

Experimental technique

Question Paper 2

Level	International A Level
Subject	Physics
Exam Board	Edexcel
Topic	Experimental technique
Sub Topic	
Booklet	Question Paper 2

Time Allowed:	70 minutes
Score:	/58
Percentage:	/100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

- 1 A student wants to determine the efficiency of a filament bulb at transferring electrical energy to light energy. She does this by measuring the thermal energy given out by the bulb.

The bulb is mounted on a piece of wood and placed upside down in water as shown in the photograph.



- (a) Explain why the temperature of the filament in the bulb increases when a potential difference is applied.

(3)

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(b) The bulb is switched on for 7 minutes. The current is 1.95 A and the potential difference is 11.6 V.

(i) Show that the rate of electrical energy transfer is about 20 W.

(2)

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(ii) Show that the electrical work done is about 10 000 J.

(2)

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(iii) The temperature rise of the water is measured and used to determine the thermal energy gained by the water is 7800 J.

Calculate the efficiency of the bulb as a source of light.

(3)

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Efficiency =

(iv) Suggest why this represents the maximum efficiency.

(1)

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- 2 A student is asked to determine the Young modulus of nylon in the form of a fishing line. He arranges the fishing line horizontally with one end over a pulley so that masses can be hung vertically from the end of the line.

Describe an experiment that uses this arrangement to determine the Young modulus by a graphical method.

You should:

- (a) draw and label a diagram of the apparatus to be used, (1)
- (b) list any additional measuring instruments required that are not shown in the diagram, (1)
- (c) list the quantities to be measured, (1)
- (d) for two quantities explain your choice of measuring instrument, (4)
- (e) for one quantity comment on whether repeat readings are appropriate, (1)
- (f) state which is the independent variable and which is the dependent variable, (2)
- (g) explain how the data collected will be used to determine the Young modulus, include a sketch of the expected graph, (4)
- (h) comment on a main source of uncertainty and/or systematic error, (2)
- (i) comment on safety. (1)

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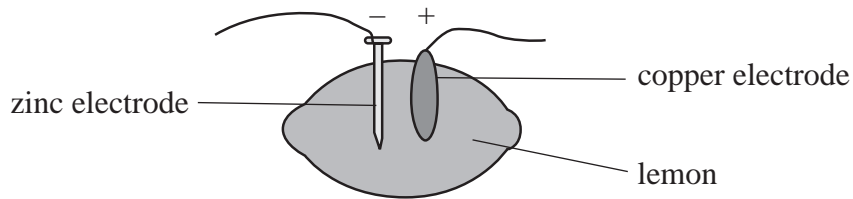
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Handwriting practice area consisting of 25 horizontal dotted lines.

(Total for Question 2 = 17 marks)

- 3 When zinc and copper electrodes are put into a lemon, the lemon can be used as an electric cell.



In an experiment to determine the e.m.f. and internal resistance of a battery made from three lemon cells, a student measures the current I for different potential differences V . Her results are shown below.

Current $I / \mu\text{A}$	Potential difference V/V
117	0.6
98	0.89
66.7	1.31
48.3	1.60
41	1.71

- (a) Criticise these results.

(2)

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- (b) The equation used for the experiment is $\mathcal{E} = V + Ir$.

Explain why a graph of V on the y -axis against I on the x -axis is a straight line with a gradient of $-r$ and an intercept on the y -axis of \mathcal{E} .

(2)

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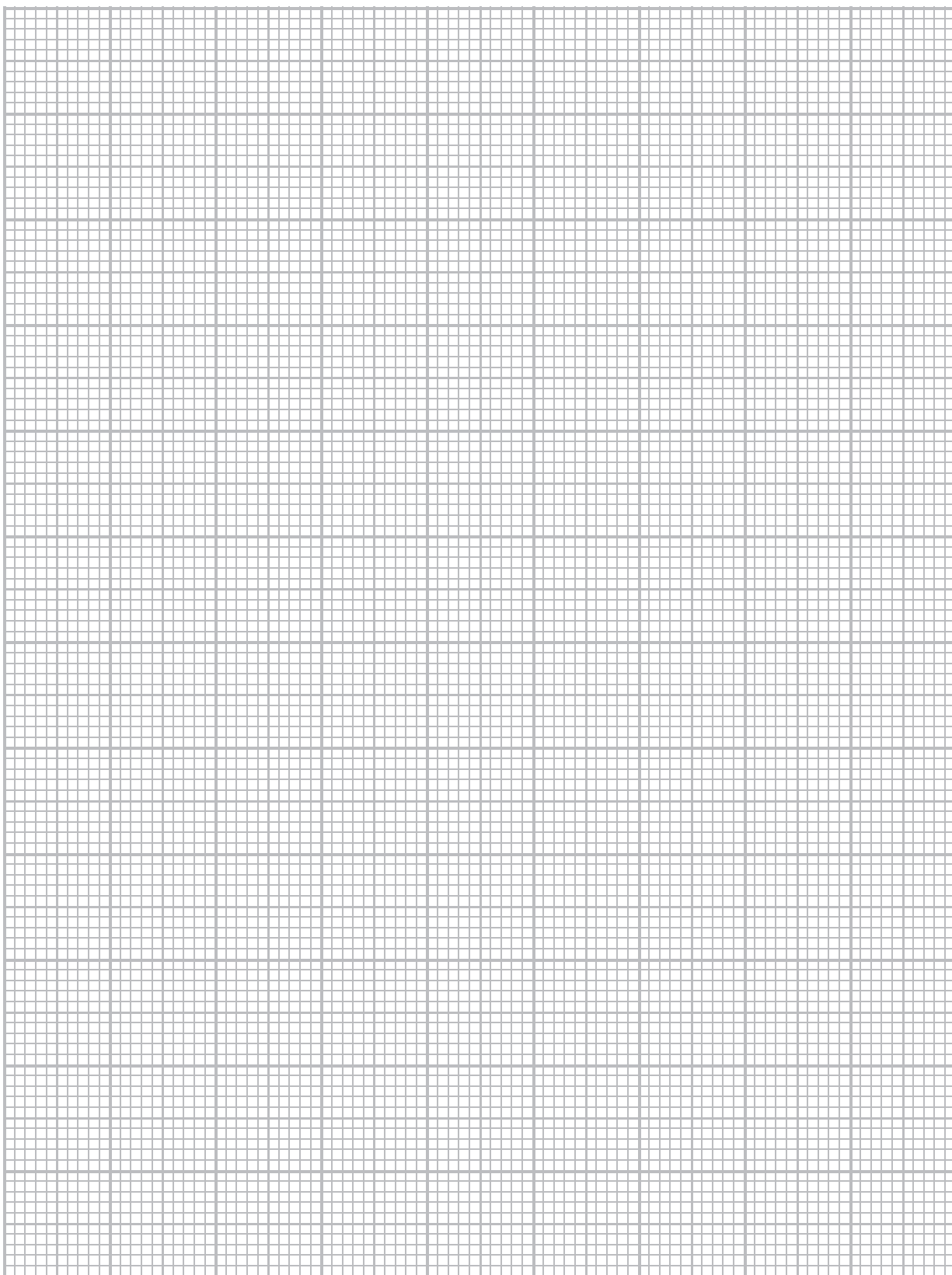
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(c) Use these results to plot the graph on the grid provided and draw a line of best fit.

(5)



(d) (i) Use your graph to determine the e.m.f. and internal resistance of the battery.

(2)

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E.m.f. =

Internal resistance =

(ii) The battery is made from 3 lemon cells connected in series.

State how you would use your answers to (d)(i) to determine the e.m.f. and internal resistance of one lemon cell.

(1)

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(Total for Question 3 = 12 marks)

- 4 A student is asked to plan an experiment to determine the energy stored in a stretched spring when it is extended by 300 mm. The student is told to use a graphical method.

For a 1 N load the extension of the spring is 40 mm.

Write a plan which could be used for this experiment.

You should:

- (a) draw a labelled diagram of the experimental set-up and list any additional apparatus required, (3)
- (b) state which quantity is the independent variable and which quantity is the dependent variable, (2)
- (c) state and explain your choice of measuring instruments for the independent and dependent variables, (4)
- (d) describe how you would ensure that your measurement of the extension is as accurate as possible, (2)
- (e) comment on whether repeat readings are appropriate in this case, (1)
- (f) explain how the data collected will be used to determine the energy stored, (4)
- (g) explain the main source of uncertainty and/or systematic error, (1)
- (h) comment on safety. (1)

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(Total for Question 4 = 18 marks)