SNC2D/2P Climate Change/Earth's Dynamic Climate

Teacher Demo: Air Pressure

Topics	Timing
atmosphere climate air pressure	preparation: 5 min demonstration: 5 min

Specific Expectations

SNC2D

A1.1 formulate scientific questions about observed relationships, ideas, problems, and/or issues, make predictions, and/or formulate hypotheses to focus inquiries or research

A1.8 analyse and interpret qualitative and/or quantitative data to determine whether the evidence supports or refutes the initial prediction or hypothesis, identifying possible sources of error, bias, or uncertainty

A1.11 communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)

D2.1 use appropriate terminology related to climate change, including, but not limited to: *albedo*, *anthropogenic*, *atmosphere*, *cycles, heat sinks*, and *hydrosphere* [C]

D3.1 describe the principal components of Earth's climate system (e.g., the sun, oceans, and atmosphere; the topography and configuration of land masses) and how the system works

SNC2P

A1.1 formulate scientific questions about observed relationships, ideas, problems, and/or issues, make predictions, and/or formulate hypotheses to focus inquiries or research

A1.8 analyse and interpret qualitative and/or quantitative data to determine whether the evidence supports or refutes the initial prediction or hypothesis, identifying possible sources of error, bias, or uncertainty

A1.11 communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)

D2.1 use appropriate terminology related to Earth's dynamic climate, including, but not limited to: *anthropogenic, atmosphere, carbon footprint, carbon sink, climate, greenhouse gases, hydrosphere,* and *weather* [C]

D3.1 describe the principal components of Earth's climate system (e.g., the sun, oceans, and the atmosphere; the topography and configuration of land masses)

Introduction

This demo illustrates the presence of atmospheric air pressure and shows how the force that it exerts is greater than the force of gravity in some situations.

Materials

safety goggles	index card
drinking glass	large tray

Safety Considerations

Eye protection should be worn in case the glass accidentally breaks.

Procedure

Wear appropriate PPE: safety goggles.

1. Fill the glass with water right up to the brim.
2. Place the index card on top of glass and hold it firmly in place.
3. **Predict**
   Students engage in Think, Pair, Share (see Teaching Suggestions/Hints):
   - Think: What will happen when the glass is held upside down and the index card is no longer held in place?
   - Pair: Discuss the question with a partner.
   - Share: Hold a brief class discussion on the prediction.
4. **Explain**
   Ask students to justify their predictions using their existing knowledge.
5. **Observe**
   Lift the water-filled glass over the tray with one hand, holding the index card to the mouth of the glass with the other hand. Carefully turn the glass upside down. Release the card.
6. **Explain**
   Ask students to explain their observations.

Disposal

No concerns

What happens?

The card will stick to the glass and the water will stay inside the glass (i.e., will not spill, even though the glass is held upside down).

How does it work?

When the glass is filled with water, there is no air in the glass and thus no air pressure. The air pressure outside the glass is thus greater than that inside the glass (zero). As a result, when the cup is turned upside down, the air pressure outside the glass exerts enough upward force to overcome the force of gravity pulling down on the water. Therefore the air holds the water inside the glass and does not allow it to spill out.

Teaching Suggestions/Hints

1. Practice this demo before performing it! It may take a few tries. Make sure you are holding the glass so that the index card is close to perfectly horizontal, otherwise the water is likely to spill.
2. Perform this demo above a sink or tray in case of a spill.

3. *Think/Pair/Share*: In this learning strategy, students individually consider a concept, question, or prediction, and then discuss their ideas with a partner. This can be followed by small group discussions or a whole class discussion. The purpose of the strategy in this demo is to:
    - activate prior knowledge;
    - think about ideas/concepts first and then share with other students for feedback;
    - pace student thinking and discussion; and
    - include all students in explaining and confirming predictions.

Next Steps

Try filling the glass halfway and repeating the demo. Some water will spill but the index card will remain in place because the air pressure outside exerts an upward force on the card greater than the combined forces of the internal air pressure and the force of gravity on the mass of water in the glass. .

Additional Resources

1. A description and images of this demo (Scroll down to "Demo 4: Air Exerts Pressure.") - http://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_air/cub_air_lesson01_activity2.xml
2. A detailed description of why this demo works - http://www.edufy.org/content/show/160