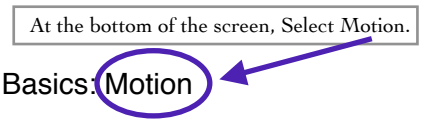
Introduction to Newton's Laws & Force
Physics

Name:_____



To Begin: http://phet.colorado.edu —> HTML 5 SIMs —> Forces and Motion Basics: Motion

Part I - Newton's First Law

Make sure the boxes that say "Force" and "Speed" are checked.

A. Apply a steady, +50 N force to the box (right is +). Watch the speedometer. Describe the motion of the box using physics terms (i.e., velocity, acceleration, displacement)

B. Reset the scenario (don't forget to check force, speed again). Apply a force of 50 N to the right for about 5 seconds then reduce the applied force to zero (the man should stop pushing). Don't reset the scenario. Describe the motion of the box. Refer to the speedometer in your answer.

C. Apply a steady, - 50 N force to the box (right is +). Describe the motion of the box.

D Explain the exact steps needed to make the box come to a stop.

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Summary

Newton's First Law of Motion States "An object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction unless acted upon by an unbalanced force." Explain how your observations in a - d support this Law.

Part II - Newton's Second Law

a. **Reset the sim. Check all of the boxes (Forces, Values, Masses & Speed). Remove the box and replace it with the garbage can. Measure the time it takes to reach the maximum speed at the forces listed in the table.** Garbage Can mass = _____ Maximum speed = _____ m/s

Applied Force	Time To Max Speed	**Acceleration**
50 Newtons		
100 Newtons		
200 Newtons		

B. Reset the sim. Check all of the boxes (Forces, Values, Masses & Speed). Remove the box and replace it with the garbage can. Use an applied force of +500 Newtons. Measure the time it takes to reach the maximum speed for the objects listed in the table. Maximum speed = _____ m/s

Object	Time To Max Speed	**Acceleration**
Garbage Can mass = _____		
Blue Refrigerator mass = _____		
One Crate mass = _____		

Summary

Newton's Second Law states "The acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object." Explain how your observations in both a and b support this Law.

Part III - Friction's Effects

The behavior of the skateboard in Part I and part II were not very realistic because friction was not present. At the bottom of the screen is a simulation that includes friction. Select this simulation.

a. Set friction to "none". Notice how the screen changed. Why do you think the app designers did that?

b. Make sure that only Speed box is checked.
   i. Apply a force to get the box to about half of it's maximum speed, then remove the force.
   ii. While the box is moving, move the friction slider to 1/2 way.

What happened to the box?

Summary

Is friction a force? What evidence do you have have?

Part IV - Back to Newton's Second Law

Reset the Friction app. Make sure Forces and Speed are checked.

a. Apply a force of 50 N. Describe the movement of the box.

b. Apply a force of 100 N. Describe the movement of the box.

c. Apply a force of 150 N. Describe the movement of the box.

d. Check the box that says "Sum of Forces" . Repeat procedure A, B, and C. What was different about c?

Summary
Newton's Second Law states "The acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object." Explain how your observations relate to the underlined portion of this Law (hint, you might want to look up the definition of the word "net").

Part V: Friction in Detail

Reset the app. Check the boxes that say "values" and "speed".

a) Apply 50 N of force to the crate, slowly click to increase the amount of applied force until you reach 350 N of applied force. Describe how the force of friction changes while you are increasing the applied force.

b) Reset the app. Check the boxes that say "values" and "speed". Slide friction to maximum (notice the ground). Apply 50 N of force to the crate. Slowly click to increase the amount of applied force until you reach 350 N of applied force. Describe how the force of friction changes while you are increasing the applied force.

i. Describe how the force of friction changes while you are increasing the applied force.

ii. What was different about this compared to a?

c) Reset the app. Check the boxes that say "values" and "speed". Place another crate on top of the first. Apply 50 N of force to the crates, slowly click to increase the amount of applied force until you reach 350 N of applied force.

i. Describe how the force of friction changes while you are increasing the applied force.

ii. What was different about this compared to a?

d) Reset the app. Check the boxes that say "values" and "speed". Apply 200 N of force to the crate until the speedometer reaches about 1/2 its maximum. Quickly change the applied force to zero and describe how the force of friction changes until the box stops moving.

Summary

Make four general statements about the force of friction based on your observations in a, b, c, and d.