COMMON CORE STANDARDS

For Literacy in History/Social Studies, Science, and Technical Subjects Grades 9 and 10

An Implementation Guide For Integrating Literacy In Science

v.1.0

By Deborah Wahlstrom
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DataDeb.WordPress.com

A special thanks . . .

to **Renée Clemens** – an outstanding English teacher and school improvement leader at Mount Clemens High School (Mount Clemens, Michigan). Over the summer 2011, Renée and I worked on unpacking the Common Core English Language Arts Standards and her insights were invaluable as I worked on this supplementary document.

A special note . . .

to use this guide to get ideas about the types of strategies and thinking skills that match each of the Common Core Standards for Literacy in History/Social Studies, Science, and Technical Subjects – Grades 9-10. I'll update this document later in the school year.

A special website . . .

for practical ideas for implementing the Common Core standards – and just plain good 'ole teaching and learning: **DataDeb.wordpress.com** This is where I will be posting high-quality materials and ideas with a slant toward things that may be a bit different from the wonderful assortment of ideas already on the web. **Sign up on the website** to get an automatic update when something is posted. You won't be sorry.

A special request . . .

to tell a friend. If there is an idea you're pretty sure someone else will like, don't forget to share the idea with him or her. These are new standards for everyone! So be a friend, and share.

INTRODUCTION

Wait. Whoa. Whooooooa. You barely have enough time to teach content. And now . . . this additional expectation? Grrrrrrrrr.

This expectation requires a great deal of thinking and hard work by the students. Hmm.

Additionally, this expectation requires students to learn fewer things really well and to learn about one thing from different perspectives. So students don't just read about meiosis and mitosis in their textbook, they read articles and other accounts related to it. Hmmmmm.

And this expectation requires students to back up their answers with evidence. Whether they're answering a question, giving a presentation, or writing a summary, they give evidence. Hmmmmmmm.

And these requirements help prepare students for college and career. In a recent presentation, David T. Conley (2011) provides four key dimensions of college readiness. These include key cognitive strategies, key content knowledge, academic behaviors, and contextual skills and awareness ("college knowledge"). Informational literacy directly supports all four. If you're a secondary teacher, you likely value your position and influence in helping students become college- and career-ready. This is bigger than students getting a diploma. This is about students having the very specific knowledge and skills that lead to success in whichever path life takes them.

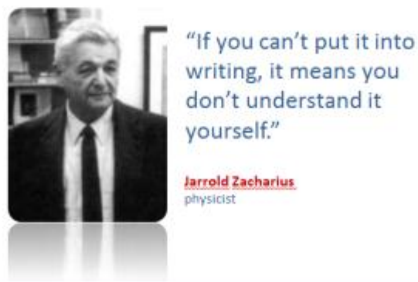
"Think of literacy as the spine; it holds everything together. The branches of learning connect to it, meaning that all core content teachers have a responsibility to teach literacy."

Vicki Phillips and Carina Wong
Melinda Gates Foundation

The purpose of this document is to provide an overview of the Common Core Standards for Literacy in History/Social Studies, Science, and Technical Subjects. These standards are an integral part of the overall standards for English Language Arts in grades K-12. The standards bring a shift toward literacy, and literacy is everyone's job. Gone are the days when just the English teachers worked on literacy. Literacy is job one of all staff. This literacy focus spans content areas and grade levels. This document provides hints and tips for the part of the Common Core Standards that were written specifically for the content areas.

The focus content area for this document is science.

OVERVIEW



The purpose of this document is to provide ideas and suggestions for improving literacy through the Common Core Standards. One of the core features of the Common Core Standards is that implementation helps ensure that students **think deeply in the content area** through literacy.

Thus, the purpose is to help jumpstart connections in the core content areas which you'll recognize as **good literacy strategies** throughout. Even if the Common Core Standards were never developed, these are the types of things we should be doing with our students.

In *College Knowledge* (2005), David Conley encourages us to think about the need for us to help students learn four intellectual standards:

1. Read to infer/interpret/draw conclusions.
2. Support arguments with evidence.
3. Resolve conflicting views encountered in source documents.
4. Solve complex problems with no obvious answers.

Sound like good thinking skills, don't they? You'll see plenty of this in the Common Core Standards for Literacy.

The Common Core Standards embrace an instructional shift for many. Examples of these shifts include (1) a greater emphasis on informational text in secondary schools, (2) building deep knowledge in the disciplines, (3) staircase of complexity, (4) text-based answers, (5) writing from sources, and (6) academic vocabulary.

In the classroom, this means a greater and wider use of non-fiction and authentic texts, a higher level of text complexity, a focus on command of evidence from one or more texts, and academic vocabulary.

What does this look like for your course? Literacy and deep thinking about the content area rule. Students read widely about a concept. Not just the textbook, but other readings as well. Students write often about what they are learning. They write responses to short pieces of non-fiction. They are fully engaged in their learning through numerous opportunities to read, write, discuss, and share what they are learning.

READING Standards for Literacy

The Common Core Standards in

Science

Grades 9 and 10

One of the core features in the Common Core Standards is that of ensuring students **think deeply in the content area** through literacy. Content-area teachers usually want their students to think deeply about the content they are learning and often search for ways to have them do so.

When you look at the suggestions for working with the standards, you'll likely notice that you already integrate so many of the ideas into your classes. You see, you likely use graphic organizers with your students. But do you make sure students talk about what is on the organizer and then write a summary of it? Do you help students make connections about why they use a particular graphic organizer? Or do you simply use the graphic organizer as the product? A good practice for using organizers is to have students not only create an organizer, but also discuss and summarize the information from it. The Common Core Standards in **English Language Arts & Literacy in Science** can spur your students to higher levels of thinking in ways such as this.

I want to make sure you see the actual Common Core Standards for Literacy. In this document, I've focused on just the reading. I'll be working on writing during the school year. For now, download the literacy standards (reading) for science.
http://datadeb.files.wordpress.com/2011/09/ccssi_ela-standards-literacy-only-9-10.pdf

Let's begin by taking a look at page 60 of the actual Common Core document, which introduces the College and Career Readiness Anchor Standards for Reading. This page provides an overview of what "students should understand and be able to do by the end of each grade span." As you read the **anchors**, you'll begin to see the expectations for student learning laid out by the Common Core Standards. (Click on the graphic to download a copy of the page.)

Common Core State Standards

College and Career Readiness Anchor Standards for Reading

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY IN HISTORY/SOCIAL STUDIES, SCIENCE, AND TECHNICAL SUBJECTS

College and Career Readiness Anchor Standards for Reading

The grades 6–12 standards on the following pages define what students should understand and be able to do by the end of each grade span. They correspond to the College and Career Readiness (CCR) anchor standards below by number. The CCR and grade-specific standards are necessary complements—the former providing broad standards, the latter providing additional specificity—that together define the skills and understandings that all students must demonstrate.

Key Ideas and Details

1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

Craft and Structure

4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
5. Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
6. Assess how point of view or purpose shapes the content and style of a text.

Integration of Knowledge and Ideas

7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.*
8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.

Range of Reading and Level of Text Complexity

10. Read and comprehend complex literary and informational texts independently and proficiently.

*Please see "Research to Build and Present Knowledge" in Writing for additional standards relevant to gathering, assessing, and applying information from print and digital sources.

Note on range and content of student reading

Reading is critical to building knowledge in history/social studies as well as in science and technical subjects. College and career ready reading in these fields requires an appreciation of the norms and conventions of each discipline, such as the kinds of evidence used in history and science; an understanding of domain-specific words and phrases; an attention to precise details; and the capacity to evaluate intricate arguments, synthesize complex information, and follow detailed descriptions of events and concepts. In history/social studies, for example, students need to be able to analyze, evaluate, and differentiate primary and secondary sources. When reading scientific and technical texts, students need to be able to gain knowledge from challenging texts that often make extensive use of elaborate diagrams and data to convey information and illustrate concepts. Students must be able to read complex informational texts in these fields with independence and confidence because the vast majority of reading in college and workforce training programs will be sophisticated nonfiction. It is important to note that these Reading standards are meant to complement the specific content demands of the disciplines, not replace them.

60 | 6-12 | HISTORY/SOCIAL STUDIES, SCIENCE, AND TECHNICAL SUBJECTS | READING

Source: http://www.corestandards.org/

Note that there are **ten anchors**: three in Key Ideas and Details, three in Craft and Structure, three in Integration of Knowledge and Ideas, and one in Range of Reading and Text Complexity.

In addition to the anchor standards are the **grade-specific standards**. The grade-specific standards provide information about what the anchor standards look like at each grade level and/or grade level span. You'll find these standards on page 62 of the Common Core document. (Click on the graphic to download a copy of the page.)

Common Core State Standards

Grade Specific Standards for Reading

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY IN HISTORY/SOCIAL STUDIES, SCIENCE, AND TECHNICAL SUBJECTS

Reading Standards for Literacy in Science and Technical Subjects 6–12 RST

Grades 6–8 students:	Grades 9–10 students:	Grades 11–12 students:
Key Ideas and Details		
1. Cite specific textual evidence to support analysis of science and technical texts.	1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.	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; provide an accurate summary of the text distinct from prior knowledge or opinions.	2. Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.	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.
3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.	3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.	3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
Craft and Structure		
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 6–8 texts and topics*.	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 9–10 texts and topics*.	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 the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.	5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).	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.	6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.	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.
Integration of Knowledge and Ideas		
7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).	7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	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. Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.	8. Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical 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. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.	9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.	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.
Range of Reading and Level of Text Complexity		
10. By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.	10. By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.	10. By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.

62 | 6-12 | SCIENCE AND TECHNICAL SUBJECTS: READING

Source: http://www.corestandards.org/

The ideas that follow are to give you a jumpstart on your own research for ways you can easily begin to use the literacy standards to help teach students science. I have written the ideas in this guide for the grade-specific standards – in this case, for grades 9-10.

Common Core State Standards for Literacy
Implementation Ideas
Science
Grades 9-10

	Common Core State Standard	Tips and Instructional Ideas for Implementing the Standards
1	**Cite specific textual evidence** to support analysis of science and technical texts, attending to the **precise details** of explanation or descriptors.	• Have students identify the **textual evidence** (word-for-word) evidence that supports the main idea in science passages you have students read. Have students state or write the **specific statements** from the text. • Have students **annolight** their texts. **Annolighting** a text combines effective highlighting with margin notes that help explain the highlighted words and phrases. (Source: Greek Central School District, Annolighting a Text). • Interrogating Texts: Six Reading Habits to Develop in Your First Year at Harvard. • Since most students are not allowed to write directly in their books, consider making copies of the pages students will annotate. • Remember to get students set up correctly for keeping notes. You'll likely find many students who have not yet been taught this important skill. Don't let students go one more minute without teaching them how to organize class and lab notes for success. Research Note Taking Note Taker Interactive Notetaker Notetaking with Drawings Cornell Notetaking Cornell Notetaking – with space to cite examples Cornell Notetaker Interactive Notebook Page Examples How to Keep a Lab Notebook Keeping a Laboratory Notebook in BIO 184 FOSS Tips for Keeping a Science Notebook FOSS Example of a Science Notebook What Makes a Great Science Lab Notebook? How to Start – and Keep – a Laboratory Notebook iPad Lab Notes

<table>
<tr>
<td>2</td>
<td>Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

Note from Deb: See the end of this document for an organizer related to complex processes, phenomena, and concepts.</td>
<td>Central Idea

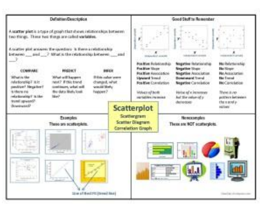
Have students give the main idea (most important point) of paragraphs they are reading. (The subheads in a text are useful for helping students "see" the most important idea of a paragraph.)
Consider using this Shrinking Notes lesson to teach students to figure out the central idea. In this lesson, students start taking notes on a 3x5 card, then they "shrink" the notes to a smaller post-it, and then "shrink" the notes again to the smallest size post-it. This is something you'd use once to teach students the concept of getting ideas to their most important point.

Trace the Depiction of a Complex Process

First, have students use a visual from the text, make a sketch of their own, or use a graphic organizer to help them see the different parts of a process.
Then have students talk with one another about the parts of the process and what each part means. Consider using guided questions to ask pairs of students questions.
Finally, have students write the sequence of the process.

Write an Accurate Summary of the Text
Having students summarize the information they are reading is an important part of literacy. To help students learn to summarize, consider giving them tools (graphic organizers) to do so. A concept map is one example of a tool to help students "see" the concepts and summarize them. Remember that when you use graphic organizers, the organizer is not the product. It's the tool for developing the product, which is this case, is summarizing.

Create concept maps that students fill in.
Concept Map from Read Write Think
Acids and Bases
Levers
Create content cards for the core concepts of each class. Teach students how to read concept cards and then write summaries about them. Check out the concept cards below and see if something similar will work for you in bringing together everything that's needed to help build concepts for students.



Content Card – Line Graph (by Deborah Wahlstrom)
Content Card – Bar Graph (by Deborah Wahlstrom)</td>
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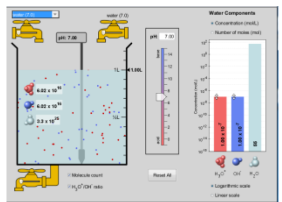
		Content Card – Scatterplots (by Deborah Wahlstrom) Content Card – Parallel (by Deborah Wahlstrom) Deb's Data Digest – for all sorts of ideas for content cards. Consider subscribing to the site to receive an email as free content cards are added. • Have students write summaries from information on content cards and concept maps.  Have students use the site, Interactive Simulations, by the University of Colorado at Boulder, to help build scientific concepts in life science, physical science, biology, chemistry, physics, earth science, and more. Don't forget the summaries! Use sites such as the Virtual Cell Animation Collection to have students review and summarize a scientific process. CSI Web Adventures provides information about processes used in forensics. Have students use Brightstorm Science to help them understand key concepts in biology, chemistry, and physics. Remember that literacy includes media other than print. Java Applets on Physics contains simulations that help students understand important scientific concepts. Have students use the applets to help them visually see and work with concepts and then have them write summaries to explain the concepts. This is also a good site to use "What if" questions. (What if we changed this variable? What do you think will happen?)
3	Follow precisely a **complex multistep procedure** when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases, or	• Notebooks are suggested in Standard 1, but since this is a tool for following complex procedures, carrying out experiments, recording measurements, etc., it's worth mentioning again. When thinking about how you want students to keep their notebooks, consider taking ideas from the science, technology, engineering, and mathematics community. • In their science logs, **have students write the steps of procedures** they are going to use in a lab investigation. Remind students to check off each step as they work through the investigation. (This is a very good habit for students to learn as in the larger world, the steps in a project don't happen in a one-period class.)

	exceptions defined from the text.	• Before embarking on an experiment, have students **read and review** with a partner the actual steps they will take while conducting the experiment. (This helps ensure that students know exactly what they are expected to do.) • In their science logs, have students record measurements and label each tally chart and/or measurement record they make. • Have students take digital pictures of some of the things they observe. These can be included in a digital lab book. Students can also use their cell phones for this, and send the pictures to a gmail account for printing.  Show students examples of actual science lab notebook pages – completed or blank. The notebooks are one of the most important tools used in science, technology, engineering, and mathematics. Graph pages are perfect for students to use when they are taking measurements and recording data. Composition books even come in all-graph pages!
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 9-10 texts and topics.	• **Create a master list of core vocabulary** students must learn for the course. Make sure students have a copy of the list. Consider posting the list online so parents see it as well. Create a word wall in the classroom so students have the words in front of them. Organize the words by concepts. For example, group words related to measurement, ecosystems, cycles, etc. This will make more sense to students than just posting the words; you'll be helping students understand the words while you're developing concepts. • **Create descriptions for each vocabulary word** (rather than definitions). Descriptions help students understand the gist of a word. For example, dictionary definition of ear: The sensory organ capable of detecting sound. Description of ear: Your ears are the two parts of your body, one on each side of your head, with which you hear sounds. • **Directly teach vocabulary to students**. Determine how students will keep up with their core content words. Examples include Frayer notecards, science terms at a special place in the science notebook, etc. Vocabulary Card Example – Mitosis (by Deb Wahlstrom) Bar Graph Content Card set up in Frayer's Model Frayer Model Overview Template for Making a Frayer Model Blank Template for a Frayer Model

Tips for Teaching Vocabulary
Strategies for Effective Vocabulary Instruction

Academic Vocabulary Games
This site is filled with terrific ideas!

Biodidac
A website with great visuals for students to use when developing vocabulary cards.

LiveScience
A website with great visuals that students can use when developing vocabulary cards.

- **Have students play lots of games and "do" lots of activities related to the words**. Here are just a few ideas of the types of activities you can do with students to give them time to work with words and their meanings.

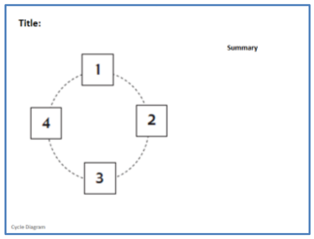
  Word Sort Description
  Word Sort – Weather and Water Cycle
  Open and Closed Word Sorts
  Motor Mouth
  Triptico Word Magnets (digital word sort)
  Quizlet (lets you print cards that can then be used as word sorts.)

- Use the **five-star vocabulary strategy** to determine whether or not students know the terms. To have students track themselves and their own learning of terms, have them first make vocabulary cards. On one side of each card, have student put the word, visual, description, and sentence. (Or use Frayer's model on one side of each card.) On the flip side of the card, have the student write the word they are trying to learn.

5-Star Vocabulary Review

When cards are completed, they are spread out on a table, word side up. Partner A points to a word. Partner B reads it and says what it is. The card is flipped and referred to for the correct answer. If the answer was correct, it gets a star and is removed from the table. *Cards are moved and rearranged to avoid location memory.* Partner A points to another word, and B says what it is. This is repeated over several days and should only take 5 to 10 minutes. Word cards that earn 5 stars

		are mastered and should be kept in a "Mastery File." All other words are kept in a Ziploc bag, ready to be used again. New words can be added. Younger students should work with no more than six word cards at a time. The number can increase with age, but not exceed ten for an activity like this. Vocabulary Card Template Cognitive Dictionary • Have students **create a foldable** for key scientific symbols and terms. (This can be kept in their science notebooks for further study and review.) • Have students keep a set of scientific symbols on hand for each course you teach. Have students integrate the symbols and terms into their vocabulary notebooks. Weather Symbols and Terminology Merriam-Webster Visual Dictionary Online – Science Symbols and Terms Commonly Used Metric System Units, Symbols, and Prefixes Topographic Map Symbols Element Symbols Periodic Table Online Free Rice – This site has science content in Chemistry, such as the Periodic Table. Dialectical Journal Dialectical Journal, Version 2
5	Analyze the **structure of the relationships** among concepts in a text including **relationships among key terms** (e.g., force, friction, reaction force, energy).	**Structures of Relationships** Science is all about the structures of relationships. Examples of relationships include cycles, cause-effect, sequence, compare and contrast, problem and solution, description, hierarchy, concept maps, sketches, and identification keys. For all of the relationships, have students create and use visuals depicting the relationship and have students write corresponding summaries.

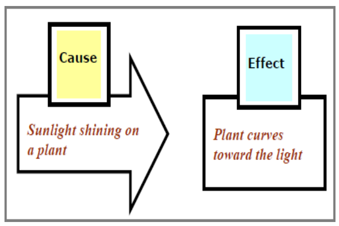


Cycles

Cycles are used to show processes, time sequences, causes and effects, and chronology. They are used to show how a series of events interact to produce a set of results again and again. Examples include: water cycle, life cycle, rock cycle.

Examples of Cycles in Science

Cycle Notetaking
Interactive Circle Plot Diagram
Interactive Food Chains

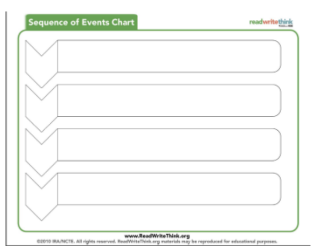


Cause-Effect

Use **cause-effect graphic organizers** for cause-effect relationships and concepts such as: “every action has an opposite and equal reaction”, Second Law of Thermodynamics,

Examples of Cause-Effect Relationships

Cause and Effect Graphic Organizer
Cause and Effect Graphic Organizer #2
Cause and Effect Graphic Organizer #3



Sequence

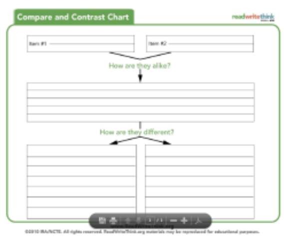
A sequence is used to describe the stages of something in a specific order.

Examples of Sequence Relationships

Sequence of Events Organizer
Sequence Chart
Sequence of Events Through Drawing
Sequence Ladder
Blank Timeline Chart
Step-by-Step Chart
Flow Chart
Horizontal Timeline

[Vertical Timeline]
[Chain of Events Organizer]

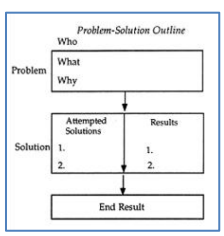
Compare and Contrast



When students compare and contrast, they look for things that are similar as well as things that are different. There are a number of ways to have students compare and contrast. The most common is likely the Venn diagram.

When having students compare and contrast, remember to have them write a summary after they have completed whichever graphic organizer they use. For example, perhaps you have asked students to use a graphic organizer to help them think about the similarities and differences between the parts of an atom. They could use a three-way Venn diagram (as three key things are being compared). After students complete the organizer, have them **explain the similarities and differences** between words (i.e., proton, neutron, electron).

Examples of Compare and Contrast Relationships
Compare and Contrast Chart from Read Write Think
Venn Diagram
Interactive Venn Diagram – 2 Circles
Interactive Venn Diagram – 3 Circles
Compare and Contrast – Herbivores and Carnivores
Blank Comparison Matrix
Column Venn Diagram
Double Bubble Map



Problem and Solution

A problem and solution organizer allows students to think about an issue or a probem, why it's a problem, and possible solutions. Students might even test their ideas in an investigation and/or short research study.

Examples of Problem and Solution Relationships
Problem and Solution Diagram
Problem and Solution Chart

Description

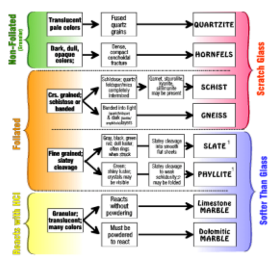
In science, descriptions rule. Students write descriptions with the observations they make.

Examples of Descriptive Relationships

Key Facts NoteTaking
Concrete Details and Commentary
Tree Diagram
Observations by Five Senses
Atomic Theories Chart

Hierarchy, Keys, Identification Charts

Hierarchy, keys, and identification charts are used to show classification pedigrees, analysis, structures, and attributes.



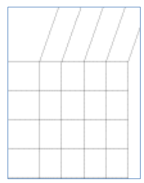
Examples of Hierarchical Relationships in Science

GeoMan's Rock Identification Chart
Moh's Hardness Scale
Moh's Scale of Hardness
Bird Identification Key
Plant Identification Key – Electronic
Leaf Identification Key
Tree Identification Key
Mini-beast Identification Key
Land Invertebrates

Concept Maps and Content Cards

- Have students **talk about the information** on content cards.
- Have students **write about information** on content cards. Have students write a well-developed paragraph to summarize the information.
- Have students do a **label sort** with information from content cards. Give students a content card and labels with statements. Some of the statements should be true. Some of the statements should be false. Have students use the content card to sort the statements into TRUE/FALSE columns. Then have students write a summary using the TRUE statements.

		 **Sketches** Use sketches to show physical structures, descriptions of places, spatial relationships, concrete objects, and visual images. Sketches help students describe the science around them. **Examples of Sketches in Science** Visualizing and Recording Mental Images Leonardo's Flying Machine Minute Sketches
6	Analyze the **author's purpose** in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.	• Give students chances to **voice their own opinions** about issues in science. Use **Agree or Disagree** to stimulate class discussions about the topic. Before students start reading, give them about five statements with which they will agree or disagree. An example statement, "Global warming is destroying life on Earth." This type of statement does not have specific right or wrong answers, but rather serves to help students think about their own opinions on science topics. Think-Write-Pair-Share: After students have written their Type One (Collins Writing) responses, have students discuss their thoughts, share their opinions, and then read the text. After students read the text, have them discuss their opinions again. **Examples of Agree/Disagree Statements** Anticipation Guide for Fungi
7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	• Have students **create tables, graphs, and charts** from their investigations and experiments. Have specific protocols for students to use when creating each type of data organizer. These protocols would include tips on correctly writing the titles, using keys, setting up the units, correctly labeling the graph and interpreting the data. • Use the **Success Sequence** (Draw, Talk, Write) to give students a chance to think about the visual information before they write about it. • Have students **write summaries** for tables, graphs, and charts they create. • Give students a set of graphs, charts, tables, and corresponding summaries. Have students match the summaries with the visuals. • Model with students how to write summaries for data visuals. • To help students see improvement in their own writing, give a short pretest. Present students with a graph. Ask them to write a summary to go with the graph. Keep the sample for comparison purposes for students to see how much they have improved after they have learned to write summaries.

8	Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.	• When students read the results of an investigation, have them **find the examples in the text** that support the writer's claim. • During class discussions, have students give the evidences from the text (e.g., textbook, article, etc.) to support points and claims they make. • Have students cite the evidence from the text. Students should get accustomed to giving page numbers when they use evidence from the text.
9	Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.	 Have students **make a chart** to help them organize information for comparing and contrasting. Examples include Venn diagrams for two or three sources and charts for more sources. These charts can be used to present a number of resources and the claims each make. Atomic Theories Chart
10	By the end of grade 10, **read and comprehend** science/technical texts in the grades 9-10 text complexity band independently and proficiently.	• **Give students plenty of opportunities to read about science**. Enlarge the students' world of science by having them read about science from many different sources. Show students how to apply good reading strategies to any source with which they work. **Strategies to help students fully comprehend science text:** • Have students take notes to clarify ideas. Teach students how to use two-column note-taking or some other structured method for keeping notes. • Remind students to challenge or question the text. Give students questions to help guide their thinking. • Remind students to stop occasionally to determine if they understand what they're reading. • Encourage students to reread things they don't understand. Remind students that most people have to read something more than once when they're reading informational text. • Remind students **to predict what will come next.** One way to help students do this is to give students a **prediction guide** that poses five true or false statements, based on facts from the text. Students record what they think before reading the text. Students then read the text, then review and check their answers. • Prompt curiosity with **questions about the text.** Read a brief section of

		the text to students and then ask the class, "What more would you like to know about . . . " After a number of student responses are taken, have students finish the reading and consider the questions while they read. • **Encourage students to use SQ3R (**Survey, Question, Read, Recite, Review). Students **survey** the text by skimming through title, summaries, headings, subheadings, and illustrations. Next, students use the boldface headings from the text to ask and record **questions** such as "What is Newton's first law of motion? With the questions in mind, student silently **read** passages to find answers. After reading, students **recite**, or paraphrase the main ideas in the form of written notes or an outline. Finally, in the **review** step, students answer their questions using the main points from the reciting step, and make major connections in the content. SQ3R Graphic Organizer • **KWL What do I know? What do I want to know? What did I learn?** • **Learning Logs**: Set aside five minutes each day for students to write what they've learned in class for the day. (This is Collins Type I Writing.) And of course, **a list of resources** for articles and other writings about science: http://successlineinc.schools.officelive.com/Science.aspx This also has a list of ideas for writing! Writing Across the Curriculum – Science (Michigan Department of Education) http://successlineinc.schools.officelive.com/Documents/Science_WAC_2_3_264454_7.pdf How to Read a Textbook, by Jim Burke Encouraging Active Reading in the Science Classroom http://science.nsta.org/enewsletter/2004-07/tst0210_56.pdf Literacy Strategies for the Science Classroom http://www.ncsu.edu/kenanfellows/kfp-cp-sites/cp20/cp20/resources/index.html Reading in the Science Classroom http://mdk12.org/instruction/curriculum/hsa/earth_space/reading_classroom.html Reading in the Science Classroom http://www.jackson.k12.ky.us/readingstrategies/pdf/mullins.pdf

		Reading Strategies Enhance Comprehension in the Science Classroom http://www.projectcriss.com/pdf_files/2_8_W07_KWL-KLEW.PDF Teaching Reading in Math and Science http://www.achievementstrategies.org/curriculum/C6d/Links/teachingreadinginmathandscience6.pdf

Examples of Websites with Science Articles
And Other Reading Materials to Help Build Science Concepts

Don't be shy about pulling everything you can for students to read. Whatever science concept students are studying, help pull together varied texts and support materials related to the concept. Go beyond the textbook to help students build strong connections within and between concepts they are learning. Encourage your students to read widely and deeply about science. Provide challenging articles that you can work through together.

BBC Science and Environment
http://www.bbc.co.uk/news/science_and_environment/

Biology News
http://www.biologynews.net/

Current Events Lesson Plan Idea
http://www.lessonplanet.com/directory_articles/elementary_science_lesson_plans/21_April_2010/340/science_current_events_lessons

Current Event Science
http://www.currenteventscience.net/biology.html

Current Event Summaries from Mr. Harvey's Class
http://lockwoodscience.blogspot.com/

DogoNews – Good for All Content Areas
http://www.dogonews.com/

Earth and Sky
http://earthsky.org/

Earthquake Science Explained – A Series of Ten Short Articles for Students, Teachers, and Families
http://pubs.usgs.gov/gip/2006/21/

Education Place (good for all content areas)
http://www.eduplace.com/ss/current/

First Science
http://firstscience.com/home/articles.html

Macroevolution
http://www.macroevolution.net/current-events-in-earth-science.html

National Geographic
http://www.nationalgeographic.com/

Nature
http://www.nature.com/nature/index.html

Nature News
http://www.nature.com/news/index.html

NOAA
http://www.nhc.noaa.gov/

NOVA – Science Now
http://www.pbs.org/wgbh/nova/sciencenow/

Physical Science Teacher
http://physicalscienceteacher.com/currentevents.php

Popular Science
http://www.popsci.com/

ProCon
http://www.procon.org/
This site is filled with current ideas that students can argue – either orally, in writing, or both! This site is worthy of your frequent visits.

ProCon for Teachers and Librarians
http://www.procon.org/education.php

Scientific American
http://www.scientificamerican.com/

Science Current Event Articles
http://www.middleschoolscience.com/sciencecurrentevents-schedule.pdf
http://www.middleschoolscience.com/currentevents.pdf
http://www.middleschoolscience.com/currenteventsformat.pdf

Science Daily
http://www.sciencedaily.com/

Science Magazine
http://www.sciencemag.org/

Science News
http://www.sciencenews.org/

Science News for Kids
http://www.sciencenewsforkids.org/

Vision Learning
http://www.visionlearning.com/latest_news.php

Windows to the Universe
http://www.windows2universe.org/teacher_resources/current_event_edu.html

Examples of Complex Processes,
Phenomena and Concepts

Science

This is not intended to be an exhaustive listing of complex processes, phenomena, and concepts. The purpose is to simply give examples of what might be under the categories from **Standard 2**. You'll likely want to complete this for whichever course you teach. There are no surprises here. The purpose of the reading standards is to help students learn science more deeply.

	COMPLEX PROCESSES	PHENOMENA	CONCEPTS
	A **complex process** has many parts. A **process** is a series of actions, changes, or functions that bring about a result. Cell division is a process, so are the changes of state in matter, and so are things like erosion.	A **phenomenon** is a fancy word for things that happen. Usually used to describe events in the natural world that can be observed.	A **concept** is an idea and all of the things that go with it. Fruit is a concept. Things that go with fruit include all the different kinds of fruit, textures of fruits, etc. The attributes of something make a **concept**.
Biology	• cell division • digestion • energy and ATP • energy transfer • evolution • organ systems • photosynthesis • respiration • protein synthesis	• behavior of animals • mutation • sensory responses • populations	• atomic structure • cells and tissues • diffusion • DNA • macromolecules • metabolism • osmosis • symbiosis
Chemistry	• chemical changes • physical changes • transfer of energy • changes of state • distillation • vapor pressure • solution formation	• Conservation of Matter • Ideal gas laws • Kinetic molecular theory • Valence bond theory • Mole/mass relationships	• acid/base • atom • chemical bond • chemical equation • chemical reaction • chemistry formula • compound • concentration • element • ion • mole • molecule • Periodic Table • ph • radioactivity • solution

Physics	• thermodynamics • reflection • refraction • magnetism • projectile motions • wave behavior	• Conservation of Energy • Conservation of Momentum • Coulomb's Law • Equilibrium • Molecules in perpetual motion • Newton's Laws • Relative motion • Work-energy theorem	• displacement • distance • electricity and magnetism • force and motion • gravity • light • solids, liquids, gases • speed • velocity • motion and time • inertia • weight • net force • projectile motion • kinetic energy • potential energy • mass • volume
Earth Science	• rock formation • erosion • atmospheric processes • water cycle • energy cycles • rock cycle • nitrogen cycle • physical weathering • chemical weathering	• changes in weather • gravity • moon's orbit • motion of the planets • shifts in landforms • Coreolis effect • El Niño • Auroras • Greenhouse effect • Hurricane	• Earth • planets • solar system • Earth's core • landform • ozone • layers of the atmosphere • salinity • light year • Big Bang theory • fossil

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Websites

Concept-Oriented Reading Instruction: http://www.cori.umd.edu/

This website includes journal articles and professional resources related to Concept-Oriented Reading Instruction.

Dr. Elfrieda Hiebert**:** http://www.textproject.org/

Dr. Hiebert's website includes presentations, articles, book chapters, book reviews, and other resources.

There are also archived vocabulary webinars by Dr. Hiebert available at "Schools Moving Up." http://www.schoolsmovingup.net/cs/wested/print/htdocs/home.htm

Office of Literacy, Massachusetts Department of Elementary and Secondary Education: http://www.doe.mass.edu/literacy/

This website includes presentations from advanced seminars, regional meetings, and summer conferences.

Seeds of Science/Roots of Reading: http://seedsofscience.org

This website includes presentations, articles, and book chapters by Dr. P. David Pearson and Dr. Gina Cervetti.