

MATERIALS

- Small propane camping stove and lighter
- Fresh broccoli shoots from the garden
- 1 large bowl, 4 tsp salt, 1 gallon water, measuring spoons, paper towels
- Paring knife, cutting board, wire strainer
- 1 large pot and lid
- 1 large bowl filled with cold water & ice
- 6—12 freezer bags and straws, masking tape and a permanent marker

PREPARATION

- Assure that there are enough broccoli side shoots in the garden for the activity

PROCEDURE

Step 1: Preparing Broccoli (for a small group)

- Select a small group to harvest tender broccoli side shoots from the garden. Snap side shoots off at the base and remove the leaves. Bring inside.
- Inspect broccoli for insects (especially aphids and imported cabbage worm). Rinse broccoli under fast running water. Pat dry with paper towels and set aside.

Step 2: Blanching Broccoli

- Before cutting the broccoli, fill the large pot with water (about $\frac{2}{3}$ full) and bring it to a boil.
- Using a paring knife and cutting board, cut the broccoli into small florets no larger than 1 – 1 ½ inches across.
- Fill the large bowl with cold water and ice. Set aside additional ice.
- Submerge the broccoli in the boiling water and blanch for 3 minutes. Have the students keep track of time.
- Drain the broccoli using a wire strainer. Immediately place the broccoli in the bowl full of ice water to cool. Add more ice if necessary. Let broccoli cool for 3 minutes. Drain thoroughly and pat dry.

Step 3: Freezing Broccoli

- Distribute hand sanitizer and divide students up into groups. Give each group a freezer bag and straw.
- Have students place blanched and cooled broccoli in freezer bags.
- Remove the air to prevent drying and freezer burn. To do so, zip the top shut but leave enough space to insert the tip of a soda straw. When straw is in place, remove air by sucking the air out. To remove the straw, press straw closed where inserted. Press the bag closed as you simultaneously remove the straw.
- Label and date the freezer bags with masking tape and a permanent marker
- Place bags in the freezer. Lay flat to freeze. Use frozen broccoli within 12 months.

ENGAGE

Cut an apple to illustrate effects of enzyme action. Have students observe how the apple slice turns progressively browner after being cut and exposed to air. Explain how enzymes act on the exposed apple, slowly breaking it down over time. The brown color is evidence of enzyme action.

OBJECTIVES

- Students will understand the benefits of freezing and refrigerating food
- Students will understand how lowering the temperature of food slows bacteria and enzyme action, thus affecting a food's rate of deterioration

EXPLAIN

Why do we refrigerate and freeze food?

All fruits and vegetables contain enzymes and bacteria that, over time, break down and change the color, flavor, and texture of food. As foods are broken down, their nutrient content also diminishes. We can keep foods fresh for longer periods of time by storing them refrigerator or freezer. Colder temperatures inhibit the activity of enzymes and bacteria, slowing the rate of deterioration. Freezing and refrigeration only slow the rate of deterioration, they do not stop it completely. Therefore, food cannot be kept fresh in cold storage forever. Eventually, enzymes and bacteria will break a food down, rendering it un-fit for consumption.

Our broccoli requires a brief heat treatment called blanching before it can be sent to the freezer for long-term storage. During this processes, broccoli is briefly submerged in boiling water and then rapidly cooled in a bowl of ice water. Blanching raises a food's temperature as fast as possible, destroying certain enzymes and bacteria while helping to preserve the color, texture, and flavor of the food. It also helps retain certain nutrients, like vitamin C. Food only needs to be blanched for a short amount of time. Overcooking it diminishes taste, texture, appearance, and nutrient content. Blanching time for broccoli is 4 minutes - this duration is just long enough to stop the action of the enzymes and kill the bacteria, but short enough to preserve the freshness of the food.

http://www.fsis.usda.gov/factsheets/focus_on_freezing/index.asp#3

ADDITIONAL CONTENT INTEGRATION *(see previous page)*

30 minutes prior to the start of the lesson, cut one slice from an apple. Label the apple slice with the time cut and set it aside. Repeat this process every 10 minutes. During the engage activity, students can compare older apple slices with a freshly cut sample. If possible, cut an apple slice the night before for a more extreme contrast.

Additional Materials

- Apple, cutting board, knife

EVALUATE

Journal prompt: How does storing food at colder temperatures prevent food spoilage?