## Food Explorations Part II:

# Hidden Antioxidants

**STUDENT LAB INVESTIGATIONS**

**Name:** _____

## Lab Overview

In this investigation, you will prepare four solutions and test them with an indicator to determine their antioxidant properties.



## Lab Objectives

*In this lab, you will learn how to…*

1. Identify substances with antioxidant properties.

2. Describe health benefits of antioxidants.

**Lab Safety: Before beginning ANY investigation you should put on your safety goggles and apron. It is important to avoid getting chemicals on your body. Always wash your hands following completion of an investigation. When handling food, you should also wash your hands prior to beginning an investigation.**

## Lab Questions

Which of the following substances are antioxidants? (Circle your answer)

Vitamin C  Cream of Tartar  Lemon Juice  Vinegar

**Predictions:** I predict the following substances are antioxidants.

_____ and _____ because…



# Observations of Antioxidants

## MATERIALS

1 acidic substance
1 beaker or measuring cup containing water (350mL or 1 cup)
1 – 9 oz plastic cup
1 black permanent marker
1 medicine dropper
1 plastic spoon
1 medicine cup or small cup containing colored iodine
½ teaspoon
Safety goggles
Aprons (optional)

## PROCEDURE

1. Choose one of the acidic substances identified in your prediction above. Use the marker to label the plastic cup with the name of your chosen acid sample (e.g. vitamin C).

2. Prepare your substance using the directions provided below:

**Substance Preparation Procedures**

- Vitamin C Tablet: Obtain 1 vitamin C tablet. Fill the cup ½ full of water. Crush the tablet and dissolve it in the water.
- Cream of Tartar: Obtain ½ tsp. of cream of tartar in a 9 oz cup. Fill the cup ½ full of water. Stir the mixture until the cream of tartar has completely dissolved.
- Lemon Juice: Fill one 9 oz cup ½ full of lemon juice.
- Vinegar: Fill one 9 oz cup ½ full of vinegar.

3. Describe your *visual* observations of your chosen acid sample before reacting with iodine in Table A.

4. To test for antioxidant properties of each acid substance, use the medicine dropper to add 12-15 drops (do not exceed) of iodine to each sample. Describe your *visual* observations of your chosen acid sample's reaction with iodine in Table A. A solution *with* antioxidant properties will not change color. A solution *without* antioxidant properties will have a brown tint.

5. Share your data with the other groups in your class to complete Table A.

**Table A: Substance Observations**

| Substance | BEFORE Reacting with Iodine | AFTER Reacting with Iodine | Antioxidant Properties? |
|---|---|---|---|
| **Vitamin C Tablet Solution** | Clear | Iodine disappeared; solution is clear | (YES) NO |
| **Cream of Tartar Solution** | Clear | Iodine turned the solution golden yellow | YES (NO) |
| **Lemon Juice** | White, Cloudy | Iodine disappeared; solution is still white and cloudy | (YES) NO |
| **Vinegar** | Clear | Iodine turned the solution dark (or golden) yellow | YES (NO) |



## Conclusion:

1. Compare and contrast the four acid samples and their chemical reactions.

Vitamin C Tablet Solution and Lemon Juice reacted the same as each other and differently than Cream of Tartar Solution and Vinegar.

2. Which acid substances had antioxidant properties? Compare your results to your predictions and explain any similarities and differences.

Vitamin C and Lemon Juice have antioxidant properties. Comparison to predictions will vary based on student predictions

3. Explain why the orange in **Part I: Enzymatic Reactions** investigation did not turn brown?

The orange did not turn brown because it contains Vitamin C, which is an antioxidant that will prevent enzymatic browning from occurring.

4. All the substances tested in this investigation were acids. Infer why they are not all antioxidants.

Student responses will vary. Acids are substances that have a high concentration of hydrogen ions (H+). While, antioxidants are substances that can prevent the transfer of H+ ions to oxidize other substances (e.g. free radical) in the body that can be potentially harmful. pH and antioxidant are not interchangeable. pH measures hydrogen ion concentration. "Antioxidant" refers to the reducing power of a compound (i.e. potential of donating electrons). Some antioxidants are acidic, but not all acids are antioxidants. For example, lemon juice is acidic and contains the antioxidant vitamin C. Cream of tartar is also acidic, but it does not contain any antioxidants.



5. Lemon juice (pH 2) is more acidic than vinegar (pH 3). Vitamin C has a slightly lower pH than vinegar. Some fruit salad recipes have yogurt as an ingredient. Yogurt contains lactic acid (pH 2.4). Will the yogurt act as an antioxidant? Explain.

pH and antioxidant are not interchangeable. pH measures hydrogen ion concentration. "Antioxidant" refers to the reducing power of a compound (i.e. potential of donating electrons).

6. As a class, discuss antioxidant properties and the potential benefits to your health.

Antioxidants aid in the prevention and repair of cells damaged from oxidation. It is important to eat foods containing antioxidants to help keep our bodies healthy and to treat and prevent the stress caused by oxidation. Antioxidants can be found in fruits, vegetables, grains, nuts, and spices. Including these foods in our diets may help prevent diseases, such as cancer and heart disease.