

Reflect

Isaac Newton developed the law of universal gravitation.

According to the law of universal gravitation, as the distance between objects with mass increases, the gravitational attraction between those objects decreases. In other words, the farther apart two objects move, the weaker their gravitational attraction becomes. Earth is very massive, so it has a strong gravitational pull. You would have to move very far away from Earth to escape its gravitational pull.

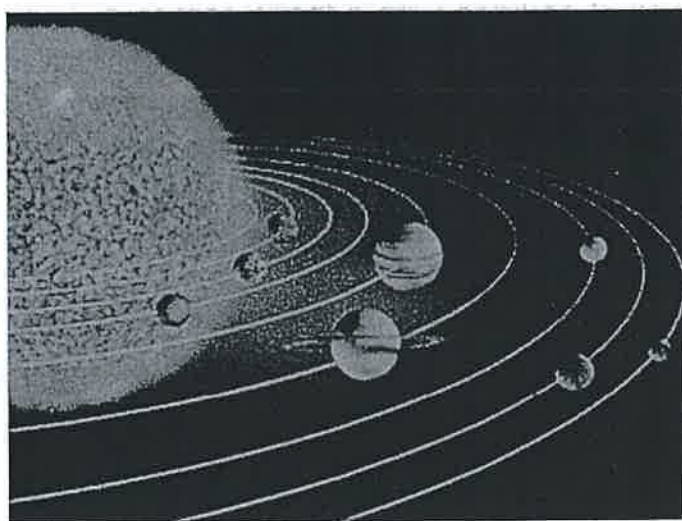
Look Out!

People often use mass and weight as though these terms mean the same thing. However, mass and weight are different properties of objects. Mass is a measure of the amount of matter in an object. Your mass is the same no matter where you are in the universe.

Weight is a measure of the force of gravity on an object. Objects with more mass than Earth have stronger gravitational pulls, and objects with less mass than Earth have weaker gravitational pulls. This would make your weight different on other planets and moons. For example, if you weigh 100 pounds on Earth, you would weigh only 16.6 pounds on the Moon! However, you would weigh 236.4 pounds on Jupiter. This is because the Moon is much less massive than Earth and has a weaker force of gravity, while Jupiter is much more massive and has a stronger force of gravity. Astronauts floating in space appear to weigh nothing. However, an astronaut's mass remains the same regardless of where he or she is in space.

The Solar System

Gravity holds together the solar system. The Sun is the most massive object in the solar system. Therefore, it has the strongest gravitational pull. The Sun's gravity causes other objects in the solar system—including planets, comets, and asteroids—to orbit or move around the Sun. (An orbit is also the path an object follows as it revolves around a more massive object.) The planets, comets, and asteroids all have their own gravitational pulls. They revolve around the Sun because the Sun is much more massive.



Reflect

Other objects in the solar system with orbital paths include moons and man-made satellites. Instead of revolving around the Sun, these objects revolve around planets. For example, the Moon revolves around Earth because it is much closer to Earth than to the Sun. Though the Moon is less massive than Earth, its gravitational pull is strong enough to affect the planet. The Moon's gravity pulls on Earth's oceans as it revolves around the planet. When the Moon is closer to an ocean or a lake, it pulls the water away from Earth. As the Moon moves away, the water falls back toward Earth. We call these regular movements of water tides.



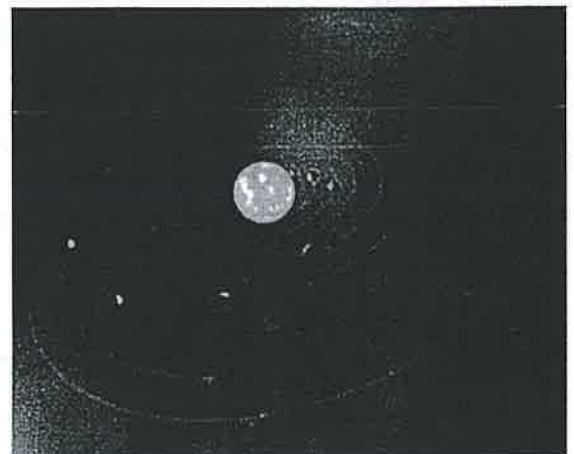
The planets and comets orbit the Sun, while moons orbit planets.

What Do You Think?

You have learned that the planets and other objects in the solar system revolve around the Sun because the Sun is so massive. Why do you think these objects do not crash into the Sun?

Elliptical Orbits

As an object in space moves around the Sun, it has a certain amount of forward momentum. The object's orbital path represents a balance between this momentum and the Sun's gravitational pull. As long as this balance is maintained, the object will continue to orbit the Sun. Now, suppose the object collides with a large asteroid. The force of the collision could move the object closer to the Sun. The Sun's gravity might then be strong enough to overcome the object's forward momentum. If this were to happen, the object would spiral toward—and eventually collide with—the Sun. On the other hand, suppose the collision moved the object farther from the Sun. At a greater distance, the object's forward momentum might be strong enough to overcome the Sun's gravitational pull. If this were to happen, the object would break free of its orbital path and move out of the solar system entirely.



The planets follow elliptical or oval-shaped orbits around the Sun.

Reflect

The orbital paths of objects in the solar system are not perfect circles. Instead, their orbital paths are elliptical or oval shaped. This means that these objects are sometimes a little closer to, and sometimes a little farther from, the Sun. When an object is closer to the Sun, it is affected more by the Sun's gravity. As a result, the object moves faster along its orbital path. When the object is farther from the Sun, it is affected less by the Sun's gravity. As a result, the object moves more slowly along its orbital path.

Try Now

What do you know?

Read the following statements about gravity. Based on what you have learned, rewrite each statement to make it true.

1. The ~~farther~~ ^{closer together} apart two objects are, the stronger the gravitational pull between them.

2. ~~Weight~~ ^{Mass} is the amount of matter in an object. ~~Mass~~ ^{Weight} is the measure of the force of gravity on an object.

3. ~~Earth~~ ^{The Sun} has the strongest gravitational pull in our solar system.

4. An object that orbits closer to the Sun is affected ~~less~~ ^{more} by the Sun's gravity.



Name: _____ Date: _____ Group: _____

Preview and Predict

Directions: Follow the instructions and answer the questions in the table below before reading the text.

Preview	Predict
What is the title of this chapter?	What do you already know about this topic?
Look at the pictures and their captions.	List two things you think you will be learning more about based on the pictures and captions. 1. 2.
Read the first sentence of each paragraph on pages 1–3.	Based on what you just read, write two questions that you hope to answer by reading the text. 1. 2.

Answers will vary



Name: _____ Date: _____ Group: _____

Outline Notes

Directions: Fill in the missing pieces of the notes while you read the text. Add in your own notes as needed.

1. Objects with mass have gravity.
 - a. As the distance between objects increases, the pull of gravity decreases.
2. Mass and weight are not the same.
 - a. Mass
 - i. How much matter is in something
 - ii. Does not change even if you go to another planet
 - b. Weight
 - i. How much gravity pulls on you
 - ii. Can be different on different planets since gravity is stronger or weaker
3. Gravity holds the solar system together.
 - a. The Sun has the strongest gravitational pull.
 - b. An orbit is the path an object takes as it moves around another object.

 - i. The Moon orbits around Earth.
 - ii. The Earth orbits around the Sun.
 - iii. Many orbital paths are elliptical, or oval-shaped.
 - c. The orbiting planets do not crash into the Sun because the planets have momentum that keeps them moving forward on their path. It is a special balance.

Use the space below to add any additional notes or interesting facts.



Name: _____ Date: _____ Group: _____

Walk Around Paragraph

Answer the prompt with your answer. Write down other students' sentences to create a whole paragraph.

Sentence 1 answers the prompt:

How does gravity affect other objects?

In addition ...

Answers will vary

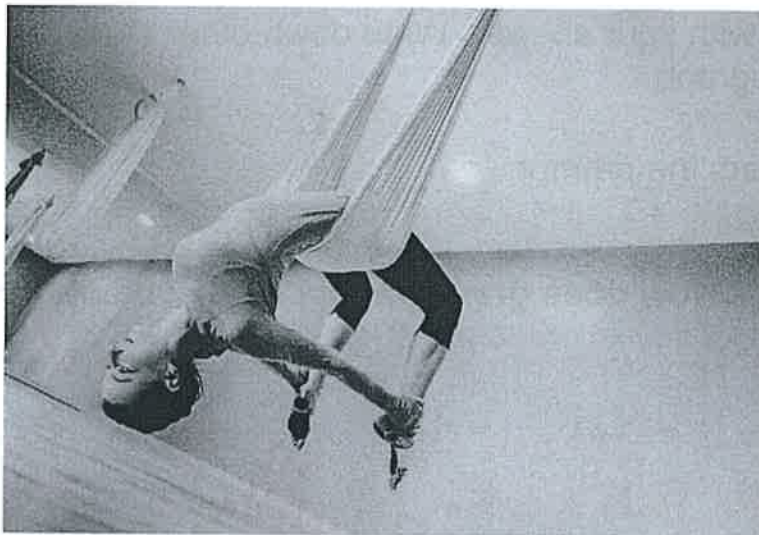
Also ...

Finally ...



Name: _____ Date: _____ Group: _____

Antigravity Yoga



1. Why does this type of yoga allow for more movement?

This type of yoga allows you to move in all directions since you are not on the floor

2. Label the forces acting on the person below. Draw arrows to show the direction of the force.



3. Describe how another form of exercise uses gravity.


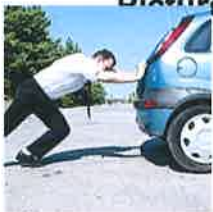
Weight lifting uses gravity to make you stronger. Gravity is pulling on the weights so that you have to use your muscles to overcome gravity and lift them.





Independent Practice

Name: **Answer Key** Date: _____ Group: _____

Part I: Four Square Model

<p>Definition</p> <p>The force that causes objects with mass to attract one another.</p>	<p>Picture</p> 
<p>Examples</p> <p>Apple falling to the ground from a tree.</p> <p>Planets orbiting the Sun.</p>	<p>Nonexamples</p> <p>Helium-filled balloon.</p> <p>Airplane flying in the sky.</p>
<p>Definition</p> <p>A push or pull on objects due to interaction.</p>	<p>Picture</p> 
<p>Examples</p> <p>Pulling a wagon.</p> <p>Pushing a cart.</p>	<p>Nonexamples</p> <p>Senses</p> <p>Opinions</p>

<p>Definition</p> <p>Any of the large celestial bodies that revolve around the Sun in the solar system.</p>	<p>Picture</p> 
<p>Examples</p> <p>Earth</p> <p>Mars</p>	<p>Nonexamples</p> <p>Moon</p> <p>Comet</p>
<p>Definition</p> <p>A force that pulls or keeps things together.</p>	
<p>Examples</p> <p>Magnet and iron.</p> <p>Gravity pulling a ball back to the ground.</p>	<p>Nonexamples</p> <p>Like ends of a magnet.</p> <p>Magnet and rubber.</p>



Independent Practice

Gravity
Motions and Stability: Forces and Interactions

Name: Answer Key Date: _____ Group: _____

Part II: That's a Lie!

1. New statement: Planets orbiting the Sun are examples of gravitational forces.
Reasoning: The planets do not touch the Sun and are not in contact.
2. New statement: Gravity is the force that pulls two objects towards each other; the greater the mass of an object, the stronger the attraction.
Reasoning: Objects on Earth fall to Earth, since it has more mass than the objects.



Concept Attainment Quiz

Name: _____ **ANSWER KEY** _____ Date: _____ Group: _____

I. Vocabulary Matching

 C A change in position

 A To pull towards

 B A force that pulls objects toward the center of Earth

 D An push or pull on an object

A. Attract

B. Gravity

C. Movement

D. Force

II. Identification

Use the word bank to fill in the blanks below.

weaker force stronger gravity downward

1. The force of Earth's gravity causes the Moon to stay near Earth.
2. The Moon has a weaker gravitational pull than Earth.
3. The pull of Earth's gravity downward is why snowflakes make their way to the ground.
4. Gravity on Earth is stronger than that on the Moon; therefore, we are able to stay on the ground.