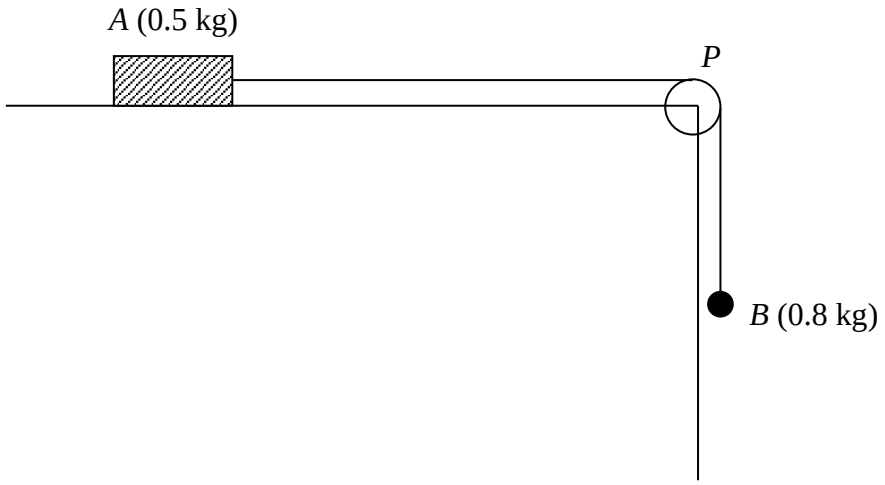
Daily Question – Mechanics - Day 5

Topic: Connected particles

Day 5 Question 1

Figure 4



A block of wood A of mass 0.5 kg rests on a rough horizontal table and is attached to one end of a light inextensible string. The string passes over a small smooth pulley P fixed at the edge of the table. The other end of the string is attached to a ball B of mass 0.8 kg which hangs freely below the pulley, as shown in Figure 4. The coefficient of friction between A and the table is μ. The system is released from rest with the string taut. After release, B descends a distance of 0.4 m in 0.5 s. Modelling A and B as particles, calculate

(a) the acceleration of B,

(3)

(b) the tension in the string,

(4)

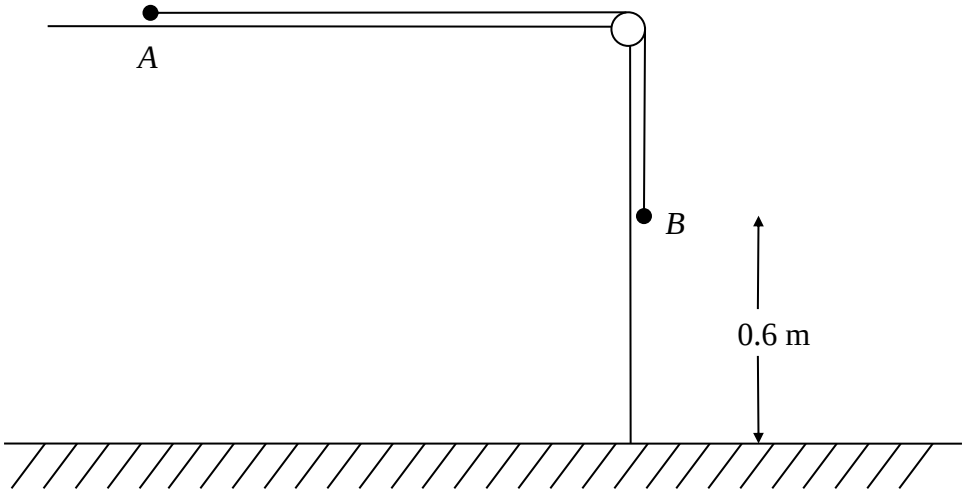
(c) the value of μ.

(5)

(d) State how in your calculations you have used the information that the string is inextensible.

(1)

Day 5 Question 2



A particle A of mass 0.8 kg rests on a horizontal table and is attached to one end of a light inextensible string. The string passes over a small smooth pulley P fixed at the edge of the table. The other end of the string is attached to a particle B of mass 1.2 kg which hangs freely below the pulley, as shown in Fig. 4. The system is released from rest with the string taut and with B at a height of 0.6 m above the ground. In the subsequent motion A does not reach P before B reaches the ground. In an initial model of the situation, the table is assumed to be smooth. Using this model, find

(a) the tension in the string before B reaches the ground,

(5)

(b) the time taken by B to reach the ground.

(3)

In a refinement of the model, it is assumed that the table is rough and that the coefficient of friction between A and the table is $\frac{1}{5}$. Using this refined model,

(c) find the time taken by B to reach the ground.

(8)