AIR PRESSURE

3.20.2019

Subject

Basic science

Prepared By

[Instructor Name]

Grade Level

5

Overview

This lesson plan covers teaching content for;

1. Definition of pressure
2. Effects of air pressure
3. Air pressure and flying or floating object

Objectives

Students should be able to;

1. Understand air pressure and how its affects the environment
2. Give explanation to flying objects
3. Justify the effect of air pressure using house hold examples.

Activity Starter/Instruction

1. Gather materials.
2. If balances and scales are not available in your classroom, determine the mass of the objects before class and provide students with the information.
3. Practice the aluminum can demonstration

Guided Practice

Day 2/ Lesson 2: 20 Mins

1. Ask the class: Does air pressure change with altitude? If so, how does it change? Why do they think this happens?
2. Direct students to each build a tower using wafers or colored tiles/blocks that is 14-wafers tall.
3. Ask students: How does this model represent air pressure changing with altitude? (Listen to student explanations.) Explanation: Imagine that the wafers are the air in the atmosphere and that the bottom wafer is at sea level—the lowest point in the troposphere. The top wafer is a higher layer in the

Teacher Guide

Day 1/ Lesson 1: 15 Mins

1. Ask students to define air pressure.
2. Ask: How strong is atmospheric air pressure? (Is it as much pressure as an ant standing on 1 square inch would exert? Or, an elephant? Or, 12 elephants?)
3. Tell students they are going to compare the pressure that different objects exert on the Earth (due to gravity) to atmospheric air pressure.
4. Divide the class into groups of four students each.
5. Distribute to each group a worksheets, graph paper, index cards and four objects (for one group, the four objects could be themselves).
6. Have the students determine the mass of their objects.
7. Direct the group that is weighing themselves to each stand on one flat foot on the scale while the measurement is made.
8. Direct students to place their object on the grid paper in the same

Materials Required

-science journal
-balance scale
-can
-Wafer cookies
-Measuring tools
-cooker or lab burner

Additional Resources

https://study.com/academy/subj/science.htm
https://study.com/academy/lesson/preventin catastrophe-from-natural-disasters-in-california.html
https://study.com/academy/practice/quiz-worksheet-high-low-air-pressure-facts-for-kids.html

Additional Notes

stratosphere or someplace like the top of Mount Kilimanjaro. Imagine that you are standing at sea level, the level of the bottom wafer. The air pressure at sea level is the highest, because at that point all the air (wafers) is pressing on everything. Now imagine that you are standing on/near the top of the stack, at a higher altitude. Here, much less air (fewer wafers) is pressing on each other, thus the air pressure is less than at sea level.

4. Share the sea level air pressure with students (14.7 psi) and the air pressure in your city.
5. Ask students to describe in their own words how air pressure changes with altitude, recording their information on worksheet 1.
6. Variation: Stack books or pillows in students' laps/arms so they can "feel" the different pressures instead of just visualizing with the wafers.
7. Show the students what a 1 inch by 1 inch square looks like. Now show the students what a 2 x 2-inch square looks like, and ask them how many pounds would be pressing down on that square. (Answer: 48).
8. The average pressure on a middle school student is 24,000 pounds! Ask: Do you feel that pressure? Why don't you feel that pressure? (See if students can explain. Answer: Humans are permeable to air. Air exists inside the body, too—from breathing, through the skin, ears, etc.—and that air balances out the pressure on the outside of the body.)

orientation as it was when it was on the balance (the position does not affect the mass, but it affects the contact/surface area value and thus, the ultimate pressure).

9. Have students carefully trace around the object, add up the squares and record the contact area on their worksheets.
10. Have the group that is weighing themselves trace around the foot they stood on. Students may need some help estimating and rounding for partial squares.
11. Have students record on their worksheets the data for every group member.
12. Ask students to calculate the pressure that each of the objects exerts. ($P = F/A$, in this case F = weight of the object.)
13. Have students write the name of their objects and the resulting pressures on index cards and tape them to the classroom board.
14. Have students rearrange the cards in order of increasing pressure.
15. On their worksheets, have students predict which object they think has the closest value to the air pressure around them and explain why.
16. Ask a few students to share their predictions.
17. Share the actual value of the air pressure with the students. Were they surprised with the results?

Guided Practice

Day 3/ Lesson 3: 20 Mins

1. Fill the bucket with ice water.

2. Fill the soda can with approximately 1 cm of water.
3. Place the soda can on the hot plate until the water boils. Be alert to not let the can boil dry!
4. Use the tongs to carefully remove the can from the heat and place it in an upright position on the tabletop (or trivet).
5. Ask: Do you see any change in the can?
6. Direct students to record their observations on worksheet
7. Repeat the heating process. This time, when you remove the can with the tongs, quickly invert it and submerge the can opening in the bucket of ice water.
8. Ask: Do you see any change in the can?
9. Direct students to record their observations on worksheet.
10. Direct students to draw a diagram of the experimental results. Have them indicate where the pressure must be the highest with a letter H and the lowest with a letter L. (Answer: Air pressure is lowest, L, inside the overturned can and highest, H, outside the can and around the experiment.)
11. Ask: Why do you think the can was crushed? (Listen to some student explanations. Answer: Before heating, the pressure inside and outside the can is the same. We

assume the pressures on both sides remain approximately the same while heating since the can does not deform. As the water boils, the air that escapes from the can is gradually replaced by water vapor until the internal atmosphere is composed almost completely of water vapor. When the can is removed from the heat, the vapor pressure drops dramatically. It decreases from 101.3 kPa at 100 ºC to about 2.3 kPa at room temperature. Therefore, as the temperature drops to room temperature, the pressure inside the can drops 97%. If the can is open to the atmosphere, air flows back into the can as the water condenses and keeps the pressure essentially constant. However, if the opening of the can is submerged, the vapor in the can cannot equilibrate with the atmosphere. In the bucket of water, the temperature in the can decreases and the water vapor condenses, creating a pressure difference of almost 99 kPa. Water is forced in to fill this partial vacuum, but before it does, air pressure on the walls implodes the can. Note that the collapsed can contains water (more than when you started), indicating water entered at the same time the walls collapsed.

12. Have students work in pairs to answer the following questions: The

air inside an aircraft is kept at a pressure similar to what human bodies experience at the Earth's surface. Knowing this, what can you say about the pressure difference between the air inside a plane versus the air outside a plane, once a plane is 30,000 ft above the Earth's surface? (Answer: The air pressure is much lower outside the plane than inside the plane.) Is pressure pushing from the inside of the plane outwards? Or, is pressure pushing on the outside on the plane inwards? It may help to figure this out by sketching a plane and using arrows to indicate the direction of pressure. (Answer: Pressure is pushing from the inside [high pressure] to the outside where the pressure is lower.)

Assessment Activity

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Summary

Students gain an understanding of air pressure by using candy or cookie wafers to model how it changes with altitude, by comparing its magnitude to gravitational force per unit area, and by observing its magnitude with an

	aluminum can crushing experiment. Three student worksheets (and answer keys) are provided.	