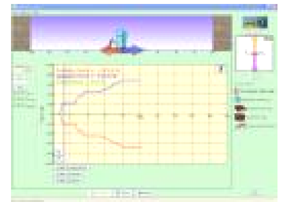
Name:_________________________

Forces in 1D PhET Simulation Lab *rvsd 2009*



Introduction:

Newton's Laws describe motion and forces in the world around us. Object have inertia, undergo acceleration and experience forces. Forces are measured in Newtons (N)…
Newton's First Law states:

____

Newton's Second Law states:

____

Newton's Third Law states: ____

When objects slide past each other in contact, ***friction*** usually plays a part. There are two types of friction; ***Static***, which exists between objects BEFORE the objects start moving and ***kinetic*** which exists between objects that ARE MOVING.

Remember…it is not the presence of forces that cause acceleration…it is the presence of unbalanced or NET forces!

Procedure: *Play with the Sims → Motion → Forces in 1 Dimension* Run Now!

1. Clear the simulation between runs to reset the simulation.
2. **Slowly** drag the cabinet to the right to apply a force (blue vector). Observe the *applied force* and *friction force*.
3. Without movement, the applied force and friction forces are _____________.
4. Once the cabinet starts to move, keep your mouse immobile to apply the same, constant force.

What happened? ____

5. Repeat steps 1-3, but release the mouse button once the cabinet starts to move. Without applied force, the force of friction does what? ____
6. Repeat the above experiments after clicking on Graph Acceleration, Graph Velocity, and Graph Position to show the AVD graphs of motion.

Draw a sketch of the acceleration, velocity, and distance graphs produced when the cabinet moves with a **constant acceleration.** *(acceleration is produced when Force applied > Force friction. This is a NET FORCE)*

Acceleration vs time | Velocity vs time | Distance vs time

- Click the ***Friction*** box (left side of the simulation) to remove friction.
- Drag the cabinet to apply a force for a few seconds and then release the mouse and allow the cabinet to move freely.
- Without friction, all the force applied creates acceleration.
- Without an applied force (while coasting), the acceleration becomes__________ and velocity becomes ________.

The Math of Newton's Second Law:

Reset the simulation. *Keep friction turned off during the next set experiments.*

Set the Force on the slider (on the left) to a value as shown in the boxes below. (Press "CLEAR", type in value, press ENTER") Determine the acceleration from the acceleration-time graph.

Force applied	Mass (cabinet)	acceleration
100. N	200. kg	
200. N	200. kg	
400. N	200. kg	
600. N	200. kg	

Force applied	Mass (cabinet)	acceleration
50. N	200. kg	
20. N	200. kg	
10. N	200. kg	

Fill in the table below and check your work with the simulations.

Force applied	Mass (fridge)	acceleration
800. N	400. kg	1.
50. N	400. kg	2.
1000. N	400. kg	3.
Force applied	**Mass (dog)**	**acceleration**
25. N	25.0 kg	4.
5.	25.0 kg	2.0 m/s^2
200. N	25.0 kg	6.
Force applied	**Mass (large book)**	**acceleration**
5. N	10.0 kg	7.
20. N	10.0 kg	8.
9.	10.0 kg	4.0 m/s^2
Force applied	**Mass (crate)**	**acceleration**
100. N	300. kg	10.
300. N	300. kg	11.
12.	300. kg	2.5 m/s^2

Conclusion Questions:

1. As a small force was applied to the cabinet, the cabinet didn't move because the magnitude of the force of friction *was larger than / smaller than / equal to* the applied force. BE CAREFUL HERE

2. I'm not accelerating, so the net (vertical) force on me, while I'm sitting here doing this lab is ___________.
3. Without friction, applying a **constant force** produces a *decreasing / constant / increasing* **acceleration**.
4. Without friction, applying a **constant force** produces a *decreasing / constant / increasing* **speed**.
5. While coasting (no applied force) without friction, the acceleration is __________ and velocity is ________________.
6. When a force of 300. N is applied to an object that experiences 200. N of friction the **net force** that will cause acceleration would be ___________.
7. Imagine you push a 50. kg crate with 200. N of force. If friction pushes back with 100 N of force, the crate will accelerate with a magnitude of __________m/s^2.