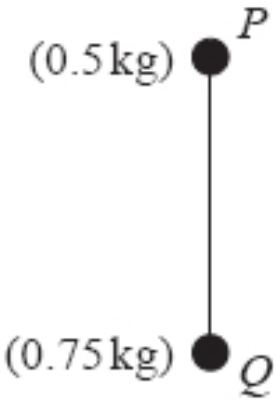
Year 1 Chapter 10: Forces and Motions (Vertical Motions)

Q1.

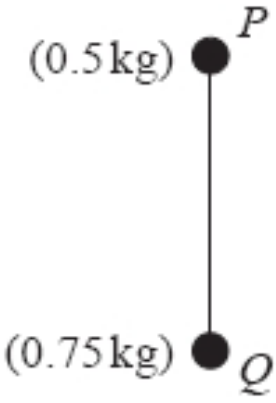


A vertical light rod *PQ* has a particle of mass 0.5kg attached to it at *P* and a particle of mass 0.75kg attached to it at *Q*, to form a system, as shown in the diagram above.

The system is accelerated vertically upwards by a vertical force of magnitude 15N applied to the **particle at *P***. Find the thrust in the rod.

(Total for question = 6 marks)

Q2. THURST



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The system is accelerated vertically upwards by a vertical force of magnitude 15N applied to the **particle at *Q***. Find the thrust in the rod.

(Total for question = 6 marks)

Q3.

A woman travels in a lift. The mass of the woman is 50 kg and the mass of the lift is 950 kg.

The lift is being raised vertically by a vertical cable which is attached to the top of the lift.

The lift is moving upwards and has constant deceleration of 2 m s^{-2}.

By modelling the cable as being light and inextensible, find

(a) the tension in the cable,

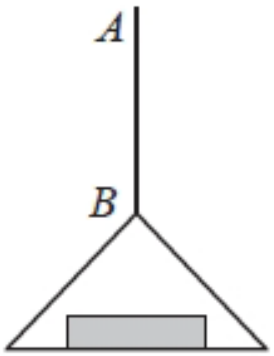
(3)

(b) the magnitude of the force exerted on the woman by the floor of the lift.

(3)

(Total 6 marks)

Q4.



A vertical rope *AB* has its end *B* attached to the top of a scale pan.

The scale pan has mass 0.5 kg and carries a brick of mass 1.5 kg, as shown in Figure 1.

The scale pan is raised vertically upwards with constant acceleration 0.5 m s^{-2} using the rope *AB*.

The rope is modelled as a light inextensible string.

(a) Find the tension in the rope *AB*.

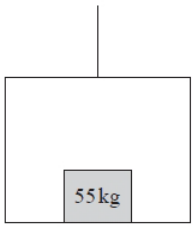
(3)

(b) Find the magnitude of the force exerted on the scale pan by the brick.

(3)

(Total for question = 6 marks)

Q5.



A lift of mass 200 kg is being lowered into a mineshaft by a vertical cable attached to the top of the lift. A crate of mass 55 kg is on the floor inside the lift, as shown in Figure 2.

The lift descends vertically with constant acceleration.

There is a constant upwards resistance of magnitude 150 N on the lift.

The crate experiences a constant normal reaction of magnitude 473 N from the floor of the lift.

(a) Find the acceleration of the lift.

(3)

(b) Find the magnitude of the force exerted on the lift by the cable.

(4)

(Total for question = 7 marks)

Q6. SUVAT

A particle P is projected vertically upwards from a point A with speed u m s^{-1}.

The point A is 17.5 m above horizontal ground.

The particle P moves freely under gravity until it reaches the ground with speed 28 m s^{-1}.

(a) Show that $u = 21$

(3)

At time t seconds after projection, P is 19 m above A.

(b) Find the possible values of t.

(5)

The ground is soft and, after P reaches the ground, P sinks vertically downwards into the ground before coming to rest. The mass of P is 4 kg and the ground is assumed to exert a constant resistive force of magnitude 5000 N on P.

(c) Find the vertical distance that P sinks into the ground before coming to rest.

(4)

(Total 12 marks)