

(Building with Energy in Mind)

Lesson Overview: Students take on the identity of building contractors as they identify best building materials by measuring how various materials conduct or insulate from cold and heat. Students also test the durability of materials by simulating physical disaster conditions.

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Subject(s): Chemistry and Physics

Suggested Grade Level(s): 6 - 8

Time Duration: 5 40-45 minute class periods

Common Core State Standards Addressed:

Common Core Reading Standards for Literacy in History/Social Studies Grade 6 Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.

College and Career Readiness: Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

NextGen Science Standards 6-8 Grade:

- All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.
- The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions.
- Technology use varies over time and from region to region.

Objectives:

- Students will conduct experiments to measure the conductivity, and resilience of various building materials.
- Students will conduct supplemental research to support the findings in their experiments.
- Students will draw conclusions based on experiments and research about the value of different building materials.
- Students will present their findings in an oral and multimedia report.

Materials:

There are various ways to heat objects. One of the easiest and safest is with water. See this series of lessons for detailed images and descriptions of how to safely heat metals and wood objects

<http://www.middleschoolchemistry.com/lessonplans/chapter2/lesson1>

- Various building materials. Depends on what is available. May include but not limited to: **Cardboard, Metal, drywall, hardwood, brick, Plexiglas, glass**

Activities and Procedures: (Number all activities/procedures. Be specific.)

Example:

Day 1	<p>Taking on the identity and planning</p> <p>Present this narrative to the students: “A new uninhabited island has been discovered of the Pacific coast of California. It is considered an American territory and many are looking to move there to live, citing a healthy climate and cheap land. This is a unique opportunity to build a more sustainable village or town. As engineers your task is to recommend the best building materials. The materials you recommend must save energy while maintaining safe shelter. You may conduct experiments and research before you make your recommendation.”</p>
Day 2	<p>Data gathering and analysis</p> <p>Tell the students you will focus on the way heat is conducted by various materials that could be used to build the outside walls of a home. This is called “thermal conductivity” because you’re focusing on how heat passes through a material. This is different from passing a current of electrical energy through a material. Conduct experiments testing the speed and thoroughness with which heat is conducted via the various building materials. Arrange the data on a table from most to least conductive.</p>
Day 3	<p>Synthesis</p> <p>Read the article from EcoBuilding Pulse found here http://www.ecobuildingpulse.com/green-materials/building-with-local-and-alternative-materials.aspx</p> <p>Synthesize the ideas in the article with your findings. Discuss a possible recommendation for the new settlers.</p>

Day 4	For the next two days students work in groups to arrange their data in a multimedia report aimed at convincing the new settlers to use a certain material. Which materials would best conserve energy? Which materials would best withstand extreme weather conditions and related natural disasters? Reports must cite evidence from both student experiments and research. Possible platforms are Prezi.com, Keynote, Powerpoint, GooglePresentation, and Padlet.com All but Keynote and Powerpoint are free to use and require only an internet connection to access.
Day 5	Use the final day to have students share their presentation with the class or perhaps invite other classes to view the presentations. Online presentations on Prezi or Padlet may be shared more widely in the school or even in the wider community.

Assessments:

Performance Task: The Presentation will serve as the final assessment of student ability to collect, analyze and present data.

	D	C	B	A
Collect Data about Building Materials	Attempts an experiment to test thermal conductivity of a material.	Attempts and completes an experiment on at least one material's thermal conductivity. Collects data.	Attempts and completes multiple experiments on thermal conductivity of various materials. Collects and organizes data.	Attempts and completes multiple experiments on thermal conductivity of various materials. Collects and organizes data in a way that supports analysis.
Analyzing Data and Applying it to Real World Situation	Attempts to make conclusions based on experiments. Tries to connect experiment results to real life consequences.	Makes conclusions based on experiment. Connects results to real life consequences.	Makes conclusions based on experiment. Connects results to real life consequences related to building homes.	Makes thoughtful conclusions based on experiment. Connects results to real life consequences related to building homes and draws on research.
Present Findings and Conclusions in a Convincing Way	Attempts to form an opinion on best possible building materials	Forms an opinion on building materials and attempts to back it up with evidence	Forms and opinion on best building materials and backs it up with evidence from experiments	Forms and opinion on best building materials. Supports it with multiple experimental data and research.

Adaptations:

1. Access to materials

If materials prove difficult to come by records of experiments of others may be obtain online or in textbooks. If it proves impossible to stage an experiment, one may be described or a video of one may be shown.

Examples (This is why you may be uncomfortable in an aluminum house)

<http://www.youtube.com/watch?v=Fw-xwWl06dg>

http://www.youtube.com/watch?v=B532u9IM_Oc

2. Access to computers or online resources

Since you obtained these lessons there must be at least one internet capable machine in your home or school. However, if students lack these resources, they may present their findings using trifold boards, poster boards or construction paper sheets on which they will lay out their findings.

3. If students are disconnected from this challenge or unfamiliar with the idea of building materials consider the story of the Three Little Pigs as a hook to the lesson.

4. For the gamers in your audience the popular game Minecraft has various levels of building materials which show various levels of heat and water resistance within the game. A connection can illustrate that materials behave differently when subjected to heat.

5. Advanced students may want to keep track of temperature fluctuations in their homes by taking thermostat readings daily. Comparing the data and correlating it with the types of homes students live in, can provide further evidence in days 4 and 5.

Extra Credit/Additional Resources:

Prezi.com -> free web presentation software

Padlet.com → Free webspace that is easy to navigate and present information on. Quicker to learn than prezi.

<http://www.ecobuildingpulse.com/green-materials/building-with-local-and-alternative-materials.aspx> - **Article on alternative building materials**