

Balanced & Unbalanced Forces

Force

*An object's motion changes because of **force**.*

Pushing and Pulling are Kinds of Forces

Motion is movement that changes an object's position. Pushing or pulling forces can be used to change the motion of an object.

When force is applied, the object can start moving, stop moving, change speed, or change direction.



Effect of Force Strength on Motion

The motion of an object acted on by a force depends partly on *the strength* of the push or pull. The stronger the push or pull, the faster the object will move. For example, the father in the picture below is pushing his daughter in a swing. When he pushes her with more force, the swing moves faster.



Types of Forces

Forces are interactions between two objects. Forces can cause objects to start moving, stop moving, or to change their motion. Different forces work in different ways to change an object's motion.

Friction

Friction is a force that acts between objects that are touching, or *in contact*. Friction acts in the *opposite direction of the movement*, and it causes the object to slow down or stop. Friction may even help keep an object from moving at all.

When one surface passes over another a force called friction tries to slow objects down. The smoother the surfaces the less friction there is between the surfaces. A ball will have less friction acting on it as it rolls across pavement than when it rolls across grass.

Pushing

A push is a force that can cause something to move *away* from the person or object pushing it. Pushing usually only happens when objects are touching. For people to push a car, they must touch it.



The boy is pushing the lawn mower. The push causes the mower to move away from himself.

Pulling

Pulling is a force that can cause something to move *toward* the person or object pulling it. Like pushing, pulling usually only happens when objects are touching.



The man is pulling the sled. The pull causes the sled to move toward himself.

Gravity

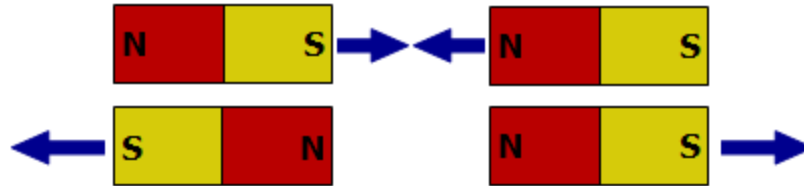
Gravity is the force between *any two objects*. But we usually only notice an object's force of gravity if the object is very large, like the Earth. An object's force of gravity pulls other objects toward it. So, the Earth's gravity pulls everything on Earth (or near Earth) down toward the center of the Earth. Earth's gravity is able to act on things, even if the things aren't touching the Earth's surface.



Earth's gravity pulls the skydiver down. Gravity is pulling even though the skydiver is not touching the Earth.

Magnetism

Magnetism is the force with which a magnet pushes or pulls another magnet or an object that contains a material such as iron or nickel. A magnet can either *attract* (move the object closer) such an object or *repel* it (move it away). The *north* pole of one magnet will attract the *south* pole of another. But north poles repel north poles and south poles repel south poles.



Opposite poles of two magnets attract, while poles that are the same repel.

Magnetism can work at a distance. It can also *keep* working if two magnetized objects are touching.

Balanced & Unbalanced Forces

*An object's motion can be changed by **unbalanced** forces. **Balanced** forces do not change the motion of an object.*

Balanced Forces

The motion of an object will not change if the forces pushing or pulling the object are **balanced**. An object that is sitting still will stay still if the forces acting on it are balanced. If an object is in motion, it will keep moving in the same direction and at the same speed if the forces acting on it are balanced. Look at Diagram A, shown below.

Diagram A: Balanced Forces



These forces are balanced, so the motion of the object stays the same.

The object in the diagram could be sitting still, or it could be moving. But its *motion* is not changing. This is because the forces acting on it from opposite sides are exactly the same size.

Unbalanced Forces

An unbalanced force *can* change an object's motion. An unbalanced force acting on a still object could make the object start moving. An unbalanced force acting on a moving object could make the object change direction, change speed, or stop moving. Look at Diagram B, shown below.

Diagram B: Unbalanced Forces



These forces are unbalanced, so the object moves to the right.

In Diagram B, Force 1 is a large force acting on the object by pushing the object *toward the right*. Force 2 is smaller, and it is pushing on the object *toward the left*. Some of Force 1 acts to stop Force 2 from moving the object. Since Force 1 is larger, there is still some force left over. This leftover force makes the object start moving to the right. The red arrow shows the direction of the object's new motion.

In the picture below, Henry and Ben are playing tug of war. Henry is much stronger than Ben. Both boys pull on the rope, but Henry pulls with a greater force. How does the rope move?



The rope moves toward Henry since Henry is stronger than Ben, and Henry is pulling on the rope with a greater force.