

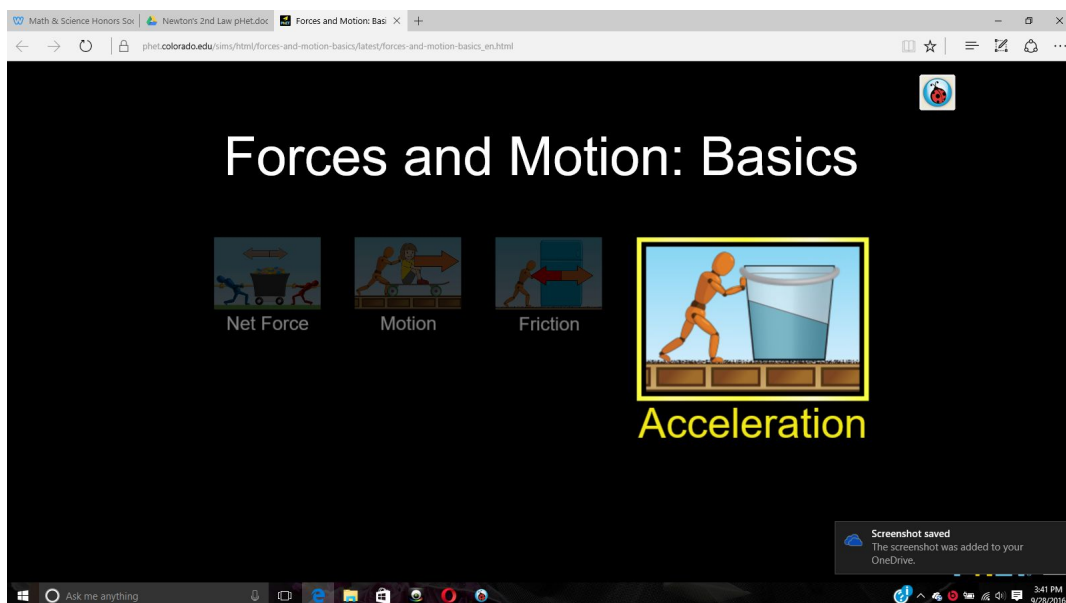
Force, Mass and Acceleration

Part 1: Explore the Sim

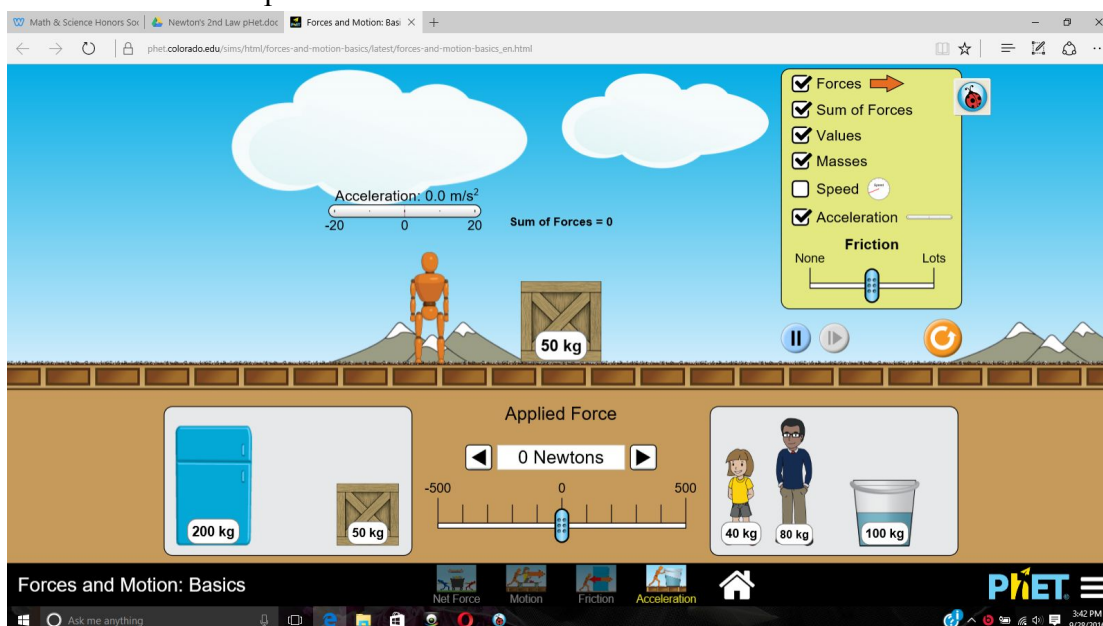
Click on the link!!!

https://phet.colorado.edu/sims/html/forces-and-motion-basics/latest/forces-and-motion-basics_en.html

A screenshot of the simulation is shown below. You want to choose **Acceleration!**



When the sim opens select the boxes for values, acceleration, forces, sum of forces, and masses. It should look like the pic below.



Explore the simulation and answer the following questions:

1. How can you change the amount of friction?
2. How can you change the amount of force applied to make the objects move?
3. How can you select different objects to change the mass?

Part 2: Explore the effect of force on acceleration (with no friction)

- Now you have had a chance to explore the sim, let's see if you can figure out the relationship between the total force applied and the motion of an object.

Prediction: (answer the question below in your notebook)

1. What effect will increasing the force have on the motion of an object?

Directions:

- You will complete 5 trials.
- copy the data table into your notebook
- **Start by turning friction off.**
- Select an object for Joe to push.
- Record the mass of the object.
- Have Joe push the same object with different magnitudes (amounts) of force, record the acceleration of the object for each force.
- Divide Force by mass

Table 1: Part 2 Results

Mass of object (kg) <i>Keep this constant</i>	Total force (N)	Acceleration (m/s ²)	$\frac{F}{m}$

Conclusions: (answer questions in your notebook)

1. What did you notice about the magnitude of acceleration and the quotient of force and mass?
2. Write a rule to describe the relationship between force and acceleration.

Part 3: Explore the effect of mass change on acceleration (with no friction)

- Now you have had a chance to explore the sim, let's see if you can figure out the relationship between the mass and the motion of an object.

Prediction: (answer the questions in your notebook)

1. What effect will increasing the mass have on the motion of an object?

Directions:

- You will complete 5 trials.
- copy the data table into your notebook
- **Start by turning friction off.**
- Select an object for Joe to push.
- Record the mass of the object. **With each trial change the mass of the object.**
- Have Joe push object with the **same amount of force**, record the acceleration of each of the object.
- Divide force by mass (force \div mass)

Table 2: Part 3 Results

Mass of object (kg)	Total force (N) <i>Keep this constant</i>	Acceleration (m/s ²)	$\frac{F}{m}$

Conclusion: (answer the following questions in your notebook)

1. What did you notice about the magnitude of acceleration and the quotient of force and mass?
2. Write a rule to describe the relationship between mass and acceleration.

Part 4: Using what you have learned

Now let's see if you can apply what you have learned. Some of the cells in the table below have been left blank. Predict what the answer should be, then use the simulation to find out if you were correct.

Total Force (N)	Mass (kg)	Acceleration (m/s ²)	Predicted answer	Simulation answer
200	10	?		
500	20	?		
?	50	10		
?	100	15		
250	?	5		
1000	?	20		
?	150	15		
?	250	25		

And finally.....

What do you now understand about the relationship between Force, Mass and Acceleration?

Extension: Explore the effect of force on acceleration (with friction)

Repeat the experiment from part 2, but this time have friction turned on.

1. Will you be able to use the rule you developed in part 2? Why or why not?
2. How will adding friction effect your results?

Table 3: Extension Results

Mass of object (kg) <i>Keep this constant</i>	Total force (N)	Acceleration (m/s ²)	$\frac{F}{m}$

How did your results from part 2 compare to your results from this extension?

Explain the relationship between the force applied to an object, the mass of an object and the acceleration of the object.

This activity is a modification of a lesson submitted to pHet by Patricia Martinez of Greeley Central High School