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## Friction iPad Lab (In Class Instructions)

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# Friction iPad Lab

Name: \_\_\_\_\_

## Instructions

### Block on Horizontal Surface

In this part of the lab, you will make and analyze a video of a block traveling along a horizontal surface.

1. Make the video of the motion using Vernier's Video Physics app on the iPad. Some suggestions for making video that's easy to analyze follow. Make sure that
  - the cart shows up well against the background
  - the iPad camera is stationary
  - the iPad is held parallel to the track
  - the cart's motion fills a majority of the screen (use landscape orientation for the iPad).
  - there is a meter stick in the picture just in front of the motion (this will be your reference object)
2. Use Video Physics to your video. Check to make sure it's good enough for analysis. Is the object clear (not blurry)? Is there a spot on the object that's easy to mark? Does the motion fill most of the screen? Is the action all in a plane that's parallel to the iPad? If your video isn't good, now's the time to reshoot it.
3. Once you think your video is good enough, track/mark the motion of the object using Video Physics. Adjust the axes so that the motion of the object is along the x-axis. Use the software to mark the length of your reference object (the meter stick). Check your graphs in Video Physics to make sure that y-velocity and y-acceleration are both zero throughout the motion. (If not, adjust your axes slightly and recheck).
4. Analyze the motion using Vernier's Graphical Analysis app on the iPad. Only consider the part of the motion where the block is moving freely- that is, from just after the block is released until just before it stops. In the space below, record the block's acceleration and briefly describe how you found it:

Acceleration = \_\_\_\_\_

Describe how you found the value:

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5. Analyze this data to find the coefficient of kinetic friction between the block and the surface. Record your work and answer in the space below:

Show your work here:

$\mu_k =$

### Block on horizontal surface with much more mass

In this part of the lab, you will analyze what happens if you repeat the experiment above, but with more mass.

6. Record the mass of the block and the additional mass you will use in the space below:

Record the mass of the block here:

Record the additional mass you will use here:

7. Make a **numerical prediction**. How quickly will the block slow down with the additional mass? Show your work and your prediction in the space below:

Show your work here:

$a =$

8. Make a video to test your prediction. Based on your measurements, does the mass significantly affect the acceleration of the block?

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### Block sliding up an incline

In this part of the lab, you will make and analyze a movie of the block as it slides to a stop while going up an incline.

9. Set up your incline. Record measurements for finding the angle the track makes with the horizontal.

Angle of ramp (and supporting data, diagrams)

10. Make a video of the block slowing down as it travels up the incline. Give it a quick shove and allow it to come to a stop (just like you did for the other parts of the lab). Use Video Physics and Graphical Analysis to find out the acceleration of the block. Remember to check the quality of your video as you go. Record the acceleration value below:

Acceleration = \_\_\_\_\_

Describe how you found the value:

11. Use the value of acceleration above to calculate the coefficient of kinetic friction.

Show your work here:

$\mu_k =$

