

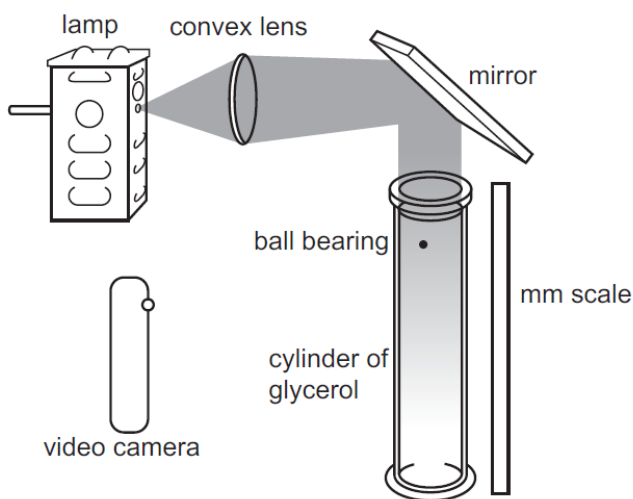
## **A level Physics B**

**H557/01** Fundamentals of physics

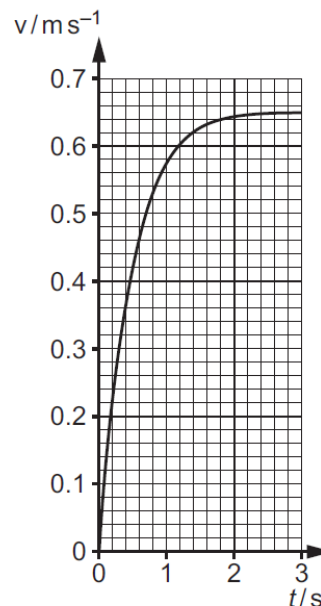
### **Question Set 11**

1

A ball bearing of diameter 12 mm was dropped through a tube of glycerol (a viscous liquid).  
 The tube was next to a millimetre scale as shown in **Fig.1**. The ball bearing was dropped from rest at the surface of the liquid. It was filmed using a video camera.



**Fig.1**



**Fig. 2**

- (a) **Fig. 2** shows the graph of velocity against time obtained by analysing the video recording.  
 This method has an uncertainty of about  $\pm 3\%$  for velocity measurement.

Use data from **Fig.2** and the measurement precision to calculate the terminal velocity of the ball bearing and its absolute uncertainty.

terminal velocity = .....  $\pm$  .....  $\text{ms}^{-1}$

[2]

- (b) Describe the motion shown in the graph at time  $t = 0.5\text{ s}$  and explain it by reference to the forces acting on the ball bearing.

[2]

- (c) (i) The investigation is extended to see how the terminal velocity  $v_T$  varies with ball bearing diameter  $D$ .

Identify and justify **one** other variable that you would control during this investigation.

[2]

(c) (ii)

This table shows the data obtained in the extended investigation.

Diameter $D$ /mm	Terminal velocity $v_T$ /ms <sup>-1</sup>
12.0	0.65
10.0	0.49
6.0	0.25
4.0	0.11
2.4	0.04

For a sphere falling through a viscous medium it is suggested that

$$v_T \propto D^2$$

Use data points from the table to propose and carry out a test of this relationship and state your conclusion.

Proposal	Working	Conclusion

[5]

**Total Marks for Question Set 11: 11**

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