🚀 Lesson Plan: Forces

Grade Level: 7
Subject: Physical Science
Duration: 45–60 min
NGSS MS-PS2-2: Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

🎯 Learning Objectives

By the end of this lesson, students will be able to:

- **Define** a force as a push or pull that can change an object's speed or direction.
- **Explain** how the net force on an object depends on the sizes and directions of all the forces acting on it.

- **Gravity:** A force that pulls objects toward each other; on Earth, gravity pulls objects downward toward the center of the planet.
- **Inertia:** The tendency of an object to keep doing what it is doing—staying still or moving at a steady speed—unless an unbalanced force acts on it.
- **Mass:** The amount of matter in an object; an object with more mass needs a larger force to change its motion by the same amount.

💼 Materials Needed: (all links are included in this PDF)

- Printed copies of the Forces Study Guide (https://newpathworksheets.com/api/guide/study-guide-science-grade-7-forces-1.pdf)
- Forces vocabulary matching worksheet (https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-7-forces-1-1.pdf)
- Forces practice worksheet (types of forces and net force) (https://newpathworksheets.com/api/worksheet/worksheet-science-grade-7-forces-1-0.pdf)
- Forces practice worksheet (Newton's laws and motion) (https://newpathworksheets.com/api/worksheet/worksheet-science-grade-7-forces-1-1.pdf)
- A toy car or wooden block to push across a smooth desk and a rough surface to compare friction
- Two spring scales to pull an object in opposite directions and read balanced versus net force
- A length of rope for a two-person tug-of-war to demonstrate balanced and unbalanced

- Use the Study Guide to define force and net force and to explain the difference between balanced and unbalanced forces. (https://newpathworksheets.com/api/guide/study-guide-science-grade-7-forces-1.pdf)
- Demonstrate balanced versus unbalanced forces with a two-person tug-of-war on a rope: when the pulls are equal the rope stays still, and when one side pulls harder the rope moves toward the larger force.
- Push a toy car across a smooth desk and then across a rough surface so students can see how friction opposes motion and changes the car's speed.

Step 3: Guided Practice (15 minutes)

- Complete the vocabulary matching worksheet together, defining force, net force, balanced forces, unbalanced forces, friction, and inertia. (https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-7-forces-1-1.pdf)
- Use two spring scales to pull a block in opposite directions; have students add the readings by size and direction to find the net force and predict which way the block will move.
- Have students push a tennis ball and a basketball with the same effort to see how greater mass produces a smaller change in motion.

Step 4: Independent Practice (12 minutes)

- Have students complete the practice worksheet on types of forces and net force, identifying gravity, friction, and balanced or unbalanced situations. (https://newpathworksheets.com/api/worksheet/worksheet-science-grade-7-forces-1-0.pdf)
- Have students complete the second practice worksheet applying Newton's laws to everyday examples of changing motion. (https://newpathworksheets.com/api/worksheet/worksheet

For advanced learners:

- Challenge students to draw free-body diagrams for an object and calculate the net force when three forces act along the same line.
- Have students explain how the same net force produces a larger change in motion for a low-mass object than for a high-mass object.

For learners needing support:

- Provide a labeled force diagram with arrows of different lengths for balanced and unbalanced forces so students can see the net force at a glance.

- Give students a small set of pre-made cards showing force values and directions to add together before they work with the spring scales.

Extension Activities

- Have students design and run a friction investigation, measuring how far a toy car rolls across surfaces such as tile, carpet, and sandpaper, and graph the results.
- Have students build a balloon-powered car and explain how the net force from the escaping air changes the car's motion.

Complete List of Available Resources:

- NewPathWorksheets: Forces (https://newpathworksheets.com/science/grade-7/forces-1)

FORCES

Force is a pull or a push and its strength is measured in units called **newtons**. Forces can act in combination and produce what is referred to as **net force**. When two forces are exerted in the same direction, net force can be calculated by adding the two forces together. On the other hand, if two forces are opposed to each other, they tend to cancel each other out.

is are the amount of contact between the two objects and the types of surfaces that are in contact. As everyone knows, lubrication of a surface makes sliding much easier.

Friction can take various forms:

- One would be the initial friction of trying to start to move an object
- Then there is the friction involved during the movement
- There is even friction between a solid and a liquid as the solid moves through the liquid.

Gravity

Gravity is a type of force that pulls objects towards each other and toward the earth. The amount of gravitational force depends upon the mass of the objects that are interacting and the distance between

Newton's Laws

The scientist we usually think of when we talk about gravity and falling objects is Isaac Newton. Newton is credited with the development of three laws dealing with the movement of objects.

Newton's first law, simply phrased, is that an object that is at rest will remain at rest and that an object in motion will continue in motion. This is only true, of course, until another force acts to either move or stop the object. The resistance to this force is referred to as **inertia**.

A good example of this is the difficulty you have trying to stop a moving object once it gets going.

Newton's second law states that the acceleration of an object depends on the net force affecting that object and the mass of the

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Lesson Checkpoint:
State one of Newton's Laws and give an example of it in action.

Momentum

The amount of motion that takes place is **momentum**. To calculate momentum, you multiply the **mass** of an object by its **velocity**. Since velocity is involved, this means that momentum is affected not only by the mass and speed of an object but also by the direction the object is moving. When groups of objects are involved, if there is no outside force, the total momentum of the group does not change. For example, in a collision between two cars, momentum may be transferred from one car to the other but not lost. This is referred to as the Law of Conservation of Momentum.

Lesson Checkpoint:
What are the two attributes of an object used to calculate momentum?

PREVIEW

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Forces & Motion

Name _____ Class _____ Date _____

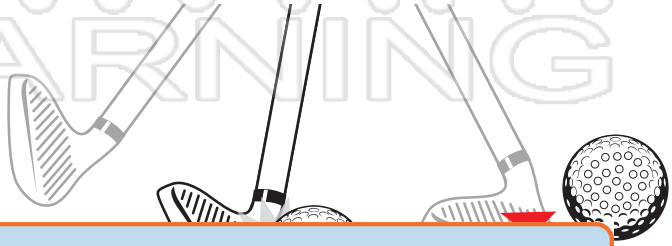
Scientists define **force** as a **push** or a **pull.** A force is described by its **strength** and **direction** in which it exerts.

A **force** provides an object with the **energy** to **move, stop** moving, or **change direction. Newton (N)** is the **standard unit of measure** for **force.**

Sir Isaac Newton is credited with the development of **three laws** dealing with the **movement** of objects.

Newton's 1st Law of Motion

An object **at rest** tends to **stay at rest** and an object **in motion** tends to **stay in mo**
same



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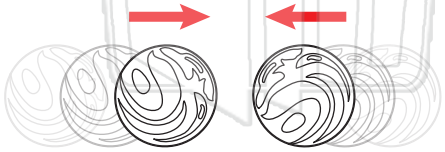
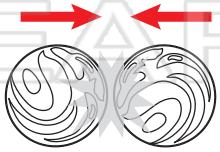
When the **same force** is applied to both carts, the **acceleration** of the **empty cart** will be **greater** than the acceleration of the **loaded cart.**

Newton's 3rd Law of Motion

For every **action** there is an **equal and opposite reaction.**





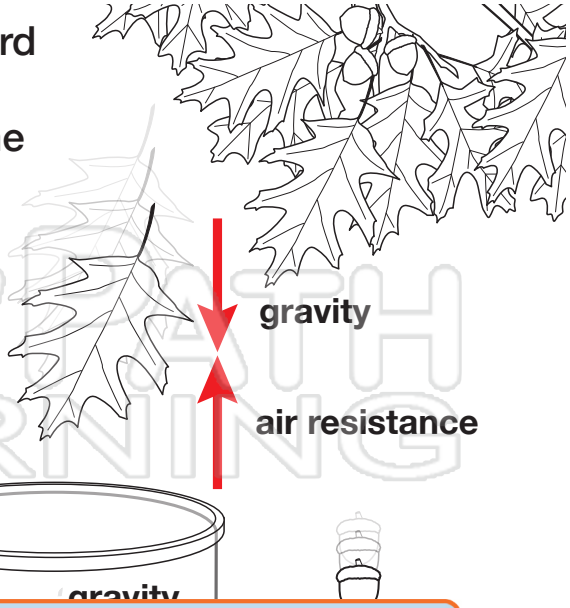
Marbles exert equal force on each other.

Both marbles change velocity and direction.

Forces & Motion

Name _____ Class _____ Date _____

Gravity is a type of force that pulls objects toward each other and toward the Earth. The amount of gravitational force depends upon the **mass** of the objects and the **distance** between them.



The **acceleration** of an object near the surface of the Earth due to gravity is **9.8 m/s²**. If both the acorn and leaf fall from the tree at the same time, **air resistance** will slow down the leaf and the acorn will hit the ground first. In a **vacuum**, both will reach the ground at the same time.

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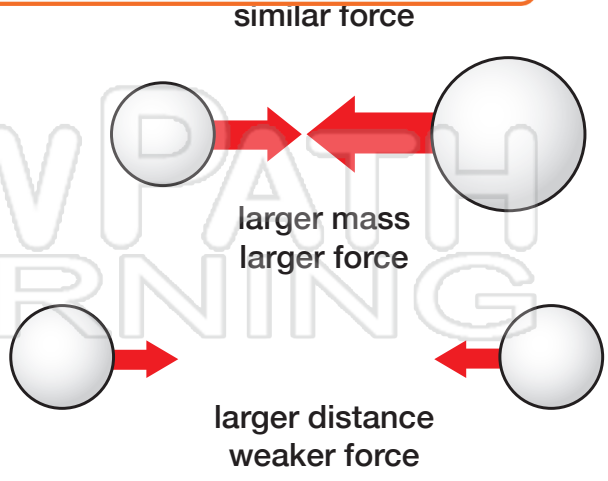
gravitational force (force of attraction) on other objects. The strength of the gravitational force is dependent upon the **mass** of the objects and the **distance** between them. The larger the mass of the objects, the larger the force is between the two objects. The farther away the two objects are, the weaker the gravitational force is between them.



Forces & Motion

Name _____ Class _____ Date _____

Fill in the blanks.

_____ is a **push or pull** upon an object. It provides an object with the _____ to move, stop moving, or change direction.

_____ is the standard unit of measure for force.

_____ is an **attractive force** that pulls objects together. The strength of this force is dependent upon the _____ of the objects and t

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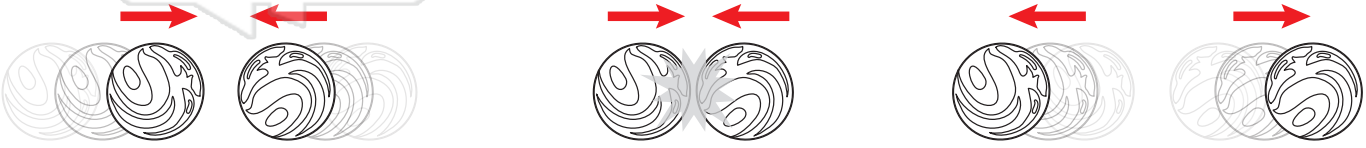
_____ and the amount of _____ applied.

Newton's 3rd Law of Motion

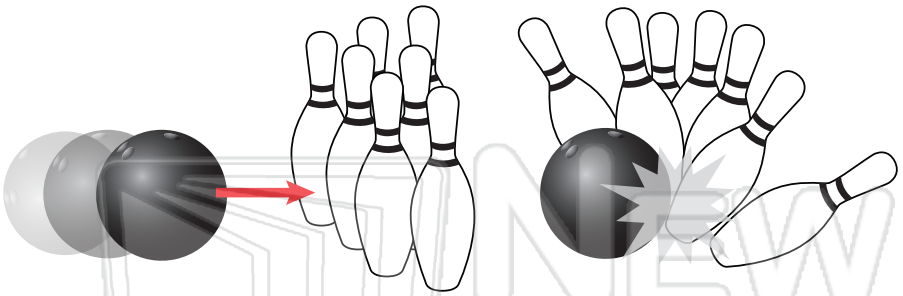
For every action there is an _____ and _____ reaction.



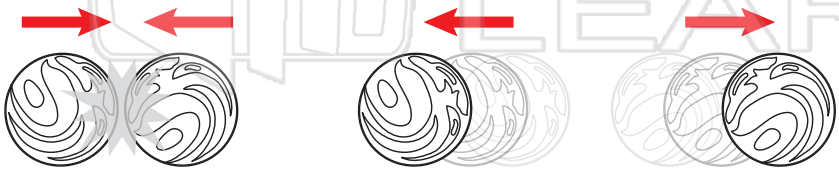
Forces & Motion

Name _____ Class _____ Date _____

Look at each example. Check the Law of Motion that is being illustrated.



- ☐ 1st Law of Motion
- ☐ 2nd Law of Motion
- ☐ 3rd Law of Motion



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- ☐ 3rd Law of Motion

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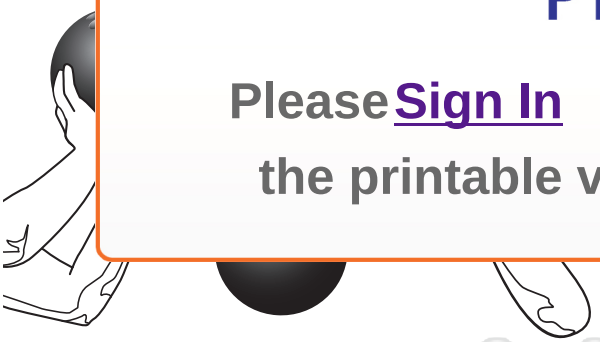

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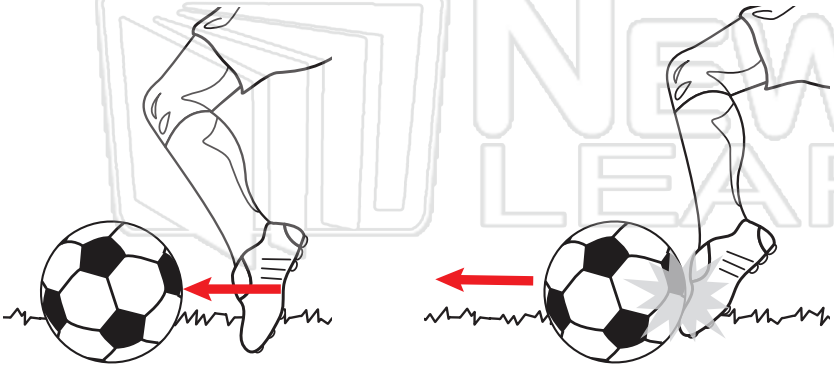

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Forces & Motion

Answer Key

Fill in the blanks.

_____Force_____ is a **push or pull** upon an object. It provides an object with the _____energy_____ to move, stop moving, or change direction.

_____Newton (N)_____ is the standard unit of measure for force.

_____Gravity_____ is an **attractive force** that pulls objects together. The strength of this force is dependent upon the _____mass_____ of the objects and t

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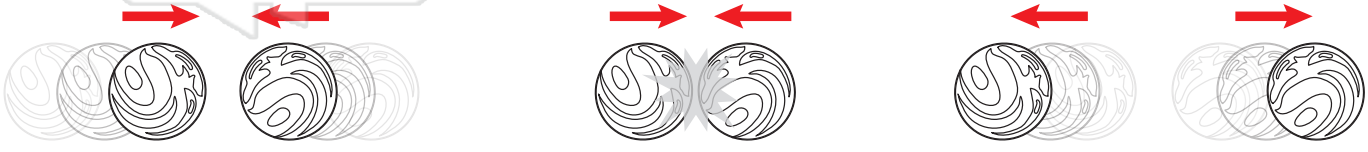
_____mass_____ and the amount of _____force_____ applied.

Newton's 3rd Law of Motion

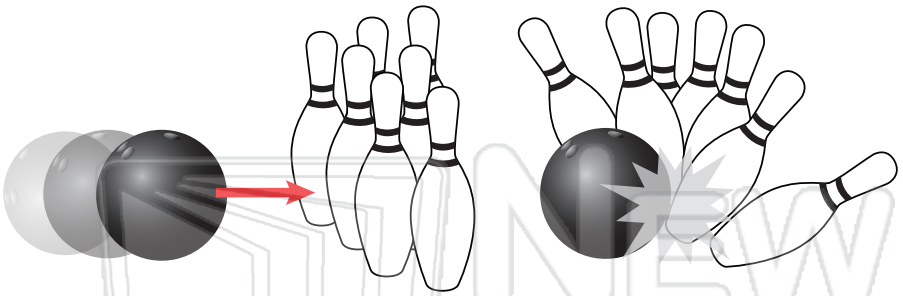
For every action there is an _____equal_____ and _____opposite_____ reaction.



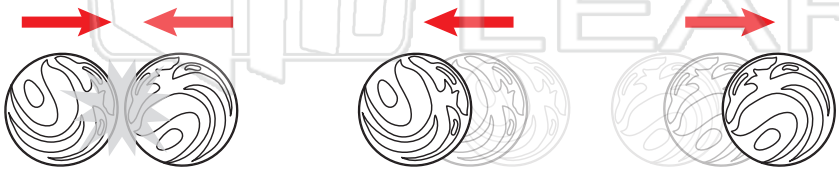
Forces & Motion

Answer Key

Look at each example. Check the **Law of Motion** that is being illustrated.



- [x] 1st Law of Motion
- [ ] 2nd Law of Motion
- [ ] 3rd Law of Motion



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- [ ] 2nd Law of Motion
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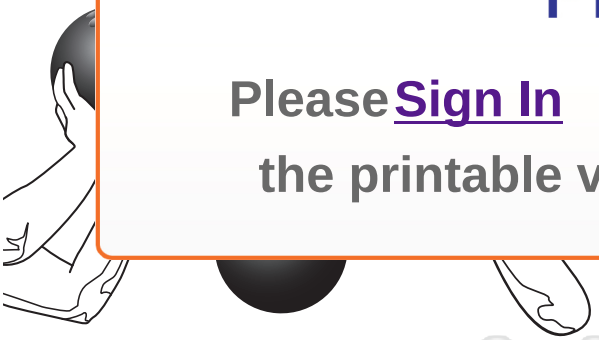

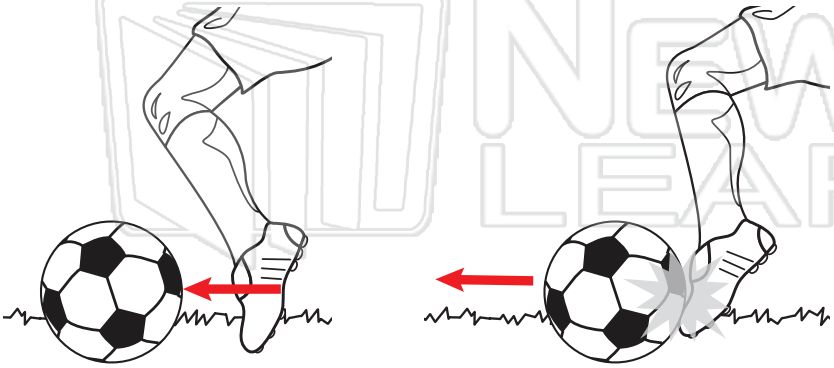

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- [ ] 2nd Law of Motion
- [ ] 3rd Law of Motion

Forces

Sci G

Name_____ Class_____ Date_____

1 In the image below, what **forces** are working **against** the man as he tries to push the rock?

A humidity and friction
B gravity and friction
C gravity and temperature
D friction and momentum

2 In order for a man to move a large rock, what could be done to make the rock **move more easily**?

A decrease the man's force against the rock
B increase the friction under the rock
C decrease the air under the rock
D decrease the friction under the rock

3 **Force** is measured in units called _____.

A calories
B inches
C newtons
D neutrons

$F = ma$

4 To calculate the amount of force, a student would multiply **mass x acceleration**. Knowing this, how could the amount of force be maintained if the mass is decreased?

A increase acceleration

5

7

C friction decreases
D gravity decreases

B 50 kg
C 100 kg
D 200 kg

$F = ma$

9 When a person rows a boat, he pushes the water backwards, but the boat goes forward. This is an example of **Newton's third law**, which states _____.

A what comes up must come down
B energy is always conserved
C for every action there is an equal and opposite reaction
D every object in motion tends to stay in motion unless acted on by an external force

10 **Net force** is the **difference** between a force going one way and another force going the opposite way. As a boy is rowing **forward**, what could happen to **reduce** his net force?

A wind pushes him forward
B wind pushes him back
C waves push him forward
D humidity holds him back

Forces

Sci G

Name_____ Class_____ Date_____

1 In the image below, what **forces** are working **against** the man as he tries to push the rock?

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B wind pushes him back
C waves push him forward
D humidity holds him back

B

Forces

Sci G

Name_____ Class_____ Date_____

1 Objects **remain at rest** until they are pushed, pulled, or lifted. This tendency to remain at rest until moved is an example of _____.

A Newton's first law
B Newton's second law
C Newton's third law
D Newton's fourth law

2 In the diagram below, movement will take place in which **direction**?

15 N 10 N

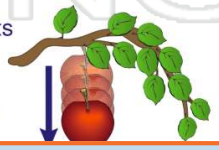
A right to left
B left to right
C upwards
D downwards

3 The **net force** to the **right** would increase if _____.

15 N 10 N

A friction on the red arrow decreased
B friction on the blue arrow increased
C friction on the blue arrow decreased

4 **Gravity** is a force _____.



A that attracts objects to each other
B that keeps our atmosphere away from earth

5

7

C movement to the right
D movement downward

B movement to the left
C movement to the right
D movement downward

9 The tendency for all objects to have a **difficult time stopping** once they are in motion is called _____.

A momentum
B force
C acceleration
D velocity

10 Momentum is calculated by multiplying the **mass** of an object by its **velocity**. If the mass of a train engine is **25,000** kilograms and its velocity is **50** mph then its momentum is _____.

A 1,500,000 kg x mph
B 1,250,000 kg x mph
C 1,200,000 kg x mph
D 1,000,000 kg x mph

Forces

Sci G

Name_____ Class_____ Date_____

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A Newton's first law
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A right to left
B left to right
C upwards
D downwards

B

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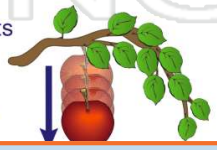
B friction on the blue arrow increased
C friction on the blue arrow decreased

C

4 **Gravity** is a force _____.

A that attracts objects to each other
B that keeps our atmosphere away from earth



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A

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B

C movement to the right
D movement downward

B movement to the left
C movement to the right
D movement downward

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A momentum
B force
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A 1,500,000 kg x mph
B 1,250,000 kg x mph
C 1,200,000 kg x mph
D 1,000,000 kg x mph

B

Forces

Sci G

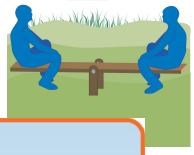
Name_____ Class_____ Date_____

Match each of the following terms to its definition:

Centripetal force	Balanced force	Newton	Friction
Unbalanced force	Momentum	Net force	Force

1. - a push or pull upon an object that causes it to change speed or direction

2. - a force that is being equally opposed by an opposing force



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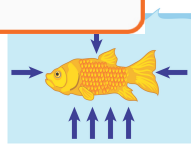
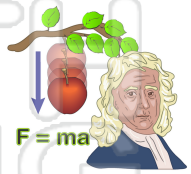
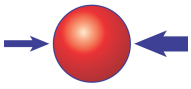


7. - the mathematical unit used to describe the amount of force



8. - a force that is not being opposed by an opposing force



Forces

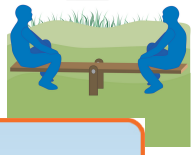
Name_____ Class_____ Date_____

Match each of the following terms to its definition:

Centripetal force	Balanced force	Newton	Friction
Unbalanced force	Momentum	Net force	Force

1. force - a push or pull upon an object that causes it to change speed or direction

2. balanced force - a force that is being equally opposed by an opposing force



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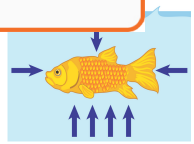
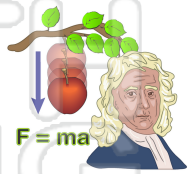
other

5. mo
depen

6. net



7. Newton - the mathematical unit used to describe the amount of force



8. unbalanced force - a force that is not being opposed by an opposing force