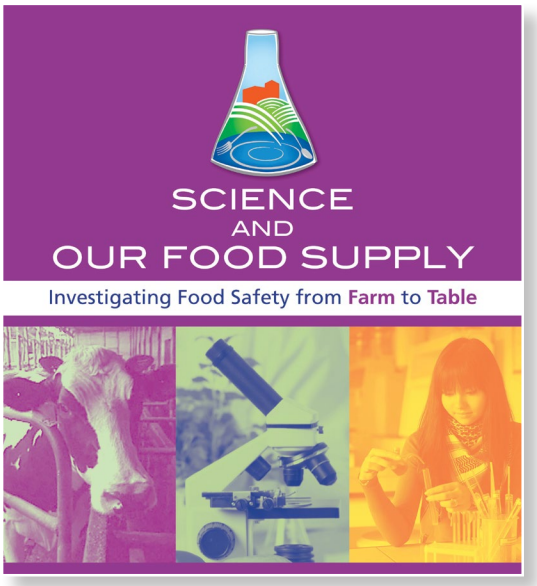
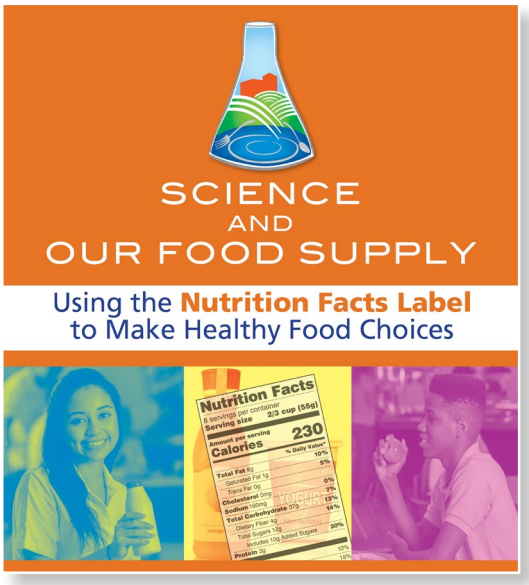
SCIENCE AND OUR FOOD SUPPLY

Student Activity Sheets





High School – 3rd Edition

DEPARTMENT OF HEALTH & HUMAN SERVICES · USA

FDA

SCIENCE AND OUR FOOD SUPPLY

Student Activity Sheets

This document contains all of the current *Science and Our Food Supply* high school student activity sheets in a **fillable PDF format**. Teachers can send the entire file or individual activity worksheets to students to complete and return, according to the teacher's instructions. The fillable activity sheets support learning on various virtual platforms and help reduce paper use.

The web links provided in this Student Activity Worksheet book were current at the time of publication. In the event that they change and/or are no longer available, we suggest that you visit the "home page" of the organization and search for topical information.

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TABLE OF CONTENTS (CONTINUED)

BACTERIA EVERYWHERE

DATA TABLE

Name _____ Date _____ Class/Hour _____

Lab 1 - Find the Bacteria		Lab 2 - Observe and Record the Results	
Choose the Areas to Be Examined	**Predict the Most/Least Abundant Areas**	**Amount of Colonies 5 (most) 0 (Least)**	**Describe the Size, Shape, and Colors of the Colonies**

Which sample showed the most growth of bacteria? Was this the result that you predicted?

STUDENT WORKSHEET

CHAIN OF FOOD – FROM THE FARM

Name _____ Date _____ Class/Hour _____

1. What do crops need to grow on a farm?

2. What environmental factors could jeopardize crops' growth and decrease the amount of available food?

Steps in the Farm-to-Table Continuum

1. Source/Production of goods (where the food item originates)
2. Processing/manufacturing
3. Transportation
4. Retail (local retail stores, grocery stores, food markets, restaurants, etc.)
5. Table (home, restaurant, cafeteria, fast-food eatery, etc.)

Food doesn't originate at the grocery store or restaurant. Use the questions below and on the following page to trace the journey of some food crops along the Farm-to-Table Continuum; discover some of the ways food could become compromised or contaminated; and discuss strategies to prevent that contamination.

3. Review these two videos about the Farm-to-Table path (if needed):

The Journey of Food: From the Farm to Your Table (6:49)
www.youtube.com/watch?v=fWyqYxxtfU4

From Cow to Cup: The Journey of Milk (3:08)
www.youtube.com/watch?v=5o_Dwl0vDEY

4. Describe the Farm-to-Table path for **two** of these five food crops: wheat, corn, rice, soybeans, or sweet potatoes. As an alternative for one of the crops, you might want to choose one that grows in your state. Record descriptions of what happens at each step of your food crop's journey, and factors that could affect food safety in each of the steps of the Continuum. Try to include all the people involved at each step (e.g., farmers, produce pickers, truckers, grocery workers, shelf stockers, restaurant workers, etc.).

Crop _____

Continuum Steps	Description of This Step as It Applies to the Crop	Food Safety Considerations
Source		
Processing		
Transportation		
Retail		
Table		

Sources: _____

Crop _____

Continuum Steps	Description of This Step as It Applies to the Crop	Food Safety Considerations
Source		
Processing		
Transportation		
Retail		
Table		

Sources: _____

STUDENT WORKSHEET

CHAIN OF FOOD – FROM THE FARM (CONTINUED)

5. Select one of the two food crops and describe the HACCP stages that are most important to keep this crop safe. Include what would happen if the product became too wet, too hot, or too cold before leaving the farm.

6. Review these two videos about climate change (if needed) and then answer the questions that follow.

Food Safety and Climate Change (1:08)
www.youtube.com/watch?v=b8GnHOFHOhU

Climate Change, Global Food Security, and the U.S. Food System (6:05)
www.youtube.com/watch?v=v24wT16OU2w

a. Choose one of the food crops and describe how characteristics of the environment (e.g., excess rain, drought) could increase the likelihood of the crop becoming contaminated with pathogenic bacteria.

b. Describe two ways to help protect the global food safety and security. These can be existing methods or ideas that you think could be tried.

STUDENT WORKSHEET

LAB 1: BLUE'S THE CLUE

Name _____ Date _____ Class/Hour _____

1. Predict how temperature affects the rate of bacterial growth in the two different milk samples kept at the three different temperatures: room temperature, chilled in the refrigerator, and frozen.

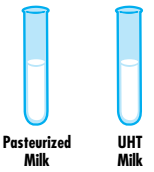
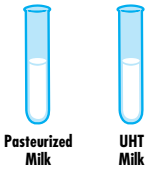
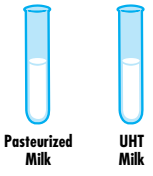
2. What's an important difference between the two milk products? Is there any information on the labels that relates to the question about the effect of temperature on bacterial growth?

3. What are the similarities and differences between pasteurized and UHT treatments?

4. Could there be differences in the growth of bacteria between the two milks? What do you think the differences might be?

5. How can you tell if bacteria are growing in the test samples?

Blue's the Clue Data Table

Day 1 Original Sample	Day 2 Describe Visual Changes	Day 3 Describe Visual Changes	Day 4 Describe Visual Changes
Room Temperature  Pasteurized Milk UHT Milk	**Pasteurized:** **UHT:**	**Pasteurized:** **UHT:**	**Pasteurized:** **UHT:**
Refrigerated  Pasteurized Milk UHT Milk	**Pasteurized:** **UHT:**	**Pasteurized:** **UHT:**	**Pasteurized:** **UHT:**
Frozen  Pasteurized Milk UHT Milk	**Pasteurized:** **UHT:**	**Pasteurized:** **UHT:**	**Pasteurized:** **UHT:**

STUDENT WORKSHEET
LAB 1: BLUE'S THE CLUE (CONTINUED)

6. What is pasteurization?

7. What is the time/temperature relationship involved in pasteurization?

8. How can some types of milk stay fresh and safe without being refrigerated?

9. Were bacteria killed at the different temperatures? Why or why not? How could you tell?

10. What is a basic difference between conventionally pasteurized and UHT milk?

11. Explain the importance of knowing about the Danger Zone in food safety.

12. What do chilling, freezing, and heating do to bacteria?

STUDENT WORKSHEET

LAB 2: MYSTERY JUICE

Name _____ Date _____ Class/Hour _____

Share your observations with the class.

1. Examine the two samples of cider/juice ("Juice A" and "Juice B") and record your observations in the Mystery Juice Data Table. You should record at least three observations about each juice.
2. Can you tell by your observations which of the two juices is pasteurized? _____
3. Predict which of the juices is pasteurized. _____

Mystery Juice Data Table

	Juice A	Juice B
Observations at the Start of the Lab		
Observations of the Bacterial Growth		

4. Which of the two juices is pasteurized? _____
   - What is your evidence for this inference?

5. Relate your findings to food safety.

6. Which juice would you prefer to drink, pasteurized or unpasteurized? Why?

7. What effect would freezing have on microorganisms in unpasteurized juice?

8. How does pasteurization relate to your everyday life?

9. Can you tell if a food is pasteurized by looking at it?

STUDENT WORKSHEET

ACTIVITY 1 : IRRADIATION WEBQUEST

Name _____ Date _____ Class/Hour _____

These questions are designed to help you discover some interesting information about irradiated food.

Use the following resources to answer the questions below. Research other Credible Sources to answer the worksheet questions if needed.

- *Food Irradiation – What You Need to Know*
  www.fda.gov/Food/IngredientsPackagingLabeling/IrradiatedFoodPackaging/ucm261680.htm
- *Realizing the Benefits of Food Irradiation*
  www.ift.org/news-and-publications/food-technology-magazine/issues/2019/september/columns/processing-food-irradiation
- *How Food Irradiation Works*
  https://www.cdc.gov/radiation-health/food-irradiation/?CDC_AAref_Val=https://www.cdc.gov/foodsafety/communication/food-irradiation.html

1. What is food irradiation and how is it done?

2. Does the FDA have a role in the irradiation of food? If so, please explain.

3. When used as approved, name at least three effects that irradiation has on food.

4. Why is the prevention of foodborne illness so important?

5. What role does irradiation play in preventing foodborne illnesses? Provide some examples.

6. What are some foodborne illness-causing microorganisms that can be controlled through irradiation?

7. Irradiation is also used to control insects. How is this done?

8. What is the difference between irradiation used to control foodborne illness-causing microorganisms and irradiation used to control insect pests?

9. In the United States, when was food irradiation first approved by the FDA and for what purpose? When was it first actually used and for what purpose?

10. What famous group of high-flying individuals routinely eats meat sterilized by irradiation? Explain why.

STUDENT WORKSHEET

ACTIVITY 1 : IRRADIATION WEBQUEST (CONTINUED)

11. How is the process of sterilizing foods through irradiation different from the irradiation of foods for general use?

12. Explain how gamma rays are used to irradiate food. Include a description of how "the source" is safely stored.

13. Explain how the electron beam is used to irradiate foods. How is this method of irradiation different from gamma rays?

14. Explain how X-rays are used to irradiate foods. How are X-rays similar to and different from gamma rays?

15. How are food irradiation and pasteurization alike, and how are they different?

16. What effect does irradiation have on the taste, texture, or appearance of food?

17. Compare the nutrient value of irradiated and non-irradiated foods.

18. In the United States, what foods have been approved for irradiation?

19. How can you identify foods in the grocery store that have been irradiated? Explain the difference in labeling between bulk food and individual ingredients.

20. How can you identify foods in a restaurant that have been irradiated?

21. Do consumers need to follow different or additional food handling procedures when using irradiated foods?

STUDENT WORKSHEET

ACTIVITY 1: FAST-FOOD FOOTWORK

Name _____ Date _____ Class/Hour _____

1. Select a food establishment for your group to research. _____

2. Develop a food safety plan to ensure that the food in your eatery is safe as you respond to the following questions that will help you build a description and profile for your eatery.

About the eatery:

a) What types of foods are prepared and served? _____

b) Who are the typical customers? _____

c) How is the safety of the food ensured

– During storage? _____

– During preparation? _____

– After preparation and before serving? _____

– While serving? _____

d) What happens to food that's not used? _____

e) How are employees trained in food safety procedures? _____

f) How are cleanliness and handwashing standards maintained? _____

g) Are there any unique machines or procedures that the establishment uses to ensure food safety?

_____

h) Who are the key people involved in monitoring food safety at your eatery (managers, health department authorities, health inspectors, etc.)?

_____

i) What role does food safety play in employees' daily jobs? _____

j) Do customers have any responsibility for food safety? _____

About the regulations and the inspectors:

a) What do food inspectors look for when they visit a food establishment?

_____

b) What are the local, county, and state health regulations governing the food establishment?

_____

c) How do these health regulations relate to bacterial growth and its spread?

_____

d) How does the manager implement Hazard Analysis and Critical Control Point (HACCP) procedures?

_____

STUDENT WORKSHEET

LAB 1: CROSSED UP!

Name _____ Date _____ Class/Hour _____

1. Review the kitchen items on display. In the chart below, predict which have the most and the least bacteria. Why would/wouldn't bacteria be found on these items?

Class Predictions About All Items to Be Sampled

Kitchen Items with the Most Bacteria	Kitchen Items with the Least Bacteria

2. Select and list the items that your group will sample:

List your items in the corresponding Group Results column below.

Group Results

Kitchen Items with the Most Bacteria	Kitchen Items with the Least Bacteria

3. When you compare your predictions with the results, what are some surprises?

4. List the class results in the chart below:

Class Results

Kitchen Items with the Most Bacteria	Kitchen Items with the Least Bacteria

STUDENT WORKSHEET

LAB 1: CROSSED UP! (CONTINUED)

5. When you compare the class predictions with the class results, are there any surprises?

6. Could bacteria transfer from kitchen items to your food? Your hands? What might happen in these cases?

7 Why do certain kitchen items have more bacterial growth than others?

8. How do the data you collected relate to the Four Steps to Food Safety?

9. How could you reduce the bacteria on the items you tested?

10. What are your suggestions to avoid cross-contamination in the kitchen?

11. What advice would you give to family members to help them prevent the spread of foodborne bacteria?

STUDENT WORKSHEET

LAB 2: COOKING RIGHT

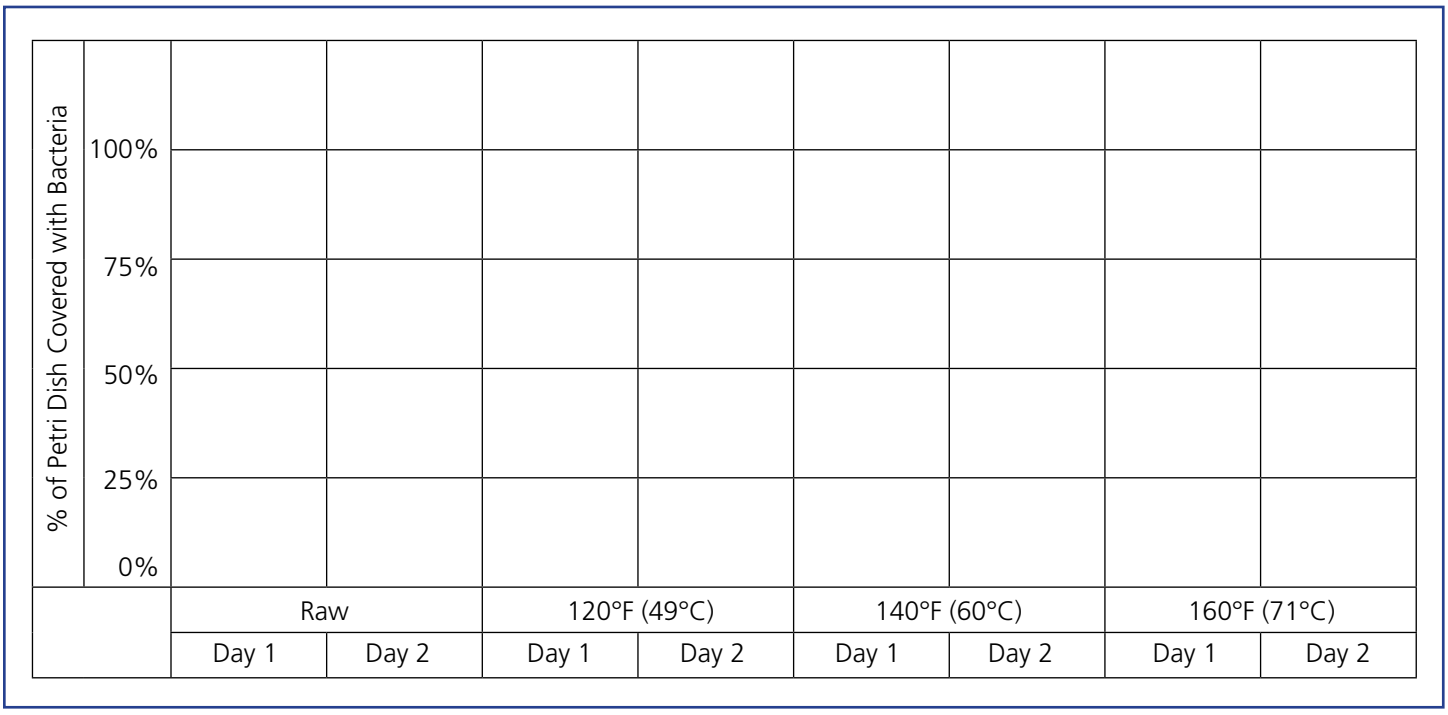
Name _____ Date _____ Class/Hour _____

Record your observations for each day; include the number of colonies you see on the agar as a percentage.

Cooking Right/The Science of Cooking a Hamburger Data Table

	Petri Dish Control	Raw Hamburger	120°F (49°C)	140°F (60°C)	160°F (71°C)
Day 1					
Day 2					

Graph Results



STUDENT WORKSHEET
LAB 2: COOKING RIGHT (CONTINUED)

1. Which temperature produced the most effective reduction in bacterial numbers?

2. How did the number of bacteria in the raw hamburger compare with the cooked burgers?

3. What is the purpose of the control dish?

STUDENT WORKSHEET

LAB 3: A CHILLING INVESTIGATION

Name _____ Date _____ Class/Hour _____

Record your observations for each day; include the number of colonies you see on the agar as a percentage.

A Chilling Investigation Data Table

	Control	Chilled	Room Temperature
Day 1			
Day 2			

1. Why did your teacher cut the package of ground beef in half, rather than just buying two individual packages?

2. Did the cold temperature kill the bacteria in the refrigerated sample? Why or why not?

3. What did you observe about the unrefrigerated sample?

4. Where in the Farm-to-Table Continuum was the safety of the meat compromised? How could this have been prevented?

5. Who had the final responsibility for the safety of this meat?

6. Would cooking the unrefrigerated meat thoroughly make it safe for human consumption? Provide a rationale for your response and support your answer with evidence.

STUDENT WORKSHEET

LAB 4: DON'T CROSS ME

Name _____ Date _____ Class/Hour _____

Record your observations for each day; include the number of colonies you see on the agar as a percentage.

Don't Cross Me Data Table

	Control	Control Board A	Control Board B	Cheese Control	Board A	Board B
Day 1						
Day 2						

Conclusions:

1. What does the Cold Chain have to do with the things you have learned in the last three labs?

2. What are some ways our food can become contaminated after we purchase it?

3. Does what you learned about ground beef/hamburger apply to other foods as well? What about poultry? Fish? Seafood? Eggs?

4. What are some other things you have learned in these three labs?

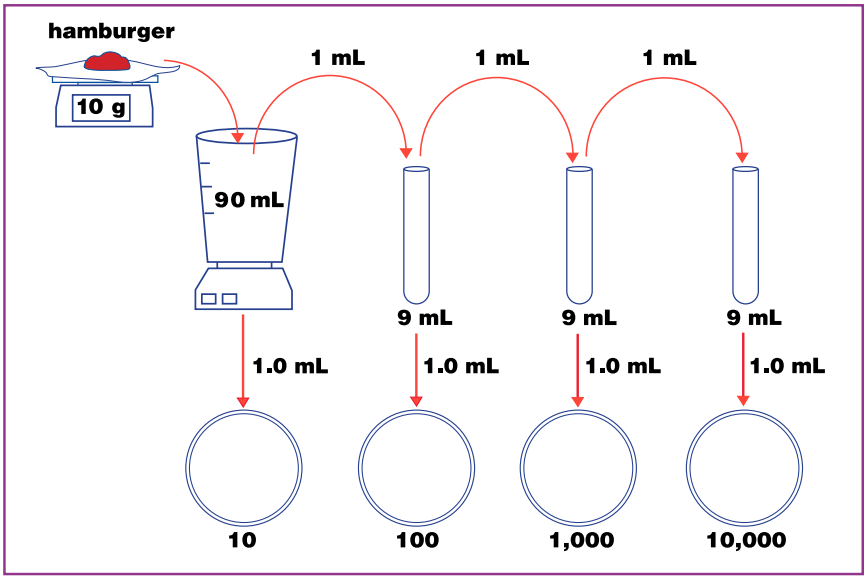
STUDENT WORKSHEET

LAB 5: COLIFORM COUNTS

Name _____ Date _____ Class/Hour _____

This advanced lab is a combination of teacher demonstration and student activity. Please follow the directions carefully and refer to the diagrams in the "Inoculate Petri Dishes" section.

NOTE: Dilutions are made in case the bacterial colonies on the agar dishes from the 1:10 and 1:100 dilutions are too numerous to count.



Respond to the following questions once you have completed the lab:

1. What is the purpose of the control dish?

2. Which concentration of the ground beef solution was the easiest to count? Why?

3. What was the purpose of this lab? Explain how the lab relates to reducing foodborne illness.

4. What should be done to ensure that the hamburger is safe to eat?

5. What do you think is the source of coliform bacteria in the meat?

6. Do you think that pathogens make you sick every time you eat them? Why? Why not?

7. List three other foods that you would like to test for coliform bacteria. Explain why you chose each food.

8. What do you think the coliform count would be for raw oysters and sushi?

9. Do you think fresh strawberries would be high or low in coliforms? Explain.

STUDENT WORKSHEET

ACTIVITY 1 – PART 1: OUTBREAK INVESTIGATION

Name _____ Date _____ Class/Hour _____

Pathogen Database DNA Matching

1. Watch these three GenomeTrakr videos which are all located in the FDA GenomeTrakr Video Library: www.fda.gov/food/whole-genome-sequencing-wgs-program/genometrakr-video-library
   - *Whole Genome Sequencing for Infectious Disease Outbreaks*
   - *Using DNA to Find the Source of an Outbreak*
   - *GenomeTrakr Revealed*
2. Follow the instructions below to match the three DNA sequences to known pathogens in this database from the National Institutes of Health (NIH).
   a) Go to the website for the National Institutes of Health's National Center for Biotechnology Information (NCBI) data base. https://blast.ncbi.nlm.nih.gov/Blast.cgi
   b) Click on Nucleotide BLAST.
   c) Copy and paste Sequence One into the "Enter Query Sequence" box.
   d) Scroll down to "Choose Search Set" and select "Standard Data Base" and "Nucleotide Collection (nr/nt)."
   e) Scroll down to "Program Selection" and Select "Somewhat Similar Sequence."
   f) Click the blue "BLAST" button; it could take a minute or two to process the request.
   g) When the results appear, scroll down and look at the first match.
   h) Examine the column labeled "E value." The closer this value is to zero, the less likely it is that the match is random.
   i) Examine the column labeled "Power Query." This number tells you the percent of the query that you entered that aligns with the gene listed on the match.
   j) Enter the name of the organism for which the DNA sequence is a match into the data table. -Note the name of the organism for which the DNA sequence is a match.
   k) Repeat the process for the next two sequences.

Sequence One:

ATGTTTTATCCGGATCCTTTTGACGTCATCATCATTGGCGGGGGTCATGCAGGCACCGAGGCCGCGATGG
CCGCGGCGCGTATGGGTCAACAGACTCTGCTTTTGACACACAATATCGACACTCTGGGGCAGATGAGCTG
CAACCCGGCGATCGGCGGTATTGGGAAGGGACATCTGGTAAAAGAAGTGGATGCACTCGGCGGTCTGATG
GCGAAAGCGATCGATCAGGCGGGTATCCAGTTTAGGATACTAAACGCAAGCAAAGGACCGGCGGTTCGCG
CTACCCGAGCTCAGGCGGATCGTGTGCTCTACCGTCAGGCGGTACGTACGGCGCTGGAGAACCAACCGAA
CCTGATGATCTTCCAGCAGGCGGTTGAAGATCTTATTGTCGAAAACGATCGCGTGGTCGGTGCTGTTACC
CAAATGGGACTGAAGTTCCGTGCCAAAGCCGTCGTGCTCACCGTTGGGACGTTCCTCGACGGTAAAATTC
ATATCGGTCTGGATAATTACAGCGGTGGCCGTGCTGGTGATCCGCCGTCCATTCCGCTTTCTCGCCGTTT
GCGTGAACTGCCGCTGCGCGTTGGTCGTCTGAAAACCGGGACACCACCGCGTATTGATGCTCGAACCATC
GACTTTAGCGTACTGGCGCAACAGCATGGCGATAACCCAATGCCGGTATTCTCGTTTATGGGCAATGCGT
CCCAGCATCCCCAGCAGGTGCCGTGTTATATCACTCATACCAACGAGAAAACCCATGATGTGATCCGCAG
TAACCTCGATCGTAGCCCAATGTACGCAGGGGTGATCGAAGGTGTCGGCCCACGCTACTGCCCGTCGATC
GAAGACAAAGTCATGCGCTTCGCCGACAGAAATCAGCATCAGATCTTCCTTGAACCGGAAGGACTGACCT
CTAATGAAATTTATCCGAACGGTATCTCCACCAGCCTGCCGTTCGATGTGCAGATGCAAATCGTCCGCTC
TATGCAGGGGATGGAAAACGCGAAGATCGTGCGTCCGGGTTATGCCATTGAGTATGACTTCTTCGATCCT
CGCGACCTGAAACCGACGCTGGAGAGCAAGTTTATCCAGGGGCTGTTCTTTGCTGGTCAGATTAACGGCA
CTACCGGTTACGAAGAAGCCGCTGCGCAAGGTTTGCTGGCCGGTCTTAACGCTGCCCGTCTGTCTGCTGA
CAAAGAAGGTTGGGCTCCGGCACGTTCTCAGGCGTATCTCGGCGTACTAGTTGATGACCTGTGCACTTTA
GGAACCAAAGAACCGTATCGTATGTTTACTTCGCGCGCAGAATATCGTCTGATGCTACGCGAAGATAATG
CGGATCTGCGTTTGACTGAAATCGGTCGTGAACTGGGCCTGGTGGATGACGAACGTTGGGCGCGCTTTAA
CGAGAAACTTGAGAATATCGAGCGCGAGCGTCAGCGTCTGAAATCGACCTGGGTAACCCCGTCGGCGGAA
GCTGCAGCCGAAGTGAATGCTCACCTGACTGCGCCGCTTTCCCGTGAAGCCAGTGGTGAAGATCTGCTGC
GTCGTCCGGAAATGACTTATGAAAAATTAACCACGCTGACGCCGTTTGCCCCTGCGTTGACAGACGAACA
GGCGGCGGAACAGGTTGAGATTCAGGTTAAATACGAAGGTTATATCGCGCGCCAGCAAGATGAGATCGAA
AAGCAGCTGCGTAACGAGAACACCCTGCTACCCGCGACACTGGATTACCGCCAGGTATCCGGTCTTTCTA
ACGAAGTGATCGCCAAACTTAACGATCACAAACCAGCCTCTATCGGCCAAGCTTCGCGTATTTCTGGCGT
CACGCCTGCGGCCATCTCCATTCTGCTGGTGTGGCTGAAAAAACAGGGTATGCTGCGTCGTAGCGCATAA

Sequence Two:

ATGTGGATACGCCCGTTGCAGGCGGAACTGAGCGATAACACGCTGGCTTTGTATGCGCCA
AACCGTTTTGTGCTCGATTGGGTAAGAGATAAGTACCTCAACAATATCAATGGATTACTC
AACACATTCTGCGGCGCGGATGCCCCACAACTGCGTTTTGAAGTGGGAACAAAGCCCGTT
ACGCAAACGCTAAAAACGCCTGTGCATAACGTTGTCGCGCCTACGCAGACAACGACGGCG
AGCCGCAGCGCGTAGCGCCTGCGGCCCGTTCGGGCTGGGATAACGTACCAGCGCCGGCG
GAGCCGACCTACCGCTCCAACGTCAATGTTAAACATACATTTGATAACTTCGTCGAAGGT
AAATCCAACCAACTGGCGCGCGCGGCGGCACGTCAGGTGGCGGATAATCCTGGCGGCGCT
TATAACCCGTTATTCCTCTATGGCGGCACCGGTCTGGGTAAAACTCACCTGCTGCACGCG
GTGGGTAACGGCATTATGGCGCGCAAACCCAACGCGAAAGTCGTGTATATGCACTCCGAG
CGCTTTGTGCAGGACATGGTAAAAGCCCTGCAAAATAACGCCATCGAAGAGTTTAAACGC
TACTACCGCTCCGTTGACGCATTGCTGATCGACGATATTCAATTCTTCGCCAATAAAGAA
CGATCCCAGGAAGAGTTTTTCCATACCTTTAACGCTCTGCTGGAAGGCAATCAGCAGATC
ATTTTGACGTCGGATCGCTATCCGAAAGAGATCAACGGCGTTGAGGATCGTCTCAAGTCC
CGCTTTGTTGGGGGCTGACAGTGGCGATCGAACCACCAGAGCTGGAAACCCGCGTGGCG
ATCCTGATGAAAAAAGCGGACGAAAATGATATTCGTCTGCCAGGCGAAGTAGCGTTCTTT
ATCGCCAAGCGTCTACGCTCTAACGTACGTGAACTGGAAGGCGCGCTGAACCGGGTGATC
GCCAATGCCAACTTTACCGGCCGGGCGATTACTATCGACTTTGTGCGCGAAGCGCTGCGC
GATTTACTGGCGTTGCAGGAAAAACTGGTCACCATCGACAATATTCAGAAGACGGTGGCC
GAGTATTACAAAATCAAAATTGCGGATCTGCTTTCTAAGCGTCGATCTCGCTCGGTAGCA
CGTCCGCGCCAGATGGCTATGGCGCTGGCAAAAGAACTCACCAACCACAGTCTGCCGGAA
ATCGGCGATGCGTTTGGCGGGCGCGACCACACTACCGTACTTCATGCCTGTCGTAAAATT
GAGCAACTGCGTGAAGAAAGCCACGATATCAAAGAAGATTTTTCGAATTTAATCAGAACA
TTGTCGTCGTGA

STUDENT WORKSHEET

ACTIVITY 1 – PART 1: OUTBREAK INVESTIGATION (CONTINUED)

Sequence Three:

GCAGAGAAGTTTGGCGACTACCTAACGCGTTTCTTCGGCAAGTCCGATCTGAACATGGCTCAAAGCTATA
AGCTGGGTAAAAATGACGCAGGTGAAGCAATCTTCAACCGCGTGGTGGTAATGGATGGCAACACGTTAGC
AAGCTACAAGCCGACCTTCGGTGACAAGACCACCATGCAGGGGATCCTAGATCTACCTGTGTTTGACGCT
ACACCGATGAAAAAGCCCGGTACTTCAGATGTCGATGGCAATGCAAAAGCCGTAGATGATACGAAAGAAG
CATTGGCTGGTGGAAAGATACTTCACAACCAAAATGTGAATGACTGGGAACGTGTTGTTGTGACTCCGAC
AGCGGACGGCGGTGAAAGCCGTTTTGATGGTCAAATCATCGTGCAAATGGAGAACGATGATGTCGTTGCA
AAAGCCGCTGCGAACCTTGCGGGTAAGCACCCAGAAAGCAGTGTGGTGGTGCAGATCGATTCAGACGGCA
ACTATCGCGTGGTGTATGGCGATCCGTCAAAGCTGGATGGAAAGCTACGTTGGCAGTTAGTAGGTCATGG
TCGAGATGACTCAGAAAGTAACAACACGCGTTTAAGTGGCTACAGTGCCGACGAGCTGGCAGTGAAATTG
GCCAAGTTCCAACAGTCGTTTAATCAAGCGGAAAACATCAACAATAAGCCTGATCATATCAGTATTGTTG
GTTGTTCTTTGGTGAGTGACGATAAGCAAAAAGGCTTTGGTCATCAGTTTATTAACGCGATGGATGCGAA
TGGTCTTCGTGTCGATGTCTCTGTACGCAGTTCTGAACTGGCCGTAGACGAGGCAGGGCGTAAACATACC
AAGGACGCGAATGGTGATTGGGTCCAAAAAGCCGAAAACAACAAAGTTTCGCTAAGCTGGGACGAGCAAG
GTGAAGTTGTTGCCAAGGATGAACGTATTCGCAACGGTATTGCGGAAGGCGACATCGATCTCTCTCGTAT
TGGTGTCAGCGACGTTGACGAGCCAGCTCGTGGTGCAATCGGTGACAACAATGATGTGTTTGATGCGCCA
GAAAAACGCAAAGCGGAGACAGAAACCTCATCTTCTTCTGCAAACAATAAACTCAGCTACTCAGGTAACA
TTCAAGTCAATGTGGGTGATGGTGAGTTTACGGCAGTGAACTGGGGCACATCGAATGTGGGCATTAAAGT
CGGCACGGGTGGCTTTAAGTCGCTGGCTTTTGGTGACAATAACGTCATGGTTCACATCGGCAATGGTGAG
AGCAAGCACAGCTTCGATATTGGTGGTTATCAGGCACTGGAAGGTGCGCAAATGTTCATCGGTAATCGTA
ATGTGAGCTTCAACTTAGGTCGAAGTAATGATCTGATTGTGATGATGGACAAGTCGATTCCGACTCCGCC
ATTGGTTAATCCGTTCGATGGTGCCGCTCGTATTTCGGGCGTACTGCAAAGCATTGCCACCTCGGGTGAG

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3. Record the three pathogens on the chart below, and research and record the symptoms that people would probably have if affected by each pathogen.

DNA Sequence	Pathogen	Symptoms
Sequence One		
Sequence Two		
Sequence Three		

4. Summarize how this database can be useful in identifying a pathogen involved in an outbreak.

In Part 2, you will start from the beginning to investigate an outbreak. To prepare, consider some of the questions you might ask as part of your detective work. Identifying the pathogen that causes an outbreak is a very important step, but investigators then need to identify the **source** of the pathogen to prevent others from getting sick. The five "Ws" (questions whose answers are considered basic in information gathering or problem solving) can help narrow down the clues that could lead to the source. Write down a question that begins with each of the five "Ws" that you would ask people who became sick; these questions should help you to start a traceback.

Who

What

Where

When

Why

Plus "How"

STUDENT WORKSHEET

ACTIVITY 1 – PART 2: OUTBREAK INVESTIGATION (CONTINUED)

Name _____ Date _____ Class/Hour _____

For this activity, choose a real outbreak to investigate and research from either website 1 from CDC or website 2 from FDA. Identify all additional sources of information used for responses on this worksheet.

Website 1 from CDC: List of Multistate Foodborne Outbreak Notices:

https://www.cdc.gov/foodborne-outbreaks/active-investigations/all-foodborne-outbreak-notices.html?CDC_AAref_Val=https://www.cdc.gov/foodsafety/outbreaks/lists/outbreaks-list.html

Use the information that you learn through your research to fill out either table.

Name of pathogen causing the outbreak	
Location of first reports of outbreak	
Dates of infection (You may need to click on "Timeline")	
Any other locations of outbreak (You may need to click on "Map")	
Number of individuals infected	
Number of hospitalizations	
Number of deaths	
Food product linked to outbreak	
Was a recall issued? If yes, describe.	
Could individuals prevent the illness through safe food practices? If yes, describe how.	

Website 2 from FDA: Public Health Advisories from Investigations of Foodborne Illness Outbreaks:

www.fda.gov/food/outbreaks-foodborne-illness/public-health-advisories-investigations-foodborne-illness-outbreaks

Date of Outbreak	
Name of pathogen involved in the outbreak	
Facts about the pathogen	
Number of individuals infected	
Food product linked to outbreak	
Was a recall initiated? If so, explain.	
What advice would you provide to prevent such infections?	

STUDENT WORKSHEET

ACTIVITY 2: NEW FOOD SAFETY TOOLS

Name _____ Date _____ Class/Hour _____

As you respond to these questions, please list the Credible Sources you used.

What is the new food safety tool that you chose to research?

1. Is the basic science underlying this potential tool new or was it already being used for something else?

2. Who are the researchers or inventors?

3. In what year did their research begin?

4. How was the new idea tested?

5. Would this new tool replace an existing tool or is the current tool an enhancement to make it more effective?

6. Did the researchers change their minds about aspects of the possible tool during their research or development?

7. Did the researchers/inventors make new discoveries?

8. Who will benefit from the new tool?

9. How could this new tool improve food safety?

10. Is the food safety tool you researched being used today? If not, when might the discovery/invention be used for food sold to consumers?

STUDENT WORKSHEET

ACTIVITY 1: DISSECTING THE NUTRITION FACTS LABEL

Name _____ Date _____ Class/Hour _____

1. Arrange the cards in order of the food you think has the most protein per serving to the food you think has the least protein per serving. Complete Column 1 in the data table below with that information.
2. After you read the food product nutrition labels, rearrange the foods in the correct order of most to least Protein per Serving – record that in Column B. If you find 2 products with the same information, list them alphabetically.
3. Record the arrangement of the foods according to the amount of Protein per Serving listed on the Nutrition Facts label for each food. In the last column, mark an up arrow (↑) if the actual ranking was higher than you initially recorded, a down arrow (↓) if it was lower than you initially recorded, and an equal mark (=) if it was the same as your ranking. [Note: If you are filling in this worksheet online, you can write Up or Down for the arrow direction.]

Data Table to Rank Foods According to Protein per Serving

A List the foods in order of those you think have the **most** Protein per Serving to the **least** Protein per Serving	**B** Look at the Nutrition Facts label for each product and list the products in order from those with the **most** Protein per Serving to those with the **least** Protein per Serving. Include how many grams of protein for each one.	**C** Compare each food position in column A with the same food's position in column B. Record ↑ if the position in B is higher, ↓ if the position in B is lower, and = if the position is the same in columns A and B.

1. What information did your group use to initially rank the foods according to the amount of protein per serving?

2. How accurate was your group's initial ranking of the food products?

3. What food products surprised your group by their ranking and why?

4. Why do you think it is important to understand the Nutrition Facts label?

Nutrition Facts Label Mini-Book

VITAMINS AND MINERALS

NUTRIENTS TO GET LESS OF

NUTRIENTS TO GET MORE OF

% DAILY VALUE

CALORIES

SERVINGS PER CONTAINER

SERVING SIZE

Strawberry Yogurt Smoothie

Nutrition Facts

1 servings per container
Serving size 1 bottle (207 mL)

Amount per serving
Calories **100**

	% Daily Value *
Total Fat 0.5g	**1%**
Saturated Fat 0g	**0%**
Trans Fat 0g	
Cholesterol 5mg	**2%**
Sodium 80mg	**3%**
Total Carbohydrate 22g	**8%**
Dietary Fiber 3g	**11%**
Total Sugars 18g	
Includes 14g Added Sugars	**28%**
Protein 6g	

Vit.D 4mcg 20% • Calcium 280mg 20%
Iron 0mg 0% • Potas. 290mg 6%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Using the Nutrition Facts Label to Make Healthy Food Choices — Module 1

STUDENT WORKSHEET

ACTIVITY 1: SCAVENGER HUNT (CONTINUED)

Name _____ Date _____ Class/Hour _____

Part C

For this Scavenger Hunt, use your set of **Product Cards** to answer the following questions about the products. You can use the information in your **Mini-Book**, the label on the back of the **Product Card**, and the Interactive Nutrition Facts Label website: www.accessdata.fda.gov/scripts/interactivenutritionfactslabel.

For example: "Find the product that is healthiest for saturated fat." Look through the Nutrition Facts labels on the back of the **Product Cards** and find the one that your group thinks is healthiest for saturated fat. Write the name of that product in the correct space below and then give your group's reason for choosing that particular product.

1. Which products are the healthiest for saturated fat? Explain your answer.

a. Product Name _____ b. Grams of saturated fat _____

c. Explanation _____

2. Which products are the least healthy for saturated fat? Explain your answer.

a. Product Name _____ b. Grams of saturated fat _____

c. Explanation _____

3. Find a product that is a good source of fiber.

a. Product Name _____ b. Grams of fiber _____

c. Explain why you picked this product. _____

4. Which product has the highest amount of added sugars per serving? Would you recommend this product to a classmate? Why or why not?

a. Product Name _____ b. Amount of Added Sugar _____

c. Recommendation and Explanation

_____

5. Which product has the highest amount of sodium per serving? Would you recommend this product to your grandparent who has high blood pressure? Why or why not?

a. Product Name _____ b. Amount of Sodium _____

c. Recommendation and Explanation

_____

continued on next page

STUDENT WORKSHEET
SCAVENGER HUNT (CONTINUED)

6. A general rule is that 5% DV or less of a nutrient per serving is considered low; 20% DV or more of a nutrient per serving is considered high. Select a product and explain why it falls in either category.

a. Product Name

b. Explanation

7. Pick one product and look at the section on the Nutrition Facts label that lists vitamins and minerals. What are the vitamins and minerals listed on the selected food label?

a. Product Name

b. Vitamins

c. Minerals

8. Pick one of the products that you think would be a good source of protein.

a. Product Name

b. Why it is a good source of protein?

Review your responses to the Scavenger Hunt questions and compare them with two other groups. How close were your responses to those of the other groups?

STUDENT WORKSHEET
ACTIVITY 2: ANALYZING SERVING SIZE

Name _____ Date _____ Class/Hour _____

DATA TABLE FOR _____

(Cereal Name)

Complete these questions and the Data Table with information about your chosen cereal.

1. When you eat cereal for breakfast, how much do you estimate you eat (ex: 1/2 cup, 1 cup, 2 cups, etc.)? _____
2. When you pour your bowl of breakfast cereal, how many servings do you think are in the bowl? _____
3. What does the Nutrition Facts label for your breakfast cereal say about Serving Size? _____
4. Compare the amount of cereal you actually poured into your bowl with the amount per serving on the label.
   How many servings are in the original bowl of cereal that you poured? _____

	Nutrition Facts label Information	Our Poured Bowl of Cereal	Our Bowl of Cereal with 1 Cup of 2% Milk
Serving Size			
Calories			
Carbohydrates			
Fiber			
Total Sugars			
Added Sugars			
Protein			

5. Compare the portion size of the bowl you poured with that of 2 other groups. If their portion sizes are different, why do you think they are different?
   _____
6. One of the entries in your **Mini-Book** is **Nutrients To Get Less Of**. One of these nutrients is added sugar.
   a. How much added sugar is in one serving of your cereal? _____
   b. How much added sugar is in the portion of cereal that you poured into the bowl without measuring? _____

   Look at the ingredients for your selected cereal and answer the following questions.
   c. What added sugars are in the cereal? _____
   d. Why should you try to limit added sugars? _____
   e. What could you do to make your cereal choice more healthy?
   _____

STUDENT WORKSHEET

ACTIVITY 3: CREATING A NUTRITION FACTS LABEL

Name _____ Date _____ Class/Hour _____

Smoothie Name _____

Ingredients: Base _____ Volume _____ Added Sugars _____ (if any, see page 27)

Fruit _____ Volume _____

Sweetener/flavoring (if any) _____ Volume _____ Added Sugars _____ (if any, see page 27)

A Nutrition Calculator Values for Combined Ingredients from www.verywellfit.com/recipe-nutritionanalyzer-4157076

_____ serving per container

Serving size _____

Calories/serving _____

Total Fat _____ g

Saturated Fat _____ g

Cholesterol _____ mg

Sodium _____ mg

Total Carbohydrates _____ g

Dietary Fiber _____ g

Total Sugars _____ g

Protein _____ g

Vitamin D _____ mcg

Calcium _____ mg

Iron _____ mg

Potassium _____ mg

Assume 0g *Trans* Fat

Added Sugars/Serving _____ g

B Label from Label-Making Tool at www.onlinelabels.com/tools/nutrition-label-generator

Nutrition Facts

_____ servings per container

Serving size _____

Amount per serving

Calories _____

	% Daily Value *
Total Fat _____ g	_____ %
Saturated Fat _____ g	_____ %
Trans Fat _____ g	
Cholesterol _____ mg	_____ %
Sodium _____ mg	_____ %
Total Carbohydrate _____ g	_____ %
Dietary Fiber _____ g	_____ %
Total Sugars _____ g	
Includes _____ g Added Sugars	_____ %
Protein _____ g	
Vit.D _____ mcg _____ % • Calcium _____ mg _____ %	
Iron _____ mg _____ % • Potas. _____ mg _____ %	

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Check Rounding Rules for These Select Nutrients

	Vit. D	Calcium	Iron	Potas.	Added Sugars
Daily Value	20 mcg	1,300 mg	18 mg	4,700 mg	50 gm
Rounded Amount for Label	Express to nearest 0.1 mcg	Express to nearest 10 mg	Express to nearest 0.1 mg	Express to nearest 10 mg	< 0.5 g express as 0 < 1 g express as "Contains less than 1 g" or "less than 1 g" > 1 g express to nearest 1 g
Un-rounded %DV	%DV = (actual amount (g)/DV) X 100				
Rounded %DV for Label	≤10% level: express to the nearest 2% >10% to ≤ 50% level: express to nearest 5% >50% level: express to nearest 10%				Round to the nearest 1% Round down if ≤ 0.49% and up if ≥ 0.50%
Low %DV option for specific nutrients	If less than 2%, may be declared by a zero or by the use of an asterisk (or other symbol) that refers to another asterisk (or symbol) that is placed at the bottom of the table that is followed by the statement "Contains less than 2 percent of the Daily Value of this (these) nutrient (nutrients)."				If less than 1 gm, may not be included on the Nutrition Facts label, but (in such cases) the statement "Not a significant source of added sugars" is required as a footnote below the table of nutrients.

Use the Rounding Rules to revise the values for Added Sugars, Vitamin D, Calcium, Iron, and Potassium, if needed.

1. Is your recipe a good source for nutrients? If yes, which ones?

2. Are there any nutrients in your recipe that should be limited? If yes, which one(s) and give the reasons for each one.

3. Which nutrients in your recipe would you change to make it a healthier choice? Experiment with your recipe: change an ingredient and/or the amount of the ingredient in the recipe and explain how the nutrients change on the label.

STUDENT WORKSHEET

ACTIVITY 1: HOW MUCH ADDED SUGAR IS IN YOUR BEVERAGE?

Name _____ Date _____ Class/Hour _____

This activity will help you to visualize how much sugar is in a beverage.

1. Make a list of your group's top 6 favorite beverages and then respond to these questions:

a. Which beverages on your list do you think have the most added sugars?

b. Which do you think have the least added sugars?

2. Watch these two videos that introduce Total Sugars and Added Sugars:

Added Sugar on the Food Label www.youtube.com/watch?v=PygjyyWvqhU

Hy-Vee KidsFit at Home – Rethink Your Drink www.youtube.com/watch?v=eu9BgqCqIa8.

3. Your teacher has prepared some numbered beverage containers and bags with various amounts of sugar that represent the amount of added sugars in the various beverages. As you look at the containers and bags of sugar, match the bags of sugar you think represents the amount of added sugars in each beverage.

SUGAR IN BEVERAGES DATA TABLE

BEVERAGE	SUGAR BAG (letter)	GRAMS OF ADDED SUGARS	GRAMS OF TOTAL SUGARS	PERCENT OF TOTAL SUGARS FROM ADDED SUGARS (i.e., ADDED SUGARS/TOTAL SUGARS x 100%)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

continued on next page

STUDENT WORKSHEET

HOW MUCH ADDED SUGAR IS IN YOUR BEVERAGE? (CONTINUED)

4. Look at the Nutrition Facts labels for the beverages in this activity and record the Total Sugars and Added Sugars for each on your Worksheet.

In which beverages were the amounts of Total Sugars and Added Sugars the same?

5. Review the completed data table with your class to learn how well your group matched the beverages with the bags of sugar, and make corrections as needed.

a. List which beverages had the most Added Sugars:

b. Which findings surprised your group the most?

6. Read the **Total and Added Sugars** and **Total Carbohydrates** Fact Sheets and review the videos, *Added Sugar on the Food Label* and *Hy-Vee KidsFit at Home – Rethink Your Drink*, to answer the following questions.

a. Sugar belongs to a group of chemical compounds called carbohydrates. What are the different kinds of carbohydrates that are used by your body?

b. Why are carbohydrates important for your health?

c. The calories in sugary beverages are said to be "empty calories." What does this mean?

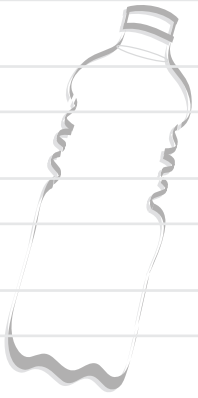
d. What is the difference between naturally occurring sugars and Added Sugars?

e. For a 2,000-calorie daily diet, the Daily Value for Added Sugars is 50 grams. For a person with this diet, which of the drinks in this activity would you recommend and why?

f. Why is milk called a "nutrient dense" food?

g. Why is it important to read the labels on the foods and beverages you consume?

h. What are some ways to limit your added sugars intake?



7. When all groups have completed their responses to the questions, review the answers with the class.

STUDENT WORKSHEET
ACTIVITY 2: SODIUM IN SNACK FOODS

Name _____ Date _____ Class/Hour _____

What is sodium and why do you think sodium is included in the list of nutrients on the Nutrition Facts label?

1. Watch the video, *Sodium on the Food Label* www.youtube.com/watch?v=wY11olmXrOg and read the FDA Facts Sheet **Sodium in Your Diet** and then answer the following questions:

a. According to the Fact Sheet what is sodium?

b. How does this definition compare with your group's definition?

c. How is sodium different from salt?

d. Why is sodium called an essential nutrient?

e. When you look at the Nutrition Facts label on the **Sodium in Your Diet** Fact Sheet, you see there are 430 mg (milligrams) of sodium in that food. If you could visualize 430 milligrams, what do you think it might look like?

f. One teaspoon of salt contains 2,300 mg of sodium. What is the volume for salt (measured by teaspoon) with 430 mg of sodium, and how does this compare with your previous visualization for 430 mg of sodium?

2. In the **Sodium in Your Diet** Fact Sheet, savory snacks are listed as one of the food categories that contributes about 40% of the sodium you eat. Make a list of your group's favorite snacks.

a.

b.

c.

d.

e.

f. Which snacks on your list do you think contain the most sodium? Remember, a snack does not need to taste salty to contain a lot of sodium.

3. Your **Snack Food** cards show pictures of snacks or information about the amount of sodium in a person's diet. Your teacher has shown you a set of bags of salt that represent the amount of sodium in the items on the cards. Match the picture on the card with the bag of salt that you think represents the amount of sodium in the product in the picture. When you finish matching all of the pictures with bags of salt, record the name of the item on the card in the column beside the amount of salt listed on the **Sodium in Snack Foods Data Table.**

continued on next page

STUDENT WORKSHEET

SODIUM IN SNACK FOODS (CONTINUED)

SODIUM IN SNACK FOODS DATA TABLE		
	SNACK FOOD	
MILLIGRAMS OF SODIUM	OUR ANSWER	CORRECT ANSWER
1 mg		
40 mg		
160 mg		
170 mg		
250 mg		
400 mg		
450 mg		
920 mg		
1,500 mg		
1,910 mg		
2,300 mg		
3,440 mg		

When everyone has completed their data tables, review your group's answers with the rest of the class. If you had any incorrect responses, write the correct answer in that column in the data table.

4. Complete the following questions. You can review the video, *Sodium on the Food Label* www.youtube.com/watch?v=wY11olmXrOg and the **Sodium in Your Diet** Fact Sheet.

a. What did you find surprising about the snack foods?

b. How can eating foods high in sodium affect your health?

c. How much sodium does the body need in order to function each day?

d. How much sodium should we consume daily?

e. What is the average daily intake of sodium by Americans over 2 years of age?

f. From where does most of the sodium in your diet come?

g. Name 3 foods that you eat that are high in sodium.

h. Name 3 foods that you eat that are low in sodium.

5. Watch the video, *Eating Too Much Salt? 4 Ways to Cut Back…Gradually* www.youtube.com/watch?v=OG8RCuZNbeA.

Describe 3 things you will do to reduce the amount of sodium that you eat.

6. Refer to your list of snacks. Which do you think are the most healthy and why?

A

Crunchy Cheese Snack
(1 ounce)

B

Vegetable Juice
(11.5 ounces)

C

Pretzels
(1 ounce)

D

Diet Soda
(12 ounces)

E

Medium Banana
(7 - 7.9 inches)

F

Regular Potato Chips
(1 ounce)

G

Baked Potato Chips
(1 ounce)

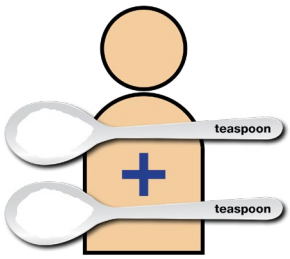
H

Sunflower Seeds
(1 ounce)

I

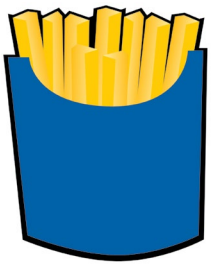
Recommended
Amount Per Day

J



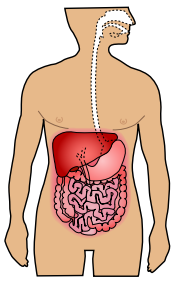
Average American
intake of Sodium

K



Large Fries
(5.3 ounces)

L



Amount of Sodium
Your Body Needs

STUDENT WORKSHEET
MEAL PLANNING – BREAKFAST

Name _____ Date _____ Class/Hour _____

1. Watch *Reading the Food Label*. www.youtube.com/watch?v=s5zroZfMn0I
2. Create a healthy breakfast that will be part of a 2,000-calorie daily plan; aim for about 500-600 calories (total) for this meal.
3. Determine your own calorie needs with the MyPlate Calculator: www.myplate.gov/myplate-plan.
4. Write the names of the foods you choose across the top row of the table below and complete the information about each food in the column below the food. Include the number of servings you plan to consume for each food, and multiply the calories and nutrients by the number of servings.

Use the Nutrition Facts label on your chosen foods to determine the amount of nutrients in each food and how each nutrient contributes to the %DV. To learn more about nutrients to get more and less of, explore the many online resources such as FDA's *Nutrition Information for Raw Fruits, Vegetables, and Seafood* www.fda.gov/food/food-labeling-nutrition/nutrition-information-raw-fruits-vegetables-and-fish.

Food Name(s)								
Servings Per Container								
Serving Size								
# of Servings Consumed								
Totals: (nutrient value x number of servings)								
Calories								
Total Fat (%DV)								
Saturated fat (%DV)								
Trans fat*								
Cholesterol (%DV)								
Sodium (%DV)								
Total Carbohydrate (%DV)								
Dietary Fiber (%DV)								
Total Sugars* (g)								
Added Sugars (%DV)								
Protein* (g)								
Vitamin D (%DV)								
Calcium (%DV)								
Iron (%DV)								
Potassium (%DV)								

*While the Nutrition Facts label does not list a %DV for *trans* fat, Total Sugars, or protein, you can record the grams of each of these three components for a food.

What is your cumulative breakfast %DV for each of the following?

Vitamin D _____
Calcium _____
Iron _____
Potassium _____

What is your cumulative breakfast %DV (or milligrams/grams) for each of the following?

Saturated fat _____
Sodium _____
Added Sugars _____

STUDENT REVIEW WORKSHEET
MEAL PLANNING

Name _____ Date _____ Class/Hour _____

1. Where on the Nutrition Facts label can you find serving size and servings per container?

2. Why are these important to know?

3. Where can you find how many calories you can get from a food?

4. Why is it important to know the amount of energy (calories) you get from a food?

5. How do you use %DV to determine which nutrients in the food are low and which are high?

6. How would you define the phrase 'nutrient-dense foods'?

7. Which of the foods in your breakfast meal was the most nutrient-dense?

8. Which was the least nutrient-dense food?

9. What values did you use to determine this?

STUDENT WORKSHEET

ACTIVITY 1: GET THE FACTS ABOUT FATS! – INTERACTIVE LABEL RESEARCH

Name _____ Date _____ Class/Hour _____

The Interactive Label website has some great information to help you make healthier choices. This activity will help you learn more about fats.

1. Open up the link below, click on the Fact Sheets tab, and read the following Fact Sheets: Monounsaturated and Polyunsaturated Fats; Saturated Fat; *Trans* Fat.
2. When you finish reading the Fact Sheets, complete the table and the questions that follow.

Use information found at this link to complete this chart: www.accessdata.fda.gov/scripts/InteractiveNutritionFactsLabel/

Kind of Fat	Health Benefits	Health Risks	Sources	Characteristics
Saturated				
Monounsaturated				
Polyunsaturated				
Trans				

1. Fat is called the best source of energy. Why?

2. How is the amount of energy that you get from fats different from the amount of energy that you get from proteins and carbohydrates?

3. Why are fats important for proper growth and health?

4. What are the major sources of fats in the diet?

5. To reduce the amount of saturated fat in your diet, which foods would you limit and why?

6. Create a Venn diagram to compare and contrast saturated and unsaturated fats. (Use a blank sheet of paper if needed.)

7. Explain the differences in carbon bonds in saturated fat, monounsaturated fat, and polyunsaturated fat.

8. What are typical food sources for cholesterol? What kind of fats do these same foods typically have more of?

9. At the beginning of this activity, you were asked if you thought most Americans consumed too much fat. Based on what you have learned about fats in this lesson, what is your opinion now of this statement? Explain the reasons for your opinion.

STUDENT WORKSHEET

ACTIVITY 2: SATURATED AND UNSATURATED FATTY ACID MOLECULAR MODELING

Name _____ Date _____ Class/Hour _____

Saturated Fatty Acid Models		Unsaturated Fatty Acid Models			
Length	Cluster volume	Length	# Double bonds	Double bond position(s)	Cluster volume
1.		1.			
2.		2.			
3.		3.			
4.		4.			
5.		5.			

1. How much difference was there between the cluster volume of your saturated fatty acids and the cluster volume for your unsaturated fatty acids?

2. How does cluster volume affect the density of the fatty acids? How would this affect melting point?

3. Why is it important to know about the amount and kind of fat in food?

STUDENT WORKSHEET

ACTIVITY 1: TWO MEALS ON THE GO!

Name _____ Date _____ Class/Hour _____

Directions:

Step 1: Determine the personal daily calorie needs and the sodium and saturated fat limits for you or someone else by using the My Plate Plan calculator at www.myplate.gov/myplate-plan

Step 2: Record the name of your fast food restaurant(s) and the components of two meals that you would like to eat or have eaten there. Be sure to indicate if the meal is a breakfast, lunch, or dinner.

Step 3: Use the Internet to search the fast food restaurant(s) website. Locate the nutrition information for the items and record it in the data table.

[Remember that online menu information will depend upon (1) whether or not the chosen establishment is covered under the menu labeling requirements, and (2) whether a customer can use the online menu to place an order. Additionally, restaurants may provide the information voluntarily.]

Personal Daily Calorie Needs _____

Personal Daily Sodium Limit _____

Personal Daily Saturated Fat Limit _____

Meal 1: Name of Restaurant _____

Check one: ☐ breakfast ☐ lunch ☐ dinner

Meal 2: Name of Restaurant _____

Check one: ☐ breakfast ☐ lunch ☐ dinner

	Food Selection	Total calories	Saturated Fat (g)	*Trans* fat (g)	Sodium (mg)	Total Carbohydrates (g)	Dietary Fiber (g)	Sugars (g)	Protein (g)
Meal 1									
Meal 1									
Meal 1									
Meal 1									
Meal 1 Total									
Meal 2									
Meal 2									
Meal 2									
Meal 2									
Meal 2 Total									
Total for Both Meals									

Things to remember for this activity

- The *Dietary Guidelines for Americans* also recommends consuming less than 10% of calories per day of saturated fats.
- Each gram of protein has 4 calories; each gram of carbohydrate has 4 calories; and each gram of fat has 9 calories.

STUDENT WORKSHEET

TWO MEALS ON THE GO! (CONTINUED)

Name _____ Date _____ Class/Hour _____

1. If you eat these meals, how many more calories should you eat for the rest of the day (based on your daily calculated calorie needs)?

2. How many of the calories in these meals are from saturated fat?

3. If you eat these meals, how much more saturated fat can you eat the same day?

4. How much of your daily sodium would you consume if you eat these two meals in one day?

5. How much more sodium can you eat the same day?

6. Based on the data you collected, do you think these are healthy meals? Justify your response.

7. Pick one meal that you could change so that it would meet your goals. Calculate your revised nutrient totals and record them below.

 Food Selection	Total calories	Saturated Fat (g)	*Trans* fat (g)	Sodium (mg)	Total Carbohydrates (g)	Dietary Fiber (g)	Sugars (g)	Protein (g)
Modified Meal								
Totals for Modified Meal								
Totals for Unchanged Meal								
New Two-Meal Totals								

8. How would the change in your menu affect your total calories, saturated fat, and sodium?

STUDENT REVIEW WORKSHEET
TWO MEALS ON THE GO!

Name _____ Date _____ Class/Hour _____

1. What is meant by a healthy eating pattern?

2. What information will you be able to find on most restaurant menus that will help you make healthy decisions about the food you order? Why is this information important?

3. Which restaurants are required to meet the menu labeling requirements?

4. In restaurants where the calorie information is on the menu, what additional information should the restaurant have available for the consumer?

5. When you made the choices for your healthier fast food meal, which nutrients played the most important role in making those choices?

6. List at least three tips you would use to order a healthier meal when eating out, and explain why you would use them.

7. Why is it important to know your personal daily calorie needs, and your sodium and saturated fat limits?

STUDENT WORKSHEET

ACTIVITY 2: ✔ YOUR SNACKS!

Name _____ Date _____ Class/Hour _____

Everyone likes to snack! But is your snack healthy for you? Let's find out.

Compare two of your favorite snacks with two school snacks for optimal nutrition. Use the information from the Nutrition Facts label on the packages to complete the tables. Place a ✔ if it meets the criteria as a Smart Snack and **X** if it does not.

List the criteria for a snack to be a Smart Snack:

Nutrient	Snack
Calories	
Total Fat	
Saturated Fat	
Trans Fat	
Sodium	
Sugar	

Your Snack	✔ or X		✔ or X	School Snack
	☐ ☐	Name of Snack	☐ ☐	
	☐ ☐	Serving Size	☐ ☐	
	☐ ☐	Calories	☐ ☐	
	☐ ☐	Total Fat	☐ ☐	
	☐ ☐	Saturated Fat	☐ ☐	
	☐ ☐	*Trans* Fat	☐ ☐	
	☐ ☐	Sodium	☐ ☐	
	☐ ☐	Sugar	☐ ☐	

Your Snack	✔ or X		✔ or X	School Snack
	☐ ☐	Name of Snack	☐ ☐	
	☐ ☐	Serving Size	☐ ☐	
	☐ ☐	Calories	☐ ☐	
	☐ ☐	Total Fat	☐ ☐	
	☐ ☐	Saturated Fat	☐ ☐	
	☐ ☐	*Trans* Fat	☐ ☐	
	☐ ☐	Sodium	☐ ☐	
	☐ ☐	Sugar	☐ ☐	

1. Did your snack meet the criteria for a Smart Snack? _____
2. How do you know? _____
3. How will this make you rethink your snack choices? _____
4. Explain how likely you are to choose a Smart Snack instead of another snack in a grocery store.

STUDENT REVIEW WORKSHEET
✔ YOUR SNACKS

Name _____ Date _____ Class/Hour _____

1. What nutrient information must be shown on snacks sold in some vending machines? How would this information influence the snack you purchase from this vending machine?

2. What is a **Smart Snack**? How is this snack different from ones not sold in schools?

3. Do you think that snacks sold in schools should be healthier than those sold in the supermarket? Please provide your reasons.

4. An "anytime" snack has been defined as a snack that is nutrient dense. Which of the snacks you reviewed for this activity would belong to this group? What information did you use to put the snack(s) in this group?

5. A "sometimes" snack has been defined as a snack high in empty calories, saturated fats, added sugars, or sodium and are foods that should be limited. Which of the snacks you reviewed for this activity would belong to this group? What information did you use to put the snack(s) in this group?

STUDENT WORKSHEET

MAKING A NEW APPLE CULTIVAR

PART A: *APPLE - HOW DOES IT GROW?*

WWW.YOUTUBE.COM/WATCH?V=UWLMEH1HIBW

Name _____ Date _____ Class/Hour _____

1. What is meant by the statement "Each apple seed is genetically unique?"

2. Explain how grafting is used to propagate new apple trees.

3. Explain the importance of pollinators in the production of the apple crop.

4. Describe some methods that apple growers use to control pests?

5. If apples are only harvested in the late summer and fall, how are they available to consumers all year round?

6. How does the United States compare to other countries in the amount of apples produced?

STUDENT WORKSHEET

MAKING A NEW APPLE CULTIVAR

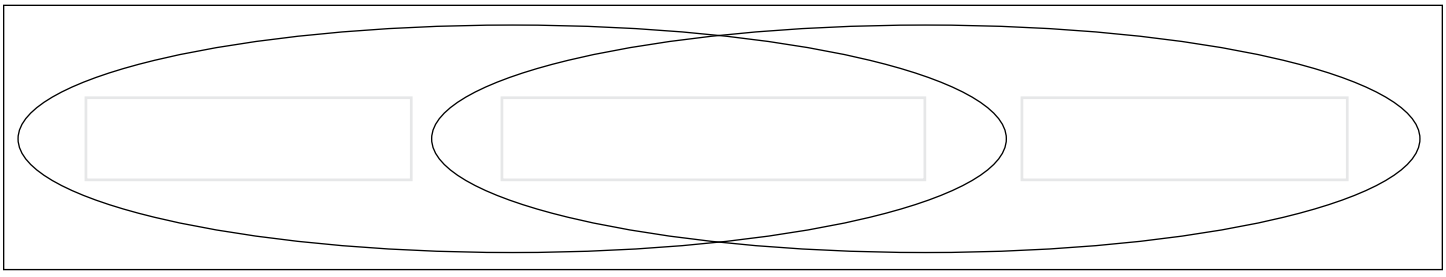
PART B: COMPARING APPLE CULTIVAR TRAITS

Name _____ Date _____ Class/Hour _____

Refer to the following websites for this activity: **www.orangepippin.com** and **www.cosmiccrisp.com/the-facts**

	Enterprise Apple	Honeycrisp™ Apple	Cosmic Crisp® Apple
Fruit Color			
Flesh Color			
Fruit Crispness			
Fruit Size			
Fruit Browning			
Fruit Shape			
Fruit Taste			
Skin Thickness			
Use			
Disease Resistance			
Scab			
Mildew			
Fireblight			
Cedar Apple Rust			
Bitter Pit			

Make a Venn diagram to explain the similarities and differences between the Enterprise and Honeycrisp™ apples.



Using the data you have collected, is there a way to determine if any of the apples' traits are dominant or recessive?

When comparing the Cosmic Crisp® apple to the Enterprise and Honeycrisp™ apples, what do you notice about the taste of the apples? How could the inheritance of taste be explained? Are there any other traits that seem to be similarly inherited? What would you need to do to determine whether or not your ideas for inheritance are correct?

STUDENT WORKSHEET

MAKING A NEW APPLE CULTIVAR

PART C: DEVELOPING THE COSMIC CRISP® APPLE

Name _____ Date _____ Class/Hour _____

Complete this worksheet as you watch the following two videos:

Why are there so many types of apples?
www.youtube.com/watch?v=mQePz62zkqA and
Farmweek – New Apple – **www.youtube.com/watch?v=jZsu-_EGa_M**

1. The Cosmic Crisp® apple was developed through selective breeding. Explain selective breeding and list the steps that apple breeders might use in this process.

2. In researching the Cosmic Crisp®, you probably did not find information about the apple's skin thickness. What might you predict the apple's skin thickness to be? What information did you use to make this prediction?

3. How long was the WA 38 (Cosmic Crisp®) cultivar in development at Washington State University?

4. How do apple breeders ensure that the new apple cultivar is the same as the original seedling?

5. How was the public introduction of the Cosmic Crisp® apple different than the way in which new apple cultivars are usually introduced?

6. How do apple breeders maintain long-lasting rights over an apple cultivar?

7. The breeders of the Cosmic Crisp® apple believe that they have produced an apple that is better than most of the other apples available today in our grocery stores. Explain why you either agree or disagree with this statement.

8. Looking to the future, what would the traits be of your "perfect" new apple cultivar?

STUDENT WORKSHEET

STRAWBERRY DNA EXTRACTION

STRAWBERRY DNA EXTRACTION LAB EXPLANATION - WWW.YOUTUBE.COM/WATCH?V=VNJWNIJKTZK

Name _____ Date _____ Class/Hour _____

1. What is DNA?

2. Where in the cell is the DNA found?

3. What does the word *extraction* mean?

4. How do you think you could extract the DNA from cells?

5. Does your food contain DNA, and if so, where would that DNA be found?

6. Each step in the extraction process aids in isolating DNA from the other cellular materials. Explain why each step was necessary and put the DNA extraction procedure into context by answering the following questions:

   Why did you have to mash the strawberries?

   What was the purpose of the salt in the DNA extracting solution?

   What was the purpose of the liquid detergent in the DNA extracting solution?

   Explain what happened when you added the alcohol to the strawberry extract.

   What did the extracted DNA look like?

7. Why is it useful for scientists to be able to extract DNA from fruits and vegetables? List at least two reasons.

8. If you could extract the DNA from any fruit or vegetable, which one would you choose and why would you want to study its DNA?

STUDENT WORKSHEET

ACTIVITY 1: GENETIC ENGINEERING

Name _____ Date _____ Class/Hour _____

KWL CHART			
Exploration Question	**What do I know?**	**What do I want to know?**	**What did I learn?**
What is bacterial transformation?			
What is genetic engineering?			

Answer the questions below after viewing these videos: *Soybean Genetic Modification* www.youtube.com/watch?v=wTraZwHDHXk, *Restriction Endonucleases (enzymes)* https://www.youtube.com/watch?v=GJrAsW41a64, and *3D Animation – Bacterial Transformation 3D Animation* https://vimeo.com/170630548

1. What is bacterial transformation?

2. Can bacteria transform naturally? If so, how?

3. What are plasmids?

4. What is the role of plasmids in bacterial transformation?

5. What is the role of DNA ligase?

6. Explain how the calcium chloride bath is used to insert the foreign DNA into the bacterial cell.

7. What happens when DNA is transcribed and replicated?

8. What do the scientists do to confirm that transformation has taken place?

STUDENT WORKSHEET
GENETIC ENGINEERING CARDS

Name _____ Date _____ Class/Hour _____

Match a description card with a Genetic Engineering Process card.

1

Separation of the desired gene

The transformation plasmid with the desired gene is separated from the bacterial cells and purified.

2

Ligation of the transformation plasmid parts

The desired gene, selection marker gene, and the "empty" transformation plasmid are combined in a test tube with a DNA ligase to seal the sticky ends of the DNA molecules together. This new bacterial transformation plasmid has incorporated the desired gene and the selection marker gene.

3

Addition of desired gene to bacteria

The transformation plasmid with the desired gene and the selection marker gene are added to bacterial cells.

4

Obtaining the desired gene

Scientists use one of several methods to screen and isolate the cell with the library plasmid containing the desired gene.

5

Transference of the desired gene

Scientists choose an appropriate insertion method to insert the desired gene into the plant cells they are studying.

6

Testing the genetically engineered plants

The plant is tested to determine if it incorporated the desired trait.

7

Isolation of the bacteria with the desired gene

The bacteria are plated onto a selective medium. Only bacteria with the desired gene and the selection marker gene will survive. The bacteria serve as a ready supply of the desired gene for use by scientists.

8

Propagating the genetically engineered plants

Plant cells are grown on selective media so that only the transformed cells carrying the new genes will grow. The media also contains substances that encourage the plant cells to grow into new plants.

9

Preparation of the transformation plasmid parts

The desired gene, a selection marker gene, and "empty" transformation plasmid are cut to make them compatible for ligation.

10

Isolation of the desired gene

The library plasmids with the desired gene are placed in a test tube with a restriction enzyme. The enzyme cuts the DNA at specific sites and frees the desired gene from the library plasmid.

Part 1:

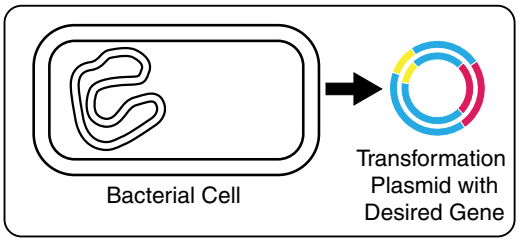
Match each description card to the corresponding picture card that shows that step in the GE process. Then record the number – letter matches (e.g., 1 – A) matches here:

continued on next page

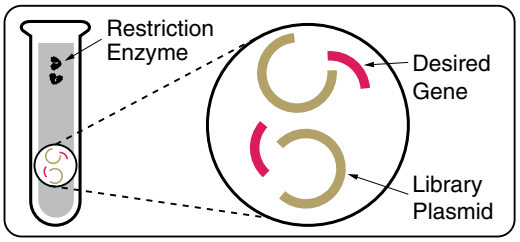
STUDENT WORKSHEET

GENETIC ENGINEERING CARDS (CONTINUED)

A



B



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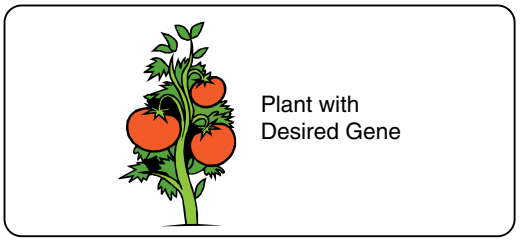
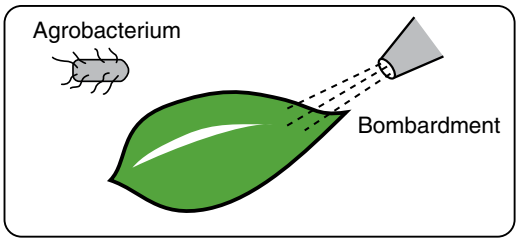
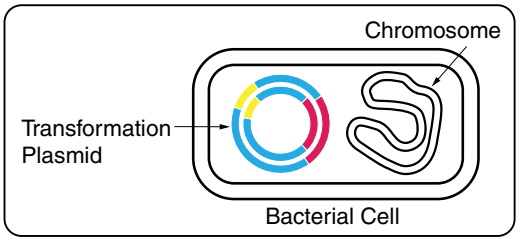


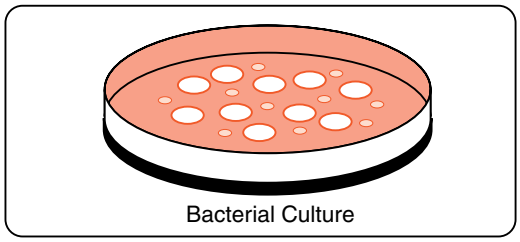
D



E



F



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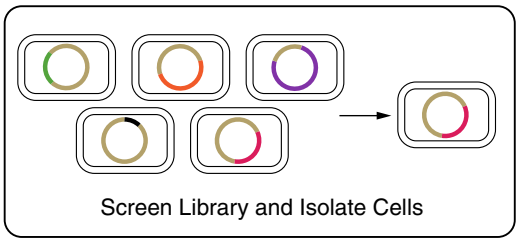
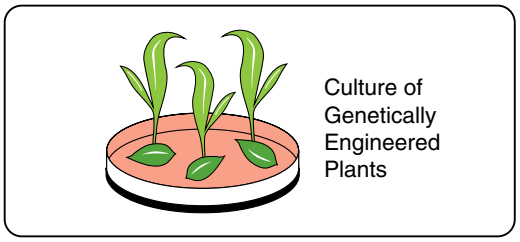
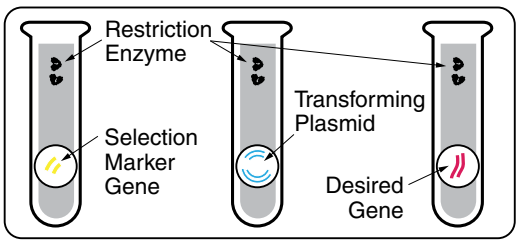


H



I



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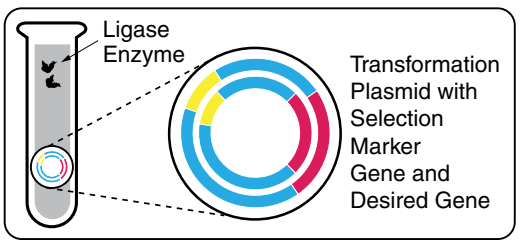


Part 2:

Write the sequence that these ten steps would occur using their number – letter matches here:

CRISPR-CAS NOTE-TAKING GUIDE AND INFOGRAPHIC WORKSHEET

Name _____ Date _____ Class/Hour _____

Directions: Watch the following four (short) videos and read the article about gene editing; then answer the questions.

- *Gene Editing Yields Tomatoes That Flower and Ripen Weeks Earlier* **www.youtube.com/watch?v=Jem3hP734uA**
- *CRISPR Gene Editing Explained* **https://video.wired.com/watch/crispr-gene-editing-explained**
- *CRISPR Explained (Mayo Clinic)* **www.youtube.com/watch?v=UKbrwPL3wXE**
- *CRISPR – a Word Processor for Editing the Genome* **www.ibiology.org/genetics-and-gene-regulation/crispr**

Why Gene Editing Is the Next Food Revolution - **www.nationalgeographic.com/environment/future-of-food/food-technology-gene-editing**, complete the following questions.

1. Why do scientists want to be able to edit DNA?

2. What is CRISPR and how do scientists use it?

3. In what type of organism was CRISPR first discovered?

4. What does the acronym CRISPR stand for?

5. What is Cas?

6. How did scientists harness or program the CRISPR-Cas9 system they identified in bacteria?

7. Describe the steps in the CRISPR-Cas system.

8. List some potential benefits/applications of CRISPR technology for our food.

continued on next page

CRISPR-CAS NOTE-TAKING GUIDE AND INFOGRAPHIC WORKSHEET (CONTINUED)

Infographic Planning

Remember: An infographic: (1) Is an explanation that helps you more easily understand something, (2) integrates words and pictures, (3) is self-explanatory, (4) makes for faster understanding of a concept, and (5) is understandable.

Refer to the Poster/Infographic Rubric on page 50 as you plan your infographic.

1. Review "A Visual Guide to Genetic Modification" **https://blogs.scientificamerican.com/sa-visual/a-visual-guide-to-genetic-modification**
2. After reviewing the first infographic "Conventional Crossbreeding," consider the following questions:
   - What makes this infographic interesting – the content, the design, or both?
   - How was the information arranged and presented? Were there sections, titles, and/or graphs?
   - How are fonts, color, and graphics used?
   - Did the design contribute to how you felt about the information?
   - What did you like about the infographic?
   - What would you change in the infographic to make it better?
3. As you design your infographic, consider the following questions:
   - What is your goal?
   - Who is your audience?
   - What information do you want to include?
   - What information is essential? What information is not?
   - Did you create an outline to organize your information?
   - How will you arrange your flow of information?
   - What colors and layout work best?
   - Have you streamlined your information?
4. Use the back of this page or another sheet of paper to design a rough sketch of your infographic.

STUDENT WORKSHEET
ACTIVITY 1: AGRICULTURAL PESTS

Name | Date | Class/Hour

Write your working definition for agricultural pests here:

Use the internet to find pictures of pests; use the links at the end of these directions to begin your research. List a minimum of 6 on the table below and complete the data table. Use the Credible Source Guide for your references. List if they are a pest or beneficial, and in the Action column, explain why they belong in this category.
https://www.aphis.usda.gov/aphis/resources/pests-diseases/hungry-pests/Pest-Tracker or:
https://www.organiclesson.com/beneficial-insects-garden-pest-control/

DATA TABLE

Name and Kind of Organism	Pest or Beneficial	Action

List the pests that affect the plants shown in the video, *The Amazing Way Plants Defend Themselves*
https://ed.ted.com/lessons/the-amazing-ways-plants-defend-themselves-valentin-hammoudi

List the pests that affect agricultural crops shown in the video, *Do We Really Need Pesticides*?
https://ed.ted.com/lessons/do-we-really-need-pesticides-fernan-perez-galvez#review

Final working definition for agricultural pests:

STUDENT WORKSHEET

ACTIVITY 2: PEST MANAGEMENT RESEARCH PROJECT

Group Members _____ Pest _____

Use the tables below to collect data for your poster.

PEST		
Description of Pest	**Native/Non-Native (Where it came from and how it got here)**	**Life Cycle Most Dangerous to Crop**
Crop(s) Affected	**Damage to Crop**	**Number of Individual Pests Present to Significantly Harm Crop**

PEST MANAGEMENT OPTIONS			
Management Method	**Environmental Impact**	**Effectiveness**	**Data Source(s)**

continued on next page

STUDENT WORKSHEET

ACTIVITY 2: PEST MANAGEMENT RESEARCH PROJECT (CONTINUED)

Best possible management solution(s).

Note any data you find about the environmental impact of the best management solution(s), using **+** for positive impact, **—** for negative impact and **0** for no impact.

Air Quality		Pollinators		Human Health	
Biodiversity		Wildlife		Surface Water	
Groundwater		Soil Fauna		Irrigation	
CO_2 Emissions		Estuaries		Fossil Fuels	
Waste		Methane Emissions		Desertification	
Sustainability		Government Policy		Flora	

STUDENT WORKSHEET

ACTIVITY 3: CITRUS GREENING DISEASE

Name _____ Date _____ Class/Hour _____

Answer the following questions as you watch these two videos:
Bitter Fruit - Citrus Greening Disease Threatens Florida Industry www.youtube.com/watch?v=T5nqVmliUaM and *Citrus Greening Disease* www.youtube.com/watch?v=G_1sobDdtiM.

1. What is citrus greening disease and what are its symptoms?
2. What is the name of the bacterium that causes the disease?
3. How does the disease spread in a citrus grove?
4. How widespread is this disease in the United States?
5. Which groups of people are impacted by citrus greening disease?
6. What is the research objective of the scientists' work in the video?
7. What is the hypothesis for their research?
8. What happens to the bacterium in the body of a psyllid that enables it to be transmitted from one citrus tree to another?
9. List the 4 steps in the Detached Leaf Transmission Assay.
10. How do the scientists detect the bacteria in the infected leaves and why do they use this method?
11. What did the scientists learn through their research?
12. What do the scientists hope to eventually be able to do with their information?
13. Why do you think this research is important?
14. If you could use Genetic Engineering to create a way to control HLB, what would you design, and which pest control method would it use?

CITRUS GREENING MANAGEMENT PROGRAMS DATA TABLE

Research various citrus greening management strategies, and complete the chart below.

Management Program	Management Description	Effectiveness of Treatment	Environmental Impact	Part of Tree Treated	Where Used and Frequency

STUDENT WORKSHEET
MALNUTRITION REPORT

Name _____ Date _____ Class/Hour _____

Refer to the Hunger Map and review which countries have the highest percentages of malnourishment (over 35% of the population). Select one of these countries to research and answer the following questions. Be sure to refer to the Credible Source Guide as you do your research. 2019 - Hunger Map (World Food Programme) **https://docs.wfp.org/api/documents/WFP-0000108355/download/?_ga=2.160307259.785805201.1573072332-1794787673.1573072332** (updated annually)

1. How do you know that the Hunger Map **(provided)** is a credible source?

2. Which countries exhibit undernourishment for greater than 35% of their population?

3. Choose one of those countries for your report on malnutrition. Which country did you choose? Why?

4. Sketch the shape of the country you chose and identify on which continent this country is located.

5. Describe the country's climate.

6. Complete the chart below using the **Credible Source Guide**.

Question	Answer(s) From Your Research	Citation: Title/Website Address
a. Identify one nutrient that this country struggles to provide its population.		
b. What percentage of the population suffers from malnourishment?		
c. What crops are grown in this country?		
d. Which foods are considered the staples in this country (rice, beans, cassava)?		
e. What are the reported causes of malnourishment in this country (environmental, economic, etc.)?		

continued on next page

STUDENT WORKSHEET

MALNUTRITION REPORT (CONTINUED)

Based on what you learned about the causes and effects of malnutrition in this country, what do you think can be done to help improve health here? In the chart below, identify three crops that could be nutritionally enhanced (by selective breeding or genetic engineering), grown, marketed, and distributed to the inhabitants of this country. *Confirm that the crop can grow in this country's climate and conditions.*

Nutrient-enhanced crop that could be grown in this country	Website Address/Citation

A challenge that farmers and scientists encounter after creating a nutrient-enhanced crop is whether other farmers will grow the food and people will incorporate it into their diet. Outline your plan to get one of the crops from your list into the country's cultivation system for widespread consumption. Create a five-step plan and explain each step.

Step	What you will do?	Why you will do it?
1		
2		
3		
4		
5		

STUDENT WORKSHEET

NEW PLANT VARIETY SAFETY EVALUATION PROCESS

Name _____ Date _____ Class/Hour _____

There are dozens of potato varieties that are grown in the United States. Your research team will genetically engineer a new potato variety from a host plant, the Yukon Gold potato.

Your project is to alter a trait that reduces susceptibility to one of the following three conditions:

☐ bruising ☐ blight ☐ insect damage (Choose one)

You are making a genetically engineered new variety. Decide how you want to alter the DNA.

Will you ☐ insert a transgene (a gene from another organism) or use ☐ genome editing?

Research your "host" potato variety using the internet (refer to the Credible Source Guide, page 51). First, look at Organisation for Economic Cooperation and Development) Potato composition document (pages 15 - 21) **https://www.oecd.org/env/ehs/biotrack/46815167.pdf**. The National Agricultural Library has many good sources, including FoodData Central **https://fdc.nal.usda.gov/**. Search for a specific potato, e.g., Yukon Gold, or you will get too much information. Complete the table below and record your sources.

Use the Safety Evaluation Process flow chart as a guide to determine if your new potato variety is "as safe and nutritious as comparable food" or if "additional information is needed." Your variety is hypothetical, so you have not actually tested its final composition in a laboratory. As you consider the flow chart questions (blue diamonds), you might not have enough information about your new variety to answer "yes" or "no." Choose a hypothetical answer to describe your variety, and circle the "yes" or "no" answer.

Potato Composition (% fresh weight, %FW)	A. Host Plant (Yukon Gold Potato)	B. New DNA (inserted or altered)	C. New Potato Variety	Credible Sources for A. and B. Data
Nutrient composition (starch, protein, fat, Vitamin C, potassium, etc.)				
Naturally-occurring toxins				
Naturally-occurring anti-nutrients				
Naturally-occurring allergen(s), if any				

Would you expect amino acids or proteins created through the change in DNA be present in the new potato? _____

Is your new potato variety... ☐ "as safe and nutritious as comparable food" or ☐ "additional information is needed" (select one).

Explain your decision. _____

STUDENT WORKSHEET

ARE THERE INGREDIENTS FROM GE PLANTS IN MY FOOD?

Name _____ Date _____ Class/Hour _____

Look at each **Food Label** card (pages 48-49) and think about the ingredients in that item. If there isn't a label, research the food or beverage to find out what ingredients it might contain. After you have determined which group the food belongs to (GE/possible GE or Non-GE), put a check mark in that box below and list the reason(s) for that choice.

Food Card item	Marketing label, e.g., organic	Food or ingredients that may come from GE crops	GE or Possibly GE	Food or ingredients with no corresponding GE counterpart	Non-GE
Arctic Apple			☐		☐
Cinnamon Crunch Cereal			☐		☐
Clementines			☐		☐
Coffee			☐		☐
Cosmic Crisp Apple			☐		☐
Cottage Cheese			☐		☐
Cream Filled Cookies			☐		☐
Cut Green Beans			☐		☐
Graham Crackers			☐		☐
Granola Bars			☐		☐
Honey Nut Oat Cereal			☐		☐
Margarine			☐		☐
Orange Juice			☐		☐
Pita Bread			☐		☐
Rainbow Papaya			☐		☐
Seedless Watermelon			☐		☐
Sour Cream			☐		☐
Table Salt			☐		☐
Tea			☐		☐
Wheat Bread			☐		☐

HONEY NUT OAT CEREAL

INGREDIENTS:

(Whole Grain Oats, Sugar, Oat Bran, Modified Corn Starch, Honey, Brown Sugar Syrup, Salt, Ground Almonds, Calcium Carbonate, Trisodium Phosphate, Wheat Flour, Vitamin E, Zinc, Iron, Vitamin C, Niacinamide, Vitamin B6, Vitamin B2, Vitamin B1, Vitamin A Palmitate, Folic Acid, Vitamin B12, Vitamin D)

CREAM FILLED COOKIES

INGREDIENTS:

Sugar, Unbleached Enriched Flour (Wheat Flour, Niacin, Reduced Iron, Thiamine Mononitrate {Vitamin B1}, Riboflavin {Vitamin B2}, Folic Acid), Palm, And/Or Canola Oil, High Fructose Corn Syrup, Cornstarch, Salt, Baking Soda, Soy Lecithin, Naturally And Artificial Flavor

COSMIC CRISP APPLE

ARCTIC APPLE

SEEDLESS WATERMELON

RAINBOW PAPAYA

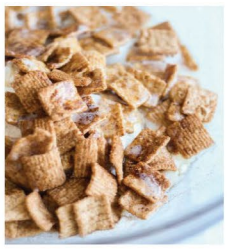
GRANOLA BARS

INGREDIENTS:

Rolled Oats, Brown Sugar, Rice Flour, Rolled Wheat, Soybean Oil, Whole Wheat Flour, Soy Protein, Dried Coconut

CLEMENTINES

CINNAMON CRUNCH CEREAL



INGREDIENTS:

Whole Grain Wheat, Sugar, Rice Flour, Canola Oil, Fructose, Maltodextrin, Dextrose, Salt, Cinnamon, Trisodium Phosphate, Soy Lecithin, Caramel Color. BHT Added to Preserve Freshness.

GRAHAM CRACKERS

INGREDIENTS:

Unbleached Enriched Flour (Wheat Flour, Niacin, Reduced Iron, Thiamine Mononitrate {Vitamin B1}, Riboflavin {Vitamin B2}, Folic Acid), Graham Flour (Whole Grain Wheat Flour), Sugar, Soybean and/or Canola Oil, Honey, Leavening (Baking Soda and/or Calcium Phosphate), Salt, Soy Lecithin, Artificial Flavor.

TABLE SALT

INGREDIENTS:
Salt, Calcium Silicate (an anticaking agent), Dextrose, Potassium Iodine

CUT GREEN BEANS

INGREDIENTS:
Organic Green Beans, Water, Sea Salt

PITA BREAD

INGREDIENTS:
Unbleached Enriched Flour (Wheat Flour Niacin Iron Thiamin Mono-Nitrate Riboflavin Folic Acid) Water Yeast Salt Dough Conditioners (Wheat Flour Mono-Diglycerides Calcium Sulfate Corn Starch Guar Gum Calcium Carbonate Soy Oil Salt Ascorbic Acid Ada Ammonium Sulfate Enzymes Sodium Meta Bisulfate Potassium Iodate) Preservatives Less Than 1% Calcium Propionate Potassium Sorbate.

WHEAT BREAD

INGREDIENTS:
Whole Wheat Flour, Water, Sugar, Wheat Gluten, Raisin Juice Concentrate, Wheat, Bran, Yeast, Molasses, Soybean Oil, Salt, Preservatives (Calcium Propionate, Sorbic Acid), Monoglycerides, DATEM, Calcium Sulfate, Grain Vinegar, Soy Lecithin, Soy, Whey (Milk)

COFFEE

INGREDIENTS:
Ground Coffee Beans

MARGARINE

INGREDIENTS:
Oil Blend (Canola, Palm, Fish, Flaxseed, And Olive Oils), Water, Contains Less Than 2% Of, Salt, Pea Protein, Natural And Artificial Flavors, Sunflower Lecithin, Vitamin A Palmitate, Beta-Carotene (Color), Vitamin D, Monoglycerides Of Vegetable Fatty Acids (Emulsifier); And Potassium Sorbate, Lactic Acid, TBHQ, Calcium Disodium EDTA (To Protect Freshness).

ORANGE JUICE

INGREDIENTS:
Water, Concentrated Orange Juice

COTTAGE CHEESE

INGREDIENTS:
Organic Cultured Pasteurized Skim Milk, Organic Pasteurized Cream, Organic Nonfat Milk, Salt, Citric Acid, Organic Guar Gum, Organic Locust Bean Gum, Acidophilus and Bifidus Cultures.

SOUR CREAM

INGREDIENTS:
Cultured Pasteurized Cream and Fat Free Milk, Enzymes

TEA

INGREDIENTS:
Green Tea

STUDENT WORKSHEET

ACTIVITY 1: PRODUCT CATEGORIES

Name _____ Date _____ Class/Hour _____

Consider each product below and complete the chart. Some products could be in more than one category.

Product	Food, Drug, Cosmetic, Dietary Supplement, or multiple possible categories?	What evidence did you use to decide on this category?	Safety evaluated before or after sales?
 Orange-flavored lip balm			
 Daily multivitamin			
 Whitening toothpaste that helps prevent cavities			
 Biotin pills (100 micrograms each)			
 Energy Drink			
 Whey protein powder			
 Coconut-scented shampoo			
 Vitamin E oil			
 Sleep aid liquid (OTC)			
 Caffeine lozenges			
 Yogurt			
 Weight loss pill			

STUDENT WORKSHEET

ACTIVITY 2: SUPPLEMENT FACTS LABEL

Name _____ Date _____ Class/Hour _____

Use the Supplement Facts label to the right or choose another one that includes multivitamins, live microbials (commonly referred to as "probiotics"), or fish oil. You could use a label from a dietary supplement found in your home, find one online, or choose one from the NIH Dietary Supplement Label Database: https://dsld.od.nih.gov.

Supplement Facts

Serving Size 1 Gelcap
Servings Per Container 100

	Amount Per Serving	% Daily Value
Vitamin A (as retinyl acetate and 50% as beta-carotene)	900 mcg	100%
Vitamin C (as ascorbic acid)	90 mg	100%
Vitamin D (as cholecalciferol)	20 mcg (800 IU)	100%
Vitamin E (as dl-alpha tocopheryl acetate)	15 mg	100%
Thiamin (as thiamin mononitrate)	1.2 mg	100%
Riboflavin	1.3 mg	100%
Niacin (as niacinamide)	16 mg	100%
Vitamin B_6 (as pyridoxine hydrochloride)	1.7 mg	100%
Folate	400 mcg DFE (240 mcg folic acid)	100%
Vitamin B_{12} (as cyanocobalamin)	2.4 mcg	100%
Biotin	3 mcg	10%
Pantothenic Acid (as calcium pantothenate)	5 mg	100%

Other Ingredients: Gelatin, lactose, magnesium stearate, microcrystalline cellulose, FD&C Yellow No. 6, propylene glycol, preservatives (propylparaben and sodium benzoate).

Choose one of the key components, such as a specific vitamin or mineral listed on the label of your chosen supplement, to research and answer the following questions about that component:

1. Identify your chosen supplement _____
2. Which component of that supplement will you research?
   _____
3. How much of that component is in one dose/serving?
   _____
4. Is this component water soluble? _____
5. Complete the first line of the chart below with information about your component.
6. Research your chosen component to learn about foods/beverages that contain that component; list at least 3 different foods/beverages that contain your chosen component on the chart below.

Use the Nutrition Facts label (or online nutrition data, such as this database https://fdc.nal.usda.gov/index.html) to research each food and/or beverage to complete the chart below. Your completed chart will help you identify food sources that could provide you with the same daily intake amount.

Dietary supplement versus food/beverage consumption

Dietary Supplement Component	Amount per serving	Number of servings/day	Daily total amount consumed
Food or beverage	**Nutrient amount per serving**	**Number of servings consumed**	**Total amount consumed**
Could you get enough of this component in foods you would eat?			

Choose one of the foods or beverages in column 1, and list some of the other nutrients (e.g., protein) that are found in that food that are **not** in the dietary supplement?

STUDENT WORKSHEET

ACTIVITY 1: BANNED FROM SPORTS

Name _____ Date _____ Class/Hour _____

1. Watch the video – *Athlete Voices - Abby Raymond*
   https://www.youtube.com/watch?v=d9tVERZHsBY

2. Write your responses to the following questions and then discuss with your group:

   a. What was the banned substance in Abby's supplement?

   b. Why did Abby think the supplement was safe to take?

   c. Have you heard of other instances when athletes were suspended or banned from a sport? What was the reason for that suspension or ban?

   d. What are some of the substances that can lead to issues for athletes?

   e. How do athletes access the substances?

   f. There are other substances found in supplements that are not drugs and are prohibited for athletes. What kind of ingredients might be prohibited for athletes and why do you think they are prohibited?

3. Select one of the following ingredients to research: 1,4-DMAA, Andarine, BMPEA, DMBA, DMHA, Higenamine, Hordenine, Methylsynephrine, N-Methyltyramine, Octopamine, Ostarine, Picamilon. Use your research to answer the following questions as succinctly as possible.
   Teacher Note: Information on this website can be used to evaluate student answers:
   https://www.fda.gov/food/dietary-supplements/dietary-supplement-products-ingredients

   a. What are the different names by which the ingredient is known?

   b. In what kind of dietary supplement(s) product has the ingredient been found?

continued on next page

STUDENT WORKSHEET

ACTIVITY 1: BANNED FROM SPORTS (CONTINUED)

c. Is this ingredient normally found in a dietary supplement or is it possible that it was mistakenly added?

d. Is the ingredient legal in the United States?

e. What is the reported effect this ingredient will have on the body?

f. Have any studies been conducted about this ingredient and, if so, by whom/which organization?

g. What are the side effects of this ingredient?

h. What promises, if any, does the company marketing the ingredient offer?

i. Has the FDA issued any warning letters about this ingredient and if so, what was the warning and was there a follow-up action from the company?

j. Has the supplement that contains this ingredient been endorsed by anyone and, if so, by whom?

k. How could the *Supplement Guide: Reducing Supplement Risk* help you to make decisions about using banned substances? https://www.usada.org/wp-content/uploads/supplement-guide.pdf

4. When you have completed your research, create a presentation about your supplement ingredient. The presentation might be a news broadcast, foldable book, poster, infographic, blog entry, video, or animated slide show.

5. Prepare a brief Fact Sheet about your supplement ingredient for distribution to the class before your presentation.

STUDENT WORKSHEET

ACTIVITY 2: DIETARY SUPPLEMENTS AND ADVERTISING

Name _____ Date _____ Class/Hour _____

1. Read each of the statements below and write A (Agree) or D (Disagree) in the Before Column.

2. Watch the video, *Teenagers using dietary supplements:* https://www.youtube.com/watch?v=hWbx-tSXOuI

3. Review the Statements on the Prediction Guide and compare your opinions with information provided in the video.

4. In the After column, write whether the information from the video Agrees (A) or Disagrees (d) with the statement.

5. In the space under each Statement, cite the information from the video that supports or refutes your original opinion.

Prediction Guide

Before	STATEMENT	After
	Dietary supplements can cause serious harm or even death.	
	It is ok to combine dietary supplements with prescription medications without consulting a doctor.	
	Dietary supplements sold for weight loss, muscle building or to increase energy are no more risky than vitamin supplements.	
	Dietary supplements may cause harm because they may contain dangerous, unlabeled ingredients.	

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STUDENT WORKSHEET

ACTIVITY 2: DIETARY SUPPLEMENTS AND ADVERTISING (CONTINUED)

To prepare for the next part of this activity, watch *The Simple Truth: Decoding the Dietary Supplement Industry* (3:00)
https://www.youtube.com/watch?v=7HIvIIM-35w

What is the name of the dietary supplement you will research?

Research Questions: As you answer these questions, cite the source for each response. (Refer to the Credible Source Guide.)

1. **About the Dietary Supplement and Its Ingredients**

   a. What are the ingredients in your supplement?

   b. Why would someone use this supplement?

   c. What scientific evidence, if any, is there to support this use?

   d. What are the active ingredients in the supplement?

   e. What are the short-term and long-term effects of using this dietary supplement?

   f. What harmful ingredients, if any, are found in the supplement and why are they harmful?

   g. In which types of stores could you find this supplement? (ex: grocery)

continued on next page

STUDENT WORKSHEET

ACTIVITY 2: DIETARY SUPPLEMENTS AND ADVERTISING (CONTINUED)

h. How safe is the use of this dietary supplement for high school students?

i. Who might use this supplement?

2. About the Advertisement(s) for the Dietary Supplement and/or Its Ingredients

a. Does the supplement promise a quick fix or does it sound too good to be true?

b. Does the supplement promote any unhealthy habits?

c. Is there a slogan that is used to promote this supplement?

d. If so, what is it, and who is the target audience?

e. How truthful is the slogan?

f. Does the advertisement provide information based on a personal story or testimonial rather than on facts?

3. If you want to find truthful information about this supplement, where would you look?

continued on next page

STUDENT WORKSHEET

ACTIVITY 2: DIETARY SUPPLEMENTS AND ADVERTISING (CONTINUED)

PSA Planning

Watch these videos to help you create your PSA.

Tips for creating an effective video PSA (5:20)
https://www.youtube.com/watch?v=Kr4Yf1xRb7U

Best Student Made PSA Ever (0:55)
https://www.youtube.com/watch?v=PR7BCsuIWjk&feature=youtu.be

Write down the tips you will use from the videos as you create your PSA.

Keep these questions in mind as you plan your PSA:

- Who is your audience?
- What is your message?
- Which PSA format (from the first video) will best convey your message:
  - Spokesperson format
  - Voice-over PSA
  - Live Action
  - The "Silent Treatment"
- What part of your research will you use?
- What is your script?
- What visuals will you use on your storyboards? Sketch your PSA frame by frame.
- What props do you think you might need?
- What is your production plan?
- What is your visual display plan?

Once your PSA plan is complete you can begin filming. A strong plan, with a tightly edited script, will result in a good PSA. Your PSA might require several edits and/or "takes" until you are ready to share it with your class.

STUDENT WORKSHEET

ACTIVITY 1: ENERGY PRODUCTS

Name _____ Date _____ Class/Hour _____

HOW DOES CAFFEINE KEEP US AWAKE?

Complete this worksheet after you view the video: *How Does Caffeine Keep Us Awake?*
https://www.youtube.com/watch?v=foLf5Bi9qXs

1. How does caffeine work in your brain to keep you awake?

2. What are your dopamine receptors and what effect does caffeine have on them?

3. What long term effects might caffeine have on your body?

4. How does your body adapt to the constant consumption of caffeine?

5. What happens to your body if you suddenly stop consuming caffeine?

6. What beneficial effects, if any, does caffeine have on the body?

7. What are some possible negative effects/risks of caffeine?

CAFFEINE AND ADH ACTIVITY BOOKLET

Printing and Folding Directions

1. Print each page.
2. Cut out each of the Tables (1, 2, & 3).
3. Fold each table in half so that the blank side for the pictures meets the text side.
4. Tape, glue, or staple the back of the text side of Table 2 to the back of the blank side of Table 1.
5. Tape, glue, or staple the back of the text side of Table 3 to the back of the blank side of Table 2.
6. Cut out the reflection questions and tape or glue them to the back of your booklet.
7. Cut out the pictures individually, match them with the corresponding text, and tape or glue them into the correct locations to illustrate the explanation.
8. On the front cover of your booklet, write a meaningful title that explains the content and add your name.
9. Answer the reflection questions.

Reflection Questions

1. What releases ADH?
2. What does ADH target?
3. What effect does ADH have on the amount of water reabsorbed into the blood?
4. What effect does ADH have on the amount of urine produced?
5. What effect does caffeine have on the amount of ADH released?
6. What effect does caffeine end up having on the amount of water reabsorbed into the blood?
7. What effect does caffeine end up having on the amount of urine produced?

1.

When the body is dehydrated, the **osmoreceptors** in the **hypothalamus** detect low water levels by recognizing high solute concentrations.

The hypothalamus signals thirst.

The hypothalamus stimulates the **pituitary gland** to release a hormone called **ADH (antidiuretic hormone)**.

2.

ADH targets the **kidneys.**

ADH causes **aquaporins** to form in the collecting ducts which allows more water to be reabsorbed in the blood stream.

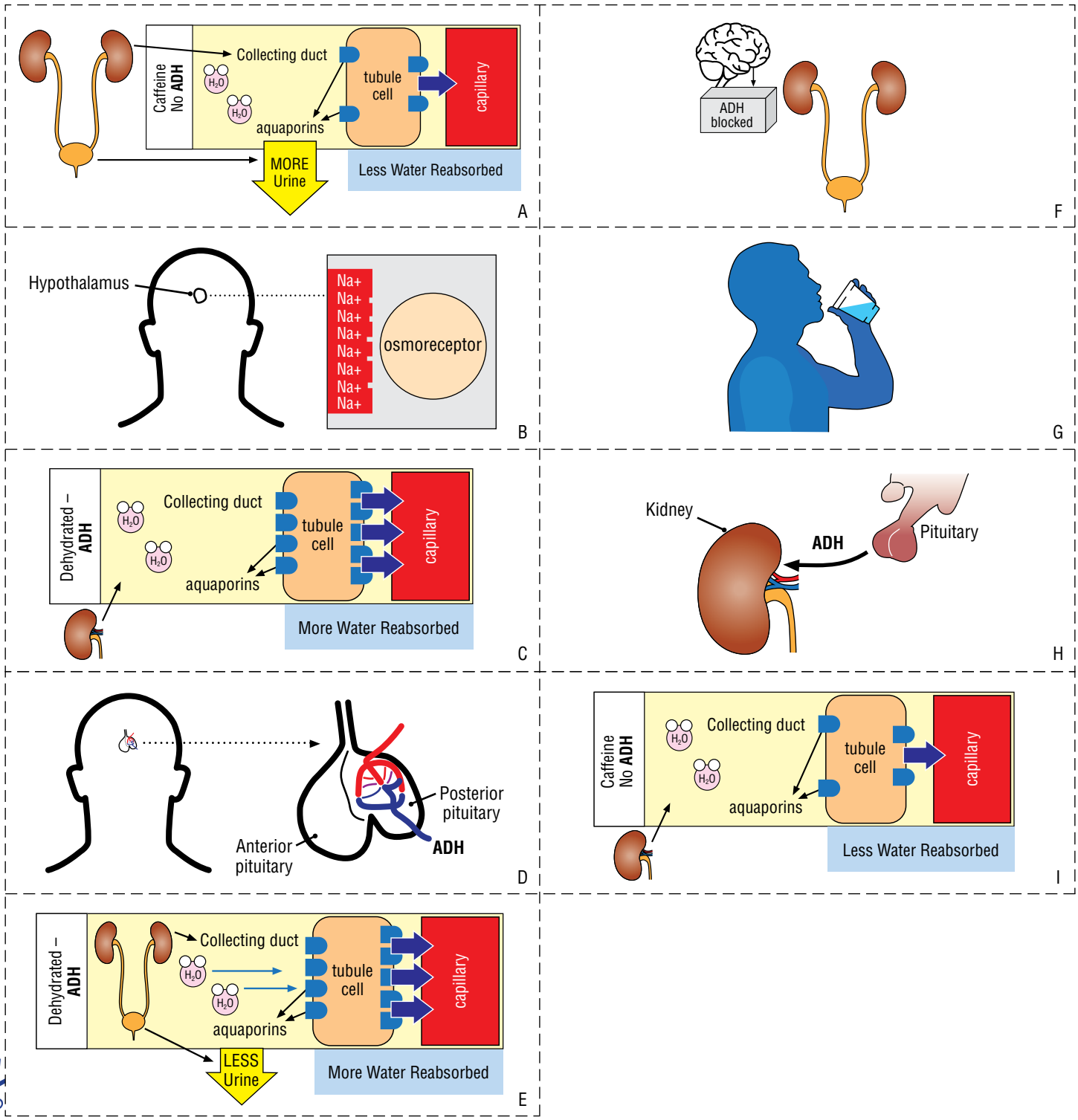
As a result, ADH causes less urine to be produced.

3.

Caffeine inhibits the release of ADH by the pituitary.

Lack of ADH results in fewer aquaporins in the collecting ducts and less water is reabsorbed into the bloodstream.

Caffeine results in increased urine production and dehydration.


Caffeine
No ADH
Collecting duct
H_2O
H_2O
aquaporins
tubule cell
capillary
MORE Urine
Less Water Reabsorbed
A
ADH blocked
F
Hypothalamus
Na+
Na+
Na+
Na+
Na+
Na+
Na+
Na+
osmoreceptor
B
G
Dehydrated – ADH
Collecting duct
H_2O
H_2O
tubule cell
capillary
aquaporins
More Water Reabsorbed
C
Kidney
ADH
Pituitary
H
Posterior pituitary
Anterior pituitary
ADH
D
Caffeine
No ADH
Collecting duct
H_2O
H_2O
tubule cell
capillary
aquaporins
Less Water Reabsorbed
I
Dehydrated – ADH
Collecting duct
H_2O
H_2O
tubule cell
capillary
aquaporins
LESS Urine
More Water Reabsorbed
E

EXTREME BOTANICALS - NATURAL DOES NOT ALWAYS MEAN SAFE

Name _____ Date _____ Class/Hour _____

b. Carefully lift the filter paper and place it in the 250-mL beaker that contains the water. Lean it up against the edge of the beaker.

c. Wait about 10 minutes for the solvent (water) to reach the line at the top of the filter paper.

d. Remove the filter paper from the beaker and put it on your lab table. Measure 2 cm from the bottom again and put a dot where you placed the drops, so that you can measure the migration.

e. Some of the contents of the capsules should have migrated up the filter paper as color. Measure from the 2 cm mark to the top of the migration.

f. Note the color(s) that are present in each migration. Record your measurements and observations in the data table.

DATA

	Capsule A	Capsule B
Measured migration in cm *(measure to the nearest tenth cm or one decimal place.)*		
Observations		

If the ingredients in the capsules were the same, you would expect that the results of your chromatography experiment would be the same for both samples. If the results are not as expected, that could mean that the purity of the contents is not identical for the two brands.

4. Reflection:

Explain what your results could mean. If your experimental results demonstrated that the two brands are not the same, what could account for those results?

Would you recommend further testing of these supplements to verify purity? Explain why or why not.

POSTER/INFOGRAPHIC RUBRIC

CATEGORIES	4	3	2	1
Required Elements	All required elements and additional information are included.	All required elements are included.	All but 1 of the required elements are included.	Several required elements were missing.
Labels	All items of importance are clearly labeled.	Almost all items of importance are clearly labeled.	Many items of importance are clearly labeled.	Labels are too small to view or no important items were labeled.
Graphics - Relevance	All graphics are related to the topic and make it easier to understand.	All graphics are related to the topic and most make it easier to understand.	All graphics relate to the topic.	Graphics do not relate to the topic.
Attractiveness	The presentation is exceptionally attractive in terms of design, layout, and neatness.	The presentation is attractive in terms of design, layout, and neatness.	The presentation is attractive but it may be a bit messy.	The presentation is poorly designed and not attractive.
Grammar	There are no grammatical/mechanical mistakes.	There are 1-2 grammatical/mechanical mistakes.	There are 3-4 grammatical/mechanical mistakes.	There are more than 4 grammatical/mechanical mistakes.

CREDIBLE SOURCE GUIDE

The internet is such an extensive source of information that it can be challenging to find credible information. A credible source is one that is balanced and is written with factual evidence. Credible sources can vary with the audience, topic, and discipline. To determine if a source can be trusted, consider the following characteristic of a credible source:

Author	Information that includes an author or additional contact information can be a good indicator of credible work. An author who is willing to identify him/herself as the writer validates this site or work. The author's credibility can also be verified through searches for their background as well as for additional articles by the author.
Date	The date of research information shows whether the information is recent. The validity of older information can be confirmed by considering whether more recent information supports it.
Sources	The information found on websites or articles should have citations, i.e., list sources of the information included in the article.
Domain	Many domains (ex: .com, .org, and .net) can be purchased and used by any person or group. The domain .edu is used by higher education schools, colleges and universities; the .gov domain is reserved for government websites. Information found on the .edu and .gov domains usually host credible information, but sometimes students are given a .edu address for their personal use by universities — be careful when citing). The .org domain is usually used by non-profit organizations that may host articles or information that supports a specific perspective and is not solely educational information.
Site Design	Often, a well-designed site can indicate reliable information (however, this is very subjective). A well-designed site or article helps make information more easily accessible.
Writing Style	Poor spelling and grammar indicate that the site or article may not be credible. Credible sites carefully review writing style and grammar to ensure that information is clear, concise, and accessible to its audience.

There are always exceptions to any rule; sometimes there are credible sites and articles that don't conform to these six categories. If you are unsure that the site you are using is credible, crosscheck the information with other sources that are known to be credible, such as an encyclopedia or another reliable source about the subject.

Adapted from UWGB: https://web.archive.org/web/20210614193138/https://uknowit.uwgb.edu/page.php?id=30276

3rd Edition

2024