Throwing Cabinets at Walls

(Newton's First and Second Law)

This lab uses the PhET simulation "Forces in One Dimension".

Free Body Diagrams

1. In the upper right hand box is what we call a “free body diagram”. Play with the page until you create a situation where there are 5 different colored arrows in the diagram. Write the label for each arrow and what it represents.

   Example F_N *– normal or perpendicular force -- the force from the surface the object sits upon*

2. Explain the purpose of a free body diagram and how it is helpful to evaluate the forces acting on an object.

Newton’s First Law

3. Turn off friction (little box on right). Apply some forces to the various objects. Make observations about

   a)What was required to move the object

   b) What was required to stop a moving object

4. Open both a velocity and acceleration graph (you may wish to "clear" the graph data). Apply a steady force for a few seconds to various objects. Observe:

a) How is acceleration affected by a steady force?

b) How is velocity affected by a steady force? Does this make sense from part a?

5. Explain how your observations agree or disagree with Newton's first law.

Newton's Second Law

6. Open a force and acceleration graph. In order to compare how mass, force and acceleration are related, fill in the table below. Choose three different forces to apply.

Object (mass (kg))	Force applied (N)	Acceleration (ms^{-2})	Force ÷ acceleration
Cabinet (200)			
Crate (300)			
Fridge (400)			

7. Compare the last column with the mass of each object. What relationship exists between force, acceleration and mass? Write a formula.

Friction and Newton's Laws

8. Turn the friction option on. Apply various size forces to the filing cabinet with friction on. Explain why the cabinet does not move for small forces but it does for larger ones (use a free body diagram to help explain).

9. Explain, using Newton's first law, why the cabinet comes to a stop when you do not maintain a steady pushing force.