1 A large metal ball is hung from a crane by means of a cable of length 5.8 m as shown in Fig. 1.1.

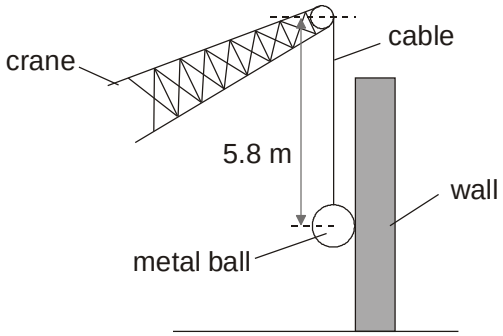

Fig. 1.1

To knock down a wall, the metal ball of mass 350 kg is pulled away from the wall while keeping the cable taut, and then released. The crane does not move. Fig. 1.2 shows the variation with time *t* of the speed *v* of the ball after release.

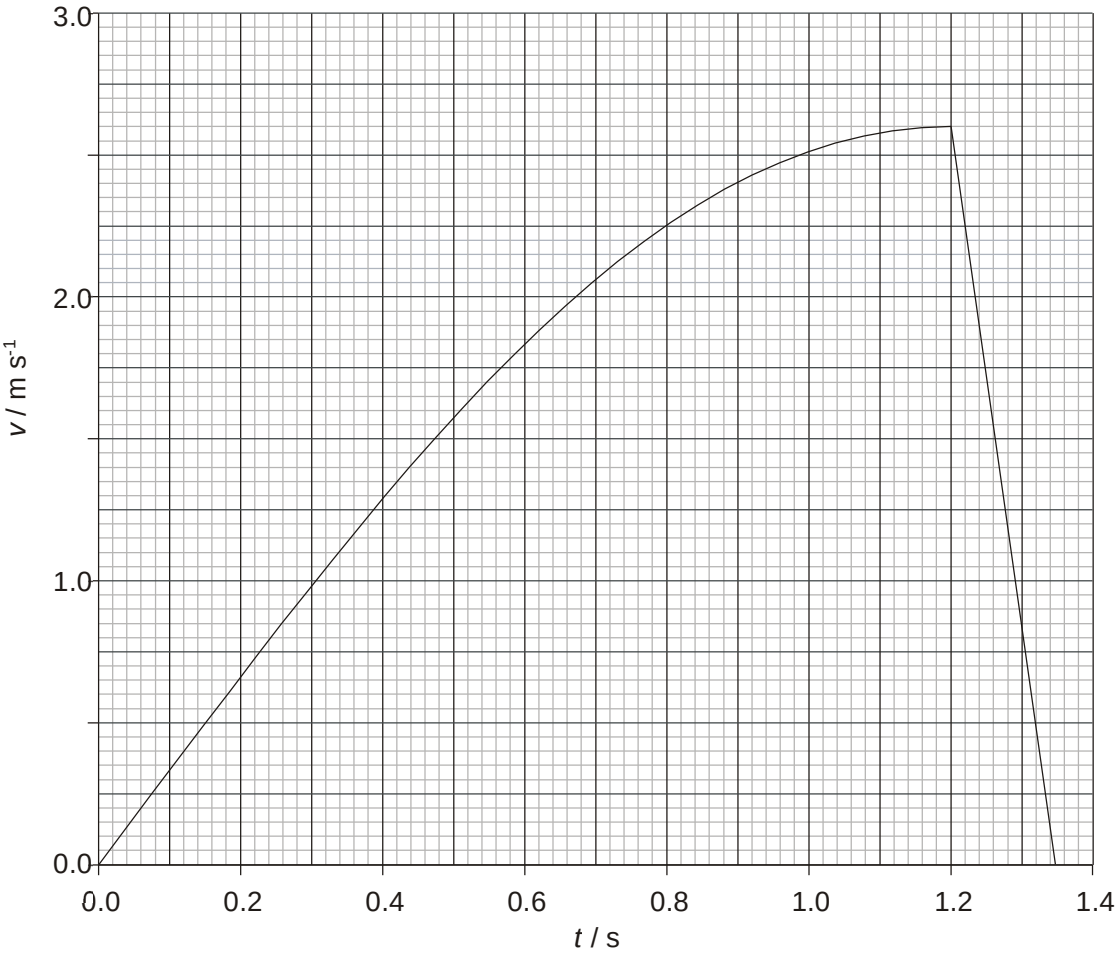

Fig. 1.2

The ball contacts the wall when the cable from the crane is vertical.

(a) At the instant just before the ball hits the wall,

(i) explain why the tension in the cable is not equal to the weight of the ball;

……

…… [1]

(ii) by reference to Fig. 1.2, estimate the tension in the cable.

tension = ……..…….. N [2]

(b) For the collision between the ball and the wall, determine the average force exerted by the ball on the wall.

average force exerted by the ball on the wall = ……..…….. N [2]

(c) The metal ball has lost momentum.
State the principle of conservation of linear momentum and discuss whether it applies to this situation.

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…… [2]

(d) During the impact of the ball with the wall, 12% of the total kinetic energy of the ball is converted into thermal energy in the ball. The metal of the ball has specific heat capacity 450 J kg^{-1} K^{-1}. Determine the average rise in temperature of the ball as a result of colliding with the wall.

average rise in temperature = ……°C [2]

2 **(a)** Explain what is meant by *upthrust*.

……

…… [1]

(b) Before a small balloon is inflated, its mass is 1.30 g as recorded on an electronic mass balance. The balloon is inflated with air so that it is spherical in shape with a diameter of 22.0 cm.

(i) The density of air is 1.21 kg m^{-3}. Calculate the mass of air displaced by the balloon.

mass of air displaced = …….. g [2]

(ii) The inflated balloon gives reading of 1.55 g when placed on the balance. Calculate the mass of air in the balloon.

mass of air in balloon = …… g [2]

(iii) Explain why the value in **(b)(ii)** is larger than the value in **(b)(i).**

……...

……... [1]