SREB

SREB Readiness Courses
Transitioning to college and careers

Literacy Ready

Science Unit 1. Nutrition

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Unit 1
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Unit 1
Course Overview

Overview and Rationale:

In this unit, students are introduced to disciplinary literacy in the sciences. Students will learn strategies for reading multiple types of text including science textbooks, research articles and news articles. They will also learn a variety of ways to write about science from personal reflection to public consumption and to comprehend science information in multiple representations including animations, diagrams, charts and tables.

Note for this version: The latest science unit revisions are intended to provide a more focused approach to using disciplinary literacy to understand science texts as preparation for research. In an effort to make this unit more literacy-based, the science-related activities requiring teachers to have a stronger background in the sciences have been replaced or removed. Students still need to read and comprehend the "hard science" texts and apply their knowledge to produce written assignments. The revised science units will concentrate on strategies to read and comprehend a variety of complex science texts and use the information to research and create an authentic product. Teachers should prepare for teaching the science units by pre-reading the textbook excerpts to understand the terminology and explanations. If necessary, we encourage you to seek assistance from science colleagues if you are unclear about a reading or details from a text.

How to Use This Unit:

We have designed this unit to be somewhat flexible. The pacing guide is based on 250 minutes of instruction per week. Lessons are not based on specific instructional minutes; they are designed conceptually. Thus, one lesson may run for 50 minutes and another 250 minutes. For each lesson you will find a list objectives and goals as well as a listing of activities and resources needed.

Students will use the academic notebook during each lesson. This notebook will provide a means to record notes, vocabulary and complete lesson activities. Thus, it will serve as a way to assess student learning. Students should be encouraged to add to their vocabulary collection each week. Additionally, students should complete the weekly reflections in the academic notebook to think about both the science and the literacy skills they are learning.

For each lesson objective you will find a formative evaluation rubric to assess student progress during each activity. We suggest that you assign a point value to each of these assessments to encourage students to complete each activity, participate in discussions and group work, and complete assignments in the Academic Notebook. These points should "count" toward their grade in the course and serve as regular reinforcement and reward for completing activities both in and outside of the class.

Unit Objectives:

1. Students will develop skills to critically examine science claims using multiple sources of information.
2. Students will understand the processes involved in evaluating science claims.
3. Students will learn about the components of science literacy.
4. Students will learn strategies for approaching both general and discipline specific vocabulary.
5. Students will explain the processes involved reading in the sciences.
6. Students will integrate ideas from lecture, lab, and text.
7. Students will transform science information from visual to written form and vice versa.
8. Students will summarize, analyze and verbalize scientific stances.
9. Students will write informative and explanatory texts citing specific examples, using data-driven information and concrete details.

Week 1

Lesson 1: Evaluating Science Claims (210 minutes)

1. Students will be introduced to the course and to the idea of disciplinary literacy. They will learn to look for long noun phrases and multiple representations in science text.
2. Students will participate in our gateway activity on evaluating science claims. They will watch a video on an energy drink, read two text excerpts and one article abstract on an energy drink. They will use guiding questions to introduce them to the ways to evaluate science claims in the news by examining scientific evidence.
3. Students will compare and contrast the claims by creating a chart of their findings.
4. Students will be introduced to the final project where they will create an informational pamphlet about a nutrition topic.
5. Students will view sample pamphlets and discuss the element of effective pamphlets.

Lesson 2: Close Reading in the Sciences: Nutrition (125 minutes)

1. Students will learn about and practice close reading with a college-level science text and respond to text dependent questions.
2. Students will learn the annotation strategy of text marking as a way to read closely and monitor comprehension of text.
3. Students will learn about how to approach both general and discipline-specific vocabulary using prefixes, roots and suffixes.
4. Students will reflect on the processes involved while reading in the sciences.

Week 2

Lesson 3: Analogies in Science (125 minutes)

1. Students will begin to learn the concept of transforming science information. They will use a model of enzymes as puzzle pieces to understand the complexity of activation energy and induced fit.

2. Students will continue to read and annotate excerpts from the biology text.
3. Students will apply the concepts they learned about enzymes to solve and explain a case study on enzyme deficiency.
4. Students will complete the weekly reflection.

Week 3

Lesson 4: Transforming Science Information (100 minutes)

1. Students will read and annotate an article about counting calories.
2. Students will read and annotate an excerpt from Chapter 5 of the biology text on transport across membranes. They will focus on understanding how the concepts function.
3. To aid their understanding, they will view animations of the science processes as they read.
4. Students will learn to transform animations from visual to text and back to a visual representation.
5. Students will apply the principles of transformation of information to a static diagram in the text.

Lesson 5: Synthesizing Knowledge Gained from Text Part 1 (75 minutes)

1. Students will read an article on BMI.
2. Students will begin to investigate a variety of health disorders.
3. Students will learn to take notes using the Cornell Method.
4. Students will take notes on a lecture about insulin.
5. Students will synthesize their knowledge on the complexity of calories by working in groups discussing reasons why counting calories may not be enough to maintain health.

Week 4

Lesson 6: Taking Science Quizzes (175 Minutes)

1. Students will be introduced to the concept of group quizzes as a way of learning and discussing science concepts at deeper levels.
2. Students will generate their own quiz review using two strategies—talk-throughs and reciprocal questioning—using materials and readings from the biology text.
3. Using the strategies developed during week three, students will conduct the quiz review in small groups in class.
4. Students will take the quiz. First they will take it individually and then in their small group.
5. Students will reflect on the quiz, addressing both their learning and their conceptual understanding.
6. Students will complete the weekly reflection.

Week 5

Lesson 7: Introduction to Science Research (75 minutes)

1. Students will learn the elements of reading scientific articles.
2. Students will learn strategies for conducting library searches.
3. Students will go to the library to research their topic.

Lesson 8: Research and Writing in Science Part 1 (100 minutes)

1. Students will take notes from science articles.
2. Students will create an outline of the pamphlet.
3. Students will complete the weekly reflection.

Week 6

Lesson 8: Research and Writing in Science Part 2 (150 minutes)

4. Students will create an outline of the pamphlet.
5. Students will work on drafting, developing and editing their final project.

Lesson 9: Final Project Presentations (100 minutes)

1. Students will present the pamphlets to the class.
2. Students will have time for any state/local assessments.

Lesson 1
Evaluating Science Claims

Overview and Rationale:

This lesson introduces students to the purpose of the unit. They will begin to learn about disciplinary literacy in science, the ways scientists think when reading and writing and the literacy conventions that are specific to the sciences. These ideas will be reinforced throughout the unit as instructors model literacy processes and as students have an opportunity to try new ways to read, write, and learn in science. It is important for students to understand that they will be responsible for learning the science as they learn new strategies for reading and writing in the sciences.

This lesson also engages students in evaluating science claims. They will watch a short video on energy drinks and then read several articles about a particular energy drink called Oxygizer. This activity is designed to pique student interest as well as introduce the topic of evaluating science claims from multiple contexts. Students will learn several strategies for evaluating science claims. Students will learn to pay attention to where science evidence is coming from as well as to the science claims that are made. They will also think about the sample population, the data collected, and the way science is reported in the news. This way of thinking about science will allow students to begin to think about the structure and sequence involved in presenting scientific evidence. This way of viewing data is akin to what scientists do as they read claims derived from research.

Tasks/Expected Outcomes:

1. Students will be introduced to the two levels of thinking required in this unit: thinking like a scientist and thinking about learning in the sciences.
2. Students will learn about the components of science literacy.
3. Students will develop the skills to critically examine science claims.
4. Students will evaluate claims by using multiple sources of information.
5. Students will be able to explain the processes involved in evaluating science claims.
6. Students will review and understand the written product for the unit, the scoring rubic and sample brochures.
7. Studens will develop a plan for developing their written products.

College and Career Readiness Standards (CCRS)

English Language Arts Science/Technical Subjects Standards: Reading

1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

4 Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text (e.g., how Madison defines faction in Federalist No. 10).

6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

English Language Arts History/Social Studies, Science/Technical Subjects Standards: Writing

1a Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.

2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

2a Introduce a topic and organize ideas concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

2b Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

2c Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.

2d Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.

7 Conduct short as well as more sustained research projects to answer a question (including a self generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

English Language Arts Speaking and Listening Standards

1a Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well reasoned exchange of ideas.

2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

Throughout this course, only 11-12 grade standards are used.

LDC	Skills and Ability List

Skills Cluster 1: Preparing for the Task

1. Bridging Conversation

Ability to connect the task and new content to existing scientific knowledge, skills, experiences, interests and concerns.

2. Task Analysis

Ability to understand and explain the task's prompt and rubric.

3. Project Planning

Ability to plan so the task is accomplished on time.

Skills Cluster 2: Reading Process

1. Science Epistemology

Ability to understand the underlying idea that science is an attempt to build understandings though constructed models and as approximations, findings are subject to revision and science knowledge is constructed incrementally using peer critique and public dissemination.

2. Science Inquiry

Ability to generate questions and select appropriate research to advance and challenge explanations, corroborate evidence, and evaluate sources and evidence.

3. Note-taking

Ability to read purposefully, select and use relevant information; to summarize and/or paraphrase.

4. Organizing Notes

Ability to organize and synthesize information.

5. Close Reading

Ability to interpret text with particular questions in mind that reflect scientific inquiry, and to use self-regulation to understand scientific processes presented in the text.

(www.literacydesigncollaborative.org)

Materials:

- Academic notebook
- Belk and Maiers Chapter Three and Four
- 5-hour energy video — http://www.brandfailure.com/5-hour-energy-commercial/

Timeframe:

210 minutes

Targeted Vocabulary:

Words that Help You Discuss the Discipline

- science literacy
- theory
- Scientific method

Discipline Specific Vocabulary

- double-blind study
- oxygenated water beverage

General Academic Vocabulary

- skepticism
- slake

Activity One — Introduction to the Unit (Approx. 50 minutes)

College and Career Readiness Standards: Science/Technical Reading– 2, 7

Explain to students that in this unit students will learn both science content and reading and writing strategies to help them learn the content. They will also learn about disciplinary literacy, which are the specialized skills and strategies that scientists use. The goal of this unit is to help students prepare for college and career readiness in science.

In pairs, ask students to discuss the following questions:

1. What are some of some of the problems/challenges you have had with learning science in the past?
2. What do you think students need to know to learn science?

Discuss student responses as a whole class. Make sure that students understand that learning science is not "smarts" or some innate talent.

In general, students need to have some prior knowledge of science, an understanding of the way science is conducted and some effective ways to read, write, and understand science. These effective strategies are a part of learning disciplinary literacy in science. In this unit we will learn a variety of ways to make science learning more effective.

Ask students to open their Academic Notebook:

Turn to the course overview. Ask students to read these two paragraphs together. (Read aloud.)

FROM THE STUDENT ACADEMIC NOTEBOOK p 3

Course Overview

Welcome to the first disciplinary literacy science unit of the SREB Readiness Course- Literacy Ready. What does disciplinary literacy in science mean? According to Shanahan & Shanahan (2012), disciplinary literacy refers to the specialized skills and strategies needed to learn at higher levels in each discipline. That means that how people approach reading and writing in the sciences would differ from how they approach it in history, English, mathematics or other fields. It also means that students need to learn more than the content in any particular discipline—they also need to learn how reading and writing are used within that field. So, disciplinary literacy in science in this unit will introduce you to the knowledge, skills and tools used by scientists.

You will learn to "make explicit connections among the language of science, how science concepts are rendered in various text forms, and resulting science knowledge" by learning ways to "develop the proficiencies needed to engage in science inquiry, including how to read, write, and reason with the language, texts, and dispositions of science" (Pearson, Moje, Greenleaf, 2010). These ideas are the principal focus of this unit. While certainly the content covered in this course is important, a primary purpose of this unit is to equip you with the tools necessary to be more successful in your college coursework. You will take part in many reading and writing activities aimed at improving your disciplinary literacy in science. To that end, the creators of the course have developed this Academic Notebook.

Ask students to examine a "juicy sentence" in-depth.

First, ask students to examine this quote "[literacy in science] makes explicit connections among the language of science, how science concepts are rendered in various text forms, and resulting science knowledge."

Unpack this sentence. Ask, what does explicit connections mean? What do you think the language of science deals with? How does it differ from the language of, say history or mathematics? What are they talking about when they say that science concepts are rendered in various text forms? What does the word rendered mean? What kinds of these text forms have you encountered before (diagrams, charts, animations, etc)? Why does this result in science knowledge?

Ask students to think about this process. Ask, how did focusing on this juicy sentence impact your understanding? How does this differ from ways you have read in the past? (Skimming, reading but not really focusing or comprehending. This time I really had to pay attention). This unpacking of ideas and reading parts more than one time is a way to do "close reading," a strategy students will use throughout this unit.

Discuss with students the idea that some of disciplinary ways that science is written and represented can make reading a challenge. Discuss two common science writing practices to look for in science text: Long noun phrases and multiple representations. These ideas will be developed further throughout this unit.

Long noun phrases: Ask students to find the noun in the following sentence:

Glass crack growth rate is associated with applied stress magnitude.

(Students might say glass but the first noun is actually a noun phrase *glass crack growth rate*.)

Then ask them to find the second noun phrase (applied stress magnitude).

Science is filled with these noun phrases that helps with the precision of ideas that is very important to scientists. Some other examples to share are:

- gene replacement therapy,
- primate genome sequences, and
- the polymerase chain reaction laboratory technique.

Ask students to turn to Lesson One in their Academic Notebook. Here they will find a section from the chapter on diet and nutrition. Ask students to work with a partner to find the noun phrases in this section.

FROM THE STUDENT ACADEMIC NOTEBOOK p 5

Carbohydrates as Nutrients. Foods such as bread, cereal, rice, and pasta, as well as fruits and vegetables, are rich in sugars called carbohydrates. Carbohydrates are the major source of energy for cells. Energy is stored in the **chemical bonds** between the carbons, hydrogens, and oxygens that comprise **carbohydrate molecules**. Carbohydrates can exist as **single-unit monomers** or can be bonded to each other to produce **longer-chain polysaccharide polymers**.

The **single-unit simple sugars** are digested and enter the bloodstream quickly after ingestion. Sugars found in milk, juice, honey, and most refined foods are simple sugars. Fructose, the sugar found in **corn syrup**, is shown in figure 3.1 a.

When **multisubunit sugars** are composed of many different **branching chains** of **sugar monomers**, they are called **complex carbohydrates**. Complex carbohydrates are found in vegetables, breads, legumes, and pasta.

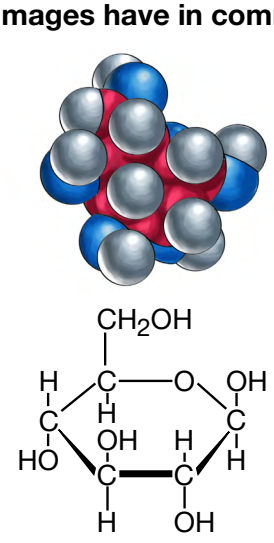
(Belk and Maier pages 56-57)

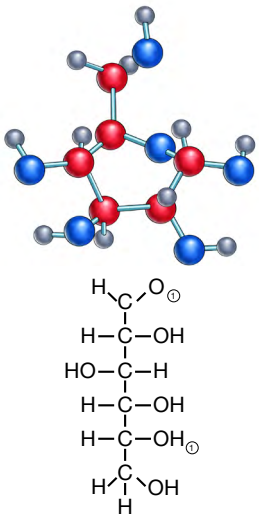
Tell students that being able to identify entire concepts by using a noun phrase is an essential skill for reading science and a skill we will continue to work on. At this point we want students to read these as a single phrase rather than as separate terms. They need to start linking the ideas together as they read.

Ask students to examine the four molecules in your notebook. Ask, what do these images have in common?

FROM THE STUDENT ACADEMIC NOTEBOOK p 6

What do these images have in common?





Students may identify that these are all the same molecule (glucose). Discuss briefly why one might find all of these depictions within a single science textbook.

Space filling models are used to show how much room a molecule occupies.

Ball and stick models can help us understand bond patterns and we can pinpoint exactly which atoms are bonded or nonbonded.

The other two figures show the structural formula of the molecule. The one on the right is showing the structural formula (notice how it shows the carbon "backbone" and the one on the left—that looks like a ring—is showing the condensed structure of glucose).

Be sure that students understand that there is no one "right" way to represent molecules—which type a scientist uses depends on what s/he is trying to portray. However, students need to be able to see that they are all representing the same thing. You also need to be able to transform the information into other forms (for example, you should be able to view the molecule and write out the chemical structure).

In this unit we will learn several ways to transform science information from visual to text and back again. This will be an important idea to remember as we work through the unit.

Ask students to take a look at the rest of the Academic Notebook to help familiarize them with how they will use it in this unit.

Turn to the table of contents. Students will see that there are 10 overall lessons in this unit. The entire unit will span six weeks.

Students will have an quiz during Lesson Six. Be sure to discuss that this will be a science quiz, not a strategies quiz. That means that even though students are learning reading and writing strategies for learning sciences, the quiz will assess how well they learned the *science*—there will not be any questions about the strategies themselves.

Students will also have a final project at the end of the unit. Students will learn more about this as it gets closer, but basically they will research a topic related to diet and nutrition and create an informational pamphlet about it.

Ask students to turn to the section about the purpose of the notebook. Ask, "What is the purpose?" Answers: 1) tools and information for learning, 2) place to record work, and 3) assessment tool—it will be collected periodically for grading.

Ask students to turn to lesson one in their Academic Notebook. Ask them to pair with a partner to take turns reading this short article on how scientists think from *Science Daily* to each other.

FROM THE STUDENT ACADEMIC NOTEBOOK pp 7-8

How Scientists Think: Fostering Creativity In Problem Solving

Sep. 22, 2009—Profound discoveries and insights on the frontiers of science do not burst out of thin air but often arise from incremental processes of weaving together analogies, images, and simulations in a constrained fashion. In cutting-edge science, problems are often ill-defined and experimental data are limited.

To develop an understanding of the system under investigation, scientists build real-world models and make predictions with them. The models are tentative at first, but over time they are revised and refined, and can lead the community to novel problem solutions. Models, thus, play a big role in the creative thinking processes of scientists.

Dr. Nancy J. Nersessian has studied the cognitive processes that underlie scientific creativity by observing scientists at work in their laboratories. She says, "Solving problems at the frontiers of science involves complex cognitive processes. In reasoning with models, part of the process occurs in the mind and part in the real-world manipulation of the model. The problem is not solved by the scientist alone, but by the scientist—model combination. This is a highly creative cognitive process." Her research is published in an upcoming issue of *Topics in Cognitive Science*.

Her study of the working methods of scientists helps in understanding how class and instructional laboratory settings can be improved to foster creativity, and how new teaching methods can be developed based on this understanding. These methods will allow science students to master model-based reasoning approaches to problem solving and open the field to many more who do not think of themselves as traditional "scientists." (http://www.sciencedaily.com/releases/2009/09/ 090921162150.htm)

Get students to talk about how this information can help us in thinking about science learning. Ask, "if you had to pick only one word from this short article that you think is the most important, what would it be? Take a minute to think and write your word on a post-it note."

Post all words around the room. Ask students to examine all the words to select two that relate—they do NOT have to select their original word. Ask students to explain their choices to a partner, discussing why they think these words are the most important from this selection. Then ask them to write out their reasoning in their Academic Notebook.

Discuss the ways students were asked to think about reading and science in this lesson:

- What did you learn about science learning that you did not know before?
- How do you think learning disciplinary strategies for reading and writing in science will help you in this course and beyond?

Activity Two — Reading Science Claims (Approx. 75 minutes)

College and Career Readiness Standards: Science/Technical Reading– 1, 2, 4, 6, 7, 9; Speaking and Listening 1a, 2

Students will view a short TV commercial for 5-Hour Energy — http://www.brandfailure.com/5-hour-energy-commercial/.

After watching the ad, first ask students to name the claims made in the commercial. Listed below are the claims students may discuss.

- Seventy-three percent of doctors would recommend a low calorie energy supplement to their healthy patients who use energy supplements.
- Has four calories.
- Is used nine million times per week.
- Three-thousand doctors asked about it.

Ask students to valuate those claims by asking critical questions about the veracity of the findings.

Ask the following text dependent questions:

Why is the first claim suspect? (Doctors recommend a low calorie energy supplement to patients who are already using them? Doctors are not necessarily recommending this particular product).

What do we need to know about the fact that it is used nine million times (how many users? Nine million? One million?)

Discuss how students can ask critical questions and design experiments to evaluate claims made by advertisers.

Students will read Oxygizer articles from Belk and Maier Chapters Two and Three *(Savvy Reader* featurettes) using a close reading approach.

FROM THE STUDENT ACADEMIC NOTEBOOK p 9

Savvy Reader Detox Drinks

A Clear Winner in the Feel-Good Stakes | *By Caroline Stacey* | *The Independent* (London) | January 3, 2004

So you thought water was just a drink? Think again. It's a lifestyle choice. We can all safely drink our litre or more a day straight from the tap. But where's the cachet or the profit in that? It's almost as free as air. And wonderful and hydrating though tap water is, the latest bottled waters offer so much more—to make you sportier, healthier, and less hungover.

With Oxygizer you pay for air and water together. It's oxygenated, but not fizzy. Bottled in the Tyrolean mountains by a company based in Innsbruck, Austria, it describes itself as "a sip of fresh air." Already big in the Middle East—where water's a more precious commodity than it is here—it has been launched in Europe and now in the UK.

Oxygizer doesn't just slake a thirst, it provides the body with extra oxygen too. A litre contains 150 mg of oxygen, around 25 times more than what's in a litre of tap water. This apparently helps remove toxins and ensures a stronger immune system, as well as assisting the respiratory system so you recover better from exercise. Some claim detox benefits, it helps hangovers, and even enhances flavours to make food taste better.

1. List the claims made by this article. Is there enough information presented in this article to back up the claims made?
2. Use the appropriate questions in the checklist provided in Chapter 1, Table 1.2, to evaluate this newspaper article. What types of information are missing from this article?
3. Is any data presented to substantiate the claim that oxygenated water improves health?

Start with the first Oxygizer article in the Academic Notebook. Read the first paragraph together. Ask students to find claims.

- Water is a lifestyle choice—no profit in drinking tap water, bottled water offers much more.

Ask students to read the next two paragraphs in pairs. Have the pairs jot down the claims they find:

- Oxygizer is water and oxygen—describes itself as "a sip of fresh air."ß
- Doesn't just "slake" thirst, also gives extra oxygen to body, removes toxins and ensures a stronger immune system, assists respiratory system so you can recover from exercise better, detox benefits, enhances flavors, makes food taste better.

After students list their findings in a whole class discussion. Ask, what the author of this article thinks about this product's claims? How does she present these ideas?

Ask, what does the word "slake" mean? (To quench, to satisfy) If you didn't know the meaning, how can you use the context in the sentence, "Oxygizer doesn't just slake a thirst, it provides the body with extra oxygen too," to help you figure out the meaning? (Slake a thirst seems to be doing something to the thirst and that fact that it provides oxygen too seems to indicate that slake is doing something positive to thirst—maybe quenching it.)

Students will examine both the claims and the research abstract from the article that the developers of the drink used to substantiate their claims.

First, ask students to read the first sentence of the abstract in the academic notebook. Ask, what is the hypothesis of the study?

(That oxygenated water can support physical working capacity.) What does this mean? How do you know that?

Discuss that there is a lot of science that students might not be able to understand in this abstract as it is written for science researchers, but that is okay at this point. Direct students to read in a more targeted way. Ask students to find the following: 1) how the study was conducted, 2) what the results were, and 3) what the conclusions were. Ask students to work together to find out how the study was conducted. (Double blind cross-over study with 10 subjects. Two weeks drinking oxygenated water, two weeks drinking the opposite type.) Ask students to discuss what guided them to the results. (Results showed no significant…) Even if students cannot understand the exact meaning of the rest of the sentence, they can determine that this study did not show an influence on performance.

Ask students to discuss the conclusions. No significant influence and oxygenated water does not enhance aerobic performance.

FROM THE STUDENT ACADEMIC NOTEBOOK p 10

Abstract

It has been asserted that the consumption of oxygenated water can support physical working capacity. As this has not been accurately investigated yet, we analyzed effects of a two-week period of daily O_2-water ingestion on spiroergometric parameters and lactate metabolism in healthy adults. Twenty men (24 ± 2.5 years of age) with comparable aerobic abilities performed four exhaustive bicycle spiroergometric tests. Applying a double-blind crossover study design, 10 subjects drank 1.5 liters of highly oxygenated water every day during the two weeks between the initial two tests whereas the other group consumed 1.5 liters untreated water from the same spring. After a two-week wash-out period subjects underwent a second period consuming the opposite type of water. Spiroergometric parameters and lactate kinetics between both groups at submaximal and maximal levels were analyzed using a MANOVA. Results showed no significant influence on aerobic parameters or lactate metabolism, neither at submaximal nor at maximal levels (all p-values ≥ 0.050). Merely increments of $V \cdot EO_2$ at submaximal levels were demonstrable ($p = 0.048$). We conclude that the consumption of oxygenated water does not enhance aerobic performance or lactate kinetics in standardized laboratory testing.

Does Oxygenated Water Support Aerobic Performance and Lactate Kinetics?

V. Leibetseder, G. Strauss-Blasche, W. Marktl, C. Ekmekcioglu. Int J Sports Med 2006; 27(3): 232-235

DOI: 10.1055/s-2005-865633

Ask students to read the second Oxygizer article from Belk and Maier in the Academic Notebook page 11. Discuss how scientists evaluate claims using the Oxygixer article from Chapter Three. Explain that scientists are often skeptical about new findings. Have the students consider the two statements in the Oxygizer article:

- "Using a randomized double-blind study, these tests have proven the effective influence and effect of Oxygizer on the body's performance capability."
- "Results showed no significant influence on aerobic parameters or lactate metabolism, neither at submaximal nor at maximal levels. We conclude that the consumption of oxygenated water does not enhance aerobic performance."

Ask students to identify the noun phrases in these sentences (randomized double-blind study, performance capability, aerobic parameters, lactate metabolism, aerobic performance). Discuss the meanings of the phrases as a class.

Then, ask the students to use these two statements to explain why it is helpful to develop a general level of skepticism about most product claims.

Ask students to reread the articles using the *Science in the News* checklist on page 12 that examines how to approach reading ads about the sciences.

FROM THE STUDENT ACADEMIC NOTEBOOK p 11

Savvy Reader Oxygizer Improves Performance?

The Savvy Reader feature in Chapter 2 introduced you to the oxygenated water beverage Oxygizer. In addition to making many other claims, the author of the newspaper article wrote that drinking Oxygizer would "assist the respiratory system so you recover better from exercise." The following is an excerpt from the website of the company that produces Oxygizer: "Oxygizer improves performance during periods of high physical stress and the resulting regenerative phase. Univ. Prof. Dr. Wolfgang Marktl (Head of Science at the Institute of Medical Physiology at Vienna University) and his research team have completed their scientific tests. Using a randomised double-blind study, these tests have proven the effective influence and effect of Oxygizer on the body's performance capability."

This is pretty compelling writing and may convince some to purchase this oxygenated water. However, let's also look at an excerpt from the actual scientific study performed by Dr. Marktl and published in the *International Journal of Sports Medicine* in March 2006. "Results showed no significant influence on aerobic parameters or lactate metabolism, neither at submaximal nor at maximal levels. We conclude that the consumption of oxygenated water does not enhance aerobic performance."

1. Does it appear that the author of the newspaper article read the actual study or the promotional material only?
2. How are claims made in the newspaper and on websites different from claims made by authors of articles published in scientific journals?
3. The Oxygizer website also includes some data (http://www.oxygizer.com/default.aspx?lngId=2) that seem to support their claims. Private companies can hire their own scientists to perform studies that often have results that differ from those of government and university-sponsored scientists. Would you be more skeptical of results produced by scientists hired by the company whose product they are testing or scientists who work for the government or a University?
4. Carefully consider the following two sentences from the Oxygizer website: "Univ. Prof. Dr. Wolfgang Marktl (Head of Science at the Institute of Medical Physiology at Vienna University) and his research team have completed their scientific tests. Using a randomised double-blind study, these tests have proven the effective influence and effect of Oxygizer on the body's performance capability." Each of these sentences, read separately, is true. Dr. Marktl and his team did complete their tests, and the Oxygizer scientists did produce data showing increased performance capability. However, placed adjacent to each other, these sentences seem to be indicating that Dr. Marktl's university-sponsored research came up with results that were actually produced by the Oxygizer scientists. Do you think this is a willful attempt to deceive potential customers? Most people don't have time to do such a thorough analysis of every newspaper article they read. This is why it is helpful to develop a general level of skepticism about most product claims.

FROM THE STUDENT ACADEMIC NOTEBOOK p 12

Savvy Reader (continued)

TABLE 1.2 **A guide for evaluating science in the news.** *For each question, check the appropriate box.*

Question	Possible answers: Preferred answer	Possible answers: Raises a red flag
1. What is the basis for the story?	Hypothesis test ◯	Untested assertion ◯ *No data to support claims in the article.*
2. What is the affiliation of the scientist?	Independent (university or government agency) ◯	Employed by an industry or advocacy group ◯ *Data and conclusions could be biased.*
3. What is the funding source for the study?	Government or nonpartisan foundation (without bias) ◯	Industry group or other partisan source (with bias) ◯ *Data and conclusions could be biased.*
4. If the hypothesis test is a correlation: Did the researchers attempt to eliminate reasonable alternative hypotheses?	Yes ◯	No ◯ *Correlation does not equal causation. One hypothesis test provides poor support if alternatives are not examined.*
If the hypothesis test is an experiment: Is the experimental treatment the only difference between the control group and the experimental group?	Yes ◯	No ◯ *An experiment provides poor support if alternatives are not examined.*
5. Was the sample of individuals in the experiment a good cross section of the population?	Yes ◯	No ◯ *Results may not be applicable to the entire population.*
6. Was the data collected from a relatively large number of people?	Yes ◯	No ◯ *Study is prone to sampling error.*
7. Were participants blind to the group they belonged to and/or to the "expected outcome" of the study?	Yes ◯	No ◯ *Subject expectation can influence results.*
8. Were data collectors and/or analysts blinded to the group membership of participants in the study?	Yes ◯	No ◯ *Observer bias can influence results.*
9. Did the news reporter put the study in the context of other research on the same subject?	Yes ◯	No ◯ *Cannot determine if these results are unusual or fit into a broader pattern of results.*
10. Did the news story contain commentary from other independent scientists?	Yes ◯	No ◯ *Cannot determine if these results are unusual or if the study is considered questionable by others in the field.*
11. Did the reporter list the limitations of the study or studies on which he or she is reporting ?	Yes ◯	No ◯ *Reporter may not be reading study critically and could be overstating the applicability of the results.*

Ask students to discuss how the different approaches to reading these articles affected how they focused their attention. First they read for claims, then they read an original research abstract for procedure, then they re-read to find out whether the journalist used good science in reporting. Ask, how did this work to enhance their understanding?

Ask students to organize their findings on the chart in their Academic Notebooks. This will help them summarize and compare claims across text.

FROM THE STUDENT ACADEMIC NOTEBOOK pp 13-14

Evaluation Chart

Source

5 hour energy ad

Claim	Evaluation	Conclusion

Source

Oxygizer Chapter Two article

Claim	Evaluation	Conclusion

Source

Oxygizer Chapter Three article

Claim	Evaluation	Conclusion

Source

Oxygizer research abstract

Claim	Evaluation	Conclusion

Other notes

Assessments:

Outcome 1: Students will develop skills to critically examine science claims.

Outcome 2: Students will evaluate claims using multiple sources of information.

- Individual chart of energy drink claims (in the Academic Notebook)

Evaluation Rubric			
• Accomplishes task by selecting relevant evidence.	No	Somewhat	Yes
• Accurately evaluates claims.	No	Somewhat	Yes
• Draws conclusions using the data and evidence.	No	Somewhat	Yes

Outcome 3: Students will be able to explain the processes involved in evaluating science claims.

- Teacher's analysis of discussion quality and participation

Evaluation Rubric			
• Participates fully in the discussion.	No	Somewhat	Yes
• Adds meaningful information or insights.	No	Somewhat	Yes

Activity Three — Introducing the Task (Approx. 60 minutes)

College and Career Readiness Standards: Science/Technical Reading– 1, 2, 4; Speaking and Listening– 1a, 1c, 2, 4

Introduce the task: How does the scientific community communicate important information to a lay audience? After researching scientific articles, journals and websites on important topics in nutrition, write an informational pamphlet in which you explain the issues, causes, problems and possible solutions to the public. Support your position with evidence from the texts. **Ask students to annotate the prompt and identify the elements of what they must do to be successful and the assignment.**

Introduce the students to the final project by going over the project directions. Ask students to pay close attentions to the information on gray literature in the project directions. Explain that they may not have a lot of information for this project now, but the purpose of the lessons in this unit is to help them to learn strategies to be successful on the final project.

Final Project Teacher Instructions

A pamphlet is considered to be gray literature, which is literature hard to find using conventional methods. Gray literature is an important type of scientific literature because it provides recent information, information found in the last 12 to 18 months, and includes up-to-date research. Gray literature, like the pamphlet, should be easy to understand for a lay audience. Even though students are communicating their information in a more simplified way, they will need to understand the science concepts to be able to explain them to others. They must be sure to cite their sources and include them in a works cited page so that if the reader wishes to read for more detailed information it will be available to them.

In this project, each student will select a topic about nutrition or diet that s/he thinks the public needs to know more about. It should be a timely issue that would resonate with people interested in finding out more about said topic. For example, a student might want to look at the impacts of bulimia or the promise of new obesity treatments.

Ask students to read and take notes on the directions by annotating important points in the margins of their Academic Notebook.

FROM THE STUDENT ACADEMIC NOTEBOOK pp 15-17

Nutrition Final Project Directions

Purpose: Your purpose is to create an informational pamphlet or brochure about a topic related to nutrition and diet using science research to support your claims.

A pamphlet is considered to be gray literature, which is literature hard to find using conventional methods. Gray literature is an important type of scientific literature because it provides recent information, information found within the last 12 to 18 months, and includes up-to-date research. Gray literature, like the pamphlet, should be easy to understand for a lay audience. Even though you are communicating the information in a more simplified way, you must understand the science concepts fully to be able to explain them to others. You will need to cite your sources and included them in a works cited page, so that if the reader wishes to read for more detailed information it will be available to them.

Prompt: How does the scientific community communicate important information to a lay audience? After researching scientific articles, journals and websites on important topics in nutrition, write an informational pamphlet in which you explain the issues, causes, problems and possible solutions to the public. Support your position with evidence from the texts.

In this project, you will select a topic about nutrition or diet that you think the public needs to know more about. It should be a timely issue that would resonate with people interested in finding out more about said topic.

The topics should be debatable. That is, reasonable people may have differing views about the topic. The topic should be narrow and focused enough to investigate for this assignment. For example, nutrition-related diseases is too broad a topic and could be a book instead of a pamphlet. Instead, you might want to focus on one nutrition-related disease in particular.

You will need to bring 10 copies of your pamphlet for class presentations.

You will need to include at least five sources to use in your work. To help you read and organize the material you will take notes on each source in your Academic Notebook.

Finding Articles for the Final Project: Articles can be found in many different places including journals, magazines, newspapers, and websites. Popular journals, such as *Scientific American*, are aimed at the general public. The articles are written by journalists, who have consulted with experts, to be accessible by the public. Peer-reviewed journals contain articles written by experts aimed at experts. The reader is expected to know the basics on the topic covered in the article. For the final project, we are going to focus on popular journals, magazines, newspapers and websites.

Example websites and journals:

- http://www.scientificamerican.com/.
- http://news.sciencemag.org/.
- http://www.mayoclinic.com/.
- http://www.nih.gov.

To format your pamphlet, you will use a four-column layout. This will give you a total of eight panels to use to explain your information. How you organize the information in your pamphlet will depend upon your topic. A sample layout is shown below; be sure to include all of the elements in your pamphlet. Fold the paper so that the title page will be on the front and the works cited will be on the back when the pamphlet is folded and ready to be read. The layout will need to be printed on legal sized paper. The four-column layout will give you more room to include the information from your sources. You can use Microsoft Word or Microsoft Publisher to complete the pamphlet.

Microsoft Word Directions:

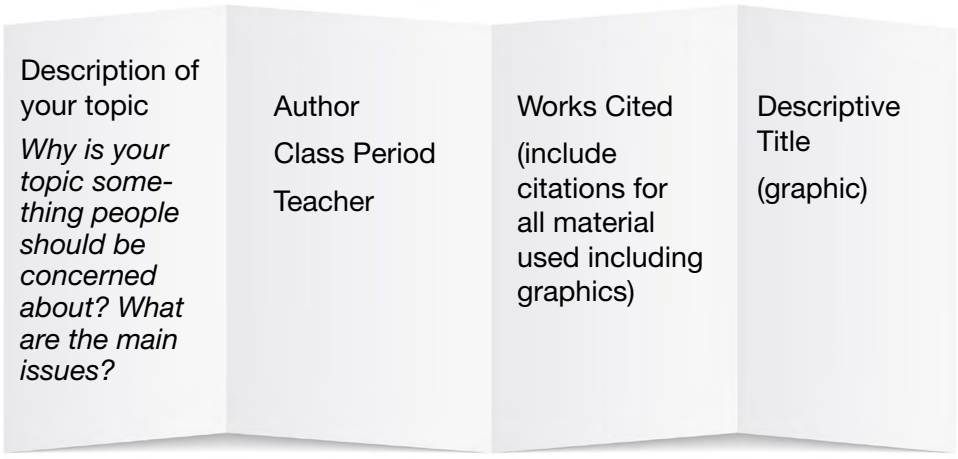
- Open Microsoft Word.
- Go to File, then Page Setup and then choose Landscape (under the Margins Tab).
- While you are there, change the top and bottom margins to one inch. Change the right and left margins to 0.5 inches.

- Click on the Paper Tab while in Page Setup and choose Legal.
- Next, choose Format, then click on columns and then choose four.

Microsoft Publisher Directions:

- Open Microsoft Publisher.
- Click on Publications for print.
- Click on Brochures.
- Choose from the Informational Brochures section.
- Once the brochure is chosen, on the left hand side of the screen, click on four-panel.

Side One



Side Two

Grading Rubric

Category	Excellent	Good	Almost	Not Yet
Attractiveness & Organization (Organization)	Exceptionally attractive formatting and well-organized information.	Attractive formatting and well-organized information.	Well-organized information.	Formatting and organization of material are confusing to the reader.
Content - Accuracy (Ideas)	The science is exceptionally well explained including all relevant information.	The science is well explained including all relevant information.	The science is explained including most relevant information.	The pamphlet has little of the required information.
Writing - Mechanics (Conventions)	No errors.	No major errors, one to two minor errors.	Has some major and minor errors.	Has some major and minor errors.
Scientific language and terminology	Used carefully throughout the pamphlet in ways the public can understand.	Used in most of the pamphlet in ways the public can understand.	Is used, but is confusing for readers.	Is not used.
Graphics/ Pictures	The graphics go well with the text and there is a good mix of text and graphics.	The graphics go well with the text, but there are so many that they distract from the text.	The graphics go well with the text, but there are too few.	The graphics do not go with the accompanying text or appear to be randomly chosen.
Sources	Carefully chosen, excellent sources that provide a full picture of the issues involved in the topic.	Carefully chosen sources that provide a good picture of the issues involved in the topic.	Sources do not provide a full picture of the issues involved in the topic.	Incomplete sources.
Citations	No errors in APA style.	Few errors in APA style.	Many errors in APA style.	APA style not used.

Ask students to discuss their understandings of the project as a whole group. Be sure that students understand what is being asked of them and how they are expected to conduct the research for this project.

Discuss the elements of pamphlets by asking students to analyze an example pamphlet. Show several examples of pamphlets. In small groups, ask students to identify the elements of one of the following pamphlets (each group can take a different pamphlet to analyze):

- Lyme disease brochure (http://sagehen.ucnrs.org/documents/visitors/vectors/lyme.pdf)
- Alcohol pamphlet (see handout)
- El Niño pamphlet (http://www.nws.noaa.gov/om/brochures/climate/El_NinoPublic.pdf)
- Living life online (http://publications.usa.gov/USAPubs.php?PubID=383).

Discuss how language and vocabulary are used in the pamphlet examples. Draw attention to how pamphlets should make complex topics understandable to the public, and the language and other devices (like diagrams or illustrations) they use to do this.

For example pamphlets should:

- Explain the issue in ways that are easy to understand.
- Add to the reader's knowledge about the topic.
- Seek to change the reader's attitude about the topic or calls the reader to action.
- Use diagrams or illustrations effectively.
- Use headings and subheadings to emphasize key points.

Language usage:

- Defines scientific terms used.
- Uses active voice (this is different than most science text that uses passive voice).
- Avoids negative language ("you should quit smoking" rather than "don't smoke.").

Discuss how the language in a pamphlet differs from other scientific language they have encountered in the unit. Students should be aware that they will need to carefully inform their readers by defining the science terms that they will use. Ask them to pay attention to the ways that vocabulary is both used and explained in their sample pamphlet.

Ask small groups to analyze one of the pamphlets using the guiding questions in their Academic Notebook.

FROM THE STUDENT ACADEMIC NOTEBOOK pp 18-19

Elements of an effective Pamphlet

1. The pamphlet my group analyzed:

2. What was the purpose of the pamphlet? Who is the writer?

3. Who was the intended audience? How can you tell?

4. How was the information presented? Were there directions? A call to action?

5. What kind of vocabulary was used in the pamphlet? (Technical, scientific, general?) How did the language choice impact the message?

6. How were science concepts explained?

7. Which of the following text features were contained in the pamphlet? Which ones were particularly effective?

Print Features	Organizational Aids	Graphic Aids	Illustrations
• font • italics • bold print • colored print • bullets • titles • headings • subheadings • labels • sidebars • text boxes • captions	• table of contents • index • glossary • preface • pronunciation guide • appendix	• diagrams • sketches • graphs • comparisons • figures • maps • charts • tables • cross-sections • timelines • overlays	• colored photographs • colored drawings • black & white photographs • black & white drawings • labeled drawings • enlarged photo-graphs

In their Academic Notebooks, the students will finalize their topics given their understanding of the task and they will summarize their thoughts about what the project entails to ensure that students understand what they are being asked to do.

FROM THE STUDENT ACADEMIC NOTEBOOK p 20

My Topic Idea:

This is an important topic because:

What I need to find out:

What I want to let the public know about:

Understanding the final project: in your own words, summarize the task.

Ask several students to share out their task summaries to be sure everyone understands what they are being asked to do.

Activity Four — Planning the Project (Approx. 25 minutes)

College and Career Readiness Standards: Science/Technical Writing– 7

Students will write a plan for completing the project on time in their Academic Notebook. Ask students to brainstorm the tasks they will need to complete the task by the due date (searching for at least five sources, reading and taking notes on articles, creating an outline of the pamphlet, drafting the pamphlet using the eight-panel format outlined in the directions, editing and revising draft, etc.).

FROM THE STUDENT ACADEMIC NOTEBOOK p 21

Project Planning Timeline

Make a plan for completing the project by the due date. Be sure to include deadlines for finding and reading your sources, creating a rough draft and a final draft to be discussed in class.

Project Title:

What will be done?	By when?	What resources will I need?	What goals do I have?	Notes

Ask students to share out their plans in small groups. Students can revise their plans based upon feedback from the group.

Discuss any lingering questions about the project as a whole class.

Teacher Checklist	Use this list to ensure that you have completed all of the lesson components. I . . .

- [ ] 1. Discussed science learning.
- [ ] 2. Introduced disciplinary literacy.
- [ ] 3. Discussed “juicy sentence.”
- [ ] 4. Provided an overview of the course.
- [ ] 5. Introduced the Academic Notebook.
- [ ] 6. Read and discussed how scientists think.
- [ ] 7. Reflected on activity one.
- [ ] 8. Viewed and discussed 5-hour energy video.
- [ ] 9. Read Oxygizer articles.
- [ ] 10. Discussed finding science claims.
- [ ] 11. Read Oxygizer research article abstract.
- [ ] 12. Discussed evaluating claims using Oxygizer articles.
- [ ] 13. Introduced and used “science in the news” checklist.
- [ ] 14. Asked students to compare/contrast claims on chart.
- [ ] 15. Asked students to identify possible project topics on diet and nutrition before class.
- [ ] 16. Introduced final project.
- [ ] 17. Discussed “gray” literature.
- [ ] 18. Asked students to read and annotate project directions.
- [ ] 19. Discussed directions as a whole class.
- [ ] 20. Discussed the use of language and vocabulary in pamphlets.

- [ ] 21. Asked students to analyze a sample pamphlet in small groups using the guiding questions in the Academic Notebook.
- [ ] 22. Asked students to finalize topic and summarize their understanding of the project in the Academic Notebook.
- [ ] 23. Asked students to create a project timeline in their Academic Notebook.
- [ ] 24. Asked students to share plan in small groups.

Lesson 2

Close Reading in the Sciences: Nutrition

Overview and Rationale:

Students will learn text annotation as a way for students to mark the text while they read. Annotations can be used in *any* field, because *what* is annotated can be tailored to the specific requirements of the discipline. In science, they should focus on the elements of the text that are important to scientists: processes, systems, models and explanations, diagrams, interactions, descriptions, classifications, evidence, and so on. Paying attention to these elements will help students to understand important scientific information. Students will also start to think about the following four types of vocabulary as they read each text:

1. **Discipline specific vocabulary:** These are content area words like *polymer* or *macromolecule* that help students understand the content they are reading—these are often the boldface words in science texts.
2. **Words that help you discuss the discipline:** These are words that discipline experts use when they practice the discipline such as *hypothesis*, *theory*, *model*, *process* and *evidence*.
3. **General academic vocabulary:** These are difficult words that can be used in any discipline, like *expediency*, *plethora* and *enumerate*.
4. **General vocabulary used in a discipline-specific way:** These are words that have general meanings and specific meanings in a discipline. “Class” in history means something different than “class” in science.

Tasks/Expected Outcomes:

1. Students will explain the processes involved while reading in the sciences.
2. Students will learn about how to approach both general and discipline-specific vocabulary.
3. Students will learn about and practice close reading with a college-level science chapter on nutrition.

College and Career Readiness Standards (CCRS)

English Language Arts Science/Technical Subjects Standards: Reading

1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grade 11–12 texts and topics.

5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

7 Integrate and evaluate multiple sources of information presented in different media or formats as well as in words in order to address a question or solve a problem.

10 By the end of grade 12, read and comprehend science/technical texts in the grade 11-12 CCR complexity band independently and proficiently.

English Language Arts Standards: Writing

9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

Throughout this course, only 11-12 grade standards are used.

LDC	Skills and Ability List

Skills Cluster 1: Preparing for the Task

1. Bridging Conversation

Ability to connect the task and new content to existing scientific knowledge, skills, experiences, interests, and concerns.

Skills Cluster 2: Reading Process

1. Science Epistemology

Ability to understand the underlying idea that science an attempt to build understandings though constructed models and as approximations, findings are subject to revision, and that science knowledge is constructed incrementally using peer critique and public dissemination.

2. Scientific Terminology

Ability to locate and understand scientific words and phrases that identify key concepts and facts, processes, or information.

3. Close Reading

Ability to interpret text with particular questions in mind that reflect scientific inquiry, and to use self-regulation to understand scientific processes presented in the text.

4. Science Inquiry

Ability to generate questions and to select appropriate research to advance and challenge explanations, corroborate evidence, and evaluate sources and evidence.

5. Annotation and Note-taking

Ability to read purposefully, select, and use relevant information; to summarize and/or paraphrase; to use and understand multiple representations and science processes.

(www.literacydesigncollaborative.org)

Materials:

- Academic notebook
- Biology text, Chapter 34.1
- Annotation example
- Access to a dictionary (online is fine)

Timeframe:

125 minutes

Targeted Vocabulary:

Words that Help You Discuss the Discipline

- annotation
- theory

Discipline-Specific Vocabulary

- digestive system
- nutrients
- enzyme

Activity One — Preparing to Annotate (Approx. 10 minutes)

Ask students how scientists go about their work. What are scientists looking for when reading? What are their goals when conducting an experiment? What are their goals when writing up results? What does this mean for the ways students should approach reading, writing, and thinking in the sciences?

Be sure to discuss that precision of language is important, as is understanding procedures and processes. Scientists use scientific terms to describe other scientific terms, not to be deliberately confusing, but to be very precise in the description.

Activity Two — Reading for Scientific Thinking (Approx. 15 minutes)

College and Career Readiness Standards: Science/Technical Reading– 1

Students will be introduced to the types of reading they will engage in as a part of this course.

Have students begin to examine Chapter 34 of the biology text. Guide the reading by first focusing on the photos for the chapter and impact of those images on the reader (pages 977-979). Model one or two responses to help them understand what you are asking (Why is there a big spread of food?). Ask students to read the title of Chapter 34. Ask, what does the title tell you this chapter will be about? Is this something you are familiar with? Now let's look at the chapter outline. What do the animal pictures represent? What is the purpose of this chapter?

Tell students that their focus will be to learn the science material, be able to support their knowledge by citing specifics from text sources and to learn new strategies for learning the material. Explain to them that in this unit, they will learn how to read in multiple passes with different goals (vocabulary, making notes, etc.). Students will also learn strategies for annotating their text to pull out the most relevant information, and they will share their annotations with a partner and in a full class discussion. Students will read this chapter as well as other science materials in the nutrition unit.

Activity Three — Annotation and Close Reading (Approx. 90 minutes)

College and Career Readiness Standards: Science/Technical Reading– 1, 2, 4, 5, 6

Ask students to turn to Lesson Two in their Academic Notebooks on page 22.

Go through the materials in the Academic Notebook by asking students to work in pairs reading about the basics of annotation. They should be reading for an understanding of the concepts of reading in the sciences, the specifics of text annotation, and the reasons why a person would want to annotate. Ask students to circle or underline key ideas in the text as they read.

FROM THE STUDENT ACADEMIC NOTEBOOK pp 22-25

Reading Science Text

(Adapted from Nist-Olejnik & Holschuh, 2013).

In science textbooks you will find many new terms and definitions. Often, the terms introduced in early chapters will be used later in the text to define other terms. So you need to be sure you understand the new terms as they appear to avoid trouble understanding future reading. Science textbooks also discuss proven principles and theories in terms of their relationship to each other. Therefore, it is important to be aware of and understand how the theories connect and how they explain the science concepts you are learning.

Concepts in science textbooks are usually presented sequentially, which means the concepts build on each other. Your best plan is to test yourself as you read to make sure you fully understand each concept. It is also helpful to create reading goals to monitor what you are learning. This means that rather than focusing on getting through a chapter, focus on learning concepts every time you read. Adopt a scientific approach and ask yourself questions such as:

What data supports this concept or theory?

What other theories is this concept related to?

How does this phenomenon work? What is the scientific process involved?

Why does this phenomenon occur?

What does it show us?

It is also important to pay attention to the diagrams in each chapter. They are there to help you picture the science process so that you can see what is happening. Understanding diagrams is crucial to doing well in most science courses.

Gearing Up for Reading

To gear up for reading, start by reading the chapter title and thinking about what you already know about that concept. Focus on primary and secondary headings to understand how the chapter is organized and how the ideas are related together. If your text has an outline of topics at the beginning of each chapter, use it to help you think about the key points. If not, skim through the chapter for key terms and think about how they are related to the appropriate heading or subheading. Pay special attention to diagrams and figures, and think about how they relate to the overall focus of the chapter. Finally, read the chapter objectives and guiding questions if your textbook has these features.

What and How to Annotate During Reading

Because of the large amount of new terminology involved in learning science, it is important for you to read your science textbooks before class. In this way, you will be familiar with the terms and concepts discussed in the text and you will be able to build your understanding of the concepts as you listen in class. It is also a good idea to connect the concepts discussed in class with the concepts described in your text by comparing your lecture notes to your text annotations each time you read. This will help you follow the flow of the concepts and will help you understand how the ideas are connected.

When you annotate your science text, you need to match your annotations to the course expectations. For example, if you are expected to think at higher levels, be sure your annotations include more than just the bold-faced terms. If you are expected to be able to explain science processes, be sure your annotations help you learn to do just that.

In general, it is a good idea to limit the amount of material you annotate. Annotate big concepts and save the details for your rehearsal strategies. A big mistake that students make when annotating science is that they tend to annotate too much. It is also essential to focus on putting the ideas into your own words. This will help you monitor your understanding of what you have read and will keep you from copying exactly from the text. In addition, look for experiments and results or conclusions drawn from scientific theories, and seek to make connections between the experiments and the concepts they generate.

Science texts often contain diagrams or charts to explain concepts. Because science exams usually contain questions about the concepts described in diagrams or charts, you must be able to read and understand each one. As you read your text, annotate the diagrams and take the time to reflect on what they are depicting. A good self-testing strategy to make sure you fully understand the concept is to cover up the words in the diagram and try to talk through the information. If you can explain how the concept works, you've shown that you understand it. If you find that you cannot explain it, reread your annotations or the diagram text to be sure you understand the key points.

In the annotation example, notice how the annotations focus on explaining the concepts rather than just memorizing the terms.

Example of Annotations in a Science Textbook

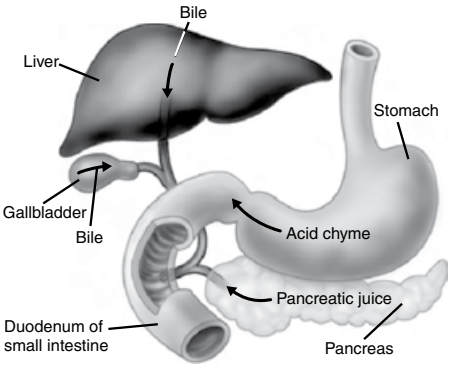


Figure 22.12
The duodenum. Acid chyme squirted from the stomach into the duodenum (the beginning of the small intestine) is mixed with pancreatic juice, bile from the liver and gallbladder, and intestinal juice produced by the duodenal lining itself. As peristalis propels the mix along the small intestine, hydrolases break food molecules down to their monomers.

The duodenum receives digestive juices from the pancreas, liver, and gallbladder (**Figure 22.12**). The **pancreas** is a large gland that secretes pancreatic juice into the duodenum via a duct. Pancreatic juice neutralizes the stomach acids that enter the duodenum and contains hydrolases that participate in the chemical digestion of carbohydrates, fats, proteins, and nucleic acids.

Bile is a juice produced by the **liver**, stored in the **gallbladder**, and secreted through a duct into the duodenum. Bile contains no digestive enzymes but does have substances called bile salts that make fats more accessible to lipase. Fats, including those from the cheese of the pizza we're following, are a special problem for the digestive system because they do not dissolve in water. The fats in chyme start out as relatively large globules. Only those molecules on the surface of the globules are in contact with the lipase dissolved in the surrounding solution. Agitation from the rhythmic contraction of muscles in the intestinal wall breaks the fat globules into small droplets, but without the help of bile salts, those droplets would quickly fuse again into larger globules that would be difficult to digest. Through a process called emulsification, bile salts essentially coat the tiny fat droplets and prevent them from fusing. Similarly, emulsification by a chemical additive helps keep oil permanently mixed with vinegar in some commercial salad dressings.

The intestinal lining itself also aids in enzymatic digestion by producing a variety of hydrolases. The cumulative activities of all these hydrolytic enzymes break the different classes of food molecules completely down into monomers, which are now ready for absorption into the body.

Absorption of Nutrients Wait a minute! The previous sentence said that nutrients "are now ready for absorption by the body." Aren't these nutrients already in the body? Not really. The alimentary canal is a tunnel running through the body, and its cavity is continuous with the great outdoors. The doughnut analogy in **Figure 22.13** should convince you that this is so. Until nutrients actually cross the tissue lining of the alimentary canal to enter the bloodstream, they are still outside the body. If it were not for nutrient absorption, we could eat and digest huge meals but still starve to death, in a sense.

Most digestion is complete by the time our pizza meal reaches the end of the duodenum. The next several meters of small intestine (called the jejunum and the ileum) are specialized for nutrient absorption. The structure of the intestinal lining, or epithelium, fits this function (**Figure 22.14**). The surface area of this epithelium is huge—roughly 300m^2, equal to the floor space of a one bedroom apartment. The intestinal lining not only has large folds, like the stomach, but also fingerlike outgrowths called villi, which makes the epithelium something like the absorptive surface of a fluffy bath towel. Each cell of the epithelium adds even more surface by having microscopic projections called microvilli. Across this expansive surface of intestinal epithelium, nutrients are transported into the network of small blood vessels and lymphatic vessels in the core of each villus.

Digestion Sm Intestine
- when food reaches sm int. it has been thru mech. and chem. digestion
- hydrolisis is initiated

Duodendum
1st ft. of sm int.
- where food is broken into monomers
- gets digest. juice from pancreas (pancreatic juice via duct— neutralizes stomach acid & contains hydrolases for chem digest), liver (bile), gallbladder (where bile is stored and via duct)
- Bile salts—make fats accessible to lipase thru **emulsification**— bile salts coat fat droplets to keep them separated (like oil and water in dressing) Int. lining produces hydrolases to get food ready for absorption

Absorption
Nutrients don't really 'enter' body until entering bloodstream. Nut abs occurs in jejunum and ileum (next parts of sm int.)
Epithelium—int. lining (huge—300m², folded, and has villi). Very absorptive. Each cell has microvilli—all help transport nutrients

The Annotation System of Text Marking

What is Annotation?

- Writing brief summaries in the textbook's margin.
- Enumerating multiple ideas (i.e., causes, effects, reasons characteristics).
- Sketching pictures or charts to explain difficult processes/concepts.
- Writing possible test questions.
- Noting puzzling or confusing ideas that need clarification.
- Underlining key ideas.

Why Should I Annotate?

- It will improve your concentration so you will not become distracted and have to reread.
- It can provide an immediate self-check for your understanding of the textbook's key ideas.
- It will help you remember more.
- It can assist you in test preparation.
- It will negate the need of time spent in rereading the chapters.
- It will help you state ideas in your words.

What Should I Annotate?

- Definitions.
- Lists, features, causes, effects, reasons, characteristics.
- Diagrams and processes.
- Examples of main idea.
- Good summaries.
- Possible test questions.
- Something you do not understand.

In a whole-class discussion, ask students to summarize what annotation is and what they are expected to annotate when they read in the sciences. Be sure that students understand that annotation should focus on the information they need to remember and that (except for definitions) the annotations should be in their own words. Also, if the text does not leave enough room to write in the margins, they can use sticky notes or strips of paper placed in the book's binding. If they are very careful to keep track of chapter and page numbers, they can also write their annotations in a notebook. However, when they review their annotations they will need to look at both the annotation AND the text so that they can refer to diagrams and other text materials as they study.

Students will begin to read and annotate Chapter 34 in the biology text. Work through the introduction of Chapter 34 together. Read page 977 aloud. Ask questions such as:

What is the difference between how plants and animals obtain nutrients (photosynthesis vs. consuming other organisms)? What kind of molecules do animals need to function (amino acids, lipid molecule, nucleotides, simple sugars)? In what forms are foods that we consume proteins, fats, complex carbohydrates)? What happens when there is an imbalance of food, storage and energy expenditure (health problems such as obesity, type-2 diabetes, cardiovascular problems)?

Ask students to work in pairs to find one word that is the most important for understanding the introduction. Possible answers: nutrients, digestion, absorption, balance). Ask, Are these words that you have not herd before?

Ask students to look at the vocabulary in the next section on pages 978-979 and ask the following questions: Are there any unfamiliar words that you can find?

(Give students time to read and search.) What does the word omnivore mean? How did you know (defined in the passage)? Can you figure it out from context? If you did not know the word, how could that impact your understanding of this section? What do the lion and the ladybug have in common according to the caption (both are omnivores)

Ask students to think about the different types of vocabulary they will encounter in most science texts. They will be on the lookout for all four types as they read in this course. As they read, ask them to circle or underline words that fit into one of these four types of words. Remind students that the science-specific terms will need to be understood within the larger science concept. We will discuss several strategies to help them learn both the vocabulary and the concept throughout the unit.

FROM THE STUDENT ACADEMIC NOTEBOOK p 26

Discipline specific vocabulary: These are content area words like *polymer* or *macromolecule* that help students understand the content they are reading—these are often the boldface words in science texts.

Words that help you discuss the discipline: These are words that discipline experts use when they practice the discipline such as *hypothesis*, *theory*, *model*, *process* and *evidence*.

General academic vocabulary: These are difficult words that can be used in any discipline, like *expediency*, *plethora* and *enumerate*. (And milieu and laden that we just found.)

General vocabulary used in a discipline-specific way. These are words that have general meanings and specific meanings in a discipline. “Class” in history means something different than “class” in science.

Ask students to read the section labeled, “Parts of the Digestive System” beginning on page 983 in the biology text. Ask students to work in pairs to read and annotate pages 983-986 together, using the annotating strategies learned thus far. Explain that, although this course is not intended to teach “science,” reading and understanding science texts is important when taking a science course in the future. So, practicing the strategies now will pay off later. Monitor the paired work and assis students who are struggling. Allow students 15-20 minutes to read and annotate. Then ask students to stop. Ask the following text dependent questions: 1. What is chyme and where is it formed (partially digested food and gastric juices formed in the stomach)? ask students to identify the part in the text where they can find the correct answer. 2. Why does the small intestine have finger-like projections called “villi” (to increase surface area to increase absorption of nutrients)? Ask where they found the answer.

Ask students to identify the information that they felt was important to annotate thus far (Answers will vary.). Check to make sure that the major points are being found. Allow students to continue to read and annotate this section. Unfinished reading and annotating should be completed for homework. Announce that there will be a quiz on this section during the next class.

Activity Four	Comprehension Check

College and Career Readiness Standards for Science/Technical Reading– 2, 4, 6, 7, 10

Administer the Reading Quiz (found on the next page). Score according to recommended point values.

Assessment:

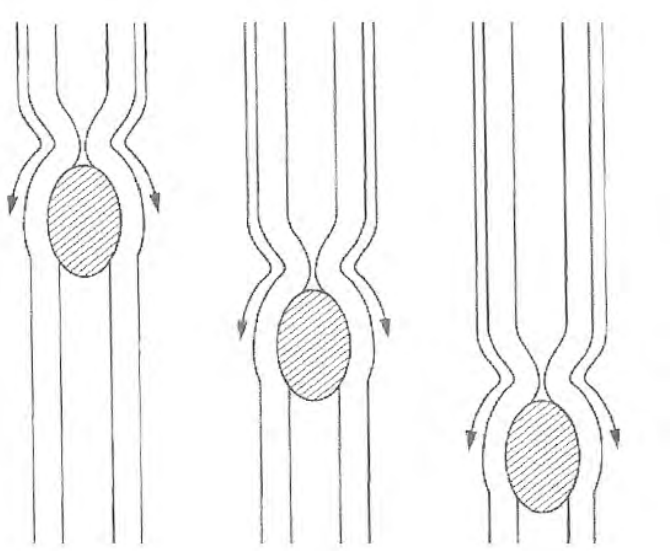
Outcome 1: Students will explain the processes involved while reading in the sciences.

- Reading quiz
- Annotation checklist

Lesson 2 Activity 4 Reading Quiz

1. Explain the process of digestion that takes place specifically in the stomach based on your reading of the text. Include accurate use of as many of the science terms you can in your summary.

2. Explain the process shown in the diagram. Label the organ in the picture, the shaded, egg-shaped object in the picture and provide the technical name for this process.



Quiz Grade:

Give whatever you deem appropriate (See suggested scoring below.). The purpose of the quiz is to reinforce the need for students to complete assignments regularly, to use learned vocabulary in their work and to demonstrate general comprehension. The focus is less on the "specific science" and more on reinforcing the strategies for learning. The science knowledge is important to help guide students to further research into topics for the culminating written project.

Scoring for quiz:

Question 1:
The stomach secretes gastric juices for the chemical breakdown of food. It is the major site for protein digestion. Pepsin breaks down proteins. The stomach muscles constrict and relax. The partially digested food and the gastric juice form chime.

Give 10 points for this general answer and give 3 additional points for each correctly used term"

Pepsin, pepsinogen, gastric juices, chime, pyloric sphincter

Total Points Possible: 25

Question 2:

- The organ is the esophagus. The long tube should be labeled. 2 points
- The shaded, egg-shaped figure is food. 2 points
- The process is called peristalsis. 2 points
- This is the process of swallowing food. Muscles in the esophagus gently squeeze in a downward motion and the partially digested food travels from the mouth to the stomach 5 points

Total Points Possible: 11

Activity Five — Science Vocabulary and Annotation

College and Career Readiness Standards for Science/Technical Reading– 4

Ask students to share the vocabulary words they had circled as they read the biology text. Ask other students to give meanings for the identified words and where they found the definitions in the text.

Ask students to think about some of the vocabulary they have been reading so far. Many science terms use Greek and Latin roots with common prefixes and suffixes. By learning some of these roots, students can often determine the meaning of a word. Ask students to look at the word esophagus.

Prefix = eso (inward, within, inner)

Root = phag (eat)

Use the Prefix, Root, Suffix list as you read. Note to the students that the three pages of prefixes, etc. should be thought of as three pages stacked to show how the alphabetical order appears. This will avoid confusion as they use the chart.

Assessment:

Outcome 3: Students will learn about and practice close reading with a college-level science chapter on digestion.

- Student text annotation
- Arrange students in pairs. Have them exchange annotations and use the annotation checklist to evaluate each other's annotations.

Annotation Checklist

- ☐ Your annotations are perfect! Keep up the good work.
- ☐ You have missed many key ideas. Go back and annotate them.
- ☐ You need to put your annotations in your own words—do not copy from the book!
- ☐ Be briefer in your annotations. You do not need to write in full sentences
- ☐ You have ignored the graphic aids. Annotate them.
- ☐ You need to note the specific examples—they could reappear on the quiz.
- ☐ You need to enumerate the specific facts, characteristics, causes, events, etc., in the margin or in the text. Get the details, too!
- ☐ Your annotations need to focus on the key ideas more and less on details.
- ☐ You are underlining too much—work more on writing your summaries in the margin.
- ☐ You are annotating too much! It will take you forever to do a chapter.
- ☐ You are annotating too little! You do not have enough information annotated to use as a study aid.
- ☐ You need to develop some symbols of your own and use them.
- ☐ You need to develop a method for organizing your annotations.
- ☐ Please annotate these sections or pages again.

p. _____ p. _____

p. _____ p. _____

SCIENTIFIC ROOT WORDS, PREFIXES, AND SUFFIXES pp 27-29

(http://www.succeedinscience.com/apbio/assignments/generalinfo/rootwords.pdf)

a-; an- ab- -able	not; without; lacking; deficient away from; out from capable of	cente- centi- centr-	pierce; hundredth; center	-err- erythro- -escent	wander; go astray red; becoming
ac-	to; toward	cephal-	head	eso-	inward; within; inner
-aceous	of or pertaining to	cerat-	horn	eu-	well; good; true; normal
acou-; acous -	hear	cerebr-	brain	eury-	widen
ad-	to; toward	cervic-	neck	ex-	out of; away from
aden-	gland	chel-	claw	extra-	beyond; outside
adip-	fat	chem-	dealing with chemicals	-fer-	bear; carry; produce
aero-	air	chir-	hand	ferro-	iron
agri-	field; soil	chlor-	green	fibr-	fiber; thread
-al	having the character of	chondr-	cartilage	-fid; fiss-	split; divided into
alb-	white	chrom-; -chrome	color	-flect; -flex	bend
alg-; -algia	pain	chron-	time	flor-	flower
alto-	high	-chym-	juice	flu-; fluct-; flux	flow
ambi-	both	-cid-; -cis -	cut; kill; fall	foli-	leaf
ameb-	change; alternation	circa-; circum-	around; about	fract-	break
amni-	fetal membrane	cirru-	hairlike curls	-gam-	marriage
amphi-; am-pho-	both	co-	with; together	gastr-	stomach
amyl-	starch	cocc-	seed; berry	geo-	land; earth
ana-	up; back; again	coel-	hollow	-gen; -gine	producer; former
andro-	man; masculine	coll-	glue	-gene-	origin; birth
anemo-	wind	coni-	cone	-gest-	carry; produce; bear
ang-	choke; feel pain	contra-	against	-glen-	eyeball
angi-	blood vessel; duct	corp-	body	-glob-	ball; round
ante-	before; ahead of time	cort-; cortic-	outer layer	gloss-	tongue
anter-	front	cosmo-	world; order; form	gluc-; glyc-	sweet; sugar
antho-	flower	cotyl-	cup	glut-	buttock
anti-	against; opposite	counter-	against	gnath-	jaw
anthropo-	man; human	crani-	skull	-gon	angle; corner
-ap-; -aph-	touch	cresc-; cret-	begin to grow	-grad-	step
apo-; ap-	away from	crypt-	hidden; covered	-gram; graph	record; writing
aqu-	water	-cul-; -cule	small; diminutive	grav-	heavy
archaeo-	primitive; ancient	cumul-	heaped	-gross-	thick
-ary; -arium	place for something	cuti-	skin	gymno-	naked; bare
arteri-	artery	cyan-	blue	gyn-	female
arthr-	joint; articulation	-cycle; cycl-	ring; circle	gyr-	ring; circle; spiral
-ase	forms names of enzymes	-cyst-	sac; pouch; bladder	-hal-; -hale	breathe; breath
aster-; astr-	star	cyt-; -cyte	cell; hollow container	halo-	salt
-ate	verb form - the act of...	dactyl-	finger	hapl-	simple
ather-	fatty deposit	de-	away from; down	hecto-	hundred
-ation	noun form - the act of...	deca-	ten	-helminth-	worm
atmo-	vapor	deci-	tenth	hem-	blood
audi-	hear	deliquesc-	become fluid	hemi-	half
aur-	ear	demi-	half	hepar-; hepat-	liver
auto-	self	dendr-	tree	herb-	grass; plants
bacter-; bactr-	bacterium; stick; club	dent-	tooth	hetero-	different; other
barb-	beard	derm-	skin	hex-	six
baro-	weight	di-; dipl- (Latin)	two; double	hibern-	winter
bath-	depth; height	di-; dia- (Greek)	through; across; apart	hidr-	sweat
bene-	well; good	dia- (Latin)	day	hipp-	horse
bi- (Latin)	two; twic e	digit-	finger; toe	hist-	tissue
bi-; bio- (Greek)	life; living	din-	terrible	holo-	entire; whole
-blast-	sprout; germ; bud	dis-	apart; out	homo- (Latin)	man; human

brachi-	arm	dorm-	sleep	homo- (Greek)	same; alike
brachy -	short	dors-	back	hort-	garden
brady-	slow	du-; duo-	two	hydr-	water
branchi-	fin	-duct	lead	hygr-	moist; wet
brev-	short	dynam-	power	hyper-	above; beyond; over
bronch-	windpipe	dys-	bad; abnormal; difficult	hyph-	weaving; web
cac-	bad	ec-	out of; away from	hypno-	sleep
calor-	heat	echin-	spiny; prickly	hypo-	below; under; less
capill-	hair	eco-	house	hyster-	womb; uterus
capit-	head	ecto-	outside of	-iac	person afflicted with disease
carcin-	cancer	-elle	small	-iasis	disease; abnormal condition
cardi-	heart	-emia	blood	-ic	(adjective former)
carn-	meat; flesh	en-; endo-; ent-	in; into; within	ichthy-	fish
carp-	fruit	-en	made of	ign-	fire
carpal-	wrist	encephal-	brain	in-; il-; im-; ir-	not
cata-	breakdown; downward	enter-	intestine; gut	in-; il-; im-; ir-	to; toward; into
caud-	tail	entom-	insects	in-	very; thoroughly
-cell-	chamber; small room	-eous	nature of; like	-ine	of or pertaining to
cen-; -cene	now; recent	epi-	upon; above; over	infra-	below; beneath
inter- intra-	between within; inside	-oma omni-	abnormal condition; tumor; all	sacchar- sapr-	sugar rotten
-ism	a state or condition	onc-	mass; tumor	sarc-	flesh
iso-	equal; same	oo-	egg	saur-	lizard
-ist	person who deals with...	opthalm-	eye	schis -; schiz-	split; divide
-itis	inflammation; disease	opt-	eye	sci-	know
-ium	refers to a part of the body	orb-	circle; round; ring	scler-	hard
-kary-	cell nucleus	-orium; -ory	place for something	-scop-	look; device for seeing
kel-	tumor; swelling	ornith-	bird	-scribe; -script	write
kerat-	horn	orth-	straight; correct; right	semi-	half; partly
kilo-	thousand	oscu-	mouth	sept-	partition; seven
kine-	move	-osis	abnormal condition	-septic	infection; putrefaction
lachry-	tear	oste-	bone	sess-	sit
lact-	milk	oto-	ear	sex-	six
lat-	side	-ous	full of	-sis	condition; state
leio-	smooth	ov-	egg	sol-	sun
-less	without	oxy-	sharp; acid; oxygen	solv-	loosen; free
leuc-; leuk-	white; bright; light	pachy -	thick	som-; somat-; -	body
lign-	wood	paleo-	old; ancient	somn-	sleep
lin-	line	palm-	broad; flat	son-	sound
lingu-	tongue	pan-	all	spec-; spic-	look at
lip-	fat	par-; para-	beside; near; equal	-sperm-	seed
lith-; -lite	stone; petrifying	path-; -pathy	disease; suffering	-spher-	ball; round
loc-	place	-ped-	foot	spir-; -spire	breathe
-log-	word; speech	-ped-	child	-spor-	seed
-logist	one who studies...	pent-	five	stat-; -stasis	standing; placed; staying
-logy	study of...	per-	through	stell-	stars
lumin-	light	peri-	around	sten-	narrow
-lys-; -lyt-; -lyst	decompose; split; dissolve	permea-	pass; go	stern-	chest; breast

macr-	large	phag-	eat	stom-; -stome	mouth
malac-	soft	pheno-	show	strat-	layer
malle-	hammer	-phil-	loving; fond of	stereo-	solid; 3-dimensional
mamm-	breast	phon-; -phone	sound	strict-	drawn tight
marg-	border; edge	-phore; pher-	bear; carry	styl-	pillar
mast-	breast	photo-	light	sub-	under; below
med-	middle	phren-	mind; diaphragm	super-; sur-	over; above; on top
meg-	million; great	phyc-	seaweed; algae	sym-; syn-	together
mela-; melan-	black; dark	phyl-	related group	tachy-	quick; swift
-mer	part	-phyll	leaf	tarso-	ankle
mes-	middle; half; intermediate	physi-	nature; natural qualities	tax-	arrange; put in order
met-; meta-	between; along; after	phyt-; -phyte	plant	tele-	far off; distant
-meter; -metry	measurement	pino-	drink	telo-	end
micro-	small; millionth	pinni-	feather	terr-	earth; land
milli-	thousandth	plan-	roaming; wandering	tetr-	four
mis-	wrong; incorrect	plasm-; -plast-	form; formed into	thall-	young shoot
mito-	thread	platy-	flat	-the-; -thes-	put
mole-	mass	pleur-	lung; rib; side	-thel-	cover a surface
mono-	one; single	pneumo-	lungs; air	-therm-	heat
mort-	death	-pod	foot	-tom-	cut; slice
-mot-	move	poly-	many; several	toxico-	poison
morph-	shape; form	por-	opening	top-	place
multi-	many	port-	carry	trache-	windpipe
mut-	change	post-	after; behind	trans-	across
my-	muscle	pom-	fruit	tri-	three
myc-	fungus	pre-	before; ahead of time	trich-	hair
mycel-	threadlike	prim-	first	-trop-	turn; change
myria-	many	pro-	forward; favoring; before	-troph-	nourishment; one who feeds
moll-	soft	proto-	first; primary	turb-	whirl
nas-	nose	pseudo-	false; deceptive	-ul-; -ule	diminutive; small
necr-	corpse; dead	psych-	mind	ultra-	beyond
nemat-	thread	pter-	having wings or fins	uni-	one
neo-	new; recent	pulmo-	lung	ur-	urine
nephro-	kidney	puls-	drive; push	-ura	tail
-ner-	moist; liquid	pyr-	heat; fire	vas-	vessel
neur-	nerve	quadr-	four	vect-	carry
noct-; nox-	night	quin-	five	ven-; vent-	come
-node	knot	radi-	ray	ventr-	belly; underside
-nom-; -nomy	ordered knowledge; law	re-	again; back	-verge	turn; slant
non-	not	rect-	right; correct	vig-	strong
not-	back	ren-	kidney	vit-; viv-	life
nuc-	center	ret-	net; made like a net	volv-	roll; wander
ob-	against	rhag-; -rrhage	burst forth	-vor-	devour; eat
ocul-	eye	rhe-; -rrhea	flow	xanth-	yellow
oct-	eight	rhin-	nose	xero-	dry
odont-	tooth	rhiz-	root	xyl-	wood
-oid	form; appearance	rhodo-	rose	zo-; -zoa	animal
olf-	smell	roto-	wheel	zyg-	joined together
oligo-	few; little	rubr-	red	zym-	yeast

Activity Six — Reflect on the Lesson (Approx. 10 minutes)

College and Career Readiness Standards: Science/Technical Writing– 9, 10

Students will write a reflection on learning at two levels in the weekly reflection section of their Academic Notebook. They will respond to questions on what they learned about science and what they learned about literacy.

FROM THE STUDENT ACADEMIC NOTEBOOK p 30

WEEK 1

Reflect on your experience:

1. Think about the science. What would scientists pay attention to if they were looking at a new energy drink on the market?

2. Think about your learning. How will this experience change the way you approach reading in the sciences?

3. Think about how using annotation impacted the way you read in science. What do you like about the strategy? What do you dislike about it?

Assessments:

Outcome 2: Students will learn how to approach both general and discipline-specific vocabulary.

• Group discussion of vocabulary

Evaluation Rubric			
• Participates fully in the discussion.	No	Somewhat	Yes
• Adds meaningful information or insights.	No	Somewhat	Yes

Outcome 1: Students will be able to explain the processes involved reading in the sciences.

• Class discussion

Evaluation Rubric			
• Participates fully in the discussion.	No	Somewhat	Yes
• Adds meaningful information or insights.	No	Somewhat	Yes

• Weekly Reflection

Evaluation Rubric			
• Reflects on the science learned.	No	Somewhat	Yes
• Reflects on the learning of science.	No	Somewhat	Yes
• Shows a deep understanding of both the science and the learning.	No	Somewhat	Yes

Teacher Checklist	Use this list to ensure that you have completed all of the lesson components. I . . .

- [ ] 1. Discussed reading in the sciences.
- [ ] 2. Introduced Belk and Maier Chapters Three and Four.
- [ ] 3. Discussed the concept of text annotation.
- [ ] 4. Shared annotation examples.
- [ ] 5. Discussed the components of annotation.
- [ ] 6. Practiced annotations as a whole class, in pairs, and individually.
- [ ] 7. Administered and scored the Reading Quiz.
- [ ] 8. Discussed using prefixes, roots, and suffixes for vocabulary learning.
- [ ] 9. Collected students annotations.
- [ ] 10. Provided feedback on annotations.
- [ ] 11. Asked students to complete the weekly reflection.

Lesson 3
Analogies in Science

Overview and Rationale:

In this lesson, students will engage in a chemical reaction simulation activity to dramatize the role of enzymes and to discuss the role of analogies in science. They will also read and annotate a section of Chapter 34 in the biology text on enzymes and read an article from the Mayo Clinic about lactose intolerance. Students will explain a case study on effects of enzyme deficiencies using their knowledge from the enzyme activity, the charts in their texts and supplemental readings on the topic.

Tasks/Expected Outcomes:

1. Students will understand the role of analogies in science.
2. Students will read across texts in multiple representations and make connections between text, diagram, and animation information.

College and Career Readiness Standards (CCRS)

English Language Arts Science/Technical Subjects Standards: Reading

1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information by paraphrasing them in simpler but still accurate terms.

7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

English Language Arts Standards: Writing

9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

Throughout this course, only 11-12 grade standards are used.

LDC	Skills and Ability List

Skills Cluster 1: Preparing for the Task

1. Bridging Conversation

Ability to connect the task and new content to existing knowledge, skills, experiences, interests, and concerns.

Skills Cluster 2: Reading Process

1. Science Inquiry

Ability to generate questions and to select appropriate research to advance and challenge explanations, corroborate evidence, and evaluate sources and evidence.

2. Science Constructs

Ability to understand, create, and use science models and explanations, evidence, and representations with an understanding of their limitations.

3. Close Reading

Ability to read purposefully and select relevant information; to summarize and/or paraphrase, and to examine multiple sources of information to solve a problem.

4. Using Multiple Texts

Ability to engage in the interpretation of multiple texts, requiring converging (corroboration) of information, integrating across sources, and evaluating sources and evidence.

Skills Cluster 4: Writing Process

1. Initiation of Task

Ability to establish a controlling idea and consolidate information relevant to task.

(www.literacydesigncollaborative.org)

Materials:

- Biology text, Chapter 34
- Lactose Intolerance (Mayo Clinic website) www.mayoclinic.org/diseases-conditions/lactose-intoleance/basics/definition/con-20027906
- Enzyme reactant pair cards
- Final project directions
- 3x5 note cards

Timeframe:

125 minutes

Targeted Vocabulary:

Discipline Specific Vocabulary

- activation energy
- active site
- enzyme
- induced fit
- metabolize
- substrate

General Academic Vocabulary

- specificity
- corroboration

Activity One — Chemical Reaction Simulation Activity (Approx. 50 minutes)

College and Career Readiness Standards: Science/Technical Writing– 9

Students will complete an analogy activity that will serve as a chemical reaction simulation, both with and without enzymes present. This activity will occur in three rounds.

First, students will respond to the opening questions in their Academic Notebook:

FROM THE STUDENT ACADEMIC NOTEBOOK p 32

Now that you have learned about the nutrients your body needs to maintain itself and how the body attempts to obtain those nutrients, please respond to the following questions:

What has to happen to the food we eat in order to supply our cells with the nutrients they need?

How does this happen?

After students respond individually (about five minutes), discuss digestion as a whole group to elicit their background knowledge about digestion. Lead the discussion to help students understand that digestion is a series of chemical reactions. You can then explain that students will participate in a chemical reaction analogy activity that will help them understand the role of enzymes in our digestion and metabolism. Ask students to look up ana- and -logy on their Roots, Prefixes and Suffixes list. They should find

ana = again, up, back

logy = study

Analogy literally means “study back,” or study back and forth between something or an action that we know to understand another complex thing or action.

Explain that analogies are often used in science to help make concepts more concrete. Analogies are where one compares two things—for example, in science we might compare blood and blood vessels to water and water pipes or the DNA helix is like a twisted ladder. The word *analogy* has a specialized meaning in science in that it is also

used to mean a model—so, for example, when you use styrofoam balls to create a model of the solar system, you are also creating an *analogy* of that system (also called an *analogical model*). We are using analogy in both senses in this lesson. One thing that science learners need to know is that an analogy is never a perfect match—blood through blood vessels is not exactly like water through pipes. As students use analogy, they need to be sure they understand how the science is really working. Otherwise, analogy can lead to misconceptions.

First round: To help students understand the reactant pairs sometimes find each other without an enzyme present (but that it takes longer).

As students complete the opening questions, tape index cards from the reactant pair cards randomly on the backs of students. Once you have introduced the lesson, explain to students that the cards represent reactants in a chemical reaction in this simulation activity (but be sure to note that they are not portraying actual reactants in a chemical reaction, but that they using these common substances as an analogy for actual reactants). The objective is for them to find their "partner" reactants (i.e., salt and pepper, peanut butter and jelly), so that they can form the desired product. They should mingle among their classmates, asking each other questions about what is taped to their back (only yes or no questions—"Am I used in cooking? Am I a part of the solar system? Would you find me in a house?) until they find their partner, linking arms to form the product. The teacher will set a timer at the start of the activity, and will stop the timer when all the reactions are complete (everyone has found their partner). Ask students to complete the reflection questions following this activity in their Academic Notebook. The first round should help students understand that the substrates sometimes find each other randomly.

Second Round: To help students understand the role of the enzyme to help reactant pairs find each other.

While students reflect on the first round of the simulation, the teacher can tape the second round of index cards (cut into the shape of puzzle pieces) on the backs of some students. In this second round, students will have the same reactant pairs (salt, pepper, etc.) but this time they will be cut into puzzle pieces. However, some students will be given the parts that are left after cutting out the images (not taped on their backs). These students will act as enzymes that help the substrates find each other. They will be able to see what shapes they will fit with. When the simulation begins, the enzymes can then go find the reactants that they fit with, and bring those reactants together faster to make the product. Again, the teacher will set the timer at the start of the activity, and will stop the timer when all the reactions are complete (all reactants have linked to form the products). Ask students to complete the reflection questions following this activity in their Academic Notebook.

Third Round: To help students understand the process with actual enzymes, substrates, and products.

In this round, some students will not be reactants, but instead will act as enzymes. The enzymes will be called up to the front of class to receive their "puzzle pieces." Explain to students that using an enzyme as a puzzle piece is an analogy. Other people call enzymes and substrates a "lock and key."

Cut out each of the following numbered enzyme pairs and corresponding paragraphs. Cut the enzyme pairs and paragraphs apart. Glue the enzyme pairs on the front of the card, and the corresponding paragraph on the back of the card. Cut each card into two pieces so that no two pieces are identical. (The two halves should form a puzzle-like piece.) The process of finding each other will happen as it did during round two where the enzymes find their corresponding substrates. Ask students to reflect in their Academic Notebook.

FROM THE STUDENT ACADEMIC NOTEBOOK pp 33-35

Chemical Reaction Simulation

Round 1:

Total Time to complete all chemical reactions: _____

In this simulation, each person represented a reactant. How did they find the other reactant that they were meant to undergo a chemical reaction with? How does this serve as an analogy for chemical reactions? How would you describe the rate of this reaction?

Round 2:

Total Time to complete all chemical reactions: _____

How were the parameters of the "chemical reaction" changed in this round? Based on this information, how do you think enzymes speed up chemical reactions?

Round 3:

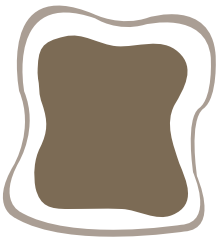
Total Time to complete all chemical reactions: _____

How did using actual enzyme-substrate combinations compare to our analogy with everyday objects? How did the analogy rounds help you understand the basic concept of the role of enzymes in chemical reactions?

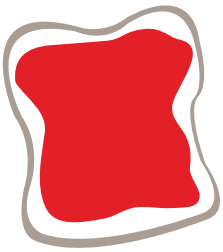
Form a hypothesis to predict what might happen if the enzyme were absent in one of the enzyme/substrate system.

CARDS for Enzyme Reactant Pairs

ROUND 1: Cut out the pairs and tape one on each student's back. They will then ask each other yes/no questions to find their match.



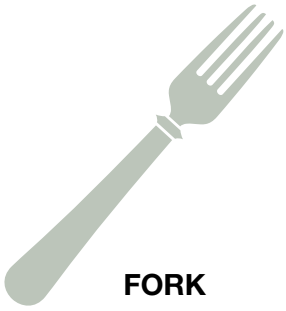
PEANUT BUTTER



JELLY

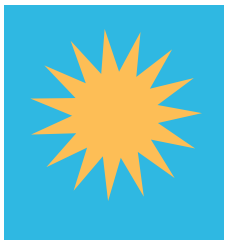
SALT

PEPPER



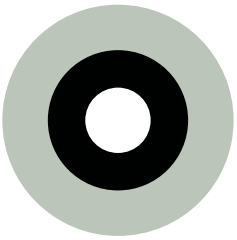
FORK

KNIFE

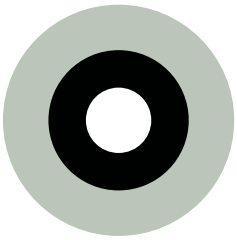


DAY

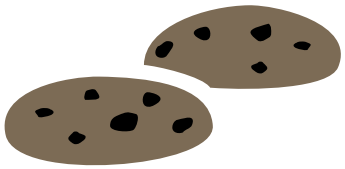
NIGHT



FRONT WHEEL

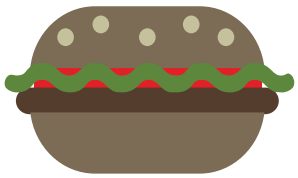


REAR WHEEL



COOKIES

MILK



BURGER

FRIES

HAMMER

NAIL

THUNDER

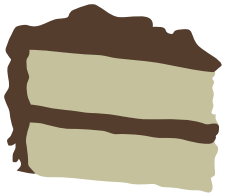
LIGHTNING

ROCK

ROLL

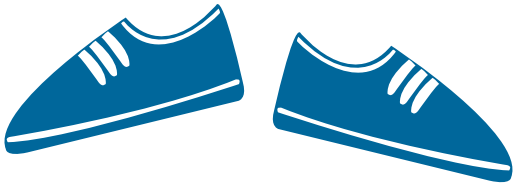
SUN

MOON



CAKE

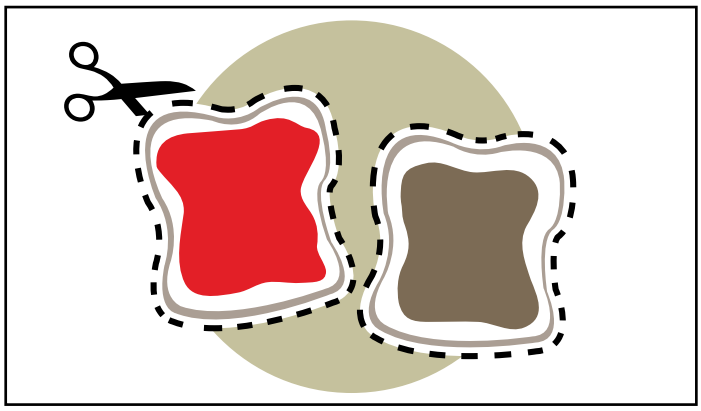
ICE CREAM

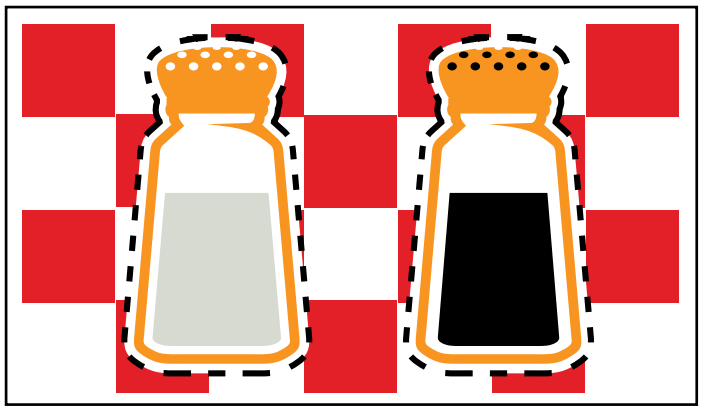


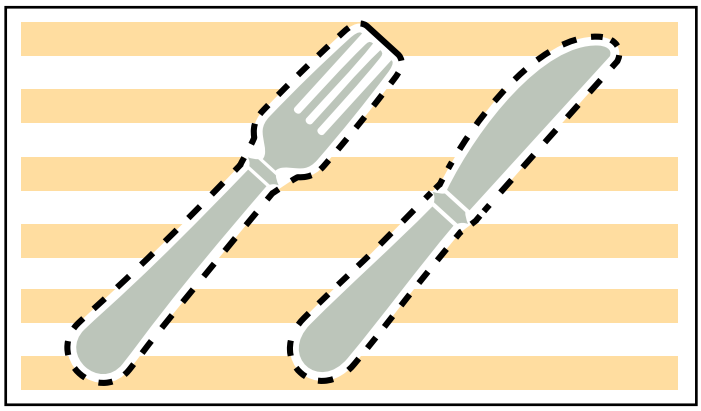
SHOES

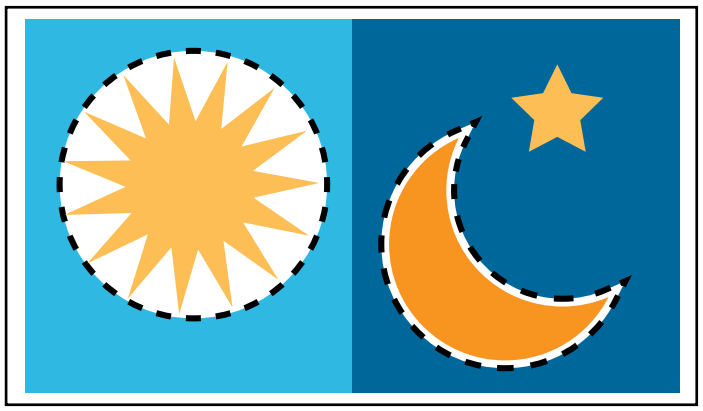
SOCKS

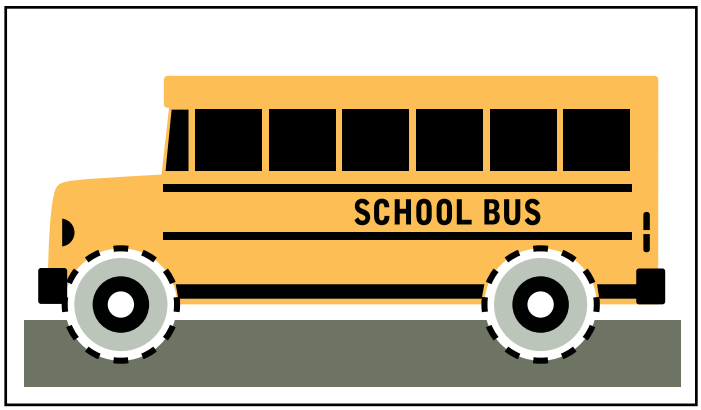
ROUND 2: Cut out the pairs and tape one on each student's back. They will then ask each other yes/no questions to find their match it. The parts that are left after cutting out the images will be given to the student acting as the enzyme that helps the puzzle pieces find each other.

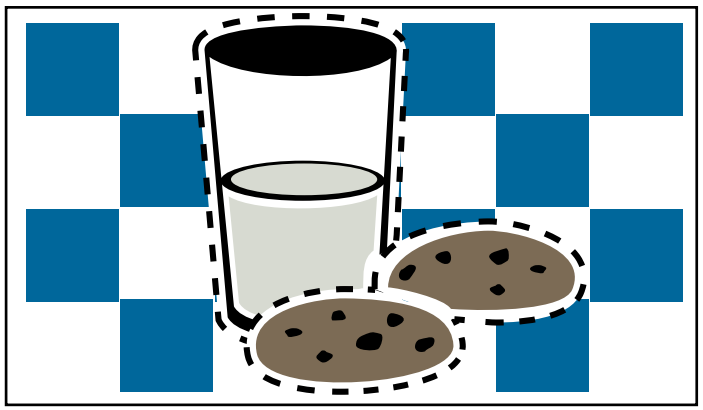


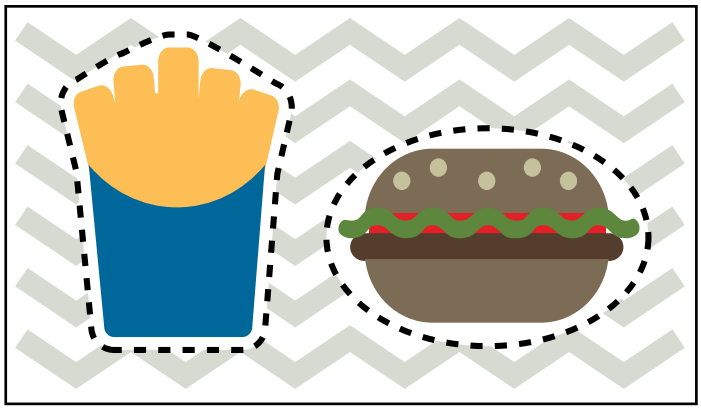


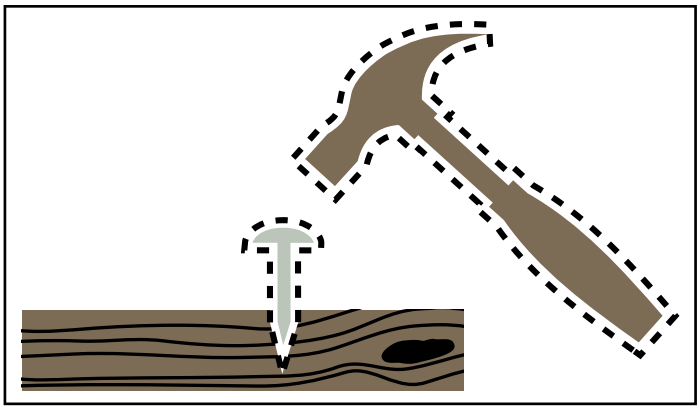


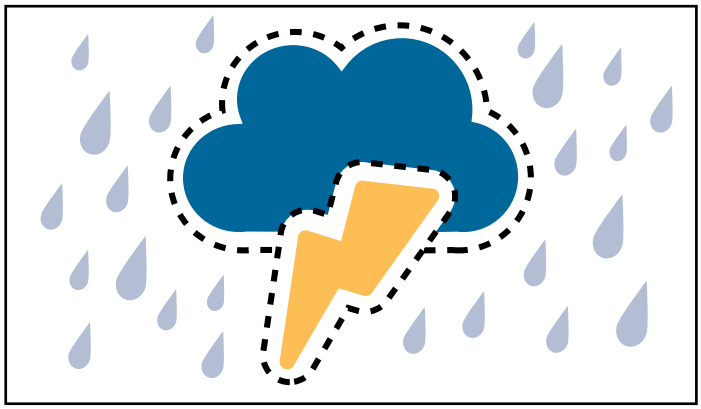


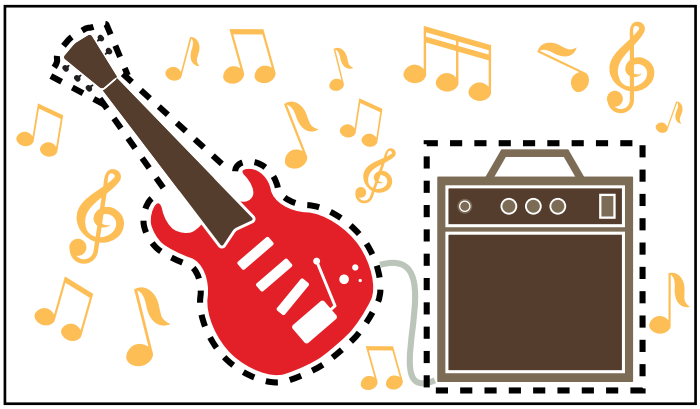


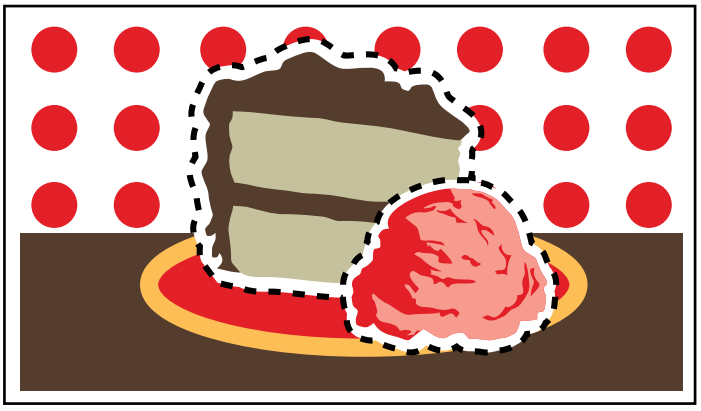


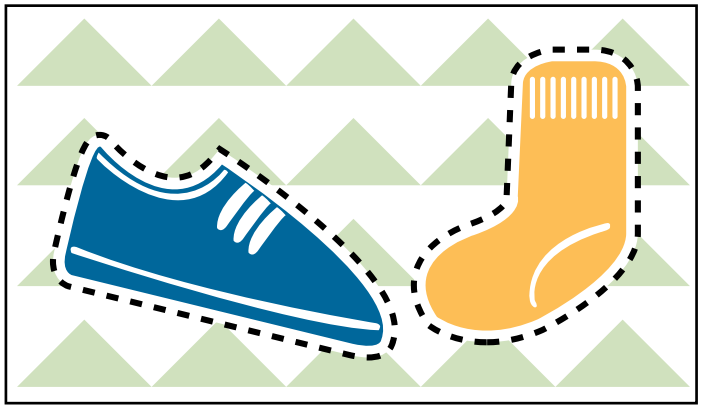












ROUND 3: In this round students will use actual enzymes and substrates to create products. Cut the partners into puzzle pieces so that the enzymes, substrates, and products will be able to find each other.

Adapted from wveis.k12.wv.us/teach21.

INSTRUCTIONS:

1. Cut out each of the following numbered enzyme pairs and corresponding paragraphs.
2. Cut the enzyme pairs and paragraphs apart.
3. Glue the enzyme pairs on the front of an index card, and the corresponding paragraph on the back of the card.
4. Cut each card into two pieces so that no two pieces are identical. (The two halves should form a puzzle-like piece.)

1. **Rennin** **Casein** found as protein in milk	Little Miss Muffett sat on a tuffet, eating her curds and whey. What was she eating? The enzyme rennin is found in the fourth stomach of young ruminant such as suckling calves. Rennin acts on the Casein at a pH of 4.7 and produces paracasein or curds. The soft clumps of cottage cheese are the curds and the watery liquid is the whey. The paracasein precipitate will occur if you add acid to milk to lower the pH. In humans, the stomach pH of 2.0 would have the same effect as the rennin. Human infants do not have this enzyme.
2. **Peptidases** **Proteins**	Peptidase enzymes break down the protein molecules into smaller peptides and amino acids. Digestion of protein is complete with in a few hours, but without peptidase the process would take about 50 years.

3. **Diastase**	**Starch**	Diastase breaks down starch into a disaccharide maltose. Barley seeds contain an extracellular enzyme diastase which digests stored starch and makes energy available for the embryo during seed germination. Diastase is now called amylase.
4. **Lactase**	**Lactose or milk sugar**	Lactase is broken down into two simple sugars, glucose and galactose. A deficiency of lactase enzyme is fairly common, especially among infants of Middle Eastern, Oriental and African descent. When the individual eats lactose the results are stomach cramps, gas and diarrhea. Lactose production diminishes with age. Some experts estimate that as many as one out of three adult Americans suffer from a degree of lactose intolerance.
5. **Plasmin**	**Blood Clot**	After blood clots serve their function they are dissolved and reabsorbed into the blood stream. Plasmin is responsible for clot breakdown. A different enzyme Thrombin changes fibrinogen to fibrin as the clot occurs.
6. **Luciferase**	**Luciferin + ATP**	One of the earliest gene transplants between species was between a fire fly and a tobacco plant. The enzyme luciferase reacts with luciferin and ATP and gives off energy in the form of a greenish-yellow light. The result in the tobacco plant was a glow in the dark plant.

7. **Hexokinase** **Glucose**	The first of nine enzymes needed to split a six-carbon sugar of glucose into two three-carbon molecules with a release of ATP energy. The complete conversion of glucose to carbon dioxide and water requires 18 enzymes. Many catalytic reactions consist of a series of enzymes.
8. **Sucrase** **Glucose + Fructose**	Simple sugars (monosaccharides) like glucose and fructose can be linked together to form longer chains of sugars (polysaccharides). The combination of glucose and fructose forms a disaccharide called sucrose, or what we know of as simple table sugar.
9. **Catalase** **Hydrogen Peroxide**	The bi-product of some cellular reactions is hydrogen peroxide, which is actually toxic to cells. Catalase is an enzyme that helps to break down the toxic hydrogen peroxide to water and oxygen. This reaction is actually why hydrogen peroxide can act as an antiseptic, as bacteria don't have the catalase enzyme to help them break down this toxin!
10. **DNA nucleotides** **DNA Polymerase**	The long twisted ladder model of DNA that we are all aware of is actually built of many small pieces (monomers) called DNA nucleotides linked together. DNA Polymerase acts to link these nucleotides (remember the A's, T's, C's and G's?) to form the sequence of DNA that makes you who you are!

After all three rounds, lead a whole group discussion about this chemical reaction simulation, so that students can share their thoughts about the reflection questions. Guide the discussion to include the realization that digestion is simply a series of chemical reactions, but if left to happen randomly would take a very long time. Enzymes speed up chemical reactions by bringing reactants together so that they can form the products faster. Ask students how this activity provides an analogy of how enzymes work.

Assessment:

Outcome 1: Students will understand the role of analogies in science.

- Analysis of enzyme activity in Academic Notebook

Evaluation Rubric			
• Provides meaningful analysis of the three rounds of the simulation.	No	Somewhat	Yes
• Adds meaningful information or insights to class discussion.	No	Somewhat	Yes

Activity Two — Annotation of Text and Model Analysis (Approx. 50 minutes)

College and Career Readiness Standards: Science/Technical Reading– 1, 7, 9

Students will read and annotate Chapter 34.2 in the biology text, pages 989-994. As they read, they are trying to corroborate their learning from the chemical reaction simulation activity. Students will do a close read of the section on Food Requirements to identify the types of nutrients the body needs.

They should also focus on the vitamin and mineral charts on pages 991-993, paying attention to the deficiencies that occur in the absence of certain vitamins and minerals.

Next, ask students to read and annotate section 34.3, pages 995-1001, Digestive System Processes. With a partner, students should answer the questions on the section in their Academic Notebooks, pages 36-38.

FROM THE STUDENT ACADEMIC NOTEBOOK pp 36-38

Connecting the Digestive Process

1. In your reading, what is the energy source for all the functions of cells? Why do you think it is important for your body to store excess glucose?

2. Think of a process that could serve as an analogy for the digestive process. Describe your analogy, and explain how your analogy compares to digestion.

3. Re-examine the "Art Connection" diagram of digestion on page 1000 of your text. Answer the multiple choice question posed in Figure 34.19. Explain your answer and identify the evidence in the text that supports your answer.

4. What does "Hydrophopbic" mean? Why are lipids called hydrophobic substances?

5. What is the role of hormones in the digestive process?

Assessment

Outcome 1: Students will understand the role of analogies in science.

- Analysis of enzyme activity in Academic Notebook

Evaluation Rubric			
• Provides meaningful responses to the questions.	No	Somewhat	Yes
• Adds meaningful information or insights to class discussion.	No	Somewhat	Yes
• Student responses are well structured.	No	Somewhat	Yes
• Responses provide evidence for conclusion.	No	Somewhat	Yes

Activity Three — Synthesis and Application (Approx. 25 minutes)

College and Career Readiness Standards: Science/Technical Writing– 1, 7, 9

Students will view an animation on lactose intolerance and discuss how visualization can help make sense of science processes. Students should note the terms identified in the animation. (https://www.youtube.com/watch?v=w_KR6k6YIls)

Have students access the Mayo Clinic website — www.mayoclinic.org/diseases-conditions/lactose-intolerance/basics/definition/con-20027906**.** If possible, or if students do not have computer access, display the site on a main screen in your classroom. Display the Mayo Clinic website on lactose intolerance. Information from the website will be used as a resource to help solve a case study. The first screen will define lactose intolerance. Students should take notes in their Academic Notebooks on page 39 to define lactose intolerance. Then, click on "symptoms," and ask students to take notes in their Academic Notebooks. Next, click on "causes," and have students take notes. This means that they will not need to read and annotate as they do in their textbook. As students attempt to solve the case, they should pay careful attention to the various ways of identifying lactose intolerance symptoms and causes. They need to also think about how this information relates to what they know about enzymes.

Discuss that enzymes are crucial in all metabolic reactions. Lactose intolerance is just one example of a disorder caused by a malfunctioning enzyme. There are many disorders caused by faulty or missing enzymes. Ask students to reflect on the importance of macro and micronutrients, as well as enzymes, in a person's overall health.

Ask students to pull together the information from the text, the website, and the animation to respond to the case study on lactose intolerance using the guiding questions in the Academic Notebook.

FROM THE STUDENT ACADEMIC NOTEBOOK pp 39-40

Lactose Intolerance Case Study

Visit the Mayo Clinic Website to answer the following questions:

1. Define lactose intolerance

2. What are the symptoms of lactose intolerance?

3. What are the causes of lactose intolerance?

Hannah, a 21 year-old female, used to enjoy going out and eating with friends. Over the past year, she has noticed that within an hour after she eats, she experiences bloating, abdominal cramping, gas, and diarrhea. These symptoms do not occur after every meal. For example, eating in her favorite sushi restaurant is fine as are the meals at the BBQ restaurant. Other foods always seem to bother her such as pizza or burgers. Because Hannah does not know when she will experience the symptoms, she always makes sure she eats somewhere close to home.

Why might one suspect lactose deficiency in this case?

What information helped you solve this case?

Draw and label two diagrams: 1) showing the digestion of lactose when lactase is present, and 2) showing the process for someone with lactose deficiency.

(space provided in Academic Notebook)

Assessment:

Outcome 2: Students will be able to read across texts in multiple representations and make connections between text, diagram and animated information.

Evaluation Rubric			
• Provides meaningful analysis of case study.	No	Somewhat	Yes
• Incorporates information from the text, diagrams, and animations.	No	Somewhat	Yes
• Responses provide evidence to support conclusions.	No	Somewhat	Yes

Weekly Reflection

Students will complete the weekly reflection in their Academic Notebook.

FROM THE STUDENT ACADEMIC NOTEBOOK p 41

WEEKLY REFLECTION: WEEK 2

1. Think about the science. What did you learn about enzymes and calories?

2. Think about your learning. How will your experiences change the way you approach reading in the sciences?

Assessment:

Evaluation Rubric			
• Demonstrates an understanding of lactose intolerance.	No	Somewhat	Yes
• Discusses new learning from this week's activities.	No	Somewhat	Yes
• Writes in reasonable prose.	No	Somewhat	Yes

Teacher Checklist | **Use this list to ensure that you have completed all of the lesson components. I . . .**

- [ ] 1. Introduced the enzyme activity.
- [ ] 2. Asked students to respond to opening questions in the Academic Notebook.
- [ ] 3. Conducted the three rounds of the enzyme activity.
- [ ] 4. Asked students to respond to activity questions in the Academic Notebook.
- [ ] 5. Led whole-class discussion on results and findings of the activity.
- [ ] 6. Asked students to annotate the biology text.
- [ ] 7. Discussed the role of vocabulary and content in science.
- [ ] 8. Viewed animation on lactose intolerance.
- [ ] 9. Displayed the Mayo Clinic website and instructed students to take notes.
- [ ] 10. Asked students to respond to case study questions in Academic Notebook.
- [ ] 11. Discussed the application of the ideas using the lactose intolerance case study.
- [ ] 12. Assigned the weekly reflection on science and disciplinary literacy.

Lesson 4
Transforming Science Information

Overview and Rationale:

This lesson introduces students to science animations. Science animations pull together science and technology in ways that have great potential for teaching and learning. Animations, accompanied by good instruction, can help students understand difficult processes. In this lesson, students will learn to use animations to illuminate the science processes. They will also learn to transform knowledge by moving from animation to text to visualization. Thus, students will experience multiple representations of science information.

Tasks/Expected Outcomes:

1. Students will be able to transform knowledge from visual to text and vice versa.
2. Students will compare and integrate representations of science processes.
3. Students will begin to understand the role of models, animations and multiple representations of information in science.
4. Students will explain science processes through discussion, writing and drawing.

College and Career Readiness Standards (CCRS)

English Language Arts Science/Technical Subjects Standards: Reading

2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

English Language Arts History/Social Studies, Science/Technical Subjects Standards: Writing

2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments or technical processes.

3 Students' narrative skills continue to grow in these grades. The Standards require that students be able to incorporate narrative elements effectively into arguments and informative/explanatory texts. In history/social studies, students must be able to incorporate narrative accounts into their analyses of individuals or events of historical import. In science and technical subjects, students must be able to write precise enough descriptions of the step-by-step procedures they use in their investigations or technical work that others can replicate them and (possibly) reach the same results.

4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

10 Write routinely over extended timeframes (time for reflection and revision) and shorter timeframes (a single sitting or a day or two) for a range of discipline-specific purposes and audiences.

English Language Arts Standards: Speaking and Listening

1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

Throughout this course, only 11-12 grade standards are used.

LDC	Skills and Ability List

Skills Cluster 2: Reading Process

1. Science Epistemology

Ability to understand the underlying idea that science is an attempt to build understandings though constructed models and approximations, findings are subject to revision and science knowledge is constructed incrementally using peer critique and public dissemination.

2. Scientific Terminology

Ability to locate and understand scientific words and phrases that identify key concepts and facts, processes or information.

3. Annotation and Note-taking

Ability to read purposefully, select and use relevant information; to summarize and/or paraphrase; to use understand multiple representations and science processes.

4. Science Constructs

Ability to understand, create and use science models and explanations, evidence, and representations with an understanding of their limitations.

5. Scientific Processes

Ability to understand and use scientific processes as a way to answer questions and evaluate text information.

6. Multiple Representations

Ability to read texts using multiple representations including diagrams, charts, tables, models, oral and written text.

(www.literacydesigncollaborative.org)

Materials:

Animations:

How Enzymes Work:

- http://highered.mheducation.com/sites/0072495855/student_view0/chapter2/animation__how_enzymes_work.html

How Diffusion Works:

- http://highered.mheducation.com/sites/0072495855/student_view0/chapter2/animation__how_diffusion_works.html)

How facilitated Enzymes Work:

- http://highered.mheducation.com/sites/0072495855/student_view0/chapter2/animation__how_enzymes_work.html

How Osmosis Works:

- http://highered.mheducation.com/sites/0072495855/student_view0/chapter2/animation__how_osmosis_works.html
- Bushwick, S. (July 25, 2011) Feel the burn: How do scientists count calories? *Scientific American* (http://blogs.scientificamerican.com/observations/feel-the-burn-how-do-scientists-count-calories/)

Timeframe:

150 minutes

Targeted Vocabulary:

Discipline Specific Vocabulary

- diffusion
- osmosis

General Vocabulary Used in a Discipline-Specific Way

- transport (active and passive)

Activity One — Reading Across Text (Approx. 50 minutes)

College and Career Readiness Standards: Science/Technical Reading– 1, 9

Ask students to read the article from *Scientific American* on how calories are measured and on how calories are reported in packaged goods. They should take notes on the article in their academic notebook, using the guiding text-based questions on the ways scientists and restaurants count and report calories. Remind students to use the text annotation strategies previously learned in this unit.

FROM THE STUDENT ACADEMIC NOTEBOOK pp 43-44

How did the scientists measure calories from restaurants?

a. Explain the procedure used to prepare the food.

b. Explain the procedure used to measure the food.

2. What is the difference between metabolizable energy and gross energy?

3. Based on what you read in this article, why do you think the researchers found differences between the calories reported by restaurants and their own results? Identify the location in the text that supports your explanation.

Discuss student responses as a whole class. At this point, ask students to support their responses with evidence from the text.

Activity Two — Building Connections (Approx. 5 minutes)

Discuss the role of animations in science learning. Ask students to think about how seeing concepts in multiple ways can help deepen their understanding. Can they think of an example from their daily life (e.g., watching, reading about and playing a sport)? Ask students to recall the animation on lactose intolerance and remember how it helped them to understand the science behind the condition.

Activity Three — Understanding Animations (Approx. 95 minutes)

College and Career Readiness Standards: Science/Technical Reading– 2, 4, 7; Writing– 2, 3, 4, 10; Speaking and Listening– 1

Start by showing students the animation on enzymes as a review of what they have learned. To access animations, click on the link and then click on the correct title for the animation listed in the column to the left of the screen.

How Enzymes Work:

- http://highered.mheducation.com/sites/0072495855/student_view0/chapter2/animation__how_enzymes_work.html

Discuss the concepts as a class. Ask, what were the key ideas that a person needs to understand from this animation? Do enzymes always function by turning two substances into one? Why not? Can you give an example from the textbook on it working the other way (one substance to two)? What science vocabulary do you need to know? Remind students that we are learning vocabulary as part of a science process so they need to know more than just the definition. They also need to know how the vocabulary concept works within the science process.

Ask students to briefly summarize the concept presented in the animation in their Academic Notebook page 45.

Ask students to read section 5.2 in the biology text, pages 147-148 (stop at "Difussion") on Passive Transport. Tell students that this section discusses a lot of important concepts in a very short section. In this lesson, students will learn how to slow down to focus on learning and understand each idea. Remind them to think about the scientific vocabulary as a part of understanding the entire science process.

Show the diffusion animation. Show the animation at least twice. You can also choose to remove the audio and text in other viewings. Ask students to write a brief summary in their Academic Notebook page 45. Ask them to include a labeled diagram of the process of diffusion. Next, ask students to read the section on diffusion in the biology text, pages 148-152. Ask them to identify any new details to the process and edit their summaries and diagrams, especially details about diffusion and cells. Discuss what details were added. Answers should include: diffusion expends no energy, cell diffusion is through a plasma membrane, cell diffusion passes through a permeable membrane, and other factos that affect the rate of diffusion.

Follow with facilitated diffusion and osmosis. Show the video twice, once for understanding and a second time without audio and captions so students can write a summary and diagram that can be understood by a classmate.

How Diffusion Works:

- http://highered.mheducation.com/sites/0072495855/student_view0/chapter2/animation__how_diffusion_works.html)

How Facilitated Diffusion Works:

- http://highered.mheducation.com/sites/0072495855/student_view0/chapter2/animation__how_facilitated_diffusion_works.html

How Osmosis Works:

- http://highered.mheducation.com/sites/0072495855/student_view0/chapter2/animation__how_osmosis_works.html .

After viewing the animations and writing the summaries, ask students to read and annotate pages 150-152 on facilitated transport and osmosis. Have them add any new information to their summaries. Once again, ask students to read the running text in the textbook, while also reading the diagram. Remind them that one strategy that is important for all science students to learn is to be able to jump back and forth within text from the diagram back to the extended description in the text. Ask students to underline the sections of text that explain the diagram.

Once students have all of their summaries written they will transform the text back to visual form with a partner. Draw the process of facilitated transport and osmosis. Talk to students about how being able to transform from visual to text or text to visual is an essential tool that scientists need. When scientists read about a science process they try to visualize it in their minds. When they view a diagram they try to explain it fully. This flexibility is a good way to make sure you understand each process.

Transforming science information: One student will read one of their explanation paragraphs and the other student will draw the process being described. Students will discuss the process and debrief on what information helped and what may have been missing from both the written and drawn work by using the diagrams in the text. Students will trade roles until all of the animations have been discussed.

Vocabulary learning: Remind students that they are learning the vocabulary of science as they are learning the science concepts. Therefore, it is important that they use the language of the discipline as they describe their animations to each other. Instead of saying, “the thing moved across the membrane,” it is important to use precise terminology, “the oxygen molecule crossed the membrane to achieve equilibrium.” As they share their summaries and work on transforming information, ask students to remember that in addition to learning the concepts, they also must learn the terms.

Assessments:

Outcome 1: Students will be able to transform knowledge from visual to text and vice versa.

Outcome 2: Students will compare and integrate representations of science processes.

Outcome 3: Students will begin to understand the role of models, animations and multiple representations of information in science.

Outcome 4: Students will be able to discuss science processes through discussion, writing and drawing.

- Written explanations of animations

Evaluation Rubric			
• Accurately explains visual science process in written form.	No	Somewhat	Yes
• Completely represents each part of the process.	No	Somewhat	Yes
• Uses scientific terminology in explanation.	No	Somewhat	Yes

- Visual representations of the animations and diagrams

Evaluation Rubric			
• Accurately explains written science process in visual form.	No	Somewhat	Yes
• Completely represents each part of the process.	No	Somewhat	Yes
• Uses scientific terminology in explanation.	No	Somewhat	Yes

Teacher Checklist **Use this list to ensure that you have completed all of the lesson components. I . . .**

- ☐ 1. Discussed the role of animations in science.
- ☐ 2. Showed and discussed the enzyme animation.
- ☐ 3. Asked students to read excerpts from the biology text.
- ☐ 4. Interspersed animations in the appropriate places within the reading on the text.
- ☐ 5. Asked students to summarize each concept in their Academic Notebooks.
- ☐ 6. Discussed the role of vocabulary and precision of terminology as an aspect of learning science concepts.
- ☐ 7. Asked students to transform their summaries back to visual with a partner.
- ☐ 8. Reflected on the learning with students.

Lesson 5

Synthesizing Knowledge Gained from Text

Overview and Rationale:

One of the guiding inquiry practices in this unit is that scientific knowledge is socially constructed using peer critique and public dissemination. This lesson provides an additional opportunity for students to hone their skills in sharing science with peers. Students will have the opportunity to take roles of an expert and of a learner while sharing scientific concepts. Students will also add to their knowledge by taking notes over a lecture and discussing BMI. Students will synthesize their knowledge on calories, nutrition and BMI in a class discussion.

Tasks/Expected Outcomes:

1. Students will be able to clearly explain science concepts to peers.
2. Students will learn the Cornell Method of note-taking.
3. Students will synthesize concepts from multiple sources and representations to discuss the complexity of calories.
4. Students will develop arguments based on evidence from multiple sources.

College and Career Readiness Standards (CCRS)

English Language Arts Science/Technical Subjects Standards: Reading

1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon or concept, resolving conflicting information when possible.

10 By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

English Language Arts Standards: Speaking and Listening

1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

1a Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well reasoned exchange of ideas.

1b Work with peers to promote civil, democratic discussions and decision making, set clear goals and deadlines, and establish individual roles as needed.

1c Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.

1d Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.

2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.

Throughout this course, only 11-12 grade standards are used.

LDC	Skills and Ability List

Skills Cluster 2: Reading Process

1. Scientific Terminology

Ability to locate and understand scientific words and phrases that identify key concepts and facts, processes, or information.

2. Close Reading

Ability to interpret text with particular questions in mind that reflect scientific inquiry, and to use self-regulation to understand scientific processes presented in the text.

3. Scientific Processes

Ability to understand and use scientific processes as a way to answer questions and evaluate text information.

4. Annotation and Note-taking

Ability to read purposefully, select and use relevant information; to summarize and/or paraphrase; to use and understand multiple representations and science processes.

Skills Cluster 3: Transition to Writing

1. Bridging Conversation

Ability to transition from reading or researching phase to the writing phase.

Skills Cluster 4: Writing Process

1. Planning

Ability to develop a line of thought and text structure appropriate to a scientific informational synthesis.

2. Development

Ability to construct an initial draft with an emerging line of thought and structure.

(www.literacydesigncollaborative.org)

Materials:

- WebMD Article "How Accurate is BMI?" (http://www.webmd.com/diet/how-accurate-body-mass-index-bmi)

Timeframe:

150 minutes

Targeted Vocabulary:

Discipline Specific Vocabulary

- antherosclerotic
- body mass index (BMI)
- hypertension
- hydrophobic/hydrophilic
- low/high density lipoproteins

General Academic Vocabulary

- predisposition

Activity One — Gathering Information from Group (Approx. 50 minutes)

College and Career Readiness Standards: Science/Technical Reading– 1, 2; Speaking and Listening– 1a, 1c, 2, 4

In class, divide students into small groups to research one of the health disorders you will assign.

A. Divide students into five to seven groups. Each group will be assigned one health disorder (obesity, diabetes, hypertension, heart attack & stroke, anorexia & bulimia). *Note: If necessary, heart attack, stroke, anorexia and bulimia can each be done by a separate group to make seven topics. Provide research time for students to gather details about their assigned disorder to share within their groups. Students should write down the website where they found the information.*

B. Each group will gather the following information on their assigned disorder: definition of their disorder, causes, associated risks and treatments.

C. Each group will select a "juicy sentence" from their section to share with the class. They will begin with that sentence as a way to begin to explain the information.

D. Each student in the group will learn the information about their assigned disorder well enough to explain it to their peers.

E. Give students time to become familiar with their disorder and to make a plan for sharing the information with their peers.

F. Ask each group to present their topic to the class. Encourage students to ask questions for clarification.

G. At the end of the group sessions, answer any other questions students may have about the disorders.

Ask students to read the BMI article and discuss in their groups why we need to know more than BMI.

- Web MD Article (http://www.webmd.com/diet/how-accurate-body-mass-index-bmi)

Ask students to take notes in their Academic Notebook page 71 focusing on:

- A definition of BMI.
- The role of BMI.
- The pros and cons of using BMI to measure healthy weight.

Discuss summaries as a class.

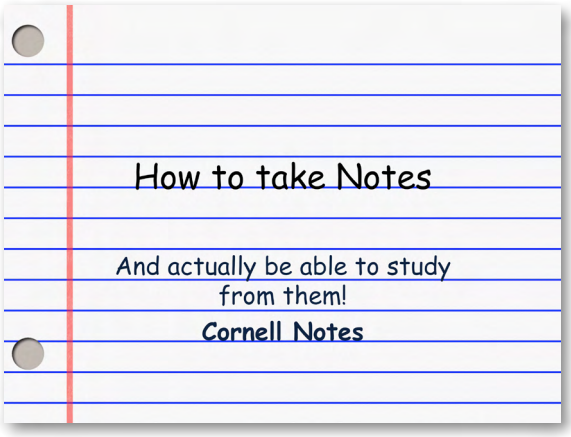
Assessment:

Outcome 1: Students will be able to clearly explain science concepts to peers.

Evaluation Rubric			
• Participates fully in the discussion	No	Somewhat	Yes
• Adds meaningful information or insights	No	Somewhat	Yes

Activity Two — Cornell Note Taking (15 minutes)

Go over the Cornell Notes PowerPoint with the class. Discuss the importance of recording the key points during the lecture, including examples, diagrams, etc. Then, discuss the importance of using the margins to write questions after the lecture for testing themselves on the material.

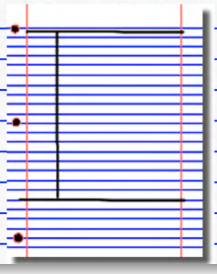


Strategy No. 1
Cornell Notes

- What it is – a way to take more organized notes
- What you will need – lined notebook paper (and something to write with of course!)

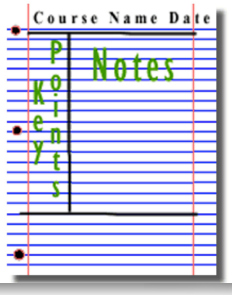
Cornell notes: How it works

- Put the subject and date at the top of your paper (and each page thereafter), then
- Divide your paper into three sections, like this:



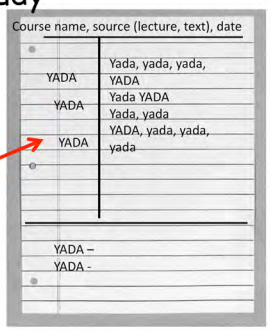
Cornell notes: How it works – Taking notes

- The large box to the right is for writing notes, either from the lecture or as you read.
- Skip a line between main ideas and topics.
- Don't use complete sentences, and don't try to copy down every word from the text or the lecture. Use abbreviations, whenever possible. Develop a shorthand of your own, such as using "&" for the word



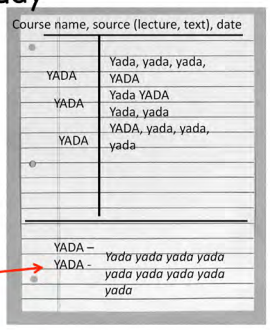
Cornell Notes: Using your notes to study

- Review notes as soon as possible after class!
- Pull out main ideas and put them in the left column



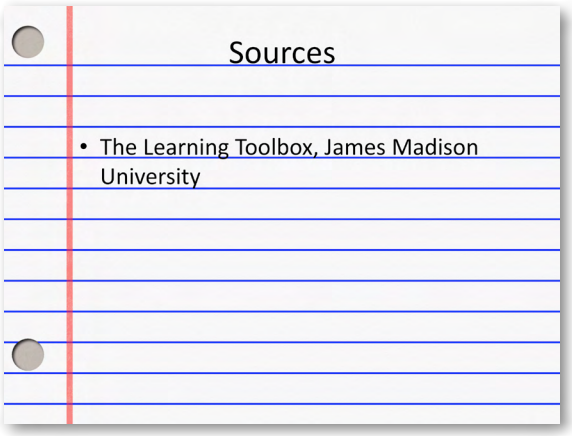
Cornell Notes: Using your notes to study

- Write a summary of the main ideas in the bottom section



Notebook:

- Look in your academic notebook on page _____, which has already been divided for you.



Activity Three — Insulin Lecture (35 minutes)

College and Career Readiness Standards: Science/Technical Reading– 2, 5

Students will take notes on a lecture about insulin. Remind students to use the Cornell note-taking method. When delivering the lecture, stop periodically to ask students to summarize what they have heard and to ask questions. Ask students to draw a line under the notes they have taken so far, label the next part "Summary," and add a summary of their notes. After the lecture, students will compare their notes to look for ways to improve them in accuracy and completeness. After checking their notes, they will create a way to test their knowledge of the information by pulling out key concepts or writing questions in the margins to ask themselves. Ask students to "grade" their work using the lecture note checklist.

Go to (www.sreb.org/Ready). Sign in to your Literacy Ready account. Go to the section labeled: Literacy Ready PowerPoint Slides for teacher use, and download the Science Unit 1, Lesson 6 PowerPoint.

Although the text below can be used as the lecture notes, you may wish to print out the slides with the notes contained on each side and use these notes as you lecture. These notes will give you a rhythm for when to change slides and will give you a good basis for checking the students' use of the Cornell Note taking format.

TEACHER RESOURCE

Lecture on Insulin

Davidson College Biology

How does insulin work in the human body?

Insulin secretion

Insulin is synthesized in the beta cells of the pancreas through a glucose transporter by means of facilitated diffusion. The main function of the pancreas is to produce insulin, digestive enzymes, and other hormones (Norman, 2002). The secretion of insulin is controlled by the glucose concentrations in the blood stream. As the level of glucose rises in the blood, the insulin levels also increase. As carbohydrates or sugars

are absorbed by the intestines after a meal, insulin is secreted by the pancreas in response to this increase in blood sugar. Due to the heightened levels of glucose, membrane depolarization of the beta cells occurs, causing extracellular calcium to rush into the cell. This in turn stimulates the export of secretory granules, which contain insulin, out of the cell (Bowen, 2004). Most cells throughout the human body have insulin receptors to which insulin binds, and these cells activate other receptors designed to absorb the glucose from the blood stream. To elevate the glucose levels in the beta cells, calcium-independent pathways are triggered by these receptors. Insulin also works in the liver, muscle, and fat cells controlling glucose levels in the body (Purves, et. al., 2001). When glucose levels fall below normal range due to a lack of insulin, glycogen synthesis in the liver ceases and the enzymes responsible for the breakdown of glycogen become active (Bowen, 2004). And without insulin, many of our cells in the body would not be able to take up glucose and would have to resort to alternative fuels like fatty acids for energy (Norman, 2002).

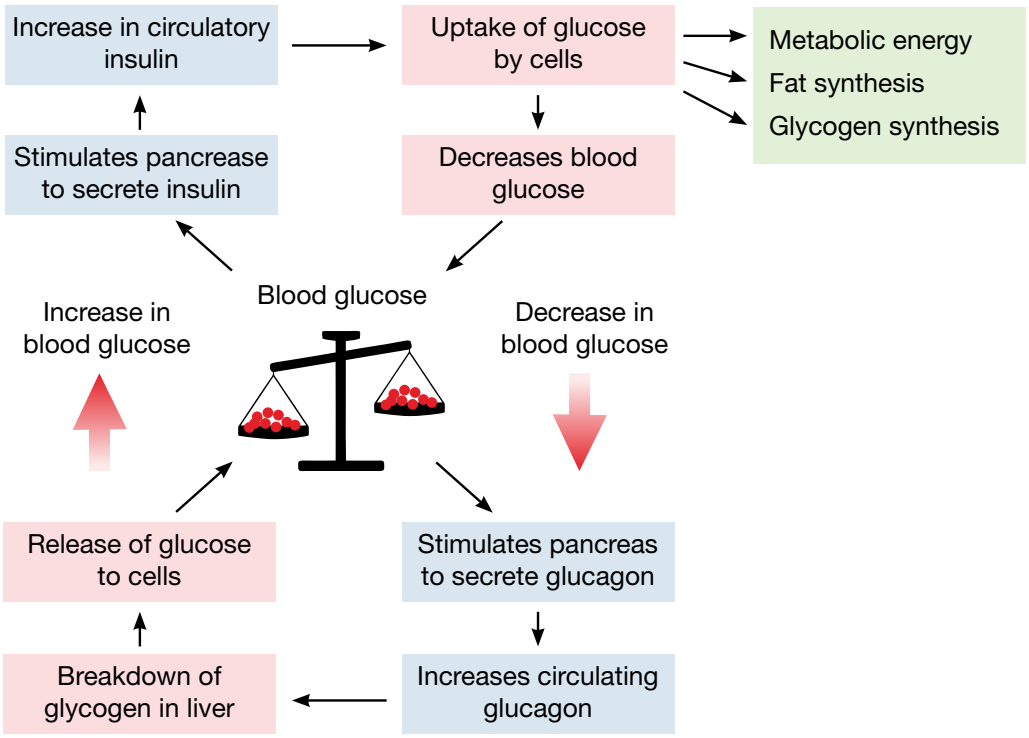


Figure 5. Diagram of the insulin and glucose regulation model.

As blood sugar (glucose) rises, insulin is secreted in the pancreas, it is circulated through out the body and glucose is taken up by cells and blood sugar decreases. With a decrease in blood sugar, the pancreas secretes glucagon to breakdown glycogen in the liver and release glucose into the blood. This process maintains homeostasis in the body in reference to blood glucose levels (Roberts, 2003). Permission pending (http://bcs.whfreeman.com).

Insulin receptors

Once insulin is secreted by the pancreas, it goes directly to the liver through the portal vein where it affects carbohydrate and lipid metabolism. This is where the action of the insulin receptors comes into place. The insulin receptors are tyrosine kinase, integral membrane proteins, which contain two alpha subunits and two beta subunits. The alpha subunits are entirely extracellular and hold the binding site for the insulin. The beta subunits are attached to each of the alpha subunits by a sulfur bond and extend through the plasma membrane to anchor the protein in the cell wall. The two complexes are connected by a disulfide bond (Bowen, 2004).

When insulin binds to the alpha subunit, the beta subunits phosphorylate themselves. One of the substrates of the insulin receptor, IRS-1, is the most studied. This substrate serves as a docking center for activation of other enzymes to mediate insulin's effects by a signal transduction process, creating a complex biological response.

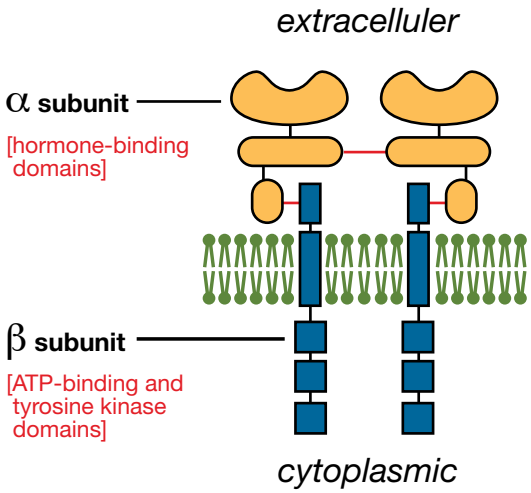


Figure 6. An insulin receptor.

This insulin receptor has two alpha subunits (yellow) and two beta subunits (blue). The red lines are bonds, showing the sulfur bond between the alpha and beta subunits and a disulfide bond between the two complexes (Bowen, 2004).

(http://arbl.cvmbs.colostate.edu/hbooks/pathphys/endocrine/pancreas/insulin_phys.html)

Carbohydrate and Lipid Metabolism effects

Glucose metabolism is regulated by insulin in different types of cells. During digestion in the small intestine, glucose is extracted from carbohydrates by hydrolysis into the blood stream. With the detection of increased levels of glucose in the blood, insulin is secreted by beta cells in the pancreas (Bowen, 2004). Once insulin binds to the appropriate insulin receptors, cytoplasmic vesicles under the plasma membrane fuse with the plasma membrane and glucose transporters (Na+-independent and Na+-dependent) and break through the plasma membrane. These glucose transporters are required for muscle, adipose and some other tissues in the presence of insulin in order to transport glucose. Glucose also needs to be regulated and the phosphorylase A receptor measures the amounts of glucose present in the liver. With an influx of glucose, it binds to these receptors and alters the shape so it can be dephosphorylated and release the insulin to stimulate the formation of glycogen in the liver (Stryer, 1995). Glucose is changed into glycogen by the aid of insulin to ultimately maintain homeostasis in blood sugar (Roberts, 2003). The liver measures the amount of glucose in the blood stream and takes up or releases glucose as necessary (Stryer, 1995).

Whenever the liver builds up high levels of glycogen for the human body, glucose is absorbed from a food product and redirected into a different metabolic pathway. Fatty acids are made in this pathway and are transported out of the liver as lipoproteins.

The lipoproteins produced are often used in other tissues, like adipose tissue, to make triglycerides. Insulin inhibits the breakdown of fat in adipose tissue by inhibiting the intracellular lipase that hydrolyzes triglycerides to release the fatty acids. Insulin is basically responsible for stimulating further accumulation of triglycerides in fat cells in adipose tissue (Bowen, 2004). Researchers from the Indian Institute of Chemical Biology have recently speculated that a new cell could be secreting insulin as well. Insulin is thought to only be secreted from beta cells in the pancreas, but now it is thought to exist in adipocytes. The structure-function relationship seem to be very similar and the amino acid sequences of AdpInsl and mammalian beta cell insulin can be related. As an insulin target cell, adipocytes can express the insulin gene and secrete the insulin protein to serve as a natural alternative to the beta cell insulin (Roy, 2003).

Other metabolic reactions insulin stimulates

- glucose transport
- amino acid transport
- glycogen synthase activity
- increases rate of general protein synthesis
- decreases lipolysis and protein degradation (Lilly, 1996).

How does insulin affect the human body?

Insulin regulates a variety of other cellular processes, such as protein and fat synthesis, RNA and DNA synthesis, cell growth, and differentiation. However, Insulin's main concern is the regulation of glucose uptake in the "clinical manifestation of diabetes" (Pittman, et.al., 2004). High levels of glucose will cause water to move from cells in the body to the blood by osmosis and the kidneys will increase in urine output to excrete excess fluid volume from the blood. This is why diabetes is concerned with issues of an overproduction of "sweet" urine (Purves, et. al., 2001). Also, with insufficient amounts of insulin or a mutation within the insulin protein, different diseases can develop like diabetes. There are two main types of diabetes mellitus, idiopathic and secondary. Idiopathic diabetes is divided into two subgroups, Type I and II, and secondary diabetes has many causes that can lead to a host of other diseases. We are most accustomed to idiopathic diabetes, Type I and II.

Idiopathic Diabetes, Type I

Insulin dependent diabetes (IDDM) usually manifests in childhood (juvenile-onset diabetes) and is a result of an autoimmune destruction of the beta calls in the pancreas (King, 2004). This type of diabetes affects about 2 million people in the United States. Within these patients, there is an insufficiency of insulin and a supplement of insulin is necessary by injection. It is known to be genetic, but the actual reason to the destruction of the beta cells is unknown.

Idiopathic Diabetes, Type II

Non-insulin dependent diabetes (NIDDM) is characterized by persistent hyperglycemia. It usually manifests in people over the age of 40 (adult-onset diabetes). It can result from a genetic defect and can cause insulin resistance or insulin deficiency, one associated with obesity and one not associated with obesity (King, 2004). Type II diabetes affects about 85% of the total diabetic population. For these patients obesity seems to be a common issue because of the increase in fat from adipose tissue. Therefore, the

main form of treatment is a low carbohydrate diet (little sugar) and an exercise program (Vander, 1998).

Secondary Diabetes

This type of diabetes can result in many causes including:

- Maturity onset diabetes of the young (MODY); has an onset prior to age 25 with shown impairment of beta cell function and late beta cell failure; there are six types:
  - Pancreatic disease
  - Endocrine disease
  - Drug-induced diabetes
  - Mutations in the insulin gene
  - Mutations in insulin receptor gene which can lead to Leprachaunism, Rabson-Mendenhall syndrome, and Type A insulin resistance
  - Neurgenic differentiation 1—very rare, only found in five families to date
- Gestational diabetes, shown during pregnancy and following childbirth

Other disease involving impaired glucose tolerance (King, 2004).

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Bowen, R. 1999 June 15. Insulin Synthesis and Secretion. <http://arbl.cvmbs.colostate.edu/hbooks/pathphys/endocrine/pancreas/insulin.html>. Accessed 2005 Feb 12.

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Assessment:

Outcome 2: Students will learn the Cornell Method of note-taking.

- Lecture notes

Lecture Note Checklist:

Please circle the appropriate number.

	5 *Always*	4	3 *Sometimes*	2	1 *Never*
The lecture notes are titled and dated.	5	4	3	2	1
The notes are easy to read.	5	4	3	2	1
The notes are organized.	5	4	3	2	1
You underline or star key ideas.	5	4	3	2	1
You utilize abbreviations of longer words.	5	4	3	2	1
You skip spaces between ideas/concepts.	5	4	3	2	1
You indent minor points.	5	4	3	2	1
You note all the important concepts.	5	4	3	2	1
You paraphrase what the instructor says.	5	4	3	2	1
Your notes incorporate examples.	5	4	3	2	1
Your notes are accurate.	5	4	3	2	1
Your notes are complete.	5	4	3	2	1
Your notes include self-test questions.	5	4	3	2	1
Your self-test questions: a. Are complete.	5	4	3	2	1
b. Will prepare you for the instructor's tests.	5	4	3	2	1
c. Cover all the material from that day's lecture.	5	4	3	2	1
d. Use short-answer format.	5	4	3	2	1
e. Are appropriate for the type of tests in the class.	5	4	3	2	1
f. Combine material from multiple lecture topics into a single question.	5	4	3	2	1

Activity Four — Synthesizing Knowledge (Approx. 50 minutes)

College and Career Readiness Standards: Science/Technical Writing– 2, 4, 7, 9, 10; Speaking and Listening– 1a, 1, b, 1c, 1, d, 2, 4

Ask students to synthesize the information on insulin in nutrition and health by discussing a question on the role of counting calories. Ask students to read the question below. Have them state their ideas about what concepts and sources they would need to respond to the prompt.

FROM THE STUDENT ACADEMIC NOTEBOOK p 55

Prompt

Is counting calories enough for a person to maintain health? After viewing animations and lectures, and reading informational articles, compare the interpretations of the role of calories and argue for the other factors that need to be considered. Be sure to support your position with evidence from the texts and videos.

Ask students to demonstrate their understanding of the concepts of this unit as a whole by discussing the prompt in small groups. They will have about 25 minutes to talk as a group and 25 minutes to discuss their response.

Ask students to write down their ideas to the following questions before they discuss the prompt in small groups. Divide the students into three groups. Assign each group one of the three questions and have them brainstorm possible answers, and then look up resources to answer their assigned question. Have students note the resources and enter the details into their Academic Notebook, pages 55-56. remind students that they can also try the references at the end of the insulin lecture.

FROM THE STUDENT ACADEMIC NOTEBOOK pp 55-56

Use the prompt above to show your understanding of the complexity of calories. You may use your notes from the text, articles and videos to support your stance. Think about the following:

- How could a person be overweight, but calculate a lower-than-recommended daily caloric intake? Discuss the role of metabolism, nutrients, fat and calories.
- Explain the science behind the saying, “you are what you eat” in terms of a person’s overall health. What role does “transport” play?
- What factors do we need to consider when looking at someone’s overall health (nutrients, enzymes, health disorders)?
- Make a recommendation for someone trying to lose weight about what they need to think about in addition to calories. What if that person had an obesity-related disease? What additional recommendations would you have?

Students will use the chart in their Academic Notebook page 57 to record their sources and ideas. They will be able to use their notes as they discuss their response.

List the text, lecture or animation information that supports your stance.

Source (text, lecture, etc.)	Quote/Facts	Summary of how this information supports your stance

Students will report out their findings. Students in other groups should take notes in their Academic Notebooks on the reported details. Ask students to then answer the final question on page 56 individually.

Assessments:

Outcome 3: Students will synthesize concepts from multiple sources and representations to discuss the complexity of calories.

Outcome 4: Students will develop arguments based on evidence from multiple sources.

- Teacher analysis of discussions

Evaluation Rubric			
• Participates fully in the discussion.	No	Somewhat	Yes
• Adds meaningful information or insights.	No	Somewhat	Yes
• Uses sources in meaningful ways.	No	Somewhat	Yes
• Produces a credible argument.	No	Somewhat	Yes
• Writes in reasonable prose.	No	Somewhat	Yes

Teacher Checklist	Use this list to ensure that you have completed all of the lesson components. I . . .

- [ ] 1. Asked small groups to prepare one health disorder to share with the class.
- [ ] 2. Guided student presentations of health disorders.
- [ ] 3. Asked students to read and take notes on BMI article.
- [ ] 4. Discussed the Cornell Method of note-taking.
- [ ] 5. Presented the insulin lectures.
- [ ] 6. Asked students to use the Cornell Method to take notes over the lecture.
- [ ] 7. Asked students to review notes in small groups and to make marginal annotations/review questions.
- [ ] 8. Presented guiding question prompt for synthesizing knowledge on calories.
- [ ] 9. Asked students to work in groups to prepare for class discussion on the prompt.
- [ ] 10. Led class discussion on the prompt.

Lesson 6
Taking Science Quizzes

Overview and Rationale:

This lesson helps students learn to prepare for, take and learn from a science quiz. Students will generate their own quiz review by thinking about the types of questions teachers ask, the amount of material they need to know and the strategies that will help them master the material. By creating their own quiz review rather than relying on the teacher to supply a review, students must be able to select the information to be learned and create a way to learn it. In this lesson, they will learn two strategies to help them generate effective quiz reviews. Students will take a quiz that asks mainly higher-level questions. They will take the quiz twice, once individually and once collaboratively. The purpose of the collaborative, or group, quiz is not to make the job easier for students. Rather, the group quiz is used to get students talking about and debating science concepts. Research has indicated that collaborative quizzes promote comprehension, improve test-taking skills and provide an opportunity for all students to participate in discussion.

Tasks/Expected Outcomes:

1. Students will utilize strategies to generate their own quiz reviews.
2. Students will learn to ask and answer higher-level questions.
3. Students will learn to use group testing as a way to increase their ability to explain and understand science concepts.
4. Students will evaluate their own quiz performance.

College and Career Readiness Standards (CCRS)

English Language Arts Science/Technical Subjects Standards: Reading

1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

English Language Arts History/Social Studies, Science/Technical Subjects Standards: Writing

2d Use precise language, domain-specific vocabulary and techniques, such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

English Language Arts Speaking and Listening Standards

1a Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well reasoned exchange of ideas.

1c Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify or challenge ideas and conclusions; and promote divergent and creative perspectives.

2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance and style are appropriate to purpose, audience and a range of formal and informal tasks.

Throughout this course, only 11-12 grade standards are used.

LDC	Skills and Ability List

Skills Cluster 1: Preparing for the Task

1. Bridging Conversation

Ability to connect the task and new content to existing scientific knowledge, skills, experiences, interests, and concerns.

2. Task Analysis

Ability to understand and explain the task's prompt and rubric.

Skills Cluster 2: Reading Process

1. Science Epistemology

Ability to understand the underlying idea that science is an attempt to build understandings though constructed models and as approximations, findings are subject to revision, and that science knowledge is constructed incrementally using peer critique and public dissemination.

2. Scientific Terminology

Ability to locate and understand scientific words and phrases that identify key concepts and facts, processes, or information.

3. Science Constructs

Ability to understand, create and use science models and explanations, evidence and representations with an understanding of their limitations.

4. Scientific Processes

Ability to understand and use scientific processes as a way to answer questions and evaluate text information.

5. Organizing Notes

Ability to organize and synthesize information.

6. Multiple Representations

Ability to read texts using multiple representations including diagrams, charts, tables, models, oral and written text.

(www.literacydesigncollaborative.org)

Materials:

- Academic notebook
- Biology text chapters 5.2 and 34.1-3
- 3x5 Index cards
- Nutrition quiz (Note: you will need one copy for each student and one copy for each group.)

Timeframe:

175 minutes

Targeted Vocabulary:

- Student-selected vocabulary from the biology text

Activity One — Introducing the Topic (Approx. 5 minutes)

Introduce the concept of group quizzes. Explain to students that in this class they will take a quiz based on the biology text chapters 5.2 and 34.1-3, the articles read and the animations discussed (15 questions). However, this quiz may work a little differently than they are used to because it will be both an individual and group quiz. First, students will take the quiz individually and turn it in. The individual quiz will count for two-thirds of the total quiz score. Then, students will retake the same quiz with a small group. In the group, students need to discuss each question and come to a consensus regarding the
appropriate answer in order to fill out a single answer sheet that will be submitted as a group. The group quiz scores will count as up to one-third of the total quiz score. The purpose of taking the quiz in a group is to allow students the opportunity to talk/debate/sink their teeth into the science.

Ask students to look at the peer Evaluation page in the Academic Notebook. To encourage everyone to participate and to prevent "freeloading" during the group quiz, students will be asked to evaluate the other members of the group on how well they contributed to group functioning. This evaluation will be used to determine how many group quiz points each student will receive. For example, if a student receives an average score of 80 percent from their peers, that student would receive 80 percent of their group's quiz points. (Of course, the teacher reserves the right to overrule any peer evaluation score if it appears to be inaccurate or inappropriate, such as when evaluations have been biased because of personality conflicts.)

Activity Two — Preparing for the Quiz (Approx. 70 minutes)

College and Career Readiness Standards: Science/Technical Reading– 1, 2, 4, 5; Writing– 9,10; Speaking and Listening– 1a, 1c, 2, 4

Students will generate their own quiz review. Rather than using a teacher-generated review, ask students to work together to create a review that covers all of the material up to this point: text, animations and supplemental readings. As described in the Academic Notebook, students will learn two strategies to help them create the review: talk-throughs and reciprocal questioning.

FROM THE STUDENT ACADEMIC NOTEBOOK p 59

The Talk-Through

A "talk-through" is a method of preparing and reviewing for an quiz that involves practicing and rehearsing aloud the key ideas of a text or science process. A talk-through is very similar to a lecture that you would give someone. In fact, when giving a talk-through, a student should imagine being an instructor giving a lecture to students who know very little about the topic you are teaching. Students will record key information on a notecard, then use the card as a prompt to help them say the information out loud to a classmate.

To create the talk-throughs, ask students to generate a list of possible topics in small groups—nutrients, osmosis, transport, etc. Students can use the materials to remind themselves of all the topics learned so far. (If they mention strategies, such as annotation, remind them that the strategies are used as a vehicle to learn the science content—the quiz will only include science—not strategies.)

List the topics on the board and ask students to make sure that all of the concepts are listed. Then ask students to group the topics together to discuss processes. For example, concentration gradient, diffusion, facilitated diffusion and osmosis could be combined under the process of passive transport. It is better for one student to do a talk through on these ideas as a whole so that they can see how the processes are alike and how they differ (rather than having one student do diffusion, another student do facilitated diffusion, etc.). However, if a student is having a lot of trouble understanding one of those topics, say facilitated diffusion, it is okay for them to tackle that one on its own.

Each student will choose a topic/process to work on. It is okay if there are some duplicates, but all of the important topics should have at least one student creating a talk through card. On the 3x5 card, students will write only a few words to help guide them as they explain the concept to others, but it should not be a full listing of all the details—the point is to know the concept without needing more than a little prompt. Once they have the card written, they will review all the materials where their topic was discussed (text, articles, animations, etc.) to make an outline of what they will say when they use their talk through.

Remind students to use precise language as they create and practice their card. They will be practicing the vocabulary they learned, as they seek to understand the science processes. As they present the talk through to their classmates, they need to pay careful attention to using the correct terminology. Knowing definitions for the terms is not sufficient in science; it is much more important to understand how the term is used within the science process.

Students should practice their talk through several times (in class and/or at home) before giving their talk during the quiz review. Once students have their talk through card written and have practiced it at least one time, ask them to get into small groups to learn the next strategy.

Reciprocal Questioning:

Students will use reciprocal questioning as a way to review the science concepts they have learned so far. In small groups, ask students to create 10 questions and answers. They will use these questions to quiz classmates on the material as a way to prepare for the quiz. They should remember to include questions from the textbook, articles, videos, animations, etc.

Have the students use the following guidelines to create questions:

- Avoid "what" questions. Ask higher-level questions using words such as *why*, *how*, *explain* or *compare*. For example, it is much better to ask a question such as, "*Explain the role of enzymes in lactose intolerance,"* than to ask, "*What is an enzyme?"*
- Predict short answer items (even if you are taking multiple-choice tests) because they will help you check your knowledge of an entire concept, rather than one small part.

- Ask questions that require application, analysis or interpretation of ideas. These are the types of questions you will be asked on the quiz.
- Get at the "big picture."
- Ask questions that make people really think about the concepts.
- General hint: if it takes more words to ask the question than to answer it, ask a tougher question.

In small groups, ask students to create one sample question using the guidelines. Share the questions as a class to make small fixes where necessary (if students pose a "what" question, ask them to change it to a more complex question. If students pose a question over one small concept, have them work to make it a more encompassing question). Once the class understands how to create big, broad questions, ask each group to create 10 challenging questions that will be used during the quiz review. Students should also sketch out the answers—this can be in a bulleted list format. They just need enough information to know if the person responding to their question is correct.

FROM THE STUDENT ACADEMIC NOTEBOOK pp 60-61

QUESTION	ANSWER *(note: you can write this as a bulleted list)*	Source(s) *(please specifically note where the material came from—text, article, lecture, etc.)*	Page number
1.			

(additional space provided through Question 10)

Debrief on the learning so far. Ask students to discuss their experience using these two rehearsal strategies (talk thoughs and creating Q&A). How is it helping them review for the quiz so far? What do they need to do/know to prepare for the quiz review? What questions do they have about either the strategies or the science concepts?

Assessments:

Outcome 1: Students will utilize strategies to generate their own quiz reviews.

- Talk-Through

Evaluation Rubric			
• Student is able to provide an accurate and complete verbal recall of a science topic using only their talk-through text.	No	Somewhat	Yes
• Student makes use of information from multiple sources in their talk-through.	No	Somewhat	Yes

Outcome 2: Students will learn to ask and answer higher-level questions.

- Predicted questions and answers

Evaluation Rubric			
• Contains at least 10 questions and answers.	No	Somewhat	Yes
• Questions come from all of the sources used thus far.	No	Somewhat	Yes
• Answers are complete enough to indicate that the student understands the entire concept.	No	Somewhat	Yes

Activity Three — Quiz Review (Approx. 25 minutes)

College and Career Readiness Standards: Science/Technical Reading– 2, 4, 5; Speaking and Listening– 1a, 1c, 2, 4

After creating the two strategies, students will conduct the review.

- **Ask students to work in pairs to share their talk-throughs.** One student will present the card as the other student listens. The listening student should ask questions about the concept being discussed. Then the pair will swap roles so that the listening student now shares his/her talk through. Students will trade partners several times to hear as many talk-throughs as possible.
- **Place students in small groups (four to six students) that differ from the groups that worked together to create questions in the last class for the reciprocal questioning.** One student will ask a predicted question and the rest of the group will try to answer it without looking at their notes or text. The group can work together to respond. Then another student will ask a question using the same process. This continues until each student has asked at least one question. Then, students will regroup to ask questions with a new set of peers as time allows.

Activity Four — Taking the Quiz (Approx. 50 minutes)

College and Career Readiness Standards: Science/Technical Writing– 2, 9, 10

Students will take the quiz in both individual and group format. First, students will have 25 minutes to take the quiz individually. They will then submit that quiz and work with their group on a new copy of the quiz. They will have the remaining 25 minutes to discuss the questions and respond to the quiz as a group.

Activity Five — Evaluating the Quiz (Approx. 25 minutes)

College and Career Readiness Standards: Science/Technical Writing– 2, 9, 10

Before discussing the quiz as a class, ask students to fill out the quiz evaluation and the group evaluation in their Academic Notebook once they have received the feedback on the quiz (both group and individual).

FROM THE STUDENT ACADEMIC NOTEBOOK pp 62-64

Group Quiz Evaluation

The purpose of this evaluation is to help you learn from your experience preparing for and taking the quiz. Think about how you felt about your level of preparation before the quiz, where you focused your effort, and how you felt taking both the individual and group portions of the quiz.

1. What went right? Analyze the quiz to discuss what you did well and what helped your thinking about these concepts.
2. What went wrong? Analyze the quiz to discuss areas you might want to work on. In this analysis:
   - Think about the errors you made and diagnose the nature of your difficulties as they relate to the nutrition concepts learned, problem solving expected, or your beliefs about science and/or science learning. Note: don't just describe a difficulty; you need to analyze your thinking. (Example: A poor diagnosis would be, "I was confused" or "I picked the wrong answer." A good diagnosis would provide a reason for the errors: "I thought that a person's basal metabolic rate was the same as their overall metabolic rate.")
3. What will I do differently next time? Conduct an overall assessment of your quiz performance. This is where you will look for patterns to your errors, think about particular aspects of the quiz that may have been difficult for you, types of questions you missed, general concepts that were difficult, etc. In your assessment, write about how understanding these issues will impact your science quiz taking in the future.

Peer Evaluations

Class (include class, time and day):

Name:_____ Group Name_____

This is an opportunity to evaluate the contributions of your teammates to group quizzes. Please write the names of your teammates in the spaces below and give them the scores that you believe they earned. You will have 10 points available to distribute for each member or your group, not counting yourself (e.g. if you are in a group of six people, you each will have 50 points to distribute. A group of five would have 40 points, etc.).

If you believe everyone contributed equally, then you should give everyone 10 points. If everyone in the group feels the same way, you will all have an average of 10 points and receive 100 percent of the group score. An average of nine would receive 90 percent of the group quiz score, etc. Be fair and accurate in your assessments.
If someone in your group didn't contribute adequately (i.e., had not studied, didn't communicate with the rest of the group, frequently missed class, etc), give them fewer points. If someone worked harder than the rest, give that person more than 10 points.

There are some rules that you must observe in assigning points:

- This is not a popularity contest. Don't give anyone a grade that they don't deserve (high or low) for personal reasons or otherwise.
- "Contributing to the group" does not simply mean giving the most correct answers. Asking good questions, challenging the group, etc, are also ways to contribute.
- You cannot give anyone in your group more than 15 points.
- You do not have to assign all of your group points, but you cannot assign more than the total number of points allowed for each group (i.e., (# of people in group – 1) x 1 points).

Group Member: Score:

1. _____ _____
2. _____ _____
3. _____ _____
4. _____ _____
5. _____ _____
6. _____ _____
7. _____ _____
8. _____ _____

Indicate why you gave someone more than 10 points.

_____

_____

_____

Indicate why you gave someone less than 10 points.

_____

_____

_____

If you were to give yourself a score, what would it be? Why?

_____

_____

_____

Discuss student experiences taking the quiz. How did preparing and conducting quiz review help them learn? How can you use this in their science classes?

Ask students to complete their weekly reflection.

FROM THE STUDENT ACADEMIC NOTEBOOK p 65

Week 4

1. Think about the science. What did you learn about transforming information and taking science tests?

2. Think about your learning. How will your experiences change the way you approach reading in the sciences?

Assessments:

Outcome 1

- Reflection Writing

Evaluation Rubric			
• Reflection references the resources read.	No	Somewhat	Yes
• Reflection uses information from sources to support student's feelings.	No	Somewhat	Yes
• Reflection is written in appropriate prose.	No	Somewhat	Yes

Outcome 3: Students will learn to use group testing as a way to increase their ability to explain and understand science concepts.

Outcome 4: Students will be able to evaluate their own quiz performance.

- Individual quiz
- Group quiz

Teacher Answer Key

1. c
2. d
3. a
4. d
5. c
6. b
7. d
8. d
9. c
10. See Chapter 34.2, page 995. Answers may include: polar bears, seals, bears or other animals that store body fat for the winter months. The animals need fat for winter insulation; stored fat provides energy; prevents animals from famine.
11. See Chapter 34.2 page 995.
12. Answers will vary but should include:

    Difficulties that are listed on the charts in Chapter 34.2, pages 991-993.
13. Answers will vary but should include:

    When a lactose intolerant person drinks milk, the lactose in the milk makes it way to the small intestine. There is a limited amount of lactase (enzyme) present. The majority of the lactose molecules remain intact. Bacteria eat the intact lactose in the large intestines causing an increase in pressure, which causes water to flow outside the intestines. This causes bloating, gas, cramping, and diarrhea.
14. Diagrams should resemble the facilitated diffusion animation.
15. As blood sugar (glucose) rises, insulin is secreted in the pancreas, it is circulated through out the body, glucose is taken up by cells and blood sugar decreases. With a decrease in blood sugar, the pancrease secretes glucagon to breakdown glycogen in the liver and release glucose into the blood. This process maintains homeostasis in the body in reference to blood glucose levels

- Teacher assessment of quiz evaluation
- Teacher assessment of peer group evaluation

Evaluation Rubric			
• Provides thoughtful reflection.	No	Somewhat	Yes
• Accurately assesses performance.	No	Somewhat	Yes
• Provides meaningful feedback to peers in group.	No	Somewhat	Yes
Questions 1-9: 4 points each Questions 10-15: 6 points each Allow 4 points for participation in the quiz.			

Teacher Checklist | **Use this list to ensure that you have completed all of the lesson components. I . . .**

- ☐ 1. Introduced the concept of individual and group quizzes.
- ☐ 2. Discussed the talk-through strategy.
- ☐ 3. Brainstormed and listed possible talk-though concepts.
- ☐ 4. Asked students to choose concept and create talk through using course materials and sources.
- ☐ 5. Discussed the use of vocabulary and precise terminology in the talk through.
- ☐ 6. Introduced the reciprocal questioning strategy.
- ☐ 7. Discussed guidelines for creating effective questions.
- ☐ 8. Asked students to write questions and answers using the chart in the Academic Notebook.
- ☐ 9. Asked students to reflect on using the rehearsal strategies for quiz preparation.
- ☐ 10. Guided students though the quiz review by asking them to switch from talk throughs to reciprocal questioning.
- ☐ 11. Gave students the individual quiz.
- ☐ 12. Gave students the group quiz.
- ☐ 13. Graded the quizzes and returned them to students.
- ☐ 14. Asked students to evaluate their experiences preparing for and taking the quiz in their Academic Notebook.

Nutrition Quiz

Name:

_____

Class period:

_____

1. Which of the following is an important part of our diet, but is not considered a nutrient because it is not absorbed by our bodies?
   a. Protein
   b. Carbohydrates
   c. Fiber
   d. Fats

2. Which of the following is true about vitamins?
   a. vitamins function as a coenzyme
   b. vitamins help with the absorption of other nutrients
   c. deficiencies can effect our cells
   d. all of the above

3. Which of the following describes how an enzyme and substrate fit together?
   a. The shape of the enzyme changes when the substrate binds to the enzyme.
   b. The active site is permanently changed after the substrate binds to the enzyme.
   c. The enzyme is like a key that fits into the substrate which is like a lock.
   d. After the product is reduced, the enzyme breaks down and can no longer function.

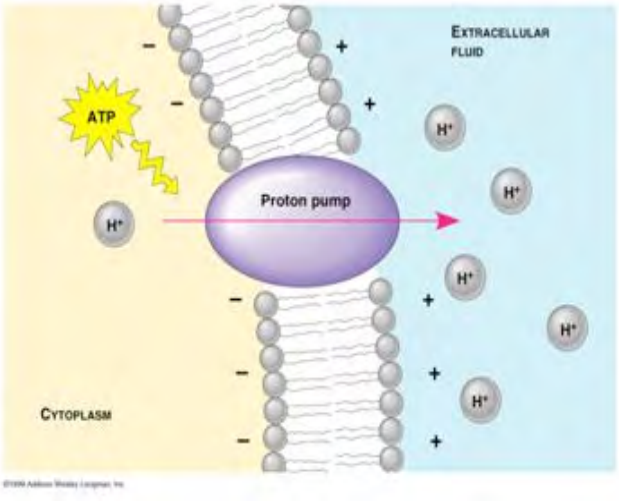
4. What would happen if activation energy barriers didn't exist?
   a. Substrates would not bind properly to enzymes.
   b. Chemical reactions in the body would never occur.
   c Coenzymes would not work, but enzyme function would not be affected.
   d. All chemical reactions in the body would proceed whether they were needed or not.

5. Which of the following is <u>not</u> a factor that affects the rate of diffusion?
   a. Temperature
   b. Distance traveled
   c. Whether the substance was derived from animal or plant tissue
   d. Surface area and thickness

6. Activation energy is similar to the "push" needed to start rolling a stalled car down a hill. How do enzymes fit into this analogy?
   a. Enzymes increase the effort that's needed to start the car moving.
   b. Enzymes decrease the effort that's needed to start the car moving.
   c. Enzymes increase the steepness of the hill that the car will roll down.
   d. Enzymes decrease the distance the car needs to move to reach the bottom of the hill.

7. This type of movement moves molecules from areas of high concentration to areas of low concentration and does not require energy.
   a. Active Transport
   b. Diffusion and Active Transport
   c. Passive Transport
   d. Diffusion and Passive Transport

8. What type of transport is shown in the picture?
   a. Diffusion
   b. Osmosis
   c. Passive Transport
   d. Active Transport



9. The role of insulin in the human body is to
   a. increase the level of sugar in the blood.
   b. decrease the amount of body fat.
   c. trigger body cells to take up glucose.
   d. trigger the immune system to destroy the beta cells in the pancreas.

10. It is said that some animals benefit from obesity. What animals are they and how does obesity benefit them?

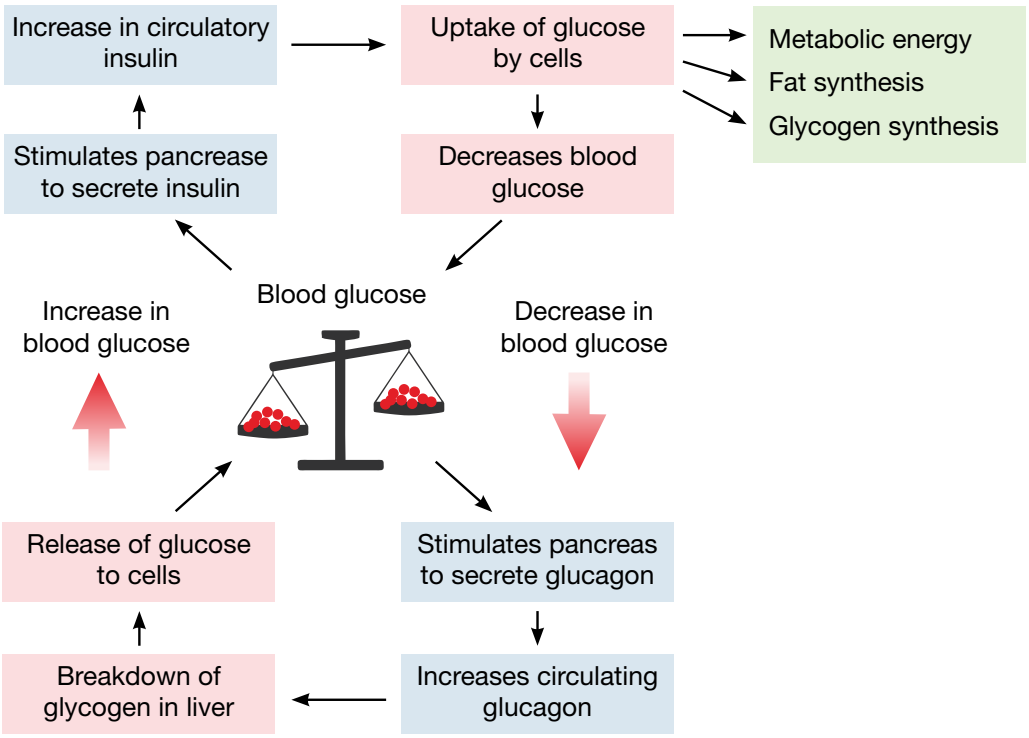
11. What are essential nutrients? Give examples and explain why they are important.

12. There are several nations where malnutrition is a common occurrence. What may be some of the health challenges posed by malnutrition?

13. Explain the role of enzymes in lactose intolerance. Describe what happens when a person who is lactose intolerant drinks milk.

14. Draw and clearly label a diagram explaining how facilitated diffusion works.

15. Write a paragraph explaining the process described in this diagram.



Lesson 7
Introduction to Science Research

Overview and Rationale:

In this lesson, students will begin their final project: producing a pamphlet. A pamphlet is considered gray literature because it contains very recent information that may be difficult to find using conventional channels. Gray literature is an important type of scientific literature because it provides recent information, often discovered within the last 12 to 18 months, and includes up-to-date research. Gray literature often includes information from the cutting edge of science, including patents, technical reports from government agencies or scientific research groups, working papers from research groups or committees and white papers. The goal in this project is for students to research a topic related to health and nutrition, then present it in a way that will be easy to understand for a lay audience. Even though students are communicating their information in a simplified way, they must fully understand the concepts in order to communicate them in ways that can inform and educate the public.

Tasks/Expected Outcomes:

1. Students will learn to identify appropriate sources.
2. Students will conduct library searches for sources.

College and Career Readiness Standards (CCRS)

English Language Arts Science/Technical Subjects Standards: Reading

1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

English Language Arts History/Social Studies, Science/Technical Subjects Standards: Writing

2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

2a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

2b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

2c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.

2d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.

7 Conduct short as well as more sustained research projects to answer a question (including a self generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

Throughout this course, only 11-12 grade standards are used.

LDC	Skills and Ability List

Skills Cluster 2: Reading Process

1. Science Epistemology

Ability to understand the underlying idea that science is an attempt to build understandings though constructed models and as approximations, findings are subject to revision and that science knowledge is constructed incrementally using peer critique and public dissemination.

2. Scientific Information

Ability to select and read appropriate research and understand the elements of scientific processes.

3. Science Inquiry

Ability to generate questions and to select appropriate research to advance and challenge explanations, corroborate evidence, and evaluate sources and evidence.

4. Annotated Bibliography

Ability to briefly explain the hypotheses, content, methods, results, conclusions and implications of the cited text.

Skills Cluster 3: Writing Process

1. Initiation of Task

Ability to identify the components of scientific research articles.

2. Planning

Ability to develop a line of thought and text structure appropriate to a scientific informational synthesis.

3. Development

Ability to construct an initial draft with an emerging line of thought and structure.

(www.literacydesigncollaborative.org)

Materials:

- Academic notebook
- Oregon Graduate Institute of Science and Technology Efficient Reading Pamphlet
- Pamphlet examples. Visit these sites and download sample brochures to serve as exemplars for the student work.
  - Sagehen Filed Studies— (http://sagehen.ucnrs.org/Documents/info%20sheet.pdf)
  - Alcohol brochure — (http://www.centurycouncil.org/sites/deafault/materials/all-brochure-kids.pdf.)
  - El Nino pamphlet — (http://www.nws.noaa.gov/om/brochures/climate/El_NinoPublic.pdf)
  - Living life online — (http://publications.usa.gov/USAPubs.php?PubID=383)

Timeframe:

85 minutes

Targeted Vocabulary:

General Academic Vocabulary

- annotated bibliography
- gray literature

Activity One — Introducing the Project (Approx. 10 minutes)

College and Career Readiness Standards: Science/Technical Reading– 1, 2, 4; Writing– 2, 2a, 2b, 3c, 2d

Before they come to class, the students will identify possible topics suitable for a research project that will result in an informational brochure/pamphlet explaining the issues, causes, problems and possible solutions to the public. To brainstorm possible topics, students should consider the following two ideas:

1. The topics should be debatable. That is, reasonable people may have differing views about the topic.
2. The topic should be narrow and focused enough to investigate for this assignment. For example, nutrition-related diseases is too broad a topic and could be a book. Instead, students might want to focus on one nutrition-related disease in particular.

They will write their ideas in their Academic Notebooks. Students will discuss the ideas with a small group.

Re-introduce the task: How does the scientific community communicate important information to a lay audience? After researching scientific articles, journals and websites on important topics in nutrition, write an informational pamphlet in which you explain the issues, causes, problems and possible solutions to the public. Support your position with evidence from the texts. **Ask students to annotate the prompt and identify the elements of what they must do to be successful on the assignment.**

FROM THE STUDENT ACADEMIC NOTEBOOK p 66

Nutrition Final Project Directions

Purpose: Your purpose is to create an informational pamphlet or brochure about a topic related to nutrition and diet using science research to support your claims.

A pamphlet is considered to be gray literature, which is literature hard to find using conventional methods. Gray literature is an important type of scientific literature because it provides recent information, information found within the last 12 to 18 months, and includes up-to-date research. Gray literature, like the pamphlet, should be easy to understand for a lay audience. Even though you are communicating the information in a more simplified way, you must understand the science concepts fully to be able to explain them to others. You will need to cite your sources and included them in a works cited page, so that if the reader wishes to read for more detailed information it will be available to them.

Prompt: How does the scientific community communicate important information to a lay audience? After researching scientific articles, journals and websites on important topics in nutrition, write an informational pamphlet in which you explain the issues, causes, problems and possible solutions to the public. Support your position with evidence from the texts.

In this project, you will select a topic about nutrition or diet that you think the public needs to know more about. It should be a timely issue that would resonate with people interested in finding out more about said topic.

The topics should be debatable. That is, reasonable people may have differing views

about the topic. The topic should be narrow and focused enough to investigate for this assignment. For example, nutrition-related diseases is too broad a topic and could be a book instead of a pamphlet. Instead, you might want to focus on one nutrition-related disease in particular.

You will need to bring 10 copies of your pamphlet for class presentations.

You will need to include at least five sources to use in your work. To help you read and organize the material you will take notes on each source in your Academic Notebook.

Finding Articles for the Final Project: Articles can be found in many different places including journals, magazines, newspapers, and websites. Popular journals, such as *Scientific American*, are aimed at the general public. The articles are written by journalists, who have consulted with experts, to be accessible by the public. Peer-reviewed journals contain articles written by experts aimed at experts. The reader is expected to know the basics on the topic covered in the article. For the final project, we are going to focus on popular journals, magazines, newspapers and websites.

Activity Two — Reading Scientific Articles (Approx. 25minutes)

College and Career Readiness Standards: Science/Technical Reading– 1, 6, 8

Guided student reading of the pamphlet from the Oregon Graduate Institute of Science and Technology on efficient reading of science papers pages 67-68. Ask students to read the section entitled, "Why Read?" In small groups, have them discuss their purposes for reading these articles. Talk about the different reading purposes discussed in this section and how they might use many of them in creating their own pamphlet—the skimming technique discussed in the pamphlet can be useful as they are searching the library for the articles (reading the abstract and skimming the rest) and reading carefully is more appropriate as they use the articles for research.

Now move to the section on deciding what to read and building a framework for reading. Ask students to read independently.

Ask the following questions:

- How can you decide what to read? How can skimming the article help you?
- What does the term superseded mean? Students should use their prefix/suffix chart to help them figure out the meaning if they do not know this term (to supplant; to replace with a newer model).
- Why is this concept especially important in science? (You want to make sure you are getting the most current information that has not been superseded.)
- So what does this mean in terms of searching for articles? (In general, look for newer articles.)

Read the section on reading in depth independently. Then ask the following questions:

- What do you think is meant by scientific skepticism?
- What are the most important ideas to remember about reading a science article in depth? (To challenge assumptions; to be selective in terms of finding good sources, to make sure that the conclusions are supported by the data.)

(Note: side two of the pamphlet will be used in Lesson Eight.)

Taking Notes: React to what you read

Taking notes will help you to understand what you read and will save you effort in the future. When you have just read a paper, you may understand it well. The definitions are clear, the charts show correlations at a glance. But next week, when you are writing a report on this subject, or next year, when you need to refer to the paper again, it may not be so clear.

Highlight major points

On papers you plan to keep, underline main points or mark them with a line in the margin; make notes so that new ideas will stand out. When you find a definition of a new term, abbreviation or acronym, write "def" in the margin. When you find an example that clarifies a point, note that in the margin.

When you see a chart or table, examine it. Figure out what its significance is. What trends does it show? What correlations? Write a note explaining it in your own way.

React to the points in the paper

If you see a correlation to other work, note it in the margin. If you doubt a statement, note your objection. If you find a pleasing quotation, write it down.

Construct your own example

This can tell you if you understand the definitions and terminology, give you insight on why a theorem or result holds, and expose aspects not covered by the examples in the paper.

Summarize what you read

When you have digested an article, write a short summary. In your own words, state what you learned from the paper. What were the main points for you? Keep the summary with the article for future reference.

Reacting to what you are reading gets you emotionally involved in the argument. Emotion emphasizes what is said, making it easier to remember. Writing a summary helps to relate the paper to what you already know, again aiding memory by tying into your framework for the subject. The summary also serves as a reference when you need to return to the paper.

Summary: How to read a paper

Preparation
- Quiet place.
- Pencil, paper, photocopy of article.

Deciding what to read
- Read title, abstract.
- Read it, file it or skip it?

Read for breadth
- What did they do?
- Skim introduction, headings, graphics, definitions, conclusions and bibliography.
- Consider the credibility.
- How useful is it?
- Decide whether to go on.

Read in depth
- How did they do it?
- Challenge their arguments.
- Examine assumptions.
- Examine methods.
- Examine statistics.
- Examine reasoning and conclusions.
- How can I apply their approach to my work?

Take notes
- Make notes as you read.
- Highlight major points.
- Note new terms and definitions.
- Summarize tables and graphs.
- Write a summary.

An online version of this document can be found here:
http://www.cse.ogi.edu/~dylan/efficientReading.html

Thanks to Dave Maier for additional suggestions.

Efficient Reading of Papers in Science and Technology

This brochure provides an approach to help you read scientific papers efficiently and effectively.

Prepared by:
Michael J. Hanson
Updated by:
Dylan J. McNamee

version of January 6, 2000

Introduction: Why Read?

Before beginning to read a paper, consider why you are doing it. What do you want to get out of it? Your needs control how you read. If you only need an overview, a brief skim may suffice. If you will present the paper to others, you will need to dig deeply, to challenge the paper's arguments until you understand it fully. If you will use the information later, taking notes will help you remember it. If you don't know what you hope to gain from the paper, you can not tell whether reading it will be beneficial or a waste of time.

In order to get the most from your reading, you should be properly prepared. Find a quiet place to work where you will not be disturbed or distracted, have a pencil and note pad at hand, and bear in mind exactly what you expect to get from this paper.

The following method for reading a scientific paper offers you ideas about the process of reading a paper, how to decide what to read, how to build a broad framework by skimming, and how to challenge the paper to get depth of understanding. Finally, it will show you how to take notes so that the key points won't be lost as soon as you set the paper down. Since reading is the process of getting ideas from the author, you must focus on the author's thoughts, not just read the words on the paper.

Deciding what to read

When you first approach a paper, ask yourself "What did the author do?" Reading the title and the abstract should tell you this. Then decide if the paper is useful to you now. If so, read it. If not, might the paper be useful to you later? If so, file it. If it is not relevant to you, skip it.

Reading for Breadth: Build a framework

If you decide to read the paper, first skim it.

- Read the introduction.
- Read the section headings.
- Look at the tables and graphs to see what they say and read the captions.
- Read the definitions and theorems.
- Read the conclusions.
- Consider the credibility of the article:
  - Who wrote it? Are they well-known?
  - Where do they work? What biases might they have as a result of their employer?
  - Where was the article published? What is the reputation of the journal? Was the journal refereed?
  - When was it written? Might it be outdated or superceded?
- Skim the bibliography:
  - How extensive is it?
  - Are the authors aware of current work?
  - Does it reference classic papers in this field?
  - Have you read any of the papers that are referred to?
  - Do you know relevant research that isn't cited?

By skimming the paper first you can learn what the authors did, and develop a framework to understand the parts of the paper. Developing a framework adds to your general understanding of the field, and gives you a basis to understand the paper. If you know what conclusions they draw, you can follow their arguments more easily. Knowing where they are going can help you to follow their path and give you a chance to find shortcuts or places where they missed a turn.

Once you have skimmed a paper you have a broad idea of what they did. Then you can decide if you want to know more. If you are interested in how they did it, then read the body of the paper for details. If not, file away what you have learned and congratulate yourself

Reading in Depth: Challenge what you read

There is a lot of junk published, so you should be selective in what you read and what you believe. When you read a paper in detail, approach it with scientific skepticism. You can do this by trying to tear the arguments apart.

Examine the assumptions

- Do their results rely on any assumptions about trends or environments?
- Are these assumptions reasonable?

Examine the methods

- Did they measure what they claim?
- Can they explain what they observed?
- Did they have adequate controls?
- Were tests carried out in a standard way?

Examine the statistics

- Were appropriate statistical tests applied properly?
- Did they do proper error analysis?
- Are the results statistically significant?

Examine the conclusions

- Do the conclusions follow logically from the observations?
- What other explanations are there for the observed effects?
- What other conclusions or correlations are there in the data that they did not point out?

By challenging what you read, you will understand better what the author is saying and why they say it. You will also be able to decide whether the evidence supports their conclusions, and to draw your own conclusions from their data. Once you understand the paper, ask yourself how you can apply their approach to your own work.

Activity Three — Searching for Information (Approx. 50 minutes)

College and Career Readiness Standards: Science/Technical Reading– 1, 6, 7, 8; Writing– 7, 8

The students will spend the class in the library. Students will begin to conduct searches in the library to find sources for their project. Any additional library time needed for searching will be done on their own.

Review the following guidelines with students:

- Articles do not need to be peer-reviewed scholarly articles for this assignment, but they should be from credible sources such as the National Institutes of Health, *Scientific American*, etc.
- Newer articles will generally have the most up-to-date information.
- Ask students to use the project directions to help them as they select the articles they plan to use.
- Ask students to think about their topic and their plan for their pamphlet as they select the articles they plan to use.

FROM THE STUDENT ACADEMIC NOTEBOOK p 69

Finding Articles for the Final Project

Articles can be found in many different places including journals, magazines, newspapers, and websites. Popular journals, such as *Scientific American*, are aimed at the general public. The articles are written by journalists, who have consulted with experts, to be accessible by the public. Peer-reviewed journals contain articles written by experts aimed at experts. The reader is expected to know the basics on the topic covered in the article. For the final project, popular journals, magazines, newspapers and websites are acceptable.

Example websites and journals:

- http://www.scientificamerican.com/.
- http://news.sciencemag.org/.
- http://www.mayoclinic.com/.
- http://www.nih.gov.

Assessments:

Outcome 1: Students will select a topic related to health and nutrition that is appropriate for a research project.

Outcome 2: Students will learn to identify appropriate sources.

- Teacher evaluation of student topic
- Student summary of topic

Evaluation Rubric			
• Contains an appropriate topic.	No	Somewhat	Yes
• Demonstrates an understanding of the importance of the issue.	No	Somewhat	Yes
• Demonstrates an understanding of the research that will need to be done to complete the project.	No	Somewhat	Yes
• Used library time wisely and productively.	No	Somewhat	Yes

Teacher Checklist	Use this list to ensure that you have completed all of the lesson components. I . . .

- [ ] 1. Guided student reading of the OGI institute pamphlet on efficient reading of science papers.
- [ ] 2. Discussed conducting library searches.
- [ ] 3. Provided library time for finding sources.

Lesson 8
Research and Writing in Science

Overview and Rationale:

In this lesson, students will use the research they have done to write an explanation of their topic in a way that can be understood by the public. In order to be able to write about science in a way that is understandable and accessible to the public, students must deeply understand the concepts. Students will bring in the articles they have selected and will begin to outline their final project. They will use a framework to organize their thoughts. They will examine several pamphlets to understand the basic elements of an effective informational pamphlet. Finally, students will draft a pamphlet and will learn to edit and revise using peer feedback.

Tasks/Expected Outcomes:

1. Students will use science research to explain science to the public.
2. Students will identify important concepts from science articles and use the information to support their ideas.
3. Students will explain the science topic they are researching by citing specific evidence from their sources.
4. Students will engage in scientific inquiry by forming hypotheses, researching evidence and providing support across multiple sources to support their claims.

College and Career Readiness Standards (CCRS)

English Language Arts Science/Technical Subjects Standards: Reading

1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

4 Determine the meaning of symbols, key terms and other domain-specific words and phrases as they are used in a specific or technical context relevant to grades 11-12 texts and topics.

5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in text, identifying important issues that remain unresolved.

7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

8 Evaluate the hypotheses, data analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon or concept, resolving conflicting information when possible.

10 By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

English Language Arts History/Social Studies, Science/Technical Subjects Standards: Writing

2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments or technical processes.

2a Introduce a topic and organize ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

2b Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations or other information and examples appropriate to the audience's knowledge of the topic.

2c Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.

2d Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

2e Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).

4 Produce clear and coherent writing in which the development, organization and style are appropriate to task, purpose, and audience.

5 Develop and strengthen writing as needed by planning, revising, editing, rewriting or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

7 Conduct short as well as more sustained projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

9 Draw evidence from informational texts to support analysis, reflection, and research.

10 Write routinely over extended timeframes (time for reflection and revision) and shorter timeframes (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Throughout this course, only 11-12 grade standards are used.

LDC	Skills and Ability List

Skills Cluster 1: Preparing for the Task

1. Bridging Conversation

Ability to connect the task and new content to existing scientific knowledge, skills, experiences, interests and concerns.

2. Task Analysis

Ability to understand and explain the task's prompt and rubric.

Skills Cluster 2: Reading Process

1. Scientific Information

Ability to select and read appropriate research and understand the elements of scientific processes.

2. Scientific Terminology

Ability to locate and understand scientific words and phrases that identify key concepts and facts, processes, or information.

3. Close Reading

Ability to interpret text with particular questions in mind that reflect scientific inquiry, and to use self-regulation to understand scientific processes presented in the text.

4. Scientific Processes

Ability to understand and use scientific processes as a way to answer questions and evaluate text information.

5. Annotation and Note-taking

Ability to read purposefully, select and use relevant information; to summarize and/or paraphrase; to use and understand multiple representations of science processes

6. Organizing Notes

Ability to organize and synthesize information.

Skills Cluster 3: Transition to Writing

1. Bridging Conversation

Ability to transition from reading or researching phase to the writing phase.

Skills Cluster 4: Writing Process

1. Development

Ability to construct an initial draft with an emerging line of thought and structure.

2. Revision

Ability to apply revision strategies to refine development of information or explanation, including line of thought, language usage and tone as appropriate to audience and purpose.

3. Editing

Ability to apply editing strategies and presentation applications.

(www.literacydesigncollaborative.org)

Materials:

- Final project directions
- Student articles for final project
- Efficient reading pamphlet (from Lesson Seven)
- Pamphlet examples
- APA guidelines — http://owl.english.purdue.edu/owl/resource/560.01.

Timeframe:

250 minutes

Activity One — Taking Notes on Science Research (Approx. 75 minutes)

College and Career Readiness Standards: Science/Technical Reading– 1, 2, 5, 6, 7, 8, 9, 10

(Students will need to have all of their sources with them for this class.)

Ask students to turn to the Efficient Reading pamphlet in their Academic Notebook (Lesson Seven pages 67-68). Ask students to review the introduction section.

Ask, why are we reading these articles? (To gather information for our pamphlets. To learn more about our topic, to understand the detail of our topic, etc.)

How does our purpose shape how you will approach the reading and what types of information are you looking for as you read? (We are not trying to learn every detail for a test; we are trying to find what the research questions were, how the research was done, what the authors found, and what that means for the public. Basically, we are trying to find the information we will report on in our pamphlet.)

Ask students to read the section in the pamphlet on Taking Notes. Discuss the importance of making notes as you read so that you can recall what the author was discussing. Talk about the two types of notes suggested—first, in the margins as students read, and second, writing a summary after the information has been digested. Students will take both types of notes as they read. There is a graphic organizer in their Academic Notebook to help them record their ideas.

Ask students to take out one of the articles they found. Ask students to note the type of source it is in the graphic organizer in their Academic Notebook and to write down the bibliographic information. Show the following website for APA style guidelines — http://owl.english.purdue.edu/owl/resource/560/01/.

Ask students to identify the purpose of the article. Often this will be in the abstract. If there is no abstract, ask students to skim the article to find the intent of the research.

Ask students to continue to read the article taking notes as they go. Circulate as they are reading to respond to questions.

After about 10 minutes of independent reading and note taking, ask students to discuss the process so far. What questions do they have? How is taking notes helping them process what they have read?

FROM THE STUDENT ACADEMIC NOTEBOOK p 70

APA Basic Form

Articles

Author, A. A., Author, B. B., & Author, C. C. (Year). Title of article. *Title of Periodical, volume number* (issue number), pages. doi:http://dx.doi.org/xx.xxx/yyyyy

Books

Author, A. A. (Year of publication). *Title of work: Capital letter also for subtitle.* Location: Publisher. (this type also uses a hanging indention)

Online periodical

Author, A. A., & Author, B. B. (Date of publication). Title of article. *Title of Online Periodical*, volume number(issue number if available). Retrieved from http://www.someaddress.com/full/url/.

Source (type – book, journal article, research report, etc.)	
Bibliographic information (full reference using APA style)	
Purpose of the paper	
Description	
Data (include page number)	
Examples (include page number)	
Important figures or tables (include page number)	
Summary	
What the public needs to know	

Students will have the rest of the time to take notes on their sources. They will need to have all of their sources read before moving to the next task (outlining) pages 91-95.

Assessments:

Outcome 1: Students will use science research to explain science to the public.

Outcome 2: Students will identify important concepts from science articles and use the information to support their ideas.

Evaluation Rubric			
• Contains at least five appropriate sources.	No	Somewhat	Yes
• Uses APA style.	No	Somewhat	Yes
• Provides a summary of the article.	No	Somewhat	Yes
• Provides assessment of the content.	No	Somewhat	Yes

Activity Two — Outlining (Approx. 50 minutes)

College and Career Readiness Standards: Science/Technical Writing– 1, 2, 4, 6, 7, 8, 9, 10

Ask students to review their notes on their sources. From their findings, have them generate a list of five to seven key ideas that they think are the most important to include in their pamphlet. Write these ideas in the Academic Notebook.

FROM THE STUDENT ACADEMIC NOTEBOOK p 76

List five to seven key ideas from your findings:

Ask students to examine the editing and revision checklist and the project grading rubric. They should use these as resources as they create their outline, draft and final pamphlets.

Then, ask students to write an outline for each of the panels of their pamphlet. This can be a bulleted list of ideas at this point. They will be crafting a draft over then next few class periods.

FROM THE STUDENT ACADEMIC NOTEBOOK pp 77-79

Title:

Description of your topic (Why is your topic something people should be concerned about? What are the main issues?):

Background information (causes, symptoms, examples, descriptions, effects on the body, etc.):

Latest research on the topic (These are your five to seven key points. Be sure to include relevant statistics/data/charts, etc.)

Solutions/resolutions/actions people can take:

Ask students to share out their plans with a partner. The pair should be looking for logical flow of ideas, completeness and precision of ideas, precise terminology, and support for ideas.

Provide time for students to ask questions as a whole class.

Assessment:

Outcome 3: Students will explain the science topic they are researching by citing specific evidence from their sources.

- Outline of pamphlet

Evaluation Rubric			
• Applies an outline strategy to support the controlling idea.	No	Somewhat	Yes
• Provides citations and references with elements for correct form.	No	Somewhat	Yes
• Draws a credible implication from information about an issue or topic.	No	Somewhat	Yes
• Writes in readable prose.	No	Somewhat	Yes

Weekly reflection: Ask students to complete the reflection in their Academic Notebooks.

FROM THE STUDENT ACADEMIC NOTEBOOK p 80

Week 5

1. Think about the science. What did you learn about science research and health disorders?

2. Think about your learning. How will your experiences change the way you approach reading in the sciences?

Activity Three — Drafting a Pamphlet (Approx. 100 minutes)

College and Career Readiness Standards: Science/Technology Writing– 2a, 2b, 2c, 2d, 2e, 4, 7, 8, 9, 10

The students will draft a pamphlet. First, ask students to examine the eight-column structure of the pamphlet (described in the project directions in Lesson 7). The draft should follow this format.

Remind students to think about how language is used to in the pamphlet examples. (Have the pamphlet examples from Lesson Seven available for students to look at.) Draw attention to how pamphlets should make complex topics understandable to the public and to the language and other devices (like diagrams or illustrations) they use to do this.

For example, pamphlets should:

- Explain the issue in ways that are easy to understand.
- Add to the reader's knowledge about the topic.
- Seek to change the reader's attitude about the topic or call the reader to action.
- Use diagrams or illustrations effectively.
- Use headings and subheadings to emphasize key points.

Language usage:

- Use scientific terms.
- Define scientific terms used.
- Use precise language (avoid general nouns such as these, those, they).
- Use active voice (this is different than most science text that uses passive voice).
- Avoid negative language ("you should quit smoking" rather than "don't smoke").

Discuss how the language in a pamphlet differs from other scientific language they have encountered in the unit. Talk about the need to define any science terms that they use in language that is understandable to the reader.

Ask students to review their outlines as they begin a draft of their pamphlet. Their goal is to create a fully drafted pamphlet using their sources and the notes from the sources. As students work, circulate through to help guide students and answer questions. After about 20 minutes of work, pull the class together to discuss their progress and answer any questions.

Once students have a draft, they should read their work to revise.

FROM THE STUDENT ACADEMIC NOTEBOOK p 81

Revising your Work

Read your draft and think about the following questions:

1. Evaluate your main point. What are you trying to say in this pamphlet? Would it be clear to someone reading your pamphlet for the first time?
2. How is the writing appropriate for your intended audience?
3. What is your purpose for informing readers about your topic? Is your purpose clear in your draft?
4. Evaluate your evidence. Do you offer enough scientific evidence to support your points?
5. How are specific statistics/figures/data used to support your points?
6. Is there any information that doesn't seem to fit your purpose or your topic? You either need to add more support for that information, or cut the idea.
7. Do the ideas flow from one point to another? Will the reader be able to follow a logical progression of ideas?
8. Can you read through the pamphlet in the way it is currently designed or do ideas need to be reordered?
9. Are you using and defining scientific terms? Are you using precise language to get your ideas across?
10. Are the references cited properly?
11. What specific suggestions/solutions do you provide for readers?
12. How does the information in the pamphlet follow the format outlined in the project directions?
13. Read for grammar and spelling errors.

Revise your paper based upon your responses to the questions to create a stronger pamphlet.

Ask students to discuss their responses to these questions in pairs, demonstrating evidence from their draft. The pairs should consult the grading rubric for the project to make sure their draft is on track.

Assessment:

Outcome 3: Students will explain the science topic they are researching by citing specific evidence from their sources.

- Draft of pamphlet

Evaluation Rubric			
• Writes a concise summary statement or draft opening that establishes a controlling idea and identifies key points that support development of information and/or explanation.	No	Somewhat	Yes
• Writes in readable prose.	No	Somewhat	Yes
• Revises work appropriately.	No	Somewhat	Yes
• Utilizes peer feedback and grading rubric appropriately in revision.	No	Somewhat	Yes

Activity Four — Peer Editing (Approx. 25 minutes)

College and Career Readiness Standards: Science/Technical Writing– 5

Ask students to read a partner's draft using the Editing and Revision checklist to provide feedback. Students will use the editing and revision checklist to evaluate their partner's pamphlet. After they complete their initial assessment, the pairs should discuss their evaluations—talking about what was good about the draft and what needs to be revised before presenting the pamphlet.

FROM THE STUDENT ACADEMIC NOTEBOOK pp 82-84

Editing & Revision Checklist

Paper's Author

Paper's Editor

Directions for the editor: Answer all questions to the best of your ability. The writer's grade somewhat depends on you. If you have questions or you are not sure about something, ask me. You need to read the paper several times. Do not skip sentences. Do not skim. Read very closely. Even read aloud quietly, so you can hear problems.

Directions for the writer (after the peer editing process): Make any changes necessary to gain a yes answer to all questions.

Headings and Subheadings:

☐ Yes ☐ No 1. Is there effective use of main heading?

☐ Yes ☐ No 2. Are there subheadings used?

☐ Yes ☐ No 3. Does the heading grab the reader's attention?

☐ Yes ☐ No 4. Do the subheadings contain all the proper information?

Introduction to the topic:

☐ Yes ☐ No 1. Is there an attention-getter?

☐ Yes ☐ No 2. Is there background information about the topic?

☐ Yes ☐ No 3. Are the main terms and issues defined?

Background information:

☐ Yes ☐ No 1. Is there a description of the causes of the problem and/or a description of the issue?

☐ Yes ☐ No 2. Is there an effective description of the symptoms, effects on the body, etc.?

☐ Yes ☐ No 3. Does the writer provide citations for the information?

Description of Research

☐ Yes ☐ No 1. Is there an informative presentation of the latest research on the topic?

☐ Yes ☐ No 2. Is there information about how the research impacts the public?

☐ Yes ☐ No 3. Is the science clearly explained?

☐ Yes ☐ No 4. Are diagrams/illustrations used effectively?

Conclusions:

☐ Yes ☐ No 1. Does the writer present solutions or resolutions to the issue?

☐ Yes ☐ No 2. Does the writer present several reasonable actions people can take?

☐ Yes ☐ No 3. Is the author's concluding sentence meaningful and memorable?

Works Cited Page

☐ Yes ☐ No 1. Is the Works Cited information complete?

☐ Yes ☐ No 2. Has the author used at least five different sources?

☐ Yes ☐ No 3. Are all of the author's sources appropriate for this assignment?

☐ Yes ☐ No 4. Are the sources in alphabetical order?

☐ Yes ☐ No 5. As much as you can tell, is each source listed in the correct format (APA style)?

Grammar/mechanics Checklist:

1. Read through the entire pamphlet and look at all of the words that end with –s. Check and make sure that the writer didn't forget to make a possessive –s. On the paper, put 's (apostrophe s) anywhere where it is needed.
2. Read through the entire paper and look for any sentence that begins with the following words: **when, because, since, if, although, after, even though, while, in order that.** First, make sure these sentences are not fragments. Second, **make sure there is a comma after the subordinate clause.**
3. Check for sentences beginning with the word "So." Get rid of the word. It probably isn't needed. Do the same for sentences beginning with **"And"** or **"But."**
4. Circle any use of the words **"you," "your," "me," "I," "we,"** and so on. Suggest how the writer can avoid these words.
5. Mark all uses of the words **"they"** and **"their,"** and make sure that the antecedents are plural. Also check to make sure there is a clear antecedent for these words.
6. Mark all uses of the words **"this," "that," "these,"** or **"those."** Remind the writer to follow these words with specific nouns.
7. Read the entire paper and make sure that all sentences make sense. Mark sentences that don't make sense and suggest how the writer can change them.
8. Read the entire paper again and make sure that all words are **spelled correctly.** Circle words that are questionable. Check for common misspelled words: *then, than, effect, affect, its, it's, their, there, to, too, two.*
9. Make sure that titles are properly designated by *italics,* underlining, or **quotation marks.**
10. Read through the entire paper and check every time the writer uses the word **that.** Make sure it shouldn't be **who.**
11. Check every comma in the paper, and make sure that it is not bringing together two complete sentences.
12. Check all of the following words: **and, but, so, for, or.** Make sure that there isn't a comma needed. Ask me if you are not sure. If these words are bringing together two complete sentences, then use a comma before the conjunction.
13. Anytime you see a **colon** (:) or a **semi-colon** (;), make sure that it is used correctly.
14. Read the paper one last time and make sure that there are no other mistakes that you can identify. Check for transitions, double negatives, verb forms, subject-verb agreement, and so on. Help the writer get an A.
15. Check to make sure that the entire paper is in **consistent tense** (no shifting from past to present, etc.).
16. Check all verbs ending with –ing, and make sure you can't change it. You are looking for passive verbs: some form of the verb *be* + the past participle of the verb.

Example: "Many options were *tried* by the soldiers" can be changed to "The soldiers *tried* many options." Check to make sure that passive sentences couldn't be better if they were active.

Assessment:

Outcome 4: Students will engage in scientific inquiry by forming hypotheses, researching evidence and providing support across multiple sources to support their claims.

- Development of pamphlet

Evaluation Rubric			
• Provides an opening to include a controlling idea and an opening strategy relevant to the prompt.	No	Somewhat	Yes
• Provides an initial draft with all elements of the prompt addressed.	No	Somewhat	Yes
• Writes in readable prose.	No	Somewhat	Yes

- Peer editing

Evaluation Rubric			
• Demonstrates use of revision strategies that clarify logic and development of ideas; embeds relevant details; improves word-usage and phrasing and creates smooth transitions between sentences and paragraphs.	No	Somewhat	Yes
• Applies a text structure to organize reading material content and to explain key points related to the prompt.	No	Somewhat	Yes

Teacher Checklist	Use this list to ensure that you have completed all of the lesson components. I . . .

- [ ] 1. Asked students to review the efficient reading pamphlet.
- [ ] 2. Discussed purpose for reading sources.
- [ ] 3. Asked students to read note taking sections of the efficient reading pamphlet.
- [ ] 4. Discussed the basics of APA style.
- [ ] 5. Guided students as they took notes over their sources using the graphic organizer in their Academic Notebooks.
- [ ] 6. Asked students to begin to outline their ideas by listing five to seven key ideas for their pamphlet in their Academic Notebook.
- [ ] 7. Guided students as they wrote an outline of their pamphlet using the questions in their Academic Notebook.
- [ ] 8. Asked students to complete the weekly reflection at the end of week five.
- [ ] 9. Began the process of drafting the pamphlet by asking students to review the project directions.
- [ ] 10. Discussed the use of language and vocabulary in pamphlets.
- [ ] 11. Guided students as they drafted pamphlets.
- [ ] 12. Asked students to use the guiding questions to revise their work.
- [ ] 13. Asked students to work in pairs to provide feedback using the peer editing checklist in their Academic Notebooks.
- [ ] 14. Asked students to complete their final pamphlets.

Lesson 9
Final Project Presentations

Overview and Rationale:

In the last lesson of the unit, students will turn in their finalized pamphlets. To make the information public, students will share their pamphlets with the class. Students will also evaluate their peers. Peer evaluation benefits both the presenter, who gains additional feedback, and students, who listen more carefully and gain deeper insight into the process.

Tasks/Expected Outcomes:

1. Students will present their final project to their peers.
2. Students will engage in science discourse explaining and defending their work.
3. Students will use evidence to support their claims.

College and Career Readiness Standards (CCRS)

English Language Arts Standards: Speaking and Listening

1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

1a Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well reasoned exchange of ideas.

1c Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.

2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

3 Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.

4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience and a range of formal and informal tasks.

5 Make strategic use of digital media (e.g., textual, graphical, audio, visual and interactive elements) in presentations to enhance understanding of findings, reasoning and evidence and to add interest.

6 Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate. (See grades 11–12 Language standards 1 and 3 on page 54 for specific expectations.)

English Language Arts Standards: Writing

9 Draw evidence from literary or informational texts to support analysis, reflection and research.

10 Write routinely over extended timeframe (time for research, reflection and revision) and shorter timeframe (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

Throughout this course, only 11-12 grade standards are used.

LDC	Skills and Ability List

Skills Cluster 1: Preparing for the Task

1. Bridging Conversation

Ability to connect the task and new content to existing knowledge, skills, experiences, interests and concerns.

2. Task Analysis

Ability to understand and explain the task's prompt and rubric.

Skills Cluster 2: Reading Process

1. Science Inquiry

Ability to generate questions and select appropriate research to advance and challenge explanations, corroborate evidence and evaluate sources and evidence.

2. Scientific Processes

Ability to understand and use scientific processes as a way to answer questions and evaluate text information.

(www.literacydesigncollaborative.org)

Materials:

- Academic notebook
- State/local assessments

Timeframe:

100 minutes

Targeted Vocabulary:

- From pamphlet presentations

Activity One — Sharing Information (Approx. 75 minutes)

College and Career Readiness Standards: Speaking and listening– 1, 1a, 1c, 2, 3, 4, 5, 6

Ask students to share their pamphlets in small groups. Each student will need to bring ten copies of their pamphlet for class presentations. Students will be placed in groups of three. Students will decide the order in which they will read the pamphlets. Ask students to assume the following roles as they read:

1. One student will take the role of a consumer for whom the pamphlet was written (for example, a pamphlet on lowering cholesterol would be of great interest to someone who suffers from high cholesterol) and will take notes in their Academic Notebook as they read about how the pamphlet impacted their understanding of the topic. They will also note what action they will take based upon the knowledge they gained from the pamphlet. This student will note any questions they have for the author.
2. One student will take the role of a skeptic and will question the reliability of the information being presented in the pamphlet based on what they know about science. They will take notes on the same two questions in their Academic Notebook, and will also note questions they have for the author.

Ask students to discuss their pamphlets in small groups. After students read and take notes over one pamphlet, the group will discuss the information presented. Talk with students about their role in small group discussions. They are expected to be active participants who engage the pamphlet author in a dialogue about his/her pamphlet information. Be sure that they understand that they are expect to:

- Look at and make eye contact with each member of the small group.
- Ask questions about the information presented in the pamphlet.
- Discuss how the pamphlet impacted their understanding of the topic and whether or not it changed their stance.
- Be able to summarize the topic presented and make connections to their own topic and/or to what we have learned about diet and nutrition.

Students will switch roles and continue reading each other's pamphlets until all three pamphlets are discussed. Students can continue to re-group in groups of three to discuss pamphlets with other classmates as time allows.

FROM THE STUDENT ACADEMIC NOTEBOOK pp 86-90

Presenter:

Reviewer:

Topic:

Date:

Understanding of the topic –

Actions I will take –

Questions I have for the author –

	5 Excellent	4	3 Good	2	1 Poor
How effectively did the pamphlet introduce the topic?	5	4	3	2	1
How clearly and fully was the science evidence presented?	5	4	3	2	1
Were the recommendations effective, logical and complete?	5	4	3	2	1

What was the strongest part of the pamphlet?

What would you suggest for improvement?

Activity Two	Reflection (Approx. 25 minutes)

College and Career Readiness Standards: Writing– 9, 10

Ask students to complete the weekly reflection.

FROM THE STUDENT ACADEMIC NOTEBOOK p 91

Week 6

1. Think about the science. What did you learn science research?

2. Think about your learning. How will your experiences change the way you approach reading in the sciences?

Assessments:

Outcome 1: Students will present their final project to their peers.

Outcome 2: Students will engage in science discourse explaining and defending their work.

Outcome 3: Students will use evidence to support their claims.

- Peer Evaluation on presentations

Evaluation Rubric			
• Provides effective, specific feedback to peers.	No	Somewhat	Yes
• Includes comments on areas for improvement.	No	Somewhat	Yes
• Includes comments on pamphlet strengths.	No	Somewhat	Yes

- Pamphlet discussion

Evaluation Rubric			
• Research is appropriate and effective.	No	Somewhat	Yes
• Pamphlet is effective and informative.	No	Somewhat	Yes
• Information/resources are presented effectively.	No	Somewhat	Yes
• Student is able to discuss/answer questions about their work.	No	Somewhat	Yes

Grading Rubric

Category	Excellent	Good	Almost	Not Yet
Attractiveness & Organization (Organization)	Exceptionally attractive formatting and well-organized information.	Attractive formatting and well-organized information.	Well-organized information.	Formatting and organization of material are confusing to the reader.
Content - Accuracy (Ideas)	The science is exceptionally well explained including all relevant information.	The science is well explained including all relevant information.	The science is explained including most relevant information.	The pamphlet has little of the required information.
Writing - Mechanics (Conventions)	No errors.	No major errors, one to two minor errors.	Has some major and minor errors.	Has some major and minor errors.
Scientific language and terminology	Used carefully throughout the pamphlet in ways the public can understand.	Used in most of the pamphlet in ways the public can understand.	Is used, but is confusing for readers.	Is not used.
Graphics/ Pictures	The graphics go well with the text and there is a good mix of text and graphics.	The graphics go well with the text, but there are so many that they distract from the text.	The graphics go well with the text, but there are too few.	The graphics do not go with the accompanying text or appear to be randomly chosen.
Sources	Carefully chosen, excellent sources that provide a full picture of the issues involved in the topic.	Carefully chosen sources that provide a good picture of the issues involved in the topic.	Sources do not provide a full picture of the issues involved in the topic.	Incomplete sources.
Citations	No errors in APA style.	Few errors in APA style.	Many errors in APA style.	APA style not used.

Teacher Checklist | **Use this list to ensure that you have completed all of the lesson components. I . . .**

- [ ] 1. Asked students to share their pamphlets in small groups.
- [ ] 2. Assigned students to the following roles (ensuring that each student had an opportunity to portray each role):
    a. Presenter.
    b. Consumer.
    c. Skeptic.
- [ ] 3. Asked students to briefly summarize each presentation and make connections to science learning in small groups.
- [ ] 4. Asked students to complete the weekly reflection.

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SREB Readiness Courses

Transitioning to college and careers

Literacy Ready

Science Unit 1. Nutrition

The Academic Notebook

Name

Unit 1
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Course Overview

Welcome to the first disciplinary literacy science unit of the SREB Readiness Course-Literacy Ready. What does disciplinary literacy in science mean? According to Shanahan & Shanahan (2012), disciplinary literacy refers to the specialized skills and strategies needed to learn at higher levels in each discipline. That means that how people approach reading and writing in the sciences would differ from how they approach it in history, English, mathematics, or other fields. It also means that students need to learn more than the content in any particular discipline—they also need to learn how reading and writing are used within that field. So, disciplinary literacy in science in this unit will introduce you to the knowledge, skills, and tools used by scientists.

You will learn to "make explicit connections among the language of science, how science concepts are rendered in various text forms, and resulting science knowledge" by learning ways to "develop the proficiencies needed to engage in science inquiry, including how to read, write, and reason with the language, texts, and dispositions of science" (Pearson, Moje, Greenleaf, 2010). These ideas are the principal focus of this unit. While certainly the content covered in this course is important, a primary purpose of this unit is to equip you with the tools necessary to be more successful in your college coursework. You will take part in many reading and writing activities aimed at improving your disciplinary literacy in science. To that end, the creators of the course have developed this Academic Notebook.

Purposes of the Academic Notebook

The Academic Notebook has three roles in this course. First, the notebook provides you with a starter kit of tools aimed to prepare you for college science courses. These tools will assist you in learning and comprehending the information from the scientific text, animations, and lectures you receive in the class.

A second role of the notebook is to provide you with a personal space to record your work. The Academic Notebook is where you will take your notes for the class on any materials you are covering. For example, if you are reading an article in class, take notes in this notebook. If you are doing a lab, make your observations and notes here. Likewise, if you are listening to a lecture, take notes here. Use the tools in the resource portion of the notebook to assist you in organizing your notes.

The third and final role of the notebook is that of an assessment tool. Your instructor may periodically collect the notebooks and review your work to ensure that you are remaining on task and to assist you with any material that is causing you difficulty. Your instructor may also assign tasks to be completed in the notebook, such as in-class writing assignments. At the end of this six-week unit, your instructor will review the contents of this notebook as part of your overall grade. Thus, it is important that you work seriously, as this notebook becomes the record of your activity in this course.

Helpful Hints for Science Literacy Success

About Scientists: How do scientists think?

As you will spend much of your time in class learning this on your own, it is best to be brief. In short, scientists learn by careful observation of the world around them to discover general principles. They do this through careful experimentation that results in data. Scientists use this data to draw conclusions. You likely have heard of the scientific method. Scientists use this method as a structured way to investigate the questions they have. An important use of the scientific method is to be able to replicate previous work. Scientists strive to organize, analyze, and explain things clearly. Scientists believe that science is an attempt to build understandings of the world and that science findings are tentative and subject to revision based on new understandings.

About Scientists: What do scientists ask?

Scientists ask lots of questions about nature and the world around them. These are questions that you will hopefully come to ask upon completing this coursework, and the tools in the resource materials section of the Academic Notebook are intended to aid you in asking these questions.

Scientists are systematic when they ask questions. Scientific inquiry helps scientists answer questions through investigation. They begin with observations. They may start with big, broad questions: “Why? What’s going on? How is this explained?” They then may break a larger question into smaller parts to examine. They examine work that has already been done. They use the scientific method to hypothesize, test, analyze and draw conclusions. This inquiry is often cyclical, with experience and observation leading to new hypotheses.

Lesson 1
Evaluating Science Claims

In this lesson, you will . . .

- Be introduced to the two levels of thinking required in this unit: thinking like a scientist and thinking about learning in the sciences.
- Learn about the components of science literacy.
- Develop the skills to critically examine claims made by manufacturers of sports/energy drinks.
- Evaluate claims by using multiple sources of information.
- Apply your knowledge by evaluating claims made by other popular energy drinks and present your findings to your peers.
- Explain the processes involved in evaluating science claims.
- Review and understand the writing project for the unit and, the scoring rubric and a plan to develop your project.

Please work with a partner to circle all of the noun phrases you find in this section.

Carbohydrates as Nutrients. Foods such as bread, cereal, rice and pasta, as well as fruits and vegetables, are rich in sugars called carbohydrates. Carbohydrates are the major source of energy for cells. Energy is stored in the chemical bonds between the carbons, hydrogens and oxygens that comprise carbohydrate molecules. Carbohydrates can exist as single-unit monomers or can be bonded to each other to produce longer-chain polysaccharide polymers.

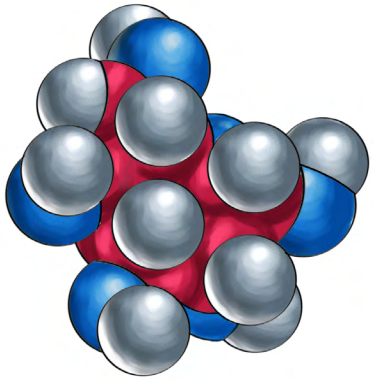
The single-unit simple sugars are digested and enter the bloodstream quickly after ingestion. Sugars found in milk, juice, honey and most refined foods are simple sugars. Fructose, the sugar found in corn syrup, is shown in figure 3.1 a.

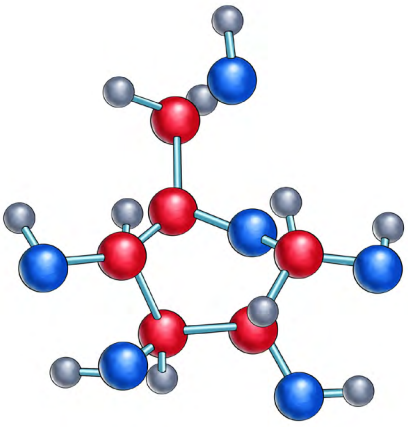
When multisubunit sugars are composed of many different branching chains of sugar monomers, they are called complex carbohydrates. Complex carbohydrates are found in vegetables, breads, legumes and pasta *(Belk and Maier pages 56-57).*

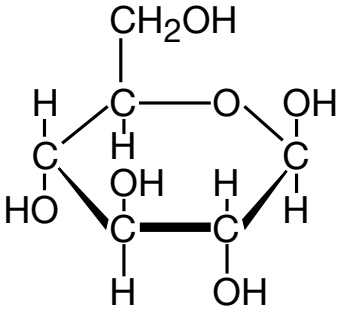
Activity

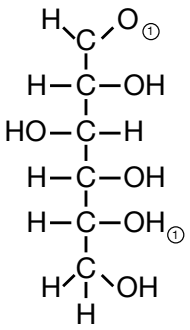
1 Introduction

What do these images have in common?









Read this short article on how scientists think from *Science Daily*

Sep. 22, 2009 — http://www.sciencedaily.com/releases/2009/09/090921162150.htm.

Sep. 22, 2009 — Profound discoveries and insights on the frontiers of science do not burst out of thin air but often arise from incremental processes of weaving together analogies, images, and simulations in a constrained fashion. In cutting-edge science, problems are often ill-defined and experimental data are limited.

To develop an understanding of the system under investigation, scientists build real-world models and make predictions with them. The models are tentative at first, but over time they are revised and refined, and can lead the community to novel problem solutions. Models, thus, play a big role in the creative thinking processes of scientists.

Dr. Nancy J. Nersessian has studied the cognitive processes that underlie scientific creativity by observing scientists at work in their laboratories. She says, “Solving problems at the frontiers of science involves complex cognitive processes. In reasoning with models, part of the process occurs in the mind and part in the real-world manipulation of the model. The problem is not solved by the scientist alone, but by the scientist – model combination. This is a highly creative cognitive process.” Her research is published in an upcoming issue of *Topics in Cognitive Science*.

Her study of the working methods of scientists helps in understanding how class and instructional laboratory settings can be improved to foster creativity, and how new teaching methods can be developed based on this understanding. These methods will allow science students to master model-based reasoning approaches to problem solving and open the field to many more who do not think of themselves as traditional “scientists.” (http://www.sciencedaily.com/releases/2009/09/090921162150.htm)

REFLECT: Write down the two related words that are the most important in this piece.

Word 1:

Word 2:

Briefly explain your thinking in selecting these two words:

Activity
2 Reading Science Claims

Oxygizer

First read the first Savvy Reader section from Belk and Maier.

Savvy Reader Detox Drinks

A Clear Winner in the Feel-Good Stakes | *By Caroline Stacey* | *The Independent* (London) | January 3, 2004

So you thought water was just a drink? Think again. It's a lifestyle choice. We can all safely drink our litre or more a day straight from the tap. But where's the cachet or the profit in that? It's almost as free as air. And wonderful and hydrating though tap water is, the latest bottled waters offer so much more—to make you sportier, healthier, and less hungover.

With Oxygizer you pay for air and water together. It's oxygenated, but not fizzy. Bottled in the Tyrolean mountains by a company based in Innsbruck, Austria, it describes itself as "a sip of fresh air." Already big in the Middle East—where water's a more precious commodity than it is here—it has been launched in Europe and now in the UK.

Oxygizer doesn't just slake a thirst, it provides the body with extra oxygen too. A litre contains 150 mg of oxygen, around 25 times more than what's in a litre of tap water. This apparently helps remove toxins and ensures a stronger immune system, as well as assisting the respiratory system so you recover better from exercise. Some claim detox benefits, it helps hangovers, and even enhances flavours to make food taste better.

1. List the claims made by this article. Is there enough information presented in this article to back up the claims made?
2. Use the appropriate questions in the checklist provided in Chapter 1, Table 1.2, to evaluate this newspaper article. What types of information are missing from this article?
3. Is any data presented to substantiate the claim that oxygenated water improves health?

Abstract

It has been asserted that the consumption of oxygenated water can support physical working capacity. As this has not been accurately investigated yet we analyzed effects of a two-week period of daily O_2-water ingestion on spiroergometric parameters and lactate metabolism in healthy adults. Twenty men (24 ± 2.5 years of age) with comparable aerobic abilities performed four exhaustive bicycle spiroergometric tests. Applying a double-blind crossover study design, 10 subjects drank 1.5 liters of highly oxygenated water every day during the two weeks between the initial two tests whereas the other group consumed 1.5 liters untreated water from the same spring. After a two-week wash-out period subjects underwent a second period consuming the opposite type of water. Spiroergometric parameters and lactate kinetics between both groups at submaximal and maximal levels were analyzed using a MANOVA. Results showed no significant influence on aerobic parameters or lactate metabolism, neither at submaximal nor at maximal levels (all p-values ≥ 0.050). Merely increments of $V \cdot EO_2$ at submaximal levels were demonstrable ($p = 0.048$). We conclude that the consumption of oxygenated water does not enhance aerobic performance or lactate kinetics in standardized laboratory testing.

Does Oxygenated Water Support Aerobic Performance and Lactate Kinetics?

V. Leibetseder, G. Strauss-Blasche, W. Marktl, C. Ekmekcioglu. Int J Sports Med 2006; 27(3): 232-235

DOI: 10.1055/s-2005-865633

Please reread the two Savvy Reader articles from Belk and Maier and use the checklist on the next page to evaluate the news report.

Oxygizer

Now read a second Oxygizer article from Belk and Maier. We will examine both the claims and the research abstract from the article that the developers of the drink used to substantiate their claims.

Savvy Reader Oxygizer Improves Performance?

The Savvy Reader feature in Chapter 2 introduced you to the oxygenated water beverage Oxygizer. In addition to making many other claims, the author of the newspaper article wrote that drinking Oxygizer would "assist the respiratory system so you recover better from exercise." The following is an excerpt from the website of the company that produces Oxygizer: "Oxygizer improves performance during periods of high physical stress and the resulting regenerative phase. Univ. Prof. Dr. Wolfgang Marktl (Head of Science at the Institute of Medical Physiology at Vienna University) and his research team have completed their scientific tests. Using a randomised double-blind study, these tests have proven the effective influence and effect of Oxygizer on the body's performance capability."

This is pretty compelling writing and may convince some to purchase this oxygenated water. However, let's also look at an excerpt from the actual scientific study performed by Dr. Marktl and published in the *International Journal of Sports Medicine* in March 2006. "Results showed no significant influence on aerobic parameters or lactate metabolism, neither at submaximal nor at maximal levels. We conclude that the consumption of oxygenated water does not enhance aerobic performance."

1. Does it appear that the author of the newspaper article read the actual study or the promotional material only?
2. How are claims made in the newspaper and on websites different from claims made by authors of articles published in scientific journals?
3. The Oxygizer website also includes some data (http://www.oxygizer.com/default.aspx?lngId=2) that seem to support their claims. Private companies can hire their own scientists to perform studies that often have results that differ from those of government and university-sponsored scientists. Would you be more skeptical of results produced by scientists hired by the company whose product they are testing or scientists who work for the government or a University?
4. Carefully consider the following two sentences from the Oxygizer website: "Univ. Prof. Dr. Wolfgang Marktl (Head of Science at the Institute of Medical Physiology at Vienna University) and his research team have completed their scientific tests. Using a randomised double-blind study, these tests have proven the effective influence and effect of Oxygizer on the body's performance capability." Each of these sentences, read separately, is true. Dr. Marktl and his team did complete their tests, and the Oxygizer scientists did produce data showing increased performance capability. However, placed adjacent to each other, these sentences seem to be indicating that Dr. Marktl's university-sponsored research came up with results that were actually produced by the Oxygizer scientists. Do you think this is a willful attempt to deceive potential customers? Most people don't have time to do such a thorough analysis of every newspaper article they read. This is why it is helpful to develop a general level of skepticism about most product claims.

Savvy Reader (continued)

TABLE 1.2 **A guide for evaluating science in the news.** *For each question, check the appropriate box.*

Question	Possible answers: Preferred answer		Raises a red flag	
1. What is the basis for the story?	Hypothesis test	◯	Untested assertion *No data to support claims in the article.*	◯
2. What is the affiliation of the scientist?	Independent (university or government agency)	◯	Employed by an industry or advocacy group *Data and conclusions could be biased.*	◯
3. What is the funding source for the study?	Government or nonpartisan foundation (without bias)	◯	Industry group or other partisan source (with bias) *Data and conclusions could be biased.*	◯
4. If the hypothesis test is a correlation: Did the researchers attempt to eliminate reasonable alternative hypotheses?	Yes	◯	No *Correlation does not equal causation. One hypothesis test provides poor support if alternatives are not examined.*	◯
If the hypothesis test is an experiment: Is the experimental treatment the only difference between the control group and the experimental group?	Yes	◯	No *An experiment provides poor support if alternatives are not examined.*	◯
5. Was the sample of individuals in the experiment a good cross section of the population?	Yes	◯	No *Results may not be applicable to the entire population.*	◯
6. Was the data collected from a relatively large number of people?	Yes	◯	No *Study is prone to sampling error.*	◯
7. Were participants blind to the group they belonged to and/or to the "expected outcome" of the study?	Yes	◯	No *Subject expectation can influence results.*	◯
8. Were data collectors and/or analysts blinded to the group membership of participants in the study?	Yes	◯	No *Observer bias can influence results.*	◯
9. Did the news reporter put the study in the context of other research on the same subject?	Yes	◯	No *Cannot determine if these results are unusual or fit into a broader pattern of results.*	◯
10. Did the news story contain commentary from other independent scientists?	Yes	◯	No *Cannot determine if these results are unusual or if the study is considered questionable by others in the field.*	◯
11. Did the reporter list the limitations of the study or studies on which he or she is reporting ?	Yes	◯	No *Reporter may not be reading study critically and could be overstating the applicability of the results.*	◯

Evaluation Chart

Source

5 hour energy ad

Claim	Evaluation	Conclusion

Source

Oxygizer Chapter Two article

Claim	Evaluation	Conclusion

Source

Oxygizer Chapter Three article

Claim	Evaluation	Conclusion

Source

Oxygizer research abstract

Claim	Evaluation	Conclusion

Other notes

Activity

3 Introducing the Task

Nutrition Final Project Directions:

Prompt: How does the scientific community communicate important information to a lay audience? After researching scientific articles, journals and websites on important topics in nutrition, write an informational pamphlet in which you explain the issues, causes, problems and possible solutions to the public. Support your position with evidence from the texts.

Purpose: Your purpose is to create an informational pamphlet or brochure about a topic related to nutrition and diet using science research to support your claims.

A pamphlet is considered to be gray literature, which is literature hard to find using conventional methods. Gray literature is an important type of scientific literature because it provides recent information, information found within the last 12 to 18 months, and includes up-to-date research. Gray literature, like the pamphlet, should be easy to understand for a lay audience. Even though you are communicating the information in a more simplified way, you must understand the science concepts fully to be able to explain them to others. You will need to cite your sources and include them in a works cited page, so that if the reader wishes to read for more detailed information it will be available to them.

In this project, you will select a topic about nutrition or diet that you think the public needs to know more about. It should be a timely issue that would resonate with people interested in finding out more about said topic.

The topics should be debatable. That is, reasonable people may have differing views about the topic. The topic should be narrow and focused enough to investigate for this assignment. For example, nutrition-related diseases is too broad a topic and could be a book instead of a pamphlet. Instead, you might want to focus on one nutrition-related disease in particular.

You will need to bring 10 copies of your pamphlet for class presentations.

You will need to include at least five sources to use in your work. To help you read and organize the material you will take notes on each source in your Academic Notebook.

Finding Articles for the Final Project: Articles can be found in many different places including journals, magazines, newspapers, and websites. Popular journals, such as *Scientific American*, are aimed at the general public. The articles are written by journalists, who have consulted with experts, to be accessible by the public. Peer-reviewed journals contain articles written by experts aimed at experts. The reader is expected to know the basics on the topic covered in the article. For the final project, we are going to focus on popular journals, magazines, newspapers and websites.

Example websites and journals:

- http://www.scientificamerican.com/.
- http://news.sciencemag.org/.
- http://www.mayoclinic.com/.
- http://www.nih.gov.

To format your pamphlet, you will use a four-column layout. This will give you a total of eight panels to use to explain your information. How you organize the information in your pamphlet will depend upon your topic. A sample layout is shown below—be sure to include all of the elements in your pamphlet. Fold the paper so that the title page will be on the front and the works cited will be on the back when the pamphlet is folded and ready to be read. The layout will need to be printed on legal sized paper. The four-column layout will give you more room to include the information from your sources. You can use Microsoft Word or Microsoft Publisher to complete the pamphlet.

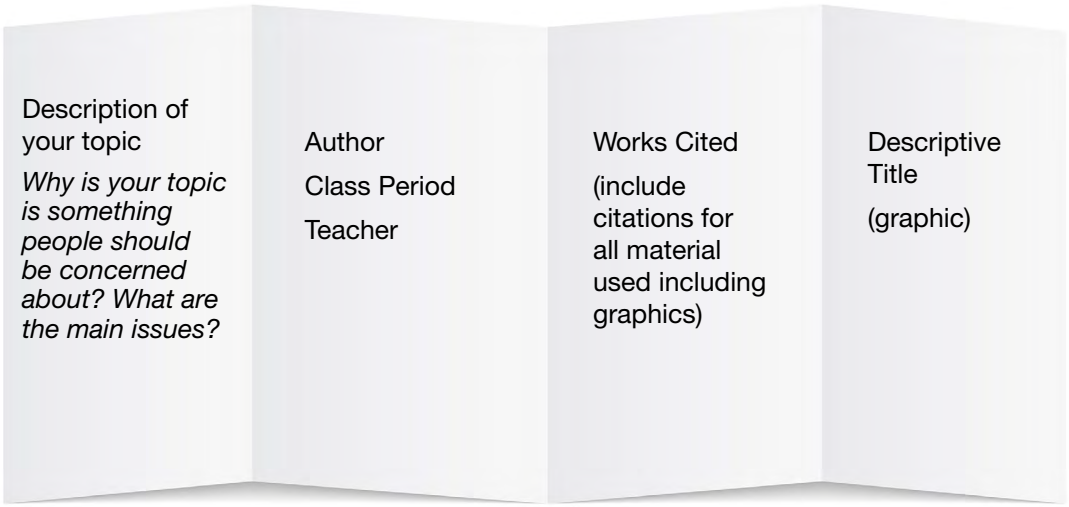
Microsoft Word Directions:

- Open Microsoft Word.
- Go to File, then Page Setup and then choose Landscape (under the Margins Tab).
- While you are there, change the top and bottom margins to one inch. Change the right and left margins to 0.5 inches.
- Click on the Paper Tab while in Page Setup and choose Legal.
- Next choose Format, then click on columns and then choose Four.

Microsoft Publisher Directions

- Open Microsoft Publisher.
- Click on Publications for print.
- Click on Brochures.
- Choose from the Informational Brochures section.
- Once the brochure is chosen, on the left hand side of the screen, click on four-panel.

Side One



Side Two

Grading Rubric

Category	Excellent	Good	Almost	Not Yet
Attractiveness & Organization (Organization)	Exceptionally attractive formatting and well-organized information.	Attractive formatting and well-organized information.	Well-organized information.	Formatting and organization of material are confusing to the reader.
Content - Accuracy (Ideas)	The science is exceptionally well explained including all relevant information.	The science is well explained including all relevant information.	The science is explained including most relevant information.	The pamphlet has little of the required information.
Writing - Mechanics (Conventions)	No errors.	No major errors, one to two minor errors.	Has some major and minor errors.	Has some major and minor errors.
Scientific language and terminology	Used carefully throughout the pamphlet in ways the public can understand.	Used in most of the pamphlet in ways the public can understand.	Is used, but is confusing for readers.	Is not used.
Graphics/ Pictures	The graphics go well with the text and there is a good mix of text and graphics.	The graphics go well with the text, but there are so many that they distract from the text.	The graphics go well with the text, but there are too few.	The graphics do not go with the accompanying text or appear to be randomly chosen.
Sources	Carefully chosen, excellent sources that provide a full picture of the issues involved in the topic.	Carefully chosen sources that provide a good picture of the issues involved in the topic.	Sources do not provide a full picture of the issues involved in the topic.	Incomplete sources.
Citations	No errors in APA style.	Few errors in APA style.	Many errors in APA style.	APA style not used.

ELEMENTS OF AN EFFECTIVE PAMPHLET

1. The pamphlet my group analyzed:

2. What was the purpose of the pamphlet? Who is the writer?

3. Who was the intended audience? How can you tell?

4. How was the information presented? Were there directions? A call to action?

5. What kind of vocabulary was used in the pamphlet? (Technical, scientific, general?) How did the language choice impact the message?

6. How were science concepts explained?

7. Which of the following text features were contained in the pamphlet? Which ones were particularly effective?

Print Features	Organizational Aids	Graphic Aids	Illustrations
• font • italics • bold print • colored print • bullets • titles • headings • subheadings • labels • sidebars • text boxes • captions	• table of contents • index • glossary • preface • pronunciation guide • appendix	• diagrams • sketches • graphs • comparisons • figures • maps • charts • tables • cross-sections • timelines • overlays	• colored photographs • colored drawings • black & white photographs • black & white drawings • labeled drawings • enlarged photo-graphs

My Topic Idea:

This is an important topic because:

What I need to find out:

What I want to let the public know about:

Understanding the final project: In your own words, summarize the task.

Project Planning Timeline

Make a plan for completing the project by the due date. Be sure to include deadlines for finding and reading your sources, and creating a final draft to be discussed in class.

Project Title:

What will be done?	By when?	What resources will I need?	What goals do I have?	Notes

Lesson 2
Close Reading in the Sciences: Nutrition

In this lesson, you will . . .

- Explain the processes involved while reading in the sciences.
- Learn about how to approach both general and discipline-specific vocabulary.
- Learn about and practice close reading with a college-level science chapter on nutrition.

Activity 3

Annotational Close Reading

Reading Science Text

(Adapted from Nist-Olejnik & Holschuh, 2013).

In science textbooks, you will find many new terms and definitions. Often, the terms introduced in early chapters will be used later in the text to define other terms. So you need to be sure you understand the new terms as they appear to avoid trouble understanding future reading. Science textbooks also discuss proven principles and theories in terms of their relationship to each other. Therefore, it is important to be aware of and understand how the theories connect and how they explain the science concepts you are learning.

Concepts in science textbooks are usually presented sequentially, which means the concepts build on each other. Your best plan is to test yourself as you read to make sure you fully understand each concept. It is also helpful to create reading goals to monitor what you are learning. This means that rather than focusing on getting through a chapter, focus on learning concepts every time you read. Adopt a scientific approach and ask yourself questions such as:

- What data supports this concept or theory?
- What other theories is this concept related to?
- How does this phenomenon work? What is the scientific process involved?
- Why does this phenomenon occur?
- What does it show us?

It is also important to pay attention to the diagrams in each chapter. They are there to help you picture the science process so that you can see what is happening. Understanding diagrams is crucial to doing well in most science courses.

Gearing Up for Reading

To gear up for reading, start by reading the chapter title and thinking about what you already know about that concept. Focus on primary and secondary headings to understand how the chapter is organized and how the ideas are related together. If your text has an outline of topics at the beginning of each chapter, use it to help you think about the key points. If not, skim through the chapter for key terms and think about how they are related to the appropriate heading or subheading. Pay special attention to diagrams and figures, and think about how they relate to the overall focus of the chapter. Finally, read the chapter objectives and guiding questions if your textbook has these features.

What and How to Annotate During Reading

Because of the large amount of new terminology involved in learning science, it is important for you to read your science textbooks before class. In this way, you will be familiar with the terms and concepts discussed in the text and you will be able to build your understanding of the concepts as you listen in class. It is also a good idea to connect the concepts discussed in class with the concepts described in your text by comparing your lecture notes to your text annotations each time you read. This will help you follow the flow of the concepts and will help you understand how the ideas are connected.

When you annotate your science text, you need to match your annotations to the course expectations. For example, if you are expected to think at higher levels, be sure your annotations include more than just the bold-faced terms. If you are expected to be able to explain science processes, be sure your annotations help you learn to do just that.

In general, it is a good idea to limit the amount of material you annotate. Annotate big concepts and save the details for your rehearsal strategies. A big mistake that students make when annotating science is that they tend to annotate too much. It is also essential to focus on putting the ideas into your own words. This will help you monitor your understanding of what you have read and will keep you from copying exactly from the text. In addition, look for experiments and results or conclusions drawn from scientific theories, and seek to make connections between the experiments and the concepts they generate.

Science texts often contain diagrams or charts to explain concepts. Because science exams usually contain questions about the concepts described in diagrams or charts, you must be able to read and understand each one. As you read your text, annotate the diagrams and take the time to reflect on what they are depicting. A good self-testing strategy to make sure you fully understand the concept is to cover up the words in the diagram and try to talk through the information. If you can explain how the concept works, you've shown that you understand it. If you find that you cannot explain it, reread your annotations or the diagram text to be sure you understand the key points.

In the annotation example on the next page, notice how the annotations focus on explaining the concepts rather than just memorizing the terms.

Example of Annotations in a Science Textbook

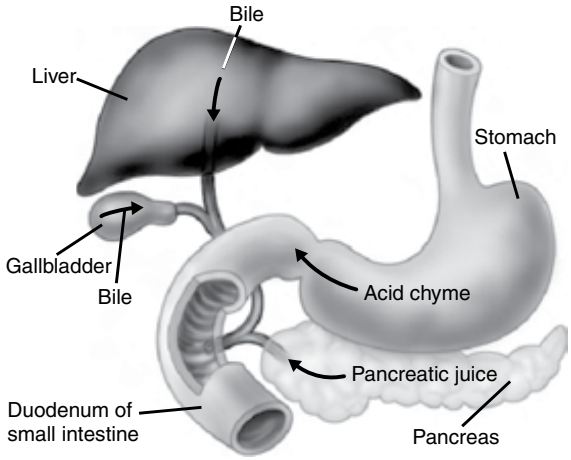


Figure 22.12
The duodenum. Acid chyme squirted from the stomach into the duodenum (the beginning of the small intestine) is mixed with pancreatic juice, bile from the liver and gallbladder, and intestinal juice produced by the duodenal lining itself. As peristalis propels the mix along the small intestine, hydrolases break food molecules down to their monomers.

The duodenum receives digestive juices from the pancreas, liver, and gallbladder (**Figure 22.12**). The **pancreas** is a large gland that secretes pancreatic juice into the duodenum via a duct. Pancreatic juice neutralizes the stomach acids that enter the duodenum and contains hydrolases that participate in the chemical digestion of carbohydrates, fats, proteins, and nucleic acids.

Bile is a juice produced by the **liver**, stored in the **gallbladder**, and secreted through a duct into the duodenum. Bile contains no digestive enzymes but does have substances called bile salts that make fats more accessible to lipase. Fats, including those from the cheese of the pizza we're following, are a special problem for the digestive system because they do not dissolve in water. The fats in chyme start out as relatively large globules. Only those molecules on the surface of the globules are in contact with the lipase dissolved in the surrounding solution. Agitation from the rhythmic contraction of muscles in the intestinal wall breaks the fat globules into small droplets, but without the help of bile salts, those droplets would quickly fuse again into larger globules that would be difficult to digest. Through a process called emulsification, bile salts essentially coat the tiny fat droplets and prevent them from fusing. Similarly, emulsification by a chemical additive helps keep oil permanently mixed with vinegar in some commercial salad dressings.

The intestinal lining itself also aids in enzymatic digestion by producing a variety of hydrolases. The cumulative activities of all these hydrolytic enzymes break the different classes of food molecules completely down into monomers, which are now ready for absorption into the body.

Absorption of Nutrients Wait a minute! The previous sentence said that nutrients "are now ready for absorption by the body." Aren't these nutrients already in the body? Not really. The alimentary canal is a tunnel running through the body, and its cavity is continuous with the great outdoors. The doughnut analogy in **Figure 22.13** should convince you that this is so. Until nutrients actually cross the tissue lining of the alimentary canal to enter the bloodstream, they are still outside the body. If it were not for nutrient absorption, we could eat and digest huge meals but still starve to death, in a sense.

Most digestion is complete by the time our pizza meal reaches the end of the duodenum. The next several meters of small intestine (called the jejunum and the ileum) are specialized for nutrient absorption. The structure of the intestinal lining, or epithelium, fits this function (**Figure 22.14**). The surface area of this epithelium is huge—roughly 300m^2, equal to the floor space of a one bedroom apartment. The intestinal lining not only has large folds, like the stomach, but also fingerlike outgrowths called villi, which makes the epithelium something like the absorptive surface of a fluffy bath towel. Each cell of the epithelium adds even more surface by having microscopic projections called microvilli. Across this expansive surface of intestinal epithelium, nutrients are transported into the network of small blood vessels and lymphatic vessels in the core of each villus.

Digestion Sm Intestine
- when food reaches sm int. it has been thru mech. and chem. digestion
- hydrolisis is initiated

Duodendum
1st ft. of sm int.
- where food is broken into monomers
- gets digest. juice from pancreas (pancreatic juice via duct—neutralizes stomach acid & contains hydrolases for chem digest), liver (bile), gallbladder (where bile is stored and via duct)
- Bile salts—make fats accessible to lipase thru **emulsification**—bile salts coat fat droplets to keep them separated (like oil and water in dressing) Int. lining produces hydrolases to get food ready for absorption

Absorption
Nutrients don't really 'enter' body until entering bloodstream. Nut abs occurs in jejunum and ileum (next parts of sm int.)
Epithelium—int. lining (huge—300m^2, folded, and has villi). Very absorptive. Each cell has microvilli—all help transport nutrients

The Annotation System of Text Marking

What is Annotation?

- Writing brief summaries in the textbook's margin.
- Enumerating multiple ideas (i.e., causes, effects, reasons characteristics).
- Sketching pictures or charts to explain difficult processes/concepts.
- Writing possible test questions.
- Noting puzzling or confusing ideas that need clarification.
- Underlining key ideas.

Why Should I Annotate?

- It will improve your concentration so you will not become distracted and have to re-read.
- It can provide an immediate self-check for your understanding of the textbook's key ideas.
- It will help you remember more.
- It can assist you in test preparation.
- It will negate the need of time spent in re-reading the chapters.
- It will help you state ideas in your words.

What should I annotate?

- Definitions.
- Lists, features, causes, effects, reasons, characteristics.
- Diagrams and Processes.
- Examples of main idea.
- Good summaries.
- Possible test questions.
- Something you do not understand.

Four Types of Vocabulary Encountered in Science Texts

1. **Discipline specific vocabulary:**

   These are content area words like *polymer* or *macromolecule* that help students understand the content they are reading—these are often the boldface words in science texts.

2. **Words that help you discuss the discipline:**

   These are words that discipline experts use when they practice the discipline such as *hypothesis*, *theory*, *model*, *process* and *evidence*.

3. **General academic vocabulary:**

   These are difficult words that can be used in any discipline, like *expediency*, *plethora* and *enumerate*.

4. **General vocabulary used in a discipline-specific way:**

   These are words that have general meanings and specific meanings in a discipline. "Class" in history means something different than "class" in science.

SCIENTIFIC ROOT WORDS, PREFIXES AND SUFFIXES

(http://www.succeedinscience.com/apbio/assignments/generalinfo/rootwords.pdf)

a-; an- ab- -able	not; without; lacking; deficient away from; out from capable of	cente- centi- centr-	pierce; hundredth; center	-err- erythro- -escent	wander; go astray red; becoming
ac-	to; toward	cephal-	head	eso-	inward; within; inner
-aceous	of or pertaining to	cerat-	horn	eu-	well; good; true; normal
acou-; acous -	hear	cerebr-	brain	eury-	widen
ad-	to; toward	cervic-	neck	ex-	out of; away from
aden-	gland	chel-	claw	extra-	beyond; outside
adip-	fat	chem-	dealing with chemicals	-fer-	bear; carry; produce
aero-	air	chir-	hand	ferro-	iron
agri-	field; soil	chlor-	green	fibr-	fiber; thread
-al	having the character of	chondr-	cartilage	-fid; fiss-	split; divided into
alb-	white	chrom-; -chrome	color	-flect; -flex	bend
alg-; -algia	pain	chron-	time	flor-	flower
alto-	high	-chym-	juice	flu-; fluct-; flux	flow
ambi-	both	-cid-; -cis -	cut; kill; fall	foli-	leaf
ameb-	change; alternation	circa-; circum-	around; about	fract-	break
amni-	fetal membrane	cirru-	hairlike curls	-gam-	marriage
amphi-; am-pho-	both	co-	with; together	gastr-	stomach
amyl-	starch	cocc-	seed; berry	geo-	land; earth
ana-	up; back; again	coel-	hollow	-gen; -gine	producer; former
andro-	man; masculine	coll-	glue	-gene-	origin; birth
anemo-	wind	coni-	cone	-gest-	carry; produce; bear
ang-	choke; feel pain	contra-	against	-glen-	eyeball
angi-	blood vessel; duct	corp-	body	-glob-	ball; round
ante-	before; ahead of time	cort-; cortic-	outer layer	gloss-	tongue
anter-	front	cosmo-	world; order; form	gluc-; glyc-	sweet; sugar
antho-	flower	cotyl-	cup	glut-	buttock
anti-	against; opposite	counter-	against	gnath-	jaw
anthropo-	man; human	crani-	skull	-gon	angle; corner
-ap-; -aph-	touch	cresc-; cret-	begin to grow	-grad-	step
apo-; ap-	away from	crypt-	hidden; covered	-gram; graph	record; writing
aqu-	water	-cul-; -cule	small; diminutive	grav-	heavy
archaeo-	primitive; ancient	cumul-	heaped	-gross-	thick
-ary; -arium	place for something	cuti-	skin	gymno-	naked; bare
arteri-	artery	cyan-	blue	gyn-	female
arthr-	joint; articulation	-cycle; cycl-	ring; circle	gyr-	ring; circle; spiral
-ase	forms names of enzymes	-cyst-	sac; pouch; bladder	-hal-; -hale	breathe; breath
aster-; astr-	star	cyt-; -cyte	cell; hollow container	halo-	salt
-ate	verb form - the act of...	dactyl-	finger	hapl-	simple
ather-	fatty deposit	de-	away from; down	hecto-	hundred
-ation	noun form - the act of...	deca-	ten	-helminth-	worm
atmo-	vapor	deci-	tenth	hem-	blood
audi-	hear	deliquesc-	become fluid	hemi-	half
aur-	ear	demi-	half	hepar-; hepat-	liver
auto-	self	dendr-	tree	herb-	grass; plants
bacter-; bactr-	bacterium; stick; club	dent-	tooth	hetero-	different; other
barb-	beard	derm-	skin	hex-	six
baro-	weight	di-; dipl- (Latin)	two; double	hibern-	winter
bath-	depth; height	di-; dia- (Greek)	through; across; apart	hidr-	sweat
bene-	well; good	dia- (Latin)	day	hipp-	horse
bi- (Latin)	two; twic e	digit-	finger; toe	hist-	tissue
bi-; bio- (Greek)	life; living	din-	terrible	holo-	entire; whole
-blast-	sprout; germ; bud	dis-	apart; out	homo- (Latin)	man; human

brachi-	arm	dorm-	sleep	homo- (Greek)	same; alike
brachy -	short	dors-	back	hort-	garden
brady-	slow	du-; duo-	two	hydr-	water
branchi-	fin	-duct	lead	hygr-	moist; wet
brev-	short	dynam-	power	hyper-	above; beyond; over
bronch-	windpipe	dys-	bad; abnormal; difficult	hyph-	weaving; web
cac-	bad	ec-	out of; away from	hypno-	sleep
calor-	heat	echin-	spiny; prickly	hypo-	below; under; less
capill-	hair	eco-	house	hyster-	womb; uterus
capit-	head	ecto-	outside of	-iac	person afflicted with disease
carcin-	cancer	-elle	small	-iasis	disease; abnormal condition
cardi-	heart	-emia	blood	-ic	(adjective former)
carn-	meat; flesh	en-; endo-; ent-	in; into; within	ichthy-	fish
carp-	fruit	-en	made of	ign-	fire
carpal-	wrist	encephal-	brain	in-; il-; im-; ir-	not
cata-	breakdown; downward	enter-	intestine; gut	in-; il-; im-; ir-	to; toward; into
caud-	tail	entom-	insects	in-	very; thoroughly
-cell-	chamber; small room	-eous	nature of; like	-ine	of or pertaining to
cen-; -cene	now; recent	epi-	upon; above; over	infra-	below; beneath
inter- intra-	between within; inside	-oma omni-	abnormal condition; tumor; all	sacchar- sapr-	sugar rotten
-ism	a state or condition	onc-	mass; tumor	sarc-	flesh
iso-	equal; same	oo-	egg	saur-	lizard
-ist	person who deals with...	opthalm-	eye	schis -; schiz-	split; divide
-itis	inflammation; disease	opt-	eye	sci-	know
-ium	refers to a part of the body	orb-	circle; round; ring	scler-	hard
-kary-	cell nucleus	-orium; -ory	place for something	-scop-	look; device for seeing
kel-	tumor; swelling	ornith-	bird	-scribe; -script	write
kerat-	horn	orth-	straight; correct; right	semi-	half; partly
kilo-	thousand	oscu-	mouth	sept-	partition; seven
kine-	move	-osis	abnormal condition	-septic	infection; putrefaction
lachry-	tear	oste-	bone	sess-	sit
lact-	milk	oto-	ear	sex-	six
lat-	side	-ous	full of	-sis	condition; state
leio-	smooth	ov-	egg	sol-	sun
-less	without	oxy-	sharp; acid; oxygen	solv-	loosen; free
leuc-; leuk-	white; bright; light	pachy -	thick	som-; somat-; -	body
lign-	wood	paleo-	old; ancient	somn-	sleep
lin-	line	palm-	broad; flat	son-	sound
lingu-	tongue	pan-	all	spec-; spic-	look at
lip-	fat	par-; para-	beside; near; equal	-sperm-	seed
lith-; -lite	stone; petrifying	path-; -pathy	disease; suffering	-spher-	ball; round
loc-	place	-ped-	foot	spir-; -spire	breathe
-log-	word; speech	-ped-	child	-spor-	seed
-logist	one who studies...	pent-	five	stat-; -stasis	standing; placed; staying
-logy	study of...	per-	through	stell-	stars
lumin-	light	peri-	around	sten-	narrow
-lys-; -lyt-; -lyst	decompose; split; dissolve	permea-	pass; go	stern-	chest; breast

macr-	large	phag-	eat	stom-; -stome	mouth
malac-	soft	pheno-	show	strat-	layer
malle-	hammer	-phil-	loving; fond of	stereo-	solid; 3-dimensional
mamm-	breast	phon-; -phone	sound	strict-	drawn tight
marg-	border; edge	-phore; pher-	bear; carry	styl-	pillar
mast-	breast	photo-	light	sub-	under; below
med-	middle	phren-	mind; diaphragm	super-; sur-	over; above; on top
meg-	million; great	phyc-	seaweed; algae	sym-; syn-	together
mela-; melan-	black; dark	phyl-	related group	tachy-	quick; swift
-mer	part	-phyll	leaf	tarso-	ankle
mes-	middle; half; intermediate	physi-	nature; natural qualities	tax-	arrange; put in order
met-; meta-	between; along; after	phyt-; -phyte	plant	tele-	far off; distant
-meter; -metry	measurement	pino-	drink	telo-	end
micro-	small; millionth	pinni-	feather	terr-	earth; land
milli-	thousandth	plan-	roaming; wandering	tetr-	four
mis-	wrong; incorrect	plasm-; -plast-	form; formed into	thall-	young shoot
mito-	thread	platy-	flat	-the-; -thes-	put
mole-	mass	pleur-	lung; rib; side	-thel-	cover a surface
mono-	one; single	pneumo-	lungs; air	-therm-	heat
mort-	death	-pod	foot	-tom-	cut; slice
-mot-	move	poly-	many; several	toxico-	poison
morph-	shape; form	por-	opening	top-	place
multi-	many	port-	carry	trache-	windpipe
mut-	change	post-	after; behind	trans-	across
my-	muscle	pom-	fruit	tri-	three
myc-	fungus	pre-	before; ahead of time	trich-	hair
mycel-	threadlike	prim-	first	-trop-	turn; change
myria-	many	pro-	forward; favoring; before	-troph-	nourishment; one who feeds
moll-	soft	proto-	first; primary	turb-	whirl
nas-	nose	pseudo-	false; deceptive	-ul-; -ule	diminutive; small
necr-	corpse; dead	psych-	mind	ultra-	beyond
nemat-	thread	pter-	having wings or fins	uni-	one
neo-	new; recent	pulmo-	lung	ur-	urine
nephro-	kidney	puls-	drive; push	-ura	tail
-ner-	moist; liquid	pyr-	heat; fire	vas-	vessel
neur-	nerve	quadr-	four	vect-	carry
noct-; nox-	night	quin-	five	ven-; vent-	come
-node	knot	radi-	ray	ventr-	belly; underside
-nom-; -nomy	ordered knowledge; law	re-	again; back	-verge	turn; slant
non-	not	rect-	right; correct	vig-	strong
not-	back	ren-	kidney	vit-; viv-	life
nuc-	center	ret-	net; made like a net	volv-	roll; wander
ob-	against	rhag-; -rrhage	burst forth	-vor-	devour; eat
ocul-	eye	rhe-; -rrhea	flow	xanth-	yellow
oct-	eight	rhin-	nose	xero-	dry
odont-	tooth	rhiz-	root	xyl-	wood
-oid	form; appearance	rhodo-	rose	zo-; -zoa	animal
olf-	smell	roto-	wheel	zyg-	joined together
oligo-	few; little	rubr-	red	zym-	yeast

Activity
4

Week 1
Weekly Reflection

Reflect on your experience:

1. Think about the science. What would scientists pay attention to if they were looking at a new energy drink on the market?

2. Think about your learning. How will this experience change the way you approach reading in the sciences?

3. Think about how using annotation impacted the way you read in science? What do you like about the strategy? What do you dislike about it?

Lesson 3
Analogies in Science

In this lesson, you will . . .

- Read, understand and apply science concepts to a health-related case.
- Read across texts in multiple representations and make connections between text, diagram and animation information.
- Present case study results in a short presentation to peers indicating an understanding of how to make science knowledge public.

Activity

1 Chemical Reaction Simulation

Now that you have learned about the nutrients your body needs to maintain itself and how the body attempts to obtain those nutrients, please respond to the following questions:

What has to happen to the food we eat in order to supply our cells with the nutrients they need?

How does this happen?

Chemical Reaction Simulation

Round 1:

Total Time to complete all chemical reactions:

In this simulation, each person represented a reactant. How did they find the other reactant that they were meant to undergo a chemical reaction with?

How does this serve as an analogy for chemical reactions?

How would you describe the rate of this reaction?

Chemical Reaction Simulation

Round 2:

Total Time to complete all chemical reactions:

How were the parameters of the "chemical reaction" changed in this round?

Based on this information, how do you think enzymes speed up chemical reactions?

Chemical Reaction Simulation

Round 3:

Total time to complete all chemical reactions:

How were the parameters of the "chemical reaction" changed in this round?

Based on this information, how do you think enzymes speed up chemical reactions?

Form a hypothesis to predict what might happen if the enzyme were absent in one of the enzyme/substrate systems.

Activity

2 Annotation of Text and Model Analysis

Connecting the Digestive Process

1. In your reading, what is the energy source for all the functions of cells?

Why do you think it is important for your body to store excess glucose?

2. Think of a process that could serve as an analogy for the digestive process. Describe your analogy, and explain how your analogy compares to digestion.

3. Re-examine the “Art Connection” diagram of digestion on page 1000 of your text. Answer the multiple choice question posed in Figure 34.19. Explain your answer and identify the evidence in the text that supports your answer.

4. What does “Hydrophopbic” mean? Why are lipids called hydrophobic substances?

5. What is the role of hormones in the digestive process?

Activity

3 Synthesis and Application

Lactose Intolerance Case Study

Visit the Mayo Clinic Website to answer the following questions:

1. Define lactose intolerance

2. What are the symptoms of lactose intolerance?

3. What are the causes of lactose intolerance?

Hannah, a 21 year-old female, used to enjoy eating out with friends. Over the past year, she has noticed that within an hour after she eats, she experiences bloating, abdominal cramping, gas, and diarrhea. These symptoms do not occur after every meal. For example, eating in her favorite sushi restaurant is fine as are the meals at the BBQ restaurant. Other foods always seem to bother her such as pizza or burgers. Because Hannah does not know when she will experience the symptoms, she always makes sure she eats somewhere close to home.

Why might one suspect lactose deficiency in this case?

What information helped you solve this?

Draw and label two diagrams: (1) showing the digestion of lactose when lactase is present and (2) showing the process for someone with lactose deficiency.

Week 2
Weekly Reflection

1. Think about the science. What did you learn about enzymes and calories?

2. Think about your learning. How will this experience change the way you approach reading in the sciences?

Lesson 4
Transforming Science Information

In this lesson, you will . . .

- Transform knowledge from visual to text and vice versa.
- Compare and integrate representations of science processes.
- Understand the role of models, animations and multiple representations of information in science.
- Explain science processes through discussion, writing and diagramming.

Activity

1 Reading Across Text

Notes on *Feel the Burn*. *Talk through*.

1. How did the scientists measure calories from restaurants?

a. Explain the procedure used to prepare the food.

b. Explain the procedure used to measure the food.

2. What is the difference between metabolizable energy and gross energy?

3. Based on what you read in this article, why do you think the researchers found differences between the calories reported by restaurants and their own results? Identify the location in the text that supports your explanation.

Activity

3 Understanding Animations

Visualization represents any technique for creating images to represent abstract data. One specific area of visualization is scientific visualization. In general the term "scientific visualization" is used to refer to any technique involving the transformation of data into visual information, using a well-understood, reproducible process. Scientific visualization is important because scientists understand the utility of being able to transform information from text to visual and back to text as ways to convey meaning and explain difficult or abstract processes.

Write a summary paragraph explaining the Enzyme Animation.

Write a paragraph explaining the Diffusion Animation.

Draw a labeled diagram of the process of diffusion.

Draw a diagram of Facilitated Transport based on your partner's summary.

Draw a diagram of Osmosis based on a partner's summary.

Lesson 5

Synthesizing Knowledge Gained From Text

In this lesson, you will . . .

- Clearly explain science concepts to peers.
- Learn the Cornell Method of note-taking.
- Pull concepts together from multiple sources and representations to discuss the complexity of calories.
- Develop arguments based on evidence from multiple sources.

Activity

1 Gathering Information on Health Disorders

Research your assigned health disorder and take notes below.

Health Disorder information notes:

(include information on the definition of the disorder, causes, associated risks, and treatments)

Website used for your information:

Juicy sentence to share with the class:

Notes on the reports from other groups:

Summary of BMI article:

Activity

23 Cornell Note Taking

Cornell Notes page

Cornell Notes page

Activity

3 Insulin Lecture

Lecture Note Checklist:
Please circle the appropriate number.

	5 *Always*	4	3 *Sometimes*	2	1 *Never*
The lecture notes are titled and dated.	5	4	3	2	1
The notes are easy to read.	5	4	3	2	1
The notes are organized.	5	4	3	2	1
You underline or star key ideas.	5	4	3	2	1
You utilize abbreviations of longer words.	5	4	3	2	1
You skip spaces between ideas/concepts.	5	4	3	2	1
You indent minor points.	5	4	3	2	1
You note all the important concepts	5	4	3	2	1
You paraphrase what the instructor says.	5	4	3	2	1
Your notes incorporate examples.	5	4	3	2	1
Your notes are accurate.	5	4	3	2	1
Your notes are complete.	5	4	3	2	1
Your notes include self-test questions.	5	4	3	2	1
Your self-test questions: a. Are complete.	5	4	3	2	1
b. Will prepare you for the instructor's tests.	5	4	3	2	1
c. Cover all the material from that day's lecture.	5	4	3	2	1
d. Use short-answer format.	5	4	3	2	1
e. Are appropriate for the type of tests in the class.	5	4	3	2	1
f. Combine material from multiple lecture topics into a single question.	5	4	3	2	1

Activity

4 Synthesizing Knowledge

Prompt:

Is counting calories enough for a person to maintain health? After viewing animations and lectures and reading informational articles, compare the interpretations of the role of calories and argue for the other factors that need to be considered. Be sure to support your position with evidence from the texts and videos.

Use the prompt above to show your understanding of the complexity of calories. You may use your notes from the text, articles and videos to support your stance. Think about the following:

- How could a person be overweight, but calculate a lower-than-recommended daily caloric intake? Discuss the role of metabolism, nutrients, fat and calories.

- Explain the science behind the saying, “you are what you eat,” in terms of a person’s overall health. What role does transport play?

- What factors do we need to consider when looking at someone's overall health (nutrients, enzymes, health disorders)?

- Make a recommendation for someone trying to lose weight about what they need to think about in addition to calories. What if that person had an obesity-related disease? What additional recommendations would you have?

List the text, lecture, lab or animation information that supports your stance.

Source (text, lecture, etc.)	Quote/Facts	Summary of how this information supports your stance

Lesson 6
Taking Science Quizzes

In this lesson, you will . . .

- Utilize strategies to generate your own quiz reviews.
- Learn to ask and answer higher-level questions.
- Use group-testing as a way to increase your ability to explain and understand science concepts.
- Evaluate your own quiz performance.

In this class, you will take a short quiz (15 questions). However, this quiz may work a little differently than you are used to. First, you will take the quiz individually and turn it in. Your individual quiz will count for two-thirds of your total quiz score.

Then, you will retake the same quiz with your group.

In your group, you need to discuss each question and come to a consensus regarding the appropriate answer in order to fill out a single answer sheet that you will submit as a group. The group quiz scores will count as up to one-third of your total quiz score.

To encourage everyone to participate and to prevent “free-loading” during the group quiz, you will be asked to evaluate the other members of your group on how well they contributed to group functioning. This evaluation will be used to determine how many group quiz points each student will receive. For example if a student receives an average score of 80 percent from their peers, that student would receive 80 percent of their group’s test points. (Of course, the instructor reserves the right to overrule any peer evaluation score if it appears to be inaccurate or inappropriate such as when evaluations have been biased because of personality conflicts.)

Activity 2

Preparing for Science Tests

The talk-through:

A "talk-through" is a method of preparing and reviewing for an quiz that involves you in practicing and rehearsing aloud the key ideas of a text or science process. A talk-through is very similar to a lecture that you would give someone. In fact, when giving a talk-through, you should imagine yourself as an instructor giving a lecture to students who know very little about the topic you are teaching. For example, if you know a lot about the ozone layer or how to use the IBM computer and taught your roommate or friend to understand the concept of the ozone layer or how to use the IBM computer, you have probably given a talk-through.

To create an effective talk-through:

1. Select a difficult concept from Belk and Maier Chapter Three or Four, the animations you viewed, the lectures or the articles you read thus far. Think about the important ideas involved in the concept you selected.
2. Organize the key ideas and details on an index card, but be brief—don't write everything as the card is meant only to prompt your memory.
3. Find a quiet place, close the material you are using and use your talk-through card to deliver aloud your talk-through.
4. After practicing your first talk-through, refer back to the material to be sure you included all of the key ideas and that your talk-through was accurate and complete.

Question and Answer Strategy

In this strategy, you will use the science concepts you learned so far to create 10 questions. You will use these questions to quiz your classmates over the material as a way to prepare for the quiz. Remember to include questions from the textbook, articles, videos, animations, etc.

Use the following guidelines as you create your questions:

- Avoid "what" questions. Ask higher-level questions using words such as *why*, *how*, *explain* or *compare*. For example, it is much better to ask a question such as, *"Explain the role of the enzymes in lactose intolerance."* than it is to ask, *"What is an enzyme?"*
- Predict short answer items (even if you are taking multiple-choice tests) because it will help you check your knowledge of an entire concept, rather than one small part.
- Ask questions that require application, analysis or interpretation of ideas. These are the types of questions you will be asked on the quiz.
- Get at the "big picture."
- Ask questions that make people really think about the concepts.
- (General hint: if it takes more words to ask the question than to answer it, ask a tougher question.)

Activity

2 Quiz Review

QUESTION	ANSWER *(note: you can write this as a bulleted list)*	Source(s) *(please specifically note where the material came from—text, article, lecture, etc.)*	Page number
1.			
2.			
3.			
4.			
5.			

6.

7.

8.

9.

10.

Activity

5 Evaluating the Quiz

GROUP QUIZ Evaluation:

The purpose of this evaluation is to help you learn from your experience preparing for and the quiz. Think about how you felt about your level of preparation before the quiz, where you focused your effort, and how you felt taking both the individual and group portions of the quiz. What were the results of your experiments? What was surprising in these results?

1. What went right? Analyze the quiz to discuss what you did well and what helped your thinking about these concepts.

2. What went wrong? Analyze the quiz to discuss areas you might want to work on. In this analysis:

   Think about the errors you made and diagnose the nature of your difficulties as they relate to the nutrition concepts learned, problem solving expected, or your beliefs about science and/or science learning. Note: don't just describe a difficulty; you need to analyze your thinking. (Example: A poor diagnosis would be, "I was confused" or "I picked the wrong answer." A good diagnosis would provide a reason for the errors "I thought that a person's basal metabolic rate was the same as their overall metabolic rate.")

3. What will I do differently next time? Conduct an overall assessment of your quiz performance.

   This is where you will look for patterns to your errors, think about particular aspects of the quiz that may have been difficult for you, types of questions you missed, general concepts that were difficult, etc. In your assessment, write about how understanding these issues will impact your science quiz taking in the future.

PEER EVALUATIONS

Name:_____ Group Name:_____

This is an opportunity to evaluate the contributions of your teammates to group quizzes. Please write the names of your teammates in the spaces below and give them the scores that you believe they earned. You will have 10 points available to distribute for each member or your group, not counting yourself (e.g., if you are in a group of six people, you each will have 50 points to distribute. A group of five would have 40 points, etc.). If you believe everyone contributed equally, then you should give everyone 10 points. If everyone in the group feels the same way, you will all have an average of 10 points and receive 100 percent of the group score. An average of nine would receive 90 percent of the group quiz score, etc. Be fair and accurate in your assessments. If someone in your group didn't contribute adequately (i.e., had not studied, didn't communicate with the rest of the group, frequently missed class, etc.), give them fewer points. If someone worked harder than the rest, give that person more than 10 points.

There are some rules that you must observe in assigning points:

- This is not a popularity contest. Don't give anyone a grade that they don't deserve (high or low) for personal reasons or otherwise.
- Contributing to the group does not simply mean who gave the most correct answers. Asking good questions, challenging the group, etc., showing up reliably are also ways to contribute.
- You cannot give anyone in your group more than 15 points.
- You do not have to assign all of your group points, but you cannot assign more than the total number of points allowed for each group (i.e., (number of people in group – 1) x 10 points).

Group Member:	**Score:**
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____
6. _____	_____
7. _____	_____
8. _____	_____

Indicate why you gave someone more than 10 points.

_____

Indicate why you gave someone less than 10 points.

_____

If you were to give yourself a score, what would it be? Why?

Week 4
Weekly Reflection

1. Think about the science. What did you learn about transforming information and taking science tests?

2. Think about your learning. How will this experience change the way you approach reading in the sciences?

Lesson 7
Introduction to Science Research

In this lesson, you will . . .

- Plan your project.
- Learn to identify appropriate sources.

Activity 1

Nutrition Final Project Directions

Purpose: Your purpose is to create an informational pamphlet or brochure about a topic related to nutrition and diet using science research to support your claims.

A pamphlet is considered to be gray literature, which is literature hard to find using conventional methods. Gray literature is an important type of scientific literature because it provides recent information, information found within the last 12 to 18 months, and includes up-to-date research. Gray literature, like the pamphlet, should be easy to understand for a lay audience. Even though you are communicating the information in a more simplified way, you must understand the science concepts fully to be able to explain them to others. You will need to cite your sources and include them in a works cited page, so that if the reader wishes to read for more detailed information it will be available to them.

In this project, you will select a topic about nutrition or diet that you think the public needs to know more about. It should be a timely issue that would resonate with people interested in finding out more about said topic.

The topics should be debatable. That is, reasonable people may have differing views about the topic. The topic should be narrow and focused enough to investigate for this assignment. For example, nutrition-related diseases is too broad a topic and could be a book instead of a pamphlet. Instead, you might want to focus on one nutrition-related disease in particular.

You will need to bring 10 copies of your pamphlet for class presentations.

You will need to include at least five sources to use in your work. To help you read and organize the material you will take notes on each source in your Academic Notebook.

Finding Articles for the Final Project: Articles can be found in many different places including journals, magazines, newspapers, and websites. Popular journals, such as *Scientific American*, are aimed at the general public. The articles are written by journalists, who have consulted with experts, to be accessible by the public. Peer-reviewed journals contain articles written by experts aimed at experts. The reader is expected to know the basics on the topic covered in the article. For the final project, we are going to focus on popular journals, magazines, newspapers and websites.

Activity
2 Reading Scientific Articles

Taking Notes: React to what you read

Taking notes will help you to understand what you read and will save you effort in the future. When you have just read a paper, you may understand it well. The definitions are clear, the charts show correlations at a glance. But next week, when you are writing a report on this subject, or next year, when you need to refer to the paper again, it may not be so clear.

Highlight major points

On papers you plan to keep, underline main points or mark them with a line in the margin; make notes so that new ideas will stand out. When you find a definition of a new term, abbreviation or acronym, write "def" in the margin. When you find an example that clarifies a point, note that in the margin.

When you see a chart or table, examine it. Figure out what its significance is. What trends does it show? What correlations? Write a note explaining it in your own way.

React to the points in the paper

If you see a correlation to other work, note it in the margin. If you doubt a statement, note your objection. If you find a pleasing quotation, write it down.

Construct your own example

This can tell you if you understand the definitions and terminology, give you insight on why a theorem or result holds, and expose aspects not covered by the examples in the paper.

Summarize what you read

When you have digested an article, write a short summary. In your own words, state what you learned from the paper. What were the main points for you? Keep the summary with the article for future reference.

Reacting to what you are reading gets you emotionally involved in the argument. Emotion emphasizes what is said, making it easier to remember. Writing a summary helps to relate the paper to what you already know, again aiding memory by tying into your framework for the subject. The summary also serves as a reference when you need to return to the paper.

Summary: How to read a paper

Preparation
- Quiet place.
- Pencil, paper, photocopy of article.

Deciding what to read
- Read title, abstract.
- Read it, file it or skip it?

Read for breadth
- What did they do?
- Skim introduction, headings, graphics, definitions, conclusions and bibliography.
- Consider the credibility.
- How useful is it?
- Decide whether to go on.

Read in depth
- How did they do it?
- Challenge their arguments.
- Examine assumptions.
- Examine methods.
- Examine statistics.
- Examine reasoning and conclusions.
- How can I apply their approach to my work?

Take notes
- Make notes as you read.
- Highlight major points.
- Note new terms and definitions.
- Summarize tables and graphs.
- Write a summary.

An online version of this document can be found here:
http://www.cse.ogi.edu/~dylan/efficientReading.html

Thanks to Dave Maier for additional suggestions.

Efficient Reading of Papers in Science and Technology

This brochure provides an approach to help you read scientific papers efficiently and effectively.

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Introduction: Why Read?

Before beginning to read a paper, consider why you are doing it. What do you want to get out of it? Your needs control how you read. If you only need an overview, a brief skim may suffice. If you will present the paper to others, you will need to dig deeply, to challenge the paper's arguments until you understand it fully. If you will use the information later, taking notes will help you remember it. If you don't know what you hope to gain from the paper, you can not tell whether reading it will be beneficial or a waste of time.

In order to get the most from your reading, you should be properly prepared. Find a quiet place to work where you will not be disturbed or distracted, have a pencil and note pad at hand, and bear in mind exactly what you expect to get from this paper.

The following method for reading a scientific paper offers you ideas about the process of reading a paper, how to decide what to read, how to build a broad framework by skimming, and how to challenge the paper to get depth of understanding. Finally, it will show you how to take notes so that the key points won't be lost as soon as you set the paper down. Since reading is the process of getting ideas from the author, you must focus on the author's thoughts, not just read the words on the paper.

Deciding what to read

When you first approach a paper, ask yourself "What did the author do?" Reading the title and the abstract should tell you this. Then decide if the paper is useful to you now. If so, read it. If not, might the paper be useful to you later? If so, file it. If it is not relevant to you, skip it.

Reading for Breadth: Build a framework

If you decide to read the paper, first skim it.

- Read the introduction.
- Read the section headings.
- Look at the tables and graphs to see what they say and read the captions.
- Read the definitions and theorems.
- Read the conclusions.
- Consider the credibility of the article:
  - Who wrote it? Are they well-known?
  - Where do they work? What biases might they have as a result of their employer?
  - Where was the article published? What is the reputation of the journal? Was the journal refereed?
  - When was it written? Might it be outdated or superceded?
- Skim the bibliography:
  - How extensive is it?
  - Are the authors aware of current work?
  - Does it reference classic papers in this field?
  - Have you read any of the papers that are referred to?
  - Do you know relevant research that isn't cited?

By skimming the paper first you can learn what the authors did, and develop a framework to understand the parts of the paper. Developing a framework adds to your general understanding of the field, and gives you a basis to understand the paper. If you know what conclusions they draw, you can follow their arguments more easily. Knowing where they are going can help you to follow their path and give you a chance to find shortcuts or places where they missed a turn.

Once you have skimmed a paper you have a broad idea of what they did. Then you can decide if you want to know more. If you are interested in how they did it, then read the body of the paper for details. If not, file away what you have learned and congratulate yourself

Reading in Depth: Challenge what you read

There is a lot of junk published, so you should be selective in what you read and what you believe. When you read a paper in detail, approach it with scientific skepticism. You can do this by trying to tear the arguments apart.

Examine the assumptions

- Do their results rely on any assumptions about trends or environments?
- Are these assumptions reasonable?

Examine the methods

- Did they measure what they claim?
- Can they explain what they observed?
- Did they have adequate controls?
- Were tests carried out in a standard way?

Examine the statistics

- Were appropriate statistical tests applied properly?
- Did they do proper error analysis?
- Are the results statistically significant?

Examine the conclusions

- Do the conclusions follow logically from the observations?
- What other explanations are there for the observed effects?
- What other conclusions or correlations are there in the data that they did not point out?

By challenging what you read, you will understand better what the author is saying and why they say it. You will also be able to decide whether the evidence supports their conclusions, and to draw your own conclusions from their data. Once you understand the paper, ask yourself how you can apply their approach to your own work.

Activity

3 Finding Articles for the Final Project

Articles can be found in many different places including journals, magazines, newspapers, and websites. Popular journals, such as *Scientific American*, are aimed at the general public. The articles are written by journalists, who have consulted with experts, to be accessible by the public. Peer-reviewed journals contain articles written by experts aimed at experts. The reader is expected to know the basics on the topic covered in the article. For the final project, popular journals, magazines, newspapers and websites are acceptable.

Example websites and journals:

- http://www.scientificamerican.com/.
- http://news.sciencemag.org/.
- http://www.mayoclinic.com/.
- http://www.nih.gov.

Lesson 8
Research and Writing in Science

In this lesson, you will . . .

- Use science research to explain science to the public.
- Identify important concepts from science articles and use the information to support your ideas.
- Explain the science topic you are researching by citing specific evidence from your sources.
- Engage in scientific inquiry by forming hypotheses, researching evidence and providing support across multiple sources to support your claims.

Taking Notes on Reading

We will be using APA style to cite sources. Please see the following website for examples of APA style: http://owl.english.purdue.edu/owl/resource/560/07/.

APA Basic Form

Articles

Author, A. A., Author, B. B., & Author, C. C. (Year). Title of article. *Title of Periodical, volume number* (issue number), pages. doi:http://dx.doi.org/xx.xxx/yyyyy.

Books

Author, A. A. (Year of publication). *Title of work: Capital letter also for subtitle.* Location: Publisher. (this type also uses a hanging indention)

Online periodical

Author, A. A., & Author, B. B. (Date of publication). Title of article. *Title of Online Periodical*, volume number (issue number if available). Retrieved from: http://www.someaddress.com/full/url/.

Activity

1 Taking Notes on Scientific Research

Use these charts to help you take notes on your sources:

Source (type – book, journal article, research report, etc.)	
Bibliographic information (full reference using APA style)	
Purpose of the paper	
Description	
Data (include page number)	
Examples (include page number)	
Important figures or tables (include page number)	
Summary	
What the public needs to know	

Source (type – book, journal article, research report, etc.)	
Bibliographic information (full reference using APA style)	
Purpose of the paper	
Description	
Data (include page number)	
Examples (include page number)	
Important figures or tables (include page number)	
Summary	
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Source (type – book, journal article, research report, etc.)	
Bibliographic information (full reference using APA style)	
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Bibliographic information (full reference using APA style)	
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Data (include page number)	
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Important figures or tables (include page number)	
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What the public needs to know	

Source (type – book, journal article, research report, etc.)	
Bibliographic information (full reference using APA style)	
Purpose of the paper	
Description	
Data (include page number)	
Examples (include page number)	
Important figures or tables (include page number)	
Summary	
What the public needs to know	

Activity

2 Outlining

Key Idea/Support Outline

List five to seven key ideas from your findings.

Begin to outline your ideas for the eight panels of the pamphlet.

Title:

Description of your topic (Why is your topic something people should be concerned about? What are the main issues?):

Background information (causes, symptoms, examples, descriptions, effects on the body, etc.):

Latest research on the topic (These are your five to seven key points. Be sure to include relevant statistics/data/charts, etc.):

Solutions/resolutions/actions people can take:

Week 5
Weekly Reflection

1. Think about the science. What did you learn about science research and health disorders?

2. Think about your learning. How will this experience change the way you approach reading in the sciences?

Activity

3 Revising your Work

Read your draft and think about the following questions:

1. Evaluate your main point. What are you trying to say in this pamphlet? Would it be clear to someone reading your pamphlet for the first time?
2. How is the writing appropriate for your intended audience?
3. What is your purpose for informing readers about your topic? Is your purpose clear in your draft?
4. Evaluate your evidence. Do you offer enough scientific evidence to support your points?
5. How are specific statistics/figures/data used to support your points?
6. Is there any information that doesn't seem to fit your purpose or your topic? You either need to add more support for that information or cut the idea.
7. Do the ideas flow from one point to another? Will the reader be able to follow a logical progression of ideas?
8. Can you read through the pamphlet in the way it is currently designed or do ideas need to be reordered?
9. Are you using and defining scientific terms? Are you using precise language to get your ideas across?
10. Are the references cited properly?
11. What specific suggestions/solutions do you provide for readers?
12. How does the information in the pamphlet follow the format outlined in the project directions?
13. Read for grammar and spelling errors.

Activity

4 Peer Editing

Editing & Revision Checklist

Paper's Author

Paper's Editor

Directions for the editor: Answer all questions to the best of your ability. The writer's grade somewhat depends on you. If you have questions or you are not sure about something, ask me. You need to read the paper several times. Do not skip sentences. Do not skim. Read very closely. Even read aloud quietly, so you can hear problems.

Directions for the writer (after the peer editing process): Make any changes necessary to gain a yes answer to all questions.

Headings and Subheadings:

- ☐ Yes ☐ No 1. Is there effective use of main heading?
- ☐ Yes ☐ No 2. Are there subheadings used?
- ☐ Yes ☐ No 3. Does the heading grab the reader's attention?
- ☐ Yes ☐ No 4. Do the subheadings contain all the proper information?

Introduction to the topic:

- ☐ Yes ☐ No 1. Is there an attention-getter?
- ☐ Yes ☐ No 2. Is there background information about the topic?
- ☐ Yes ☐ No 3. Are the main terms and issues defined?

Background information:

- ☐ Yes ☐ No 1. Is there a description of the causes of the problem and/or a description of the issue?
- ☐ Yes ☐ No 2. Is there an effective description of the symptoms, effects on the body, etc.?
- ☐ Yes ☐ No 3. Does the writer provide citations for the information?

Description of Research

- ☐ Yes ☐ No 1. Is there an informative presentation of the latest research on the topic?
- ☐ Yes ☐ No 2. Is there information about how the research impacts the public?
- ☐ Yes ☐ No 3. Is the science clearly explained?
- ☐ Yes ☐ No 4. Are diagrams/illustrations used effectively?

Conclusions:

☐ Yes ☐ No 1. Does the writer present solutions or resolutions to the issue?
☐ Yes ☐ No 2. Does the writer present several reasonable actions people can take?
☐ Yes ☐ No 3. Is the author's concluding sentence meaningful and memorable?

Works Cited Page

☐ Yes ☐ No 1. Is the Works Cited information complete?
☐ Yes ☐ No 2. Has the author used at least five different sources?
☐ Yes ☐ No 3. Are all of the author's sources appropriate for this assignment?
☐ Yes ☐ No 4. Are the sources in alphabetical order?
☐ Yes ☐ No 5. As much as you can tell, is each source listed in the correct format (APA style)?

Grammar/mechanics Checklist:

1. Read through the entire pamphlet and look at all of the words that end with –s. Check and make sure that the writer didn't forget to make a possessive –s. On the paper, put 's (apostrophe s) anywhere where it is needed.
2. Read through the entire paper and look for any sentence that begins with the following words: **when, because, since, if, although, after, even though, while, in order that.** First, make sure these sentences are not fragments. Second, **make sure there is a comma after the subordinate clause.**
3. Check for sentences beginning with the word "So." Get rid of the word. It probably isn't needed. Do the same for sentences beginning with **"And"** or **"But."**
4. Circle any use of the words **"you," "your," "me," "I," "we,"** and so on. Suggest how the writer can avoid these words.
5. Mark all uses of the words **"they"** and **"their,"** and make sure that the antecedents are plural. Also check to make sure there is a clear antecedent for these words.
6. Mark all uses of the words **"this," "that," "these,"** or **"those."** Remind the writer to follow these words with specific nouns.
7. Read the entire paper and make sure that all sentences make sense. Mark sentences that don't make sense and suggest how the writer can change them.
8. Read the entire paper again and make sure that all words are **spelled correctly.** Circle words that are questionable. Check for common misspelled words: *then, than, effect, affect, its, it's, their, there, to, too, two.*
9. Make sure that titles are properly designated by *italics,* underlining, or **quotation marks.**

10. Read through the entire paper and check every time the writer uses the word **that.** Make sure it shouldn't be **who.**
11. Check every comma in the paper, and make sure that it is not bringing together two complete sentences.
12. Check all of the following words: **and, but, so, for, or.** Make sure that there isn't a comma needed. Ask me if you are not sure. If these words are bringing together two complete sentences, then use a comma before the conjunction.
13. Anytime you see a **colon** (:) or a **semi-colon** (;), make sure that it is used correctly.
14. Read the paper one last time and make sure that there are no other mistakes that you can identify. Check for transitions, double negatives, verb forms, subject-verb agreement, and so on. Help the writer get an A.
15. Check to make sure that the entire paper is in **consistent tense** (no shifting from past to present, etc.).
16. Check all verbs ending with –ing, and make sure you can't change it. You are looking for passive verbs: some form of the verb *be* + the past participle of the verb.

Example: "Many options were *tried* by the soldiers," can be changed to, "The soldiers *tried* many options." Check to make sure that passive sentences couldn't be better if they were active.

Lesson 9
Final Project Presentations

In this lesson, you will . . .

- Present your final project to your peers.
- Engage in science discourse, explaining and defending your work.
- Use evidence to support your claims.

Activity

1 Sharing Information

Presenter: **Reviewer:**

Topic: Date:

Understanding of the topic –

Actions I will take –

Questions I have for the author –

	5 Excellent	4	3 Good	2	1 Poor
How effectively did the pamphlet introduce the topic?	5	4	3	2	1
How clearly and fully was the science evidence presented?	5	4	3	2	1
Were the recommendations effective, logical, and complete?	5	4	3	2	1

What was the strongest part of the pamphlet?

What would you suggest for improvement?

Presenter: **Reviewer:**

Topic:

Date:

Understanding of the topic –

Actions I will take –

Questions I have for the author –

	5 Excellent	4	3 Good	2	1 Poor
How effectively did the pamphlet introduce the topic?	5	4	3	2	1
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Presenter: **Reviewer:**

Topic: Date:

Understanding of the topic –

Actions I will take –

Questions I have for the author –

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What was the strongest part of the pamphlet?

What would you suggest for improvement?

Presenter: **Reviewer:**

Topic:

Date:

Understanding of the topic –

Actions I will take –

Questions I have for the author –

	5 Excellent	4	3 Good	2	1 Poor
How effectively did the pamphlet introduce the topic?	5	4	3	2	1
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What was the strongest part of the pamphlet?

What would you suggest for improvement?

Presenter: **Reviewer:**

Topic: Date:

Understanding of the topic –

Actions I will take –

Questions I have for the author –

	5 Excellent	4	3 Good	2	1 Poor
How effectively did the pamphlet introduce the topic?	5	4	3	2	1
How clearly and fully was the science evidence presented?	5	4	3	2	1
Were the recommendations effective, logical, and complete?	5	4	3	2	1

What was the strongest part of the pamphlet?

What would you suggest for improvement?

Activity
2

Week 6

Weekly Reflection

1. Think about the science. What did you learn about science research?

2. Think about your learning. How will this experience change the way you approach reading in the sciences?

Reading Notes