Nasco education LESSON PLAN

K to Career solutions

stemworks

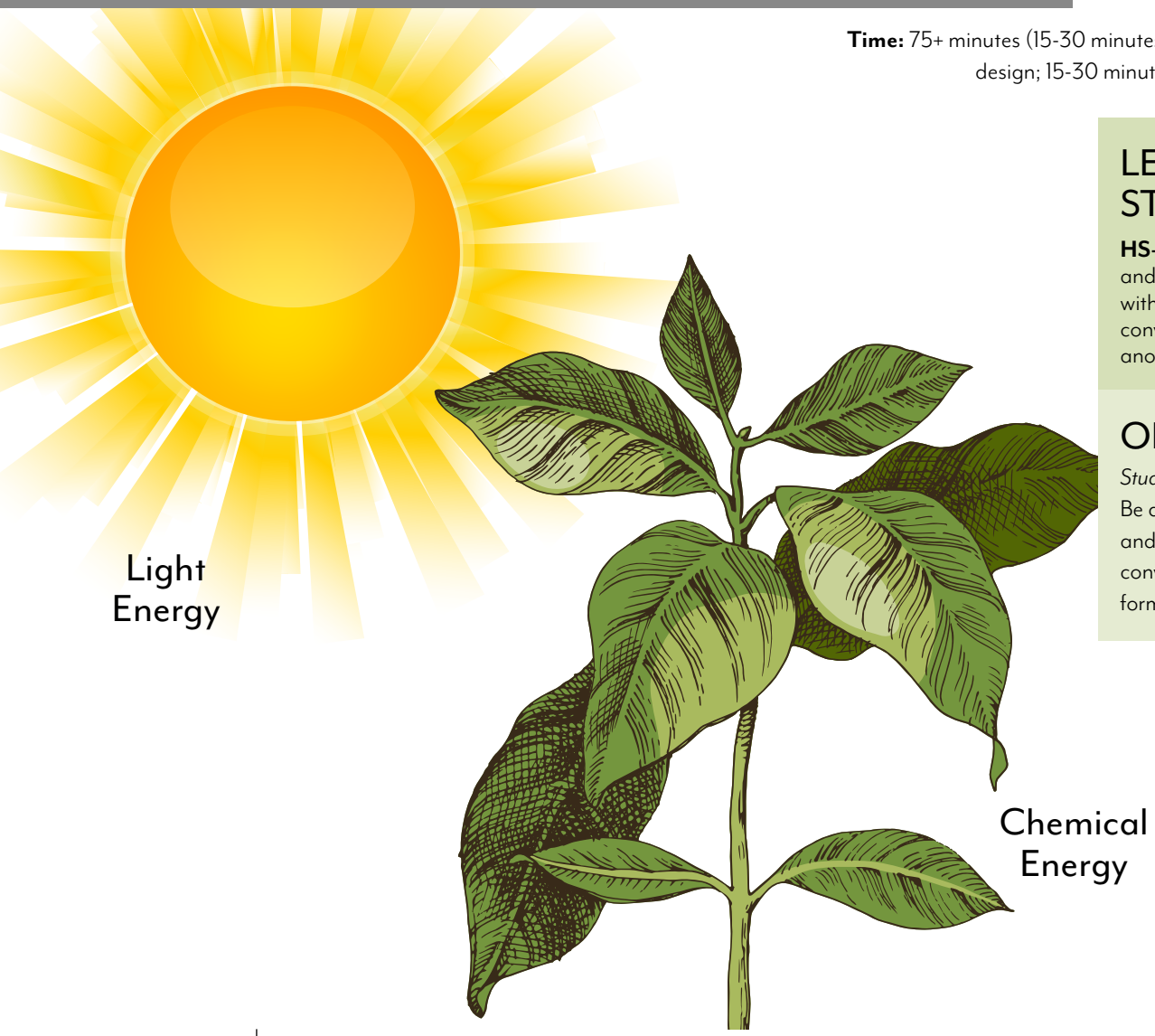
ENERGY CONVERSIONS

VOL. 24

Developed with Laura Beres

Grades 9-12

Time: 75+ minutes (15-30 minutes to research; 15-30 minutes to design; 15-30 minutes to build; 30 minutes to test)



LEARNING STANDARDS

HS-PS3-3 — Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

OBJECTIVES

Students will...

Be able to design, construct, and test a device that converts energy from one form to another.

LESSON CONTENT

- Different forms of energy include kinetic energy, potential energy, thermal energy, electrical energy, chemical energy, gravitational energy, radiant energy, mechanical energy, sound energy, elastic potential energy, light energy (solar energy), rotational energy and magnetic energy.
- Energy conversion can happen in many ways. Some of the most common and easiest to understand for students are:
  - Elastic potential to kinetic (springs or rubber bands to cause motion)
  - Thermal to chemical (cooking)
    - A more advanced conversion would be solar to thermal to chemical, which would use a solar oven to cook food.

TEACHER'S NOTES

- Students may work individually or in groups.
- Presenting the investigation ahead of time would allow students to brainstorm materials that they could bring from home.

MATERIALS NEEDED FOR SOLAR OVEN

- Large, flat cardboard box similar to an Amazon book box or pizza box
- Craft glue **(9735678)**
- Aluminum foil **(W09459)**
- Plastic wrap **(KI01037[I])**
- Duct tape **(BE01465)**
- Sheet of black paper, or something dark in color like a black oven tray **(9715511[AE])**
- Heat-proof glass bowl or casserole dish (optional, depends on design)
- Thermometer **(SB33327)**
- Stopwatch or clock **(TB14784)**
- Marshmallows, pizza dough, hot dogs, or other food that could be heated/cooked in solar oven

EXTENSIONS AND CONTENT CONNECTIONS

- Discussing energy conservation or energy efficiency could be extensions to this activity.
- Students could spend additional time converting other forms of energy following the same methods.

MISCONCEPTIONS

The following are **FALSE** statements:

- Heat energy is the same as solar energy.
- Energy can be changed completely from one form to another without losing any.
- An object at rest has no energy.
- Things "use up" energy.

MODIFICATIONS

If students are learning virtually or need to maintain safety protocol, they may use materials commonly found at home. If students are in-person at school, but material sharing could be a risk, ask students to bring materials from home for their own experiment.

SAFETY NOTES

When using anything that could be hot, exercise caution! Items left in the sun could retain large amounts of heat and using a hot pad or towels to touch and move them is advised.

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Name: _____ Period: _____ Date: _____

A Community in Crisis!

Attention High School Students: Your community is in crisis and needs your help! The power company had a major disaster and it has affected the supply. The biggest need in your community right now is a way to cook and prepare meals without the use of electricity or natural gas. Thankfully the weather forecast calls for sunny days ahead — use this to your advantage. Your community thanks you!

In this activity, you will design and create a way to convert energy from one form to another.

Pre-Lab Thinking:

1. List types of energy:

2. I am going to convert _____ energy to _____ energy by creating _____ .

Plan Your Design:

Research styles and methods of cooking with solar power using everyday materials:

What materials will you need? Create a list:

Goals for Design:

- Design is coherent and reasoning can be provided for all aspects.
- Construction is done with accuracy and is neat.
- Solar cooker reaches an internal temperature of 110°F (good), 140°F (better), 160°F (best).

Draw a diagram of your design. Add as much detail as possible to help as you build.

Trials:

First food I tried to cook was _____ .

Record observations at the following time intervals:

After 5 minutes:

After 10 minutes:

Did the food seem to finish cooking? How long did it take?

Second food I tried to cook was _____ .

Record observations at the following time intervals:

After 5 minutes:

After 10 minutes:

Did the food seem to finish cooking? How long did it take?

Conclusion: How well did your device work? What were the strengths? What were the flaws? What might be modified for next time? Did your device work as planned? Using your materials list, explain why these were used and what purpose they had.