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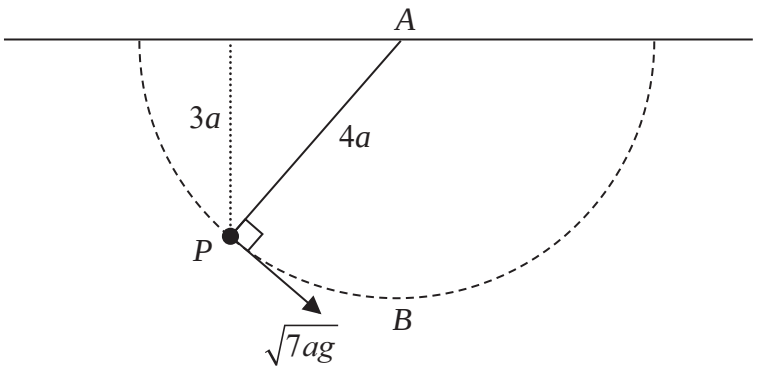


Figure 2

One end of a light inextensible string of length $4a$ is attached to a fixed point A on a horizontal ceiling. A particle, P, of mass m is attached to the other end of the string. The particle is held in equilibrium at a vertical distance $3a$ below the ceiling, with the string taut. The particle is then projected with speed $\sqrt{7ag}$, in the direction perpendicular to the string, in the vertical plane containing A and the string, as shown in Figure 2. In the subsequent motion the string remains taut.

(a) Find the speed of P at the instant before it hits the ceiling.

(4)

The point B is the lowest point of the path of P. The first time P passes through B the tension in the string is T_1 and the second time P passes through B the tension in the string is T_2

Given that the coefficient of restitution between P and the ceiling is $\frac{1}{2}$

(b) find the ratio $T_1 : T_2$ in its simplest form.

(7)

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