Motion

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When you place a book on a table, why does the book stay there and not suddenly scoot off to the side? When you drop a rubber ball, why does it fall and then bounce? The answers to these questions belong to the science called *mechanics*, the branch of physics concerned with how and why objects move—that is, with the forces that cause objects to move and the principles that guide their movement. This knowledge has important applications in everything from building safe roads to launching satellites into space.

Third Law of Motion

Newton's third law of motion is usually stated: *To every action, there is an equal and opposite reaction*.

This statement means that whenever objects interact with each other, they exert forces upon each other. Those forces are equal, and they act in opposition. If two balls bounce off each other, for example, their interaction results in two equal and opposite forces, one acting on each ball. Often the reacting force is not so obvious, but it is always there. When you stand on a floor, you exert a downward force on the floor. That force is opposed by the upward force that the floor exerts on you.

The rowing action of an oar in water is another example. With each stroke, the oar pushes water backward. The opposing force of the water pushes the rowboat forward. In a rocket blastoff, gases rushing backward from the engine create forward motion (*Figure 6*). In a car, the spinning wheels push backward against the road, and the road pushes the car forward. Forces always come in pairs—equal and opposite action-reaction force pairs. If this were not so, the boat, the rocket, and the car would not move forward at all.

Here's another way to state this principle: Whenever an interaction gives momentum to an object, the other object (or objects) involved in the interaction receives equal momentum in the opposite direction. Physicists sometimes refer to Newton's third law of motion as the law of conservation of momentum.

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