

SCSU CRISP CCSA Kit Pages 2016

Title of Module: Save the Penguins

Subject or Unit of Study: Physical Science, Heat Transfer

GRADE LEVEL: Middle School

LENGTH OF DEMO/LESSON: 2 Class periods (if using extension extra class periods will be needed)

STUDENT OBJECTIVES

Students will...

1. Describe the methods of heat transfer
2. Create a budget sheet and stay on budget (perform simple mathematics)
3. Measure with accuracy and precision to two decimal places
4. Design and construct a working model that reduces the transfer of heat

NEXT GENERATION SCIENCE STANDARDS

MS-PS3-3: Apply science principles to design or test a device that will minimize or maximize thermal energy transfer.

MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of a problem.

If using Extension:

MS-ETS1-3 and MS-ETS1-4

NATIONAL STANDARDS & COMMON CORE

CONNECTICUT STATE STANDARDS

MATERIALS

List all materials needed for this lesson/demonstration

<ul style="list-style-type: none">● Thermometer● Variety of Tapes<ul style="list-style-type: none">○ Duct tape○ Scotch Tape○ Electrical tape● Scale● Rulers● Pricing Sheet	<ul style="list-style-type: none">● Animal Ice Tray● Heat or incandescent Lamp● Monopoly Money● Scissors● Timers● Freezer● Water● Regular ice cubes	<ul style="list-style-type: none">● Variety of construction materials, i.e:<ul style="list-style-type: none">○ Cardboard○ PVC○ Aluminum Foil○ Cotton Balls○ Packing peanuts○ Foam core
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<ul style="list-style-type: none"> ● Goggles 	<ul style="list-style-type: none"> ● Template for formal proposal ● Template for requisition form 	<ul style="list-style-type: none"> ○ Chip board ○ Wood ○ Plastic wrap ○ Styrofoam ○ Construction paper
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SAFETY

List all safety precautions needed for this lesson/demonstration

Goggles

LEARNER BACKGROUND

Describe the students' prior knowledge or skill related to the learning objective(s) and the content of this lesson, using data from pre-assessment as appropriate.

- Basic concepts of heat transfer
- Abilities to measure
- Basic arithmetic
- Extension: graphing and monitoring temperature

LEARNING ACTIVITY OR PROCEDURE:

Explicitly layout the lesson or demonstration

Day 1:

1. Introduce problem: Global warming and the effect of penguins. How can we provide a structure that can maintain a cold temperature to ensure that the penguins do not melt.
2. Review principles of heat transfer
3. Discuss constraints and criteria: tell students to begin to design structure keeping in mind the principles of heat transfer. Remind students of feasible sizing for the structure based on budget and material availability. Penguins will be exposed for final test for 3 minutes.
4. Have students bring up their models and give students the budget (monopoly money) and pricing sheet. Students should have formal proposal completed.
 - a. Extension: students come up with own budget
5. Students should be then given time to re-design based on pricing

Day 2:

1. Review scientific method: remind students that success is based on how little their penguin melts so they should measure the before and after weight of the ice cubes during testing.
 - a. Extension: class can define their own measures of success (temperature, weight change, volume change, etc.)
2. Students now build and test their design using plain ice cubes.
 - a. Extension: Students can monitor temperature and graph changes in temperature over time. They can use infrared, Vernier, or standard thermometers to measure the differences between interior and exterior and graph the results.
3. Allow time for redesign and retesting.

Day 3:

1. Students (or student groups) come p the the teacher desk for the final test with the penguins. Each group is tested for 3 minutes and penguins are weighed by the teacher before and after.*

*If using extensions, teacher measures success by the agreed upon parameters.
2. Students work on lab write up, which should cover:
 - a. Discuss success of their project based on constraints and criteria
 - b. Discuss possible improvements (and why)
 - c. Discuss practical uses of project

d.

ASSESSMENT:

Provide an assessment to measure student progress of objectives.

1. Success is based on how little their penguin melts so they should measure the before and after weight of the ice cubes during testing.
2. Lab Write Up
3. Building Proposal

ADDITIONAL RESOURCES:

Apply any links or additional information for students or teacher including videos, websites, etc.

TEACHER NOTES:

Describe any tips/tricks for implementing this lesson/demonstration that might be helpful to future educators. Provide answer keys if applicable.

- Be sure to price materials accordingly and provide enough money to create a suitable structure

STEM CAREERS:

Design proposal template outlines the objective, scope and plans of any particular designing work to its intended clients and prospects. Such a document should be developed with a clear mention of the necessary points that are to be fulfilled.

Sample Design Proposal Template

Title of the proposal _____ [give a suitable title of the design proposal]

Proposal presented by _____ [either mention the name of the company by whom the proposal is being presented or also state the name of the concern person who can be contacted for further details]

Proposal submitted on _____ [dd/mm/yy mention the date when the proposal is being presented to the intended clients]

Overview of the company:

_____ [elaborately state about the company who has undertaken the designing work]

Ordered by _____ **Approved by** _____ **Issued**
by _____