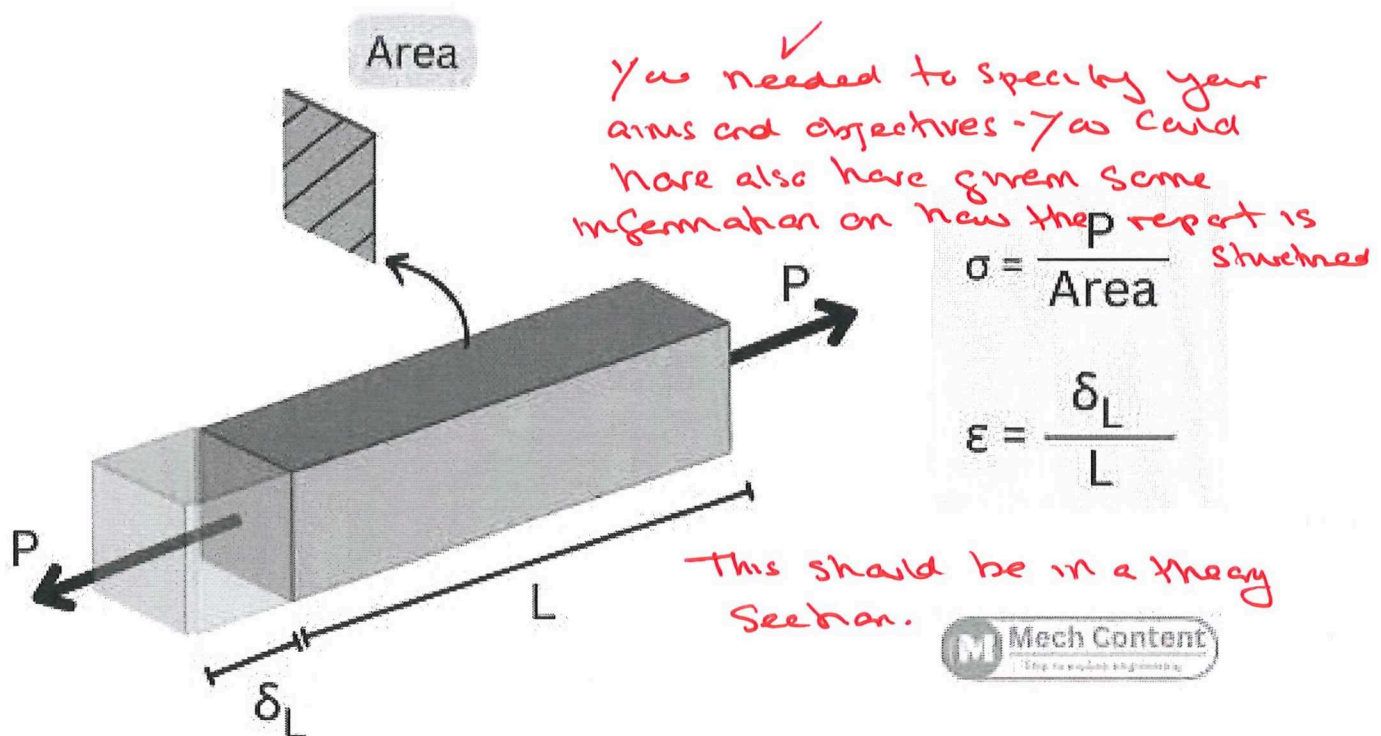
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↑ Reasonable structure but you need a section numbering system also.

Introduction

This investigation will give an insight and show what results were gained from doing the two tests with different loads of force applied, when carrying out these tests a beam was placed on two supports and a load was applied directly to the centre of the beam, this will give us the result to the modulus of elasticity, this investigation will show the results and also the methods used to correctly complete the tests, graphs and result tables will also be included to show the information correctly

Modulus of elasticity for the elastic material is the ratio of longitudinal stress to the longitudinal strain. The modulus of elasticity is also known as Young's modulus, named after scientist Thomas young. (Anon, 2022)



(Anon, 2022)

Objectives

Use appropriate technical language.

In this investigation the biggest objective is to deep dive into the elasticity of materials by using the test rig in the lab. Each material chosen will be put under a different stress and each individual test will have the applied load differently, from the results that we obtained through these tests they will help us accurately measure the elasticity of the materials that are put under stress, also turning these results into graphs by plotting the graph and adding the line of best fit to better identify the results.

Modulus of Rigidity - G - (Shear Modulus) is the coefficient of elasticity for a shearing force. It is defined as

- "The ratio of shear stress to the displacement per unit sample length (shear strain)"

Modulus of Rigidity can be experimentally determined from the slope of a stress-strain curve created during tensile tests conducted on a sample of the material.

The definition of Modulus of Rigidity:

- the ratio of shear stress to the displacement per unit sample length (shear strain)

(Engineering ToolBox, 2005)

Very limited consideration
of background theory.

You need to consider the Veneu
elastic constants in more detail.

Background

It's possible before a test to check the stresses that a material can take before failure, but the results you get can result in an inaccurate test, this means that the results you obtain from the experiment are more trustworthy and accurate, below you can see the equations for the deflection and modulus of elasticity

For the first test the method in you calculates the deflection using information already obtained, using this information along with the correct equation you can calculate the results without carrying out the test

Equation for working out the maximum deflection on a supported beam

$$\text{Deflection} = WL^3 / 48 EI$$

W = Point Load (N)

L = Distance between beams (M)

I = Second Moment of Area

E = Young's Modulus

Equation for second moment of area of bar

$$I = bd^3 / 12 \text{ (m}^4\text{)}$$

B = breadth

D = Depth of bar

Test two equations for different torques on beam

$$T / J = t / r = G\theta / L \text{ which turns into } G = (L / J) \times (T \times \theta)$$

G = Modulus of rigidity of the material

T = Torque "Torque is a moment that twists a structure" (Boston University, n.d.)

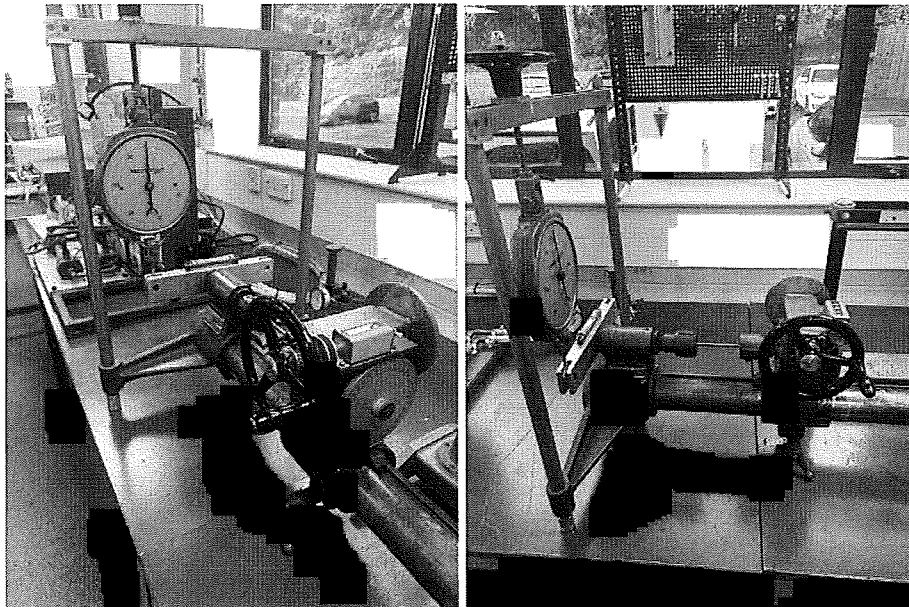
θ = Angle of twist

L = Length

J = Polar second moment of area

Equipment

- Testing machine
- Torsion Testing Rig
- DTI
- Circular protractor
- Aluminium bar
- Aluminium beam



Method

First Test: Load on aluminium beam

For the first test, it will help us find out the elasticity of a beam, when a variety of loads are applied, the aluminium beam being used is 800mm Lengthwise, to apply the load to the centre of the beam you need to work out the halfway point which is 400mm and apply the load.

Step 1: Acquire all the equipment above to carry out the test correctly

Step 2: place aluminium beam onto the test rig

Step 3: Apply a load in pounds of 0.25lbs to centre of beam

Step 4: next you will increase the load by 0.10 lbs in increments after taking results

Step 5: Apply the load 6 times to get the to 0.75lbs and end test

Step 6: Plots and put results into graph and table to see results clearly

Second Test: Torsion on a cylindrical rod

This test will allow us to work out the rigidity of an aluminium beam when a different Newton meter of torque is applied to it, to do this we will apply a load using the a worm and wheel drive, and use a spring balance to measure the torque, next a circular protractor is used to measure the angle of twist.

Step 1: Place bar onto test rig and ensure bar is secured to rig for safety.

Step 2: Apply load of 0.6NM, of torque then use spring balance to measure twist in degrees

Step 3: in increments apply extra 0.6nm of torque 6 times to complete test

Step 4: Convert angle of twist from degree to radians for results

Step 5: Plots and put results Intro graph and table to see results clearly

Results

Upon completion of the tests the results were converted into tables one of the tables was used for the modulus of elasticity and the second graph was used for the modulus of rigidity the graphs and results tables can be seen below.

Test 1 Effects of loading on beam

the equations for the modulus of elasticity

$$E = \frac{800^3}{(48 \times 333.3)} \quad 800^3 / 48 \times 333.3 \times 2.1 = 67197.12 \text{ N/mm}^2 \text{ or } 67.197 \text{ GN/m}^2$$

you needed to present the raw data and the graphs before completing the calculations.

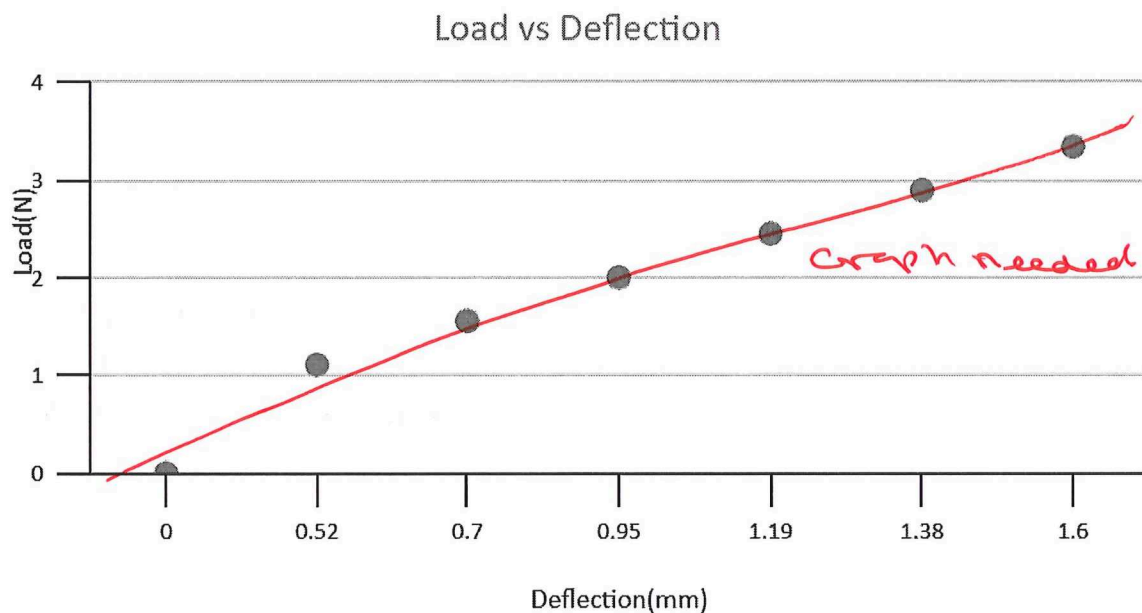
Below is the table of results

Load(Kg)	Load(N)	Deflection(mm)
0.000	0.00	0
0.114	1.11	0.52
0.159	1.56	0.7
0.204	2.00	0.95
0.250	2.45	1.19
0.295	2.89	1.38
0.341	3.34	1.6

As you can see from the results table when the load is increased the deflection is also increased, the beam would gain extra length through its elasticity.

Below is the graph from the results table

Line of best fit = $(y = 2.0983x)$



This graph replicates the results in a visual form, as you can see the line of best fit, allows us to see that when the load on the centre of the beam is increased the deflection also increases, this is expected as the bar will naturally deform under stress.

Test 2 efforts of torsion on cylindrical rod

the equations for modulus of rigidity

Steel

$$G = 0.096.13 \times 10^{-11} \times 61.497 = 90.29 \text{ GN/m}^2$$

70/30 Brass

$$G = 0.096.13 \times 10^{-11} \times 45.831 = 67.29 \text{ GN/m}^2$$

Steel

Torque Applied	Angle of twist	Twist (Rads)
0	0	0.0000
0.5	0.5	0.0087
1	1	0.0174
1.6	1.5	0.0262
2.2	2	0.0349

✓ Again, it's better to present the data before the calculations for G!

As you can see from the table, the rigidity of the beam measured in twist degrees and radians increases when adding an extra 0.6Nm of torque.

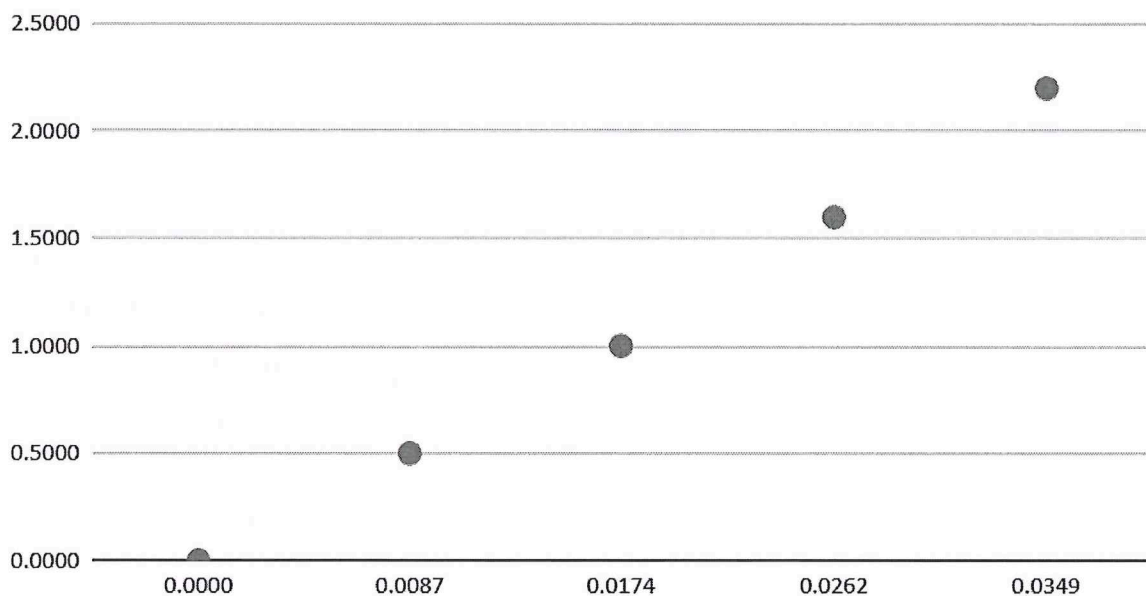
70/30 brass

Torque applied	Angle of twist	Twist (Rads)
0	0	0.0000
0.4	0.5	0.0087
0.8	1	0.0174
1.2	1.5	0.0262
1.6	2	0.0349

As you can see from the table, the rigidity of the beam measured in twist degrees and radians increases when adding an extra 0.4Nm of torque.

Steel

Line of best fit = (y61.529x)

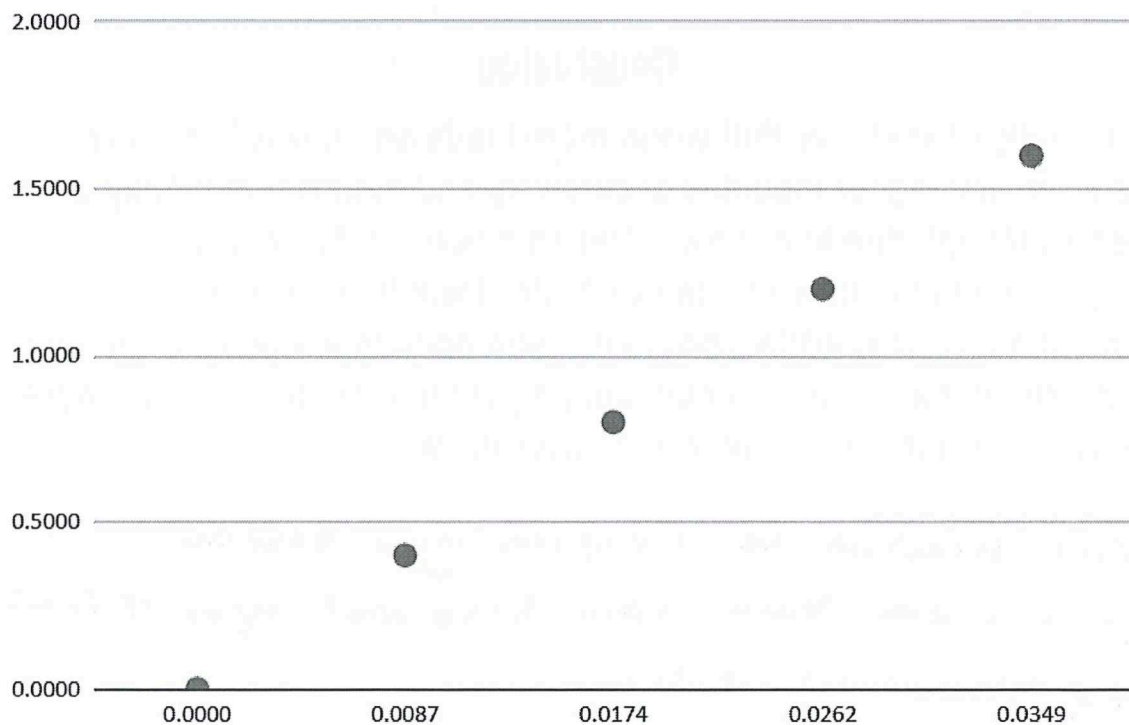


As you can see from the graph above as we increase the load on the steel rod the angle of twist does also in fact increase, while materials will always try return to their natural shape it will try to counteract the twisting motion this would be the reason for a slow rise on the graph

Poor presentation.

70/30 Brass

Line of best fit = $y = 45.86x$



As you can see from the graph above as we increase the load on the 70/30 brass rod the angle of twist does also in fact increase, while materials will always try return to their natural shape it will try to counteract the twisting motion this would be the reason for a slow rise on the graph

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Conclusion

The investigation shows that when more loads are applied across both tests there is a higher modulus of elasticity and modulus of rigidity this is expected though due to a material when placed under stress it will deform into an unnatural shape due to its strength being overcome, when extra weight is added, both test were done in a safe environment with safety at main priority, when carrying out the test the test rigs were essential in gaining the correct and accurate results.

you needed to confirm your results.

you could have also compared your values to theoretical values.

What are the main conclusions / areas where theory may be applied in practice?

Reference List:

- Anon, (2022). *Modulus of elasticity: Definition, Equation, Units, Examples with Pdf*. [online] Available at:
<https://mechcontent.com/modulus-of-elasticity/>.
- Engineering ToolBox (2005). *Modulus of Rigidity*. [online] Engineeringtoolbox.com. Available at:
https://www.engineeringtoolbox.com/modulus-rigidity-d_946.html.
- Discover Engineering. (2024). *Mechanical Testing of Materials*. [online] Available at:
<https://www.discoverengineering.org/mechanical-testing-of-materials/>.

Limited referencing.

