



APPENDIX GA36a

LEVEL 4 ASSESSMENT SPECIFICATION

Student name:	Joshua Price		Student ID number:	
Programme:	HNC Mechanical Engineering			
Module:	Materials			
Module code:	SGDM4003	Contribution to Overall Module Assessment (%):	50%	
Lecturer:	Chris Davies	Internal Verifier:	Robert Rees	
Assignment Title:	Assignment 1 Tensile Test to Destruction.	Word count (or equivalent):	2000	
Submission deadline:		Return date of provisional marks & written feedback:		
Submission method:	All written assessments, where practical and possible, must be submitted via Turnitin unless otherwise instructed by the Lecturer. (Please DO NOT put this assessment specification into Turnitin or it will match many similarities with other students' submissions.) Alternative submission method (if applicable): Late submission of the assessment will result in a late penalty mark. Penalties for late submission: Up to one week late, maximum mark of 40%. Over one week late, 0%. Only the Extenuating Circumstances Panel may approve a change to submission dates.			
Academic honesty / referencing:	Academic honesty is required. In the main body of your submission you must give credit to authors on whose research and ideas your work is based. Append to your submission a reference list that indicates the books, articles, etc. that you have used, cited or quoted in order to complete this assessment.			

Module Learning Outcomes (from module syllabus)

1. Demonstrate a detailed knowledge and understanding of the structure, properties, processing and subsequently the use of engineering materials;
2. Use standard materials testing apparatus and derive the mechanical properties of materials and analyse and understand the cause of materials failures.

STUDENT FEEDBACK FORM

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	20	
Some evidence of engagement with under literature is evident but often your work lacked sufficient depth and became too descriptive.		9
2. Knowledge and Understanding Skills	30	
Some good points raised but often your lack of research led to an overly descriptive approach and therefore a lack of detail.		15
3. Cognitive and Intellectual Skills	20	
Reasonable calculations made and reasonable observations. Limited evaluation of results.		10
4. Practical Application Skills	15	
Generalised points included but I would have liked some specific examples of the tensile test in use (an example for work would have been good here).		7
5. Transferable Skills for Life and Professional Practice	15	
Some issues noted with structure and style. These are over for improvement.		7

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)

Up to 1 week late (40% Max)
Over 1 week late (0%)

48 %

Joshua Price

Assignment 1 Tensile Test to Destruction



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Summary

A tensile test was conducted in the laboratory class in college, using 5 different materials. The piece of testing equipment for this experiment was a Hounsfield Tensometer. 5 materials were used in the experiment, those materials were:

- 70/30 Annealed Brass
- 70/30 Brass
- Annealed Copper
- 0.1% Carbon Steel Normalised
- 0.4 % Carbon Steel

The recorded results show points from which we can gather material properties and when held against other sources of the experiment, they are accurate enough to make findings. The results and research carried out and later showed in the assignment show that by heat treating the materials, or perhaps increasing the carbon content, the materials properties will determine different outcomes of materials in tension.

Limited Summary. You needed to include
Some specific results and conclusions

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↖ Section numbers needed

Introduction

The main purpose of the experiment performed was to test the tensile properties of each material using the Hounsfield Tensometer, this was to gather results with which we could compare the different properties and breaking points. With the results, we could figure out what makes materials stronger in tension and the operations carried out to alter the properties. The materials used were:

- 70/30 Annealed Brass
- 70/30 Brass
- Annealed Copper
- 0.1% Carbon Steel Normalised
- 0.4 % Carbon Steel

The experiment was carried out until the piece used broke or reached fracture point, this way we gathered the Ultimate Tensile Strength. The cross sectional area was recorded, as was the gauge length. This was so we could produce graphs and ultimately one Force vs Extension graph for all materials to compare the different properties in one place. The maximum force was recorded as well as lower yield stress/proportional force so we could calculate the tensile stress and yield/flow stress.

Method

The method for this experiment is as follows. Each individual test piece was secured into the Hounsfield Tensometer individually and was clamped in. Once secured safely, tension was slowly applied to the test piece from both securing chucks until it reached the breaking point. The extension and force was made note of at regular intervals for Force vs Extension graphs to later be made in the classroom. After the point at which the piece fractured, the gauge length and % of reduction in cross sectional area was made note of on the Tensometer.

After we produced graphs using Microsoft Excel, the maximum force and lower yield force/proportional limit could be determined. Now the following properties could be calculated using several different formulas. The properties were as follows:

- Lower Yield Force / Proportional Limit
- Maximum Force
- Flow / Yield Stress
- % Reduction in Cross Sectional Area
- % Elongation at Fracture

Results

70/30 Annealed Brass

70/30 Annealed	
Force (N)	Extension (mm)
0	0
300	0.2
1500	0.5
2200	0.7
2500	1
2800	1.3
3000	1.5
3200	1.8
3500	2.2
3700	2.6
4000	3.1
4200	3.5
4400	4
4600	4.4
4800	4.8
5000	5.3
5200	5.8
5400	6.3
5600	6.9
5800	7.6
5900	8
6000	8.3
6100	8.7
6200	9.2
6300	9.6
6400	10.1
6500	10.6
6600	11.2
6700	12
6800	12
6850	13.9
6900	14.3
6900	16
6800	17.3
6500	17.9
6000	18.2
5500	18.5
4500	18.8

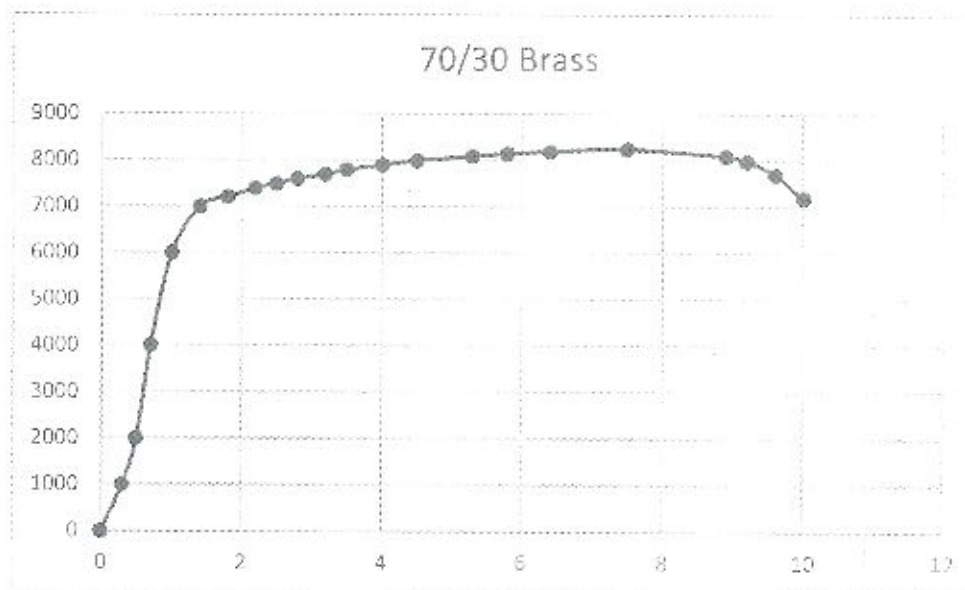


Always label each axis

Always label each table and graph - then present them in your Conclusions page and refer to them in your text

70/30 Brass

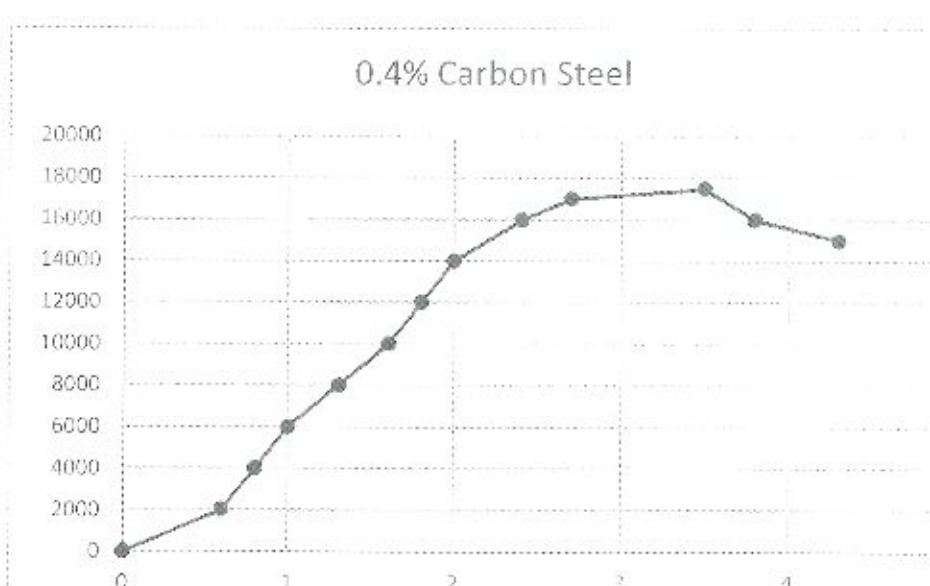
Force (N)	Extension (mm)
0	0
1000	0.3
2000	0.5
4000	0.7
6000	1
7000	1.4
7200	1.8
7400	2.2
7500	2.5
7600	2.8
7700	3.2
7800	3.5
7900	4
8000	4.5
8100	5.3
8150	5.8
8200	6.4
8250	7.5
8100	8.9
8000	9.2
7700	9.6
7200	10



0.4% Carbon Steel

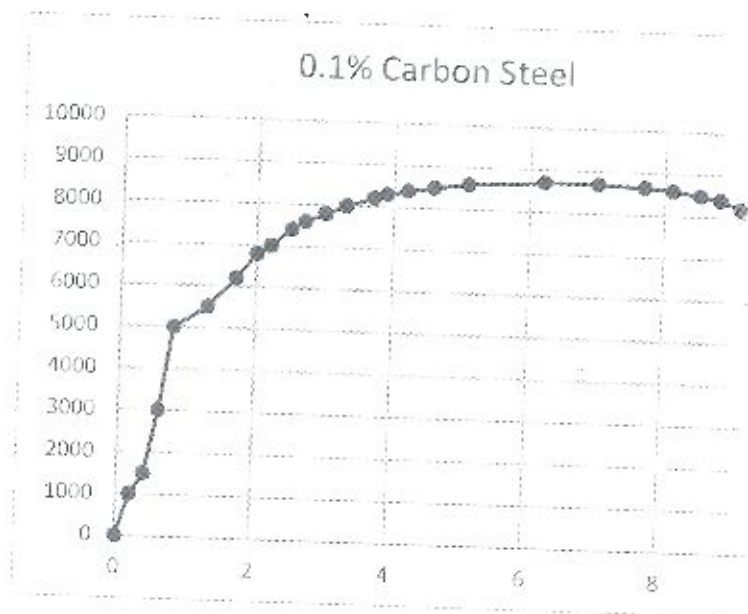
0.4% Carbon Steel

Force (N)	Extension (mm)
0	0
2000	0.6
4000	0.8
6000	1
8000	1.3
10000	1.6
12000	1.8
14000	2
16000	2.4
17000	2.7
17500	3.5
16000	3.8
15000	4.3

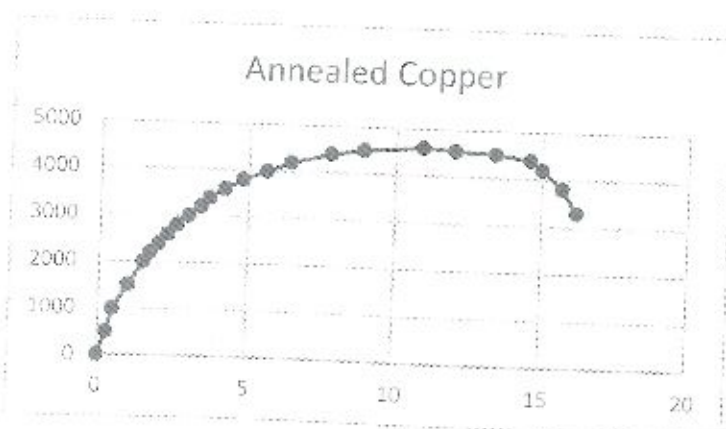


0.1% Carbon Steel

Force (N)	Extension (mm)
0	0
1000	0.2
1500	0.4
3000	0.6
5000	0.8
5500	1.3
6200	1.7
6800	2
7000	2.2
7400	2.5
7600	2.7
7800	3
8000	3.3
8200	3.7
8300	3.9
8400	4.2
8500	4.6
8600	5.1
8700	6.2
8700	7
8650	7.7
8600	8.1
8500	8.5
8400	8.8
8200	9.1
7800	9.6
7500	9.8
7000	10.1
6000	10.4



Annealed Copper



Force (N)	Extension (mm)
0	0
500	0.3
1000	0.5
1500	1
2000	1.5
2200	1.7
2400	2
2600	2.3
2800	2.6
3000	3
3200	3.4
3400	3.7
3600	4.2
3800	4.8
4000	5.6
4200	6.4
4400	7.8
4500	8.9
4600	10.9
4550	12
4500	13.4
4400	14.6
4200	15
3800	15.7
3300	16.2

	70/30 Annealed Brass	70/30 Brass	0.1 Carbon Steel	0.4 Carbon Steel	Annealed Copper
Lower Yield Force / Proportional Limit (kN)	2.2	6	6.25	7.5	1
Maximum Force (kN)	6.9	8.25	8.7	17.5	4.6
Flow / Yield Stress (N/mm ²)	110	300	312.5	375	50
Tensile Strength (MN/m ²)	345	412.5	435	875	230
% Reduction in Cross Sectional Area	70	60	45	25	72
% Elongation at Fracture	76	41.88	45	25	66

Paragraphs needed

Discussion

To carry out this experiment, as already mentioned, a Hounsfield Tensometer was used in the college laboratory. This type machine is used worldwide from students, to huge engineering firms as an accurate and reliable piece of material testing equipment. It is relatively easy to use, requires low maintenance costs and has many additional parts which can be added to the equipment for other specific experiments. It works on simply clamping a test piece of any desired material being placed in chuck-like clamps and being secured either end. The clamps then slowly pull further apart, stretching the test piece and increasing the tensile force throughout the experiment. This will continue until the test piece finally reaches the point of failure. The testing equipment gives a digital reading of the cross-sectional area at fracture which is then used to calculate the Ultimate Tensile Strength (UTS), which is a very important property in engineering materials. Tensile Testing is carried out a lot as it is a cheap way of testing the structural integrity of materials before being invested in. It's a methodical method of working out the best material for the chosen application considering the price and safety aspects. Tensile testing offers information about respectability and security of materials, assisting manufacturers absolutely positive that their final products are fit-for-reason and have been manufactured to the highest calibre. The data retrieved from carrying out an elastic test can be useful in many circumstances including: to decide clump quality, to decide on fabricating methods, to assist towards the structure techniques, to decrease material costs, and to maintain consistency with worldwide industrial gauges. This type of test is carried out in so many different industries worldwide such as the aerospace and beverage industries. Uses of this type of material testing in the aerospace trade include: strip tests on airplane composites and shearing and rigidity experiments for example fasteners such as nuts, bolts and screws as they are in tension due to loading. Uses of tensile testing in beverages companies include determining the force that is needed to open a 'ring pull' on a drinks can, etc.

You could have included some examples from work-

Paragraphs needed



Annealing

When materials are annealed, the materials are heated up and then gradually cooled. As a result of this property altering method, the metal will have stresses removed from within, therefore making it a much tougher material. However, whilst trying to remove certain defects from a material, it is often the case that other undesirable defects are then introduced, altering the material's properties more. From the results of the experiments previously shown, there is clear evidence that the normalised 70/30 Brass and the Annealed 70/30 Brass have significant differences in their material properties. According to the tabulated results, the 70/30 Brass has a higher Tensile Strength when compared to the Annealed 70/30 Brass. The reason for this is that when a metal is heat treated, it is heated above the temperature of recrystallization. When this is done, the ductility of the metal is increased, which is desirable for when you want to cold work a metal, for example in the steel industry where strip or slab steel is reduced in thickness through thickness reducing mills. Steel is made ductile in a Continuous Annealing Processing Line as by further cold rolling the steel, ductility decreases as it being worked under ambient temperature (below the recrystallization temperature), so the more it is annealed, the more times it can be cold rolled. The downside of increasing the ductility is that it reduces the material's Yield and Tensile Strength. Again by examining the results made, it is apparent that annealed copper and 70/30 annealed brass have very similar material properties. The results and research is clear evidence that annealing reduces the yield strength of a material with Yield Strengths of just 2200N and 1000N, compared to 0.4 Carbon Steel with a Yield Strength of 7500N. The graphs made on Microsoft Excel with results from the experiment show that 70/30 Annealed Brass is not as brittle than the 70/30 brass, we can tell this as on the graph, there are no clear yield points for the 70/30 annealed brass, however the normalized 70/30 brass has visible yield points around 7000N. To change the ductility and overall hardness when you anneal a material, what actually happens is that the atoms are rearranged inside the crystalline lattice configuration of the metal. As a result, the amount of dislocations of atoms within the structure is decreased through aligning the atoms better. The material's properties also influence the size of its crystal-like grain, but this can also be altered by the rate at which the material is heated and cooled, such as in the annealing process. Annealing is carried out at such high temperatures as it is believed the higher the temperature of annealing, the less time it takes for

Refs.?

recrystallization of the material. This is ideal for mass production companies such as TATA Steel, as although it costs more money to keep the CAPL Furnace at such high temperatures, the faster the production will be and therefore a larger number of coils produced. When the metal is warmed to the point at which it recrystallizes, the defects in the material's structure are able to be repaired. Overall, annealing isn't the fastest process, however the actual cooling can be done as fast as the manufacturers desire, however different speeds will alter the structure.

Carbon Levels

Both types of steel used in the college laboratory experiment were alloyed with carbon. 0.1% carbon steel and 0.4% carbon steel were used, the first one considered a low carbon steel and the second, a medium carbon steel. The experiment shows us that the 0.1% carbon steel has a lower proportional limit, maximum force, flow stress and tensile stress. The reason for this is when there is a low amount of carbon, the material is more prone to tensile stress and isn't as hard, therefore more ductile. The carbon atoms in the steel deform the structure of the crystal lattice of iron, therefore making it tougher and also stronger. Strength of metals relies on specific properties such as the spacing between atoms in the lattice and the crystal structure. Due to the 0.1% carbon steel being weaker, in the industrial world, it is used for fasteners and pipes, whereas 0.4% carbon steel is used in structures like building materials and bridges.

Tempering

Although not used in the experiment, it's worthwhile mentioning another type of heat treatment, that of which is tempering. Tempering is utilized to increase the strength of iron combinations, particularly steel. Un-tempered steel is very hard, however is not strong enough for most uses. Tempering is normally done in the solid form to decrease abundance hardness.

Tempering is utilized to adjust:

- Hardness
- Malleability
- Strength

Some good points but your work lacks sufficient detail.

Tempering is essentially heating the material to a certain temperature beneath the melting point, and is usually just done atmospheric air, although it can be done in a vacuum and other environments for different properties.

Conclusion

To conclude, the experiment was as expected and was a success. It gave us everything we needed to calculate the desired results in order to later evaluate material properties. Results were recorded as the experiments were being carried out and were then tabulated on Microsoft Excel, on which the graphs used were also produced.

70/30 brass was the only graph produced on which there were clear yield points and upper and lower yield forces. 70/30 annealed brass, annealed copper, 0.1% and 0.4% carbon steel all displayed non-continuous lines. One of the main conclusions made is that treated materials are considerably stronger than non-treated materials as the procedures like annealing or tempering alter the internal structure and crystal lattice. Finally, the experiment showed the students that the larger carbon content in materials, the stronger and more tough it is. Again this is due to distorting the crystallin structure.

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