FORCE AND MOTION

From Kids Discover Magazine

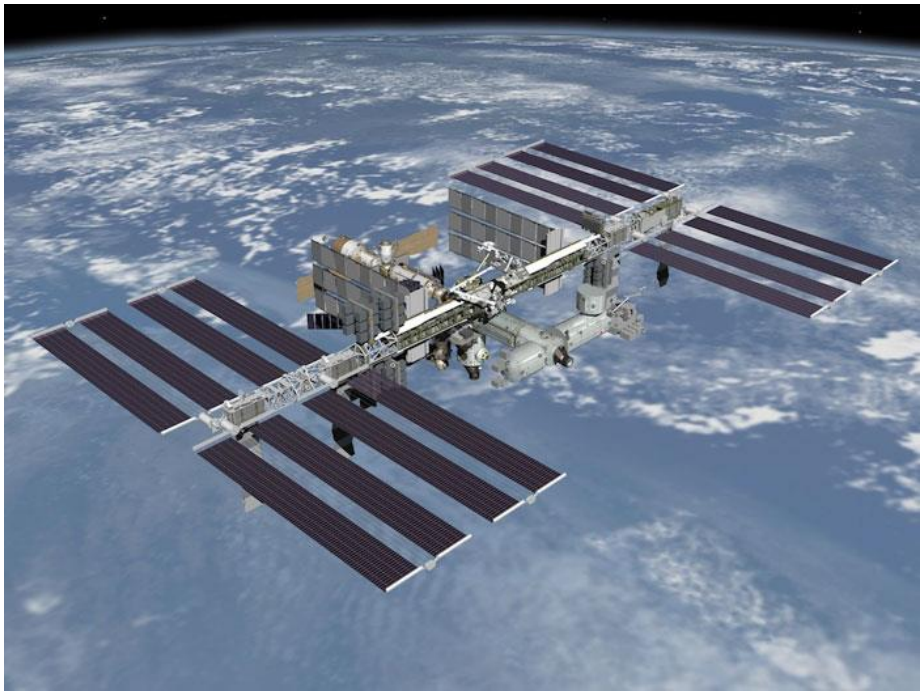
The world and the Universe are action-packed.

People and animals are always on the move. The planets are constantly circling the Sun. Are there any rules to all this activity? Yes! Our world and the whole Universe are governed by the laws of nature. Scientists who try to understand and learn about these laws are called physicists. Here are some questions that physicists across history have wondered about: When you drop a ball, why does it fall on the ground? Why doesn't it float up? If you spin a top, why doesn't it spin forever? Why does it eventually stop? Maybe you have wondered about these things, too.

To answer those questions, physicists needed to discover the laws of motion. What is motion? Motion is movement in any direction. You can move up, down, forwards, backwards, and sideways. You can move in circles. You can wiggle, wave, twist, turn, roll, flip, sway, bend, pivot, shake, and spin.

–When you pluck the string of a guitar, the string vibrates—moving quickly back and forth. That is a type of motion.
–When water flows off a cliff, it creates a waterfall. That is a type of motion.
–When you throw a football into the air, it curves up … and then down again. That is a type of motion.

About 200 miles up, the International Space Station is in motion around the Earth. The space station travels fast. In fact, it circles the Earth once every 90 minutes.



Of course, things don't just move by themselves. An object must be pushed or pulled to get in motion.

A force is a push or a pull. Here is a simple example: A cat hits a ball with its paw and makes the ball roll across the floor. The cat uses force to make the ball move. When you kick a ball or pull open a door, you are also using force. The more force you use, the faster the object will move.

▲ *When you cannonball into a pool, you create a huge splash. The force of your body hitting the water is what puts the water in motion.*

Speed measures how far an object moves in a certain amount of time. But things don't always move at the same speed. Forces can cause moving objects to speed up or slow down. "Average speed" equals "distance divided by time."

Powerful legs provide the force to make the cheetah the fastest land animal on Earth. This young cheetah can run 1 mile in 60 seconds (or 1 minute). The cheetah's average speed = 1 divided by 1, or 1 mile per minute. The cheetah is not going that fast all the time. From a starting position, it takes the cheetah 4 seconds to speed up (or accelerate) to reach its top speed.

So why do things in motion slow down and a stop after a while? The answer is "friction." Friction is another kind of force. Friction is two things rubbing or sliding against each other. Skis on snow. A car on a road. A ball rolling across a carpet. Friction is a force that slows down moving objects.

▲ *The more force the player kicks with, the faster the ball will move.*

If you roll a ball across a shaggy rug, you can see that there are lumps and bumps in the rug that make the ball slow down. The rubbing, or friction, between the ball and the rug is what makes the ball stop rolling. But what would happen if you rolled the ball across a very smooth surface and there was no wall or obstacle in the way? Would the ball keep rolling forever? Unfortunately, no. There is no such thing as a "frictionless surface." There is friction between all objects and materials when they are touching.

To the naked eye, an object or surface may look perfectly smooth. But if you looked at it under a microscope, you could see the tiny lumps and bumps that create friction when any two objects slide against each other. There is even friction when an object moves through the air.

The less friction there is, the longer objects in motion can keep moving. For example, if you pushed off and tried to slide across the sidewalk in sneakers, you wouldn't get very far. There is too much friction between the rubber soles of your sneakers and the rough concrete sidewalk. BUT if you wore ice skates and used the same amount of force to push off and slide across an ice rink, you would glide for a long way. There is not much friction between the thin metal blade of an ice skate and the slick ice of the rink.

▲ *An object moves faster when there is less friction to slow it down. The slick plastic of the inner tube and the smooth packed-down snow are a low-friction combination.*