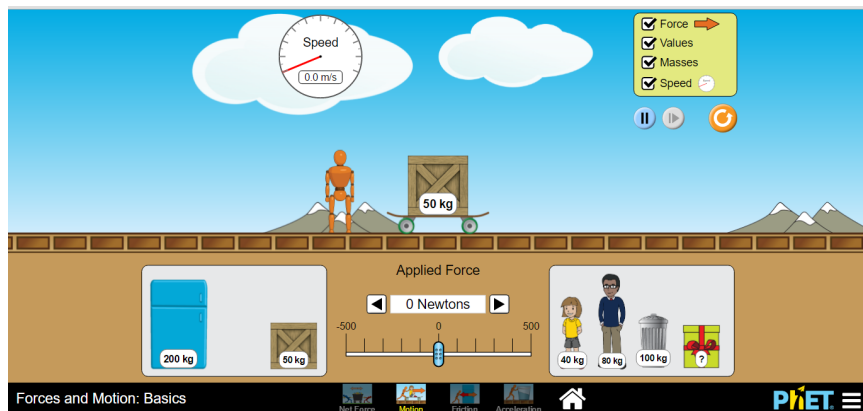


## Forces and Motion: Motion

Name: \_\_\_\_\_

### Part A Directions:

1. In Google classroom, open the link for the forces and motion Phet simulation.
2. You will see four icons on the screen. **Click the second one which says “Motion”**. You will see the simulation on “Motion” as shown below:



3. Click on all of the items inside the yellow box (upper right-hand corner).
4. Choose a particular item from bottom left/right boxes and position it on top of the skateboard.
5. Set the “Applied Force” as 50N (“N” stands for “Newton”, a unit of force) by clicking on the double right arrow once. Observe the motion of the box within 10-15 seconds. You may look at how fast the value of speed changes, as shown in the circle on the upper left corner.
6. Without changing the chosen item on the skateboard, set the applied force into higher values (from 50 N, to 100 N, 150 N, 200 N...) by clicking on the double right arrow. **Observe** the motion of the object for at least 10 seconds for each value of applied force. Carefully notice how fast the value of the speed changes for each value of force applied.

### PART A - QUESTIONS: *Please answer using complete sentences*

1. What happens to the value of the speed (does it increase or decrease?) as you increased the amount of force applied on your chosen item?

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2. What does this observation tell you about the relationship between the external force applied and the object's acceleration (the rate of change)?

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**PART B Directions:** Use the information from this section to fill in the data table on the next page. →

1. Click the “**reset**” button (the round, orange button on the upper right-hand corner) of the same simulation to clear all the current settings.

2. Check all of the additional items (values, masses, speed) inside the yellow box.

3. Set the force at **50 N**. The skateboard and its load will then start moving. Stop the motion of the cart by pressing the “pause” button **AFTER TEN (10) SECONDS** (starting from the time you set the force as 50 N). Use the computer as a timer. Check the speed (refer to the speed shown in the circle, upper left) reached by the body within the 10-second time interval. ↓

**Record this value in Table 1 (your data table on the next page) as the final velocity of that particular item.**

4. Click “reset” and check all the items inside the yellow box. Remove the crate from the top of the skateboard and place it inside the box (lower left). Position the 40-kg child on top of the skateboard. You have to **observe their acceleration** within a 10-second time interval by referring to Step 3.

**5. Do the same for all the other items listed in the table below.**

Click “reset” every time you start with a new item, and always check all the items inside the yellow box.

\*Remove the crate (the default setting) on top of the skateboard before placing a new item, unless the crate itself is the item you need to select. The force must be the same (50 N) for all these items.

6. Calculate the acceleration of all the items considered and record the data in the last column (below). **Acceleration** =  $\frac{\text{final velocity} - \text{initial velocity}}{\text{Time}}$

**TABLE 1: ACCELERATION OF DIFFERENT BODIES AT 50-N FORCE**

*Please fill in the missing values below*

Item	Mass (kg)	Initial velocity (m/s)	Final Velocity (m/s)	Time (s)	Acceleration (m/s <sup>2</sup> ) (see equation above)
Child	40	0		10	
Crate	50	0		10	
Man	80	0		10	
Metal trash bin	100	0		10	
Refrigerator	200	0		10	

**PART B - QUESTIONS:** *Please answer using complete sentences*

1. What is the relationship between the acceleration values and the mass of the items?

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2. Which of Newton's laws helps to explain what you observed?

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**CONCEPT CHECK:**

**Underline** the appropriate word inside the parentheses that best completes the sentence.

3. An object's acceleration increases as the force applied is (decreased, increased), but its acceleration decreases if the force applied is (decreased, increased).

4. When subjected to the same amount of net external force, a heavier object will experience (*less, greater*) acceleration than a lighter one.