The Amazing Coffee Keeper

Learning Goal: I will be able to…

- **Use my understanding of how energy transfer works to design and build a product that efficiently manages the transfer of energy.**

Scenario:

Every Saturday morning, your parent/guardian pours themself a cup of coffee and then they get really busy around the house. By the time they have a chance to drink the coffee, it is cold. Your parent/guardian has asked you to design a device that will keep their coffee warm until they have time to drink it.

Your Task

You are to build a device that will keep 300mL of hot water warm for at least 30 min. The device must fit easily on a kitchen table, cannot include any form of heater and must allow water to be easily poured in and out. Use materials efficiently to keep costs low (or no costs at all). All materials must be safe for use in the classroom and home.

To help you with this task, you may want to research how Thermos' are constructed and how they prevent energy transfer. You can use the videos/links under the Resources tab on my website (msdaley.neocities.org) as a starting point.

Before you begin creating, you and your group partners need to brainstorm possible solutions to this problem using your knowledge from the unit (e.g. your Science duotangs).

Once you and your group partners have brainstormed possible solutions, you will complete the following steps **IN ORDER**:

Step 1: Plan (In groups-one copy to be handed in)

- Sketch your design on a piece of paper. This should be a relatively accurate drawing and it must be neat and labelled (all materials need to be labelled).
- Write a list of materials and tools that you will need. Remember, it's best to reduce, reuse and recycle!
- Write a step-by-step procedure for creating the device.
- Once you have written your materials and procedure, please show me for approval.

Due on: Nov. 7th

Step 2: Build your Device (In groups- one device)

- Once you have been given approval for your plan, you may begin to create and build your device.

Due on: Nov. 12th

Step 3: Test (As a class. One copy of observation notes to be handed in for you and group)

- Once all devices are built, we will test your devices to see if they work!
- We will pour boiling water into your device and measure the temperature. You must record this temperature.
- Once the temperature is measured, we will leave it for 15 min then retest and then leave it for another 15 min and take a final temperature.
- We will then retest the temperature and record our temperature
- During this time, you should be filling out the observation page about how the water temperature changed (if it did) and any problems that occurred (ex. Leaking or heat escaping)
- Hand in your observation page upon completion of the experiment

Experiment Day: Nov. 17th

Step 4: Evaluate (Independent. Each of you will hand in your own copy)

- This part will be your **INDEPENDENT** portion of the task
- Please answer the following questions in complete sentences and using detail:
    - Describe how your device prevented energy loss by:
        - Conduction
          and/or
        - Convection
          and/or
        - Radiation
            - Use your duotangs to help you with this aspect **AND** your own understanding
    - What were some of the design challenges that you encountered? How did you overcome them?
    - Was your device successful or unsuccessful? Why? Provide specific examples.
    - If you were to do this project again, what would you do differently? Explain.

Due on: Nov. 27th

****This project will be done in stages and it is very important that you adhere to the deadlines.****

Upon the final due date, you will hand in <u>ALL TOGETHER,</u> your sketch, your procedure (with the materials written), your observations from the <u>test</u> stage, the written portion of your questions, the rubrics and your device!

<u>Teacher Assessment</u>

	Level 1 (0-1 mark)	**Level 2 (2-4 marks)**	**Level 3 (5-7 marks)**	**Level 4 (8-10 marks)**
Knowledge/Understanding -Explains how their device prevented energy loss through conduction, convection and/or radiation	-Simple explanation that shows limited understanding of energy loss prevention	-Partial explanation that shows some understanding of energy loss prevention	-Considerable explanation that shows considerable understanding of energy loss prevention	-Complete and detailed explanation that shows thorough understanding of energy loss prevention
Inquiry -Develops and follows a plan -Safe use of equipment -Creates a device that prevents energy loss -Explains what worked and what didn't	-Develops and follows a limited plan -Needs frequent reminders about safety -Device does not hold the heat -Does not explain what was successful and unsuccessful	-Develops and follows some aspects of an adequate -Needs some reminders about safety -Device holds some heat -Somewhat explains what was successful and unsuccessful	-Develops and follows an appropriate plan -Needs a few reminders about safety -Device holds heat most of the time -Explains what was successful and unsuccessful in a considerable manner	-Develops and follows an appropriate, detailed plan -Needs no reminders about safety -Device holds heat the whole time -Explains what was successful and unsuccessful thoroughly
Communication -Clarity and precision of work -Uses appropriate science terminology -Clarity with discussion of experiment results and how energy loss was prevented	-Presents a limited number of ideas and details with little clarity -contains few appropriate science terms -provides limited discussion of experimental results and how energy loss was prevented	-Presents ideas with some clarity but little detail -contains some appropriate science terms -provides very little discussion of experimental results and how energy loss was prevented	-Presents most of the main ideas and details clearly -contains appropriate science terms -provides detailed discussion of experimental results and how energy loss was prevented	-Presents all of the main ideas and details thoroughly -contains appropriate science terms -provides detailed and concise discussion of experimental results and how energy loss was prevented

Observations for Experiment

Purpose:

_____

Materials:

Hypothesis/Prediction:

_____

_____

_____

Steps:

1.
2.
3.
4.
5.
6.
7.
8.

Temperature at Start	Temperature at 15 min	Temperature at 30 min

Analysis

1. **What did you observe during this experiment?**

   _____
   _____
   _____
   _____

2. **What happened with the temperature during the experiment?**

   _____
   _____
   _____

3. **Why do you think this happened to your temperature? Were there problems with your device or experiment? If not, why do you think the temperature raised?**

   _____
   _____
   _____
   _____
   _____
   _____

Picture of your Device