

# Measuring Sugar in Fruit Using a Refractometer

**Grade Level:** 6th - 10th; **Type:** Earth Science

## Objective:

Students will learn how astringent, mealy, hard fruits become sweet, soft, and aromatic. Through research work, they will learn about the ripening process. Through experimental work, they will analyze the increased sugar content in ripe fruits.

## Research Questions:

- How does a fruit become ripe?
- What happens chemically when a fruit ripens?
- How does the sugar content compare between ripe and unripe fruit?
- Why are unripe fruits mealy and ripe fruits sweet?



The ripening of fruit is a complex procedure. Release of ethylene gas triggers whole families of enzymes, including amylases, kinases, hydrolases and pectinases to work their magic and neutralize acids, form anthocyanins that give colors to fruit, and soften hard, inedible fruits into toothsome, delicious ones. One critical element of the ripening involves the conversion of starches to sugars. Farmer use refractometers to use monitor this process and measure sugar content. This helps them know when to harvest crops.

You can use a refractometer to measure sugar content in upripe and ripe bananas and evaluate how important the formation of sugars is in the ripening process. If other unripe fruits are available, expand this study to include these other fruits.

## Materials:

- Unripe bananas – (purchase the same day you start the experiment)
- Refractometer
- Graph paper

## Experimental Procedure:

1. Select five green, unripe bananas that are nearly identical with respect to size and color.
2. Read the directions for using the refractometer.
3. Cut a three-inch length off one banana and mash it with a fork or run in through a blender or juicer.
4. Put the banana pulp from the three-inch section into a cheesecloth and squeeze out a few drops of liquid.
5. Test the liquid that you extracted using the refractometer. Record your results, noting the date, the fruit, the appearance of the fruit and the sugar content.
6. Repeat steps 3 through 5 at least once with the remainder of the banana. All of these readings are your “Day One” results. Average them together.
7. Repeat steps 3 – 6 for the next four days. By day five, you should have no more bananas.
8. Graph your results. The y-axis can represent the refractometer readings and the x-axis can represent time.

**Terms/Concepts:** Ripening; Ethylene gas; Enzymes; Conversion of starches to sugars; Brix meter (refractometer); Abscission zone

## References:

### Books

Stuppy, Wolfgang and Rob Kessler. Fruit: Edible, Inedible, Incredible. Firefly Books, 2008

McGee, Harold. On Food and Cooking: The Science and Lord of the Kitchen. Collier Books (1984)

### Websites

Chemistry Lab Techniques: Refractometry

<http://www2.ups.edu/faculty/hanson/labtechniques/refractometry/intro.htm>

Ross Koning: Fruit Ripening

[http://plantphys.info/plants\\_human/fruitgrowripe.shtml](http://plantphys.info/plants_human/fruitgrowripe.shtml)