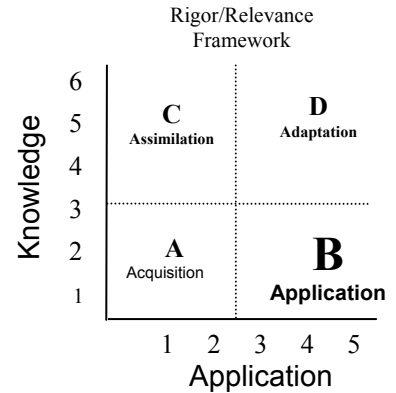




Gold Seal Lesson

BERNOULLI BUBBLES



Subject

SCIENCE

Grades 5-8

Instructional Focus

Basic Concepts and Knowledge: Students develop an understanding of scientific concepts using facts, theories, principles, and models.

Unifying Concepts and Processes: Students recognize patterns and processes, making connections in terms of systems and subsystems that explain the interrelationships of the natural and designed world.

Science as Inquiry: Students demonstrate knowledge and skills necessary to perform scientific inquiry.

Reading: Students read a variety of grade level materials, applying strategies appropriate to various situations.

Performance Task

In this inquiry, students devise a way to keep a soap bubble in flight, then use this experiential base to study the Bernoulli Principle. You will need either to have a friendly janitor or to work outdoors on a windless day. To prepare bubble solution, combine 1 cup of dish detergent, 1 tablespoon of glycerin, and 1 gallon of distilled water. Let solution sit overnight. Depending on the number of students, you may wish to double the recipe. Provide loops to use as bubble blowers, or have students use their own index finger and thumb in a circle.

Instructions to students:

Your task is to devise the best way to keep a soap bubble in flight. With your group, brainstorm as many ways as possible to keep a bubble from hitting the ground without touching it with any object. Devise several ideas even if you think your first approach will work. Record all thoughts and comments in a science journal prior to any investigative measures. Look at your list and predict which methods you think will and will not be successful. Write down your predictions.

Experiment with your ideas. How long can you make the bubbles stay aloft? Keep track of your best times. Make two lists: methods that worked and methods that did not work. Put this list on hold to use in questions 5 and 6 below.

You and your group are to use library resources to read about the Bernoulli Principle developed by Daniel Bernoulli, an 18th century scientist. Answer the following.

1. How did Bernoulli develop his ideas? Explain how the Principle applies to liquids as well as gases.

Performance Task continued

2. Neatly draw a diagram of an airplane wing. Draw the path air must travel when the air hits the front of the wings. Keep in mind some air must go over the top of the wing and some must go underneath. Scientists have discovered that regardless of whether the air goes over or under the wing, it arrives at the other side of the wing at the same instant. Which air must travel faster to make it to the other side?
3. What does the Bernoulli Principle say about faster moving air and pressure? If there is greater pressure pushing up from under the airplane what will happen?
4. What is dynamic lift?
5. One of the two major approaches that help keep an object aloft is increasing the pressure under it. Which methods on your list fall in this category?
6. The second major approach that helps to keep an object aloft is to decrease the pressure over it. Which methods on your list fall in this category?
7. How can you use the Bernoulli Principle to decrease the pressure over a bubble and help keep it aloft? (Hint: Use your hands.)
8. Using the Bernoulli Principle, see if you can walk your bubble around your classroom or schoolyard.

Summarize your experimental procedures, brainstorming session, research, and answers to the questions in a well written paper free from spelling and grammatical errors and in your best handwriting.

Scoring Guide

4 Points: Student worked well and contributed during group work and brainstorming session. Student aided the group in devising several methods to keep their bubbles aloft. Research on the Bernoulli Principle was evident in the summary. All drawings were neatly done and correctly labeled. Student summary addressed all questions, was well written, free from spelling and grammatical errors. Student demonstrated an excellent understanding of the Bernoulli Principle and how it pertains to flight.

3 Points: Student worked reasonably well and contributed during group work and brainstorming session. Student aided the group in devising methods to keep their bubbles aloft. Research on the Bernoulli Principle was evident in the summary. All drawings were neatly done and correctly labeled. Student summary did not address all questions, however it was well written and had few spelling and grammatical errors. Student demonstrated an understanding of the Bernoulli Principle and how it pertains to flight.

2 Points: Student worked reasonably well and contributed some ideas to group work and brainstorming session. Student aided the group in devising a few methods to keep their bubbles aloft. Research on the Bernoulli Principle was partially evident in the summary. Drawings were a bit sloppy. Student summary did not address all questions and contained several spelling and/or grammatical errors. Student demonstrated a partial understanding of the Bernoulli Principle and how it pertains to flight.

1 Point: Student did not work well with his/her group. Summary did not reflect research on the Bernoulli Principle. Drawings were haphazardly done. Paper contained numerous spelling and grammatical errors and handwriting was difficult to read. Student did not demonstrate an understanding of the Bernoulli Principle and how it pertains to flight.

Essential Skills

- Make observations using senses and instruments. Inferences and interpretations are arrived at based on observations. Classify observable properties and organize observations in a meaningful and logical way. (s5)
- Understand and apply statics (i.e., the relation between forces acting on an object at rest) and dynamics (i.e., the relation between the forces acting on an object and the resulting motion). (s84)
- Know and apply the principles of scientific inquiry. (Implicit in this statement are the processes of prediction, estimation, developing hypotheses, drawing conclusions, evaluation, and following ethical principles and professional procedures.) (s 114)
- Apply in writing the rules and conventions of grammar, usage, punctuation, paragraphing and spelling. (ela1)
- Gather information from a variety of sources, including electronic sources, and summarize, analyze, and evaluate its use for a report. (ela3)
- Identify, collect and/or select pertinent information while reading. (ela5)
- Use brainstorming, role playing, and standard problem solving strategies to define a problem and suggest solutions. (ela19)
- Use writing as a tool for learning in formats such as learning logs, laboratory reports, note-taking, journals and portfolios. (ela 40)

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