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Warm-Up | Gravity and Motion

Lesson Question

How does the force of gravity affect objects in the universe?

Lesson Goals

Learn about gravity.

- **Identify** factors that influence the force of gravity between objects.
- **Explain** how Earth and the moon stay in orbit.

Words to Know

Fill in this table as you work through the lesson. You may also use the glossary to help you.

force	a push or a pull that can change the motion, shape, or other features of an existing system or body
gravity	a force that pulls an object toward the center of any object that has mass
inertia	the tendency of an object to resist change in motion
mass	the amount of matter in an object

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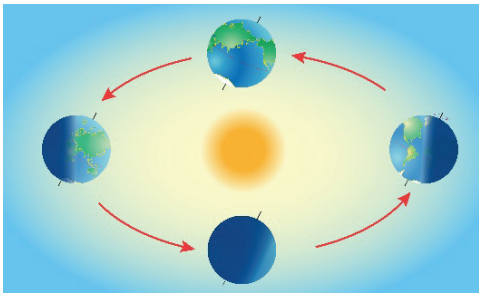
Words to Know

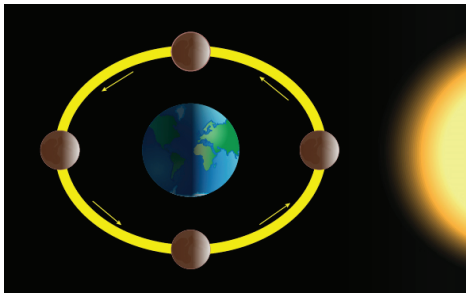
Newton's first law of motion	a law that states that an object at rest will stay at rest and that an object in motion will stay in motion until it is acted upon by an [outside] force
Newton's law of universal gravitation	a law that states that every object in the universe [attracts] every other object
weight	the force of gravity [pulling] on an object

The Orbits of Earth and Its Moon

Earth revolves around the Sun, and the moon orbits Earth.



Earth's orbit around the [Sun] takes 365.25 days.



The [moon] travels around Earth in 27.3 days.

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Sir Isaac Newton (1643–1727)

- Was a famed mathematician, astronomer, and physicist
- Was one of the most influential scientists in human history
- Developed laws of motion and helped develop a new type of math, calculus
- Created the first reflecting telescope in 1668
- Concluded that gravity is a **force** that acts between Earth and the moon

Newton's Law of Universal Gravitation

Gravity is the force that governs motion in the solar system.

- It is the force that creates stars and planets.
- It is the force that pulls an object toward the center of Earth.
- **Newton's law of universal gravitation** states that every object in the universe attracts every other object.
- Gravity is measured in newtons.

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Gravity and Mass

Mass affects the force of [gravity].

- Mass is the amount of [matter] in an object.
  - The mass of an object does not change based on location.
- Objects with more mass have more gravity.
  - Earth has [more] gravity than the moon.

Gravity and Weight

Weight is dependent on [mass] and gravity.

- Weight is the force of gravity [pulling] on an object.
- An object's weight depends on its [location] in the universe.
  - An object would weigh [less] on the moon than on Earth.

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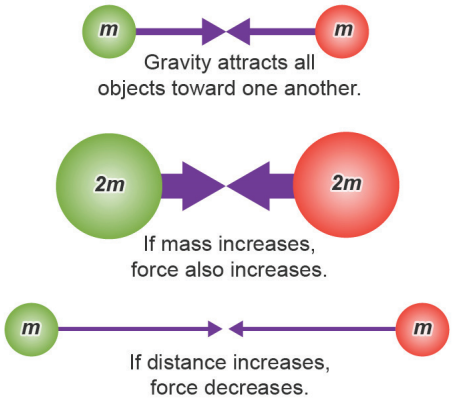
Mass, Distance, and Gravity

Mass and distance affect gravity.

- The strength of gravity between two masses [increases] when mass increases.
- The strength of gravity between two masses [decreases] as distance between them increases.



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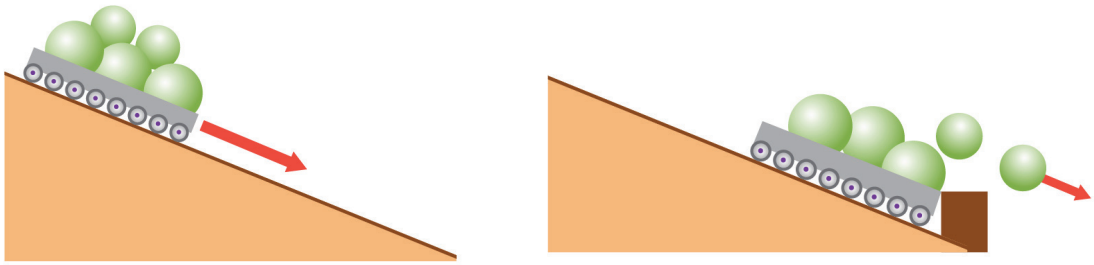
Inertia

Inertia is the tendency of an object to [resist] change in motion.



Newton's law of universal gravitation states that every object in the universe [attracts] every other object. Earth attracts the moon, and the moon attracts Earth, which causes the [tides]. Similarly, the [Sun] and Earth are constantly pulling on each other, but Earth is not pulled into the Sun. This is due to inertia.

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Newton's First Law of Motion

Newton's first law of motion states that an object at rest will stay at rest and that an object in motion will stay in motion.

- This law is also known as the law of [inertia].
- It explains that objects in motion will have a constant [speed] and direction until they are acted upon by a force.
- Objects with more [mass] have more inertia.

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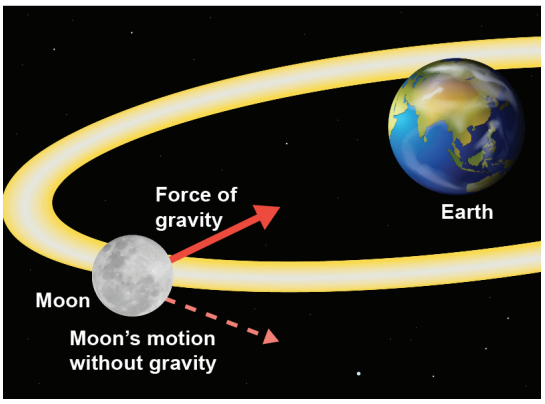
Effects of Gravity and Inertia on Orbital Motion

Both gravity and inertia keep the moon in orbit around [Earth].

- The moon's inertia prevents Earth's gravity from [pulling] the moon into Earth.
- Earth's gravity prevents the moon from going off in a [straight] line.



The Sun's gravity combines with Earth's inertia to keep Earth in orbit.

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Lesson Question

How does the force of gravity affect objects in the universe?

Answer

(Sample answer) The pull of gravity an object exerts increases with the object's mass. Gravity exerted from the different planets and the Sun is the reason planets and moons orbit around each other and around the Sun.

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Review: Key Concepts

Newton's law of universal gravitation: Objects with greater mass have greater pull on other objects.

- Every object in the universe attracts every other object.
- Objects with greater mass have greater [pull] on other objects.
- This pull is called [gravity].

Newton's first law of motion states that:

- an object at rest will stay at rest.
- an object in motion will stay in motion with a constant speed and [direction] until it is acted on by a force.

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Review: Key Concepts

Mass and distance affect gravity.

Mass of object **increases.**	Strength of gravity **increases.**
Distance between two objects [increases].	Strength of gravity **decreases.**

Review: Key Concepts

Gravity and inertia affect orbital motion.

Gravity	Inertia	Orbit
The pull of a larger body on a smaller body	The tendency of a body to keep moving in a straight line	Path taken by a body due to gravity pulling on it plus the forces of its own inertia

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Use this space to write any questions or thoughts about this lesson.

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