TAMING RAINING WITH HOVER COVER

Experiment Express:

STEM Field of Study:

Engineering

Specific STEM Area:

Material Science

Physics - Classical

Age Group:

All

Cost:

Less than (<) $10

Time:

1 hour

Materials:

Lab Notebook; Pen; Small Toys; Household items such as: Straws, Aluminum Foil, Plastic, Orange Peels; Plant leaves; Paper towels

*Anything that you can use to help shed water away from an object. Be creatively careful.

Safety:

Adult Supervision Necessary

Individual Education Plan (IEP) Goals:

Academic

Behavioral

Motor

Social

Problem Question: Can you engineer an umbrella?

Hypothesis: Before you do this experiment; try to predict the answer to the question above. Write down your Hypothesis in your logbook. Make sure to use a pen.

Directions:

1. Gather all of materials together.
2. Review safety precautions with an adult.
3. Review pictures or drawings of umbrellas and their function which is to direct water away from something or someone under its protection. The umbrella that you create can have any shape you wish; it doesn't have to look exactly like a traditional umbrella.
4. Sketch a drawing of your umbrella.
5. Duplicate the charts listed below in your lab notebook.
6. Find household items that are safe to use to engineer your umbrella. You can use orange peels, sponges, aluminum foil, wax paper, etc. Be creative – but careful. Keep in mind that you will have to test your umbrella – which means using water. You may have to move your invention to a location that will tolerate getting wet.

   *** Note: Keep in mind that your umbrella must be larger than the toys you place under it to test its effectiveness.
7. Make sure to record the items you used and rate their effectiveness.
8. Name your invention.
9. Place a small toy underneath the umbrella and see how wet it gets.

Example Experiment #1

Item Used	Effectiveness 0 -5 0= not effective; 5 = highly effective.	Why was it effective or not effective?
Straws		
Large Orange Peel		

Example Experiment #2

Item Used	Effectiveness 0 -5 0= not effective; 5 = highly effective.	Why was it effective or not effective?
Straws		
Aluminum Foil		

Think Link

Did you know that the umbrella is a 4,000-year-old invention? Neither did we. Originally, umbrellas were used in ancient Egypt, China, and India to protect people from the sun and this practice continued through until the 19th century when women used them as parasols. Around 1850, the umbrella was being manufactured with a light-weight steel frame, black in color and being used also by men.

Fun Fact: The word umbrella comes from the Latin word, "umbra," which means shade or shadow. For more information about Umbrellas visit: https://www.farmersalmanac.com/umbrella-history-and-facts-21572

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Post Experiment Questions:

1. Which item offered the best protection from the rain for the toy?
2. Why?
3. Which item offered the least protection from the rain for the toy?
4. Why?
5. Was your hypothesis correct?

Post Experiment Answers:

1. Answers will vary depending upon the results. However, make sure your student has recorded their observations in their lab notebook.
2. Answers will vary depending upon their recorded observations. However, they should offer logical explanations such as: The Orange Peel was able to shed the water very well but the straws were too weak hold the orange peel effectively.
3. Answers will vary depending upon the results. However, make sure your student has recorded their observations in their lab notebook.
4. Answers will vary depending upon their recorded observations. However, they should offer logical explanations such as: The Orange Peel was able to shed the water very well but the straws were highly effective but the wax paper was not.
5. If your hypothesis was correct, Congratulations! If not, do not worry – this is exactly why we do these experiments.

Draw Your Own Conclusion:

Why do you think umbrellas are typically in the shape of a dome? Most of us would say that the shape of a dome is the most effective way for redirecting water away from us in a rainstorm; and to be honest, it is an effective shape for shedding water away from whomever is under it. When searching for the perfect umbrella it is important to keep in mind the weather in your region. There are umbrellas that are simply designed for a gentle drizzle and can offer appropriate protection; however, if the weather in your area is more accustom to downpours and updrafts… perhaps it's necessary to search for sturdier option.

Since rain isn't the only consideration engineers need to consider when designing an umbrella; there are interesting design techniques that account for gusts of wind that whip under an umbrella and invert it into a misshapen cone rendering it useless to its owner. Some companies have fixed this issue by installing air vents near the top of the umbrella with a canopy draping over the air vents in order let the wind flow out while ensuring the user remains dry.

With this information in mind, do you think there is another shape, other than the dome that could be equally as effective in rainstorm while protecting the user from the wind and not inverting into unusable rain gear?

Experiment Expansion:

Here at STEM with the Saints, we love the saying, "Form (ever) follows function." Have you ever heard this before or know what it means? This saying is attributed to 19th Century architect Louis Sullivan who is also known as the "father of skyscrapers," at the time it meant that how something looked or was designed should follow how the item is used. Expanding from this experiment, we would like for you to observe nature and list the comparisons and differences between the umbrellas that we use for rain protection and the "umbrellas" that occur naturally in the environment. What changes would you make to your experiment design based on what you observed. Let us know at: www.stemwithsaints.org

Log Your Work:

Absolutely!

Real World Applications:

Material Science

Design

Architecture

Online Resources:

https://www.smithsonianmag.com/innovation/inventing-the-perfect-umbrella-180948266/

Literature Resources:

Jonas Hanway's Scurrilous, Scandalous, Shockingly Sensational Umbrella by Josh Crute (Author), Eileen Ryan Ewan (Illustrator)

Nature's Green Umbrella by Gail Gibbons (Author, Illustrator)