SRC ☑

Air Lift!

Topic **Force (Air Pressure)**

Objectives
- Test, kinesthetically, the force of air pressure.
- Explain, mathematically, that air has weight.
- Deduce the effect of air pressure on various objects.

Duration 15-20 minutes

Assessment Type Formative

Although air is generally invisible, it has mass. This mass, being pulled to the planet by gravity, gives air weight, allowing it to press on the earth. The weight is referred to as air pressure. Air also has density, which is determined by temperature. For example, cold air is denser than hot air. Weather changes with air pressure. A barometer is designed to measure air pressure and predict the weather. Students cannot feel air pressure on their skin, thus may not realize that air has mass.

Set-up

Assign 2-3 students to a team.

Materials

- ☐ Small plastic bowl
- ☐ Sandwich bag
- ☐ Rubber band
- ☐ Ruler

Instructions

1. Make sure that your bag has no holes in it.
2. Put the bag into the bowl so that it covers the entire inside and bottom. The edges should hang slightly over the edges all around the top.
3. Put the rubber band around the top of the bowl so that it holds the plastic in place securely.
4. Predict:
    a. What will happen when you grab the plastic on the bottom of the bowl and pull up?
    b. Will the plastic pull up easily?
    c. Will it stick to the bottom of the bowl completely?
5. Try gently lifting the plastic off of the bottom of the bowl. *Be careful not to tear the plastic.*

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Notes

For this to work properly, all of the air must be pressed out from between the bag and the bowl. It helps to use a soft cloth (i.e., hand towel or sweater) to press the bag into the bowl. Provide bowls with a rim if possible as it's easier to position the rubber band along the edge.

Calculating the exact amount of air pressure on the plastic on the inside of the bowl is a rather complicated matter, since you must account for the bowl shape. However, for a rough calculation, consider only the bottom of the bowl. Measure the area of the bottom of the bowl, then multiply by 14.7 lb/in^2 (or 1 kg/cm^2).

Discussion Questions

- What happened when you pulled on the plastic? *Why did this happen?*
- Can you actually see the air when you pull up on the plastic? *What do you see?*
- Does air have weight? *How do you know?*
- If air pressure is about 15 pounds per square inch, about how much air is pressing down on the plastic?
    - How could you calculate the amount of pressure on the plastic?
    - What does this have to do with lifting the plastic?
- What adjustments would we have to make in our lifestyles if air were weightless?

Reality Check! Evaluation

- ☐ Did students actually test the force of air pressure?
    - Did they create a pseudo-vacuum seal with the rubberband?
    - Did they compare their predictions to their results?
    - Were they able to repeat their results for each team member to experience?
- ☐ Did students understand that air was exerting pressure onto the bag?
    - Could they give examples of how air pressure on the plastic could be calculated?
    - Did they reasonably estimate the amount of pressure on the plastic?
    - Did they accurately measure the bowl?
    - Did they correctly calculate the air pressure exerted on the area?
- ☐ Were students able to speculate on changes in lifestyles as a result of weightless air?
    - We might need to live in an atmosphere enclosed area.
    - We might be able to run (fly, drive, etc.) faster since there would be no air resistance.
    - We might have to wear a breathing apparatus because the air was not held to the surface of the earth.
    - We might not use air!

    Note: These are speculations ~ there are no wrong answers!

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