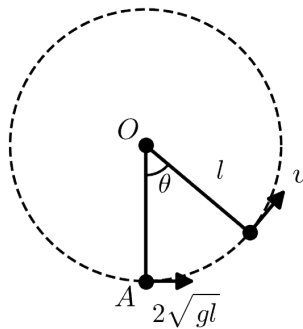


1E Objects Not Constrained on a Circular Path

Examples of objects that are constrained / not constrained to stay on a circular path:

What happens when the contact force (tension or normal reaction) becomes zero:

1. A particle P of mass m is attached to one end of a light inextensible string of length l . The other end of the string is attached to a fixed point O. The particle is hanging in equilibrium at point A, directly below O, when it is set in motion with a horizontal speed $2\sqrt{gl}$. When OP has turned through an angle θ and the string is still taut, the tension in the string is T . Find:

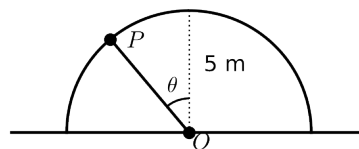


a) an expression for T

b) the height of P above A at the instant when the string goes slack

- c) the maximum height above A reached by P before it starts to fall to the ground again.

2. A smooth hemisphere with radius 5 m and centre O is resting in a fixed position on a horizontal plane with its flat face in contact with the plane. A particle P of mass 4 kg is slightly disturbed from rest at the highest point of the hemisphere. When OP has turned through an angle θ and the particle is still on the surface of the hemisphere the normal reaction of the sphere on the particle is R. Find:



- a) an expression for R
- b) the angle between OP and the upward vertical when the particle leaves the surface of the hemisphere

- c) the distance of the particle from the centre of the hemisphere when it hits the ground.