Answer on Question #52583, Physics, Mechanics | Kinematics | Dynamics

A particle of mass m is initially situated at the point p inside a hemispherical surface of radius r. A horizontal acceleration of magnitude a_0 is suddenly produced on the particle in the horizontal direction. If gravitational acceleration is neglected, the time taken by particle to touch the sphere again is:

Solution:



From figure OP = r.

The kinematics equation is

$$x = x_0 + v_o t + \frac{1}{2}a_0 t^2$$

where

 $x_0 = P$ is initial position $v_0 = 0 m/s$ is initial speed a_0 is acceleration x = B is final position. Thus,

$$t = \sqrt{\frac{2(x - x_0)}{a_0}}$$

From figure

$$x - x_0 = PB = 2PA$$
$$PA = OP \cos \alpha = r \cos \alpha$$

Hence,

$$t = \sqrt{\frac{2 * 2 * r \cos \alpha}{a_0}} = \sqrt{\frac{4r \cos \alpha}{a_0}}$$



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