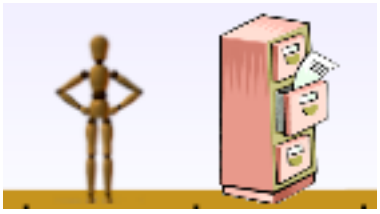
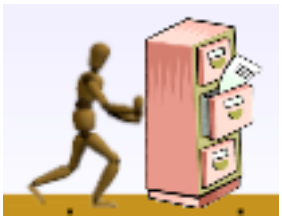
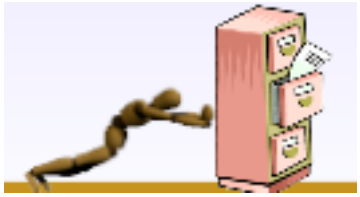
Forces and Motion Teachers Guide: Notes added below in RED

This activity was used in a 7th grade science classroom. The students used only the first tab of the Forces and Motion sim to complete the activity.

Name_____
Grade_____

Pre Lab

Joe needs to push a file cabinet across the room. He begins by just looking at it. (**Scene 1**)
He then begins pushing on the file cabinet. At first, the file cabinet does not move. (**Scene 2**) Then the file cabinet begins to slide. (**Scene 3**)

Scene 1: **Joe not pushing**	**Scene 2:** **Joe pushing but cabinet not moving**	**Scene 3:** **Joe pushing and cabinet moving**
		

a. Use words and pictures to describe all the **forces** you think are acting on the cabinet in each scene.

b. Why do you think the file cabinet moves in **scene 3** but not in **scene 1** or **2**?

c. If the floor is covered with ice, how would the motion of the cabinet change?

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Name_____
Grade_____

Forces in 1D

Learning Objectives:

- Be able to identify when an object is being acted upon by unbalanced forces.
- Be able to predict the change in motion when a force is applied to an object.

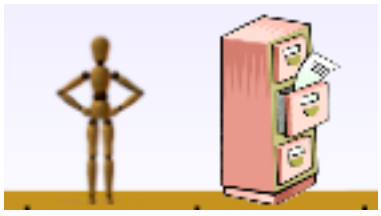
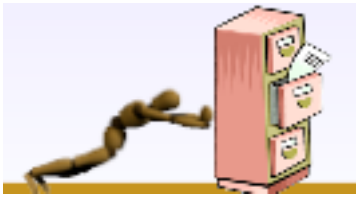
Part 1: Understanding balanced and unbalanced forces

1. Open the **Forces and Motion Simulation** by clicking the icon on your computer's screen.

2. Play with the first tab of the sim for about 5 minutes. **What do you find?**

I encourage the students to spend at least a few minutes just playing with the sim at the beginning of an activity. This helps students orient to tools available, develop ownership over controlling the simulation and gets some of the giggles out of the way so they can focus on the activity when open play is done.

3. Using the simulation for help, draw pictures showing Joe, the file cabinet and **force arrows**.

Scene 1: **Joe not pushing**	**Scene 2:** **Joe pushing but cabinet not moving**	**Scene 3:** **Joe pushing and cabinet moving**
		

4. **Describe** what is necessary to start the file cabinet moving.

5. **Compare** the Applied Force arrow and the Friction Force arrow.

   a. What is similar?

   b. What is different?

6. Use your answers to #5 to say whether the forces are **balanced or unbalanced** in each scene.

Part 2: Understanding Applied, Friction and Total Force

7. How can you make the **Friction Force** arrow longer?

8. Apply enough force to **move the cabinet**.

    a. What do you think happens to the Friction Force arrow when you stop applying force (no Applied Force arrow)?

    b. What do you think happens to the Friction Force once the cabinet stops moving?

9. How would you...

    a. ...describe Friction Force?

    b. ...describe Applied Force?

Teacher led discussion: Compare applied and friction forces.

This would be a time for students to say what they thought the friction and applied force arrows meant. The friction force arrow can be difficult for the students, as it's harder to imagine the ground pushing back. This discussion time be used as an opportunity to briefly discuss friction and even compare what happens with and without friction (ground as ice or wood).

10. Have Joe move a new object. How is moving this object different from moving the file cabinet?

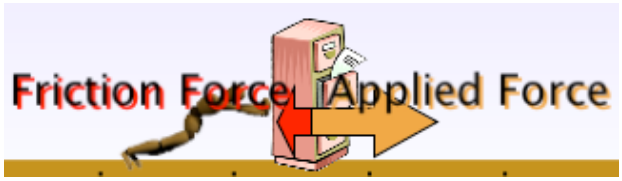
11. In the table, draw the **Total Force arrow** for the different cases:

Scene 1: **Joe not pushing**	**Scene 2:** **Joe pushing but dog not moving**	**Scene 3:** **Joe pushing and dog moving**
		

12. Can you find 3 different ways to make the **Total Force arrow** change?
    List them here:

13. In your own words, what is **Total Force**?

14. For each case, draw the **Total Force arrow**. Write which direction you think the object is moving and whether it will speed up or slow down.

a. 

b. 

c. 

Part 3: Understanding Force and Change in Speed

This section is asking students to notice acceleration (how fast an object changes speed). While it's not necessary that they know the term 'acceleration', from using the simulation they may be able to make some qualitative observations about how objects change speed. (A greater force causes greater acceleration, while a smaller force causes less acceleration). If the concept of acceleration is not something you want to introduce, take out Part 3. Depending on your learning objectives, you might want to delve deeper into this concept, and maybe even go to the third tab and have students plot acceleration.

15.

a. Give the sleepy dog  a **little push**...

...how much does the dogs speed change?

b. Give the sleepy dog a **big push**...

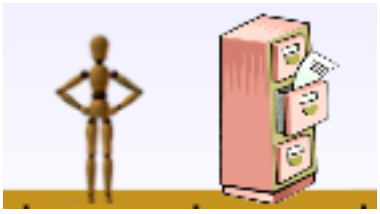
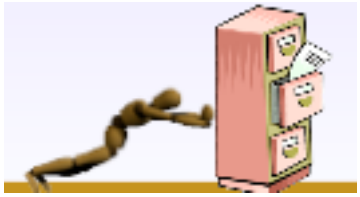
...how much does the dogs speed change?

16. Using your answers to Question #15, what general statement can you make about the **relationship between the applied force and how fast an object changes its speed.**

Name_____
Grade_____

Post Lab

1. Joe needs to push a file cabinet across the room. He begins by just looking at it. (**Scene 1**)
He then begins pushing on the file cabinet. At first, the file cabinet does not move. (**Scene 2**) Then the file cabinet begins to slide. (**Scene 3**)

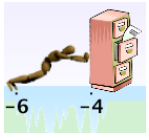
Scene 1: **Joe not pushing**	**Scene 2:** **Joe pushing but cabinet not moving**	**Scene 3:** **Joe pushing and cabinet moving**
		

a. Use words and pictures to describe all the **forces** you think are acting on the cabinet in each scene.

b. Why do you think the file cabinet moves in **scene 3** but not in **scene 1** or **2**?

c. What do you think Joe could do to make the cabinet move faster?

d. If the floor is covered with ice, how would the motion of the cabinet change?



e. What would be different if Joe was moving a book, instead of a file cabinet.

2. How ***useful for your learning*** was this science activity, compared to other science class activities? (circle)

   More useful About the same Less useful

   How ***enjoyable*** was this science class activity, compared to other science class activities? (circle)

   More enjoyable About the same Less enjoyable

   Why did you or did you not find it useful or enjoyable?

   _____
   _____
   _____
   _____