

Activity 5.4: Grading the Explaining Combustion of Propane

This tool has “grading” in the title because at this point, students can be held accountable for correct answers. Level 4 (correct) responses to the questions are in **blue bold italics** below.

Red italics suggest ways to grade student responses by giving them points for correct or partially correct answers. There are 19 points total on this worksheet.

Read about propane, then answer the questions below.

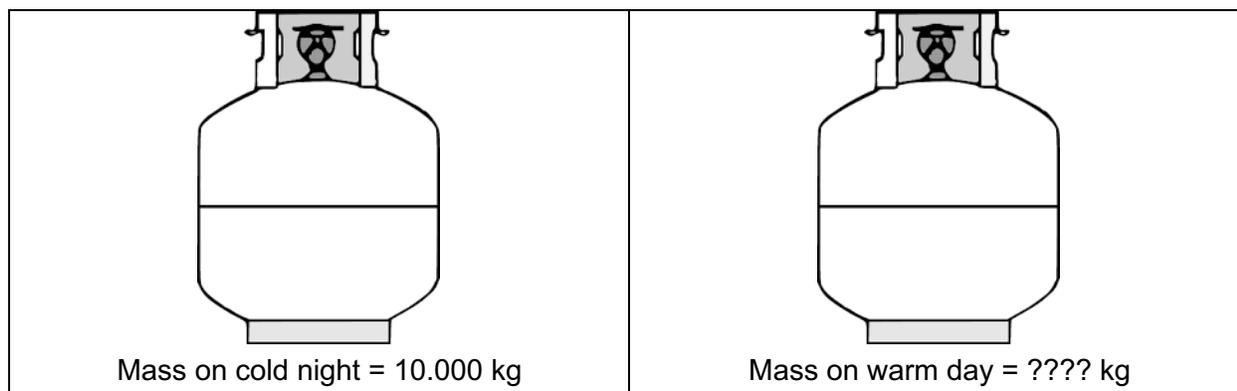
1. Explaining how propane burns. Write a paragraph about how propane burns in the flame of a gas grill. Be sure to answer the four numbered questions on your Three Questions handout.

Level 4 responses should include answers to each of the four numbered questions on the Three Questions poster and handout:

- 1. Matter movement: The propane and air are mixed and leaves holes in the burner tube. There is a spark that starts them burning outside the tube.**
- 2. Matter change: The atoms in the oxygen and propane to form carbon dioxide and water.**
- 3. Energy change: Chemical energy in the C-C and C-H bonds is transformed into light and heat energy, which heats up the air around the flame.**
- 4. Matter movement: Carbon dioxide and water leave the flame.**

1 point for answering each of the Three Questions. 4 points total

2. What happens to the mass? Think about a propane tank sitting outside with its valve closed, so no molecules can get into or out of the tank. On a cold night, almost all the propane in the tank condenses into a liquid. Its mass on the cold night is exactly 10.000 kg. The next day is warmer, so some of the liquid propane evaporates, but the propane gas stays inside the tank. What will happen to the mass of the tank?



Here are three predictions about what will happen to the mass:

- A student, Samantha, claims: “Some of the heavier liquid propane changed into a lighter gas, so the mass of the tank will be a little bit less than 10.000 kg.”
Circle one: AGREE **DISAGREE**
- Another student, Latoya, claims: “No matter entered or left the tank, so the mass will stay exactly the same: 10.000 kg.”
Circle one: **AGREE** DISAGREE

- Another student, Maria, claims: "Some heat energy was added to the tank, so the mass during the day will be a little bit more than 10.000 kg."

Circle one: AGREE **DISAGREE**

1 point for each correct answer. 3 points total.

Explain your reasoning for your choices.

Level 4 responses should include:

- **Samantha's claim is incorrect, because the number of atoms is the same so the mass will be the same.**
- **Latoya's claim is correct, because the mass stays the same if no atoms are added or removed.**
- **Maria's claim is incorrect, because energy cannot become matter, and energy does not have mass.**

1 point for correct reasoning for each claim. 3 points total.

Choose ONE claim above that you agree with. Explain how this claim could be further tested to offer evidence that better supports the claim.

A Level 4 response might offer a test that "followed all the rules" and that was focused on tracing matter from outside the tank to inside the tank (or within the tank).

- *1 point for tests that address the Matter Movement Question, identifying how atoms move into or within the tank.*
- *1 point for tests that address the Matter Change Question, identifying a process that brings atoms into the tank (or changes atoms in the tank).*

2 points total.

3. Where does the matter from burning propane come from?

When propane burns, water vapor and carbon dioxide forms. Where does the water vapor and carbon dioxide come from? Select True or False for the following statements:

T **F** Some water vapor and carbon dioxide *comes from the air*

T **F** Some water vapor and carbon dioxide *is created* by the propane

T **F** Some water vapor and carbon dioxide *comes from the propane*

T **F** Some water vapor and carbon dioxide *comes from the person* who burns the propane

1 point for each correct answer. 4 points total.

Explain your choices. Where does the water vapor and carbon dioxide from the propane come from?

Level 4 responses clearly recognize that the carbon dioxide and water vapor come from the propane's matter.

2 points for correct answer.

4. Something interesting about propane What is something interesting that you learned about propane?

Level 4 responses will provide something interesting about propane from the reading.

1 point for correct answer.