

# Plasma Grape

**Overview:** You've heard about solids, liquids, and gases, but is there anything else out there? It's time to learn about plasma! Plasma makes up most of the matter in the universe, since most of it is inside of stars, and stars make up most of the matter we can detect with our eyes.

**What to Learn:** Clouds of gas are made up of wiggly, jiggly atoms that dance all over the place. When gases are heated, more energy is added and this makes those molecules dance around even harder. When this happens, they collide with each other more often, knocking electrons off here and there. Those naked electrons and charged ions give the gas different properties than the original gas. So scientists call this new highly energetic gas *plasma*.

## Materials

- microwave (not a new or expensive one)
- green grape
- red grape
- cherry tomato
- a knife with adult help

## Experiment

1. Carefully cut the grape lengthwise almost in half. Make sure to leave a bit of skin connecting the two halves.
2. Open the grape like a book, so that the two halves are next to one another still attached by the skin.
3. Put the grape into the microwave with the outside part of the grape facing down and the inside part facing up.
4. Close the door and set the microwave for ten seconds. You may want to dim the lights in the room.
5. Repeat with other items.

**Note:** This experiment creates a momentary, high-amp short-circuit in the oven, a lot like shorting your stereo with low-resistance speakers. It's not good to operate a microwave for long periods with little to nothing in them. This is why we only do it for a few seconds. While this normally isn't a problem in most microwaves, don't do this experiment with an expensive microwave or one that's had consistent problems, as this might push it over the edge.

## Plasma Grape Data Table

Item	Results
Green grape	
Red grape	
Cherry tomato	

## Reading

There are three well-known states of matter, which are solids, liquids, and gases. Plasma is the fourth state of matter. Note – this is NOT the kind of plasma doctors talk about that is associated with blood. Other places you can find plasma include neon signs, fluorescent lights, plasma globes, and small traces of it are found in a flame.

The textbook definition says plasma is an ionized gas. What does that mean? Plasma is formed when enough energy is added (often in the form of raising the temperature) to a gas so that the electrons break free and start zinging around on their own. Since electrons have a negative charge, having a bunch of free-riding electrons causes the gas to become electrically charged. This gives some cool properties to the gas. Anytime there are charged particles like electrons off on their own, they are referred to by scientists as *ions*.

Plasma is HOT HOT gas, and in this case, HOT HOT air, with a bit of water vapor. Grapes work well for this experiment because grapes contain high quantities of juice that conducts electricity. The grape halves are like little cups full of this conductive juice connected by a tiny bridge (the part that isn't cut all the way through). When you hit the ON button on the microwave, the energy being shot at the grape moves the electrons across the bridge very quickly, which heats up the bridge until it bursts into flame... and when this happens, the electrons that are traveling through the flame arc across and ionize the air around the grape and a burst of bright plasma shoots up. If you watch carefully, you will see two flames shoot up, not one.

### Exercises

1. Describe in detail what you observed in the plasma grape experiment. Was there a flame? What color was it? About how high did it go? How long did it last?
2. What are the four types of matter?
3. The textbook definition of plasma is “an ionized gas.” What does this mean in plain English?
4. Why do you think it was necessary to make sure there was a bit of skin connecting the two halves of the grape? What do you think happens to the electrons traveling across this “bridge?”

## Answers to Exercises

1. Describe in detail what you observed in the plasma grape experiment. Was there a flame? What color was it? About how high did it go? How long did it last? (answers will vary but should include good details)
2. What are the four types of matter? (solid, liquid, gas, and plasma)
3. The textbook definition of plasma is “an ionized gas.” What does this mean in plain English? (gas that has been heated enough so the electrons break free and zoom around)
4. Why do you think it was necessary to make sure there was a bit of skin connecting the two halves of the grape? What do you think happens to the electrons traveling across this “bridge?” (The electrons move across this bridge of skin very quickly until they burst into flame, which is what ionized the air around the grape and caused the plasma to form.)