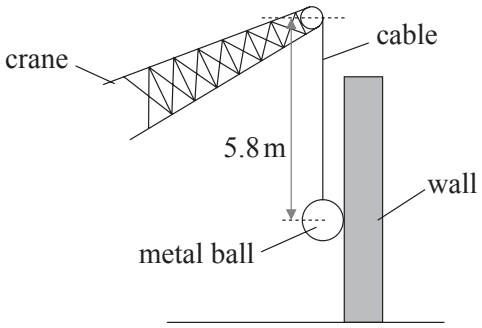
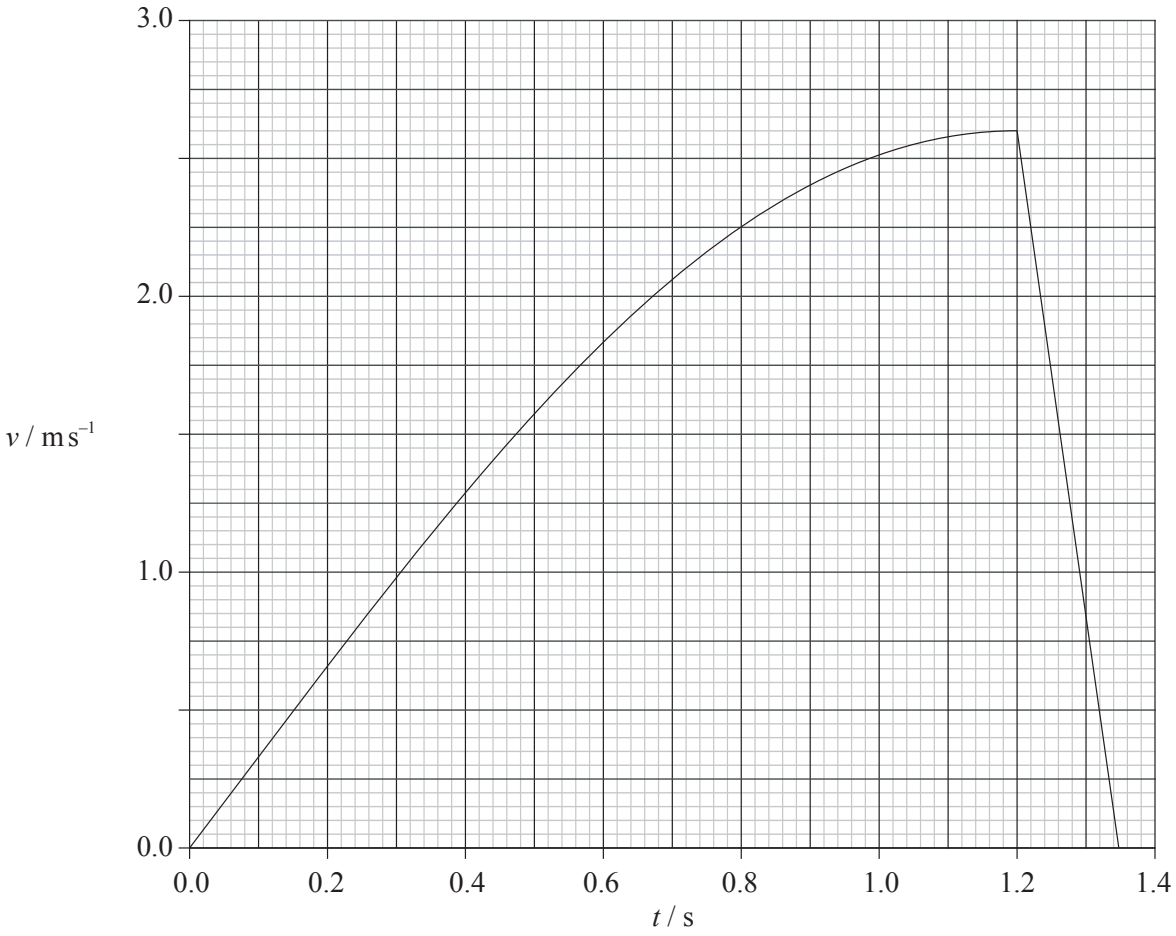
(Question B1 continued)

Part 2 Collisions

A large metal ball is hung from a crane by means of a cable of length 5.8 m as shown below.



In order to knock down a wall, the metal ball of mass 350 kg is pulled away from the wall and then released. The crane does not move. The graph below shows the variation with time t of the speed v of the ball after release.



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(Question B1, part 2 continued)

The ball makes contact with the wall when the cable from the crane is vertical.

(a) For the ball just before it hits the wall,

(i) state why the tension in the cable is not equal to the weight of the ball. *[1]*

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(ii) by reference to the graph, estimate the tension in the cable. The acceleration of free fall is $9.8\,m\,s^{-2}$. *[3]*

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(b) Use the graph to determine the distance moved by the ball after coming into contact with the wall. *[2]*

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(c) Calculate the total change in momentum of the ball during the collision of the ball with the wall. *[2]*

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(This question continues on the following page)

(Question B1, part 2 continued)

(d) (i) State the law of conservation of momentum. *[2]*

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(ii) The metal ball has lost momentum. Discuss whether the law applies to this situation. *[2]*

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(e) 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. *[4]*

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