# Lecture 23: Combining Physics Concepts II

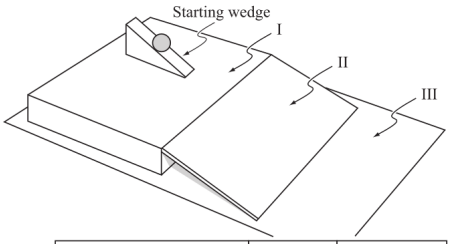
Announcements

We have learned a lot of topics in this class (kinematics, forces, energy, momentum, and all of their associated equations), and one of the hardest parts of physics can be choosing which method to use. On Friday, we will be going through activities centered around deciding when to choose a particular method.

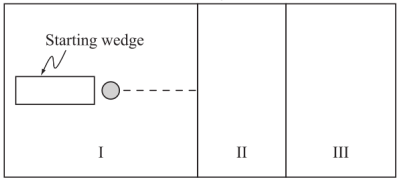
# L23-1: Rolling a Ball

- Sketch the trajectory of the ball in each case.

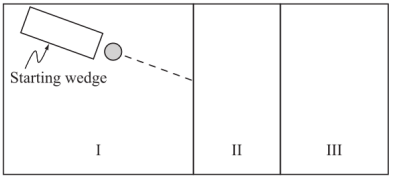
https://www.youtube.com/watch?v=3CjpPxNVjvA




- Which ball spends more time in region II?
- How does the direction of the net force on the ball in motion 2 compare to the direction of the net force on the ball in motion 1?
- How does the change in kinetic energy of the ball in motion 1 compare to the change in kinetic energy of the ball in motion 2?
  - Is your answer consistent with the net work done on the ball in motions 1 and 2?
  - How does the final speed of the ball in motion 1 compare to the final speed in motion 2?



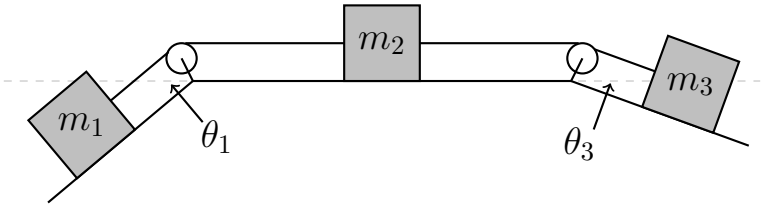

*Top view, motion 1*




*Top view, motion 2*

- Draw vectors that represent the momentum of the ball at the top of the ramp and at the bottom of the ramp in each case.
  - How is the direction of the change in momentum related to the direction of the net force on the ball as it rolls down the ramp?
  - How do the magnitudes of the changes in momentum in the two cases compare to each other?

## L23-2: Angled Ramps




- The three boxes shown at right are connected by ideal strings and pulleys. Assume the surface is frictionless. The boxes are initially at rest.
  - Do you think this situation will be easier to analyze using **forces** or **energy**? Does your answer depend on what quantity you are looking for?
- What is the speed of box 2 after it has moved a distance $L$?
  - Evaluate your answer in at least 3 special cases.
  - Is there any relationship between the three masses that will cause the blocks to remain at rest?

## Main Ideas

- The work-energy and impulse-momentum theorems can be used to solve a broad array of problems.