

# Cloudy with a Chance of Science!

## Week 3

### Day 5: Improvements Ahead!

#### Teacher/Parent Background:

When scientists and engineers are faced with a challenging question or problem, they follow steps to best address their task. In engineering fields, engineers use the Engineering Design Process to propose solutions to problems in order to make the world a better place. Once engineers have established a plan, they create/test their designs and make improvements in order to propose the best possible solution.

#### Overview:

In this activity, students will utilize the steps of the Engineering Design Process in order to create, test and improve designs to address their challenge: *How can we design a house that can withstand the effects of a monsoon?*

#### Related Standards:

- Collect, analyze, and interpret data to explain weather and climate patterns.
- Define problem(s) and design solution(s) to minimize the effects of natural hazards.

#### Key Terms:

- Engineering Design Process: a set of steps engineers use to propose solutions to problems

#### Materials List:

- Parental/adult supervision
- Possible house/roof building materials:
  - Cardboard pieces
  - Aluminum foil
  - Construction paper
  - Popsicle sticks
  - Foam
  - Fabric
  - Clay/Playdough

- Notecards
- Testing materials:
  - Pasta strainer
  - Water - 0.5 quart of 2 cups
  - Hair dryer
  - Paper towel
  - Tray to catch water spills
- Tape/glue
- Scissors
- Timer
- Pen/pencil
- *Student Resources - Pages 6-7*
  - *Step 4: Create and Test*
  - *Step 5: Improve and Re-test*

### Activity Description:

- Today is finally the big day...we get to build and test our model house designs! Before we jump right into building, let's first revisit our plans.
  - Ask students to review their design plans by referencing *Step 3: Plan*. Guide students through a "checklist" in order to evaluate their plans and move on to creating their designs:
    - Check your plans for the following:
      - Does your plan have a diagram with labels?
      - Does your plan have a materials list that includes both types and amounts?
      - Does your plan follow the materials and design requirements?
        - Review the *Challenge Details* with students.
    - If your plan is missing something, please take time with your team to address it.
      - **Note:** Depending on the learning environment, the adult/parent may be the only other person in the "class". Act as a design team member by listening to their ideas and sharing additional thoughts/your ideas, if the plan is missing any requirements.
- Now that we have reviewed our plans, let's begin the creating process!
  - Guide and actively assist students through the "Create/Test" step of the Engineering Design Process by reviewing *Step 4: Create and Test*. Key details/directions include:
    - Build your design with your team!
    - Stick to your plan, including only using the types and amounts of materials you asked for.
    - Test it out! How did your solution work; what did and did not work well? Record the testing results.

- Testing procedures are as follows:
  - 1. Build the four walls of your house, using your selected material. Use tape/glue to hold them together.
    - **Note:** Carefully monitor and assist students when using scissors to cut any materials throughout the activity. Depending on the learning environment, the adult/parent may be the only other person in the “class”. Act as a design team member by sharing the building, testing and reflecting responsibilities.
  - 2. Place a paper towel on the “floor” of your house. This will help us determine if any water leaks through!
  - 3. Build the roof of your house, using your selected material by creasing/folding it in half to form a peak.
    - Once it is peaked, place it on top of the house.
  - 4. To test how the house withstands wind, work with a parent/adult to turn on a hair dryer and set it to a cool/medium setting.
    - Move the hair dryer above and around the roof for about 1.5 minutes.
    - When done, pass the hair dryer to the adult/parent.
      - **Note:** Carefully handle the plugging in/turning on and off/unplugging of the hair dryer. Allow students to hold the dryer over the roof for testing only. For electrical and water safety considerations, completely remove the hair dryer out of the testing area for the next step.
    - Make observations, did the roof stay intact and in place?
  - 5. To test how the house withstands rainfall, place your house inside a tray, to catch spilling water.
    - Then, pour 0.5 quart or 2 cups of water into a pasta strainer. Hold the strainer above the roof.
    - When all the water has strained through, make observations. Is the roof intact and in place?

- Remove the house to observe the paper towel. Is it wet or dry?
- After testing has concluded, review testing results using *Step 4: Create and Test*, including the *Success Criteria* section, to assist students in reflecting on what did/did not work well.
- Our time is up! How can we make your design even better?
  - Next, guide and actively assist students through the “Improve” step of the Engineering Design Process by reviewing *Step 5: Improve and Re-test*. Key details/directions include:
    - Based on your testing results, discuss and decide what your team can do to make your design even better. Remember to still stay within the material and design requirements!
      - Review the *Step 5: Improve and Re-test*, including the *Team Suggested Improvements*, to assist students in discussing and deciding what to improve and how they will do so.
        - **Note:** Depending on the status of the materials, some may be able to be re-used and some may not.
        - **Note:** Depending on the learning environment, the adult/parent may be the only other person in the “class”. Act as a design team member by sharing the reflection/discussion responsibilities.
    - Begin to re-create and re-test your improved design!
      - **Note:** Depending on the learning environment, the adult/parent may be the only other person in the “class”. Act as a design team member by sharing the rebuilding and retesting responsibilities.
  - Our time is up! How did your solution work this time?
    - Prompt students to discuss, once again referencing the *Success Criteria* to determine what worked/did not work well.

## Closure:

- As we approach the end of our week-long challenge, let's reflect!
  - What was the most enjoyable part of this process? Why?
  - What was the most challenging part of this process? Why?
  - Overall, how successful would you rate your final design, on a scale of 1-5 (1 is unsuccessful)? Explain your rating.

## Extensions:

Continue the Investigation!

- Prompt students to extend the challenge with the following prompts:
  - How can you make your design even better?

- What improvements would you make now? Why?
  - What were the testing results of this version?
- Can you design a house with structures to guide falling water off of the roof and away from the house?
  - How does this design improve safety both inside and outside the house?

# Student Resources

## Step 4: Create and Test

What Worked Well?	What Didn't Work So Well?

### Success Criteria...

- Did you only use the available material amounts and types you planned for?
- Did you use only one type of material for the house walls and one type for the roof?
- Did your house have four walls and a peaked roof?
- Did your design withstand the rainfall test?
- Did you design withstand the wind test?

## Step 5: Improve and Re-test

Team Suggested Improvements
<p><b>We have decided to improve...</b></p>          <p><b>To improve this, we will...</b></p>

## Re-testing Results

What Worked Well?	What Didn't Work So Well?

Did your design withstand the rainfall test?

Did your design withstand the wind test?

Did you use only one type of material for the house walls and one type of material for the roof?

Did your house have four walls and a peaked roof?