

STEM Kit - Thermal Energy House Project

Thermal Energy House Project

Explores heat transfer, building upon the background lesson at

http://coolcosmos.ipac.caltech.edu/cosmic_classroom/light_lessons/thermal/transfer.html.

The lesson uses the engineering design process and everyday materials to show an example of conduction and convection.

Two NASA activities similarly investigate heat transfer

<http://nasawavelength.org/resource/nw-000-000-002-241/>

and

<http://www.jpl.nasa.gov/edu/teach/activity/mars-thermos/>

but this lesson is especially relevant to the students as it addresses the everyday issue of keeping a house warm. It also presents a further engineering problem, since there is a goal of keeping the heat inside the building and realistic constraints of the pricing of insulating materials, demonstrating the engineering design process found here

http://www.jpl.nasa.gov/edu/pdfs/engineering_design_process_light.pdf.

House insulation – One of the big things in 6th grade is how we use things NASA made for the space program in everyday life. These aren't lessons but all include information about how NASA has had to engineer their equipment to survive space and how they use insulators/infrared to monitor/measure.

https://spinoff.nasa.gov/spinoff2003/er_4.html

http://technology.nasa.gov/materials_and_coatings/mat-insulations.html

http://www.nasa.gov/centers/dryden/pdf/88257main_H-1779.pdf

<http://spaceplace.nasa.gov/beat-the-heat/en/>

<http://spaceplace.nasa.gov/beat-the-heat/en/>

http://science.nasa.gov/science-news/science-at-nasa/2001/ast21mar_1/

<http://science.howstuffworks.com/innovation/nasa-inventions/nasa-technology-keep-warm.htm>

<http://www.geek.com/science/geek-answers-why-does-nasa-use-so-much-gold-foil-1568610/>

Edutopia

<https://www.teachingchannel.org/videos/stem-lesson-ideas-heat-loss-project#>

Materials:

- Infrared Camera (could be checked out separately)
- Infrared thermometer (could be checked out separately)
- Balsa wood
- Hot glue guns and glue (these materials will also be used in STEM Kit #3 and #4)
- Clamp light
- Construction paper
- Various insulating materials (bubble wrap, packing peanuts, cotton balls, etc.)
- Budget sheets
- Material price list for students
- Building directions

Students will build a model house out of balsawood and construction paper. After placing the house on a clamp light, students will record temperature measurements and take a thermal image to determine where energy is being lost. Students will then be given a budget to “purchase” insulating materials. After insulating their house they will take additional temperature measurements and thermograph image to determine if they have improved the energy conservation of the home.

Total Cost of program: @\$1400.00

Most of the materials in this budget can be reused. The balsa wood and hot glue sticks would need to be replenished.

Audience and Extendibility:

I would begin teaching this program at Mountain View Intermediate School 5th and 6th grade students as part of their enrichment class. This would serve roughly 300 students per year.

These materials (especially the infrared cameras and thermometers) could be used in the HS Physical Science classes (TBD).

5th Grade Science

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- P.3.1 Explain the effects of the transfer of heat (either by direct contact or at a distance) that occurs between objects at different temperatures. (conduction, convection or radiation).
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- P.3.2 Explain how heating and cooling affect some materials and how this relates to their purpose and practical applications.

6th Grade Science

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- P.3.1 Illustrate the transfer of heat energy from warmer objects to cooler ones using examples of conduction, radiation and convection and the effects that may result.
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- P.3.2 Explain the effects of electromagnetic waves on various materials to include absorption, scattering, and change in temperature.
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- P.3.3 Explain the suitability of materials for use in technological design based on a response to heat (to include conduction, expansion, and contraction) and electrical energy (conductors and insulators).

8th Grade Science

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- P.2.1 Explain the environmental consequences of the various methods of obtaining, transforming and distributing energy.
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- P.2.2 Explain the implications of the depletion of renewable and nonrenewable energy resources and the importance of conservation.

Physical Science (HS)

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- 3.1.1 Explain thermal energy and its transfer.
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- 3.1.2 Explain the Law of Conservation of Energy in a mechanical system in terms of kinetic energy, potential energy and heat.