Lesson 2: What's inside the MRE flameless heater that's making it warm?

Navigation

We ended up with a lot of questions and ideas to investigate last class! Let's prioritize where it makes sense to go next. To help us with that, let's recall what we accomplished last class.

With your class

1. Think about the work we did last class.
    - What did we decide to design last class?
    - What did we have to do to get the heater to start warming up?

2. Discuss with your classmates.
    - Since we are trying to make our own version of a flameless heater, how could figuring out how this one works help us with our designs?

Look Inside a Flameless Heater

In your notebook

3. Watch the video of a flameless heater from an MRE being cut open and dumped out into a container.
    - What do you notice?
    - What do you wonder?

Analyze the MRE Heater Ingredient List

With a partner

4. Look at the *Ingredient List for the MRE Flameless Heater* found in your student guide with a partner. Discuss the following questions:
    - Do you recognize any of the ingredients?
    - Based on the ingredient descriptions, which substances are NOT likely to be the one(s) that cause the heater to get warm?

Then, share you thinking with the whole class.

Plan Our Experiment

Turn and talk

5. Turn and talk with a partner about the following questions:
    - What data should we collect?
    - How much of each substance should we combine?

Then, share your thinking with the whole class.

Carry Out the Experiment

With your group

6. Will salt and water heat up when combined? Follow the procedure for our investigation in your group.
    - Gather supplies: coffee cup with lid, thermometer, scale, timer or clock.
    - Weigh 4 grams of salt on a digital scale.
    - Measure 4 mL of water.
    - Put the 4 mL of water inside the coffee cup.
    - Record whatever data your class decides on.
    - Clean up your lab space when finished.

Remember to follow the safety guidelines:

- Wear goggles, non-latex gloves, and an apron during setup, investigation, and cleanup.
- Secure loose clothing, remove loose jewelery, tie back long hair, and wear close-toed shoes.
- Avoid touching your face (so substances don't get near your nose/mouth); never taste any substance in the lab.
- Move carefully so that we don't spill anything, and immediately wipe up any spills that do happen.
- Follow instructions for cleanup, and wash your hands with soap and water after cleanup is complete.
- Only combine substances and amounts our teacher tells us to so that we don't accidentally create harmful reactions, explosions, vapors, etc.
- Use caution when working with heated liquids - they can burn skin.

Set Up Your Notebook for Our Next Investigations

In your notebook

7. Finish recording the results of your salt + water combination and clean up.
8. Create another data table, like the one you used for salt + water, but for iron + water.
9. Create a third data table for magnesium + water.

Combine Other Ingredients with Water

With your class

10. As your teacher demonstrates combining water with iron and water, record temperatures and other observations in your notebook. Then, also record data as you watch the video of combining magnesium and water.

Building Understandings Discussion

With your class

11. Discuss the following question with your class:
    - What did we figure out from our investigations today?

Add to Your Progress Tracker

In your notebook

12. We just did something else that engineers do! Add a new row to your Progress Tracker. Update your Progress Tracker individually to capture what we have figured out that can help us with our designs.

Navigation

With your class

13. Discuss the following question as a class:
    - What are we wondering now?