

3-2-1 Blast Off: Forces and Motion (3rd-5th grades) Pre-Visit Activities

Vocabulary List and Student Definitions (elementary level):

- **Force:** a push or a pull
- **Motion:** the act of moving; movement
- **Gravity:** the force between two objects that attract one another (Earth's gravitational pull is much stronger than any other within its atmosphere).
- **Inertia:** A object will stay at rest or continue in motion until acted upon by a force
- **Action:** the act of doing something; something that somebody or something does
- **Reaction:** response to an action
- **Drag:** resistance against an acting force

Teacher Background and Supporting Information

1. What is Force and Motion?
 - a. A **force** is a push or a pull; the power, strength, or energy that somebody or something possesses.
 - b. Applying force causes **motion**, or the act of movement.
 - c. All matter remains in a state of **inertia**, an objects inability or unwillingness to remain at rest (or remain in motion) until the application of a force causes the object to move (or stop).
2. What are Newton's Laws of Motion?
 - a. Sir Isaac Newton developed three physical laws, called "Newton's Law of Motion".
 - b. First Law of Motion: Law of Inertia
 - i. This law is often simplified into the sentence, "A particle will stay at rest or continue at a constant velocity unless acted upon by an external unbalanced force."



A ball will sit in place until it is pushed, rolled, or kicked.

- c. Second Law of Motion: Law of Resultant Force
 - i. This law is often stated as " $F = ma$: the net (total) force on an object is equal to the mass of the object multiplied by its acceleration."



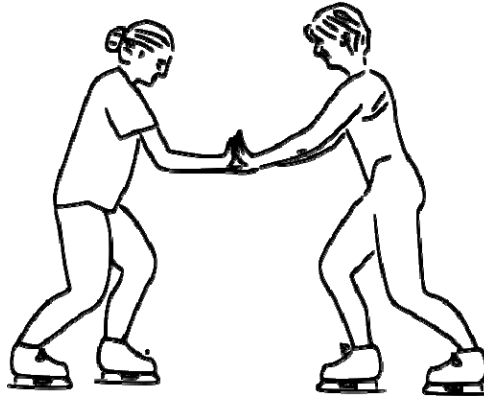
$$F_{\text{net}} = 10 \text{ N}$$

$$F_{\text{net}} = m \cdot a$$

$$F_{\text{net}} = (2 \text{ kg}) \cdot (5 \text{ m/s}^2)$$

$$F_{\text{net}} = 10 \text{ N}$$

- d. Third Law of Motion: Law of Reciprocal Actions
- i. This law is often simplified into the sentence, "Every action has an equal and opposite reaction."



The skaters' forces on each other are equal in magnitude, and in opposite directions.

Student Activities

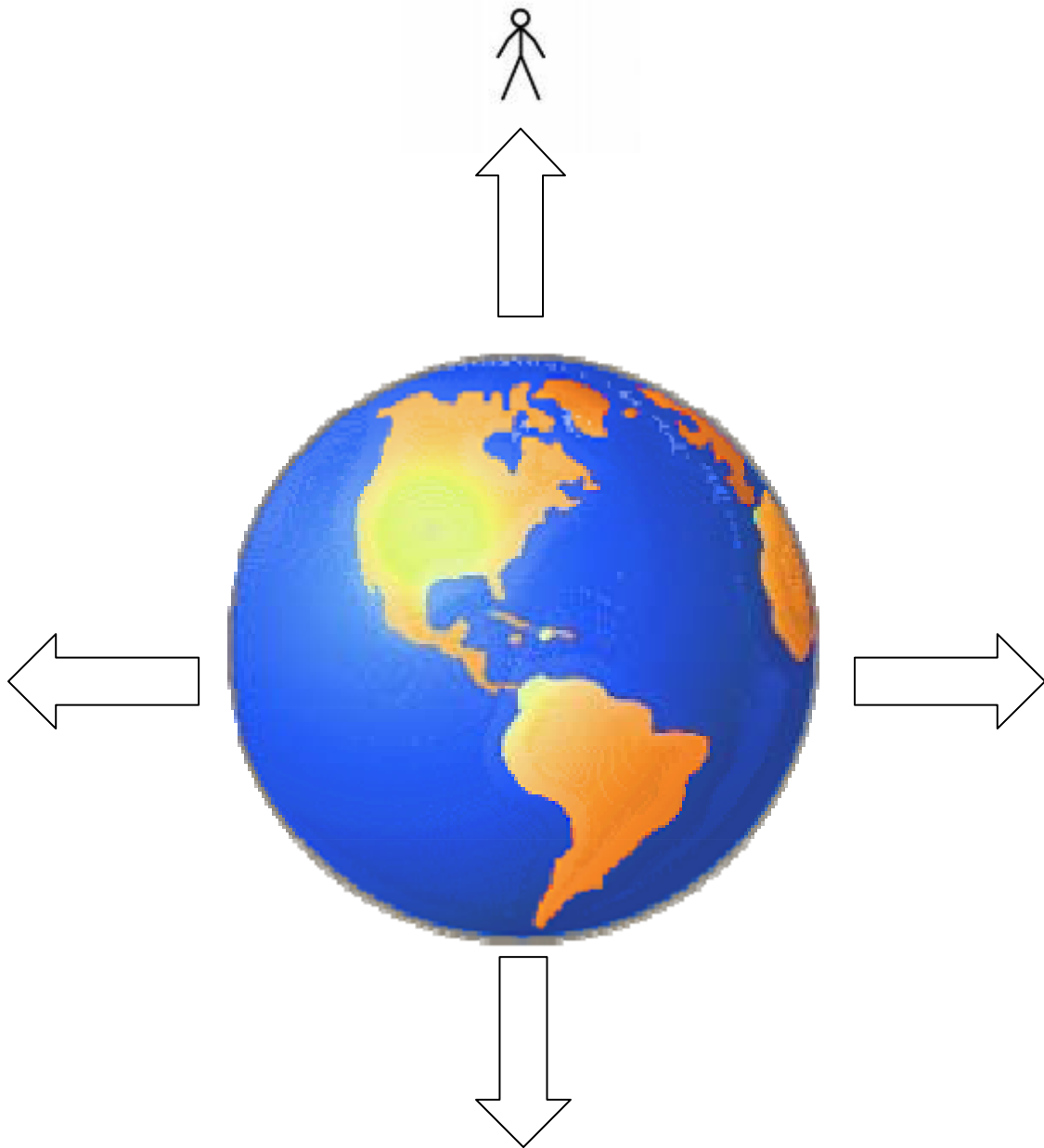
1. Read: Forces Makes Things Move by Kimberly Bradley
2. Read: Gravity is a Mystery by Franklyn Branley
3. Which Way is Up?
 - a. This activity will allow students to have a better understanding of the force of gravity as it applies to Earth.
 - b. Provide each student with a copy of the activity sheet to complete (see template on following pages).
 - c. Discuss how gravity affects objects within Earth's atmosphere.
 - i. The force of **gravity** is much greater than the force we apply when throwing an object into the air. This is why all objects eventually fall back down after being projected into the air.
4. Falling Objects
 - a. Provide students with a stopwatch (should be familiar).
 - b. Students will compare the time it takes for two objects to fall from the same height. Mark the wall with a piece of masking tape as a reference to the objects' drop point. Measure the height from the floor to the tape.
 - c. Drop a ping pong ball and golf ball; a baseball and tennis ball, tennis ball and basketball, feather and basketball, etc.
 - i. Each item should reach the ground at approximately the same time, except for the feather.
 - ii. The feather creates **drag**, or air resistance, causing it to fall at a slower rate.
 - iii. Record results (see template on following pages).

Name _____

Understanding Gravity...

1. Which way is up if you are standing at the North Pole? The South Pole? The Equator? *Draw figures to show your answer.*

2. Which way is the force of gravity pulling? *Draw arrows to show your answer.*



Name _____

Falling Object Results:

<u>Object</u>	<u>Time in seconds</u>

Height of drop point in centimeters	_____ inches
--	--------------

