

Simple Machines

Teacher Background Information (SC030300)

The word machine comes from a Greek word, *machos*, meaning expedient or something that makes work easy. The Romans used the Latin word *machina*, which means trick or device. The use of machines has changed the lives of people. From the earliest simple machines to the complicated computers of today, machines have played an important role in our technological development.

In physics energy is the ability to do work; potential energy is stored energy, while kinetic energy is causing a change in state or position. Force is the effect of kinetic energy. We usually define force for students as “a push or a pull.” Even though some forces are difficult to observe (such as the electromotive force that pulls an atom together or the push of heat energy on air masses) this definition is a good one for children. It helps them observe and measure force without imbedding misconceptions that could stand in the way of future understandings.

Work is defined as force times distance. In physics, we say that the amount of work needed to cause a particular change remains the same, but we can make work easier (reduce force) by increasing distance. This is the basic principle upon which most simple machines are designed. For example, it takes less force to pull an object up a ramp to a height of 2 feet (assuming friction is not too great) than it would to lift it straight up. Machines, like compound pulleys (block and tackle), screws, and levers increase the distance over which a force acts so that we do not have to push or pull so hard.

Use of both English and metric measurements can create confusion when teaching about force and motion. The English unit “pound” not only tells us about the amount of matter in an object, but also considers the pull of the Earth (force of gravity) on the matter. (That is why your weight in pounds would change if you were on the moon.) But the kilogram measures only mass or amount of matter. The Metric unit of force is the Newton. A spring scale (which works because Earth pulls down on matter) can be purchased in pounds or in Newtons. Most teachers feel that the use of English units is easier at the third grade level because it avoids the problem of having to introduce a new measurement system at the same time that they teach a new group of concepts.

For thousands of years, humans have made their work easier with such tools as flint knives, bone needles, stone axes, and wooden poles. Pictures on 3000-year old tombs and caves show levers and simple wheeled carts. These were the first machines. There are three simple machines: the lever, the pulley, and the inclined plane. The wheel and axle, the wedge, and the screw are modifications of the three simple machines.



A spring scale

Lever: A lever is a board or bar that rests on a turning point called the fulcrum. An object that a lever moves is called the load. The end of the lever that you push or pull moves farther than the load, so you do not have to use as much force to do the same work.

Inclined Plane:

An inclined plane is a flat surface that is higher at one end. Because an object moves farther on the plane than if it went straight up, you do not need as much force to do the same work. You can use this machine to move an object to a lower or higher place. But you must be careful to keep friction low.

Wheel and Axle: A wheel is a circular machine that does not slide when it moves. The wheel allows you to move things without friction. The axle is a rod that goes through the wheel and allows it to turn.

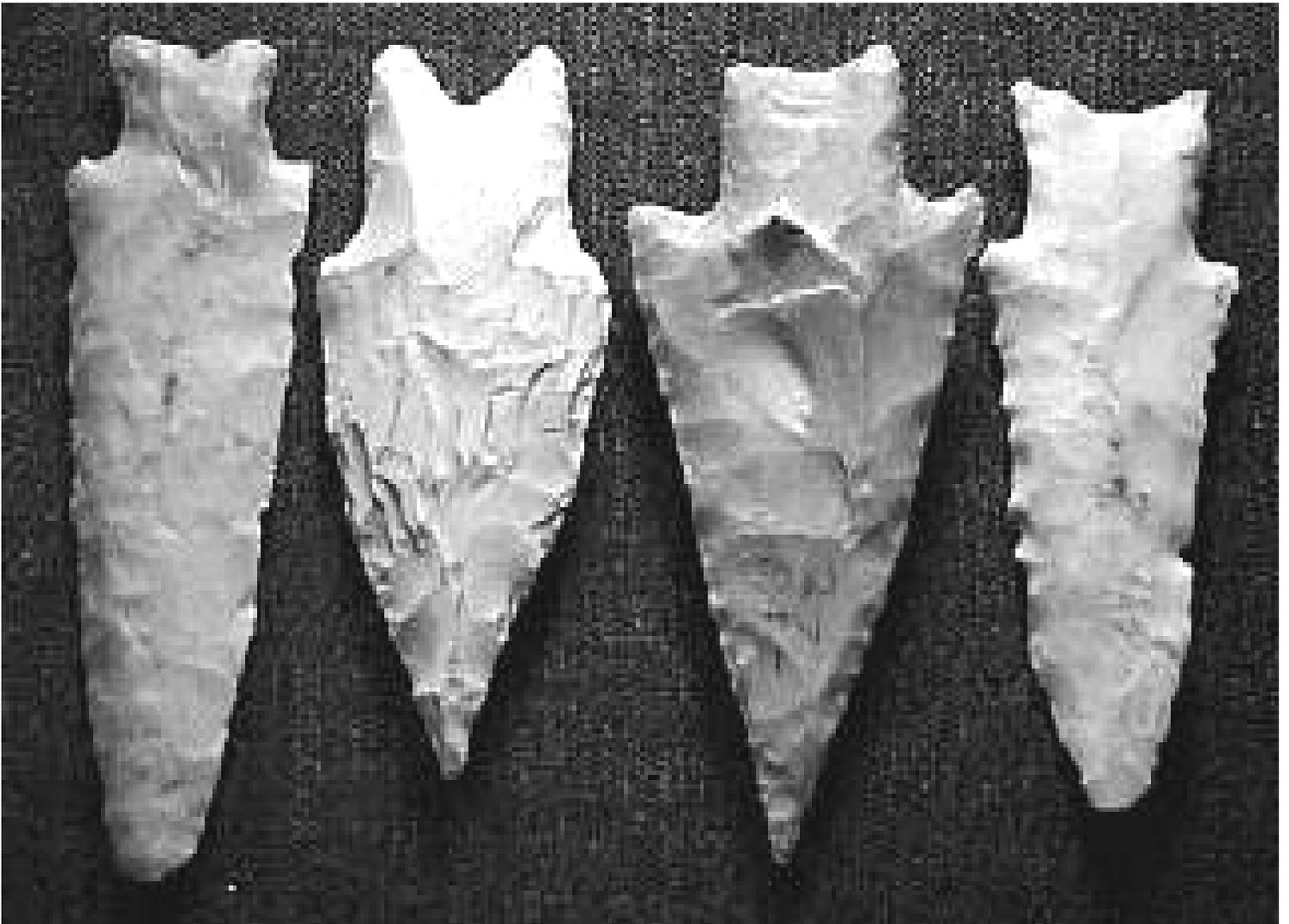
Wedge: A wedge is a simple machine made of two inclined planes. They increase the distance the force works, so that you can do the same work with less effort. Wedges help push things apart.

Pulley: A pulley is a simple machine is made up of a wheel and a rope. The wheel changes the direction of the force. Two pulleys together are called a “block and tackle.” With them the force moves farther, so the same effort does more work.

Screw: A screw is actually an inclined plane that winds around itself. Wood screws often have wedges at the end, to help them dig into the wood. Because the force goes farther around the edge, it does more work. Friction holds the screw in when you are done.

Photo Gallery







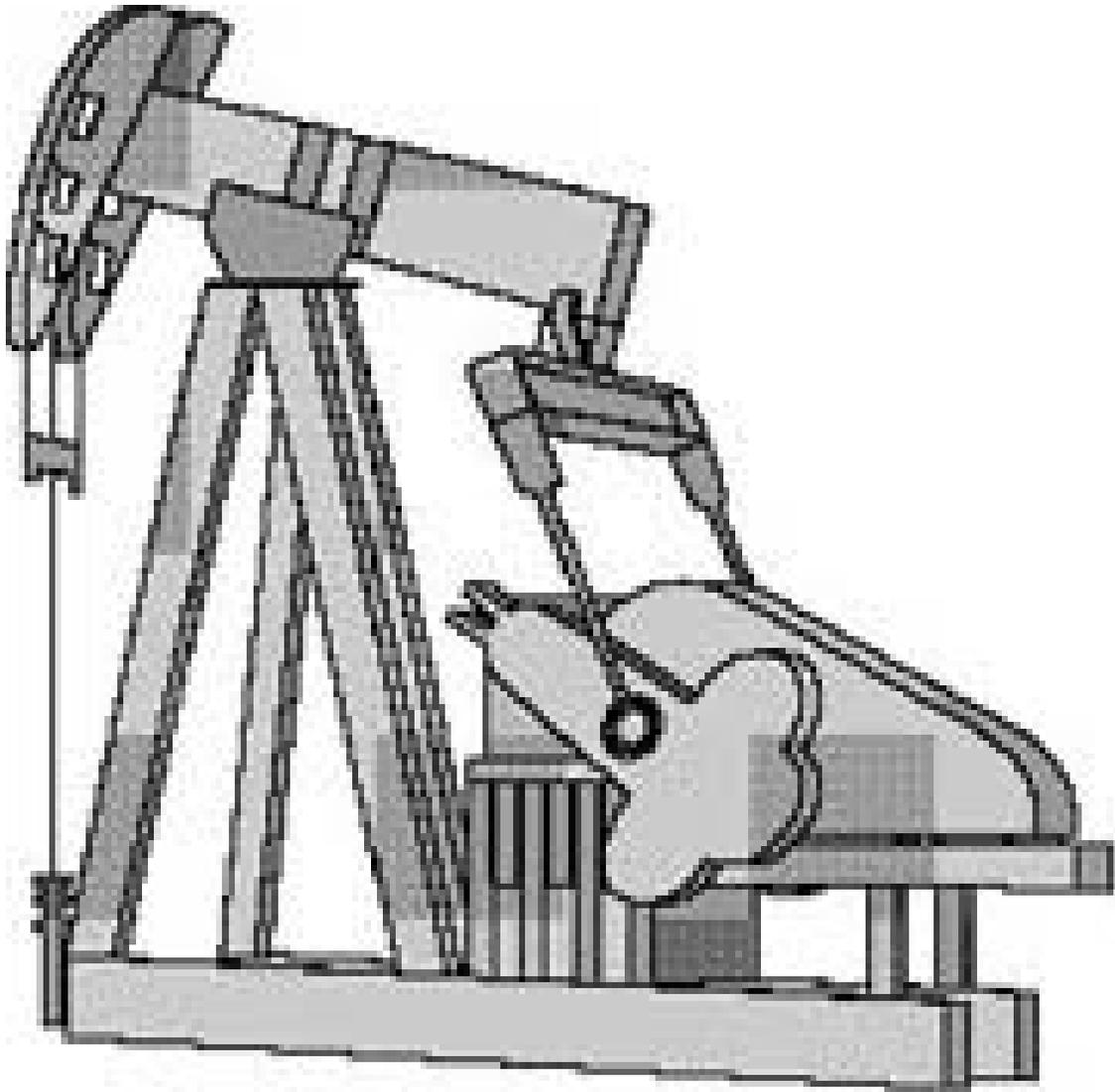














Photograph List

- Plow (wedge, lever)
- Arrowheads (wedges)
- Flag (pulley)
- Eggbeater (wheel and axle, lever)
- Bicycle (pulley, wheel and axle, lever)
- Screw driver (lever, wedge)
- Screws (inclined planes, wedges)
- Slide (inclined plane)
- Pump (compound machine)
- Scissors (lever)