

Activity # 2 (Part 1 of 2)

Understanding Forces at Work

Bridges, like all built structures, rely on unseen forces that hold them together and enable them to support additional weight, or loads. It can be difficult to visualize forces acting on an object or structure that appears to be at rest.

Objective:

After completion of this activity, students will be able to imagine the unseen forces acting on it and better understand the mechanics of bridges.

Session Time: 45 minutes total (15 minutes for Part I and 30 minutes for Part II)

Materials:

- A chair
- Two students

Methods: Discussion, demonstration, and cooperative learning

Procedure:

Part I

1. Explain that a **force** is a push or pull on an object. When an object is at rest (not moving), the forces acting on it are balanced.
2. Place a chair in the middle of the floor. Ask students whether there are any forces acting on this chair. (*Instructor's Information: Even without anyone pushing on the chair, there are forces acting on it. The force of gravity is pulling down on the chair, but it does not collapse because it supports its own weight.*)
3. Have a student push the chair a short distance across the floor. Ask what force just acted on the chair. (*Instructor's information: A push unbalanced the forces on the chair and made it move.*)
4. Have two students facing each other push on either side of the chair so that it does not move. (*Remind students that they are NOT trying to overpower the other student.*) Ask students whether there are any forces acting on the chair. Is so, why doesn't it move? (*Instructor's information: although two forces are acting on the chair, they are balanced, causing it to remain in place.*)

Part II

1. Explain to students that **compression** is the act of being pushed or pressed together. Have students place their hands with their palms together and elbows bent. Tell them to press their palms together. This pushing force is called compression.

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2. Explain that **tension** is the act of being stretched or pulled. Have students place their hands in front of them, and clasp curled fingertips together. Tell them to pull on their hands. This pulling force is called tension.
3. Divide the class into two teams.
4. Have one team find three elements under tension in the classroom or school. Have the other team find three elements under compression. Allow 15 minutes for this task. One group member should be appointed to write down the information.
5. When the time is up, compare the lists.

***Instructor's information:** Examples of elements under compression are walls, table and chair legs, vertical sides of doors or window frames, columns or piers. Examples of elements under tension are cables or strings hanging from the ceiling with an object attached to it, such as a map, poster, light or screen. Any arch or triangular structures is in both tension and compression.*

(This activity has been adapted from an interactive activity found at the National Building Museum in Washington D.C.)