

Scientific Lemons

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When life hands you lemons, do some science experiments with them!

1. Dancing Lemon Seeds (S, B, G)

This is a simple experiment that younger girls can do easily. Any carbonated beverage will work, but it is easier to see what is happening if you use a clear one. The beverage must be fresh; the experiment won't work if it has started to go flat. Divide the girls into pairs so everyone can participate.

What you need (for each pair):

- A clear glass filled with a clear carbonated beverage.
- Two or three lemon seeds

What to do:

Drop the lemon seeds into the drink. Watch what happens.

What is happening? The lemon seeds sink to the bottom, rise back up to the top, and then sink again. If you look closely, you should be able to see why.

A seed sinks at first because it is too heavy to float in the drink. While it is sitting on the bottom of the glass, notice all the little bubbles that collect around it. Those bubbles are carbon dioxide, the gas that gives the drink its fizz. When the seed collects enough carbon dioxide bubbles to float, the bubbles carry it up to the surface. Once there, though, the bubbles escape into the air, and the lemon seed sinks again.

2. Invisible Ink (S, B, G)

Write secret messages to your friends in this simple experiment.

What you need (for each girl):

- Lemon juice
- Q-Tips
- Paper
- Lamp (not a fluorescent light) (girls can share)

What to do: Dip a Q-Tip into the lemon juice, and write a message (or draw a picture) on the paper. When the juice dries, it will be invisible.

Hold the paper, with its invisible message, close to a light bulb that is turned on. Be careful not to touch the light bulb; it will be hot! What happens?

What is happening? The message appears in brown or black “ink”! Lemon juice contains something called organic compounds, which in chemistry means chemical compounds that contain carbon. In their natural, juicy form, these organic compounds don’t have much colour. When you heat them, they break down and produce pure carbon. Carbon is dark (think of coal), so you can see it on the paper.

Did you know? Fluorescent lights don’t work as well for this experiment as regular incandescent light bulbs, because they don’t produce as much heat. Incandescent bulbs are not very efficient: only some of the electricity that they get is turned into light. The rest is wasted as heat. That is useful for this experiment, but bad for our limited energy resources!

3. Lemon Battery (G, P)

This is a fun way to learn a little bit about electricity. The experiment is safe; a lemon battery does not produce enough electricity to hurt you. And you can eat the lemons (or make lemonade out of them) afterwards.

What you need (for each girl):

- Lemon
- Two pieces of copper wire about 15 cm long. 20- or 22-gauge wire works well.
- Large stainless steel paper clip
- Small knife (girls can share)
- Needle-nose pliers (girls can share)

What to do: If the wires have a plastic insulating coating, use wire strippers or nail clippers to remove about 2 cm of the coating from each end, exposing the copper wire inside. (For younger girls, or if you are short of time, do this step in advance.)

Wrap an end of one wire tightly around a loop of the paper clip. If you need to, pinch it with the pliers to make sure it is in close contact with the paper clip. The wire should be at one end of the paper clip. Cut a small slit in the lemon, all the way through the rind into the fruit itself. Push the paper clip into the slit.

Push one end of the other wire into the lemon, about one centimetre away from the paper clip. Push it straight in, parallel to the paper clip, so that the wire and the paper clip are close together but not touching inside the lemon.

Put the free ends of both wires on your tongue. They should be close together but not touching each other. Can you feel the electricity? You should get a slight tingling sensation and a metallic taste on your tongue. If aren’t sure you can feel the electricity, compare the sensation and taste with just one wire touching your tongue.

What is happening? You’ve made a battery! The juice in the lemon creates a chemical reaction between the bare copper wire and the paper clip. Small, electrically-charged particles called electrons move from one metal to the other, creating an electric current.

When you put the wires on your tongue, the electric current flows up one wire, through your saliva, then through the other wire back to the lemon. This is a very simple electric circuit.

Note: this experiment is safe; you won't be electrocuted or even get a bad shock. The lemon battery only provides about 0.3 or 0.4 volts of electricity—much less than the batteries you use in a flashlight. You have to concentrate quite hard to feel the electricity on your tongue. **DO NOT** try this with a real battery, or by sticking wires into an electrical outlet.