Oxford Cambridge and RSA

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.

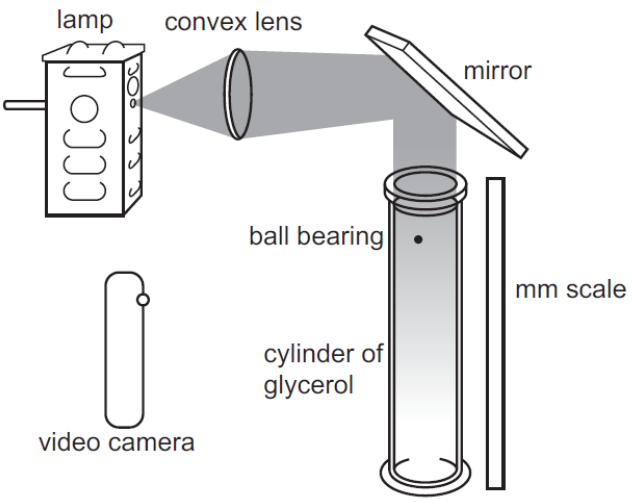

Fig.1

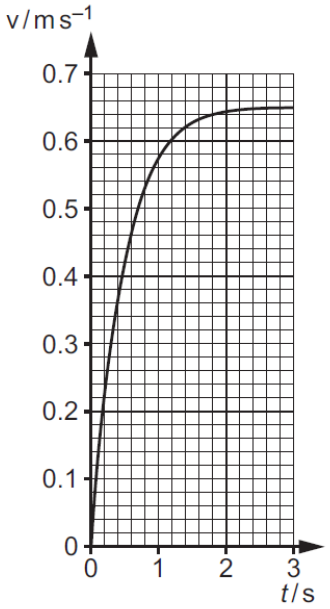

Fig. 2

(a) **Fig. 2** shows the graph of velocity against time obtained by analysing the video recording.
This method has an uncertainty of about ± 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 = ... ± ..... ms^{-1}

[2]

(b) Describe the motion shown in the graph at time $t = 0.5$ s and explain it by reference to theforces acting on the ball bearing.

[2]

(c) (i) The investigation is extended to see how the terminal velocity v_T varies with ball bearingdiameter 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 / m s^{-1}**
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 andstate your conclusion.

Proposal	Working	Conclusion

[5]

Total Marks for Question Set 11: 11