

12Ma Mechanics Mini Test 03

Forces (Connected Particles/Pulleys)

Question 1

Edexcel IAL M1 June 2021 Q04 adapted

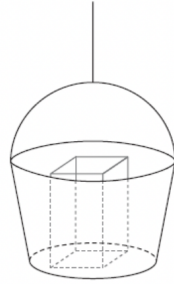


Figure 1

Figure 1 shows a large bucket used by a crane on a building site to move materials between the ground and the top of the building. The bucket is attached to a vertical cable with the bottom of the bucket horizontal.

The mass of the bucket is 15 kg. When the bucket is on the ground, a bag of cement of mass 25 kg is placed in the bucket.

The bucket with the bag of cement moves vertically upwards with constant acceleration 0.2 ms^{-2} .

The cable is modelled as light and inextensible, and air resistance is modelled as being negligible.

(a) Find the tension in the cable.

[3]

At the top of the building, the bag of cement is removed.

A box of tools of mass 12 kg is now placed in the bucket.

Later, the bucket with the box of tools is moving vertically downwards with constant deceleration 0.1 ms^{-2} .

Air resistance is again modelled as being negligible.

(b) Find the magnitude of the normal reaction between the bucket and the box of tools.

[3]

Question 2

OCR AS Maths Paper 2 June 2022 Q12 adapted

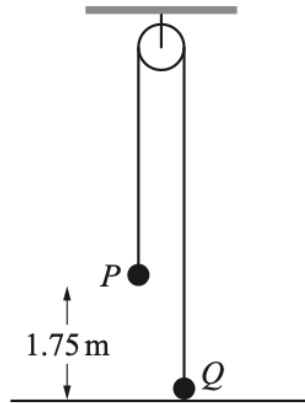


Figure 2

Figure 2 shows two particles P and Q , of masses 8 kg and 6 kg respectively. They are attached to the ends of a light inextensible string. The string passes over a smooth fixed pulley. The system is in equilibrium with P hanging 1.75 m above a horizontal plane and Q resting on the plane. The system is released from rest. You may assume that in the subsequent motion Q does not reach the pulley.

- (a) Determine the magnitude of the force exerted on the pulley by the string before P strikes the plane. [5]
- (b) Determine the total distance travelled by Q between the instant when the system is released and the instant when Q first comes momentarily to rest. [4]
- (c) When the system is again in equilibrium, find the magnitude of the normal reaction force acting on P . [2]

When this motion is observed in practice, it is found that the total distance travelled by Q between the instant when the system is released and the instant when Q first comes momentarily to rest is less than the answer calculated in part (b).

- (d) State **one** factor that could account for this difference. [1]