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1. A student's torch uses a 1.5 V supply. She investigates the lifetime of two different supplies. For each one, she connects the supply to the lamp from her torch in a series circuit. She records the current in the lamp. She records the current again after 8 hours.

The circuit symbol for a lamp is 

- (a) (i) Draw a suitable circuit diagram for this investigation.

**(3)**

- (ii) Describe how the student would perform this investigation.

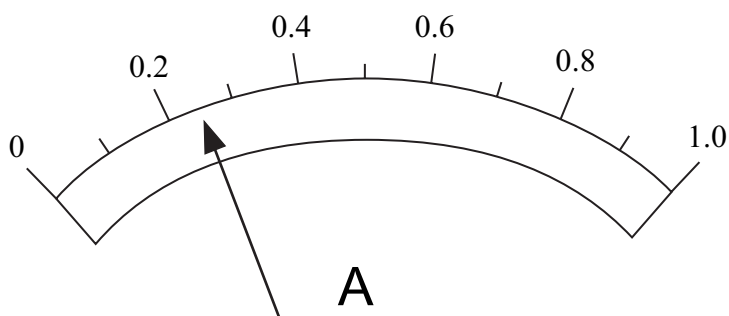
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**(3)**



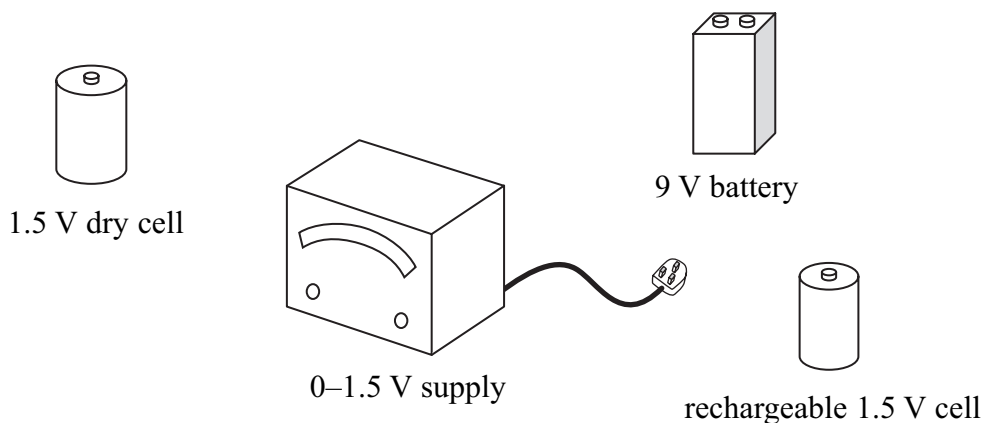
(b) An ammeter reading from her investigation is shown below.

Record this reading.



..... A  
(1)

(c) Four power supplies are shown below.




Only two of these are suitable for her torch.  
Circle these two.  
Give reasons why the other two are unsuitable.

.....  
 .....  
 .....  
 .....

(3)



- (d) The student has to find the power of her lamp. She connects a voltmeter to her circuit.

The circuit symbol for a voltmeter is 

Draw this voltmeter on your circuit diagram in part (a)(i). (1)

- (e) The student uses a light dependent resistor (LDR) to measure the brightness of the lamp. State why she should perform the experiment in a dark room.

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.....  
.....

(1)

Q1

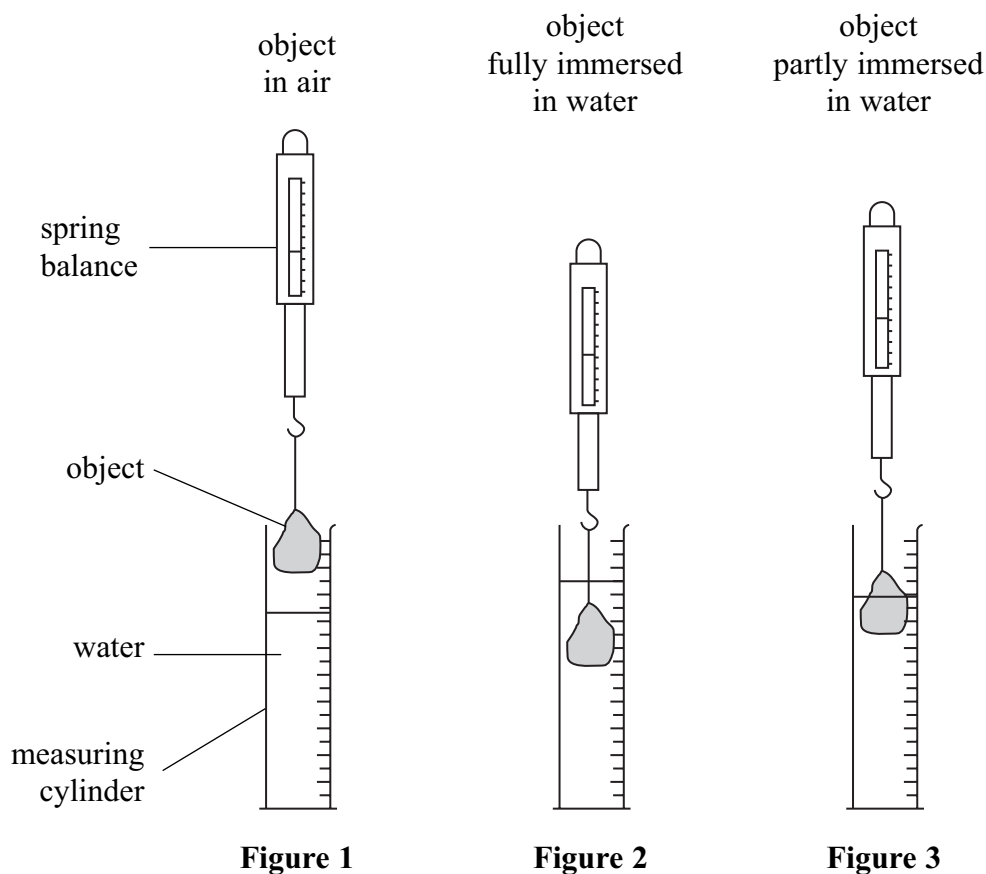
(Total 12 marks)



2. A teacher sets up a demonstration and takes readings of mass and volume for an irregularly-shaped solid object.

The object is attached to a spring balance. A 100 cm<sup>3</sup> measuring cylinder is partly filled with water.

Figures 1, 2 and 3 show the object in air, fully immersed in water and partly immersed in water.



The table shows the readings of the spring balance and the measuring cylinder. The spring balance is calibrated in grams.

	Figure 1	Figure 2	Figure 3
Mass in g (spring balance)	68	56	62
Volume in cm <sup>3</sup> (measuring cylinder)	73	85	79



(a) (i) From which Figure, 1, 2 or 3, would you take a reading to find the mass of the object?

Figure .....  
(1)

(ii) Explain your answer.

.....  
.....  
(1)

(iii) State the mass in g of the object.

Mass = ..... g  
(1)

(b) (i) From which two figures would you take readings to find the volume of the object?

Figures ..... and .....  
(1)

(ii) Explain your answer.

.....  
.....  
.....  
(1)

(iii) Calculate the volume in  $\text{cm}^3$  of the object.

Volume = .....  $\text{cm}^3$   
(2)



(c) (i)  $\text{density} = \frac{\text{mass}}{\text{volume}}$

Calculate the density in  $\text{g/cm}^3$  of the object. Give your answer to an appropriate number of significant figures.

.....  
 .....  
 .....

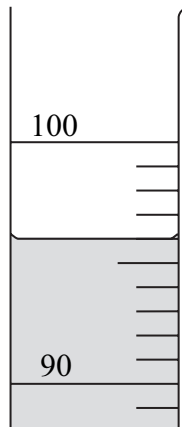
Density = .....  $\text{g/cm}^3$   
**(3)**

(ii) Justify the number of significant figures for your calculated value of density.

.....  
 .....

**(1)**

(d) The diagram shows a  $100 \text{ cm}^3$  measuring cylinder with a different quantity of water. Explain why it would not be possible to use it to find the volume of the object.



.....  
 .....  
 .....  
 .....

**(2)**





(e) (i) A regularly-shaped solid object is shown below. Briefly describe a different way to find its volume.



.....  
.....  
.....

(2)

(ii) Name the piece of equipment that would be needed.

.....

(1)

Q2

(Total 16 marks)

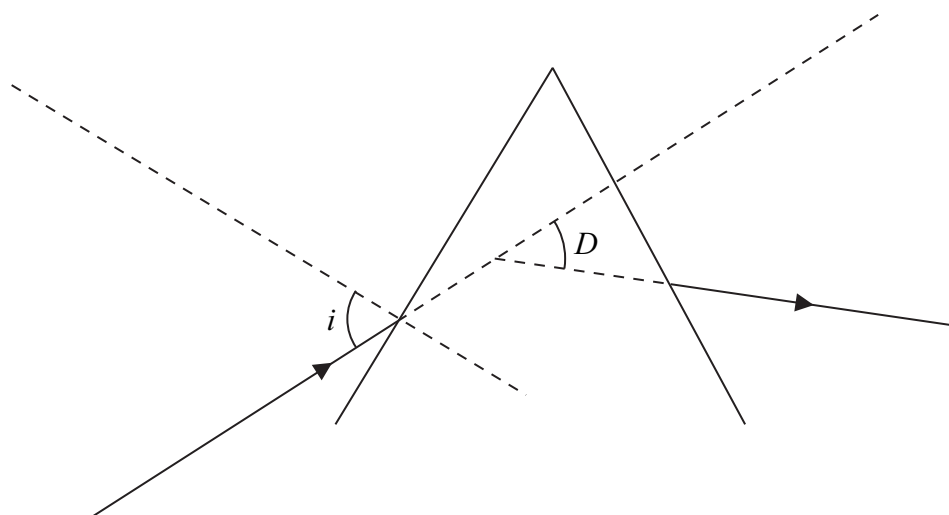
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3. (a) A ray of light enters a glass prism at an angle of incidence  $i$ . It passes through the prism and emerges as shown in the diagram. The angle  $i$  is measured between the incident ray and the normal. The angle of deviation  $D$  shows the total change of direction of the ray.



- (i) Label the normal on the diagram.

(1)

- (ii) Measure the angle of incidence  $i$ .

$i = \dots\dots\dots^\circ$   
(1)

- (iii) Measure the angle of deviation  $D$ .

$D = \dots\dots\dots^\circ$   
(1)

- (b) Name the equipment that you could use to provide the ray of light.

.....  
(1)



(c) A student measures  $D$  for different values of  $i$ . The table shows his results.

$i$ (degrees)	$D$ (degrees)
50	37
55	38
60	39
65	41
70	34
75	46

(i) On the grid opposite plot a graph of  $D$  against  $i$ . Label the axes. **(3)**

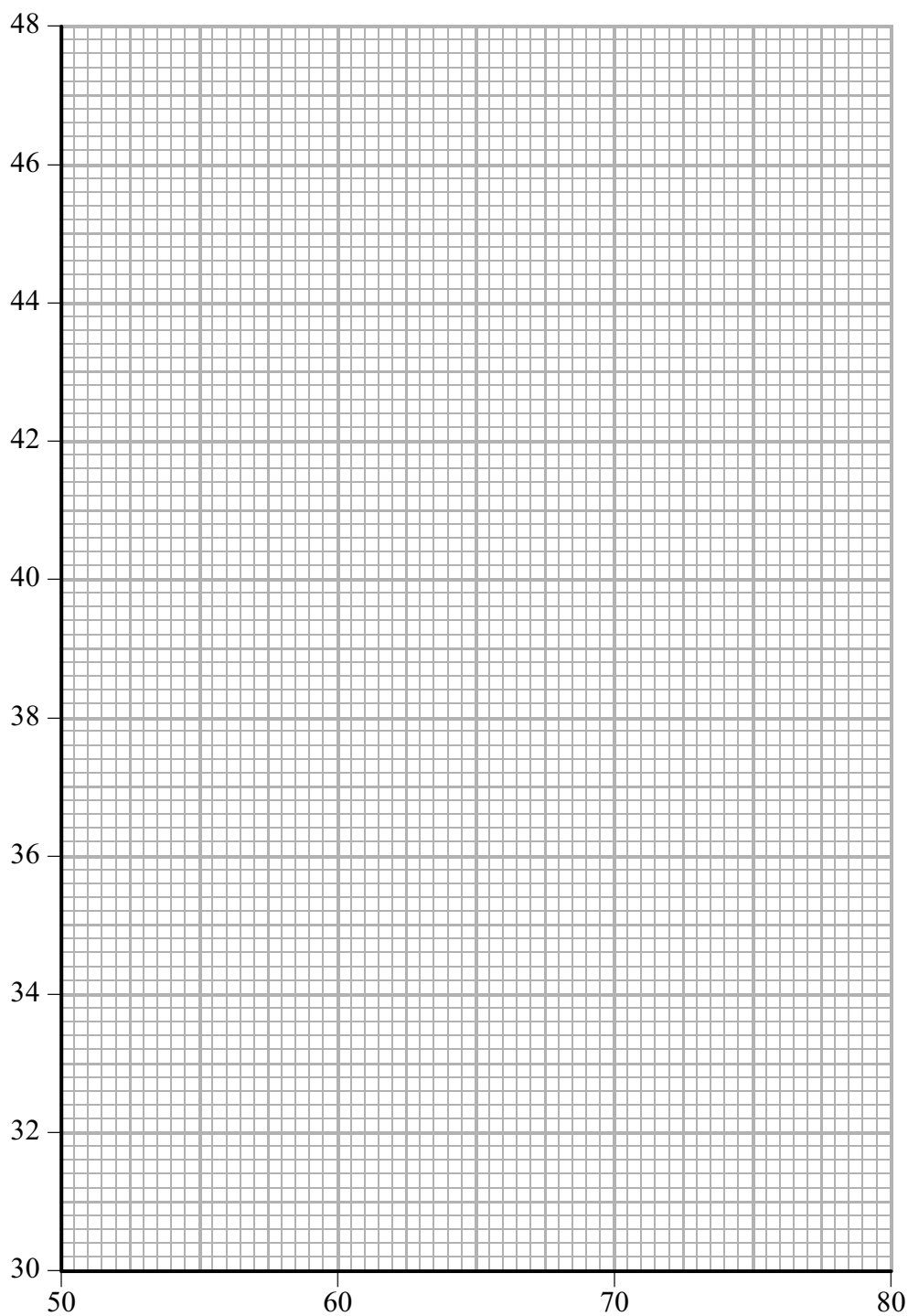
(ii) Circle the anomalous result. **(1)**

(iii) Draw the best-fit curve through the other points. **(1)**

(iv) Suggest an explanation for the anomalous result.  
 .....  
 ..... **(1)**



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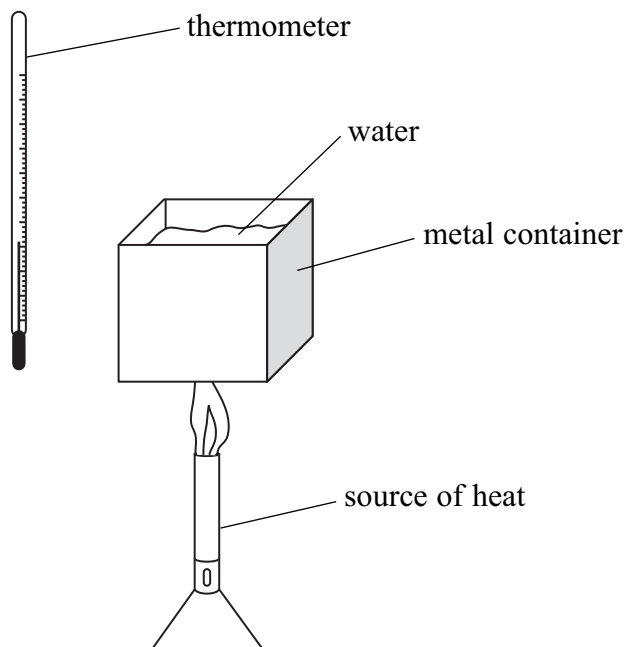


Q3

(Total 10 marks)



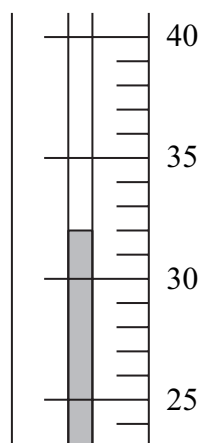
4. A teacher heats some water in a cubic metal container. Each vertical side of the container is painted a different colour: black, blue, white and silver. A student decides to investigate whether the heat radiated from each side depends on its colour. She places a thermometer 5 cm from the white surface as shown in Figure 1.



**Figure 1**

- (a) Figure 2 shows a section of the thermometer

Record the reading.

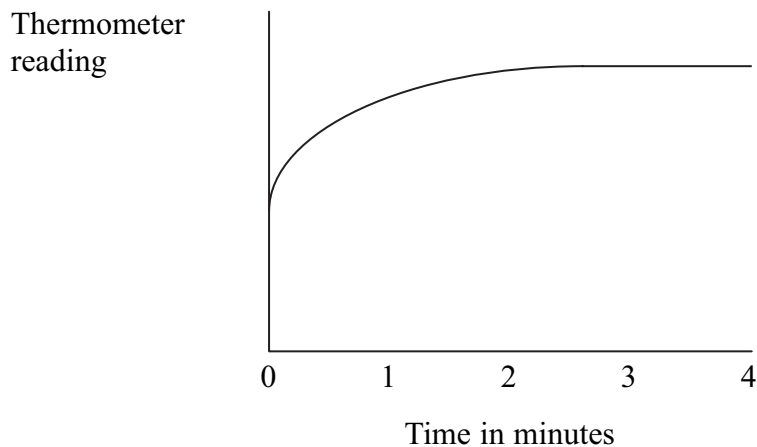


**Figure 2**

..... °C  
**(1)**



- (b) The student finds out how long it takes the thermometer to reach its maximum reading. To do so she takes a reading every 30 s for 4 minutes. The graph shows her readings.



- (i) How long in minutes does it take to reach the maximum reading?

Time = ..... minutes  
**(1)**

- (ii) Why should she not use a thermometer reading before this time?

.....  
 .....  
 .....  
**(1)**

- (c) Describe how you would use the apparatus to find out which of the colours radiates most heat.

In your account you should:

- state two items of equipment required in addition to those shown in Figure 1
- state two factors that should stay constant throughout
- describe your method.

- (i) Equipment

1 .....  
 2 .....  
**(2)**

**QUESTION 4 CONTINUES ON PAGE 16**



(ii) Constant factors

1 .....

2 .....

(2)

(iii) Method

.....

.....

.....

.....

.....

.....

(3)

(d) (i) The student's results show no difference in the amount of heat radiated from the four sides of the container.

With reference to Figure 1, suggest why this might be the case.

.....

.....

(1)

(ii) Suggest an improvement to this experiment to get more meaningful results.

.....

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(1)

Q4

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(Total 12 marks)

**TOTAL FOR PAPER: 50 MARKS**

**END**

