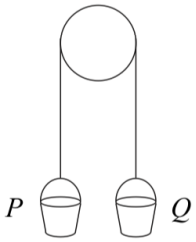
AS#67 PULLEY PROBLEMS

TAILORED TUTORS
A LEVEL MATHS

AEM questions are taken from past exam papers - they have been carefully chosen to represent a typical exam question at each level of difficulty. If you can do these questions, you're ready to move onto past papers for this topic.

APPRENTICE

A builder ties two identical buckets, P and Q, to the ends of a light inextensible rope. He hangs the rope over a smooth beam so that the buckets hang in equilibrium, as shown in the diagram. The buckets are each of mass $0.6\,\text{kg}$.



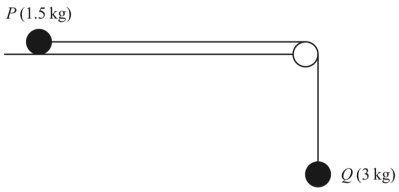
a. i. State the magnitude of the tension in the rope.
ii. State the magnitude and direction of the force exerted on the beam by the rope.

The bucket Q is held at rest while a stone, of mass $0.2\,\text{kg}$, is placed inside it. The system is then released from rest and, in the subsequent motion, bucket Q moves vertically downwards with the stone inside.

b. By forming an equation of motion for each bucket, show that the magnitude of the tension in the rope during the motion is 6.72 Newtons, correct to three significant figures.

EXPERT

Two particles P and Q have masses $1.5\,\text{kg}$ and $3\,\text{kg}$ respectively. The particles are attached to the ends of a light inextensible string. Particle P is held at rest on a fixed rough horizontal table. P moves against a resistance of 2.94 N.



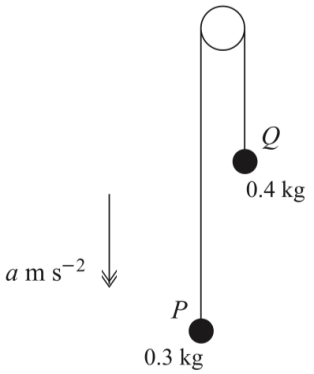
The string is parallel to the table and passes over a small smooth light pulley which is fixed at the edge of the table. Particle Q hangs freely at rest vertically below the pulley which is fixed at the edge of the table. Particle Q hangs freely at rest vertically below the pulley, as shown in the diagram. Particle P is released from rest with the string taut and slides along the table.

Assuming that P has not reached the pulley, find:

a. the tension in the string during the motion,
b. the magnitude and direction of the resultant force exerted on the pulley by the string.

MASTER

Particles P and Q, of masses $0.3\,\text{kg}$ and $0.4\,\text{kg}$ respectively, are attached to the ends of a light inextensible string. The string passes over a smooth fixed pulley. The system is in motion with the string taut and with each of the particles moving vertically. The downward acceleration of P is $a\ \text{ms}^{-2}$ (see diagram).



a. Show that $a = -1.4$.

Initially P and Q are at the same horizontal level. P's initial velocity is vertically downwards and has magnitude $2.8\,\text{ms}^{-1}$.

b. Assuming that P does not reach the floor and that Q does not reach the pulley, find the time taken for P to return to its initial position.