Force + Motion (Ch2, 3 + 6)

1 A car of mass 900 kg is travelling in a straight line on a horizontal road. The driving force acting on the car is 600 N, and a resisting force of 240 N opposes the motion.

(i) Show that the acceleration of the car is $0.4\ \text{m s}^{-2}$. [2]

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(ii) Calculate the time and the distance required for the speed of the car to increase from $5\ \text{m s}^{-1}$ to $9\ \text{m s}^{-1}$. [4]

1 A man of mass 70 kg stands on the floor of a lift which is moving with an upward acceleration of $0.3\ \text{m s}^{-2}$. Calculate the magnitude of the force exerted by the floor on the man. [4]

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4 An object is projected vertically upwards with speed $7\ \text{m s}^{-1}$. Calculate

(i) the speed of the object when it is 2.1 m above the point of projection, [3]

(ii) the greatest height above the point of projection reached by the object, [3]

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(iii) the time after projection when the object is travelling downwards with speed $5.7\ \text{m s}^{-1}$. [3]

5 A particle P is projected vertically upwards, from horizontal ground, with speed $8.4\ \text{m s}^{-1}$.

(i) Show that the greatest height above the ground reached by P is 3.6 m. [3]

A particle Q is projected vertically upwards, from a point 2 m above the ground, with speed $u\ \text{m s}^{-1}$. The greatest height **above the ground** reached by Q is also 3.6 m.

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(ii) Find the value of u. [2]

It is given that P and Q are projected simultaneously.

(iii) Show that, at the instant when P and Q are at the same height, the particles have the same speed and are moving in opposite directions. [6]

6 Small parcels are being loaded onto a trolley. Initially the parcels are 2.5 m above the trolley.

(i) A parcel is released from rest and falls vertically onto the trolley. Calculate

(a) the time taken for a parcel to fall onto the trolley, [2]

(b) the speed of a parcel when it strikes the trolley. [2]

(ii)

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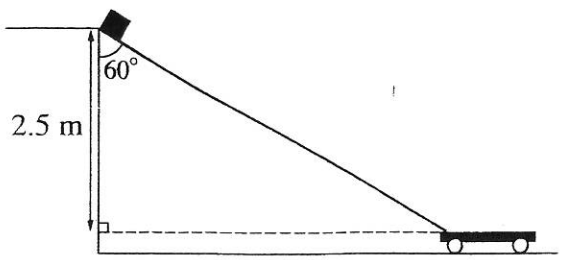

Parcels are often damaged when loaded in the way described, so a ramp is constructed down which parcels can slide onto the trolley. The ramp makes an angle of 60° to the vertical, and the coefficient of friction between the ramp and a parcel is 0.2. A parcel of mass 2 kg is released from rest at the top of the ramp (see diagram). Calculate the speed of the parcel after sliding down the ramp. [9]