Question #62150, Physics – Mechanics | Relativity

A long string is wrapped around a 6.0-cm-diameter cylinder, initially at rest, that is free to rotate on an axle. The string is then pulled with a constant acceleration of 1.9 m/s2 until 1.3 m of string has been unwound. If the string unwinds without slipping, what is the cylinder's angular speed, in rpm, at this time?

Solution

The final linear speed of the string:

$v^2 = 2ad$;

$v = \sqrt{2 \times 1.9 \times 1.3} = 2.22$ m/s;

The angular speed is:

$$\omega = \frac{v}{r} = \frac{2.22}{0.06} = 37 \text{ rad/s}$$

Answer: 37 rad/s.