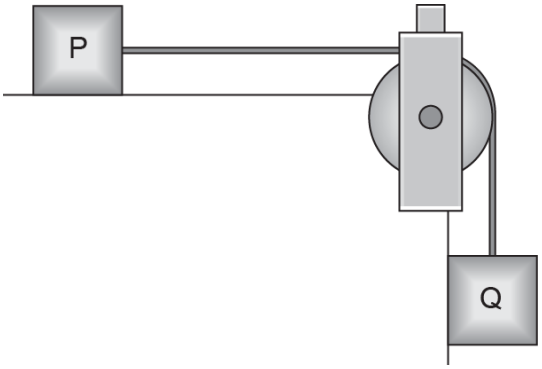
Forces and motion

Gold

The diagram below shows two bodies *P* and *Q*, of mass 8 kg and 5 kg respectively. The two bodies are connected by a light inextensible string passing over a smooth pulley. The larger mass P lies on a smooth frictionless horizontal table and the lighter mass *Q* hangs freely below the pulley.



Initially the system is at rest with the string taut. The system is then released.

a Draw a diagram showing all the forces acting on the system.
b Find the acceleration of the two masses and the tension in the string.
c An additional mass M kg is added to mass Q and the system is again released from rest. This causes the acceleration of the two masses to increase to 5 m s^{-2}. Find the size of mass M.
d What assumption does the word 'light' in the description of the string enable you to make in your solution?

Silver

Two masses, one of 3 kg and the other of 1 kg are connected by a light inextensible string passing over a smooth pulley. Both strings are taut and the 3 kg mass is released from rest at a height of 2 m above the ground.

a Find the velocity with which the 3 kg mass hits the ground.
b State one modelling assumption you have made in your answer to part **a**.

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Bronze

Two particles having masses of $2m$ and $6m$ are attached to the ends of a light inextensible string which passes over a smooth pulley. Both masses hang freely and are released from rest.

a Draw a diagram of the system, marking on your diagram all the forces acting on the masses and the pulley. Also, mark the accelerations, a, of each mass.

b

i Write down an equation of motion for the $2m$ mass.

ii Write down an equation of motion for the $6m$ mass.

c Using your equations of motion, show that $a = \frac{1}{2}g$