Materials Assignment submission

The Material Assignment is due on the **24th December 2020, at 11.55 pm Malaysia time (2.55 am Clayton time).**

Submit (as a single PDF file):

The assignment cover sheet, clearly noting all team members who contributed to the assignment

Your answers to both Part 1 and Part 2

Feedback

Grade	C
Graded on	Tuesday, 16 February 2021, 2:42 PM

Part 1 Q.1 (a)	
Description for students	Plot a single graph showing the full stress/strain curves for both samples of Al 1050. (0.5) Prepare a table showing the 0.2% proof stress, UTS, toughness and ductility of the two different materials. Include a reasonable estimate of the uncertainty. (1)
score	2 / 2
Remarks	

Part 1 Q.1 (b)	
Description for students	Describe how the dislocation density of materials changes when a work hardened sample is annealed, and explain why the dislocation density affects these different properties of the materials (3)
score	2.5 / 3
Remarks	Diagram of dislocation before and after annealing (0.5 Mark)

Part 1 Q.2 (a)	
Description for students	Plot a single graph showing the full results both the cold rolled Al 1050 and the Al 6063 alloy sample (1). Prepare a table showing the yield stress, ductility and uniform elongation of the two materials. Include a reasonable estimate of uncertainty.
score	2 / 2
Remarks	

Part 1 Q.2 (b)	
Description for students	Al 6063 is an alloy which forms precipitates during heat treatment. Explain what precipitates are, how precipitates form, and the effect precipitates have on dislocation movement in aluminium alloys. (2)
score	2 / 2
Remarks	Precipitates are a secondary phase of the material, different structure and composition

Part 1 Q.2 (c)	
Description for students	Explain why uniform elongation is an advantage for the allow sample compared to the cold rolled Al 1050 (1)
score	1 / 1
Remarks	

Part 1 Q.3 (a)	
Description for students	Plot a single graph showing the full results for the annealed Al 1050 along with drawn estimates of what the graph could look like for Al 1050 O samples (from literature values provided) (3)
score	0 / 3
Remarks	

Part 1 Q.3 (b)	
Description for students	Discuss the similarities and differences between the two graphs in part (a). Discuss what these results might imply about the number of dislocations in the specimens that you tested. (2)
score	2 / 2
Remarks	

Part 1 Q.4 (a)	
Description for students	Plot a single graph showing the elastic region of the stress/strain curves for both samples of Al 1050. (1)
score	1 / 1
Remarks	

Part 1 Q.4 (b)	
Description for students	Explain why work hardened and annealed samples should both have the same modulus, despite having different dislocation densities. (2)
score	2 / 2
Remarks	

Part 1 Q.4 (c)	
Description for students	The extensometer is able to measure extensions to a precision of ± 20 μm. Is this enough to make an accurate measurement of the elastic modulus for these samples? Support your answer with appropriate calculations. (2)
score	0 / 2
Remarks	

Part 2 Q.1	
Description for students	(a) Find the minimum cross-sectional area required to prevent yielding in member AC (b) Find the minimum second moment of area required to prevent buckling in member AC (c) Using a SHS cross section, determine the minimum cross-sectional dimensions for member AC (d) Determine the final volume and mass of the members (e) Determine the cost and carbon footprint of the materials
score	2 / 3
Remarks	c) Using a short script, and assuming min thickness of 5 mm, 130 X 130 X 5 mm (thickness) SHS (1 mark)

Part 2 Q.2	
Description for students	• Show your full process with example calculations and explanations for at least one material, as an example. • Discuss what cross-sectional shapes are appropriate for use in the designs. You will need to consider the loading of the member (hint: buckling can potentially occur in more than one direction) as well as any potential constraints caused by the processing of different materials. • State the final properties of each of your final beams (ideally in a table or similar format that is easy to read), including the final dimensions, cross-sectional area, second moment of area, volume, mass, cost and carbon footprint. • You must explicitly demonstrate that your beams comply with all required elements of the design brief.
score	7 / 12
Remarks	• Choice of appropriate cross-section shapes and discussion (1 Mark): should not be solid sections (except wood, maybe concrete) or rectangles/I-beams • Appropriate beam design *roughly* correct and adjusted for each material (2 Mark) • Explicitly show that requirements from the brief are fulfilled by all beams (e.g. list minimum I and final I values side-by-side, same for Area values) (2 Marks)

Part 2 Q.3	
Description for students	Apart from those properties that you have already considered, name 3 additional material properties that might be important in choosing materials for the bridge. For your top few materials in Question 2, rate those materials for each of these properties, and provide a short justification (e.g. 3-4 sentences) for each of your responses. (6)
score	4.5 / 6
Remarks	Too much words, no external references -1.5marks

Part 2 Q.4	
Description for students	Clearly present your final beam design and full summary of its properties, including a summary of features and drawbacks, in a clear and succinct format. (4)

score	4 / 4
Remarks	

General (for Part 2)	
Description for students	Explain your work in a clear and concise manner. Your report should be a maximum of 4 single-sided pages. No appendices.
score	2 / 5
Remarks	2 Too many words to explain