Newton's law of motion

Question Paper 6

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	Newton's law of motion
Sub Topic	Newton's law of motion
Booklet	Question Paper 6

Time Allowed: **53 minutes**

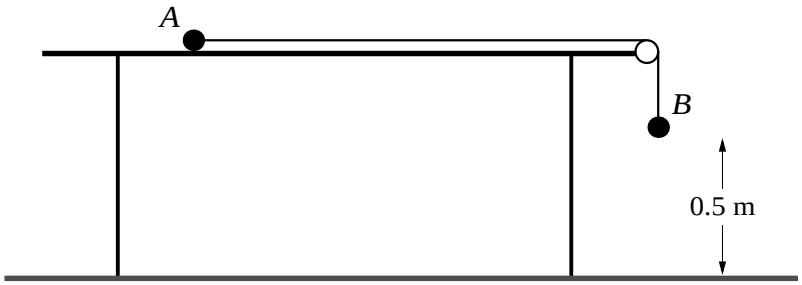
Score: **/44**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1



Particles A and B, of masses 0.3 kg and 0.7 kg respectively, are attached to the ends of a light inextensible string. Particle A is held at rest on a rough horizontal table with the string passing over a smooth pulley fixed at the edge of the table. The coefficient of friction between A and the table is 0.2. Particle B hangs vertically below the pulley at a height of 0.5 m above the floor (see diagram). The system is released from rest and 0.25 s later the string breaks. A does not reach the pulley in the subsequent motion. Find

(i) the speed of B immediately before it hits the floor, [9]

(ii) the total distance travelled by A. [3]

2

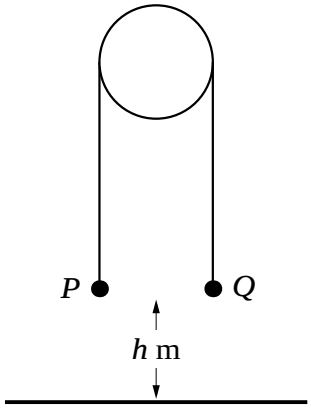


Fig. 1

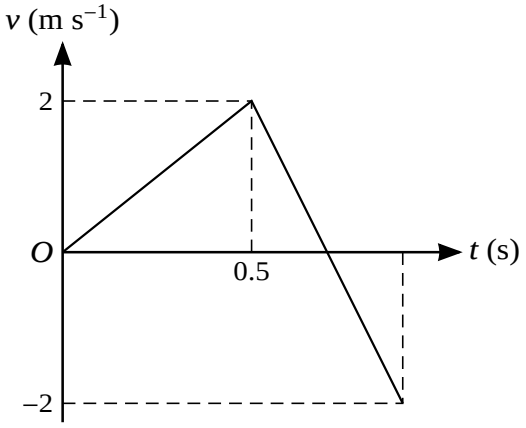


Fig. 2

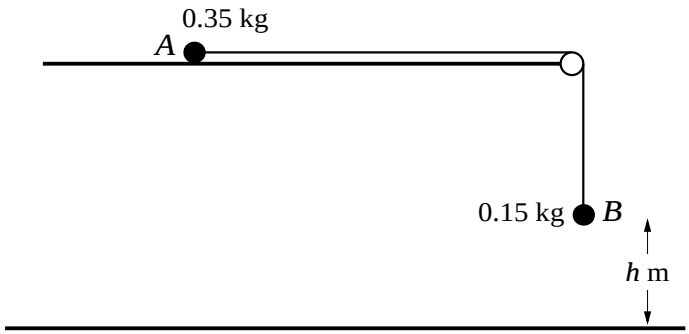
Two particles P and Q have masses m kg and $(1 - m)$ kg respectively. The particles are attached to the ends of a light inextensible string which passes over a smooth fixed pulley. P is held at rest with the string taut and both straight parts of the string vertical. P and Q are each at a height of h m above horizontal ground (see Fig. 1). P is released and Q moves downwards. Subsequently Q hits the ground and comes to rest. Fig. 2 shows the velocity-time graph for P while Q is moving downwards or is at rest on the ground.

(i) Find the value of h. [2]

(ii) Find the value of m, and find also the tension in the string while Q is moving. [6]

(iii) The string is slack while Q is at rest on the ground. Find the total time from the instant that P is released until the string becomes taut again. [3]

3



Particles A and B, of masses 0.35 kg and 0.15 kg respectively, are attached to the ends of a light inextensible string. A is held at rest on a smooth horizontal surface with the string passing over a small smooth pulley fixed at the edge of the surface. B hangs vertically below the pulley at a distance h m above the floor (see diagram). A is released and the particles move. B reaches the floor and A subsequently reaches the pulley with a speed of $3\,\text{m s}^{-1}$.

(i) Explain briefly why the speed with which B reaches the floor is $3\,\text{m s}^{-1}$. [1]

(ii) Find the value of h. [4]

4 A particle is projected vertically upwards with speed $9\,\text{m s}^{-1}$ from a point 3.15 m above horizontal ground. The particle moves freely under gravity until it hits the ground. For the particle's motion from the instant of projection until the particle hits the ground, find the total distance travelled and the total time taken. [6]

5

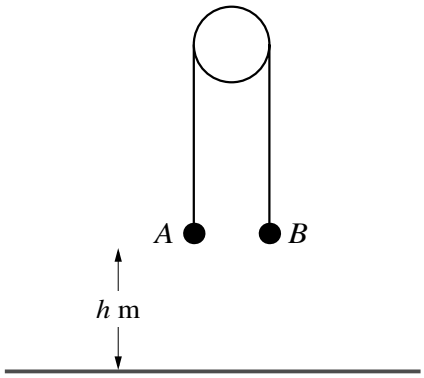


Fig. 1

Particles A of mass 0.25 kg and B of mass 0.75 kg are attached to opposite ends of a light inextensible string which passes over a fixed smooth pulley. The system is held at rest with the string taut and its straight parts vertical. Both particles are at a height of h m above the floor (see Fig. 1). The system is released from rest, and 0.6 s later, when both particles are in motion, the string breaks. The particle A does not reach the pulley in the subsequent motion.

(i) Find the acceleration of A and the distance travelled by A before the string breaks. [4]

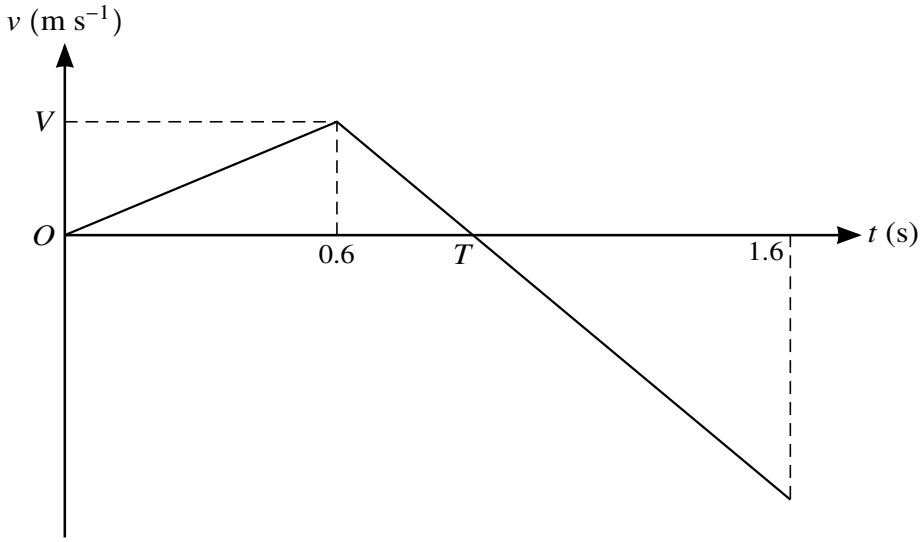


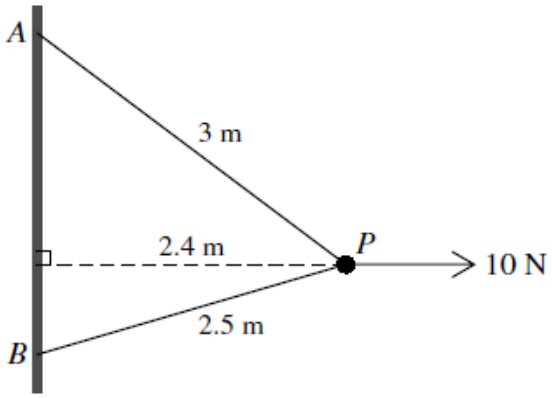
Fig. 2

The velocity-time graph shown in Fig. 2 is for the motion of particle A until it hits the floor. The velocity of A when the string breaks is V m s^{-1} and T s is the time taken for A to reach its greatest height.

(ii) Find the value of V and the value of T. [3]

(iii) Find the distance travelled by A upwards and the distance travelled by A downwards and hence find h. [3]

6



A and B are fixed points of a vertical wall with A vertically above B. A particle P of mass 0.7 kg is attached to A by a light inextensible string of length 3 m. P is also attached to B by a light inextensible string of length 2.5 m. P is maintained in equilibrium at a distance of 2.4 m from the wall by a horizontal force of magnitude 10 N acting on P (see diagram). Both strings are taut, and the 10 N force acts in the plane APB which is perpendicular to the wall. Find the tensions in the strings. [6]