Lesson plan for ***Ramp: Force and Motion*** Activities 1 and 2:
http://phet.colorado.edu

There are two activities. The first one is qualitative and the second is quantitative. There was simulation called "The Ramp", but our research showed that it had too many learning goals. The first tab of the sim is simplified and energy parts of the sim have been deleted as well. There are plans to design and produce an "Energy and Work" simulation.

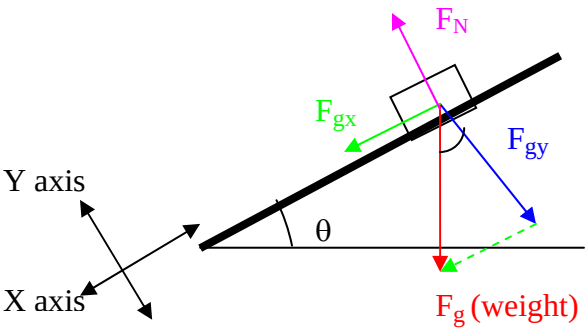
Learning Goals:
Activity 1. Students will be able to explain the motion of an object on an incline plane by drawing free body diagrams.
Activity 2. Students will be able to calculate the net force on an object on an incline.

Background:
We will have done the Moving Man and Forces and Motion activities.

***Ramp: Force and Motion* Introduction:**
I demonstrated that the data collection is for 30 seconds, but the investigation can continue without graphing. The coefficient of friction on the ramp surface is the same as the grass. Show them that you can simulate a horizontal surface by setting the angle at 0.

Lesson:
For the first lesson, have the students use the lab sheet for guidance. The activities are designed to be used in 50 minute periods including the class discussions.
Post lesson: There are 6 clicker questions

To start the second lesson, pose this question:
1. If Joe lifted the cabinet instead of using the ramp, how much force would he have to use? Have a discussion around why a ramp might be used. (We won't have studied work yet)
2. Then, open the sim on a projector for everyone to see. Ask the class to observe the value of Parallel Gravity force (on the graph) as the ramp angle is changing. Then pose: How can the force of gravity be changing? Help the class to understand that Parallel Gravity force is the portion of the weight that would cause the object to slide down the ramp. Draw the sketch below and have them copy it for future reference. I have chosen this particular diagram because this is how it is draw in our text. Have them calculate Parallel Gravity force (F_{gx} in our text) for several situations. Ask them what things might affect the value and run tests. (For example test: cabinet and fridge at different angles and locations)



$F_{gy} = F_g \cos\theta$
$F_{gx} = F_g \sin\theta$