Photo © Valentyn Volkov.

How Much Water Is in a Fruit?

The Science of Water: Activity 6

Nancy Moreno, PhD.
Barbara Tharp, MS.

Center for Educational Outreach

Baylor College of Medicine

BioEd Online

How Much Water Is in a Fruit?*

**Previously entitled, "All Dried Up."*

This activity's objectives are aligned with the National Science Education Standards, specifically to those related to Science as Inquiry and Life Science. While investigating the amount of water in an apple and an orange, students will make and record observations, weigh, measure volume, estimate and make predictions.

Concepts

- Water is a major component of most foods and living things.
- Water can be removed from foods through dehydration.

Reference

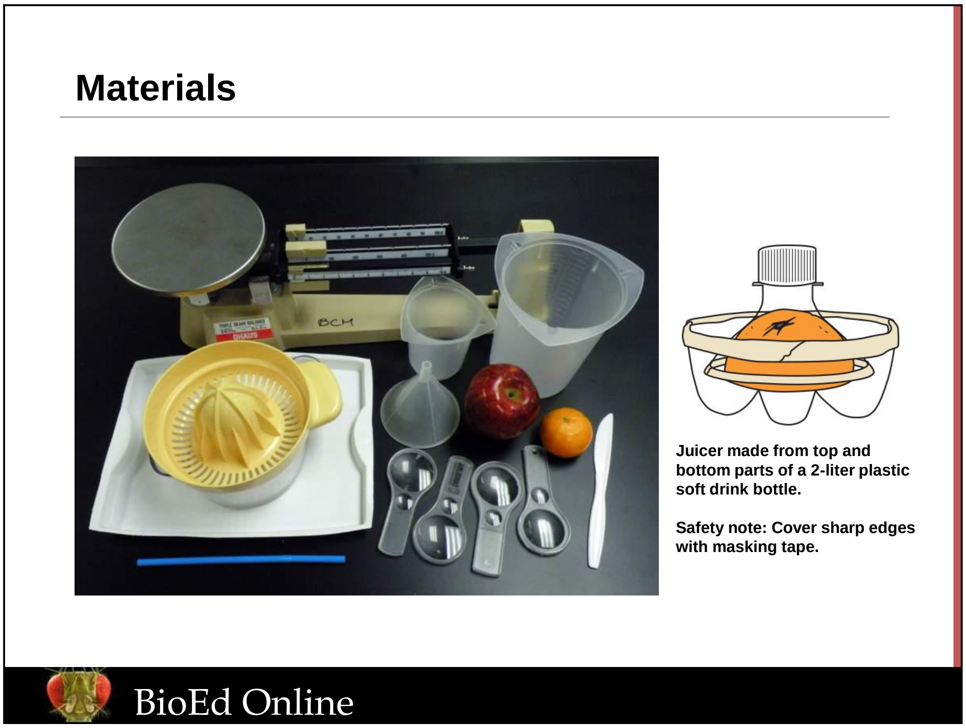
Moreno N., and B. Tharp. (2011). *The Science of Water Teacher's Guide.* Third edition. Baylor College of Medicine. ISBN: 978-1-888997-61-3. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Image Reference

Photo © Valentyn Volkov. Licensed for use.

Key Words
lesson, experiment, water, liquid,

How Much Water Is in a Fruit? © Baylor College of Medicine.



Materials

Have students work in groups of four. Place materials on a tray in a central location and have each group's Materials Manager collect the materials for his/her group. Every student will need his/her own copy of the student sheet.

Materials per Student Group

- 1,000-mL beaker or calibrated cup
- 250-mL beaker or calibrated cup
- 4 hand lenses
- Commercial juicer, or juicer made from 2-liter plastic soda bottles (see illustration on slide)
- Drinking straw
- Equal arm balance and 1-cm/1-g cube weights (if possible)
- Plastic serrated knife
- Apple
- Orange
- Water

Materials per Student

• Copy of “All Dried Up” student sheet

Reference

Moreno N., and B. Tharp. (2011). *The Science of Water Teacher’s Guide.* Third edition. Baylor College of Medicine. ISBN: 978-1-888997-61-3. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

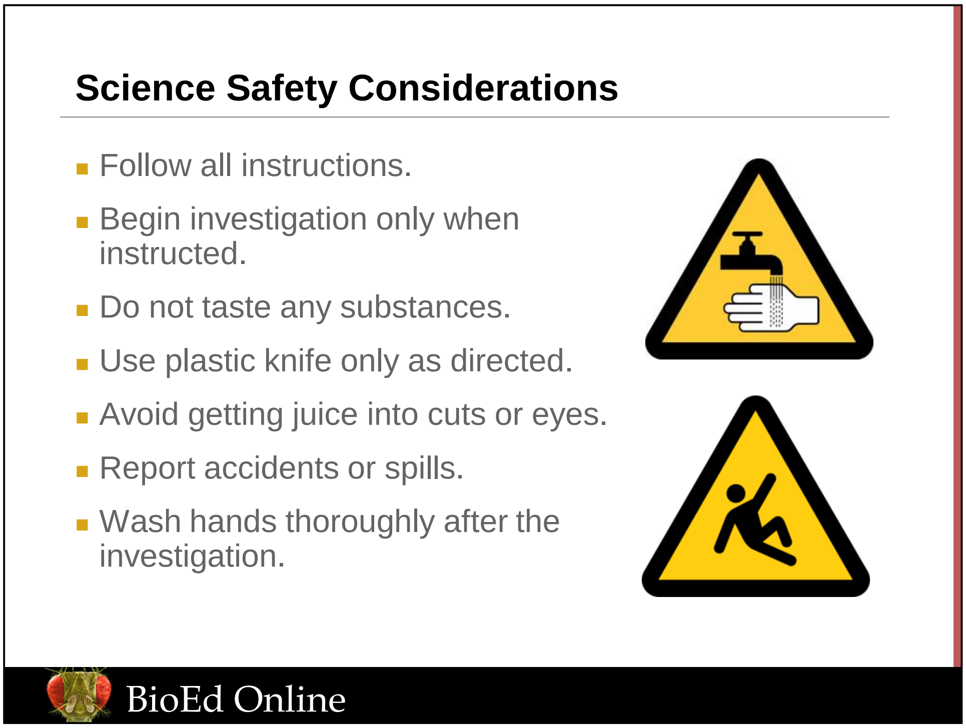
Image Reference

1.Illustration by M.S. Young © Baylor College of Medicine.

2.Photo by JP Denk © Baylor College of Medicine.

Key Words
materials, materials list,

How Much Water Is in a Fruit? © Baylor College of Medicine.



Science Safety Considerations

Students always must think about safety when conducting science investigations. This slide may be used to review safety with your class prior to beginning the activity.

Safety first!

•Always school district and school science laboratory safety guidelines.

•Have a clear understanding of the investigation in advance.

•Practice any investigation with which you are not familiar before conducting it with the class.

•Make sure appropriate safety equipment, such as safety goggles, is available.

•Continually monitor the area where the investigation is being conducted.

Safety note: Caution students to use care when using the plastic knife.

References

1.Dean R., M. Dean, and L. Motz. (2003). *Safety in the Elementary Science Classroom*. National Science Teachers Association.

2.Moreno N., and B. Tharp. (2011). *The Science of Water Teacher's Guide.* Third edition. Baylor College of Medicine. ISBN: 978-1-888997-61-3.

Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Key Words

science, classroom, safety, lab, laboratory, rules, safety signs,

What Is the Water Cycle? © Baylor College of Medicine.

Which of the Following Contain Water?

BioEd Online

Which of the following contain water?

Students will use measures of weight and volume while investigating the amounts of water in two different fruits. Students also will learn how the process of drying (removing water) helps to preserve foods.

If you ask your students to name the main components of foods they eat, most would not mention water. However, all plant and animal food products contain some water. Fresh fruits and vegetables are mostly water. A tomato, for example, is 90% water! (This high water content is one reason why fresh produce spoils relatively quickly.) Other foods, such as cereals and grains, contain less water.

Many foods in the grocery store are processed to remove moisture before packaging. Such processing creates a dry environment in which it is difficult for bacteria, molds and insects to grow/live, and gives food a longer shelf life.

Reference

Moreno N., and B. Tharp. (2011). *The Science of Water Teacher's Guide.* Third edition. Baylor College of Medicine. ISBN: 978-1-888997-61-3. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Image Reference

Photo © Inga Neilsen. Licensed for use.

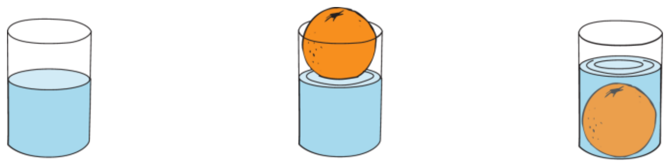
Key Words

lesson, experiment, water, liquid, dehydrate, dehydration, juice, food, volume,

How Much Water Is in a Fruit? © Baylor College of Medicine.

Let’s Get Started

1. How much water is in a bag of oranges?
2. Measure the amount, or volume, of water in a single orange by submerging it in a beaker of water. How much water did the orange displace?



3. Volume with submerged orange – original volume =?

BioEd Online

Let’s Get Started

This activity will take at least two class periods and may be extended to three.

While holding a bag of oranges up in front of the class, ask, *How much water do you think is in this bag of oranges?* Lead a class discussion about—and have students predict—the amount of water or liquid contained in just one orange. Make sure the students equate liquid with orange juice. Write their predictions on the board.

Show the students how to measure the volume of an orange by measuring how much space it takes up or displaces in a beaker of water. If 1,000 mL beakers are not available, calibrate a large plastic cup or other clear container in milliliters. Students must push the orange down, gently, until it is submerged entirely. Most oranges will displace approximately 150 mL of water.

Ask, *Did the water level go up or down? By how much? Why?* If students need help understanding the concepts of displacement and volume, have them consider how water level changes when someone gets into or out of a bathtub.

Reference

Moreno N., and B. Tharp. (2011). *The Science of Water Teacher’s Guide.* Third

edition. Baylor College of Medicine. ISBN: 978-1-888997-61-3. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Image Reference

Illustration by M.S. Young © Baylor College of Medicine.

Key Words
lesson, experiment, water, liquid, dehydrate, dehydration, juice, orange, displacement, volume,

How Much Water Is in a Fruit? © Baylor College of Medicine.

Session 1

1. How can you measure the juice inside the orange?
2. Predict the amount of water in the orange.
3. Cut your orange in half.
4. Squeeze the juice from the orange and measure its volume.
5. Save what is left of the orange after you've finished squeezing out the juice.
6. Record your data on the student sheet. How did your prediction compare with the measured amount of water?

BioEd Online

Session 1

After each group has measured the total volume of its orange, have students use a serrated plastic knife to cut their oranges in half. Each group should use its juicer (either commercial or homemade) to squeeze the juice from its orange. Students may use a 250-mL beaker or plastic cup calibrated in milliliters to measure the juice obtained from their orange. Make sure students save the remains of their oranges

Ask, *How can the remaining material be measured?* If students suggest weighing, have them consider the conversions that might be necessary to compare this weight information with their earlier measurements in mL. Have students place the remaining orange pieces into the beaker or plastic cup containing 800 mL of water, and then note the new volume.

Ask, *Do the remains of the orange displace a different amount of water than the entire orange displaced? Why? What was the volume of the entire orange? What is the volume of the remaining 'stuff?' What is the volume of water in the orange?* Students should record their observations and the values obtained on their student sheets.

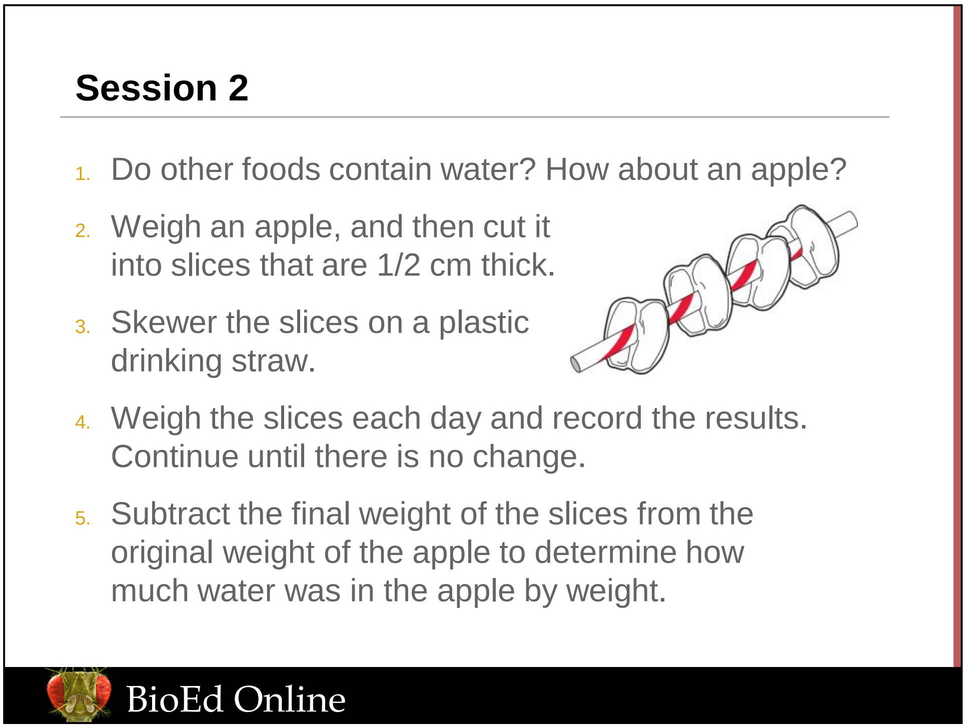
Reference

Moreno N., and B. Tharp. (2011). *The Science of Water Teacher's Guide.* Third edition. Baylor College of Medicine. ISBN: 978-1-888997-61-3. Development of this

student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Key Words
lesson, experiment, water, liquid, dehydrate, dehydration, juice, food, volume, orange, juice,

How Much Water Is in a Fruit? © Baylor College of Medicine.



Session 2

Ask students to predict whether an apple contains water, and if so, whether it contains more or less water than an orange does. Have students weigh an apple, and then cut it into 1/2-cm vertical slices. The slices may be placed between layers of paper towel or threaded on a plastic straw, as shown in the illustration on the slide. Students should weigh the slices each day, until there is little or no difference in the weight from one day to the next.

Instruct students to record the results on their worksheets. Help students to plot their data on a graph.

Finally, ask students how they might determine the weight of the water in the original apple. (They can subtract the final weight of the slices from the original weight of the apple.)

Reference

Moreno N., and B. Tharp. (2011). *The Science of Water Teacher's Guide.* Third edition. Baylor College of Medicine. ISBN: 978-1-888997-61-3. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Image Reference
Illustration by M.S. Young © Baylor College of Medicine.

Key Words
lesson, experiment, water, liquid, dehydrate, dehydration, juice, food, volume, apple, weight,

How Much Water Is in a Fruit? © Baylor College of Medicine.

Let’s Talk About It

- What surprised you about this investigation?
- What was the percentage of water in the orange? What was the percentage of water in the apple?
- Tissues and cells of living organisms are comprised mostly of water.
- Different organisms contain different percentages of water.
  - Tomato: 90%
  - Earthworm: 80%
  - Tree: 70%
  - Human: 70%

BioEd Online

Let’s Talk About It

This investigation demonstrates that oranges and apples are largely water. The volume of water will vary by the type and size of oranges and apples used.

After the experiment has ended, help older students to convert the volume of water in the orange into a percentage. Compare the findings of each student group to see if they are consistent. A standard juice orange will displace about 140–150 mL of water and will yield 40–50 mL of juice.

Next, have students convert the amount of water in the apple into a percentage. Once their calculations are complete, students will notice that the orange contains a higher percentage of water than the apple does. Other fruits, such as watermelons, have an even higher percentage of water.

The cells and tissues that make up living organisms are comprised mostly of water, but actual water content varies by species. For example, water makes up about 80% of an earthworm and about 70% of a human or a tree.

Reference

Moreno N., and B. Tharp. (2011). *The Science of Water Teacher’s Guide.* Third

edition. Baylor College of Medicine. ISBN: 978-1-888997-61-3. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Key Words
lesson, experiment, water, liquid, dehydrate, dehydration, juice, food, volume,

How Much Water Is in a Fruit? © Baylor College of Medicine.

The Science of Dehydration

- Foods can be preserved by drying.
- Drying makes food less likely to be contaminated by insects, mold, or bacteria.
- Drying makes foods lighter and easier to store and transport.
- Smoking and salting are common processes used to dry or dehydrate food.

BioEd Online

The Science of Dehydration

The earliest known use of dehydration (removing water, or drying) to preserve foods was in Egypt, around 15,000 BC. American Indians and early settlers in North America also preserved foods by drying them.

By removing most of the moisture from foods, dehydration makes many grains, meats and vegetables much less suitable environments for the growth and reproduction of molds, bacteria and insects. Drying also makes foods lighter and easier to store and transport. Other methods for preserving food through dehydration include smoking, which is faster than simple drying—and more effective as well, because the absorbed smoke is toxic to many microorganisms—and salting, which draws moisture out of food items.

Reference

Moreno N., and B. Tharp. (2011). *The Science of Water Teacher's Guide.* Third edition. Baylor College of Medicine. ISBN: 978-1-888997-61-3. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Key Words

lesson, experiment, water, liquid, dehydrate, dehydration, juice, food, volume, smoking, preserve,

How Much Water Is in a Fruit? © Baylor College of Medicine.

Extensions

- Compare the weights of different dried and non-dried food items.
  - Grapes versus raisins
  - Fresh banana slices versus banana chips
  - Dried peas versus fresh peas
- Calculate how much of a person's body weight and body volume are made up of water.
- Investigate the differences between measures of volume, weight and mass.

BioEd Online

Extensions

Students may want to compare the weights of different dried and non-dried food items. Some possible examples are listed below.

- Raisins and grapes
- Dehydrated potato slices (from packaged potato casserole mixes) and fresh potato slices
- Banana chips and fresh banana slices
- Beef jerky and strips of raw beef
- Dried peas and fresh peas

Approximately 7/10, or 70% of the human body consists of water. Have students use the following formula to calculate approximately how much of their own weight is water.

1. Your weight x 7 = __________ .
2. Your answer from step 1 ÷ 10 = amount of water in your body.

Students also can follow the steps below to calculate the percentage of their bodies comprised of water.

1. Count out the number of snap-together math cubes equal to your weight (i.e., 45 lb = 45 cubes).

2. Separate the cubes into 10 equal groups.

3. Place 7 groups in one set and 3 in another set

4. The largest set represents the portion of your body that is water.

Have students use the values derived from their calculations to estimate the volume of water in their bodies (1 lb. of water represents approximately 2 cups).

In this activity, students measure water by volume and by weight. Ask students, *Which of these measures is used most commonly for liquids? Why do you think this is so? Can you think of a way to convert a measure of volume to a measure of weight, or vice versa?*

Reference

Moreno N., and B. Tharp. (2011). *The Science of Water Teacher's Guide.* Third edition. Baylor College of Medicine. ISBN: 978-1-888997-61-3. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Key Words
lesson, experiment, water, liquid, dehydrate, dehydration, juice, food, dehydration, volume, dried,

How Much Water Is in a Fruit? © Baylor College of Medicine.