Oxford Cambridge and RSA

A Level Physics A

H556/01 Modelling physics

Question Set 22

1 A student uses a motion-sensor connected to a laptop to investigate the motion of a hollow ball of mass 1.2×10^{-2} kg falling through air.

The ball is dropped from rest. It reaches terminal velocity before it reaches the ground.

The upthrust on the ball is negligible.

Fig. 17 shows the variation with time t of the velocity v of the ball as it falls towards the ground.

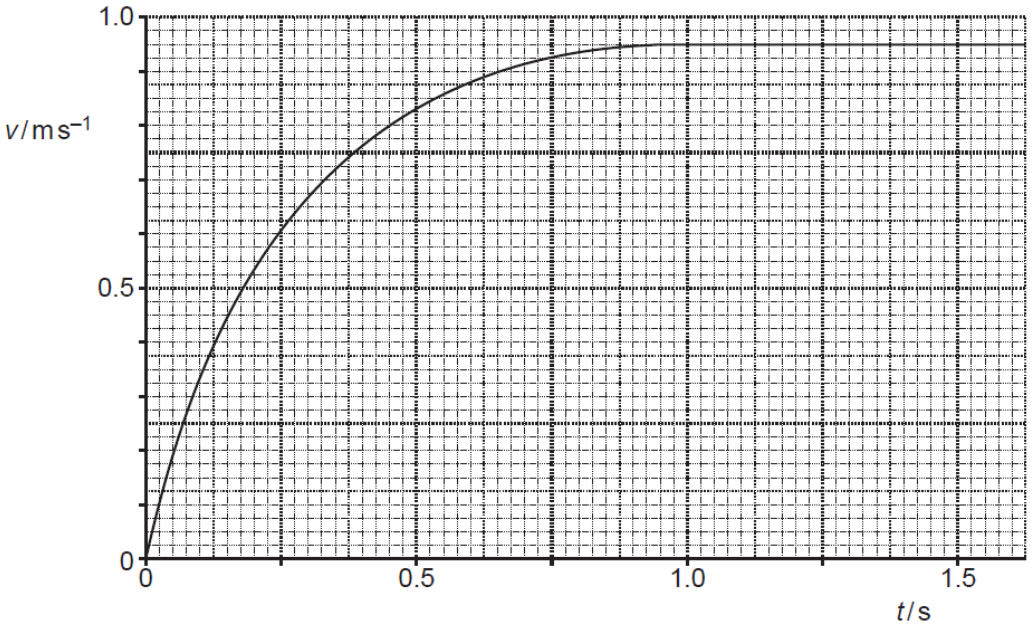

Fig. 17

(a) Draw a tangent to the curve at $t = 0.25$ s and determine the acceleration of the ball.

acceleration = ……m s^{-2} **[3]**

(b) Calculate the resultant force F acting on the ball at $t = 0.25$ s.

F = …… N **[1]**

(c) Use your answer in **(b)** to calculate the drag on the ball at time $t = 0.25$ s.

drag = ……..N **[3]**

(d) The student now adds a small amount of sand inside the hollow ball.
As before, the ball is dropped from rest and it also reaches terminal velocity before it reaches the ground.

(i) Describe how the forces acting on the sand-filled ball at $v = 0.50$ m s^{-1} compare with the forces acting on the hollow ball at this speed. **[2]**

(ii) Explain why the terminal velocity of the sand-filled ball will be greater than the terminal velocity of the hollow ball. **[2]**

Total Marks for Question Set 22: 11