

**COURSE:** Middle School

**UNIT:** Environmental/Agricultural Concepts

**EXERCISE:** Waterproof the Roof

**TIME FRAME:** 2-3 Hours



**PREPARATION:** *Summary of "to do's" that the teacher should understand and prepare before bringing this lesson to the classroom.*

Teachers will need to ensure that the proper supplies are available for students to build their solutions.

**Materials:**

- Fluffs craft white pk100
- Towel paper roll
- Twine 300'
- Paper clips, jumbo bx 100
- Card stock parchment pk100
- Tape scotch trans .5" wide
- Chenille pipe cleaners bg100 12" white
- Foil 12"x 25ft
- Planter (the "house" to be protected from water)
- Twisties, 4" white bx/2000

**Tools:**

- Large bins for planter
- Cup measuring 4 cups
- Scissors



**SAFETY:** *Summary of safety strategies in the lesson.*

Please use this space to describe safety procedures or highlights for this lesson.

**S1**

**DESIRED RESULTS:**

**ESTABLISHED GOALS:**

*Problem Solving Techniques and Applications Standards:*

Teachers should use the STEM Academy Standards Correlation System available in the STEM Connections area of a unit to extract specific standards and insert these standards here.

**TRANSFER:**

*Students will be able to independently use their learning to...*

- Accurately test and evaluate products through experimentation.

**MEANING:**

**UNDERSTANDINGS**

*Students will understand that...*

- The process and usefulness of experimentation
- Research on specific topics of interest to the government or business and industry can provide more information on a subject, and, in many cases, it can provide the knowledge to create an invention or innovation
- Product development of this type frequently requires sustained effort from teams of people having diverse backgrounds

**ESSENTIAL QUESTIONS**

*Students will keep considering...*

- How do we know whether innovation or invention is appropriate for a given problem?
- What is development in terms of to help prepare a product or system for final production?
- How can you refine a design by using prototypes and modeling to ensure a final product?
- Why must technological problems be researched before they can be solved?

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- Not all problems are technological, and not every problem can be solved using technology
- Technology cannot be used to provide successful solutions to all problems or to fulfill every human need or want
- The basic principles of roofing and construction

- Why do many technological problems require a multidisciplinary approach?
- How is a given product or system properly maintained?
- How is following directions key to ensuring an accident-free working environment

#### ACQUISITION OF KNOWLEDGE AND SKILL:

*Students will know...*

- Troubleshooting process
- The differences and definitions of innovation and invention
- What the results of an experiment mean for the problem
- Knowledge versus wisdom
- Problem solving approaches
- Problem identification
- Information gathering
- Role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving
- Research and development as a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace

*Students will be skilled at...*

- Selecting and using appropriate resources to help solve problems
- Reciting problem solving types
- Defending the need for a plan
- Explaining process strategies
- Portraying scenarios and situations
- Comparing/contrasting problems, opportunities, and solutions
- Identifying a problem
- Generating ideas
- Selecting solutions
- Testing solutions
- Making the item
- Evaluating the solution
- Presenting results
- Evaluating proposed or existing designs in the real world
- Connecting teamwork and designing to real life applications
- Compromising and working effectively in a team
- Troubleshooting issues and correcting them

#### S2 EVIDENCE:

##### EVALUATIVE CRITERIA:

- Graded Rubric

##### ASSESSMENT EVIDENCE:

*Performance Task(s):*

##### **Waterproof a Roof**

Develop a system of roofing to cover a miniature house and prevent water from leaking. Must completely cover the top of the house, utilize no single pieces larger than 2 square inches, and prevent any water from a 1-liter rainstorm from getting into the house. Draw pictures of ideas and include the materials you would need to build your design. Come to a consensus on a final group design.

*Other Evidence:*

- Thoughtful, clear, thorough
- Graded on accuracy, multiple choice questions
- Completed on time

- Online end of unit test
- Self-reflection

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### S3 LEARNING PLAN: *Summary of Key Learning Events and Instruction*

#### Pre-Assessment:

Testing and Evaluating Pre-Test

#### Outline:

1. **Introduce**
  - a. Have students read through the activity.
  - b. Have students listen as you go over the constraints, materials, and specific testing directions.
  - c. Have students write down any additional constraints or directions.
  - d. Break students into groups of 2-3.
2. **Brainstorm**
  - a. Students discuss ideas with their groups, sketch them, and write down materials into their design brief.
  - b. Students determine which design they will use and sketch their final solutions and write out their material list.
3. **Construct**
  - a. Open up materials for use
  - b. Students build their roofs.
4. **Test**
  - a. Place roof and planter into a bin and pour a liter of water over it.
  - b. Students check for leaks.
  - c. If there are leaks, students should discuss possible modifications with their group. Students should make and write down the chosen modifications then retest. Have students repeat this until their design doesn't leak or until they've reached the number of tests you have allotted (or a time limit).
5. **Communicate Results**
  - a. Have students read the reflection questions and write down their answers.
  - b. Have students write a formal report addressing and answering the reflection questions.
  - TIP: if you have sinks available, place the student solution in the sink and pour water over the solution in the sink.
  - TIP: placing a cotton ball or another absorbent material inside the "house" will help determine if the roof protected the house. Be careful that the absorbent material is off the ground if your planter has holes in the bottom.

#### Progress Monitoring:

The teacher will need to monitor student progress. Teachers should move throughout the classroom checking to see that students are keeping up with the lesson. After lecturing, the teacher should use students to help move students forward during the activity by sharing their expertise. Teacher may choose to post exemplars of student work for students to use who may have missed the lesson, missed some steps in the process, or may be struggling to keep pace with the class

In the beginning, students will have to chew on the idea of roofing and applying that to something they will make. It's very important for the students to consider current designs for roofing and applying those designs to the available materials. The ability to contribute and simultaneously allow others to contribute is a skill that will be very pertinent in almost all skilled jobs. That skill will be developed during the collaboration portion of this activity, and during the troubleshooting step. Pay extra attention to the quality of discussion happening during those phases. They'll get some practice putting things together during the construction portion. Being capable of creating something with their hands that looks good is a valuable skill. The process of drafting and altering throughout a projects project is also something that will come in handy later during students' professional lives. The problem usually comes with accepting mistakes and moving past them, which will typically arise during the trial run before the final test of their designs.



**DIFFERENTIATION:** *Summary of Key Differentiation Techniques*

Please use this space to insert your differentiation techniques. Depending on the needs of students, various techniques might be needed in a classroom, therefore use the information below and experts in the area needed to design your plan for differentiation.

The ASCD Study Guide for Integrating Differentiated Instruction and Understanding by Design: Connecting Content and Kids.  
by Carol Ann Tomlinson, Jay McTighe

Integrating Differentiated Instruction and Understanding by Design: Connecting Content and Kids.  
by Carol Ann Tomlinson, Jay McTighe  
ISBN-13: 978-1416602842  
ISBN-10: 1416602844

Differentiating Reading Instruction  
by Laura Robb.  
ISBN13: 9780545022989

A Teacher's Guide to Differentiating Instruction  
The Center for Comprehensive School Reform and Improvement



**CAREER CONNECTIONS:** *Summary of Career Opportunities Associated with this Lesson*

Please use this space to insert careers that might be connected to this lesson. This section will need continuous updating as new careers and emerging technologies change the opportunities available in the workforce.

Good sources for career connections:

Occupational Outlook Handbook  
<http://www.bls.gov/ooh>

The National Career Clusters® Framework  
<http://www.careertech.org/career-clusters>



**KEYWORDS:** *Please Insert Keywords from this Lesson with their Definitions*

Please use this space to insert keywords and their definitions

Use resources like [dictionary.com](http://dictionary.com) to find definitions to your keywords