Force and Motion Shared Reading

Science Benchmark: 03:03

Forces cause changes in the speed or direction of the motion of an object. The greater the force placed on an object, the greater the change in motion. The more massive an object is, the less effect a given force will have upon the motion of the object. Earth's gravity pulls objects toward it without touching them.

Standard III:

Students will understand the relationship between the force applied to an object and resulting motion of the object.

STUDENT BACKGROUND INFORMATION

May the Force Be With You!

Here is a riddle for you to solve. Two four-letter words describe how things move. The first two letters of both worlds spell "up" backwards. Of the four letters that are left, two letters tell you to be quiet and the other two letters are twins. What are the two words? (Hint: You will find the words as you read on.)

A *force* is a push or pull. Forces cause objects to change their *motion*. The only way a ball can get from one place to another is to be moved by a force. Objects are lazy. They will not change what they are doing unless they are "bothered" by a force. A basketball sitting on the floor will stay there forever unless a force acts on it. If you roll it across the floor, it will roll until another force acts on it. Think of another force that could stop it. Air can stop it and so can a wall.

The force of push and pull also affects the direction an object goes. The direction it goes depends on the angle the force comes from. If you kicked a soccer ball with the side of your right foot, it would go to the left. If you kicked it with the side of your left foot, it would go to the right. Can you think of other activities you do where you control the angle of the force of push and pull?

Have you figured out the answer to the riddle yet? The answer is "push" and "pull". Things change what they are doing when they are pushed or pulled. The larger the push or pull, the bigger the change. What is the difference between push and pull?

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direction – *a path that something travels*
force - *a push or pull*
motion – *a change of position*

Grade	Benchmark	Standard	Page
03	03 : 03	03	10.1.1

Use these pictures to help you decide:

A

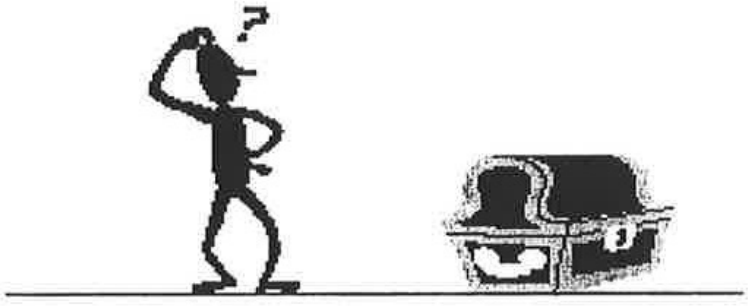
B

Which person is pulling? Pushing? A push is force that moves away from you. A pull is a force that comes towards you. "A" is pushing, "B" is pulling.

Sometimes people use *simple machines* to change the forces of push or pull. Have you ever used a simple machine to do work for you? Can you name a few examples of levers? Inclined planes? The amount of force is less, making work easier for us. They help us do the same amount of work with less effort. That is why we use them.

Is less work being done when using simple machines? No! The work is NOT any less. It just seems that way. Pushing or pulling objects with a simple machine is equal to the same amount of work a person does without the help of a simple machine.

Look at the picture below. The man wonders how to lift the treasure chest. It is much too heavy to push or pull without any help. What would you do? If you thought of using a simple machine, that would be the best way. Which simple machine would you use? Would you push or pull with the simple machine you chose?



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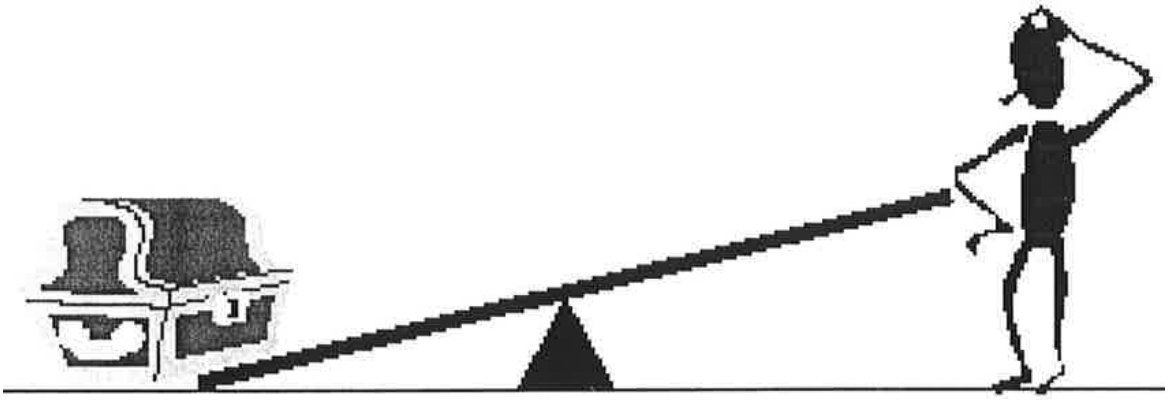
simple machines - *a lever, inclined plane or pulley*

Let's look at the lever. How would your force change?



With the lever, you can push instead of pull. The lever will make the chest feel like it has less *weight*. The weight of the chest isn't really less. The simple machine lets you use a smaller force over a greater *distance* to lift the chest.

The more force applied to an object, the greater the change in the object's *speed*. If you want to throw a fast ball, you must throw as hard as you can. If you want to swim fast, you apply as much force as you can against the water.

An object that has more weight will need more force to move it than a lighter weight object will. If you push an empty box it will seem easy. You will not have to push hard. If you push a box full of books, you will need much more force. If wind is blowing gently, a flag will flutter in the breeze. If the wind has more force and is blowing harder, the flag may stand straight out. Water running down a hill causes a force too. If the water is a small trickle, the push is very small and can only move sand and very small rocks. When more water is flowing in a stream, the push can be very forceful. This force can move rocks that weigh as much as you do.

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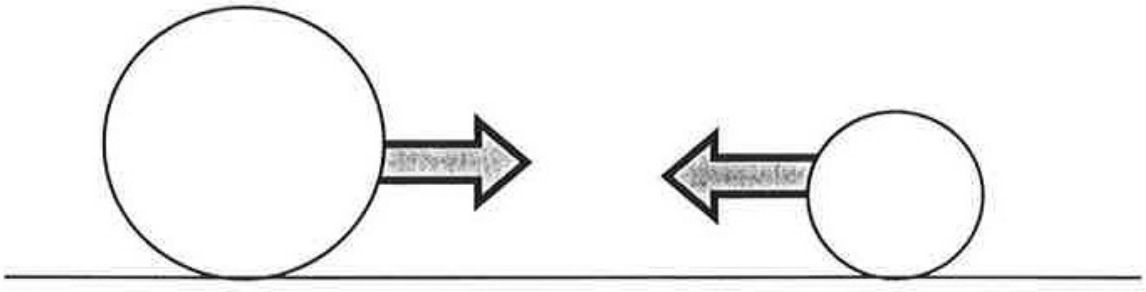
distance – *the space between two places*
speed – *how fast or slow something is moving*
weight – *a measure of the force of gravity on an object*

What happens when two objects with weight and speed run into each other? You may have seen this happen in a football game. Which player is most likely to move the other player, a large player or a small one? Let's look at two balls rolling toward each other. One is a big, heavy ball. The other is a small, lighter ball. They are moving at the same speed.



Which ball has the most force? Which ball will bounce backward? If you think the heavy ball has the most force and the light ball will bounce backward, you are right? Football players do the same thing. A large football player can move a smaller one out of the way.

Many times during the day you use the forces of push and pull. At recess, watch closely as your classmates play. What are they doing when they push or pull? How many times do they push and pull? They may be batting, kicking, or throwing a ball. The amount of applied force and the angle the force comes from affects the speed, direction, and the distance of the ball. You will be surprised how often you and your friends use these forces.

As you are playing, working, or just sitting around, "May the force be with you."

Science Language that Students Should Know and Use

1. **direction:** a path that something travels

2. **distance**: the space between two places

3. **force:** a push or pull

4. **motion**: a change of position

5. **simple machine:** a lever, inclined plane, or pulley

6. **speed:** how fast or slow something is moving

7. **weight:** a measure of the force of gravity on an object