
Teacher Guide: Unit 11 Materials for a Purpose

Guidance for Teachers

- Guidance on delivery – Page 137-138 – or reference to this from the specifications
- This includes glossary on properties to measure (a useful resource)
- Resources – Page 142 – or reference to this from the specifications.

Guidance on Assessment

- Assessment guidance – Page 140-141 – or reference to this from the specifications
- Assessment Evidence grid Unit 11 – attached.

Assignment Work

- The assignment briefs included with this unit are expected to give some ideas on how to cover the required assessment criteria.
- It is important that the time spent on the topic area links to the mark awarded.
- It is hoped that centres will use this idea as a starting tool.
- An example of student's work included with this unit gives help to support the requirements of the assignment. It is hoped that this should be used to help to support the standard required.
- Two assessment recording sheets are included – as suggestions for possible ways to record marks awarded.

Suggested Time Allocation

- Based on 50-60 hours spent on this unit
- Includes work on assignment + teaching and learning time
- Some time should also be reserved for feedback and return of work after/before moderation.

Assessment Objective to be Covered	Mark Awarded	Possible Time Allocation
AO1	10	12 hours
AO2	14	16 hours
AO3	26	30 hours

Teacher Resource Material

- Assignment No. 11.1: What is Structure?
- Assignment No. 11.1: Student Work Example/Commentary on Mark Allocation
- Assignment No. 11.2: Quality Checks
- Assignment No. 11.2: Assessment Recording Sheet
- Assessment Recording Sheet – suggestion of a possible method to collate marks from assignments.

Unit 11: Materials for a purpose

What you need to do:

You need to produce evidence of selection of materials for **two** specified purposes and of underlying knowledge of types and properties of materials [50 marks].

This evidence needs to include:

AO1: a poster and accompanying leaflet outlining the structures of polymers, metals, ceramics or glasses, and composite materials [10];

AO2: **two** case studies describing, in detail, your selection from published data of different preferred materials for stated purposes; calculations of tensile stress and strain, the Young modulus and toughness from a graph of force against extension and details of sample dimensions [14];

AO3: your reports on (i) an experiment to measure how the extension of a sample varies with tension;
 (ii) your design and testing of an impact testing machine and an assessment of its effectiveness compared with the recognised industrial standards;
 (iii) tests to show the effect of your work-hardening, annealing and tempering treatments;
 (iv) the results of your experiments to measure electrical and thermal conductivities and specific heat capacity [26].

How you will be assessed:

Assessment Objective	Mark Band 1	Mark Band 2	Mark Band 3	Mark Awarded
AO1	You will produce an outline of the structures of at least one example of each of polymers and metals; [0 1]	you will produce a description, with diagrams, of the structures of at least two examples of each of polymers and metals; physical properties are stated; [2 3]	you will produce a description, with diagrams, of the structures of more than two examples of each of polymers and metals, relating their structures to physical properties. [4 5]	/10
	You will produce an outline of the structures of at least one example of each of ceramics or glasses and composite materials; [0 1]	you will produce a description, with diagrams, of the structures of at least two examples of each of ceramics or glasses and composite materials, physical properties are stated; [2 3]	you will produce a description, with diagrams, of the structures of more than two examples of each of ceramics or glasses and composite materials, relating their structures to physical properties. [4 5]	
AO2	You will produce a first case study clearly stating the purpose, suggesting, from published data, at least two alternative materials and identifying the selected material with some reason given for the choice; [0 1]	you will produce a first case study clearly stating the objectives and constraints imposed by the purpose, suggesting, from published data, at least three possible alternative materials and identifying the selected material with criteria given for the choice; [2 3]	you will produce a first case study clearly stating the objectives and constraints imposed by the purpose, suggesting, from published data, at least three possible alternative materials, identifying the selected material and fully justifying the choice. [4 5]	/14
	You will produce a second case study clearly stating the purpose, suggesting, from published data, at least two alternative materials and identifying the selected material with some reason given for the choice; [0 1]	you will produce a second case study clearly stating the objectives and constraints imposed by the purpose, including the required properties, suggesting, from published data, at least three possible alternative materials and identifying the selected material with criteria given for the choice; [2 3]	you will produce a second case study clearly stating the objectives and constraints imposed by the purpose, including the required properties, suggesting, from published data, at least three possible alternative materials, identifying the selected material and fully justifying the choice. [4 5]	
	You will produce calculations, with some assistance, of tensile stress and strain, the Young modulus and toughness from a graph of force against extension and length and cross-sectional area of sample; [0 1 2]	you will produce calculations from given equations of tensile stress and strain, the Young modulus and toughness from a graph of force against extension and length and cross-sectional diameter of sample; [3]	you will produce calculations, unaided, of tensile stress and strain, the Young modulus and toughness from a graph of force against extension and length and cross-sectional diameter of sample. [4]	

Unit 11: Materials for a purpose (continued)				
Assessment Objective	Mark Band 1	Mark Band 2	Mark Band 3	Mark Awarded
AO3	You will produce a report on an experiment to measure how the extension of a sample varies with tension, including plan and safety precautions, a table showing one set of results, and graph; [0 1 2 3 4]	you will produce a report on an experiment to measure how the extensions of two different samples vary with tension, including your unaided plan and risk assessment, a table showing repeat sets of results, graph and calculation of gradient; [5 6]	you will produce a report on an experiment to measure how the extensions of two different samples vary with tension, including your unaided plan and risk assessment, a table showing repeat sets of results, graph and calculation of Young modulus and comments on why your samples differ. [7 8]	
	You will produce a report on your design and testing of an impact testing machine, including plan and safety precautions, a description and diagram of your method, and sample results; you use basic scientific terminology correctly; [0 1 2 3 4]	you will produce a report on your design and testing of an impact testing machine, including unaided plan and safety precautions, a description and diagram of your method, sample results and a comparison with the recognised industrial standards; your report is clear and logical and uses basic scientific terminology correctly; [5 6]	you will produce a report on your design and testing of an impact testing machine, including unaided plan and safety precautions, a description and diagram of your method, improvements from initial prototype, sample results, and an assessment of its effectiveness compared with the recognised industrial standards; your report is logical and well-structured and uses correct scientific terminology throughout. [7 8]	
	You will produce a report on tests you have carried out on samples you have work-hardened, annealed and tempered and control samples; [0 1]	you will produce a report on tests you have carried out on samples you have work-hardened, annealed and tempered and control samples, including a comparison of the treated and untreated samples; [2 3]	you will produce a report on tests you have carried out on samples you have work-hardened, annealed and tempered and control samples, including an evaluation of whether the treatments have produced the expected result. [4 5]	
	You will produce a single set of results from each of your experiments to measure the thermal conductivity of a good conductor, the electrical conductivity of a sample of resistance wire and the specific heat capacity of a metal sample, and calculated values of thermal conductivity, electrical conductivity and specific heat capacity; [0 1]	you will produce a full set of results including repeat readings from each of your experiments to measure the thermal conductivity of a good conductor, the electrical conductivity of a sample of resistance wire and the specific heat capacity of a metal sample, and calculated values of thermal conductivity, electrical conductivity and specific heat capacity and estimated uncertainty of thermal conductivity; [2 3]	you will produce a full set of results including repeat readings from each of your experiments to measure the thermal conductivity of a good conductor, the electrical conductivity of a sample of resistance wire and the specific heat capacity of a metal sample, and calculated values of thermal conductivity, electrical conductivity and specific heat capacity, and estimated uncertainty of thermal conductivity and evaluation of your result compared to 'book' value. [4 5]	/26
Total mark awarded:				/50