The Power of Air—Human Shrink Wrap

The Power of Pressure

Introduction

The world around us is filled with a powerful force—air pressure. Unfortunately, we rarely comprehend the full strength of this colorless, odorless gas that we take for granted. Students learn that standard air pressure is 101.3 kP_a, 760 mm Hg, 14.7 psi; but they do not grasp what this means. Unless we have inner ear trouble or experience decompression in an airplane, it is unlikely that we notice changing air pressure—until now.

Concepts

- Kinetic-molecular theory
- Gases

Materials

Duct tape

Lawn bags, large, heavy-duty, 2

Vacuum cleaner or shop vac

Safety Precautions

The force of the air pressure can be shocking. Be careful and sensitive to panic or discomfort in the person. Be sure to have another person assisting so the person does not lose balance and fall. Do not put the bag over the volunteer's head! Follow all laboratory safety guidelines.

Procedure

1. Slide the open end of a lawn bag into the opening of a second bag so that the bags overlap 1–2 inches. Seal the bags completely together with duct tape. Cut the end (bottom) off one bag creating a double-sized bag.
2. Place a person in the bag. They may squat or stand, as they like. Place the suction end of a vacuum hose in the bag and have the person loosely cup his/her hand around the end to prevent clothing or the plastic bag from being caught in the hose.
3. Gather the loose ends of the open bag around the neck of the person, paying attention to sealing off around the hose as well. Caution the person that the force of the air pressure on the bag as the experiment works may make it difficult to breathe. Arrange a "panic signal" if the person becomes distraught.
4. Turn on the vacuum. As the air is removed from inside the bag, the air in the room will push the bag against the person "shrink-wrapping" him. Be sure to support the person because he may lose balance and fall over. Some people may become self-conscious as their body is defined in the tight plastic bag. Shut off the vacuum at the first sign of discomfort!

Discussion

The following questions should be discussed as a class upon completion of the demonstration.

Why does the person feel the pressure of the air when inside the bag, but not normally?

Did the vacuum "suck" the air out of the bag or did the room pressure push the bag against the person?

How does this activity relate to SCUBA diving?

Calculate the force on the person's body.

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Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
Evidence, models, and explanation
Constancy, change, and measurement
Content Standards: Grades 5–8
Content Standard B: Physical Science, motions and forces
Content Standards: Grades 9–12
Content Standard B: Physical Science, structure and properties of matter

Reference

Steve Long would like to thank Wayne Groats for introducing him to this demonstration.

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *The Power of Air—Human Shrink Wrap* activity, presented by Steve Long, is available in *The Power of Pressure*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.