A particle P of mass m is attached to one end of a light elastic string of natural length a and modulus of elasticity $2mg$. A particle Q of mass km is attached to the other end of the string. Particle P lies on a smooth horizontal table. The string has part of its length in contact with the table and then passes through a small smooth hole H in the table.

Particle P moves in a horizontal circle on the surface of the table with constant speed $\sqrt{\frac{1}{2}ga}$. Particle Q hangs in equilibrium vertically below the hole with $HQ = \frac{1}{4}a$.

(a) Find, in terms of a, the extension in the string. [4]

(b) Find the value of k. [2]