

**Teacher’s Guide**

**Why Avocados are so Appealing**

***April 2020***

**Table of Contents**

[Anticipation Guide](#_Anticipation_Guide) 2

Activate students’ prior knowledge and engage them before they read the article.

[Reading Comprehension Questions](#_Student_Reading_Comprehension) 3

These questions are designed to help students read the article (and graphics) carefully. They can help the teacher assess how well students understand the content and help direct the need for follow-up discussions and/or activities. You’ll find the questions ordered in increasing difficulty.

[Graphic Organizer 5](#_Graphic_Organizer)

Thishelps students locate and analyze information from the article. Students should use their own words and not copy entire sentences from the article. Encourage the use of bullet points.

[Answers 6](#_Answers_to_Reading)

Access the answers to reading comprehension questions and a rubric to assess the graphic organizer.

[Additional Resources](#_Additional_Resources_1) 8

Here you will find additional labs, simulations, lessons, and project ideas that you can use with your students alongside this article.

[Chemistry Concepts, Standards, and Teaching Strategies 9](#_Chemistry_Concepts,_Standards,)

# Anticipation Guide

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Directions: *Before reading the article*,** in the first column, write “A” or “D,” indicating your **A**greement or **D**isagreement with each statement. Complete the activity in the box.

As you read, compare your opinions with information from the article. In the space under each statement, cite information from the article that supports or refutes your original ideas.

|  |  |  |
| --- | --- | --- |
| **Me** | **Text** | **Statement** |
|  |  | 1. Avocado is a berry.
 |
|  |  | 1. One avocado contains more potassium than a medium-sized banana.
 |
|  |  | 1. Avocados contain mostly saturated fats.
 |
|  |  | 1. Unsaturated fats can lower “bad” cholesterol levels and decrease the risk of heart disease.
 |
|  |  | 1. Avocados contain only insoluble dietary fiber.
 |
|  |  | 1. Free radicals produced by oxidation in the body can damage stable molecules your body needs to function.
 |
|  |  | 1. Avocados contain high levels of antioxidants.
 |
|  |  | 1. The U.S. production and use of avocados has been steadily declining for the past 20 years.
 |
|  |  | 1. Avocados brown faster than apples because they contain more of an enzyme that catalyzes oxidation.
 |
|  |  | 1. When avocados turn brown, you should not eat them.
 |

# Student ReadingComprehension Questions

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Directions**: Use the article to answer the questions below.

1. What are minerals?
2. What are the differences among saturated, monounsaturated, and polyunsaturated fats?
3. For those who ingest a high fat diet, what are some effects to their bodies?
4. You typically hear that eating foods containing fat is unhealthy. Why do people actually need some fats in their diet?
5. What is a free radical? How do free radicals harm the body?
6. What state of matter (solid, liquid, gas) are saturated fats at room temperature? Unsaturated fats? Why, based on their molecular structure, do they exist in these states?
7. What are some differences between soluble and insoluble fibers? Where would you find each type of fiber? How does each type affect your body?
8. How has the demand for avocados in the U.S. changed over the years? Has the U.S. been able to keep up with the demand? What would we need to do to keep pace with the demand?
9. What is hydrogenation of fats? Why is it done, and for what types of foods? How does it affect the nutritional value of foods?
10. State some effects on the environment that are caused by the increase in demand for avocados.
11. How has the cost of avocados changed over the years? What are some reasons for these changes?

**Student Reading Comprehension Questions, cont.**

**Questions for Further Learning**

1. Take a poll of your classmates: How many like avocados? Approximately how often do they eat them per week/month? In (or with) what types of foods are the avocados found?
2. Look up the U.S. Recommended Daily Allowance (RDA) for fats, especially saturated and unsaturated fats. What are your favorite foods, and what is the fat content in them? How could you adjust your diet to meet the RDA better, or are you already within range? Explain.

# Graphic Organizer

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Directions**: As you read, complete the graphic organizer below to describe the healthy chemistry of avocados.

|  |  |  |
| --- | --- | --- |
|  | **Examples** | **Benefits** |
| **Minerals** |  |  |
| **Fats** |  |  |
| **Antioxidants** |  |  |

**Summary:** In the space below, or on the back of this paper, write a short email to a friend describing the health benefits of avocados.

# Answers to Reading Comprehension Questions & Graphic Organizer Rubric

1. **What are minerals?**

*Minerals are elements that perform essential functions in organisms. They include calcium, magnesium, phosphorus, sodium and other ions.*

1. **What are the differences among saturated, monounsaturated, and polyunsaturated fats?**

*The differences between saturated and unsaturated fats are based on their structure and types of bonds. Saturated fats have all single bonds in them, and this gives them a linear structure. Unsaturated fats have carbon-carbon double bonds. These bonds will give the molecule a more bent, non-linear shape. Monounsaturated fats have one carbon-carbon double bond, while polyunsaturated fats have multiples of these bonds.*

1. For those who ingest a high fat diet, what are some effects to their bodies?

*A diet high in fats could cause an increase in cholesterol in the bloodstream. This can cause high blood pressure, heart attacks, or strokes.*

1. **You typically hear that eating foods containing fat is unhealthy. Why do people actually need some fats in their diet?**

*The body needs some fat to stay healthy. Fats help generate energy and maintain cell growth.*

1. **What is a free radical? How do free radicals harm the body?**

*When the body reacts with amino acids, sugars, and fatty acids, electrons are removed from these chemicals (this is called oxidation). These newly oxidized products are called free radicals and are unstable--they readily react with other healthy, necessary, stable molecules in the body (i.e., proteins, DNA, lipids).*

1. **What state of matter (solid, liquid, gas) are saturated fats at room temperature? Unsaturated fats? Why, based on their molecular structure, do they exist in these states?**

*Saturated fats are solids, as opposed to unsaturated fats, which are liquids. Saturated fats are linear in structure, which results in larger surface area and therefore increases the capability of intermolecular forces (LDFs) between molecules. The bends in the unsaturated fats decreases the area where the molecules can attract, so they molecules are held together as tightly by LDFs, so they are liquid.*

1. **State the difference between soluble and insoluble fibers. Where would you find each type of fiber? How does each type affect your body?**

*Soluble fiber dissolves in water, forming a gel in your stomach. Insoluble fiber does not dissolve and passes through the body. Both types can control your appetite, but insoluble fibers helps with digestion.*

1. **How has the demand for avocados in the U.S. changed over the years? Has the U.S. been able to keep up with the demand? What would we need to do to keep pace with the demand?**

*The demand for avocados has increased dramatically over the past 20 years, after being constant the previous 20 years (see graph in article). The U.S. production has remained constant, while the imports have increased greatly to keep up with the demand. If we do not want to depend on other country’s production, the U.S. must grow more. This however, will have a large impact on the environment.*

1. **What is hydrogenation of fats? Why is it done, and for what types of foods? How does it affect the nutritional value of foods?**

*Hydrogenation is the reaction of organic compounds (i.e., fats) with hydrogen. Hydrogen atoms bond with carbons that were double bonded to each other in the fat. That makes the unsaturated fats into saturated fats. This is done in foods (such as margarine) to keep the fats stable (longer shelf life) and to preserve its flavor. This lowers the nutritional value of the food because there is more “bad” fat in the food.*

1. **State some effects on the environment that are caused by the increase in demand for avocados.**

*With the increase in demand of avocados, there are a lot of environmental issues. More forests have to be cut down to grow avocado trees. Other ecosystems would be interrupted by these avocado trees. Also, avocado trees require a lot of water to grow.*

1. **How has the cost of avocados changed over the years? What are some reasons for these changes?**

*The costs of avocados has increased dramatically. The cost of growing, harvesting, and transporting affect the cost. Because the U.S. gets most of its avocados from other countries, that has an effect on the cost as well (transportation, import tax/tariffs).*

**Questions for Further Learning**

*Student answers will vary.*

**Graphic Organizer Rubric**

If you use the Graphic Organizer to evaluate student performance, you may want to develop a grading rubric such as the one below.

|  |  |  |
| --- | --- | --- |
| **Score** | **Description** | **Evidence** |
| 4 | Excellent | Complete; details provided; demonstrates deep understanding. |
| 3 | Good | Complete; few details provided; demonstrates some understanding. |
| 2 | Fair | Incomplete; few details provided; some misconceptions evident. |
| 1 | Poor | Very incomplete; no details provided; many misconceptions evident. |
| 0 | Not acceptable | So incomplete that no judgment can be made about student understanding |

# Additional Resources

**Labs and demos**

Activity: Keep avocados from turning brown. Students answer the question: What is the best way to keep a used avocado fresh?

<https://edu.glogster.com/glog/avocado-experiment/1st019imij9?=glogpedia-source>

Saturated and unsaturated fats: An organic chemistry demonstration. In this activity, students can distinguish between saturated and unsaturated fats using NaOH and potassium permanganate.

<https://pubs.acs.org/doi/abs/10.1021/ed062p320>

Activity: Analyzing fat content. In this activity, students analyze the fat content in several food items and identify foods that contain one day’s worth of calories from healthy fat.

<https://www-tc.pbs.org/wgbh/nova/teachers/activities/pdf/3401_01_nsn.pdf>

**Other Resources**

YouTube Video – Saturated vs. unsaturated fats: <https://youtu.be/Uspq--iGuUw>

A Guide to the Different Types of Fat Infographic: <https://www.compoundchem.com/2015/08/25/fat/>

Why Do Avocados Turn Brown? – The Chemistry of Avocados Infographic: <http://www.compoundchem.com/2014/08/03/why-do-avocados-turn-brown-the-chemistry-of-avocados/>

# Chemistry Concepts, Standards, and Teaching Strategies

**Connections to Chemistry Concepts**

The following chemistry concepts are highlighted in this article:

* Chemistry basics – Chemical and Physical changes
* Kinetics - catalysts
* Organic Chemistry – molecular structure; saturated vs. unsaturated
* Reactions & Stoichiometry

**Correlations to Next Generation Science Standards**

This article can be used to achieve the following performance expectations and dimensions of NGSS:

**HS-PS2-6**

Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

**Disciplinary Core Ideas**:

* PS1.A: Structure and Properties of Matter
* PS1.B: Chemical Reactions

**Crosscutting Concepts:**

* Cause and Effect: Mechanism and explanation
* Structure and Function

**Science and Engineering Practices:**

* Constructing explanations (for science) and designing solutions (for engineering)

**Nature of Science:**

* Scientific knowledge assumes an order and consistency in natural systems.

**Correlations to Common Core State Standards**

See how *ChemMatters* correlates to the[**Common Core State Standards**](https://www.acs.org/content/acs/en/education/resources/highschool/chemmatters/teachers-guide.html)  at www.acs.org/chemmatters.

**Teaching Strategies**

Consider the following tips and strategies for incorporating this article into your classroom:

* Alternative to the Anticipation Guide: Before reading, ask students if they like avocados, and why. Also ask them if they think avocados are healthy, and why they think so. As they read, students should record information they find interesting, as well as specific information describing the good chemistry of avocados.
* After they read the article, show (or ask students to watch) the 3-minute video clip referenced in the article to learn more about avocados. As they watch the video, they should record new information that was not in the article.
* Ask students what they found most interesting from reading article.