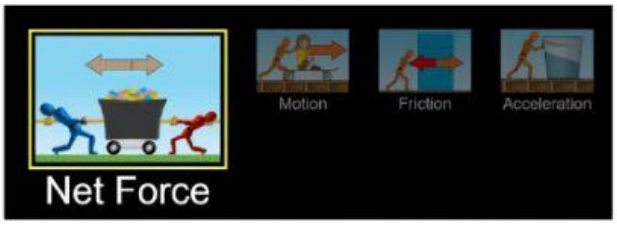
Name: _____ Date: _____

Balanced & Unbalanced Forces
PHET Tug-of-War

The link to the PHET website is at the teacher's blog. **PHET Forces and Motion Basics.** The URL is https://phet.colorado.edu/en/simulation/forces-and-motion-basics
Choose the "Net Force" option for the Tug-O-War.



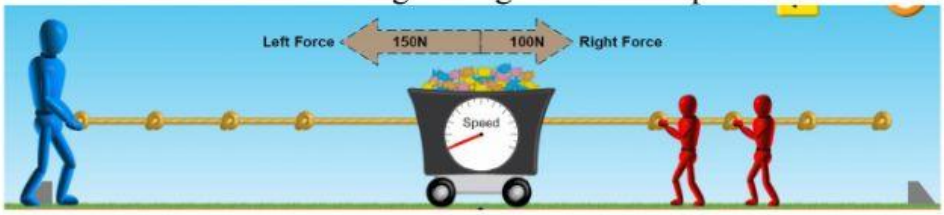
Commands

- Check the boxes that say "Values" and "Speed".
- GO! starts the tug-o-war.
- PAUSE stops the tug-o-war.
- RETURN brings the cart and ropes back to center.
- RESET ALL clears all settings.

Instructions

1. Choose the characters according to the opponent menu.

2. Drag and drop the characters onto the rope. Blue on the left of the candy cart, Red on the right of the candy cart.
   - TEAM BLUE on the left. Left forces are negative direction forces (-)
   - TEAM RED on the right. Right forces are positive direction forces (+)



3. Press the **GO!** button. The Tug-o-War will begin. 

4. Record the forces in the blue direction to the left (-F) and the red direction to the right (+F)

5. Calculate the net force acting upon the candy cart. The net force is the sum of forces when adding together the blue (negative) and red (positive forces). A net force of zero will be a condition of balanced forces. A net force with a magnitude other than zero will result in acceleration.

Net force = Blue Force + Red Force

	The Opponents		TOTAL BLUE FORCE (left, -)	TOTAL RED FORCE (right, +)	NET FORCE	Balanced or Unbalanced Forces?
	BLUE SIDE	**RED SIDE**				
1	1 Giant	Empty				
2	Empty	1 Giant 1 medium				
3	Empty	1 Giant 1 tiny twin				
4	1 Giant 1 Medium 2 Tiny twins	Empty				
5	1 Tiny twin	1 Giant				
6	1 Tiny twin	1 Giant 1 Medium				
7	1 Giant	1 Medium 1 Tiny twin				

8	1 Giant	1 Medium 2 Tiny twins				
9	1 Medium	1 Giant 2 Tiny twins				
10	1 Giant 1 Medium 2 Tiny twins	1 Giant 1 Tiny twin				
11	1 Giant 1 Medium 2 Tiny twins	1 Giant 1 Medium 2 Tiny twins				
12	1 Tiny twin	1 Giant 1 Medium 2 Tiny twins				