

Newton's Third Law

Read from **Lesson 4** of the **Newton's Laws** chapter at **The Physics Classroom**:

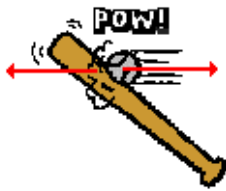
<http://www.physicsclassroom.com/Class/newtlaws/u214a.cfm>
<http://www.physicsclassroom.com/Class/newtlaws/u214b.cfm>

MOP Connection: Newton's Laws: sublevel 12

A force is a push or pull resulting from an interaction between two objects. Whenever there is a force, there are two objects involved - with both objects pushing (or pulling) on each other in opposite directions. While the direction of the pushes (or pulls) is opposite, the strength or magnitudes is equal. This is sometimes stated as Newton's Third Law of motion: *for every action, there is an equal and opposite reaction.* A force is a push or a pull and it always results from an interaction between two objects. These forces always come in pairs.



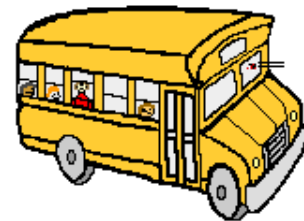
1. For each stated *action force*, identify the *reaction force*.



Bat hits ball.
Ball hits bat.



Man pushes car.
Car pushes man.



Bus hits bug.
Bug hits bus.

2. Identify by words the action-reaction force pairs in each of the following diagrams.

<p>Athlete</p> <p>Medicine Ball</p> <p>The athlete's hands push the medicine ball forward. The medicine ball pushes the athlete's hands backward.</p>	<p>Foot</p> <p>Floor</p> <p>The foot pushes backward on the floor. The floor pushes forward on the foot.</p>	<p>Ball</p> <p>Foot</p> <p>The foot pushes the ball forward. The ball pushes the foot backward.</p>
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Newton's Laws

3. **TRUE** or **FALSE**:

As you sit in your seat in the physics classroom, the Earth pulls down upon your body with a gravitational force; the reaction force is the chair pushing upwards on your body with an equal magnitude.

If False, correct the answer.

The reaction force to the Earth pulling down on your body is the force of your body pulling up on the Earth.

4. Shirley Bored sits in her seat in the English classroom. The Earth pulls down on Shirley's body with a gravitational force of 600 N. Describe the reaction force of the force of gravity acting upon Shirley.

Shirley's body pulls upward on the Earth with 600 N of force. Gravitational force, like all forces, results from a mutual interaction. In the case of gravity, it is the mutual attraction of two objects for one another. Not only does the Earth attract Shirley's mass, Shirley attracts the Earth's mass.



5. Use Newton's third law (law of action-reaction) and Newton's second law (law of acceleration: $a = F_{\text{net}}/m$) to complete the following statements by filling in the blanks.
- A bullet is loaded in a rifle and the trigger is pulled. The force experienced by the bullet is **equal to** (less than, equal to, greater than) the force experienced by the rifle. The resulting acceleration of the bullet is **greater than** (less than, equal to, greater than) the resulting acceleration of the rifle.
 - A bug crashes into a high-speed bus. The force experienced by the bug is **equal to** (less than, equal to, greater than) the force experienced by the bus. The resulting acceleration of the bug is **greater than** (less than, equal to, greater than) the resulting acceleration of the bus.
 - A massive linebacker collides with a smaller halfback at midfield. The force experienced by the linebacker is **equal to** (less than, equal to, greater than) the force experienced by the halfback. The resulting acceleration of the linebacker is **less than** (less than, equal to, greater than) the resulting acceleration of the halfback.
 - The 10-ball collides with the 14-ball on the billiards table (assume equal mass balls). The force experienced by the 10-ball is **equal to** (less than, equal to, greater than) the force experienced by the 14-ball. The resulting acceleration of the 10-ball is **equal to** (less than, equal to, greater than) the resulting acceleration of the 14-ball.