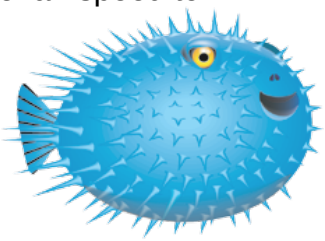
Designs That Survive Storms

Name: _____ Date: _____

Directions:

1. Gather materials to build a house and engineer storm-resistant features!
    a. **House**: cardboard, scissors, ruler, house template, tape
    b. **Weather hazards**: fan, large tray, water, measuring cup, water pouring device, sponge, measuring cup
    c. **House upgrades**: attaching material (e.*g., playdough, string, paper clips, glue, hot-glue, tape*), waterproof material (*e.g., plant leaves, foil, paint, waxed paper*), lifting material (*e.g., playdough, blocks, chopsticks, small rocks*).
2. Follow the instructions on the house template to create a model.
   (*Note: The house template provides a suggested house design, but you can design your own.*)
3. Place the house on an open surface and direct the fan in its direction. Test the structure and strength of your cardboard house by turning the fan on at low speed. Increase the fan speed to model high wind conditions.
    a. What happened at low speed?



    b. What happened at a higher speed?
4. Turn the house so that different sides face the fan and repeat step 3.
    a. Is there a difference? Describe what happened.
5. Think of a modification to help your house survive better in strong winds and write your hypothesis below:

Hypothesis: If _____

then _____

6. Make the adjustments from above to your structure using the upgrade materials listed in #1.
7. Repeat steps 3-4 to test your modified house against the high winds.
8. Observe and describe what happens.

Flood and Rain Simulations

9. Place your house in a bucket or other water-catching device.
10. Remove the roof and place a dry sponge inside (Fig 5a). Replace the roof.
11. Make it Rain! Use the measuring cup to slowly pour 2-3 cups of water over the house. You may have to experiment with how much water to use, but the same amount should be used in each rain trial so that you can compare.
12. What happens to the roof?
13. What happens to the bottom of the house?
14. Can you tell if more water is coming in through the roof or the bottom?
15. How could you test your hypothesis?
16. Remove the sponge from the house and squeeze the water into the graduated cylinder (Fig 5b). Measure the amount of water.
17. Engineer modifications to make your house more water resistant.
18. Remember that water can reach your house from above and below.
19. Think of modifications and write a hypothesis about how they will help your house survive in strong rain and floods.
20. Modify your house.
21. Test your modified house again against rain and flooding. Observe what happens and then write a statement to claim how your engineering design:
    a. did (or did not) help the house stay dry in strong rain
    b. did (or did not) help the house stay dry when the ground was flooded.

Activity Questions

1. Which material or design that worked best to protect your cardboard house against the followng. For each claim, provide evidence and write out your reasoning.
    a. Wind?

    b. Rain?

    c. Flooding?

2. In this activity, the rain came straight down and the flood water was not moving. However, during a storm, water can move quickly with a lot of force. How do you think fast moving water would affect your house differently?

3. During tsunamis, a lot of damage can be caused by large objects moving with rushing water. How can we help protect buildings from things like telephone poles and shipping containers washing around in the water?

4. During hurricanes, many people cover their windows with hard material, like plywood. How does this help protect their home?

5. Describe the area where you live and the types of threats to the home you live in.

    a. For example, do you live near the ocean, near a stream, or somewhere very windy or rainy?

6. Did native people in your area engineer homes to survive severe storms? What do you think, and what is your evidence?

7. What types of engineering modifications might help make the home you live in more storm-proof?