Leave blank

8.

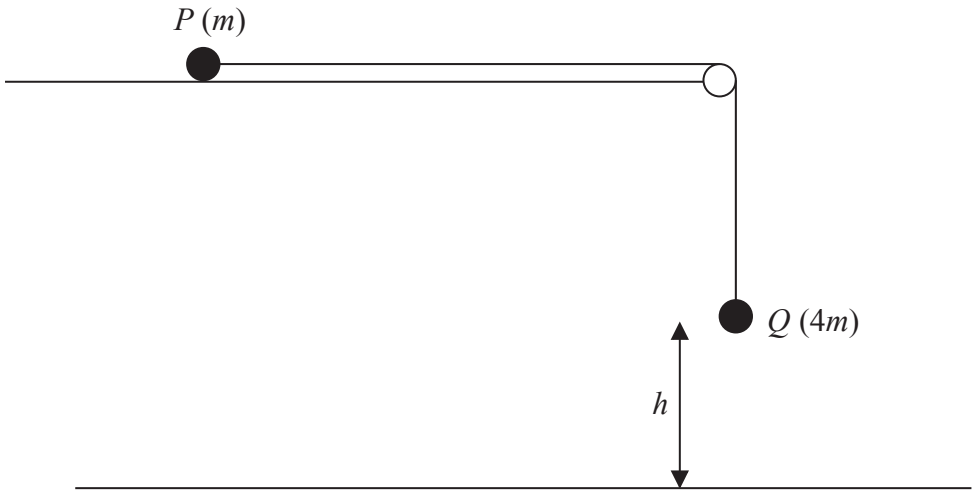

Figure 3

Two particles P and Q have masses m and $4m$ respectively. The particles are attached to the ends of a light inextensible string. Particle P is held at rest on a rough horizontal table. The string lies along the table and passes over a small smooth light pulley which is fixed at the edge of the table. Particle Q hangs at rest vertically below the pulley, at a height h above a horizontal plane, as shown in Figure 3. The coefficient of friction between P and the table is 0.5. Particle P is released from rest with the string taut and slides along the table.

(a) Find, in terms of mg, the tension in the string while both particles are moving.

(8)

The particle P does not reach the pulley before Q hits the plane.

(b) Show that the speed of Q immediately before it hits the plane is $\sqrt{1.4gh}$

(2)

When Q hits the plane, Q does not rebound and P continues to slide along the table. Given that P comes to rest before it reaches the pulley,

(c) show that the total length of the string must be greater than $2.4h$

(6)

P 4 4 8 3 6 A 0 2 4 2 8