STEM Sims™

Concrete Structures

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Do you need an idea for a scientific study?
Try out one of our ideas or make one of your own.

Start right now learning about concrete basics and how to build safe structures using concrete. Take the following brief quiz to see how much you already know about concrete. See the bottom of page 4 to check your answers.

1. During World War II, the United States government contracted a private business to build a fleet of concrete ships.
   a. true
   b. false

2. All of the following have been adding to concrete mixes to improve quality except:
   a. bubblegum scent to improve aroma.
   b. fiber to improve strength.
   c. plastic wrap to improve curing.
   d. lemon to improve durability.

3. The Space Needle in Seattle, Washington stands 605 feet high. Where is the structure's approximate center of gravity located?
   a. 205 feet below ground level
   b. 5 feet above ground level
   c. 105 feet above ground level
   d. 302.5 feet above ground level

4. Which culture is credited with building the first concrete roadway system?
   a. Egyptian- 3,000 B.C. to 2,000 B.C.
   b. Chinese- 5,000 B.C. to 4,000 B.C.
   c. Roman- 300 B.C. to 500 A.D.
   d. American- 1700 A.D. to 1850 A.D.

5. Cement is to concrete as:
   a. library is to book.
   b. shark is to whale.
   c. distance is to length.
   d. flour is to cake.

So Much Tension!

HERE IS AN EXPERIMENT FOR YOU TO TRY!

Materials Required for Each Group of Students

7- drinking straws
11- paperclips - (When opened up, the paperclips must fit inside the drinking straw. See Figure 1 below.
Small box metal washers
one pair scissors
about 4” masking tape

Procedure

Part 1. Building Your Bridge

1. Cut one drinking straw in half.
2. Bend two paperclips as shown in Figure 1.
3. Use the two half straws, one whole straw and the two bent paperclips to form a “T” structure.
4. Repeat steps 1 - 3 to make an identical “T” structure. These will be the side bridge supports.
5. Bend a new paperclip to form a 90° angle.
6. Repeat step 5.
7. Place one end of the two 90°-bent paperclips in each end of a new whole straw.
8. Place the other end of the 90°-bent paperclip in the long straw on each of the two “T” structures.
9. Stand the structure up as shown in Figure 2. Use masking tape to attach the base of the “T” to a tabletop. You may not use the masking tape for any other purpose, such as reinforcing your bridge.
10. Bend a new paperclip to form a weight hanger.
11. Attach the weight hanger on the middle of your bridge as shown in Figure 2.

Part 2. Testing Your Bridge

1. Place one washer on the weight hanger attached to your bridge.
2. Continue adding washers, one at a time, until your bridge collapses.
3. Note and record the number of washers required to collapse your bridge.

Part 3. Remodeling Your Bridge

1. Replace the long straw bent when you tested your bridge with a new whole straw.
2. Use up to four paperclips and 2 whole straws to modify your bridge to hold more weight before collapsing.
3. Repeat part 2 to retest your new bridge design.

Extension

1. Draw and label the forces acting on your original bridge when you had one washer suspended from the weight hanger.
2. Draw and label the forces acting on your remodeled bridge when you had one washer suspended from the weight hanger.
3. Discuss how and why your modified bridge performed differently than your original bridge.

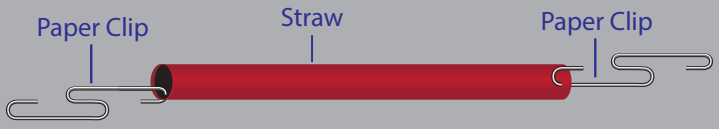


Figure 1

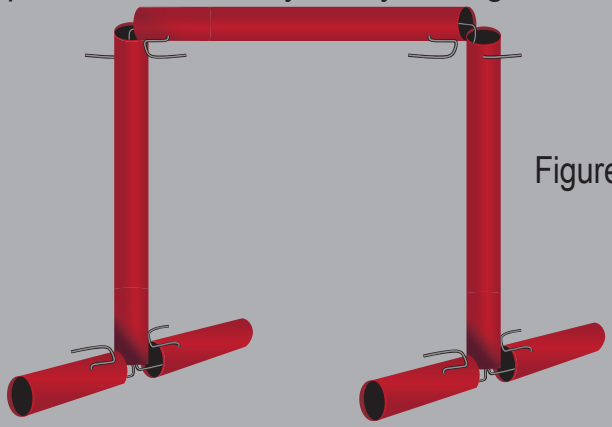


Figure 2

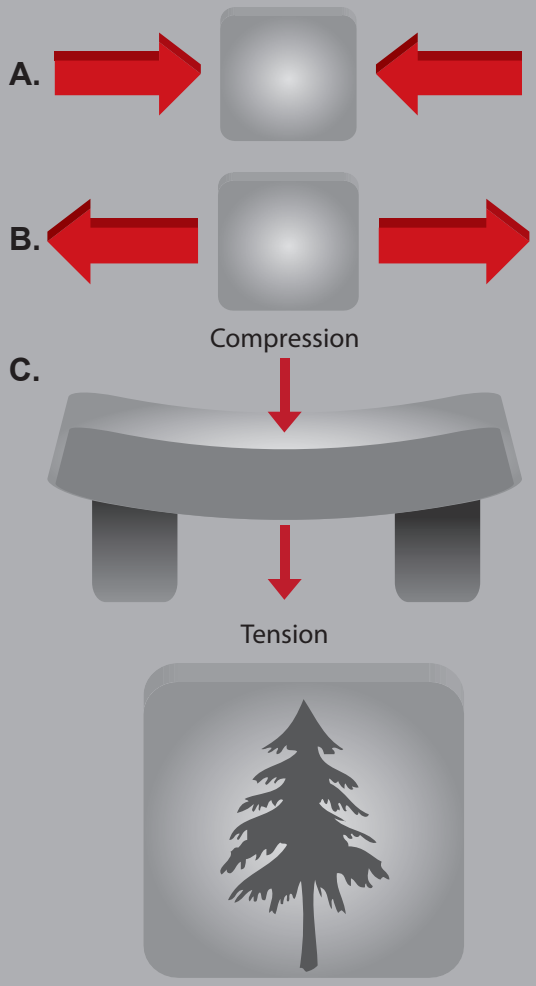
Concrete Structures

Concrete Information

A. Compression forces are two or more forces applied on an object moving towards each other in opposite directions.

B. Tension forces are two or more forces applied on an object moving away from each other in opposite directions.

C. Concrete is a common building material that withstands strong compression forces; however, the material is weak when tension forces are applied.



Do you know a new type of concrete can clear the air by dissolving pollutants? Using light and air, photocatalytic concrete breaks down organic and inorganic substances responsible for air pollution. Cement used to make the concrete is treated with titanium dioxide, which reacts with ultraviolet light to decompose pollutants such as smog-forming nitrogen oxides.

A Hungarian architect combined concrete with optical fiber to create a new type of concrete that transmits light. The material has the strength of traditional concrete and can display a view of the outside world, for example the silhouette of a tree.

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STEMsims.com

Answers: Page 2 Answers: 1) a. The U.S. government had a company build a fleet of 24 concrete ships used to transport materials due to shortages of steel. 2) d. 3) b. The center of gravity is very low due to its massive reinforced concrete foundation that weighs about 6,000 tons, while the above ground structure weighs about 3,500 tons. 4) c. The Romans had over 5,000 miles of concrete roadways during their reign. 5) d. Just as flour is one ingredient used to make a cake, cement is one of many ingredients used to make concrete.

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