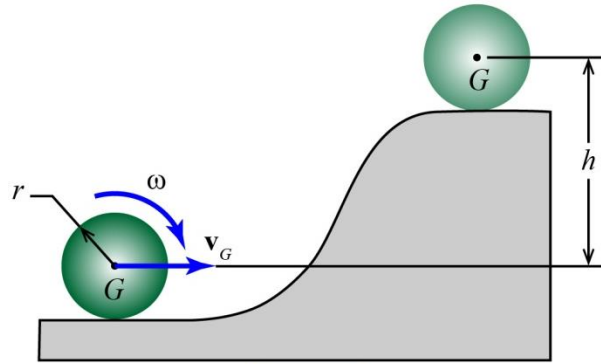


P8.4-1)^{fe} A ball rolls up a hill that has a 5-ft vertical rise. Determine the minimum speed (v_G) that the ball needs to make it up the hill. Assume that the ball rolls without slipping relative to the ground.

Given:

Find:



Solution:

Set up the problem.

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

What type of motion does ball experience? Indicate: **Pure translation**, **Pure rotation**, or **General planar** motion.

Ball:

Mass moment of inertia

Calculate the appropriate mass moment of the ball as a function of the mass and radius.

$I_{ball}(m, r) =$ _____

Relate the speed of the ball's center of mass to its angular speed. Leave the radius as a variable.

$\omega =$ _____ v_G

Work-energy balance equation

Write down the energy balance equation that will be used to determine the minimum speed of the ball and indicate which terms go to zero.

Calculate the change in potential energy.

$\Delta V =$ _____

Calculate the change in kinetic energy.

$\Delta T =$ _____

Calculate the speed at the initial state.

- a) $v_G = 4.1$ ft/s
- b) $v_G = 9.2$ ft/s
- c) $v_G = 15.2$ ft/s
- d) $v_G = 18.6$ ft/s

