Name: _____ Date: _____ CP: ___

Forces and Motion Virtual Lab

Introduction

Today we will learn about how the force put on an object determines how it will move when there is no friction and when there is friction.

1. Click this link: http://phet.colorado.edu/en/simulation/forces-and-motion-basics

This is a screen shot of the website:

2. Click the button that says "Run Now". It might take a few minutes to load.

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Explore

1. Place a man, same size or different, on each side of the rope.
2. Hit the "go" button.
3. Hit the "Return" button. Try it again with either the same amount of men on each side or a different amount of men on each side.
3. Hit the "Reset all" button. Click box next to "sum of forces" and "values," continue putting men on each side.
4. Hit the "Return" button.

Explore Questions (answer each question in the space provided)

1. Set up the simulation so the blue side wins. Draw the correct size vector arrows and force amount given to make the red side win.

2. Set up the simulation so the red side wins. Draw the correct size vector arrows and force amount given to make the blue side win.

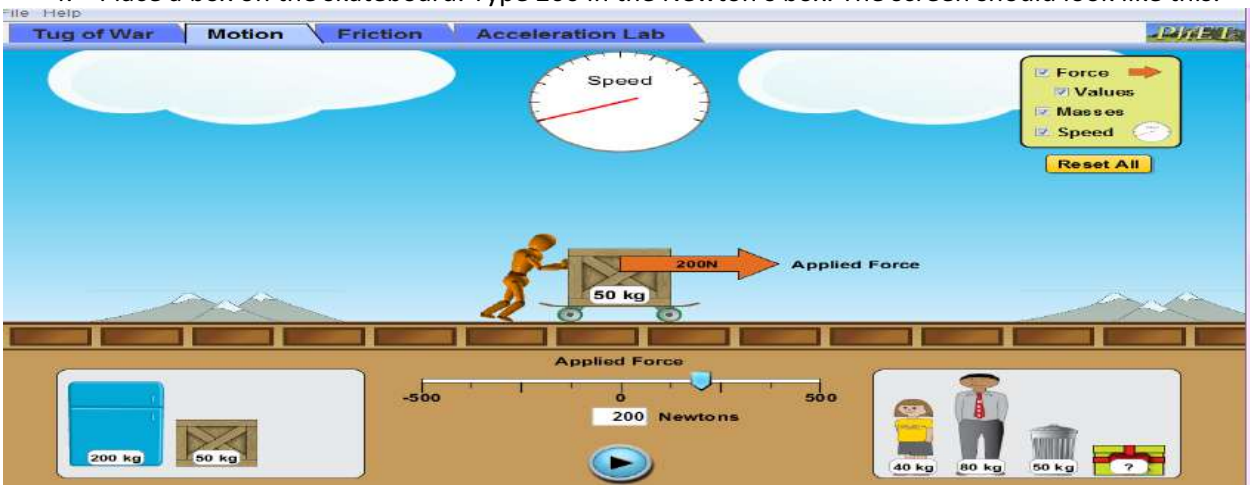
3. Set up the simulation so there is a tie on both sides. Draw the correct size vector arrows and force amount given.

4. Explain how to find the net force when forces are acting in opposite directions.

5. If only the smallest blue man were pulling on one side of the rope, what would the sum of forces be? Explain.

Part I- Motion

1. Click the tab "Motion"
2. Check the boxes next to " force, values, masses, and speed"
3. Click the pause button.
4. Place a box on the skateboard. Type 200 in the Newton's box. The screen should look like this:



5. Press the play button. What happens to the motion of the crate? (Look at the speedometer)

6. Repeat steps 4 and 5 with the refrigerator. What happens? (look at the speedometer)

7. Click the "Reset All" button.
8. Repeat steps 2-4 using different objects and different applied forces. You can also use the people.
9. When the mass on the skateboard **increases**, what happens to the speed? Explain why this happens.

10. When the mass on the skateboard **decreases**, what happens to the speed? Explain why this happens.

11. As the mass on the skateboard **increases**, what happens to the force needed to make the skateboard move? Explain why this happens.

12. As the mass on the skateboard **decreases**, what happens to the force needed to make the skateboard move? Explain why this happens.

13. Put the 80kg man on the skateboard and 5 Newtons in the box. What happens?

14. Explain how 5 Newtons of force can move an 80Kg man. (think about rolling friction versus sliding friction, if the skateboard were not on wheels)

15. What can you conclude about the friction force?

Open a new browser and type in this link to use the stopwatch. http://www.online-stopwatch.com/full-screen-stopwatch/

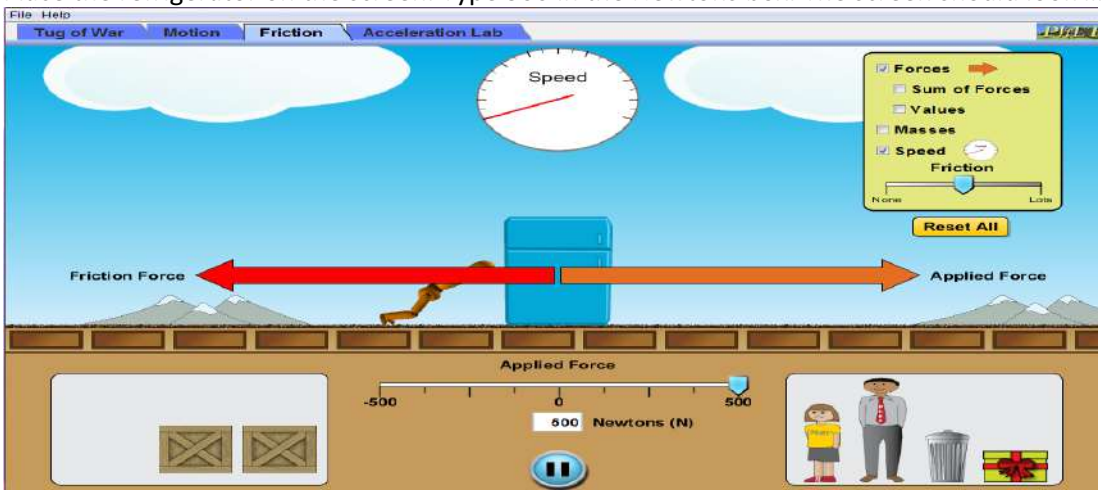
Object	Mass	Applied force (N)	Time it takes to reach maximum speed (Use stopwatch)
1 crate		300N	
2 crates		300N	
Refrigerator		300N	
Man		300N	
Girl		300N	
Mystery Object		300N	

16. Do you think the object's mass determines how long it will take for that object to reach maximum speed with an applied force of 300 N? Yes or No, Explain your answer.

17. How did you determine the mass of the mystery object?

Part II-Friction

1. Click the tab "Friction"
2. Check the boxes next to " forces" and "speed"
3. Place the refrigerator on the screen. Type 500 in the Newtons box. The screen should look like this:



4. What happened? Did the refrigerator move? Explain.

5. Click the "Reset All" button.
6. Check the boxes next to "values" and "speed"
7. Place the refrigerator on the screen. Type 500 in the Newtons box. Slide the friction tab toward "None".
8. What happens to the speed as you slide the fiction tab closer to "None"? Explain why this happened.

9. Click "Reset All."
10. Check the boxes next to "values," and "speed."

11. Complete the table. Fill in the missing values.

Object	Applied Force (N)	Friction Force (N)	Sum of Forces (N)
Crate	200	125	
Man	472		272
Refrigerator		51	99
Girl	363	100	
Garbage Can	500		375

*You can use the Friction Tab to help you check your answers.

12. Click the "Sum of Forces" box. Did you get the same number as the one displayed?
13. Develop an equation to find the sum of forces. Your equation should include applied force, friction force, and sum of forces.

14. What is another term for "sum of forces"?

Apply

Use the formula you developed in number 13 to complete the chart below.

Object	Applied Force (N)	Friction Force (N)	Sum of Forces (N)
Box	300	210	
Man	350	174	
Refrigerator	125	137	
Girl	200	78	
Garbage Can		50	100
Mystery Object	300		175

15. How does the force placed on an object affect how it moves?

16. What happens if there is too much friction? Will the object move slowly, fast or not at all? Why?

17. What if only a little friction is added, how will the object move? Why?

Part III–Summarize What You Learned

Use the REGS strategy to answer the following question: How is this simulation, Forces and Motion, related to Newton's 2nd Law of Motion? Explain your reasoning.

Newton's 2nd Law = acceleration depends on an object's mass and on the net force acting on the object (F=MA).

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