



Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education

Centre Number

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Candidate Number

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Life and Health Sciences

Assessment Unit AS 5
assessing
Material Science



SZ051

[SZ051] Assessment

TIME

1 hour 30 minutes.

Assessment Level of Control:

Tick the relevant box (✓)

Controlled Conditions	
Other	

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Answer **all eight** questions.

Write your answers in the spaces provided in this question paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question, or part question.

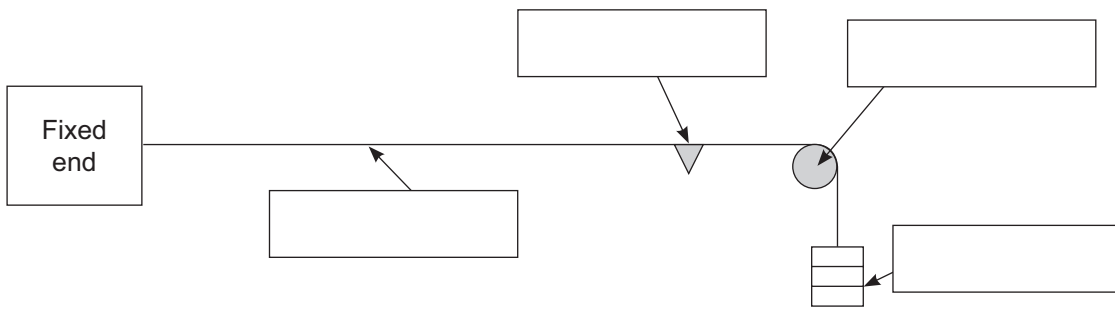
You may use an electronic calculator.

Quality of written communication will be assessed in question **8(a)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	

Total Marks	
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1 A student carries out an investigation on a piece of steel wire to determine its Young Modulus using the arrangement shown in the diagram below.



(a) Complete the diagram by writing the missing labels in the four empty boxes. [2]

(b) (i) On the diagram show accurately the length of the steel wire that should be measured. Mark this as 'L'. [1]

(ii) Choose the most appropriate length of steel wire that the student should use for the investigation. Circle the most appropriate answer.

0.5m 1.0m 2.0m [1]

(c) The student wishes to collect data to determine accurate values for stress and strain. Additional pieces of apparatus are required.

State three additional pieces of apparatus required and outline what they will each be used to measure.

Apparatus _____

Use _____

Apparatus _____

Use _____

Apparatus _____

Use _____ [3]

Examiner Only	
Marks	Remark

(d) Show that the Young Modulus E can be written as

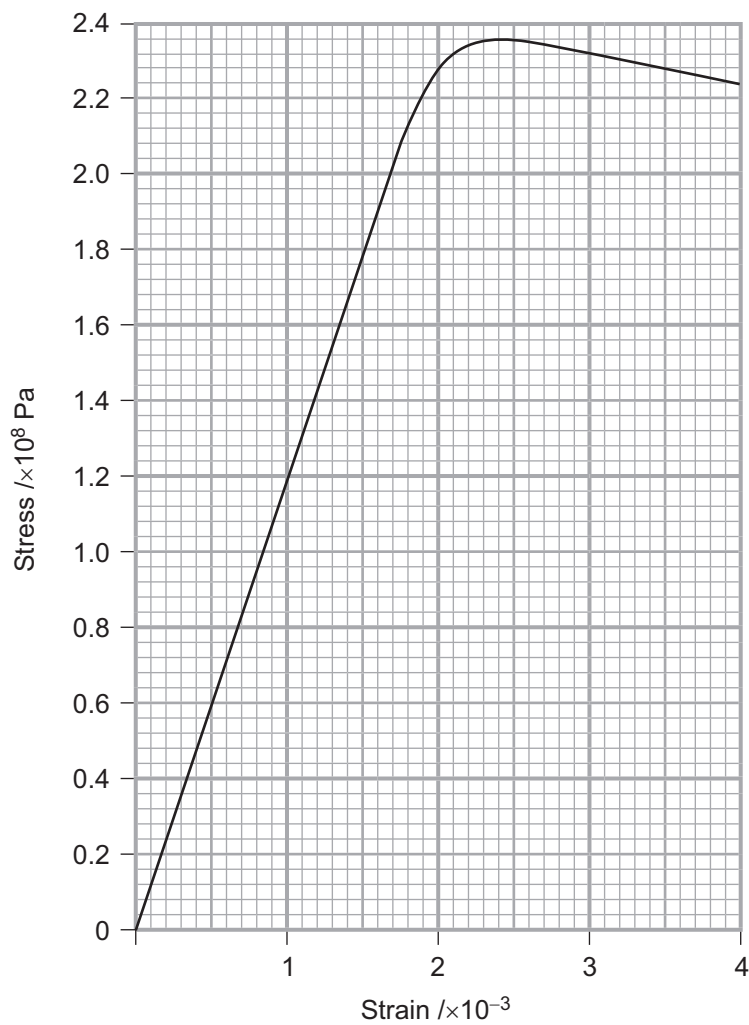
$$E = \frac{FL}{A\Delta L}$$

where F is the tensile force in the wire,
 L is the length of wire under test,
 A is the cross-sectional area of the wire, and
 ΔL is the extension of the wire.

[2]

Examiner Only	
Marks	Remark

- 2 A student produced the following stress–strain graph for copper wire as shown below.



- (a) Use the graph to determine the Young Modulus of copper, stating an appropriate unit.

Young Modulus _____ [4]

Examiner Only	
Marks	Remark

(b) The diameter of the copper wire is 1.32 mm. Calculate the stress produced when the wire is stretched by a force of 320 N.

Examiner Only	
Marks	Remark

Stress _____ Pa [5]

- 4 (a) Traditionally, penny coins were made of bronze. Bronze is a mixture of two metals, one of which is copper.



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- (i) Name the other metal that combines with copper to give bronze.

_____ [1]

- (ii) What is the special name given to a mixture of two or more materials, one of which is a metal?

_____ [1]

- (iii) In 1992 the composition of penny coins was changed to copper-plated steel. What two materials combine to give steel?

_____ [1]

- (b) The change in composition came about due to the price of copper increasing. This caused the value of the copper in pre-1992 coins to exceed their face value. Copper-plated steel was much more affordable.

Suggest two other factors you consider to be important when choosing the composition of coins. Give a reason for each choice.

Factor 1: _____

Reason 1: _____

Factor 2: _____

Reason 2: _____

_____ [4]

Examiner Only

Marks Remark

(c) Complete the table below to show the different properties of brass and stainless steel.

Property	Brass	Stainless Steel
Main composition		
Colour		Silver-grey
Use	Musical instruments	

[4]

(d) (i) What is annealing?

_____ [1]

(ii) Outline briefly how this process is carried out.

_____ [2]

Examiner Only	
Marks	Remark

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(Questions continue overleaf)

- 8 In the 1960s, copper was the most commonly used material for central heating pipes in our homes. In the 1990s, plastic pipework became more popular, particularly for use in underfloor heating systems.

Study the information in the table below.

Material	Price per 15 mm tube /£	Thermal Conductivity /Wm ⁻¹ K ⁻¹	Stiffness	Corrosion
Copper	£2.60	401	Rigid	May corrode over a period of time
Plastic (Polybutylene)	£1.52	0.23	Flexible	No effect due to excellent chemical resistance

- (a) Evaluate the factors that influence the choice of material for central heating pipes in the home.

Your answer should:

- include a brief explanation of the importance of each factor in the table above when choosing the best material;
- include another factor, not listed in the table, which is important to consider when choosing the most suitable material for this purpose and explain why;
- conclude by stating the material you would choose for central heating pipes and a reason for your choice.

Quality of written communication will be assessed in this question.

Importance of each factor

Examiner Only	
Marks	Remark

Other factor and reason

Conclusion

[6]

(b) Polyethylene is a flexible plastic foamed insulation. Give two suggestions as to why polyethylene is widely used for insulating home heating pipes.

[2]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only	
Marks	Remark

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