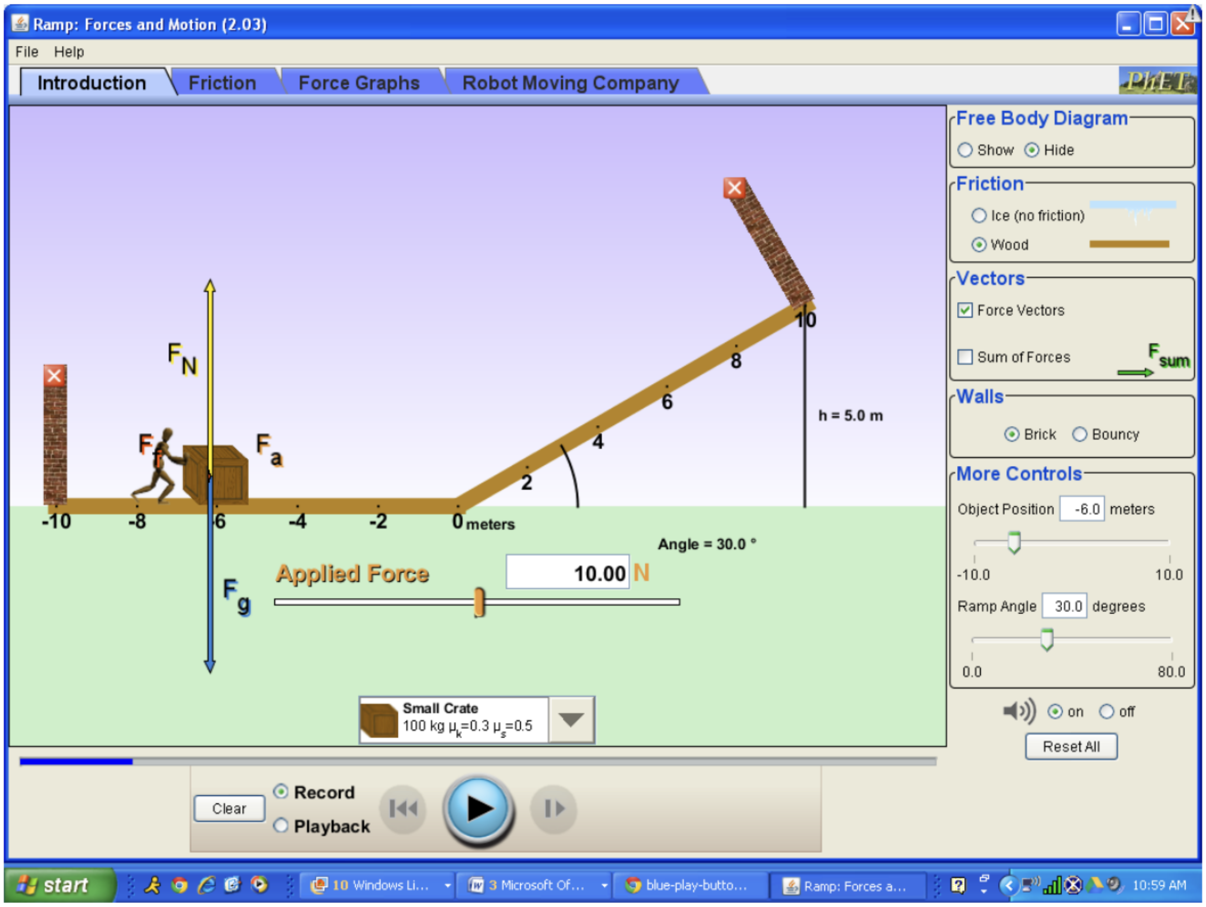
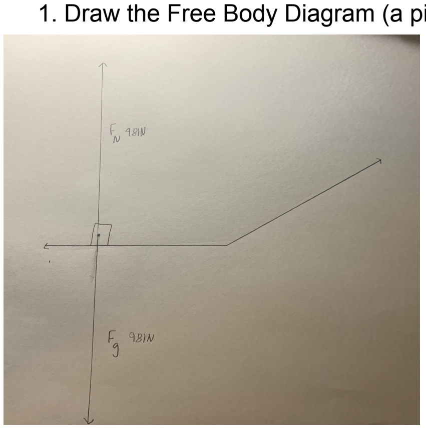
Forces Virtual Lab:

Go to http://phet.colorado.edu/en/simulation/ramp-forces-and-motion

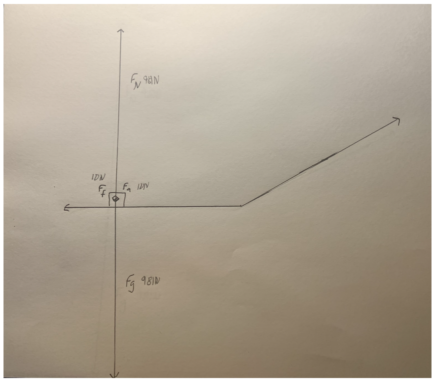


You will be starting with a crate that has a mass of 100 kg and a coefficient of sliding friction of 0.3 and a coefficient of static friction of 0.5

1. Draw the Free Body Diagram (a picture showing the forces on the crate) before you apply any force.



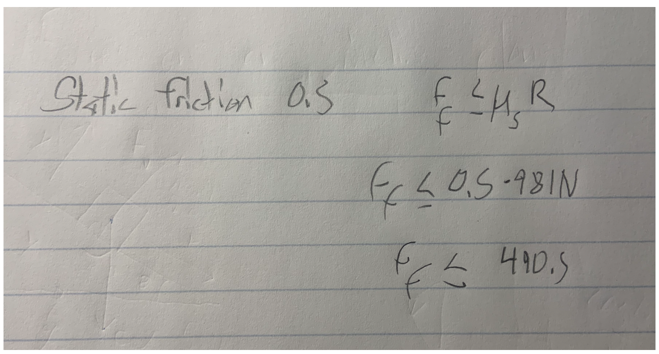
2. Add 10 N of applied force, and push the button and record what happens. Include a free body diagram showing all the forces.



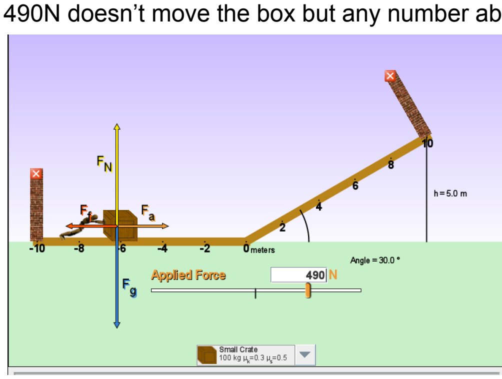
3. Add 100 N of applied force and push the button. What changed?

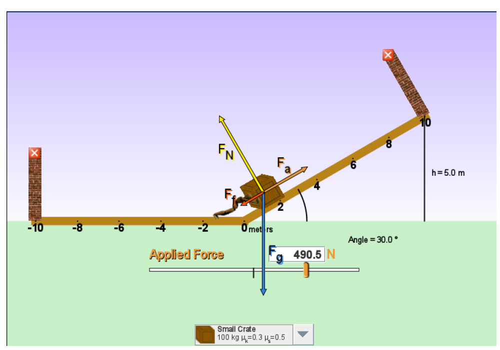
The frictional force and applied force arrows increased in length but the box didn't move.

4. Use the friction equation to calculate how much force would be required to get it moving. Show your work here….. Try it out. What happened? How did you fix the problem to get it moving?

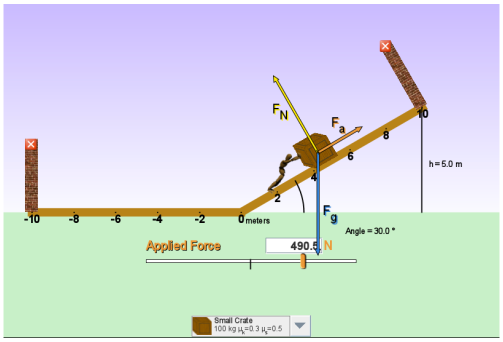


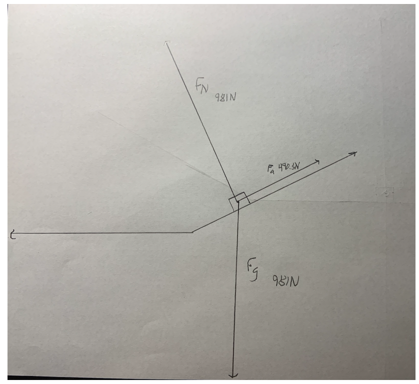
490N doesn't move the box but any number above 490 including the 490.5N I calculated moves the box.





5. What happened as the crate moved up the ramp? Show the free body diagram while the crate is on the ramp. What force is working against your applied force?





The crate slowed to a stop as it moved up the ramp. Friction and gravitational force stopped it from moving up the ramp

6. Reset all. Predict what you think would happen if you increased the angle. What actually happened? Explain why you saw what you saw.

I think if the angle increases the crate won't move as far up the ramp.

The crate slid back down the ramp and stopped at the bottom of the ramp. I think the increased angle caused the weight of the object to overcome static friction

7. Reset all. Predict what you think would happen if you decreased the angle. Try it out. Why?

I think the object will go farther up the ramp.

The object went all the way up the ramp until it hit the brick wall because the applied force was greater than the gravitational force and frictional force

8. Place the crate on the ramp with the angle at 20°. What is true about the parallel force and the friction force if the crate does not go down the ramp? Slowly increase the angle until the block JUST starts to move. Use the angle to calculate μ_s and compare to the given value for μ_s for the crate.

9. Calculate how much force you would have to apply to the crate to get it to go at constant speed up the 30° ramp. Show your work below and record your answer to the tenth of a Newton (Hint: Remember it's moving now, so which μ do you need to use?)

10. Go to the "Forces Graph" tab. Reset all. Input your applied force and push play. Stop the crate before it crashes into the wall. Is your net force = 0 (F_{sum} 7)? What does that tell you about the motion of the crate?

11. Place the block at the top of the 30° ramp (Position = 8.9 m). What is the net force on the block down the ramp? (Show your calculation below). What is the acceleration of the block down the ramp? (Include in your calculation). What would be the final velocity of the block at the bottom of the ramp?