

# Make a Reflector Oven

**Estimated Time:** 45 minutes to build, 30 minutes to modify, plus time for your favorite recipe to bake!

**SUMMARY:** Fall is a time for bonfires and roasting marshmallows! Create a reflector oven that uses radiant heat instead of direct heat to cook your food. Reflector ovens are designed to enclose your food on three sides to capture the heat and reflect the heat back onto your food. This oven uses energy in the form of heat from a fire, unlike the solar cooker we made a few weeks ago which uses energy from the sun. If you are interested in that activity, check it out using this [link](#). There are two designs in this experiment. Students might consider modifying their design and changing the setup to minimize heat loss and decrease cooking time.

## WHAT YOU'LL LEARN

- The transfer of energy from heat source to food allows for cooking to occur.
- Modify the basic design to maximize thermal energy transfer.

### Materials Used:

- Heavy duty foil
- Cardboard box (big enough to fit a 9x13" dish)
- Aluminum baking tray or portable grill tray
- Scissors
- Aluminum tape
- Spray glue (optional)
- Cookie cooling rack or empty metal cans
- Baking dish that can withstand heat or cookie sheets
- Safe area for a wood fire
- Bricks or landscaping blocks
- Charcoal briquettes (optional)
- Thermometer
- Method of timing - clock, stopwatch, or app
- Hot pads
- Ingredients for your favorite bar cookie, casserole, cookies, frozen casserole, premade cookie dough, or canned biscuits

### Safety considerations:

- Always keep an eye on your fire. Have a bucket of water or other sources of water nearby in case of fire emergencies.
- Only use oven safe bakeware (safe to at least 500°F)
- Always assume things in and around the reflector oven are hot. Handle everything with hot pads or oven mitts.
- Children should be under adult supervision for this experiment.
- Temperature test all food items before consumption.
- Do not use the charcoal oven indoors - it produces carbon monoxide.
- Check local ordinances to make sure it is legal for you to start a small campfire where you are.

- Check local burn conditions to make sure it is safe to start a small campfire. Weather conditions, such as drought and heavy winds can cause forest fires. Please only start a fire if it is safe.

### WHAT TO DO

1. Your cardboard box needs to be open on one side. Completely cover the rest of the cardboard with aluminum foil - make sure all the cardboard is covered so that it won't burn. Use your aluminum tape to go over the edges. If you are using spray glue it can help adhere the foil to the cardboard.

### Design One: Using an open fire:

2. Once your box is covered, find a safe place near your fire to set up your oven. You will need to be able to access the oven, but it needs to be close enough to radiate the heat from the fire.
3. Use the blocks or bricks to elevate one side of your box so that you can angle the box to capture heat from the fire.
4. Set your aluminum tray on blocks or on the ground. Place your baking sheet or baking dish on the aluminum tray and spray with non-stick cooking oil.
5. Place your dough on the tray and mark the time and temperature on the baking sheet
6. Let the dough bake undisturbed for approximately 10 minutes. After 10 minutes, observe the dough - is there a color change? Take the thermometer and measure the temperature in the same place as you did previously. What is the change in temperature?
7. When your baking is done, mark the time and eat your reflective baked food!

### Design Two: Using Charcoal:

8. Carefully take your reflector oven away from the fire. Let it cool down.
9. Find a location on concrete or gravel to set up your charcoal reflector oven.
10. Place a sheet of foil down and set two bricks or blocks to keep the foil down. This will also help support your reflector oven.
11. Get about 10 charcoal briquettes and place them on your aluminum tray. Set your baking rack on top of the charcoal so it is not touching the charcoal. If your cookie rack does not have legs, prop it up on the bricks or blocks.
12. Carefully light the charcoal (DO NOT use lighter fluid!)
13. Place your baking dish or cookie sheet on top of the cookie rack and measure the temperature.
14. Place your reflector oven over it. Make sure the reflector oven is sitting on the blocks or bricks you placed on the foil sheet so there is ventilation for the charcoal.
15. Keep an eye on your oven but try not to peek at your food for at least 15 minutes. A lot of heat is lost when you lift the box lid. After 15 minutes, check your food for color changes and the temperature.
16. When baking is done, mark the time and eat!
17. Looking at the two designs, which design provided the maximum heat transfer from the energy source (fire or charcoal) to the food? How could you improve one of the designs, or create an entirely new design based on what you observed?

### TIPS

- Experiment with covering your charcoal oven with a small towel or natural fiber blanket. Make sure it does not cover the ventilation in the bottom of the oven.

- How could you modify the oven to maximize heat retention but still be able to keep an eye on the food as it bakes?
- Pick an easy to bake item - canned biscuits or crescent rolls are an easy item to gauge the effectiveness of energy transfer from your heat source.
- A good reference for oven temperature is 1 briquette for every 35 degrees desired. Generally, they will generate heat for about 45 minutes.
- Use a reflector oven and a solar oven on the same day - which is more efficient at heat transfer? Which would you prefer to use?