

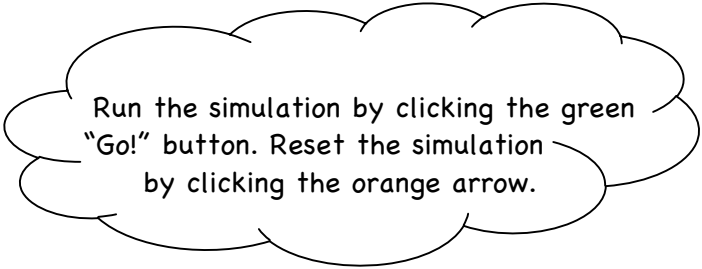
# Forces Trackstar

**DIRECTIONS:** Open "Google Chrome". Go to [trackstar.4teachers.org](http://trackstar.4teachers.org). Type "457961" into "View Track #". Click "Go". Click "View in Frames".

## Site #1: PHET Forces and Motion

### Part 1: Net Force

- 1) Click on the box labeled "Net Force."
- 2) In the right hand corner, make sure:
  - "Sum of Forces" button is checked
  - "Values" button is checked
  - "Sound" button has an "x"
- 3) For each simulation, predict the net force **BEFORE** you run the simulation. **AFTER** running the simulation, record the actual **net force (both direction and magnitude)**, and explain if the forces are **balanced** or **unbalanced**. Record everything in the data table below.



Simulation	Prediction of Net Force <i>(zero N OR more force in one direction)</i>	Actual Net Force	Balanced or Unbalanced
<b>Simulation #1:</b> Place 2 people <i>(one person per side)</i> who are the <b>same size</b> and the <b>same distance</b> away from the cart.			
<b>Simulation #2:</b> Place 2 people <i>(one person per side)</i> who are the <b>same size</b> but <b>different distances</b> away from the cart.			
<b>Simulation #3:</b> Place 2 people <i>(one person per side)</i> who are <b>different sizes</b> and the <b>same distance</b> away from the cart.			
<b>Simulation #4:</b> Place 2 people <i>(one person per side)</i> that are <b>different sizes</b> and <b>different distances</b> away from the cart.			

- 4) To make the cart move when the people are the **SAME DISTANCE** away, the people need to be the \_\_\_\_\_ *(same/different)* sizes because \_\_\_\_\_

### Part 2: Friction

Go back to the main page and click on the "Friction" box. In the same way you ran the tug of war simulation, you will run the friction simulation.

- 1) Check that the following buttons are checked:
  - Forces
  - Sum of Forces
  - Values
  - Masses
  - Speed
- 2) Change the "Applied Force" measurement. What is the minimum amount of force needed to get the box to move? \_\_\_\_\_
- 3) What happens to the speed of the box as time passes? \_\_\_\_\_
- 4) Change the Friction button to "lots". What happens to the speed over time? Why?
- 5) Eventually the forces become \_\_\_\_\_ *(balanced/unbalanced)* when the box is stationary.

- 6) Reset the friction button to the middle.
- 7) When you add an extra box, the mass \_\_\_\_\_ (*increases/decreases*). When this happens, you need \_\_\_\_\_ (*more/less*) force to overcome friction. Specifically you need at least \_\_\_\_\_.

### **Site #2: Forces at the Fun Fair**

**Predict:** Before you begin answer the questions below:

- 1) I predict \_\_\_\_\_ (*Steel/Rubber*) wheels will have the most friction.
- 2) If I add more people to my car, I am increasing the \_\_\_\_\_ of the car.
- 3) If I add more people to my car, I will need to increase the \_\_\_\_\_ so that my car will travel the same distance.
- 4) A smooth car will have less air \_\_\_\_\_ than a boxy car.

**Try it out:** How can you get a car to arrive at the unloading area safely with **1 passenger**?

Cart weight: \_\_\_\_\_ Max Speed: \_\_\_\_\_

Type of wheels: \_\_\_\_\_ Design of car: \_\_\_\_\_

**Try it out:** How can you get a car to arrive at the unloading area safely with **8 passengers**?

Cart weight: \_\_\_\_\_ Max Speed: \_\_\_\_\_

Type of wheels: \_\_\_\_\_ Design of car: \_\_\_\_\_

- 5) When I increase the amount of passengers, I had to change \_\_\_\_\_  
 \_\_\_\_\_ because \_\_\_\_\_  
 \_\_\_\_\_ .

### **Site #3: Skydiving**

- 1) When I increase the **mass**, it takes \_\_\_\_\_ (*more/less*) time for **air resistance** to equal gravity. Also, when I increase the **mass**, the **speed** of the object as it's falling is \_\_\_\_\_ (*faster/slower*).
- 2) When I increase the **size of the parachute**, it takes \_\_\_\_\_ (*more/less*) time for **air resistance** to equal gravity. Also, when I increase the **size of the parachute**, the **speed** of the object as it's falling is \_\_\_\_\_ (*faster/slower*).
- 3) If we were to drop our "rocket" from a **small** distance, what would be the best mass (*low/high*) and parachute size (*small/big*) to have? Why?

\*\* What information did you collect that can help us when we build our "rocket"? Be specific!