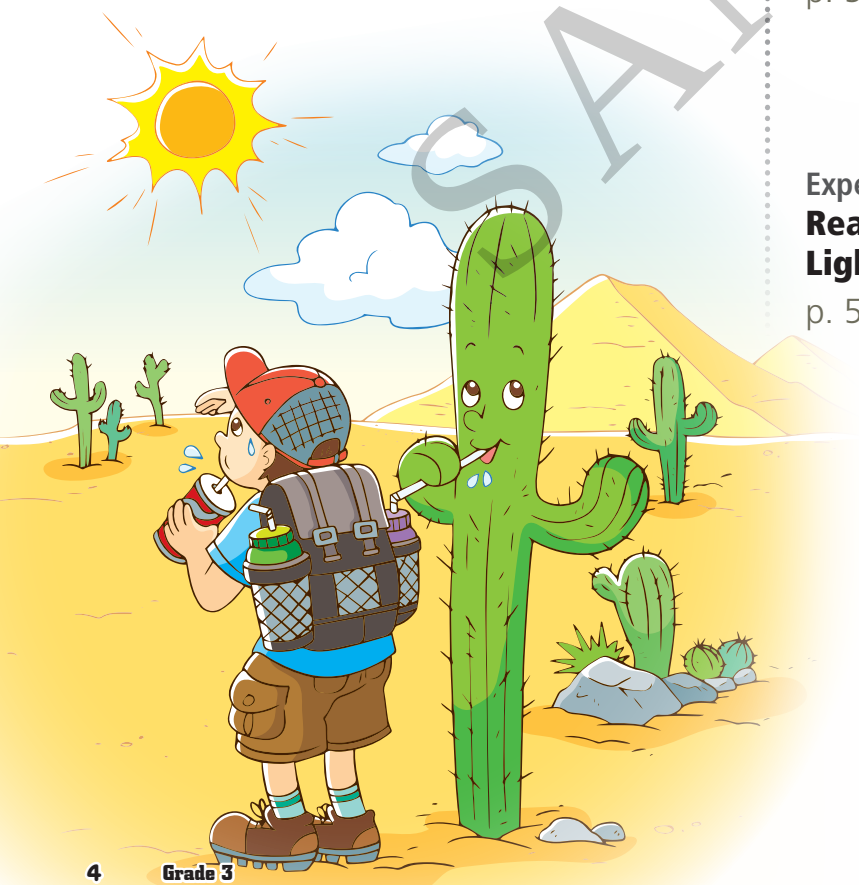
Table of Contents

Section 1: Life Systems

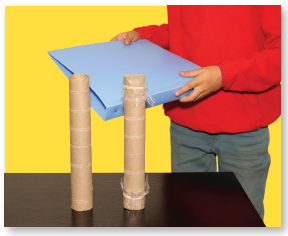
Basic Science Concepts

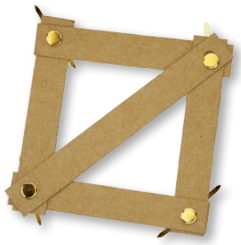


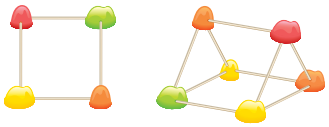
STEM Experiments

Basic Science Concepts

STEM Experiments



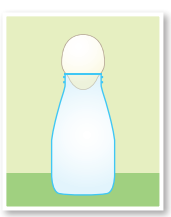




Section 3: Matter and Energy

Basic Science Concepts

STEM Experiments



Basic Science Concepts

STEM Experiments

UNCRUSHABLE EGGS

understanding what makes a structure strong

The strength of a structure is its ability to support an object's weight and the compression forces the object creates. Believe it or not, an egg is actually an example of a strong structure. If you ever try squishing an egg from its top and bottom, you will find it surprisingly strong. In fact, you can stand on eggs in a carton without breaking them. But what makes an egg so strong?

What you need:


a raw egg


a jar


cooking vinegar

Difficulty: ●○○○○

Time needed: 1 day

In this experiment, you will learn what makes a structure strong.

What to do:

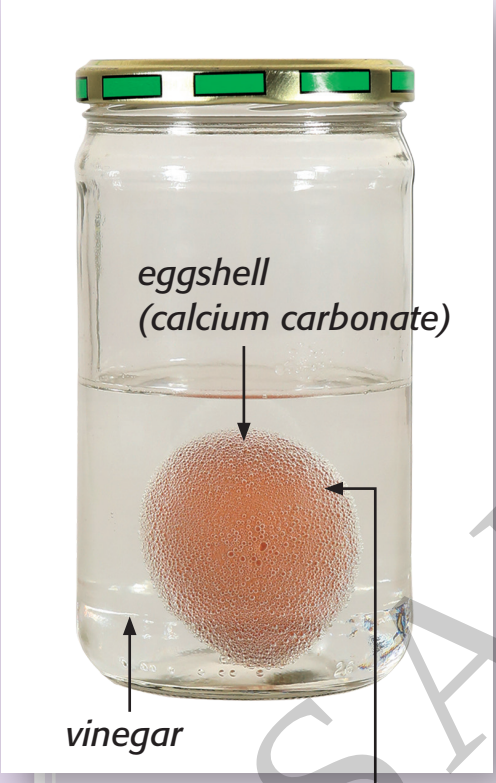
1. Put the egg in the jar.
2. Add enough vinegar to cover the egg.
3. Wait for a few minutes and watch what happens to the egg.
4. Leave the egg in the vinegar for one day.
5. Remove the egg from the jar.
6. Touch the egg. How did it feel?

STEM Note

Vinegar is made through a process called fermentation. It can be made from apples, grapes, or grains. Vinegar has antibacterial properties, which make it a natural disinfectant and useful for cleaning surfaces.

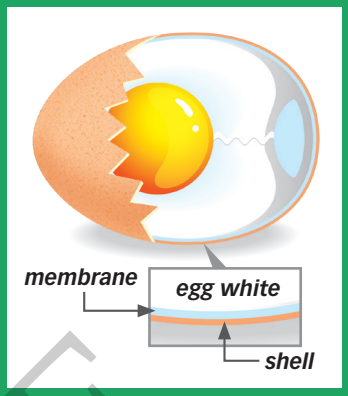
WHAT *just* happened?

Though an eggshell is fragile, the calcium carbonate, which is the substance in the eggshell that makes it hard, in combination with its dome shape, makes an egg strong and able to support a lot of weight.



In Step 3 of the experiment, did you notice some bubbles forming on the eggshell and rising to the surface of the vinegar? The bubbles were carbon dioxide, which was the result of the chemical reaction between the calcium carbonate in the eggshell and the acetic acid in the vinegar. Acetic acid can dissolve calcium carbonate. When the egg lost its solid structure, the egg inside remained intact and was held together by the egg's membrane. The membrane helped keep the dome shape of the egg, but the egg itself became flimsy and rubbery to touch.

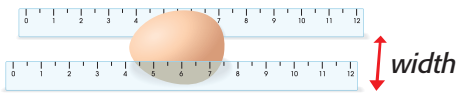
- Did the vinegar affect only the eggshell? How about the membrane (the lining between the shell and egg white) and egg white?
- Why do eggs need to be strong?
- How does the egg's dome shape contribute to its strength?
- Name some animals that lay eggs.
- What are some different shapes and sizes of eggs?



- Calcium carbonate is an essential substance for many animals. Do some research online and find out in what animals we can find calcium carbonate.

- What are some other examples of dome-shaped structures in nature?
- Use pipe cleaners or drinking straws to build a dome-shaped structure.

- Weigh the egg before you put it in the vinegar and after you take it out. Was there any difference in the weight?
- Measure the height and the width of an egg before you put it into the vinegar and after you take out. Were there any differences in the height and width?



The two rulers help keep the egg in place and their distance is the width of the egg.

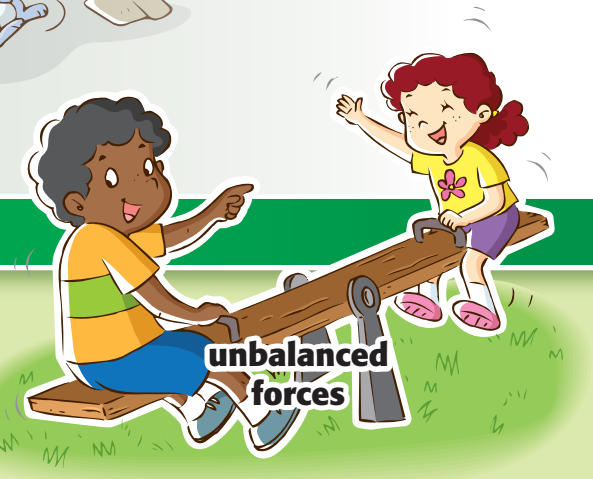
3 Forces and Movement

Forces cause movement. In this unit, you will see how forces cause objects to move in different ways, or not move at all if the two opposing forces are balanced.

After completing this unit, you will

- understand how different forces can cause a moving object to keep the same speed, speed up, slow down, change direction, or stop.
- know that movement is caused by unbalanced forces.

The man and his dog have been here for a while and haven't moved at all. They show balanced forces.



Vocabulary

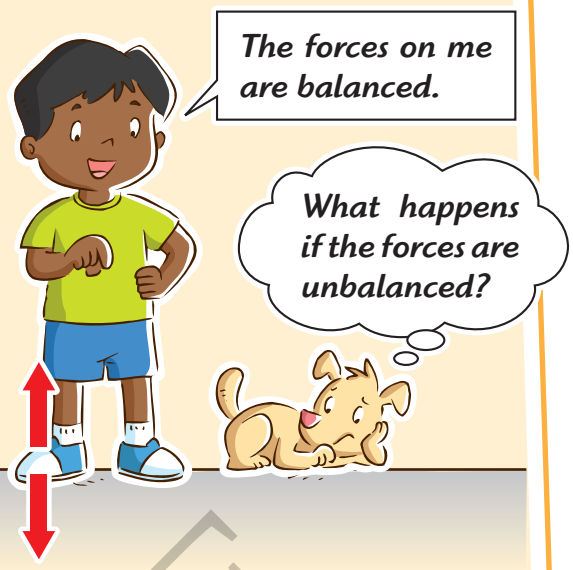
balanced forces: equal amounts of forces on opposite sides

unbalanced forces: unequal amounts of forces on opposite sides

Extension

A force starts, speeds up, slows down, stops, or changes the direction of movement.

Forces happen in pairs. Do you know that there are two forces acting upon a person standing on the floor?

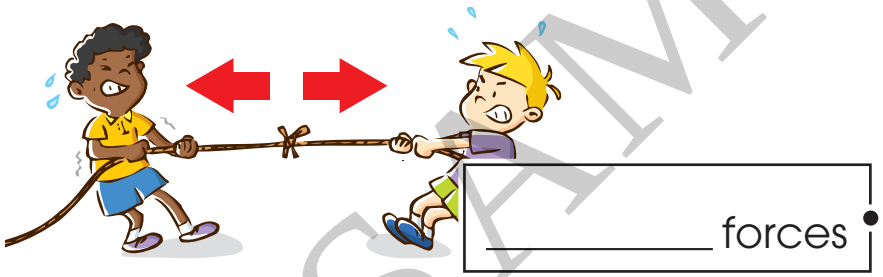


The floor pushes upward on the boy.

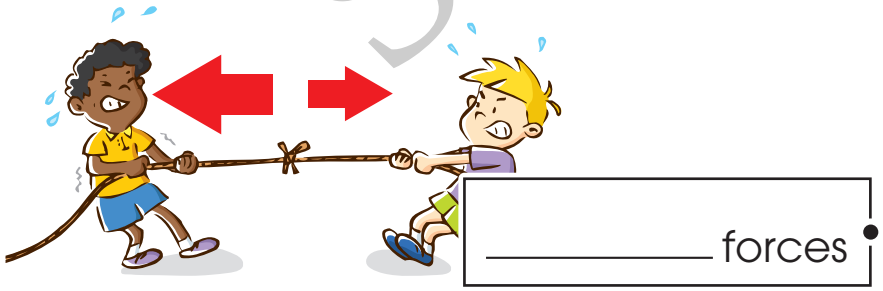
Gravity pulls downward on the boy.

A. Look at each pair of arrows. Decide whether the forces are "balanced" or "unbalanced." Then draw lines to match.

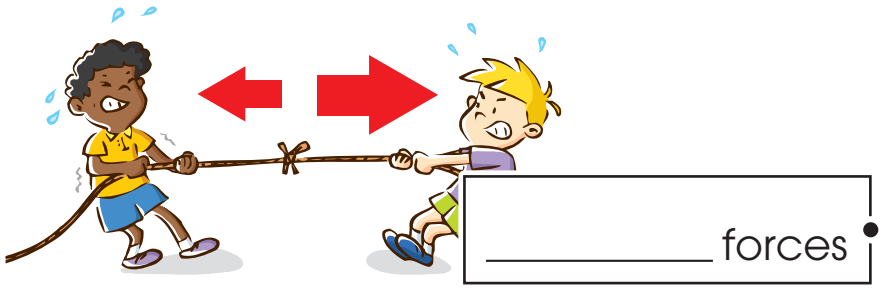
The bigger the arrows are, the greater the forces.



_____ forces



_____ forces

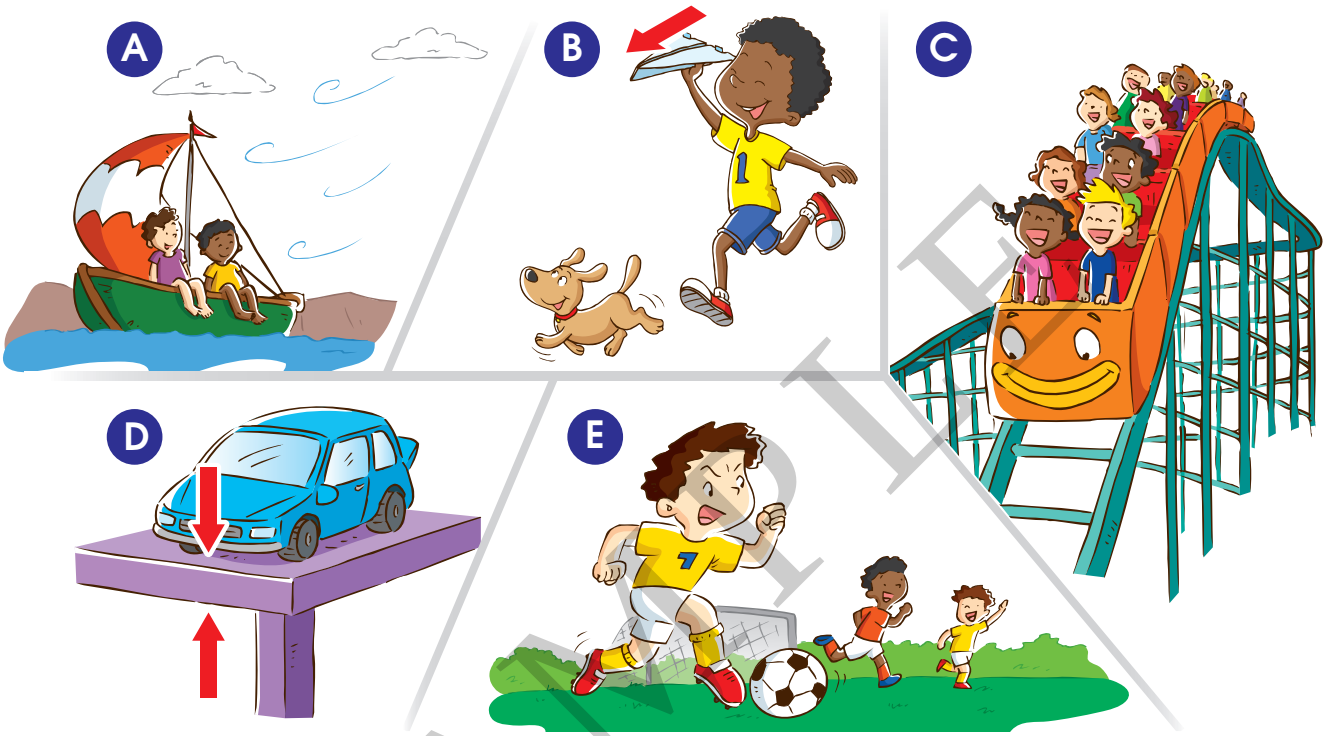


_____ forces

- moves to the left
- moves to the right
- stays at rest

B. Fill in the blanks to complete the sentences about the effects of forces on the objects.

speed up stop start change direction remain at rest



A The sailing yacht will _____ due to the force of wind if wind blows from another direction.

B The paper plane will _____ due to muscular force.

C The roller coaster will _____ due to the force of gravity.

D The toy car will _____ due to balanced opposing forces.

E The soccer ball will eventually _____ due to the force of friction.

C. Read the paragraph. Write T for true and F for false. Then draw an arrow to show balanced forces.

Balanced forces are at work on a soccer ball when it is at rest: gravity pulls the ball to the ground and the ground pushes it back. However, when a soccer player kicks the ball, the motion creates unbalanced forces, which cause the ball to move. Other forces, such as gravity and friction, act with these unbalanced forces until the ball comes to a stop, and all the forces acting on it are once again balanced.

1. When a ball is at rest, it has balanced forces.

   _____

2. Unbalanced forces can cause a ball at rest to move.

   _____

3. Unbalanced forces are at work on a ball when it is in the air.

   _____

4. Draw an arrow to show the force from the ground that acts on the ball.