

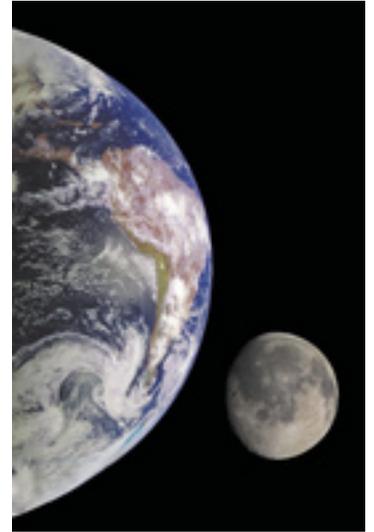
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# Gravity

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Gravity is a force that we experience every moment of every day. Gravity is the basic force in the universe. Every body (planet, moon, star, comet, asteroid, meteor, etc.) in the solar system has a force that pulls things to itself. That's gravity- the force of attraction between all objects in the universe.

On Earth, it keeps people and objects from flying off into space. Gravity even keeps our air from floating off into space! An object's weight depends on the strength of the force of gravity. The pull of gravity is different on different bodies in space so weight varies on different planets or moons. For example, if you weigh 100 pounds on Earth, you would only weigh about 16 pounds on the moon. The moon is a smaller body than Earth and so its gravity is less.



Isaac Newton discovered in the 1600s that the force of gravity depends upon the amount of matter (mass) in bodies and the distances between the bodies.

The sun pulls on the Earth. The Earth pulls back on the sun. The sun is huge! If the sun were a hollow ball, you could fit one million Earths inside of it. The sun's gravity is very strong because of its large mass. However, because the sun is 93 million miles away from the Earth, the pull of gravity decreases in proportion to its distance. The Earth's gravity pulls back on the sun. The Earth stays in orbit around the sun because the forces are balanced.

Newton's Law of Universal Gravitation explains that an attractive force is present between any two objects. The size of the force depends on the masses of the two objects and the distance between the two objects.

Newton was saying that *every* object in the universe exerts a force on every other object. According to Newton, even your pencil and a piece of paper attract one another. You can't feel this force because the masses of the pencil and paper are so small. Even you exert a gravitational force on other objects. Because your mass is so much less than the mass of the Earth, you can't feel your gravitational force. When the object is the Earth, the mass is very large. The gravitational force exerted by the Earth is what we call weight.

The force of gravity is what makes objects fall to Earth. It keeps the moon in orbit around the Earth. It keeps Earth and the other planets in orbit around the sun. Gravity holds us on the Earth so we don't float away. Gravity holds our atmosphere, too. The moon's gravity pulls on Earth's oceans and causes tides that rise and fall.

Because the Earth's gravity has the same pull on every object, all objects fall at the same speed (in a vacuum). On Earth, we have air. Air resistance will cause some objects to fall more slowly than others will. This works to our advantage when we want to fall more slowly, for example, when a skydiver jumps out of an airplane. He uses a parachute to create as much air resistance as possible to slow down his fall. But if we drop two things in a

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vacuum chamber from which we removed all the air, the two things will fall at the same speed. This is true even if one of the objects is a feather and the other is a bowling ball. Earth's gravity accelerates objects when they fall. Gravity constantly pulls on a falling object, and so the object constantly speeds up until it reaches its terminal velocity. Terminal velocity is the maximum speed an object can reach. After an object reaches this maximum, the speed of the falling object remains at this constant rate.

Gravity has the advantage of being able to work over long distances. The sun is 93 million miles away from Earth, but its gravity is strong enough to hold the Earth in its orbit. The gravity of the solar system keeps everything in the system, including comets and asteroids, orbiting the center of the system, the sun.

## Gravity

### Questions

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- \_\_\_\_\_ 1. What is gravity?
- A. the basic force of the universe
  - B. the force of attraction between all objects in the universe
  - C. a force we experience all the time
  - D. all of the above
- \_\_\_\_\_ 2. An object's weight:
- A. has nothing to do with gravity
  - B. would be the same everywhere in the universe
  - C. depends on the strength of the force of gravity
- \_\_\_\_\_ 3. The amount of gravity between two objects depends on:
- A. the weight of the two objects
  - B. the distance of each object from the sun
  - C. the amount of mass of the two objects and the distance between them
  - D. the distance of each object from each other
4. Who first stated the laws of gravity?
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_ 5. The gravitational force exerted on you by the Earth is:
- A. your buoyancy
  - B. your mass
  - C. too tiny to be measured
  - D. your weight
- \_\_\_\_\_ 6. Gravity causes:
- A. objects to fall to the ground if nothing is holding them
  - B. the moon to orbit the Earth
  - C. tides on Earth
  - D. all of the above

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- \_\_\_\_\_ 7. A falling object:
- A. constantly slows down throughout the fall
  - B. falls at the same speed throughout the fall
  - C. constantly speeds up throughout the fall until it reaches terminal velocity
- \_\_\_\_\_ 8. The speed of a falling object (without air resistance):
- A. is the same for all objects
  - B. depends on the size of the object
  - C. depends on the weight of the object
  - D. depends on the mass of the object

