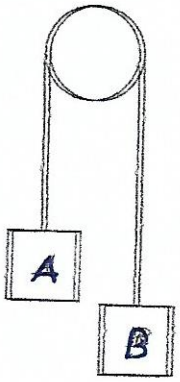
RF = ma Connected Particles

1. The diagram shows two objects A and B, of mass 5 kg and 9 kg respectively, connected by a light inextensible string passing over a smooth peg. Initially, the objects are held at rest. The system is then released.

JAN 2012

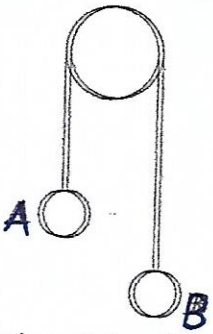


(a) Find the magnitude of the acceleration of A and the tension in the string. [7]

(b) What assumption did the word "light", underlined in the first sentence, enable you to make in your solution? [1]

2. The diagram shows two particles A and B, of mass 3·1 kg and 1·8 kg respectively, connected by a light inextensible string passing over a fixed smooth pulley. Initially, B is held at rest with the string taut. It is then released.

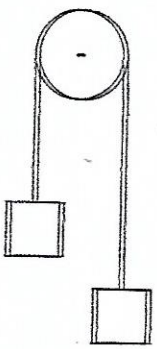
M1 JUNE 2006



Calculate the magnitude of the acceleration of A and the tension in the string. [6]

3. Two particles of masses 7 kg and 9 kg are connected by a light inextensible string passing over a smooth pulley as shown in the diagram.

M1 MAY 2002



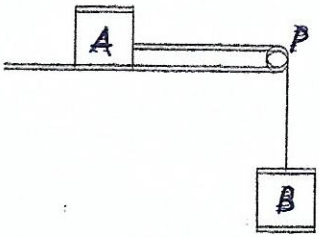
Initially the particles are held at rest with the string taut. The system is then released. Calculate

(a) the magnitude of the acceleration of each particle, [5]

(b) the tension in the string. [1]

4. The diagram shows a block A, of mass 3 kg, lying on a smooth horizontal table. It is connected to an object B, of mass 5 kg, by a light inextensible string, which passes over a smooth light pulley P fixed at the edge of the table so that B hangs freely.

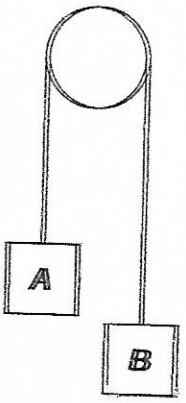
JUNE 2005



Initially the system is held at rest with the string taut. A horizontal force of magnitude 75 N is then applied to A in the direction PA so that B is raised. Find the magnitude of the acceleration of A and the tension in the string. [7]

5. The diagram shows two objects, A and B, of mass 2 kg and 5 kg respectively, connected by a light inextensible string passing over a smooth fixed pulley. Initially, the objects are held at rest with the string taut. The system is then released.

JUNE 2016



(a) Find the magnitude of the acceleration of A and the tension in the string. [7]

(b) Before the object A reaches the pulley and 2 seconds after the system is released, the string breaks.

(i) Find the speed of A when the string breaks.
(ii) Given that A does not reach the pulley in the subsequent motion and that A is 18·9 m above the ground when the string breaks, determine the time taken for A to reach the ground. [6]

6. Two particles P and Q, of masses 3 kg and 5 kg respectively, are attached one to each end of a light inextensible string which passes over a smooth peg. Initially, the particles are held at rest with the string just taut and with both hanging parts of the string vertical. The particles are then released from rest.

JUNE 2018

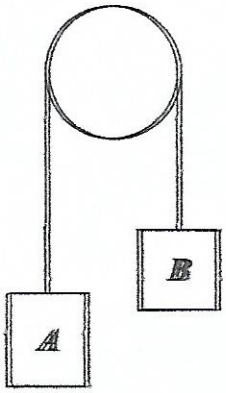
(a) Find the magnitude of the acceleration of P and the tension in the string. [7]

(b) What assumption does the word 'light', in the description of the string, enable you to make in your solution? [1]

(c) What assumption does the word 'smooth', in the description of the peg, enable you to make in your solution? [1]

7. Two particles A and B are connected by a light inextensible string which passes over a smooth fixed pulley. Particle A has mass 3 kg and particle B has mass M kg. Initially, the particles are held at rest with the string just taut and the hanging parts of the string vertical, as shown in the diagram.

JUNE 2012



The system is then released from rest and particle B moves downwards with acceleration $0{\cdot}4g\,\text{ms}^{-2}$, where g is the acceleration due to gravity.
Calculate the tension in the string and the value of M. [7]