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7.

Figure 4

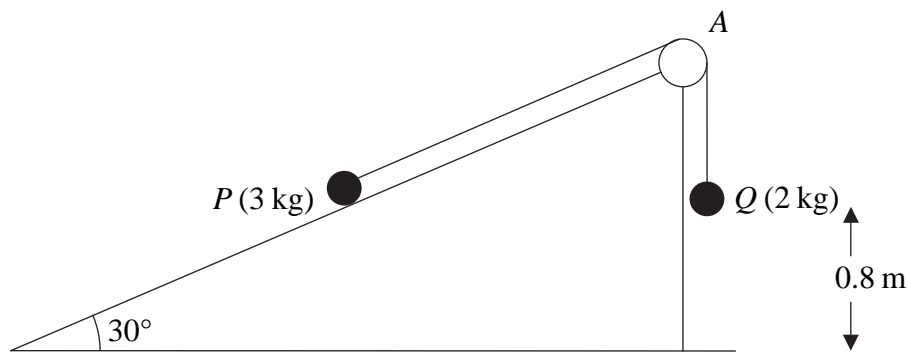


Figure 4 shows two particles P and Q , of mass 3 kg and 2 kg respectively, connected by a light inextensible string. Initially P is held at rest on a fixed smooth plane inclined at 30° to the horizontal. The string passes over a small smooth light pulley A fixed at the top of the plane. The part of the string from P to A is parallel to a line of greatest slope of the plane. The particle Q hangs freely below A . The system is released from rest with the string taut.

(a) Write down an equation of motion for P and an equation of motion for Q . (4)

(b) Hence show that the acceleration of Q is 0.98 m s^{-2} . (2)

(c) Find the tension in the string. (2)

(d) State where in your calculations you have used the information that the string is inextensible. (1)

On release, Q is at a height of 0.8 m above the ground. When Q reaches the ground, it is brought to rest immediately by the impact with the ground and does not rebound. The initial distance of P from A is such that in the subsequent motion P does not reach A . Find

(e) the speed of Q as it reaches the ground, (2)

(f) the time between the instant when Q reaches the ground and the instant when the string becomes taut again. (5)



