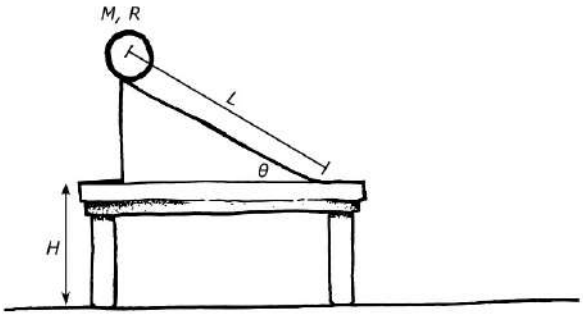
NAME _____ DATE _____

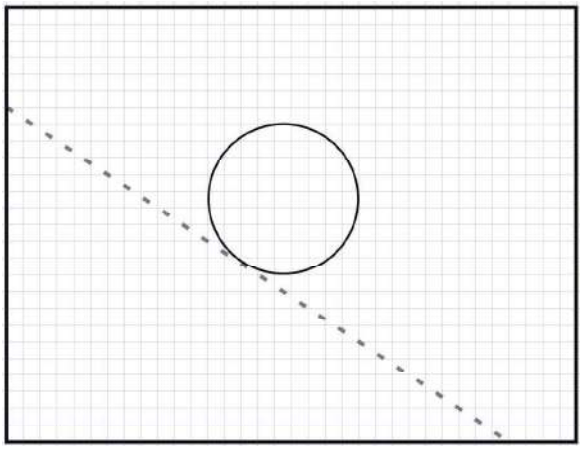
Scenario

A thin hoop of mass M and radius R is released from rest at the top of a ramp of length L as shown at right. The ramp makes an angle θ with respect to a horizontal tabletop to which the ramp is fixed. The table top is height H above the floor. Assume that the hoop rolls without slipping down the ramp and across the table. Express all algebraic answers in terms of given quantities and fundamental constants.

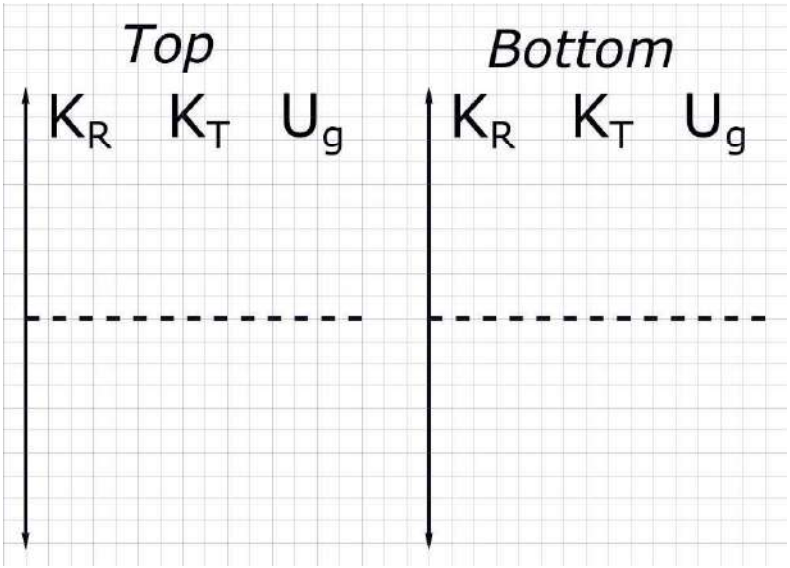


Using Representations

PART A: On the diagram below, draw and label the forces (not components) that act on the wheel as it rolls down the ramp, which is indicated by the dashed line. To clearly indicate at which point on the wheel each force is exerted, draw each force as a distinct arrow starting on and pointing away from the point at which the force is exerted.



PART B: Sketch an energy bar chart for the hoop-Earth system from the time when it is at the top of the ramp to the time when it reaches the bottom of the ramp.



PART C: Derive an expression for the speed of the center of mass of the hoop when it reaches the bottom of the ramp.

PART D: Determine an expression for the distance D from the edge of the table to where the hoop lands on the floor in terms of given variables and physical constants.

PART E: Suppose that the hoop is now replaced by a disk having the same mass M and radius R. How will the distance from the edge of the table to where the disk lands on the floor compare with the distance determined in Part D?

_____ Less than _____ The same as _____ Greater than

Briefly justify your response in terms of energy.