P8.4-3) A man and bicycle together have a mass of 100-kg, including the wheels. The wheels themselves each have a mass of 3-kg and a radius of 30 cm. If the cyclist descends from rest down a 10% grade for 300 m, estimate his velocity at the bottom of the hill. Solve for the velocity using a) a particle model and b) a rigid-body model including the rotation of the wheels. Treat the wheels as hoops and assume they roll without slip. Based on your results, which type of model would you employ?

P8.4-3

Given:

Find:

Solution:

Set up the problem.

Draw a figure and label your states on the figure. Identify your zero-gravitational potential energy on the figure.

Is this a conservative or non-conservative system?

Conservative Non-conservative

Calculate the angle of the hill in degrees.

θ = _____

Particle Model

Use the Work-Energy Equation to solve for the speed at the bottom of the hill.

v_2 = _____

Rigid Body Model

Mass moment of inertia

Calculate the appropriate mass moment of a wheel.

I_{wheel} = _____

Kinetic Energy

Calculate the kinetic energy of the bicycle at the bottom of the hill as a function of speed.

T_2 (v_2) = _____

Use the Work-Energy Equation to solve for the speed at the bottom of the hill.

v_2 = _____

Which model would you use to model a similar situation in the future? Why?

Particle Model

Rigid Body Model

Why: