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)

(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)

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

(2)

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

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

(3)

Efficiency = ...

(iv) Suggest why this represents the maximum efficiency.

(1)

(Total for Question 1 = 11 marks)

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,

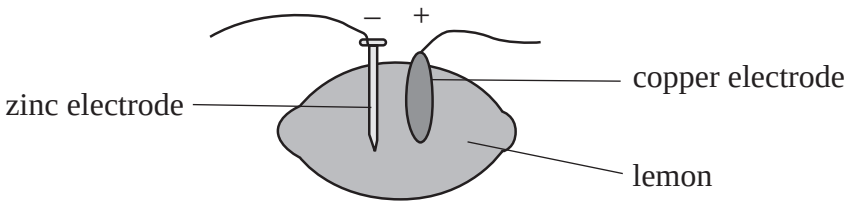
(2)

(i) comment on safety.

(1)

(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 /μA	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)

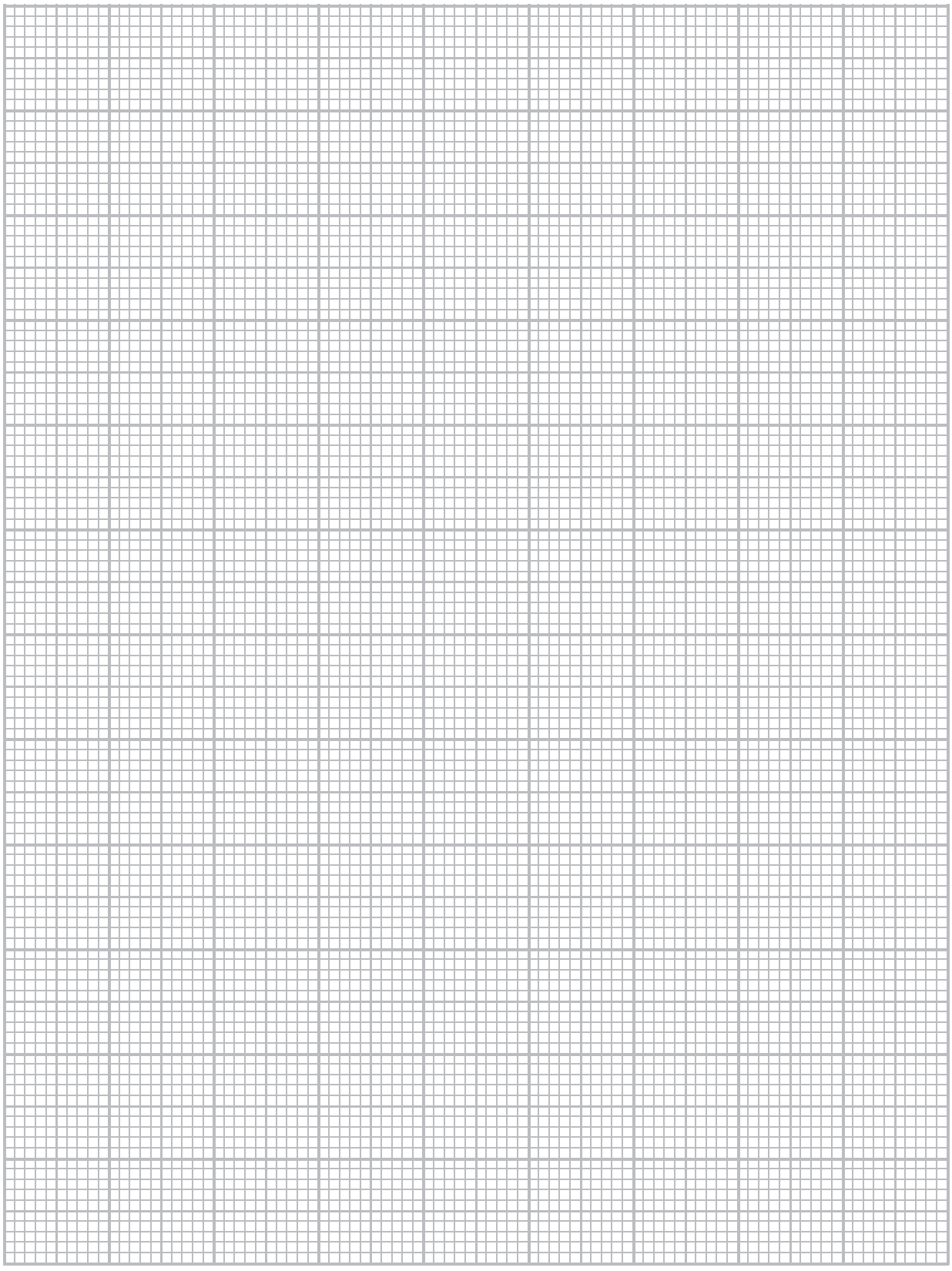
(b) The equation used for the experiment is $\mathcal{E} = V + Ir$.

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)

(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)

(Total for Question 4 = 18 marks)