Navigate to this link: https://phet.colorado.edu/sims/html/forces-and-motion-basics/1.1.0/forces-and-motion-basics_en.html

Net Force Section – enable measurement functions by checking boxes in top corner

Explore the program by placing red and blue figures on the rope to simulate a tug of war

1. Which figure can pull with the most force?

2. What is the exact measurement of force that each figure can pull the rope?

      Small –

      Medium –

      Large –

Place two small blue figures on the left against 1 medium red figure on the right

3. What is the resulting motion or speed?

4. What is the sum of the forces (net force)?

5. Use an equation to show how the net force was calculated?

6. Are the forces balanced or unbalanced? How do you know?

Place two small blue figures on the left against 1 large red figure on the right

7. What is the resulting motion or speed?

8. What is the sum of the forces (net force)?

9. Use an equation to show how the net force was calculated?

10. Are the forces balanced or unbalanced? How do you know?

11. What happens to the speed of the cart when one side is winning the tug of war?

12. Is this type of motion considered "acceleration"? Why or why not?

13. What happens to the speed of the cart when the tug of war is a tie?

14. Is this type of motion considered "acceleration"? Why or why not?

Complete the following paragraph

When 2 small figures are both pulling in the same direction, their individual forces are _____ together. When 2 small figures are pulling in the opposite direction, their individual forces _____. An unbalanced force results when the sum of all forces is _____ and causes the object to _____. A balanced force results when the sum of all forces is _____ and does not cause the object to _____.

Friction Section – Be sure to enable the functions at the top corner of the screen.

Set your friction bar to medium, select one 50-kg crate, and slowly apply rightward force using the single arrow button. Stop when applied force reaches 10N

1. What is the friction force?

2. What is the sum of the forces? In which direction?

3. Is the crate accelerating (speeding up, slowing down, or changing direction)?

Stop when applied force reaches 100N

4. What is the friction force?

5. What is the sum of the forces? In which direction?

6. Is the crate accelerating (speeding up, slowing down, or changing direction)?

Stop when applied force reaches 200N

7. What is the friction force?

8. What is the sum of the forces? In which direction?

9. Is the crate accelerating (speeding up, slowing down, or changing direction)?

Move applied force back down below 50N, but above 0N and observe

10. What is the friction force?

11. What is the sum of the forces? In which direction?

12. Is the crate accelerating (speeding up, slowing down, or changing direction)?

13. What happens to the box when the frictional force is greater than the applied force?

14. Compare the applied force required to move a 50-kg crate and the applied force required to move something much more massive, like the 200-kg refrigerator

      50-kg crate

      200-kg fridge

      Why?

15. Compare the applied force required to move a 50-kg crate when there is LOTS of friction, MEDIUM friction, and NONE friction

      LOTS of friction

      MEDIUM friction

      NONE friction

If you are done, feel free to continue to experiment in the Net Force and Friction simulations, but you may also check out the acceleration and motion simulation if you wish.