Name _____ Date _____ Class _____



# Gravity and Motion

### Key Concepts

- What determines the strength of the force of gravity between two objects?
- What two factors combine to keep the moon and Earth in orbit?

The English scientist Isaac Newton told a story about how watching an apple fall from a tree in 1666 had made him think about the moon's orbit. Newton realized that there must be a **force** acting between Earth and the moon that kept the moon in orbit.

Newton hypothesized that the force of **gravity** pulls the moon toward Earth, keeping it in orbit. In Newton's day, most scientists thought that forces on Earth were different from those elsewhere in the universe. Although Newton did not discover gravity, he was the first to realize that gravity occurs everywhere. Newton's **law of universal gravitation** states that every object in the universe attracts every other object.

The strength of gravity is measured in units called newtons, named after Isaac Newton. **The strength of the force of gravity between two objects depends on two factors: the masses of the objects and the distance between them. Mass** is the amount of matter in an object. According to the law of universal gravitation, all of the objects around you are pulling on you. You don't notice this pull because the strength of gravity depends, in part, on the masses of the objects.

Because Earth is so massive, it exerts a much greater force on you than an object such as a book does. Similarly, Earth's gravitational pull on the moon is large enough to keep the moon in orbit. The force of gravity on an object is known as its **weight.** An object's weight can change depending on its location. On the moon, you would weigh about one-sixth of your weight on Earth. This is because the moon is much less massive than Earth, so the pull of its gravity on you would be much less.

The tendency of an object to resist a change in motion is **inertia.** Isaac Newton stated his ideas about inertia as a scientific law. **Newton's first law of motion** says that an object at rest will stay at rest and an object in motion will stay in motion with a constant speed and direction unless acted on by an unbalanced force.

**Newton concluded that two factors—inertia and gravity—combine to keep Earth in orbit around the sun and the moon in orbit around Earth.** Earth's gravity keeps pulling the moon toward it, preventing the moon from moving in a straight line off through space. At the same time, the moon keeps moving ahead because of its inertia. In the same way, Earth revolves around the sun because the sun's gravity pulls on it while Earth's inertia keeps it moving ahead.





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# Gravity and Motion (pp. 474–477)

*This section describes the two factors that keep the planets in orbit around the sun and moons in orbit around planets.*

### Use Target Reading Skills

*Before you read, preview the red headings in this section of the textbook. Then complete the graphic organizer by writing each red heading and a question about that topic. Answer your questions as you read.*

| Heading | Question | Answer |
|---|---|---|
| Gravity | | |
| | | |

### Gravity (pp. 474–476)

1. Is the following statement true or false? Forces on Earth are different from those elsewhere in the universe. _____
2. What is the law of universal gravitation?

   _____

   _____
3. What two factors determine the strength of the force of gravity between two objects?

   a. _____

   b. _____

**4.** Complete the cause and effect table to show the relationship among mass, distance, and the force of gravity between two objects.

| CAUSE | | EFFECT |
|---|---|---|
| *If mass* | *and distance* | *then the force of gravity between two objects* |
| increases | stays the same | **a.** |
| **b.** | stays the same | decreases. |
| stays the same | decreases | **c.** |
| stays the same | increases | **d.** |

**e.** Use the information in the table to write one or two sentences about the relationship among mass, distance, and the force of gravity between two objects.

_____

_____

_____

_____

## Inertia and Orbital Motion (pp. 476–477)

**5.** What is inertia?

_____

_____

_____

**6.** Isaac Newton concluded that two factors combined to keep the planets in orbit. Name them.

**a.** _____

**b.** _____

**7.** Circle the letter of each statement that is true about the moon's orbit around Earth.

**a.** Earth's gravity pulls the moon toward it.
**b.** The moon keeps moving ahead because of gravity.
**c.** The moon would stop moving if Earth's gravity did not pull on it.
**d.** Inertia keeps the moon moving ahead.







# Gravity and Motion

### Understanding Main Ideas

*Answer the following questions in the spaces provided.*

**1.** How are gravity and weight related? _____

_____

_____

**2.** How does Newton's law of universal gravitation apply to Earth and the moon? _____

_____

_____

**3.** Use Newton's first law of motion to explain why a basketball rolls across the court. _____

_____

_____

**4.** How does distance affect the strength of the force of gravity? _____

_____

_____

### Building Vocabulary

*Write a brief description of each of the following.*

**5.** force _____

_____

**6.** gravity _____

_____

**7.** law of universal gravitation _____

_____

**8.** mass _____

_____

**9.** weight _____

_____

**10.** inertia _____

_____

**11.** Newton's first law of motion _____

_____