Forces at Work

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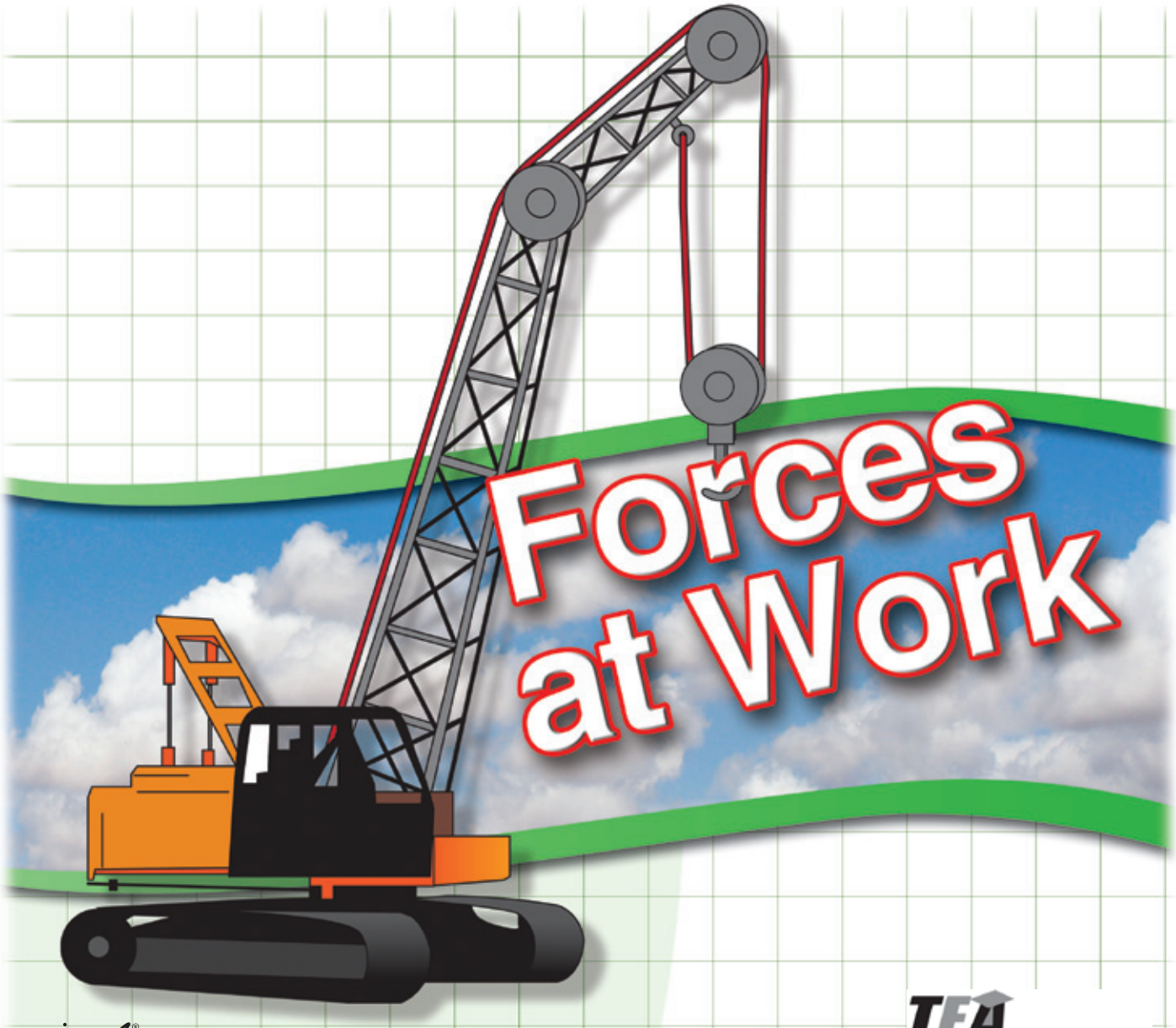

region 4
Educated Solutions

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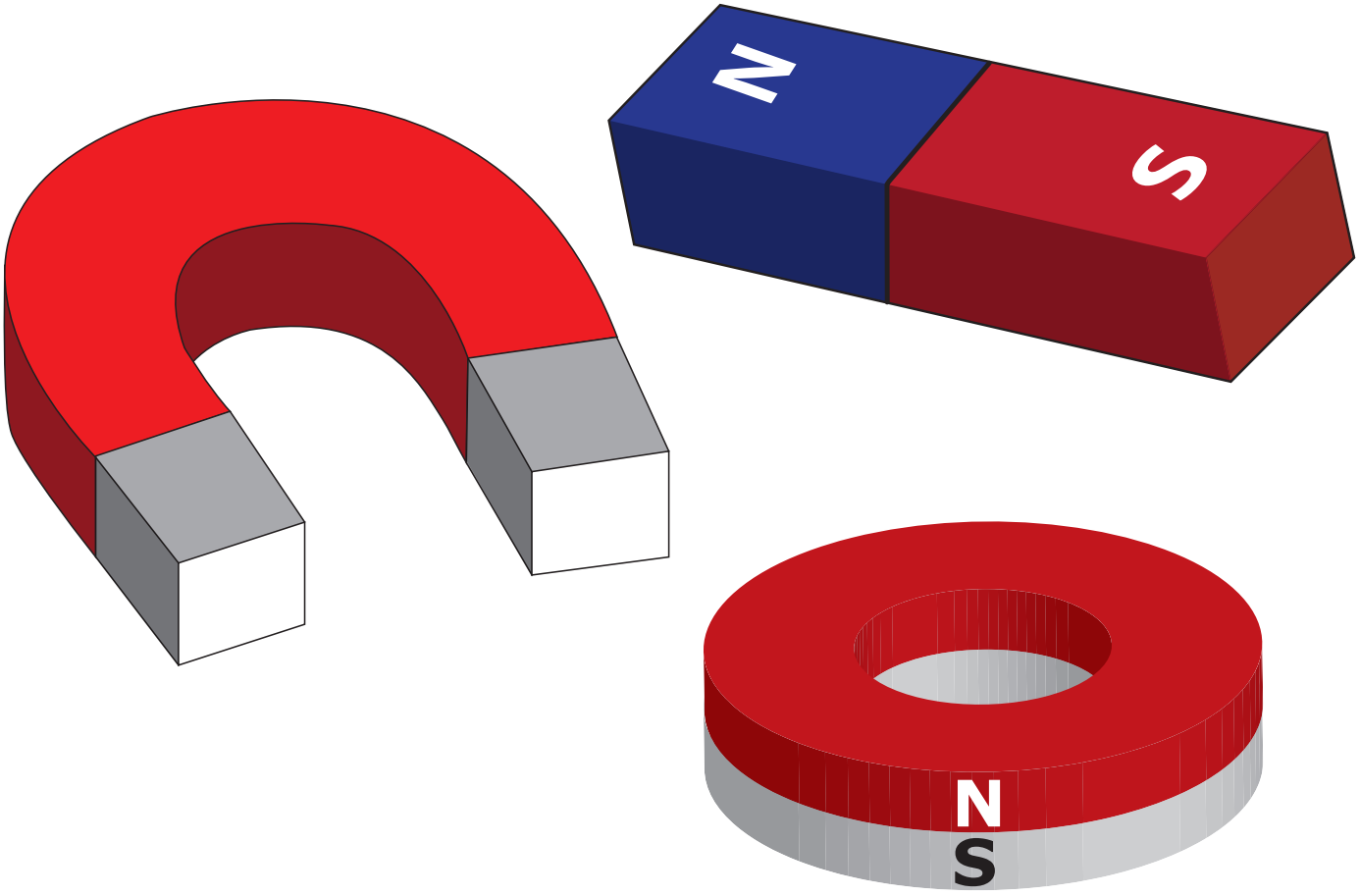
This book was developed in collaboration with Region 4 Education Service Center, Houston, Texas.

Force

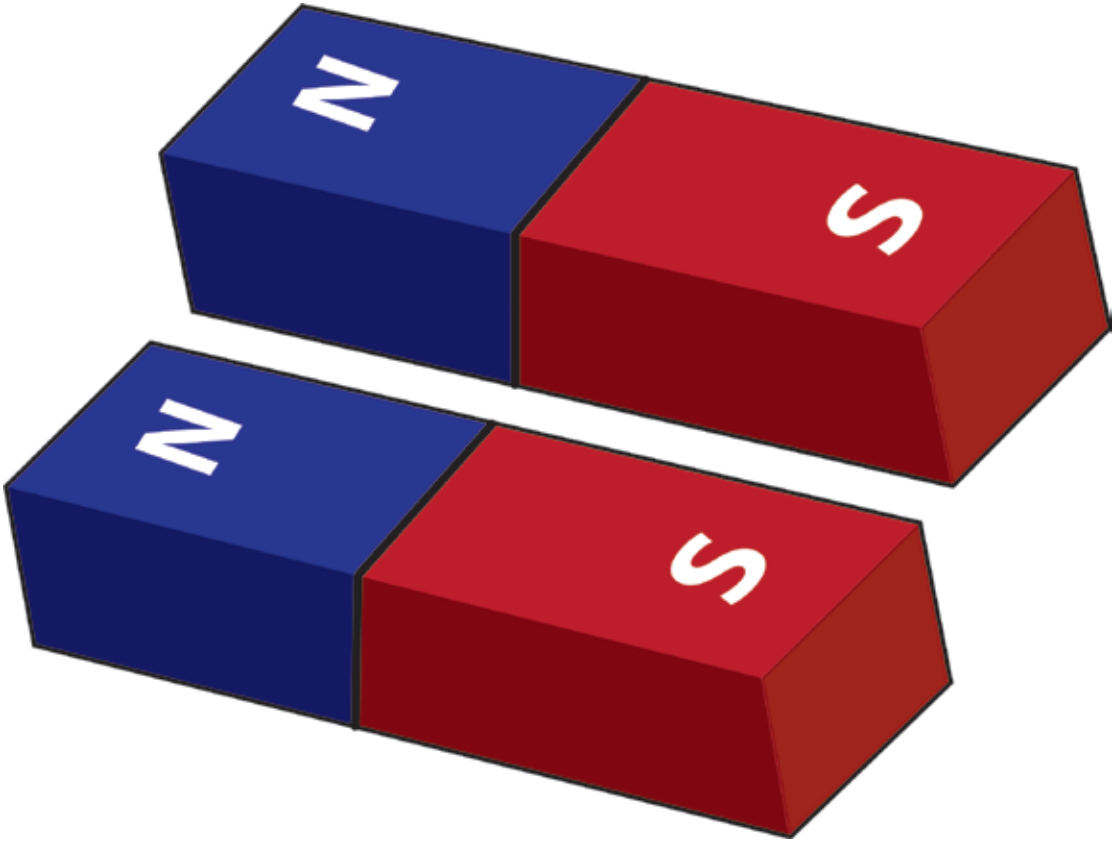
A force is a push or a pull. If you push a shopping cart, you are using force. If you pull a suitcase or a backpack on wheels, you are using force. Magnetism and gravity are forces, too.

Magnetism

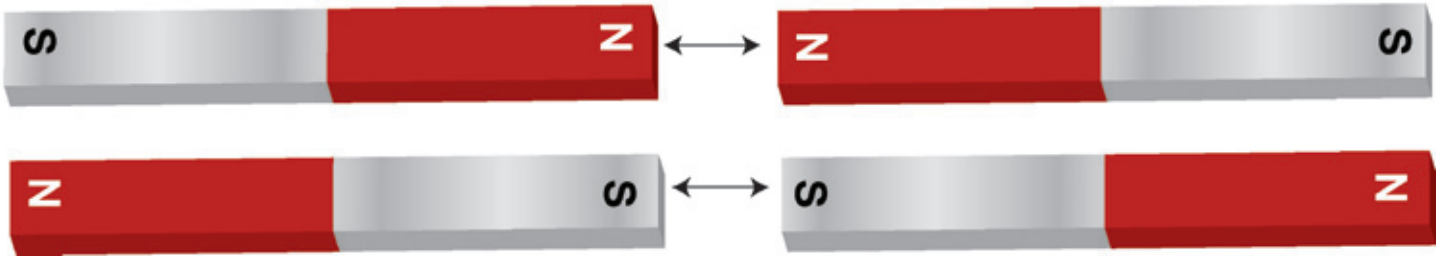
You may have used different kinds of magnets such as horseshoe, bar, and ring magnets.



Magnets can have pushing and pulling forces. They have south poles and north poles.

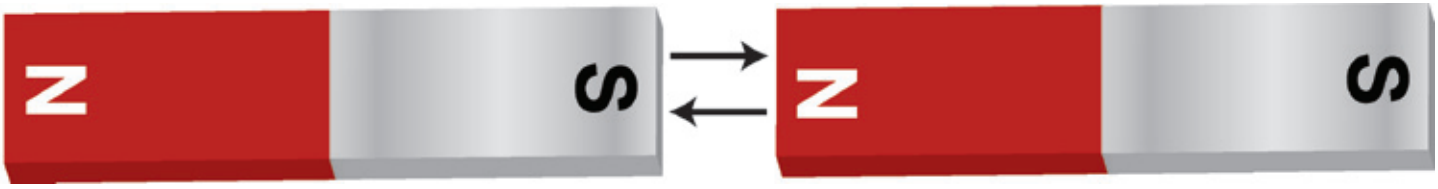


What happens if you put two bar magnets together with both north or south ends facing each other?



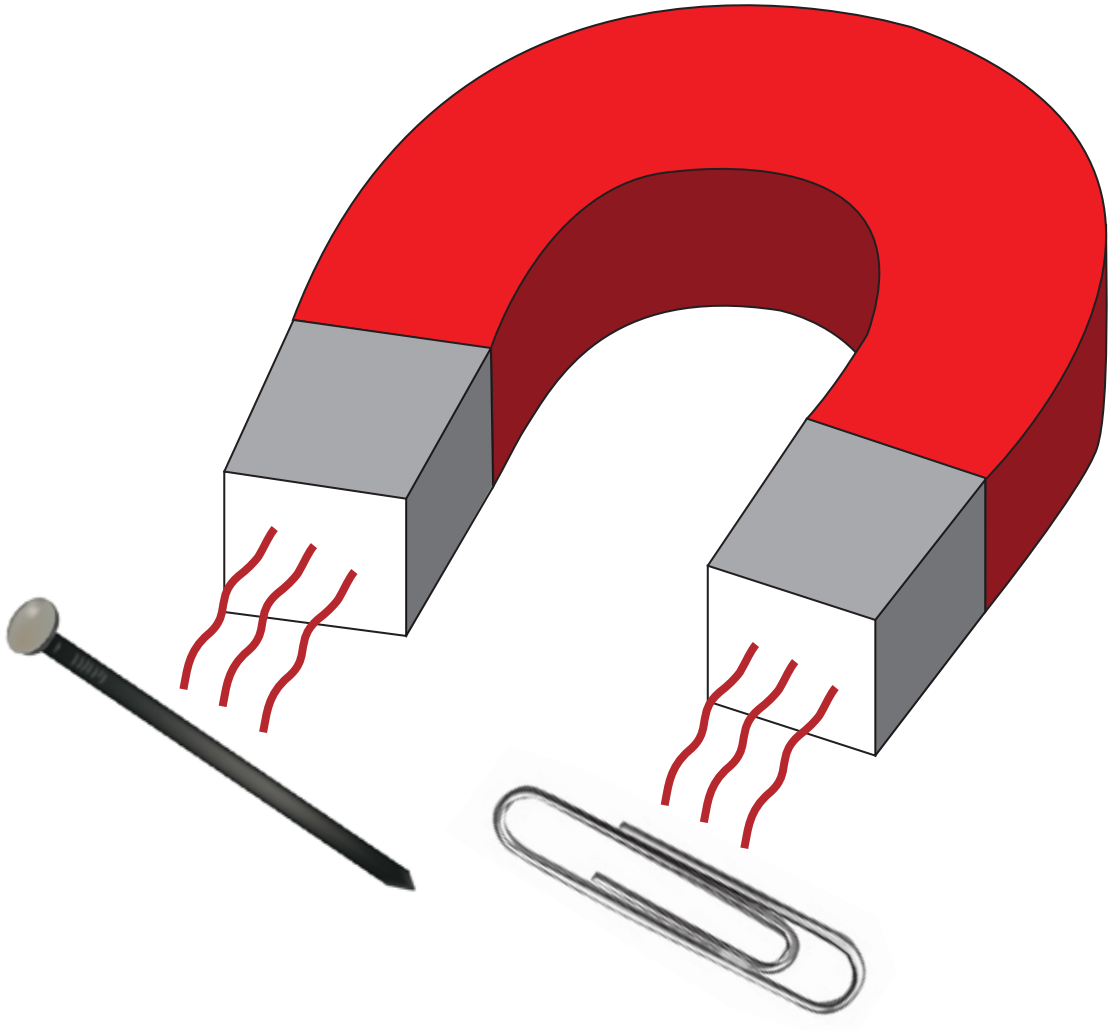
Like poles repel, or push away, from each other!

What happens if you put a south pole and a north pole facing each other?

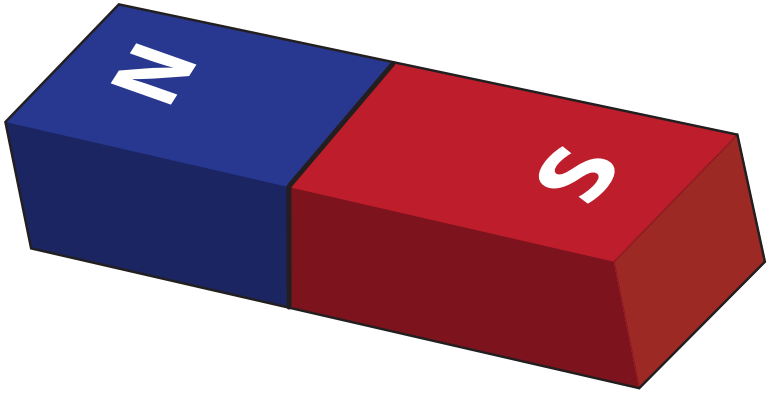


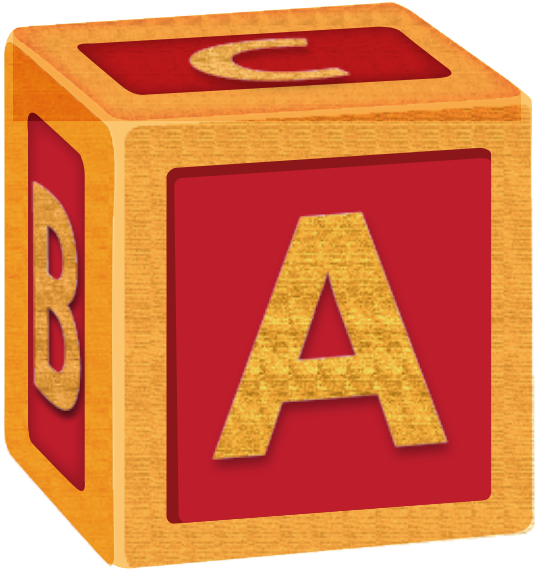
Opposite poles attract, or pull toward, each other!

Some objects are magnetic, and some are not. For example, an iron nail and a paper clip are attracted to magnets. They are magnetic.



Glass, plastic, and wood are not attracted to magnets. They are nonmagnetic.





Gravity

Gravity is a pulling force. Everything that has mass has gravitational pull. The greater an object's mass, the stronger its gravitational pull. Using that knowledge, list the following objects in order from least to most gravitational pull.

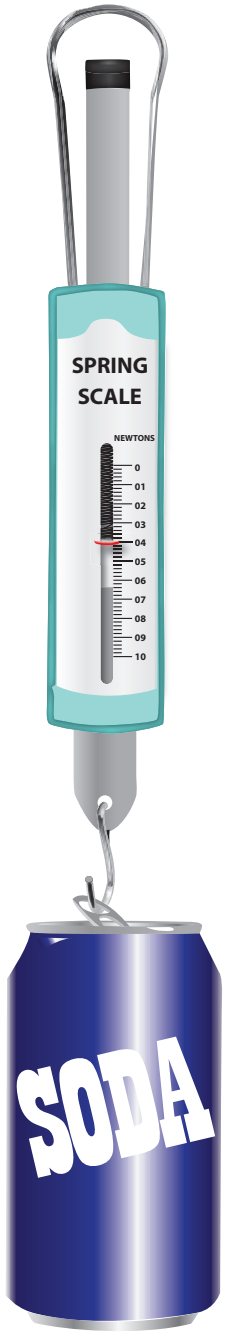
Did you say orange, truck, building, Moon, and then Earth? If so, you are right!

So, why does everything stick to Earth? Earth has a huge mass and therefore has a very strong gravitational pull. We do not feel the pull of gravity between ourselves and other objects with smaller masses because the gravitational pull is very weak.

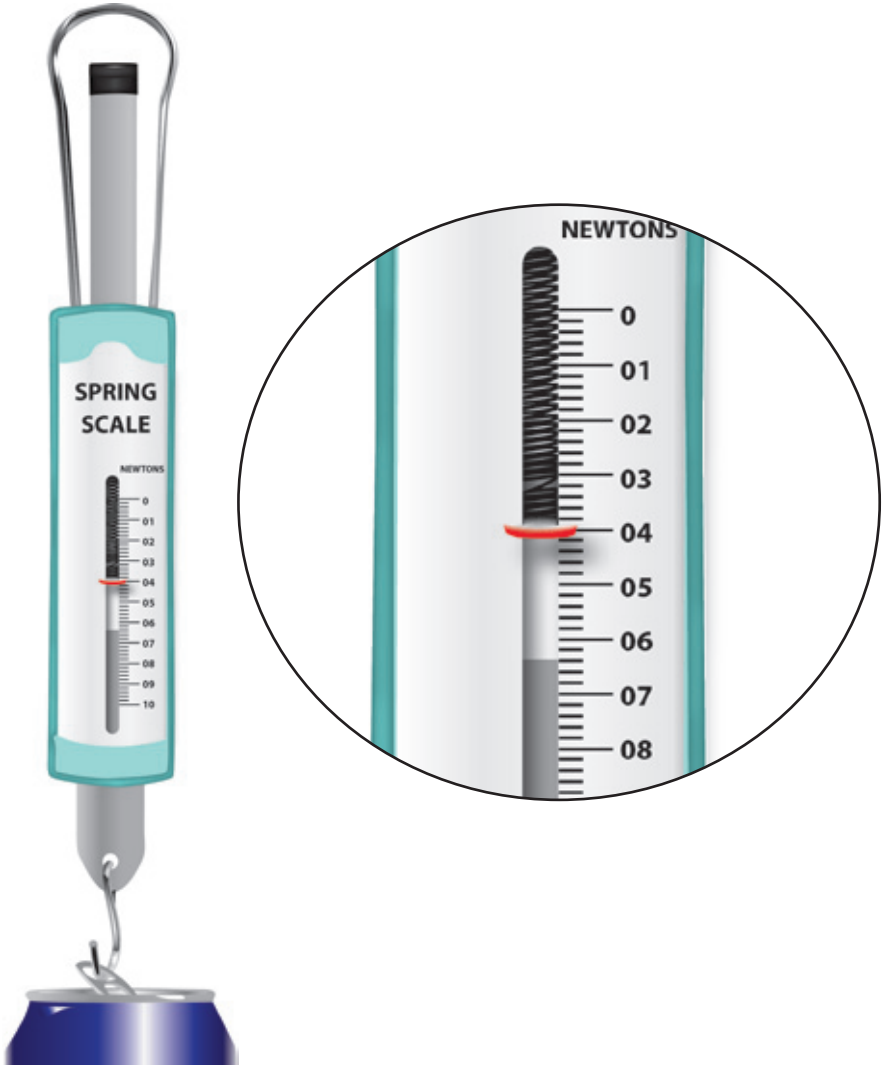
Spring Scales

How do scientists measure the amount of force used on objects? Scientists use tools called spring scales. Spring scales show us how much force is pushing or pulling on an object. We measure force in metric units called newtons (N).

To measure a pulling force using a spring scale, hold the scale by the ring. Next, gently place an object on the hook and observe how far the spring stretches. For example, observe the spring scale here. How much force is pulling on the object?



Did you say 4 newtons? Good job! Reading a spring scale is like reading a number line.

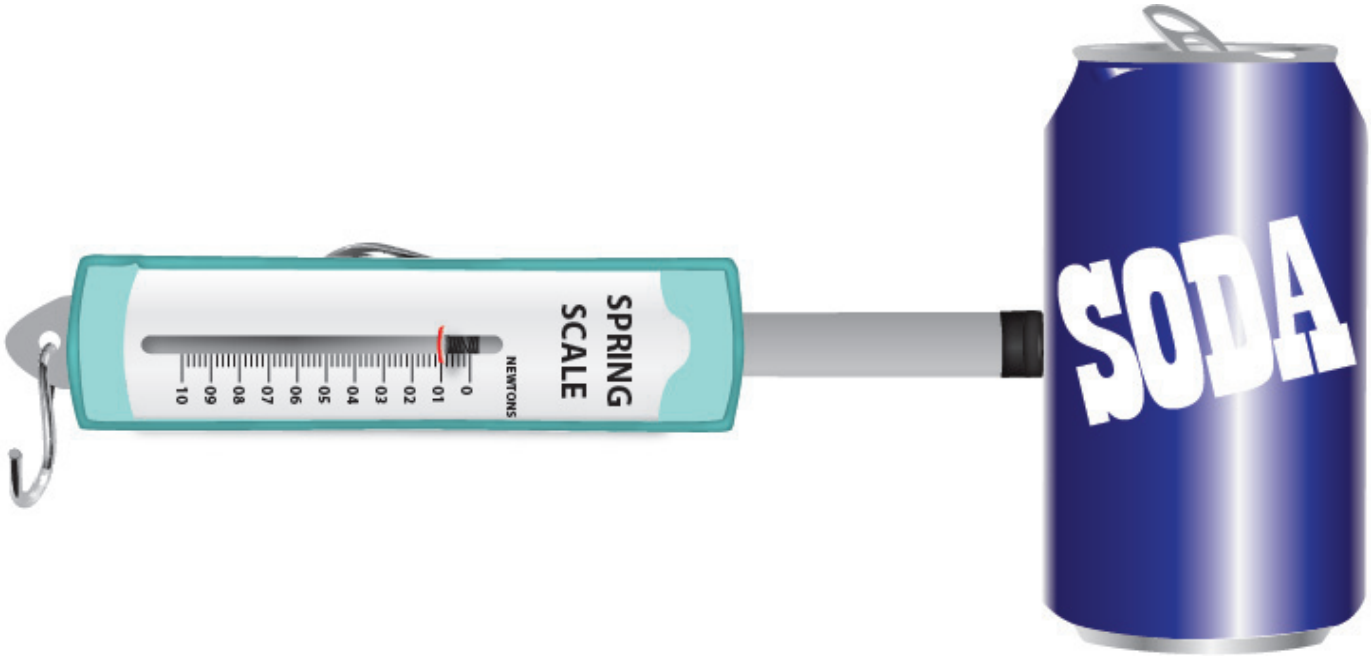


Let’s try another one.

Hold the cylinder of the spring scale parallel to the floor.

Place the push lever on the object you are going to move.

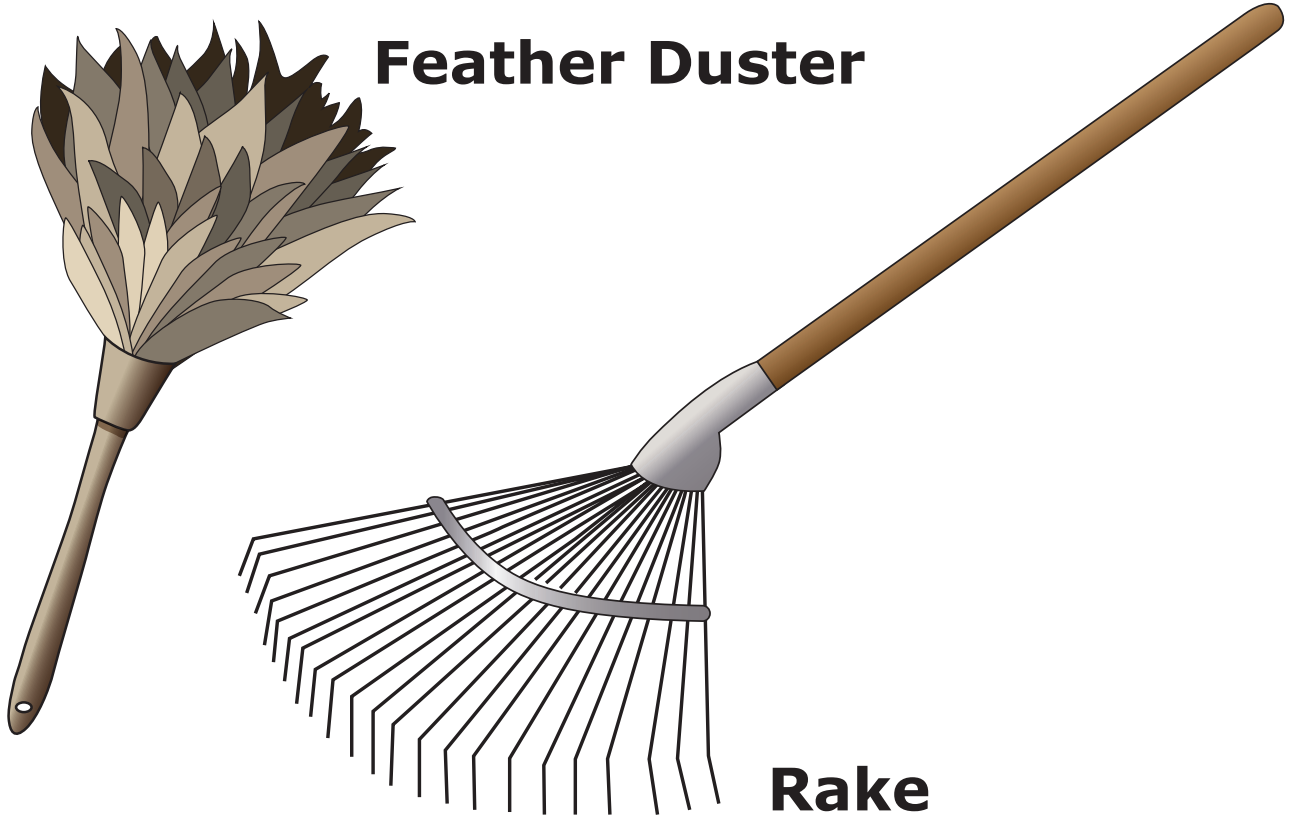
Observe the spring scale after you start pushing the object. How much force is pushing on the object?



Did you say 1 N? Correct again!

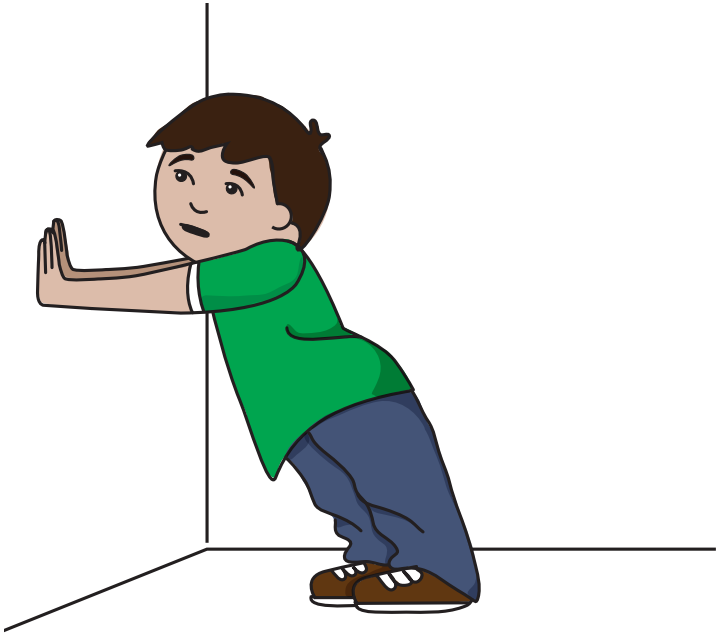
Work

What does work mean to you? Work might make you think about having to clean your room or rake leaves.



In science, you do work whenever you move an object to a new location using a pushing or a pulling force. Look at the following examples. Which one is an example of work?

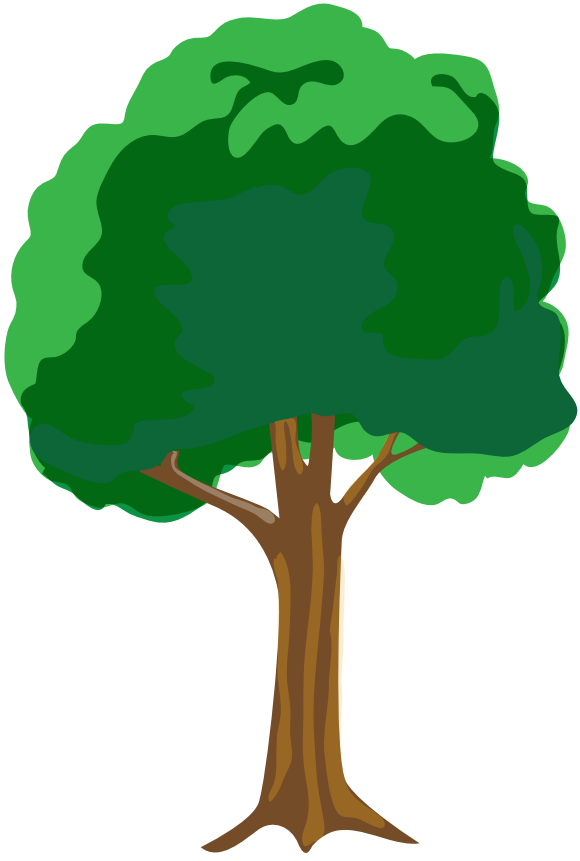
1. Pushing a chair across the room
2. Pushing with all your might on a wall that does not move



No matter how much energy you used trying to move that wall, you did not do work because the wall did not move. So, if you chose Example 1 as showing work, you were correct because a pushing force was used to move the chair from one location to another.

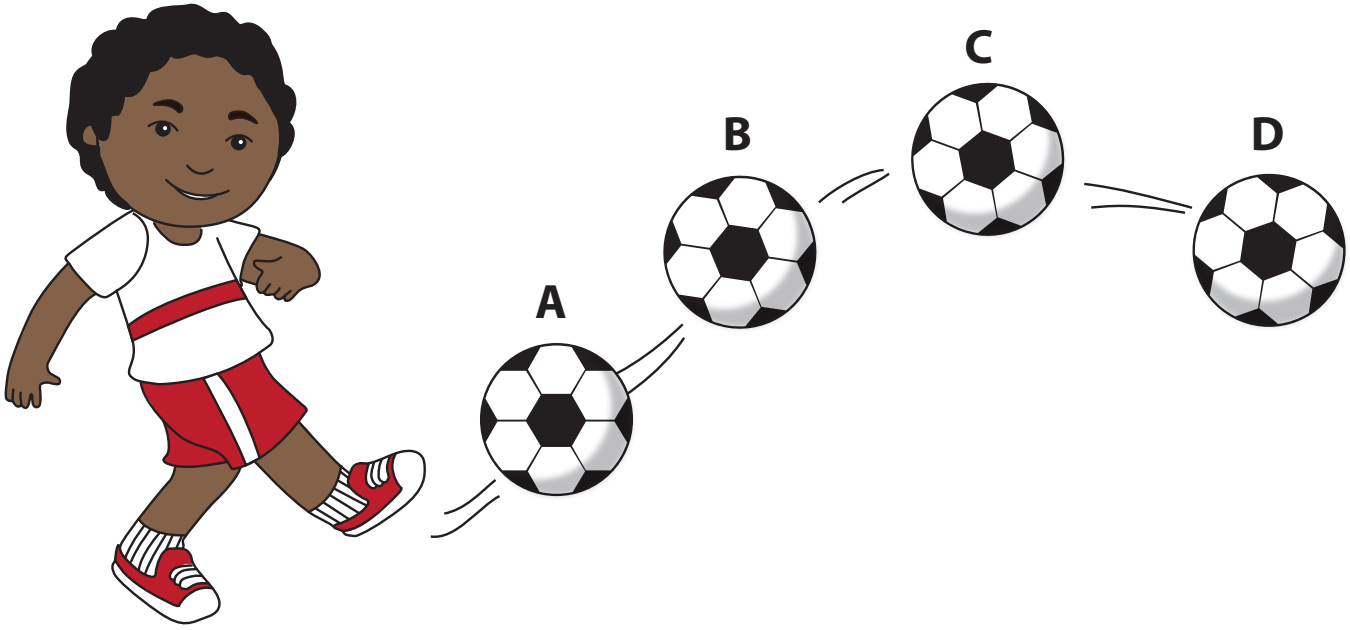
Let’s look at some tougher examples. Which one shows work?

1. Trying to pull a tree from the ground
2. Kicking a soccer ball in a game



Most likely, a person would not be able to pull a large tree from the ground. That would result in no movement and therefore no work in Example 1.

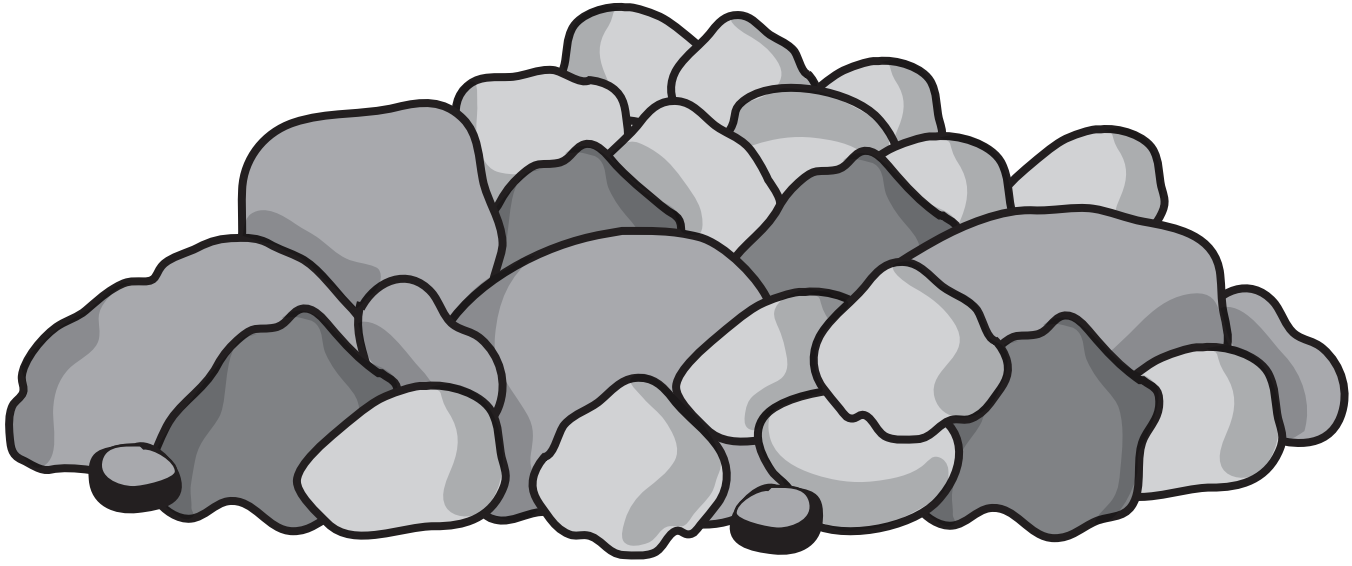
Did you choose Example 2? If so, you are correct! Kicking a soccer ball involves a pushing force that moves the ball from one location to another.



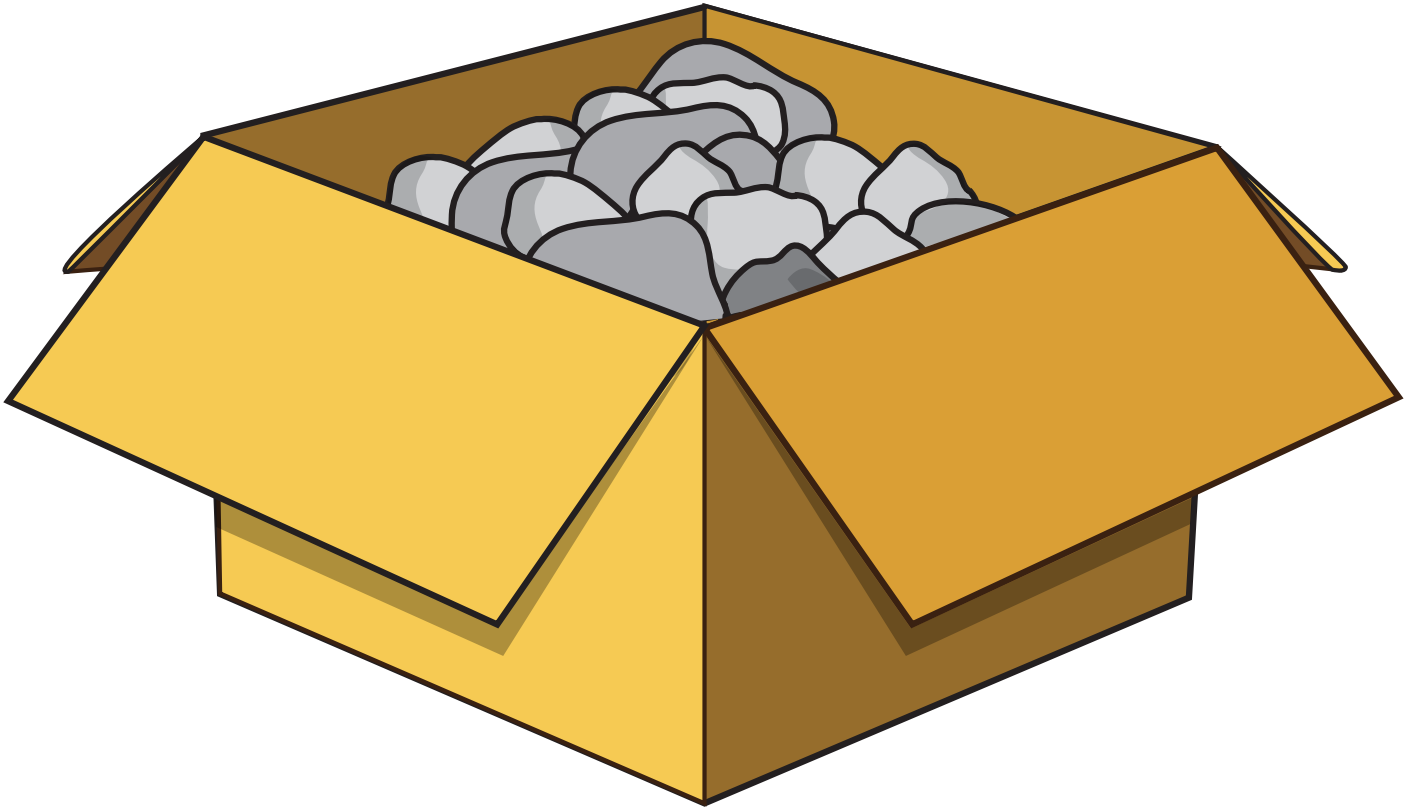
So how can we make work easier?

Simple Machines

Do you use tools that make work easier? For example, if you were helping your grandmother work in her garden and she needed you to move some rocks, how would you move them?

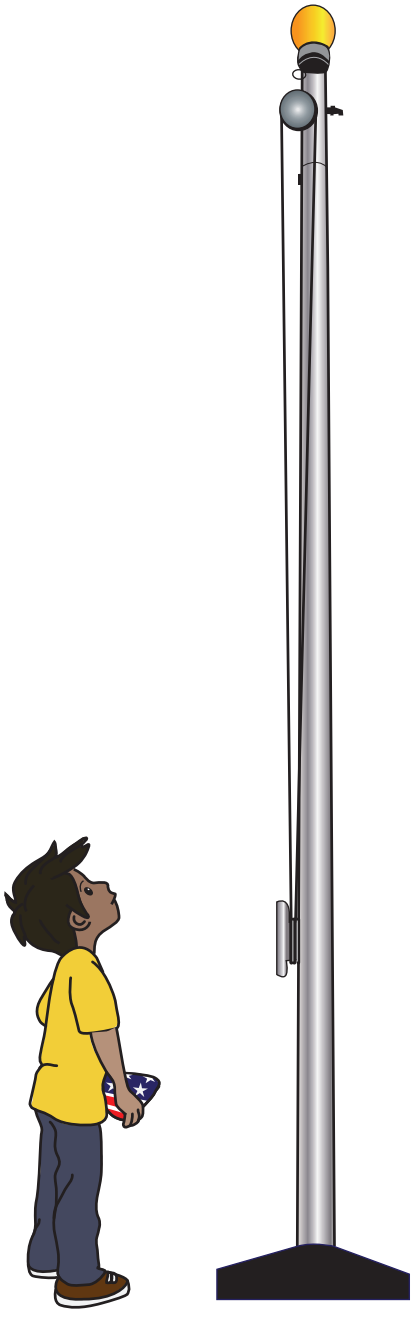


Would you carry them one at a time? Maybe two or three at a time? Would you put them in a box and pull it across the yard?

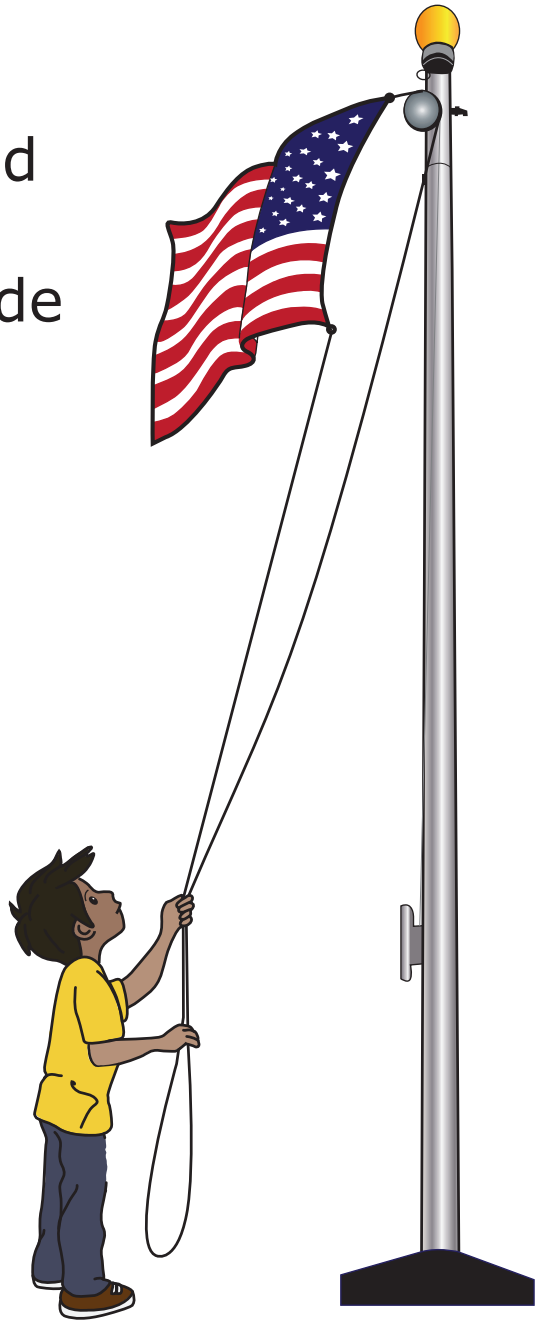


What if your box had wheels? Yes! A wagon or a wheelbarrow would be very helpful. Each of these tools has at least one wheel and axle. The axle is a straight rod that attaches to one or two wheels. A wheel and axle is called a simple machine. You can also find wheels and axles on buses, cars, and bicycles.

Let’s say you are in charge of making sure the flag is hung on the flagpole at school. What if you cannot reach the top of the pole? Would you climb to the top of the pole to hang the flag? If so, I hope you are not afraid of heights!



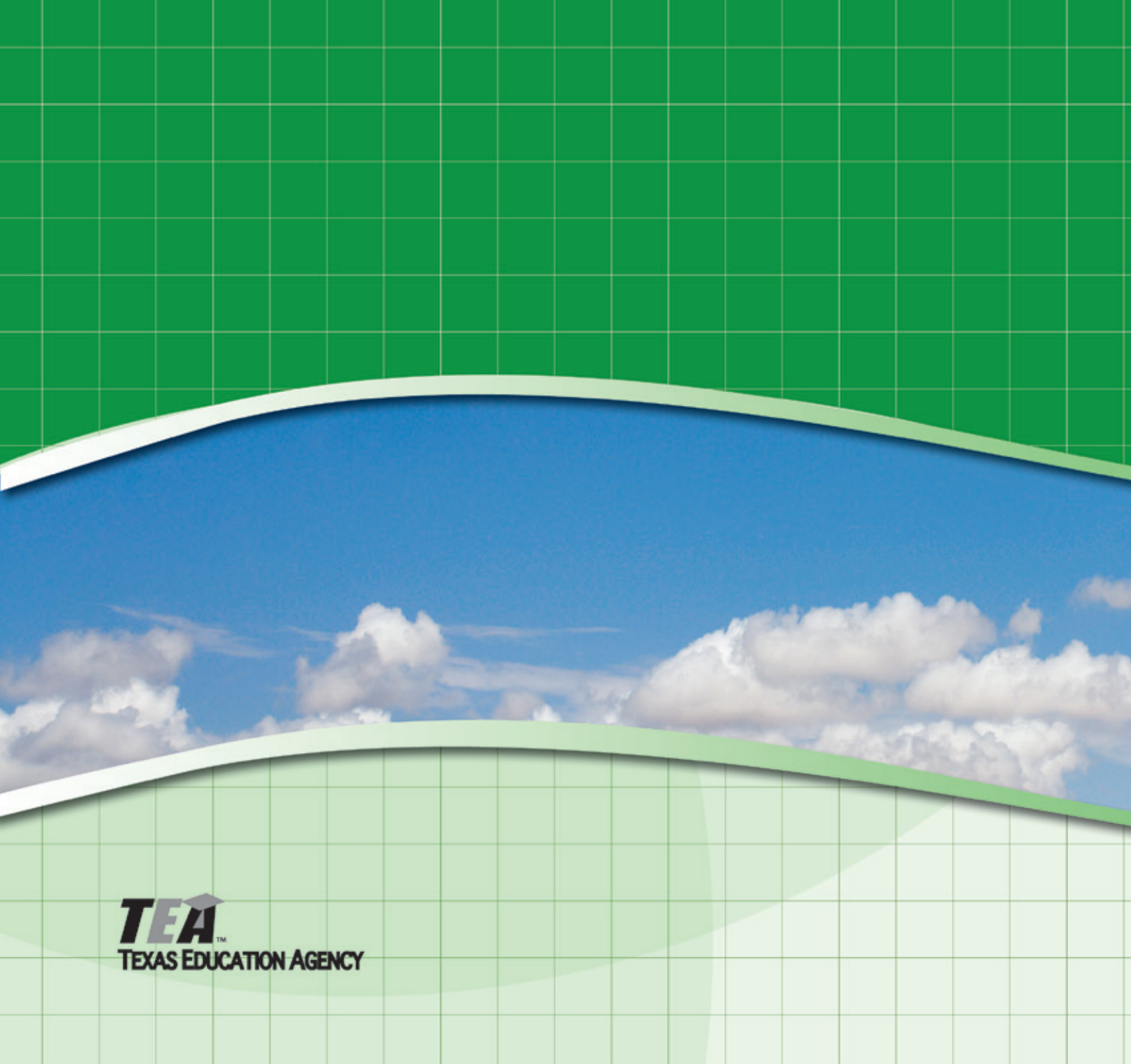
What if you could clip the flag to hooks on a rope and fit the rope into wheels at the top and bottom of the pole? Then you could just pull down on one side of the rope, causing the other side of the rope to raise the flag. Problem solved!



The wheels are actually called pulleys. Pulleys are simple machines! Pulleys can be found on cranes.

Both wheels and axles and pulleys make jobs easier.

Now you can use your knowledge of forces, work, and simple machines to your advantage!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