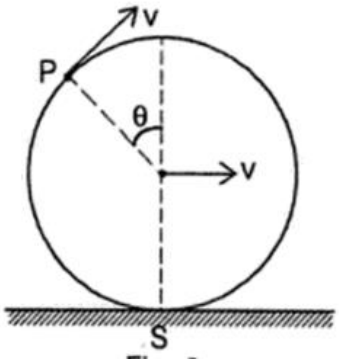
Answer on Question #66180-Physics-Mechanics-Relativity

A wheel of radius R is rolling in a straight line without slipping on a plane surface, the plane of the wheel is vertical. For the instant when the axis of the wheel is moving with a speed v relative to the surface, the instantaneous velocity of any point P on the rim of the wheel relative to the surface will be

Solution



Assume no slipping:

$$v_S = 0 = \omega R - v \rightarrow \omega R = v$$

The instantaneous velocity of any point P on the rim of the wheel relative to the surface will be

$$\vec{V} = \vec{v} + \overrightarrow{\omega R}$$

$$V = \sqrt{v^2 + v^2 + 2vv\cos\theta} = v\sqrt{2(1+\cos\theta)}$$