

**Grade Level:**

8<sup>th</sup> Grade

**Title of Lesson:**

Balanced and Unbalanced Forces

**Unit Title:**

Forces and Motion

**Performance Standard(s) Covered:**

S8P3 Students will investigate relationship between force, mass, and the motion of objects.

**Essential Question:**

What are the effects of balanced and unbalanced forces on an object in terms of gravity, inertia, and friction?

**Objective:**

Demonstrate the effect of balanced and unbalanced forces on an object in terms of gravity, inertia, and friction.

**Key Words and Terms:**

Force: push or pull

Net force: overall force acting on an object added together

Unbalanced force: will change the object's motion

Balanced force: will not change the object's motion

Inertia: tendency of an object to resist change in its motion

Newton's First Law of Motion: an object at rest will remain at rest, and an object that is moving at a constant velocity will continue unless acted upon by an unbalanced force.

Gravity: force that pulls objects together (Force that pulls objects to center of the earth)

Friction: the force that one surface exerts on another when the two rub against each other

### **Learning Activity**

#### **Abstract (limit 100 characters):**

Students will learn about balanced and unbalanced forces through a game, Tug of War. As the children play, the game will be paused to explain balanced and unbalanced forces through a way they can physically see and understand.

#### **Materials Needed:**

One rope (for the whole class)

#### **Safety Concerns:**

Falling is probably the only safety concern. In tug of war, one team may be overcome by the other, and people may be hurt.

#### **Procedure:**

- 1) Start off by reviewing what a force is (push or pull). Talk about how forces aren't just a push or pull, but also deal with direction. Then explain net force. Talk about how you add up all the forces and whichever is stronger, that is the direction the object will move.
- 2) Balanced forces=when the net force is zero(or forces are equal). Example: a book resting on a table. Gravity is exerting force down on the book, while the table is exerting the same force up on the book, creating a net force of zero.
- 3) Unbalanced forces=when there is a more powerful force. Example: a book falling off of a table. The force of someone pushing the book off of the table was stronger than the table's force.
- 4) If a force is unbalanced, there is inertia (or the resistance to change motion). It's like when a car slams into a wall, a person could fly through the windshield because of inertia. Introduce Newton's Law of Inertia.
- 5) Another property is friction, which can make an object slow down or stop. Example: a book almost falling off a table. If you push the book too softly, you cannot overcome friction, and the book will not fall off the table.

6) The last property is gravity, which is the force that pulls objects together. Example: Book falling off the table. This is why the book falls down off the table.

7) Now split the class into two groups and let them play tug of war. First, ask them to pull the same energy, making a balanced force. Next, designate a side to pull harder, showing an unbalanced force. Finally, talk about the friction between their shoes and the ground, and that if one group falls, they have inertia to keep falling until something stops them. Why do they fall? Gravity.

8) Then, if there is time left, let them play a real game of tug of war as a treat!

### **Notes and Tips:**

The kids really liked the game aspect. I would make it more of a competition in the future. Maybe give a reward to the group of kids that wins Tug of War. Explain first—stopping in the middle of the tug of war game to give a lesson isn't the best way to grab their attention.

### **References:**

Padilla, Michael J., Ioannis Miaoulis, Martha Cyr, and Peter Kahan. *Motion, Forces, and Energy*. Needham, MA: Prentice Hall, 2002. Print.