CONTENTS: Grade 7 Science and Technology

READING STRATEGIES

Getting Ready to Read: Extending Vocabulary (Creating a Word Wall)	3
Reading Different Text Forms: Reading Informational Texts (The Earth's Crust)	23
Reading Informational Texts (Interactions within Ecosystems)	31
Reading Graphical Texts – Photographs (Structural Strength and Stability)	37
Reading Graphical Texts – Graphs (Pure Substances and Mixtures)	43
Following Instructions (Heat)	49

THIS PAGE NEEDS TO BE REMOVED FROM THE PDF FILE



Getting Ready to Read: Extending Vocabulary (Creating a Word Wall)

Grade 7 Science and Technology

Students are required to learn, on average, over 2 000 words each year in various subject areas. Those who have trouble learning new words will struggle with increasingly complex tasks that they encounter in the middle and senior school years. A *word wall* is a wall, chalkboard or bulletin board listing key words that will appear in a new unit of study, printed on card stock and taped or pinned to the wall/board. The word wall is usually organized alphabetically.

Purpose

 Identify unfamiliar vocabulary and create a visible reference in the classroom for words that will appear often in a topic or unit of study.

Payoff

Students will:

- practise skimming and scanning an assigned reading before dealing with the content in an intensive way. Students
 will then have some familiarity with the location and with various elements of the text.
- develop some sense of the meaning of key words before actually reading the words in context.
- improve comprehension and spelling because key words remain posted in the classroom.

Tips and Resources

- Word Anticipation Guide: A Word Anticipation Guide allows students to use prediction skills based on context when learning new vocabulary. As students are asked to predict word meaning, they are also asked to confirm their predictions by conferencing with a partner and looking the word up using another source. Consider using the Word Anticipation Guide template found in Student Resources.
- Word Splash Activity: The Word Splash is a visually appealing, random arrangement of key words from the Word Wall around a specific topic. Students could examine the words and write a paragraph predicting the main idea of the unit. Refer to the Student Resources for a sample Word Splash.
- Word Development Guide: The language of science includes special terms that are recognized as belonging to
 primarily specific fields, as well as words that in the context of science are used in new or distinctive ways. Introducing
 vocabulary carelessly or too soon may result in an ample vocabulary, but only cosmetic understanding of terms for
 students. To facilitate learning by engaging more of the brain to enhance retention, two senses writing words and
 drawing images are used. Refer to the Student Resources for a Word Development Guide template.
- Word Connections: Word wall words can be mapped to show connections and relationships. Refer to Student Resources for a Word Connections template and a sample Grade 7 model. The teacher should field test the word selection prior to instruction, as this activity is not applicable to all word wall words.
- Word Wall Games: Refer to Teacher Resources for strategies on how to use Word Walls.
- Word Wall Words: Refer to Teacher Resources for strand specific words and definitions.
- There are classroom environments (particularly secondary) where bulletin board or blackboard space is at a premium. Some classrooms are also used for multiple subjects. This may make the development and maintenance of a word wall challenging. Consider the purchase of a portable word wall from commercial suppliers (~\$35). Words are written on cards, and placed in see-through pockets of the word wall chart. These charts can be temporarily fastened to a blackboard or bulletin board, and rolled up/taken down each class. Be sure to write the words large enough so students at the back of the room can see them clearly. Do not laminate cards, as glare can result. Alternately, use a display board (similar to those used in Science Fair projects), and attach strips of Velcro to each panel of the board. Attach Velcro also to each word card.
- Students can create graphic organizers/visual words from the word wall to facilitate understanding. *Smart Ideas* is Ministry-licensed software that could be used for this purpose. Alternately, students could use online sources to collect graphics to represent and further clarify word wall words.
- To align instructional strategies, and assessment and evaluation, be sure to include word wall words in evaluation. Scaffold concept maps and Power notes using word wall words as a beginning. Consider use of cloze activities (fill in the blank), using word wall words, for evaluation purposes. As the unit and year progresses, have students develop sentences and information paragraphs using word wall words.

Further Support

- The use of colour is very helpful to visual learners. Examples: Teacher generated word wall words could be one
 colour, student suggestions could be another colour or all words from one unit could be in the same colour, with cross
 strand or other unit words in another colour. Use different colours for different concepts (e.g., use blue for water
 words, orange for energy words, green for plant words, etc.).
- Use the Internet to find free software to produce use of word match, word search, crossword puzzles and vocabulary bingo.



Getting Ready to Read: Extending Vocabulary (Creating a Word Wall)

Grade 7 Science and Technology

	What teachers do		What students do
Be	fore		
•	Before class, preview the text for key vocabulary. Prepare strips of card stock (approximately		
•	4"×10") for words. Divide students into groups of 3. Provide stick-on notes, markers, and masking tape or pins for each group of students. Explain to students that together the class will	•	With their group, find an appropriate space where they can talk face-to-face and write down the words.
	find key vocabulary in the assigned text, and will help each other to understand and spell the key vocabulary by creating a "word wall" in the classroom that they can refer to for the duration of that particular topic	•	Find the chapter or get a copy of the assigned text.
•	Distribute Student Resource, <i>Skimming and</i> <i>Scanning to Preview Text</i> , and read and clarify the techniques with students.	•	Follow along on the handout as the teacher reviews skimming and scanning.
Du	ring		
•	Ask students to skim the text to get a general sense of what is in it and where it is located. Engage students in some general discussion of the topic, making a few brief notes on the board about big ideas	•	Skim the text, looking at illustrations and subtitles to get a general idea of the topic of the text.
•	Direct the students to independently scan the text for unfamiliar words. Ask students to create a personal list of 10 unfamiliar words. Direct the students to small groups and ask the groups to compare personal lists and	•	Scan the text for words they do not know, marking them with stick-on notes (optional) and then making a personal list of the words. Compare personal lists. Choose the words for a group master list.
•	create a group master list. Distribute eight pieces of card stock (approx. $4'' \times 10''$), markers and pieces of masking tape to each group.	•	In each group, print the key vocabulary words in large letters on card stock and tape or pin them to the blackboard or bulletin board, preferably alphabetically.
Aft	er		
•	Lead some discussion of the words and ask students to speculate on their meaning. If appropriate, describe prefixes and suffixes that are unique or common to the subject area. Ask each group to look up the meaning of their words and then to explain the meaning to the rest of the class.	•	Use the glossary in the textbook dictionary(ies) to find the meaning of the words. Present their words to the rest of the class. Add the meaning of the words to the cards in smaller letters.



Skimming and Scanning to Preview Text

Skimming				
What is it?	When you SKIM, you read quickly to get the main idea of a paragraph, page, chapter, or article, and a few (but not all) of the details.			
Why do I skim?	Skimming allows you to read quickly to get a general sense of a text so that you can decide whether it has useful information for you. You may also skim to get a key idea. After skimming a piece, you might decide that you want or need to read it in greater depth.			
How do I skim? Read in this direction.	 Read the first few paragraphs, two or three middle paragraphs, and the final two or three paragraphs of a piece, trying to get a basic understanding of the information. Some people prefer to skim by reading the first and last sentence of each paragraph, that is, the topic sentences and concluding sentences. If there are pictures, diagrams, or charts, a quick glance at them and their captions may help you to understand the main idea or point of view in the text such as "Cycle of Life", "AIDS", "Physical Fitness" or "Healthy Eating". Remember: you do not have to read every word when you skim. Generally, move your eyes horizontally (and quickly) when you skim. 			

	Scanning	
What is it?	When you SCAN you move your eyes quickly down a page or list to find one specific detail.	
Why do I scan?	Scanning allows you to quickly locate a single fact, date, name, or word in a text without trying to read or understand the rest of the piece. You may need that fact or word later to respond to a question or to add a specific detail to something you are writing.	
How do I scan?	 Knowing your text well is important. Make a prediction about where in a chapter you may find the word, name, fact, term or date. Note how the information is arranged on a page. Will 	
Read in this direction.	headings, diagrams, or boxed or highlighted items guide you? Is information arranged alphabetically or numerically as it might be in a glossary, nutrition guide or sequentially as in a sport rulebook?	
	 Move your eyes vertically or diagonally down the page, letting them dart quickly from side to side and keeping in mind the exact type of information that you want. Look for other closely associated words that might steer you towards the detail for which you are looking. 	
	4. Aim for 100% accuracy!	



R

Student/Teacher Resource

Word Connections Template

Title: 1. Title the mind m 2. Use the followin words to complete the mind map.

Word Connections Sample – Grade 7



Word Anticipation Guide

Name: _____

Date: _____

Word	What I Think It Means	Think, Pair, Share	Actual Meaning
			0
1			
	N		
1		-	
			4.







Word Development Guide

Word Splash Activity

[§]ublimation 7 COMoration e

This word splash is a random arrangement of key words around the topic we will be studying. Examine the words and write a paragraph predicting the main idea of the unit. Your prediction must be supported. Use your textbook or a dictionary if you do not know the meaning of some of the words.

oint



Word Wall for Science and Technology: Grade 7, Earth and Space Systems

The Earth's Crust

bedrock	continental drift	core
crust	deposit	erosion
horizons	humus	igneous
magma	mantle	metamorphic
minerals	sediment	sedimentary
subduction	tectonic plate	topsoil
volcano	weathering	

Word Cards with Definitions

bedrock - the layer of rock just underneath soil

deposit - a high concentration of minerals horizons - the series of layers in soil



The Earth's Crust (Grade 7) - Definitions

bedrock - the layer of rock just underneath soil

continental drift - the theory proposed by Alfred Wegener in 1912 that the continents move on the Earth's surface like huge rafts

core - the matter at the centre of the Earth; the outer core is liquid, while the inner core is solid due to the immense pressure acting on it

crust - a thin layer of solid, rock that is underneath the soil on the Earth's surface

deposit - a high concentration of minerals

erosion - the gradual wearing away over time of material on the Earth's surface

horizons - the series of layers in soil

humus - decaying plant and animal matter in the topsoil

igneous - this rock is formed when magma cools

magma - hot, liquid or partially molten rock from under the Earth's surface

mantle - a hot, partly molten layer of material just below the Earth's crust

metamorphic - rock formed as the result of extreme heat and pressure

minerals - the non-living building blocks of rocks

sediment - small rocks and eroded soil that moving water carries

sedimentary - rock that is produced as a result of immense pressure acting over a period of time that drives the water out of accumulated sediments

subduction - when one plate plunges into the hot mantle below another one

tectonic plate - one of the huge rafts of the Earth's crust that float and carry continents on the Earth's surface

topsoil - the upper layer of soil directly beneath leaves, plants, and trees

volcano - a mountain built up as result of the eruption of magma from inside the Earth's crust

weathering - erosion as the result of physical action caused by the wind, water, or ice (mechanical weathering), as a result of the actions of living things like moss and lichens (biological weathering), or as a result of chemical action like acid rain (chemical weathering)

Word Wall for Science and Technology: Grade 7, Life Systems

Interactions within Ecosystems

abiotic	adaptations	biodegradable
biome	biosphere	biotic
carnivore	community	consumer
decomposer	ecosystem	food chain
food web	habitat	herbivore
micro-organism	population	producer
species	succession	

Word Cards with Definitions

biotic - all living things in an ecosystem

herbivore - an animal that eats only plants

species - one kind of organism



Life Systems (Grade 7) - Definitions

abiotic - all nonliving things in an ecosystem

adaptations – special features or characteristics that help an organism to survive in a certain environment

biodegradable - when matter decomposes and is recycled into the environment

biome – a region of land with certain organisms (biotic) living within a specific environment (abiotic)

biosphere - the thin layer of life as it exists on this planet

biotic – all living things in an ecosystem

carnivore - an animal that eats other animals

community - a group of organisms living together in a series of relationships

consumer - any organism that feeds on other organisms

decomposer - an organism that breaks down dead organisms, to be recycled into the environment

ecosystem - how a community of living things exists in a certain environment

food chain – organisms linked into a simple pathway by who eats who

food web - a complex network of feeding relationships within an ecosystem

habitat - the physical setting of the environment in which an organism lives

herbivore – an animal that only eats plants

micro-organism - living things that can only be seen with a microscope

population - a group of organisms that are all the same kind (species) sharing the same environment

producer - an organism (green plants) that can make its own food

species – one kind of organism

succession - how the key species change within an ecosystem over time



Word Wall for Science and Technology: Grade 7

Energy and Control

boiling point	condensation	contraction
convection	conduction	evaporation
expansion	heat	heat capacity
insulator	particle theory	radiation
sublimation	solidification	water cycle
temperature	thermometer	thermostat
vapourization		

Word Cards with Definitions

expansion - increase in volume of an object

insulator - a substance that prevents the passage of heat, sound or electricity water cycle - the cycle that collects, purifies and redistributes the Earth's water



Energy and Control (Grade 7) - Definitions

boiling point - the temperature at which a liquid begins to boil and turns into a gas

condensation - the process of changing from a gas or vapour into a liquid

contraction - a decrease in the volume of an object

convection – the transfer of heat by the movement of a fluid from one part to another (or the transfer of heat by the movement of particles from one part of a fluid to another)

conduction – the transfer of heat by the collision of particles inside a material

evaporation - the change of state from a liquid to a gas

expansion - the increase in volume of an object

heat – thermal energy transferred from one object or substance to another (or a form of energy that molecules of a substance have)

heat capacity – the measure of the amount of heat needed to raise the temperature of 1 kg of a substance by $1^{\circ}C$

insulator – a substance that prevents the passage of heat, sound, or electricity

particle theory - a theory used to explain heat and pressure that suggests that all matter is made of tiny moving particles too small to be seen

radiation - the transfer of energy by means of waves such as light waves or infrared rays

sublimation – the change of state from a solid directly to a gas or from a gas directly to a solid

solidification – the change of state from a liquid to a solid, sometimes called freezing

water cycle – the cycle that collects, purifies and redistributes the Earth's water

temperature – a measure of the average energy of motion of the particles of a substance

thermometer – device that uses the expansion and contraction of a liquid to measure temperature

thermostat – a device that uses the expansion and contraction of solids to measure temperature

vapourization – the rapid conversion of a liquid into a gas or vapour, sometimes known as boiling



Word Wall for Science and Technology: Grade 7, Matter and Materials

Pure Substances and Mixtures

concentrated	dilute	dissolve
distillation	filtration	homogeneous
heterogeneous	insoluble	manufactured products
mechanical mixture	particle theory	pollutant
pure substance	raw material	saturated
soluble	solute	solution
solvent	unsaturated	WHMIS symbols

Word Cards with Definitions

insoluble - a substance that does not dissolve in a solvent pollutant - a harmful substance to life forms

unsaturated - a solution that can dissolve more solvent



Matter and Materials (Grade 7) - Definitions

- concentrated a solution with a high amount of dissolved solute
- dilute a solution that can dissolve much more solute; having a low concentration
- dissolve when the particles of one substance totally mix with the particles of another substance
- filtration a method used to separate a mixture of substances having particles of different sizes
- homogeneous particles of pure substances mix completely, appearing as one substance
- heterogeneous a mixture with visibly different substances mixed together
- insoluble a substance that does not dissolve in a solvent
- manufactured products creating something new through a process, using raw materials

mechanical mixture – contains 2 or more pure substances that do not blend when put together and therefore, can easily be separated

particle theory – how substances behave based on physical and chemical properties

pollutant – a harmful substance to life forms

pure substance - matter that contains only one kind of particle

raw material – matter that is not pure and needs to be processed to separate out the various substances

saturated – a solution that cannot dissolve any more solvent at a given temperature

- soluble how easily a substance dissolves in a solvent
- solute the substance that is dissolved in a solution

solution - when 2 or more substances combine to look like only one substance

solvent - the substance, like water, that does the dissolving in a solution

unsaturated – a solution that can dissolve more solvent

WHMIS symbols - coded pictures from the workplace hazardous material information system



Word Wall for Science and Technology: Grade 7, Matter and Materials

Structures and Mechanisms

buckle	centre of gravity	compression
force	frame structure	load
shear	shell structure	solid structure
stability	stress	structure
strut	structural failure	structural function
tension	torsion	truss

Word Cards with Definitions

buckle - to fold under a compressive force

force - a push or a pull

structure - a supporting framework



Structures and Mechanisms (Grade 7) - Definitions

buckle - to fold under a compressive force

centre of gravity – the point at which all of the gravitational force of an object may be considered to act

compression – a force that compresses or squeezes together a structure or material

force – a push or pull, or anything that attempts to cause a change in the motion or shape of an object

frame structure – a type of structure in which a skeleton (of materials) supports the weight of other parts

load – the force of gravity of an object that is not part of the structure exerted downward on a structure (the weight of an object down on a structure)

shear – two forces that act on an object in opposite directions, a sideways force on a structure (or the attempt of a part of a structure under pressure to slide over another part of the structure)

shell structure – a type of structure consisting of a thin, carefully shaped outer layer of material without a skeleton or internal frame underneath of it

solid structure – a type of structure consisting of solid material distributed throughout

stability – a feature of a structure that enables it to maintain its shape and position

stress – forces created inside a structure by other forces acting on it from the outside trying to change its shape

structure – a supporting framework

structural failure - the failure and breakdown of a structure under external or internal forces

structural function – the main purpose of a structure

strut – a part of a structure whose function is to resist compressive forces

tension – a force that pulls on a structure to stretch it apart

torsion – a force that causes an object to twist along its axis

truss – a structural element made up of a series of triangular frames (or an arch with ends that are tied together by a tie beam)



Word Wall Games

Be a Mind Reader Game: Word Walls can be used to play motivating games. This game can be played individually or in teams. The teacher thinks of a word wall word and gives five clues to that word. Your clues could include parts of the definition, synonyms or how it is used. Students number their papers from 1 to 5 and try to "read the teacher's mind". By the time the teacher gives the fifth clue, everyone in the class should guess the word and have it written down on their papers.

Word Jar Game: Place all word wall cards in a jar. Students break into 2 teams. Teams alternately send members to the jar to select a word and state its definition. Award 2 points for each correct team definition. The opposing team can earn 1 point if they can correctly define the word if the original team fails to correctly define the word.

Word Mixer Game: Play a "mixer" game with the students. Some students will receive word wall words. The remaining half of the class receives the definitions. Students move around the room trying to find their partner. Variation: Some words may have more than one meaning, hence there may be more than two students partnering.

Word Mimes Game (especially suitable for Earth and Space): Students are divided into two teams. Students select a word from the word wall, and attempt to act out the meaning of the word.

Wordo Game: Teacher determines the number of words to focus upon from the Word Wall. Students make a grid of 8 squares (e.g., a 4 x 2 matrix, similar to a bingo card) on a blank sheet of paper. Each square must be large enough for words to be written. There are two options for filling in the grid:

Option 1 - A student begins the game by calling out a word from the word wall. Classmates respond by writing the word in any space on their grid. Some teachers have students spell them as they write them, to ensure accuracy. The student who gave the first word calls on another classmate to select a second word, which all students again write in a space on their grid. As students select words from the wall and write them in their grids, the teacher writes the same words on a piece of paper and places them in a pile. This process continues until the students have all the spaces on their grids filled. Then, the teacher begins to draw words from the pile. Students mark or stamp the words in the same way (e.g., with a checkmark) until someone marks all words in a straight or diagonal line as in bingo and calls, "Wordo".

Option 2 - Instead of having all students add the same words to their grids, have students fill in their grids with any words from the wall, so that everyone has different words on their cards. Then, either the teacher calls words from the wall until a winner is declared, or students call out a word from their card, that is marked by other students that have included the same word on their own cards.



Reading Different Text Forms: Reading Informational Texts Grade 7 Science and Technology (The Earth's Crust)

Informational text forms are written to communicate information about a specific subject, topic, event or process. These texts use subject specific vocabulary, organizational patterns and diagrams to express ideas clearly and make them easier to read. Providing students with an approach to reading informational texts helps them to become more effective readers.

Purpose

- Become familiar with the elements and organization of informational texts used in the text example.
- Explore a process for reading informational texts, using a range of strategies for before, during and after reading.

Payoff

Students will:

- become more efficient at "mining" the text for information.
- practise reading strategies using the organizational patterns to assist and consolidate understanding.

Tips and Resources

- Some of the features of informational texts are headings, subheadings, introductions, and diagrams. These work together to draw readers into the text at different levels. For example, the diagram after each text section provides a visual to help students consolidate their understanding.
- Many informational texts are divided into sections that add meaning, by description or definition. For example, the sections each describe or define the layers of the earth.
- Many informational texts use visual elements (such as typeface, size of type) to emphasize important words and concepts. Different texts use these features in different ways to effectively present information.
- How you read informational text will depend on your purpose for reading. If you want to find specific information in a textbook, you might examine the headings and subheadings, and then skim through the section looking for key words and phrases related to the topic (e.g., layers of the earth). Once you have located the appropriate section, a closer reading will help you to find the information and supporting details.
- See Student Resource, Tips for Reading Informational Texts.
- See Student/Teacher Resource, *The Earth and Its Layers*. This reading passage refers to the importance of heat in the formation of the Earth's crust. Students can make connections with the Energy and Control strand: Heat.
- See Teacher Resource, *Questions to Guide Reading: The Earth and Its Layers*. These questions can be adapted for a variety of informational texts, depending on the features of the text on which you want to focus.
- See Student Resource, Organizer for The Earth and Its Layers.
- See Teacher Resource, Organizer for The Earth and Its Layers. This is a suggested completed version of the student template.

Further Support

 See strategies for *before reading*, such as **Previewing a Text**, and **Analysing the Features of a Text** in *Think Literacy: Cross-Curricular Approaches, Grades* 7 – 12. Refer to these to support and reinforce the ideas described here.



Reading Different Text Forms: Reading Informational Texts

Grade 7 Science and Technology (The Earth's Crust)

What teachers do

Before

Before reading, help students to connect new content and ideas to their prior knowledge by encouraging them to think about what they already know about the topic or the type of reading material (see Student/Teacher Resource. The Earth and Its Lavers). For example:

- Ask students to brainstorm related ideas, concepts and vocabulary, recall previous experiences and feelings • related to the subject, recall what they have learned about the topic, or **list questions** they might have about the topic.
- Provide students with related experiences, discussion topics, readings, or background information to increase background knowledge.
- Pose questions to students before they read, to help them **determine a purpose** for reading. •
- Invite students to ask questions about the content. •
- Model (using a "think aloud") how to **predict** the content based on the features of text, specialized vocabulary, • illustrations, introductory information or personal experiences. Skim, scan and sample the text to make informed predictions.
- **Identify** and pre-teach unfamiliar vocabulary and concepts that appear in the text. •

During

During reading, help students to connect the information and ideas in the text to what they already know as they monitor their understanding. (Monitoring their understanding means recognizing when confusion occurs and identifying strategies that help to regain meaning.) For example:

- Have students describe and model the different reading strategies they might use, such as **predicting**, • questioning, activating prior knowledge, inferring, monitoring, adjusting, rereading, and decoding.
- Model (using "think aloud") strategies for pausing and thinking about the text. Encourage students to **chunk** • the text, read, pause, think, and ask questions or make notes about the section of text.
- Demonstrate how to use a graphic organizer to categorize and select main ideas, important details, and • questions as you read. For example, comparison charts, T-charts, or Venn diagrams can help students to identify the ideas being compared and how they are similar and different.
- Invite students to **visualize** the concepts as they read. Have partners share and compare the visualizations. •
 - Provide students with **focus** questions, such as the following:
 - What are the main ideas?
 - How has the writer organized them?
 - How does the writer support the main ideas?
 - What is the writer's viewpoint?
 - Is this a useful source of information?

After

After reading, help students to **consolidate** and **extend** their understanding of the content. For example:

- Ask partners to restate or paraphrase what they have read, and note similarities and differences in the • retelling.
- Model how to summarize the reading selection (using a "think aloud") by identifying the essence of the text, • choosing the most important information, and organizing the information to convey the key ideas of the selection.
- Have students suggest possible diagrams or **graphic organizers** to illustrate connections among the topics. main ideas, supporting details, and prior knowledge.
- Review the process that students used for reading informational text. See Student Resource. Tips for Reading Informational Texts.



Tips for Reading Informational Texts

Before Reading

- Set a purpose for reading. Ask yourself why you are reading this particular text.
- Look over the text to see which elements appear (such as headings, subheadings, illustrations, captions, and more).
- Examine the titles, headings, and subheadings, and scan for words that stand out.
- Look for words and phrases that might give you clues about how the information is organized.
- Read any overviews, summaries or questions. In a shorter piece, read the opening and concluding sentences or paragraphs.
- Examine each illustration and read the titles or captions.
- Recall what you already know about the topic.
- Record some questions you might have about the topic.

During Reading

- Divide the reading task into smaller chunks (chunking the text into paragraphs, chunking sections by sub-headings, etc.). Read a chunk, pause and think about what you read, and write a brief one-sentence summary or brief point-form notes to help you remember important and interesting information.
- Read quickly, then slowly. Skim the sections you think will support your purpose for reading. When you find specific information you want, slow down and read it word by word. You may need to reread the passage several times.
- Read the selection and jot down thoughts, responses to your questions and new questions that occur to you.

After Reading

- Read the selection again to confirm the main idea and supporting details.
- Make connections to what you already know about the topic. How does the information you have read add to or alter what you knew about the topic?
- Record your thinking about and responses to the text. For example, write a summary, complete a graphic organizer, create a sketch, or orally retell to yourself or a friend.



Student/Teacher Resource

The Earth and Its Layers

Scientists have puzzled over the mysteries of how the Earth was formed and what it is made of for years. With the evidence they have scientists have made a model of what they think happened. Billions of years ago, *gravity* pulled together gases and dust, which created a star, our sun. The leftover material formed planets, including the Earth. The gravity pulling the leftover material together caused tremendous high-speed collisions. The collisions created such high temperatures that the rocks in the leftover material melted. Much of the Earth is still extremely hot and still in a liquid state.

Only the **Earth's crust** that part of the Earth on which we live, has cooled. This crust is rather thin, compared to the rest of the earth. Its thickness varies from 5 to 50 km. Because the crust cooled and became rigid so rapidly, cracks and breaks occurred over its surface. These broken sections are called *tectonic plates*.

Below the crust is the **mantle**, which is about 2 900 km thick. The mantle is partially melted rock, which flows very slowly. It is kept in this state by the high temperatures below it and the pressure from the material above it. Scientists say that the Earth's crust is floating on the mantle.

Inside the mantle, the material is always melting, mixing and cooling. *Convection currents* carry the hot, molten material (*magma*) to the surface. When the material cools and becomes denser, it sinks back down again. Sometimes the magma breaks through the Earth's crust, causing *volcanoes*. *Forces* within the mantle cause the tectonic plates on the Earth's crust to move. When those plates collide with tremendous force it produces *earthquakes*.

Below the mantle is **the outer core**. The outer core is 2 200 km thick. Because the temperature is so high, it is completely *liquid*. It contains molten iron and some nickel.

Finally, the **inner core** of the earth is a solid sphere, 2 400 km in diameter, made of solid iron and nickel. The *temperature* is 3 870° C, which is almost as hot as the surface of the sun. Huge pressure keeps the inner core solid.

The search for answers to the mystery of the formation of the Earth continues. One of the most recent investigations began in 1997. NASA launched a probe named Cassini from Cape Canaveral to investigate Saturn's rings and its moons. Scientists hope that the images that the probe sent back in the summer of 2004 will help them understand how our solar system, including the Earth, was formed 4.6 billion years ago.



Questions to Guide Reading: The Earth and Its Layers

	Questions to ask		Possible answers
Be	efore		
•	Why are we going to read this particular section on the Earth's layers?	•	To know more about how the Earth was formed and what it is made of
•	How do we know what the big idea or main topic is?	•	Main heading at the top of the page, in bold print, about the Earth's layers
•	What are the sub-topics in this passage and how do you know?	•	The writing is divided into paragraphs, and each paragraph has words written in bold. Sub-topics: the Earth's crust, mantle, outer core and inner core.
•	Why are some words in italics? Where would you find the meaning of those words?	•	Words are found in the glossary. The italics are a clue that they are important words.
•	What do you already know about this topic?	•	Students respond based on their prior knowledge. Teacher to record ideas on chart paper or on the board.
D	uring		
•	Read the first paragraph. What is the main idea? Where did you find the main idea? Paraphrase the key points, using your words. Continue to read each paragraph slowly for details.	•	Main idea is that the Earth formed billions of years ago out of gases and dust, with the help of gravity. The main idea is in the third and fourth sentences. Paraphrase: Scientists think that gravity pulled gases and dust together. Huge collisions created high temperatures that melted dust and rock. The Earth is still really hot.
A	iter		
•	Use the organizer to record the important points.	•	Refer to Teacher Resource, Organizer for the Earth and Its Layers.
•	What connections can you make between this reading and your own experiences?	•	Answers may vary; students could connect to movies or television programs they have seen.

Student/Teacher Resource



R

THINK LITERACY: Subject-Specific Examples Science & Technology, Grade 7-8 Science, Grade 9 Applied

Teacher Resource

	Organizer for	the Earth and I	ts Layers	
Parts of the Earth	Crust	Mantle	Outer Core	Inner core
Features	Surface of the earth covered with cracks, breaks	Kept in molten state by high temperatures below, high pressure from above Convection currents carry magma to surface=volcanoes Forces move	Completely liquid because of high temperature	Solid because of pressure of material above 3.5 million times greater than what we are used to on surface
Temperature	-50 C to +50 C	High	Very high	As hot as surface of the sun (over 3 800 ^o C)
Thickness	5 – 50 km	2 900 km thick	2 200 km thick	2 400 km in diameter
Composition	Rocks Soil (Inferred)	Partially melted rock Like thick syrup	Molten iron and nickel	Solid iron and nickel



Reading Different Text Forms: Reading Informational Texts

Grade 7 Science and Technology (Interactions within Ecosystems)

Informational text forms are written to communicate information about a specific subject, topic, event or process. These texts use subject specific vocabulary, organizational patterns and diagrams to express ideas clearly and make them easier to read. Providing students with an approach to reading informational texts helps them to become more effective readers.

Purpose

- Become familiar with the elements and organization of informational texts used in the text example.
- Explore a process for reading informational texts, using a range of strategies for before, during and after reading.

Payoff

Students will:

- become more efficient at "mining" the text for information.
- practise reading strategies using the organizational patterns to assist and consolidate understanding.

Tips and Resources

- Some of the features of informational texts are headings, subheadings, introductions, and diagrams. These work together to draw readers into the text at different levels. For example, the diagram after each text section provides a visual to help students consolidate their understanding.
- Many informational texts use visual elements (such as typeface, size of type) to emphasize important words and concepts. Different texts use these features in different ways to effectively present information.
- How you read informational text will depend on your purpose for reading. If you want to find
 specific information in a textbook, you might examine the headings and subheadings, and then
 skim through the section looking for key words and phrases related to the topic. Once you have
 located the appropriate section, a closer reading will help you to find the information and supporting
 details.
- See Student Resource, Tips for Reading Informational Text.
- See Student/Teacher Resource, Producers or Consumers?
- See Teacher Resource, *Questions to Guide Reading: Producers or Consumers?* These questions can be adapted for a variety of informational texts, depending on the features of the text on which you want to focus.
- See Student Resource, Organizer for Reading: Producers or Consumers? 5 4 3 2 1. Students complete the organizer, using the material they have just read. They are to find 5 key words from the text, 4 facts related to the main topic, 3 new words and their meanings, 2 facts you already know, and one question they still have after reading the passage.
 - It might be helpful to do one example for the first four to begin.
 - Record a representative sample of questions on chart paper to check later in the unit.

Further Support

- See strategies for *before reading*, such as **Previewing a Text**, and **Analysing the Features of a Text** in *Think Literacy: Cross-Curricular Approaches*, *Grades* 7 – 12. Refer to these to support and reinforce the ideas described here.
- See strategies for reading at the website <u>http://www.readingquest.org</u>



Reading Different Text Forms: Reading Informational Texts

•

•

•

.

•

•

Grade 7 Science and Technology (Interactions within Ecosystems)

What teachers do Before Before reading, help students to connect new content and ideas to their prior knowledge by encouraging them to think about what they already know about the topic or the type of reading material (see Student/Teacher Resource, Producers or Consumers?). For example: Ask students to brainstorm related ideas, concepts and vocabulary, recall previous experiences and feelings related to the subject, recall what they have learned about the topic, or list questions they might have about the topic. Provide students with related experiences, discussion topics, readings, or background information to increase background knowledge. Pose questions to students before they read, to help them **determine a purpose** for reading. Invite students to ask questions about the content. Model (using a "think aloud") how to **predict** the content based on the features of text, specialized vocabulary, illustrations, introductory information or personal experiences. Skim, scan and sample the text to make informed predictions. **Identify** and pre-teach unfamiliar vocabulary and concepts that appear in the text. During During reading, help students to connect the information and ideas in the text to what they already know as they monitor their understanding. (Monitoring their understanding means recognizing when confusion occurs and identifying strategies that help to regain meaning.) For example: Have students describe and model the different reading strategies they might use, such as predicting, questioning, activating prior knowledge, inferring, monitoring, adjusting, rereading, and decoding. Model (using "think aloud") strategies for pausing and thinking about the text. Encourage students to chunk the text, read, pause, think, and ask questions or make notes about the section of text. Demonstrate how to use a graphic organizer to categorize and select main ideas, important details, and questions as you read. For example, comparison charts, T-charts, or Venn diagrams can help students to identify the ideas being compared and how they are similar and different. Invite students to visualize the concepts as they read. Have partners share and compare the visualizations. Provide students with **focus** questions, such as the following: What are the main ideas? How has the writer organized them? How does the writer support the main ideas? What is the writer's viewpoint? Is this a useful source of information? After After reading, help students to consolidate and extend their understanding of the content. For example: Ask partners to restate or paraphrase what they have read, and note similarities and

- differences in the retelling.
- Model how to **summarize** the reading selection (using a "think aloud") by identifying the essence of the text, choosing the most important information, and organizing the information to convey the key ideas of the selection.
- Have students suggest possible diagrams or graphic organizers to illustrate connections among the topics, main ideas, supporting details, and prior knowledge.
- Review the process that students used for reading informational text. See Student Resource, . Tips for Reading Informational Texts.



Tips for Reading Informational Texts

Before Reading

- Set a purpose for reading. Ask yourself why you are reading this particular text.
- Look over the text to see which elements appear (such as headings, subheadings, illustrations, captions, and more).
- Examine the titles, headings, and subheadings, and scan for words that stand out.
- Look for words and phrases that might give you clues about how the information is organized.
- Read any overviews, summaries or questions. In a shorter piece, read the opening and concluding sentences or paragraphs.
- Examine each illustration and read the titles or captions.
- Recall what you already know about the topic.
- Record some questions you might have about the topic.

During Reading

- Divide the reading task into smaller chunks (chunking the text into paragraphs, chunking sections by sub-headings, etc.). Read a chunk, pause and think about what you read, and write a brief one-sentence summary or brief point-form notes to help you remember important and interesting information.
- Read quickly, then slowly. Skim the sections you think will support your purpose for reading. When you find specific information you want, slow down and read it word by word. You may need to reread the passage several times.
- Read the selection and jot down thoughts, responses to your questions and new questions that occur to you.

After Reading

- Read the selection again to confirm the main idea and supporting details.
- Make connections to what you already know about the topic. How does the information you have read add to or alter what you knew about the topic?
- Record your thinking about and responses to the text. For example, write a summary, complete a graphic organizer, create a sketch, or orally retell to yourself or a friend.

Questions to Guide Reading: Producers or Consumers?

Questions to ask		Possible answers	
•	fore What words do you think of when you hear the words producers and consumers ?	•	Student will probably suggest a variety of ideas, some of which are associated with this reading passage. Record all, with no comment other than "we will be reading to see if you are correct".
•	What is the purpose of our reading (the main reason for reading)?	•	To learn more about producers and consumers and think about the differences
•	What is the purpose of the question at the top of the reading passage?	•	The question gets the reader thinking as they read the passage.
•	Why are some words in italics? Where might you find the meaning of those words in a textbook? What italicized words have you seen before but you are not sure of the meaning? What words do you know the meaning of?	•	These are words that are important to this topic. You might find them in a glossary at the back of the book. Create a list of known and unknown words.
Du	ring		
•	Read the first paragraph. Why does the author start with this story? How does it relate to the main idea?	•	The author is setting the tone and giving some background information so that readers have a purpose for reading.
•	Continue to read each paragraph, making dot jot notes (point - form notes) of important points.		
After			
•	Use the organizer to record the main ideas.		
•	Answer the final question and discuss the responses. What connections can you make to what you have just read and what you knew before?	•	Students might share various menus from their experiences, and classify themselves as herbivores or omnivores.



Organizer for Reading: *Producers or Consumers?*

5 - 4 - 3 - 2 - 1

	key words from the text
5	1.
J	2.
	3.
	4.
	5.
	facts related to the main topic
Δ	1.
	2.
	3.
	4.
	new words and what they mean
2	1.
J	2.
	3
	···
	facts you already know
7	1.
	2.
	question you still have
	question you suit nave

Student/Teacher Resource

Producers or Consumers?

As you read the following, think about: What did you have for breakfast this morning?

Anik and Jasmine are good friends. As they walked to school together one morning, Anik told Jasmine about this new breakfast bar she had tried. Jasmine had never heard of it. That led to a discussion about what they had each eaten for breakfast. Anik's breakfast was rather simple – a glass of orange juice, the new breakfast bar made of nuts and oats, and a bowl of sliced strawberries. Jasmine's breakfast was different. She'd eaten two sausages, a scrambled egg, some toast with jam, and a strawberry milkshake.

Anik's and Jasmine's breakfasts were quite different. Anik's breakfast had foods from producers. Jasmine's breakfast included foods from producers and consumers. What are the differences between producers and consumers?

The world of living things is made up of two main categories: **producers** and **consumers**. **Producers** are green plants. They have a special feature that allows them to use sunlight to produce their own *energy* from water and *carbon dioxide*. This process is called *photosynthesis*. The orange juice, nuts, oats, and strawberries are foods from producers.

Consumers are animals. We are consumers because we cannot produce our own food or energy. Consumers need to eat to get the energy they require to live. The sausages, eggs and milk came from consumers.

Consumers can be divided into three smaller categories. *Carnivores* are animals that eat mainly other animals. *Herbivores* are animals that eat mainly plants. *Omnivores* eat both plants and animals.

Anik is a vegetarian (she eats no meat products) so she is an herbivore. Cows and horses are herbivores as well. Jasmine has meat in her diet (the sausages) but also plant products (the toast, made from grain plants). She is an omnivore. Bears, humans, and raccoons are omnivores. Animals such as cats, seals and praying mantises are considered carnivore, because they eat mainly animals for food.

Producers or consumers? Did your breakfast look more like Anik's or Jasmine's?




Reading Different Text Forms: Reading Graphical Texts (Photographs)

Grade 7 Science and Technology (Structural Strength and Stability)

Graphical text forms (such as diagrams, photographs, graphs, charts, and tables) are intended to communicate information in a concise format and illustrate how one piece of information is related to another.

Purpose

- Become familiar with the elements and features of graphical texts.
- Explore a process for reading graphical texts, using a range of strategies for before, during and after reading.

Payoff

Students will:

- become more efficient at "mining" graphical texts for information and meaning.
- practise essential reading strategies and apply them to different course-related materials.

Tips and Resources

- Sometimes a complicated idea or concept can be communicated more easily through a chart, graph, diagram or illustration. Many informational texts include graphics to supplement the main ideas and provide clues to the important concepts in the text. Some of the features of graphical texts include:
 - print features (such as typeface and size of type, titles, headings, subheadings, italics, labels and captions);
 - design features (such as colour, shape, line, placement, and focal point.);
 - organizational patterns (such as sequential, categorical, and explanatory).
- Each graphical text uses these elements and features in different ways to effectively present information in a condensed format. For example, a chart or table may illustrate key information and show how pieces of information relate to each other. A table uses columns and rows to organize the information and may include a title that describes the main idea or subject, and a caption to explain the purpose of the table. The information in a table can be read horizontally and vertically. Tables are often used to help the reader quickly grasp key information (such as number patterns).
- Many of the strategies for reading informational and literacy texts can also be used effectively to read graphical texts.
- See Student Resource, *Tips for Reading Graphical Texts*.
- See Student/Teacher Resource, Getting Over It.
- See Teacher Resource, *Questions to Guide Reading: Getting Over It.* These questions can be adapted for use with a variety of photographs, depending on the instructional focus of your lesson.
- As a follow-up to the class discussion, students are to use their own words to paraphrase the information they have learned from the photographs. Some suggested prompts are given in the Teacher Resource, *Questions to Guide Reading: Getting Over It.*

Further Support

• See Reading Graphical Texts, Think Literacy: Cross-Curricular Approaches, Grades 7 – 12.



Reading Different Text Forms: Reading Graphical Texts (Photographs)

Grade 7 Science and Technology (Structural Strength and Stability)

What teachers do

Before

Before reading, help students to connect new content and ideas to their prior knowledge by encouraging them to think about what they already know about the topic or the type of graphical text (see Student/Teacher Resource, *Getting Over It*). For example:

- Ask students to brainstorm related ideas, concepts and vocabulary, recall previous experiences and feelings related to the subject, recall what they have learned about the topic, or list questions they might have about the topic.
- Provide students with related experiences, discussion topics, readings, or background information to increase background knowledge.
- Pose questions to students before they read, to help them **determine a purpose** for reading.
- Invite students to ask questions about the graphic's purpose and the information in it.
- Model (using a "think aloud") how to **predict** the content based on the features of graphic, specialized language, related written information, or personal experiences. **Skim, scan** and **sample** the text to make informed predictions.
- Identify and pre-teach unfamiliar vocabulary and concepts that appear in the text.

During

During reading, help students to connect the information and ideas in the graphical text to what they already know as they monitor their understanding. (*"Monitoring their understanding"* means recognizing when confusion occurs and identifying strategies that help to regain meaning.) For example:

- Have students describe and model the different reading strategies they might use, such as predicting, questioning, activating prior knowledge, inferring, reading slowly, and rereading.
- Model (using "think aloud") strategies for pausing and thinking about the text. Encourage students to examine parts of the text, **read**, **pause**, **think**, and **ask questions** or **make notes** about how this information relates to other parts of the text.
- Demonstrate how to paraphrase the information presented. For example, use the sentence stem "This means...". Invite students to **organize** the information in a different way. Ask students to share and compare their interpretations.
- Provide students with focus questions, such as the following:
 - What is the purpose of this graphic?
 - What information is provided?
 - Is all of the important information included? What information is missing?
 - How is the information organized?
 - How does this information relate to what you already know about the topic?
 - Is this a useful source of information?

After

After reading, help students to **consolidate** and **extend** their understanding of the content. For example:

- Ask partners to **restate** or **paraphrase** what they have read, and **note similarities and differences** in the rephrasing.
- Model (using a "think aloud") how to **make connections** between prior knowledge and what the text is saying.
- Have students suggest possible ways to **check the accuracy and reliability** of the information presented.
- Review the process that students used for reading graphical texts, including strategies for before, during and after reading. See Student Resource, *Tips for Reading Graphical Texts*.



Tips for Reading Graphical Texts

Before Reading

- Set a purpose for reading. Ask yourself why you are reading this particular text.
- Look over the text to determine what type it is and which elements are used.
- Examine the titles, headings, captions and images. Start with the title. The title tells you what the graphic is about. The captions may also use words and phrases from the text to show how the graphic is related to the information in the written text (e.g., "Figure 1.6").
- Recall what you already know about the topic or subject.
- Record some questions you might have about the information presented.

During Reading

- Read all the labels and examine how they are related to the graphic. Each label has a purpose. The most important labels may be in capital letters, bold type, or a larger font.
- Follow the arrows and lines. They may be used to show movement or direction, or connect to the things they name.
- Look for the use of colour or symbols to emphasize important words and information. Some graphical texts have a legend or a key to explain the meaning of specific symbols and colours.
- Study the image carefully. See if you recognize the details in the image. Read the text near the picture to find an explanation of the information in the graphic. Use the figure number or title and key words to find and read the related information in the written text.
- Identify the relationships among the visuals and information presented.

After Reading

- Interpret the information conveyed in any of the graphics (e.g., diagrams, charts, graphs, maps). Ask yourself why this information might be important.
- Rephrase information orally or in writing. Imagine that you are explaining the graphic to someone who has not read it.
- Create your own graphical text (e.g., graph, map, diagram, table, flow chart) to represent the important information.

Questions to Guide Reading: Getting Over It

Questions to ask		Possible answers		
Ве	fore			
•	Why are we looking at these photographs?	•	We want to learn more about how bridges are built.	
•	What do you already know about bridges? Record responses on chart paper. Ensure that correct vocabulary has been learned before this exercise.	•	Answers will vary, the teacher should ensure the correct vocabulary and meaning is developed at this time.	
•	What are captions and what is their purpose?	•	Captions help to identify the photo and provide relevant data about the subject.	
•	Why did the author choose to use photographs and not drawings?	•	Photographs are realistic and can help us make connections with our own experiences.	
Du	ring			
•	In what ways are the bridges similar?	•	All bridges have supports, spans etc.	
•	What do you notice about the construction of each bridge?	•	Two of them use trusses; triangles are used a lot; one has an arch shape above, another below; one is cantilevered etc.	
•	How do these photos help you understand the text?	•	It makes a visual connection to the words.	
Af	ter			
•	How did you read this page? Discuss strategies.	•	Possible strategies are: read whole page of text first, then focus on photos, or vice versa, or read in thirds.	
•	With your partner, talk about the information you learned from the photos.	•	Discussion should reinforce the points above.	
•	How are these bridges similar to ones you've seen or traveled on?	•	Answers will vary.	
•	 Find another photo of a bridge. With your partner, discover as many details as you can, using the same process as we have just used. Record them in your journal or notes. Write a brief reflection, using one of these prompts (or one of your own): As I looked at the photos, I was surprised I've seen this type of construction in I would like to know more about 	•	Answers will vary.	



Getting Over It

Bridges are structures for getting over something. But no one wants to travel over a bridge that is unsafe. Civil engineers must look at many factors when they are designing bridges, including what the bridge will be crossing and what kinds of **loads** the bridge will be supporting.



Figure 1 Bridge crossing a river and a railway yard.



Figure 2 Bridge crossing a valley

Will the bridge be **stable**, in all kinds of weather conditions, and with all kinds of loads? A **static load** is the weight of a structure. It could also be a heavy ice build up. A **dynamic load** is also an **external force** that moves or changes. How would cars, or a sudden wind or an earthquake affect these structures?

Will the bridge be able to withstand the effect of various forces no matter the **magnitude**, **point and plane of application**, or the **direction** of the force? Sometimes wind coming through a valley can strike a bridge in such a way that it becomes unstable.

What should we consider regarding internal forces, such as **torsion**, **tension**, **compression** and **shearing**? These are forces caused by one part of a structure acting on another part of the same structure.

Centre of gravity is important. A structure will remain stable if its centre of gravity is between the points where it is supported.

As you examine these photos, what factors did the engineers keep in mind when they designed these bridges?



Figure 3 Bridge crossing a river.



Reading Different Text Forms: Reading Graphical Texts (Graphs)

Grade 7 Science and Technology (Pure Substances and Mixtures)

Graphical text forms (such as diagrams, photographs, graphs, charts, and tables) are intended to communicate information in a concise format and illustrate how one piece of information is related to another.

Purpose

- Become familiar with the elements and features of graphical texts.
- Explore a process for reading graphical texts, using a range of strategies for before, during and after reading.

Payoff

Students will:

- become more efficient at "mining" graphical texts for information and meaning.
- practise essential reading strategies and apply them to different course-related materials.

Tips and Resources

- Sometimes a complicated idea or concept can be communicated more easily through a chart. Many
 informational texts include graphics to supplement the main ideas and provide clues to the important
 concepts in the text. Some of the features of graphical texts include:
 - print features (such as typeface and size of type, titles, headings, subheadings, italics, labels and captions);
 - design features (such as colour, shape, line, placement, and focal point);
 - organizational patterns (such as sequential, categorical, and explanatory).
- Each graphical text uses these elements and features in different ways to effectively present information in a condensed format. For example, a chart or table may illustrate key information and show how pieces of information relate to each other. A table uses columns and rows to organize the information and may include a title that describes the main idea or subject, and a caption to explain the purpose of the table. The information in a table can be read horizontally and vertically. Tables are often used to help the reader quickly grasp key information (such as number patterns).
- Many of the strategies for reading informational and literacy texts can also be used effectively to read graphical texts.
- See Student/Teacher Resource, Is It Pure Yet?.
- Connections can be made to the Life Systems strand and the use of harmful and useful microorganisms, specifically bacteria and their role in breaking down sewage.
- See Student Resource, Tips for Reading Graphical Texts.
- See Teacher Resource, *Questions to Guide Reading: Is It Pure Yet?* These questions can be adapted for use with a variety of graphical texts, depending on the instructional focus of your lesson.
- See Student Resource, *Organizer for Reading: Is It Pure Yet?* Students complete the organizer, using the graphic they have just read. Students are to use their own words to paraphrase the information they have learned from the graphic. They should complete the organizer by making connections to their own experiences or prior knowledge by completing *My Thoughts* section. Some suggested prompts are given. A chart could be created for the classroom for future activities.

Further Support

• See Reading Graphical Texts, Think Literacy: Cross-Curricular Approaches, Grades 7 – 12.



Reading Different Text Forms: Reading Graphical Texts (Graphs)

Grade 7 Science and Technology (Pure Substances and Mixtures)

What teachers do

Before

Before reading, help students to connect new content and ideas to their prior knowledge by encouraging them to think about what they already know about the topic or the type of graphical text. For example:

- Ask students to brainstorm related ideas, concepts and vocabulary, recall previous experiences and feelings related to the subject, recall what they have learned about the topic, or list questions they might have about the topic.
- Provide students with related experiences, discussion topics, readings, or background information to increase background knowledge.
- Pose questions to students before they read, to help them **determine a purpose** for reading.
- Invite students to ask questions about the graphic's purpose and the information in it.
- Model (using a "think aloud") how to **predict** the content based on the features of graphic, specialized language, related written information, or personal experiences. **Skim, scan** and **sample** the text to make informed predictions.
- Identify and pre-teach unfamiliar vocabulary and concepts that appear in the text.

During

During reading, help students to connect the information and ideas in the graphical text to what they already know as they monitor their understanding. (*"Monitoring their understanding,"* means recognizing when confusion occurs and identifying strategies that help to regain meaning.) For example:

- Have students describe and model the different reading strategies they might use, such as predicting, questioning, activating prior knowledge, inferring, reading slowly, and rereading.
- Model (using "think aloud") strategies for pausing and thinking about the text. Encourage students to examine parts of the text, **read**, **pause**, **think**, and **ask questions** or **make notes** about how this information relates to other parts of the text.
- Demonstrate how to paraphrase the information presented. For example, use the sentence stem "This means...".
- Invite students to **organize** the information in a different way. Ask students to share and compare their interpretations.
- Provide students with focus questions, such as the following:
 - What is the purpose of this graphic?
 - What information is provided?
 - Is all of the important information included? What information is missing?
 - How is the information organized?
 - How does this information relate to what you already know about the topic?
 - Is this a useful source of information?

After

After reading, help students to **consolidate** and **extend** their understanding of the content. For example:

- Ask partners to **restate** or **paraphrase** what they have read, and **note similarities and differences** in the rephrasing.
- Model (using a "think aloud") how to **make connections** between prior knowledge and what the text is saying.
- Have students suggest possible ways to check the accuracy and reliability of the information presented.
- Review the process that students used for reading graphical texts, including strategies for before, during and after reading. See Student Resource, *Tips for Reading Graphical Texts.*



Questions to Guide Reading: Is It Pure Yet?

Questions to ask		Possible answers		
Be	fore			
•	Look at the title, sub-headings and bold print. Predict what this reading passage will be about and why we would want to read it?	•	It is about how Canadian cities treat sewage. We want to find out how our own community treats sewage. This is something that affects us.	
•	What do you already know about how sewage is treated? Record on chart paper.	•	Answers will vary.	
•	What is the title of the graphic "Chart 1" and why is it included with the text?	•	Sewage Treatment in our Cities is the title and it will compare the number of cities using the different levels of sewage treatment.	
Dι	iring			
•	What is the information to be found on the x-axis?	•	The different types of sewage treatment	
•	What is the information on the y-axis? How do you read that information?	•	The number of cities using a particular type of treatment is on the y-axis. You read the information vertically from bottom (0) to the top (7), following the bars up for each type of treatment.	
•	How does the bar graph help you to understand the text?	•	Answers will vary but should include the idea that it makes a visual comparison of the information.	
•	In what year was the data collected and by whom? Does this make it a source of reliable information?	•	1999, from the Sierra Legal Defence Fund Report, 1999 National Sewage Report Card. It does not tell us which municipalities, but we could check the website.	
Af	ter			
•	Use the Organizer for Reading: Is It Pure Yet? to record the main ideas.	•	Answers may vary.	
•	Discuss the information learned from the graph. Why did the author choose this type of graph? Is there another way that this information could have been presented? Explain.	•	A bar graph gives a visual comparison. A pie graph could be used to show percentages. A table could be used but it would not be as effective visually.	

R

Tips for Reading Graphical Texts

Before Reading

- Set a purpose for reading. Ask yourself why you are reading this particular text.
- Look over the text to determine what type it is and which elements are used.
- Examine the titles, headings, captions and images. Start with the title. The title tells you what the graphic is about. The captions may also use words and phrases from the text to show how the graphic is related to the information in the written text (e.g., "Figure 1.6").
- Recall what you already know about the topic or subject.
- Record some questions you might have about the information presented.

During Reading

- Read all the labels and examine how they are related to the graphic. Each label has a purpose. The most important labels may be in capital letters, bold type, or a larger font.
- Follow the arrows and lines. They may be used to show movement or direction, or connect to the things they name.
- Look for the use of colour or symbols to emphasize important words and information. Some graphical texts have a legend or a key to explain the meaning of specific symbols and colours.
- Study the image carefully. See if you recognize the details in the image. Read the text near the picture to find an explanation of the information in the graphic. Use the figure number or title and key words to find and read the related information in the written text.
- Identify the relationships among the visuals and information presented.

After Reading

- Interpret the information conveyed in any of the graphics (e.g., diagrams, charts, graphs, maps). Ask yourself why this information might be important.
- Rephrase information orally or in writing. Imagine that you are explaining the graphic to someone who has not read it.
- Create your own graphical text (e.g., graph, map, diagram, table, flow chart) to represent the important information.



Organizer for Reading: Is It Pure Yet?

My thoughts (use your own prompt, or choose one below)

- 1) Something that surprised me was...
- 2) I used to think.... but now I...

Title

In my own words

- 3) I'd like to know more about....
- 4) This relates to my life because...



Student/Teacher Resource

Is It Pure Yet?

Sewage is one of the types of waste found in Canadian cities. Cities have four options when it comes to **sewage disposal**. Some municipalities treat the wastewater (and the water to which it is returned) more completely than others. A few municipalities do nothing with sewage and allow it to flow straight into a large body of water. One city purifies the waste so completely that it is drinkable.

Some changes are being made slowly. Sometimes the residents of the community have to become actively involved in encouraging politicians to be more environmentally concerned.

In addition to doing nothing with sewage there are three levels of sewage treatment used by Canadian communities. See Chart 1.

Primary treatment. Only 60 per cent of the large lumps of waste are removed. The 'water' is not fit to drink or to swim in.

Secondary treatment. Most of the waste is removed (almost 90%). Air and bacteria work together to break down the sewage into less harmful materials. We could swim in this water.

Tertiary treatment. All remaining particles, harmful bacteria and chemicals are removed with chemicals, filters and radiation (exposure to sunlight). This water is drinkable.



Data adapted from the Sierra Legal Defence Fund Report: <u>The National</u> <u>Sewage Report Card</u>, 1999 http://www.sierralegal.org/reports/Sewage.pdf

How does your community treat its sewage? How can you find out?



Reading Different Text Forms: Following Instructions

Grade 7 Science and Technology (Heat)

Students are expected to read and follow instructions in Science and Technology or Science especially for experiments. This strategy asks students to examine different types of instructions, their features and elements, and how the features, language and organizational patterns can be used to help the reader understand and complete a task.

Purpose

- Provide students with strategies for reading, interpreting and following instructions to complete a specific task.
- Learn how instructions are organized.

Payoff

Students will:

- identify purpose for reading instructions.
- develop a process for reading and following instructions.

Tips and Resources

- Instructions give detailed step-by-step information about a process or procedure (e.g., directions, recipes, experiments, manuals, tests). They are sometimes called procedures or how-tos. Most instructions use organizational patterns, language, and features (charts, bold or italic type, headings, numbers, lists) to help the reader identify the task and the best way to complete it; however, some instructions are complicated without any features to help the reader determine the sequence of steps.
- For further information, see **Following Instructions**, *Think Literacy: Cross-Curricular Approaches*, *Grades 7-12.*
- See Student/Teacher Resource, Reading Different Text Forms: Butter Up!.
- See Teacher Resource, Process to Guide Reading: Butter Up! These questions can be adapted for a variety of following instructions.
- See Student Resource, Flowchart for Reading Butter Up!.

Further Support

- Provide students with a list of typical signal words and task prompts and suggestions/strategies for responding to them (e.g., place, fill, mark, repeat, record).
- Provide students with flow charts, diagrams and timelines to help track successful completion of oral or written instructions.
- Create a class framework for reading instructions such as:
 - preview
 - highlight and annotate
 - think aloud and visualize
 - reread
 - go step-by-step
 - read the diagrams or charts
 - ask questions



Reading Different Text Forms: Following Instructions

Grade 7 Science and Technology (Heat)

What teachers do

Before

- Select a set of instructions typical for science, science and technology related to a current topic or process.
- Ask students to **recall** an important occasion, when they had to follow a set of instructions (e.g., an exam, making a table, fixing a bike, installing software). Discuss what was challenging and easy about following the instructions.
- Ask students to recall what they know about effective instructions.
- Make a list of the elements and features of instructions with the class.
- Make copies of another set of instructions and cut them into slips of paper with a step on each slip (unnumbered). Place one set of jumbled instructions in as many envelopes as there are groups or pairs. Provide partners or small groups with an envelope, and ask students to **recreate** the instructions and discuss the decisions they made. Identify the strategies they used to determine the task and the sequence.
- Provide students with a copy of the selected instructions. Model for students how to **preview** the instructions (e.g., looking at title, organization, some of the signal words [sequence of steps and process verbs], graphics, illustrations, summary, materials list).

During

- Model reading the introductory material (see Student/Teacher Resource, *Reading Different Text Forms: Butter Up*) and the first 2 or 3 steps aloud, noting the **signal words** and what they tell the reader to do.
- Ask students to continue reading the instructions to **identify** the task to be completed. Suggest that students imagine themselves completing the instructions.
- Ask small groups to **discuss** the **strategies** they used to read the instructions and determine what they were expected to do.

After

- **Clarify** any confusing sections of the instructions. Use a flow chart to **outline** the steps, if necessary.
- Have students individually or in pairs **complete** the instructions. **Compare** the completed tasks.
- Discuss how students figured out what to do.
- Identify confusing or challenging parts and suggest additional strategies.



Process to Guide Reading: Butter Up!

What teachers do		What students do		
Be	fore			
•	Use the Think/Pair/Share strategy to have students recall a situation in which they had to follow a set of instructions. Create a list of elements and features of effective instructions, and record on chart paper or board.	• T b o	The list should include a title, a numbered or pulleted series of steps in sequence, clear organization and sub-headings.	
•	What additional requirements does a scientific set of instructions include?	• S h a	Scientific instructions should include a question, hypothesis, materials, procedure, observations and a conclusion.	
•	Provide students with a copy of the instructions and model how to preview the instructions.	• lo tł n	dentify the title, read the introduction, check out he italicized or bold words for meaning, and note the sequence.	
Du	iring			
•	Read the instructions aloud with the students, noting the signal words - place, fill, add, repeat, and mark.	• S a	Students note the signals, highlight or underline, nd clarify what they tell the reader to do.	
•	Using the Think/Pair/Share strategy, students paraphrase to identify the task to be completed and what they are expected to do.	• S ir ci st	Students use their own words to clarify the nstructions in the experiment. Students may reate a diagram to assist in visualizing the teps.	
•	Draw a diagram to assist in visualizing the task.	• S u	Students draw a rough sketch to consolidate inderstanding of the instructions.	
Af	ter			
•	What parts of the instructions are not clear?	• A	Answers may vary.	
•	Use the organizer to outline the required steps.	• \$	Students complete the organizer.	
•	Review safety procedures before conducting the investigation.	• T	hink/Pair/Share investigation and results.	
•	Compare results with a partner.	• A	Answers may vary.	
•	What problems did you run into as you tried to follow the instructions? What strategies did you use to solve the problems?			





Flowchart for Reading Butter Up!



Student/Teacher Resource

Reading Different Text Forms: Butter Up!

Robert was helping his father get dinner one night, when he noticed something odd about the saucepans he was using to cook the pasta and the sauce. One pot had a metal body and a plastic handle. The other pot also had a metal body, but its handle was metal. He was able to pick up both pots using the handles without having to use a potholder, but he could not pick up the pots with his bare hands. He concluded that the second pot was made of two different metals. The metal that made up the handle must not have *conducted* heat as efficiently or as rapidly as the metal in the body of the pot.

Robert decided to do his own investigation to see if other solids conducted heat with different speeds. He would use some common materials found in his kitchen: butter, a wooden spoon or a wooden stir stick, a metal spoon and a plastic spoon, and some hot (boiling) water. **Safety Note:** If conducting this investigation, students should have previous instruction regarding safe use of hot liquids.

Question: Which solid conducts heat faster?

Hypothesis: The metal will conduct the heat fastest.

Materials:

Apron Goggles Beaker or bowl of hot (boiling) water Butter Wooden spoon (or a stir stick about same size as the spoons if a wooden spoon is not available) Plastic spoon (same size as the metal spoon) Metal spoon

Procedure:

- 1. Put the same amount of butter on the handle of each spoon. (or the wooden stir stick if it is used)
- 2. The butter end does <u>not</u> go in the water. Place the bowl of all three spoons into the hot water at the same time.
- 3. On what material does the butter melt the fastest? The slowest?
- 4. Record your observations. Use a diagram, or graph to show your findings.

Analysis:

- 1. Which variables would you have to control to make this a fair test?
- 2. Why did one type of material cause the butter to melt faster than the others?
- 3. Using what you have learned, conduct a second test using a different variety of similarly sized materials.

Conclusion:

Explain your findings, using your knowledge of conduction and heat transfer.

READING STRATEGIES

Getting Ready to Read: Extending Vocabulary (Creating a Word Wall)	55
Reading Different Text Forms: Reading Informational Texts (Mechanical Efficiency)	77
Reading Informational Texts (Optics)	83
Reading Graphical Texts – Table (Cells, Tissues, Organs and Systems)	91
Reading Graphical Texts – Diagram (Water Systems)	97
Following Instructions (Fluids)	103



Getting Ready to Read: Extending Vocabulary (Creating a Word Wall)

Grade 8 Science and Technology

Students are required to learn, on average, over 2 000 words each year in various subject areas. Those who have trouble learning new words will struggle with increasingly complex tasks that they encounter in the middle and senior school years. A *word wall* is a wall, chalkboard or bulletin board listing key words that will appear in a new unit of study, printed on card stock and taped or pinned to the wall/board. The word wall is usually organized alphabetically.

Purpose

 Identify unfamiliar vocabulary and create a visible reference in the classroom for words that will appear often in a topic or unit of study.

Payoff

Students will:

- practise skimming and scanning an assigned reading before dealing with the content in an intensive way. Students
 will then have some familiarity with the location and with various elements of the text.
- develop some sense of the meaning of key words before actually reading the words in context.
- improve comprehension and spelling because key words remain posted in the classroom.

Tips and Resources

- Word Anticipation Guide: A Word Anticipation Guide allows students to use prediction skills based on context when learning new vocabulary. As students are asked to predict word meaning, they are also asked to confirm their predictions by conferencing with a partner and looking the word up using another source. Consider using the Word Anticipation Guide template found in Student Resources.
- Word Splash Activity: The Word Splash is a visually appealing, random arrangement of key words from the Word Wall around a specific topic. Students could examine the words and write a paragraph predicting the main idea of the unit. Refer to the Student Resources for a sample Word Splash.
- Word Development Guide: The language of science includes special terms that are recognized as belonging to
 primarily specific fields, as well as words that in the context of science are used in new or distinctive ways. Introducing
 vocabulary carelessly or too soon may result in an ample vocabulary, but only cosmetic understanding of terms for
 students. To facilitate learning by engaging more of the brain to enhance retention, two senses writing words and
 drawing images are used. Refer to the Student Resources for a Word Development Guide template.
- Word Connections: Word wall words can be mapped to show connections and relationships. Refer to Student Resources for a Word Connections template and a sample Grade 8 model. The teacher should field-test the word selection prior to instruction, as this activity is not applicable to all word wall words.
- Word Wall Games: Refer to Teacher Resources for strategies on how to use Word Walls.
- Word Wall Words: Refer to Teacher Resources for strand specific words and definitions.
- There are classroom environments (particularly secondary) where bulletin board or blackboard space is at a premium. Some classrooms are also used for multiple subjects. This may make the development and maintenance of a word wall challenging. Consider the purchase of a portable word wall from commercial suppliers (~\$35). Words are written on cards, and placed in see-through pockets of the word wall chart. These charts can be temporarily fastened to a blackboard or bulletin board, and rolled up/taken down each class. Be sure to write the words large enough so students at the back of the room can see them clearly. Do not laminate cards, as glare can result. Alternately, use a display board (similar to those used in Science Fair projects), and attach strips of Velcro to each panel of the board. Attach Velcro also to each word card.
- Students can create graphic organizers/visual words from the word wall to facilitate understanding. *Smart Ideas* is Ministry-licensed software that could be used for this purpose. Alternately, students could use online sources to collect graphics to represent and further clarify word wall words.
- To align instructional strategies, and assessment and evaluation, be sure to include word wall words in evaluation. Scaffold concept maps and Power notes using word wall words as a beginning. Consider use of cloze activities (fill in the blank), using word wall words, for evaluation purposes. As the unit and year progresses, have students develop sentences and information paragraphs using word wall words.

Further Support

- The use of colour is very helpful to visual learners. Example: Teacher generated word wall words could be one colour, student suggestions could be another colour or all words from one unit could be in the same colour, with cross strand or other unit words in another colour. Use different colours for different concepts (e.g. use blue for water words, orange for energy words, green for plant words, etc.).
- Use the Internet to find free software to produce use of word match, word search, crossword puzzles and vocabulary bingo.



Getting Ready to Read: Extending Vocabulary (Creating a Word Wall)

Grade 8 Science and Technology

What teachers do	What students do
Before	
 Before class, preview the text for key vocabulary. Prepare strips of card stock (approximate 4"×10") for words. Divide students into groups of 3. Provide stick-on notes, markers, and mastrape or pins for each group of students. Explain to students that together the class find key vocabulary in the assigned text, help each other to understand and spell t vocabulary by creating a "word wall" in th classroom that they can refer to for the d of that particular topic. Distribute Student Resource, <i>Skimming a Scanning to Preview Text</i>, and read and the techniques with students. 	 ely sking s will and will the ir group, find an appropriate space where they can talk face-to-face and write down the words. Find the chapter or get a copy of the assigned text. Follow along on the handout as the teacher reviews skimming and scanning.
During	
 Ask students to skim the text to get a ger sense of what is in it and where it is locat Engage students in some general discus the topic, making a few brief notes on the about big ideas. Direct the students to independently scar text for unfamiliar words. Ask students to create a personal list of a unfamiliar words. Direct the students to small groups and a groups to compare personal lists and cre group master list. Distribute eight pieces of card stock (app 4"×10"), markers and pieces of masking to each group. 	 Skim the text, looking at illustrations and subtitles to get a general idea of the topic of the text. Scan the text for words they do not know, marking them with stick-on notes (optional) and then making a personal list of the words. Compare personal lists. Choose the words for a group master list. In each group, print the key vocabulary words in large letters on card stock and tape or pin them to the blackboard or bulletin board, preferably alphabetically.
 After Lead some discussion of the words and a students to speculate on their meaning. I appropriate, describe prefixes and suffixe are unique or common to the subject are. Ask each group to look up the meaning c words and then to explain the meaning to rest of the class. 	 Use the glossary in the textbook dictionary(ies) to find the meaning of the words. Present their words to the rest of the class. Add the meaning of the words to the cards in smaller letters.



Skimming and Scanning to Preview Text

	Skimming	
What is it?	When you SKIM, you read quickly to get the main idea of a paragraph, page, chapter, or article, and a few (but not all) of the details.	
Why do I skim?	Skimming allows you to read quickly to get a general sense of a text so that you can decide whether it has useful information for you. You may also skim to get a key idea. After skimming a piece, you might decide that you want or need to read it in greater depth.	
How do I skim? Read in this direction.	 Read the first few paragraphs, two or three middle paragraphs, and the final two or three paragraphs of a piece, trying to get a basic understanding of the information. Some people prefer to skim by reading the first and last sentence of each paragraph, that is, the topic sentences and concluding sentences. If there are pictures, diagrams, or charts, a quick glance at them and their captions may help you to understand the main idea or point of view in the text such as "Cycle of Life", "AIDS", "Physical Fitness" or "Healthy Eating". Remember: you do not have to read every word when you skim. Generally, move your eyes horizontally (and quickly) when you skim. 	

	Scanning	
What is it?	When you SCAN you move your eyes quickly down a page or list to find one specific detail.	
Why do I scan?	Scanning allows you to quickly locate a single fact, date, name, or word in a text without trying to read or understand the rest of the piece. You may need that fact or word later to respond to a question or to add a specific detail to something you are writing.	
How do I scan?	 Knowing your text well is important. Make a prediction about where in a chapter you may find the word, name, fact, term or date. Note how the information is arranged on a page. Will 	
Read in this direction.	2. Note now the information is an alged on a page. Will headings, diagrams, or boxed or highlighted items guide you? Is information arranged alphabetically or numerically as it might be in a glossary, nutrition guide or sequentially as in a sport rule book?	
	 Move your eyes vertically or diagonally down the page, letting them dart quickly from side to side and keeping in mind the exact type of information that you want. Look for other closely associated words that might steer you towards the detail for which you are looking. Aim for 100% accuracy! 	

Student/Teacher Resource



Word Connections Template

Word Connections	A mind map shows how all of the words for a concept are connected or related.	
Title:	1. Title the mind map. 2. Use the following words to complete the mind map.	



Word Connections Sample – Grade 8



Word Anticipation Guide

Name:

Date: _____

Word	What I Think It Means	Think, Pair, Share	Actual Meaning
5. 5			2
4			
	N		
i.		-	
	A		
			<i>v</i> .









Word Splash Activity



This word splash is a random arrangement of key words around the topic we will be studying. Examine the words and write a paragraph predicting the main idea of the unit. Your prediction must be supported. Use your textbook or a dictionary if you do not know the meaning of some of the words.



Word Wall for Science and Technology: Grade 8, Earth and Space

Water Systems

atmosphere	climate	continental divide
ecosystems	fresh water	geological features
glacier	groundwater	Great Lakes
marine	ocean currents	polar ice caps
precipitation	salinity	salt water
sustainability	tides	water cycle
water table	watershed	

Word Cards with Definitions

atmosphere - the mixture of gases surrounding the Earth that is held down by a force of gravity

fresh water - water that contains a low concentration of dissolved salts marine - relating to the water or to the ocean, such as marine life or marine environments

Earth and Space (Grade 8) - Definitions

atmosphere – the mixture of gases surrounding the Earth that is held down by the force of gravity

climate – monthly and yearly conditions such as temperature, precipitation, and wind common to a region over a period of time

continental divide – the ridge of land running north-south across North or South America that separates waters flowing into the Pacific Ocean from those flowing into the Atlantic Ocean

ecosystems - systems of interactions between living organisms and their non-living environment

fresh water - water that contains a low concentration of dissolved salts

geological features - features on the Earth's surface or Ocean bottom such as mountains

glacier – a large mass of ice and snow that slowly flows over land

groundwater – water that soaks into the ground and is held in the cracks in underground rocks and spaces between grains of soil

Great Lakes – the five large lakes on the border between Ontario and the United States, including Lake Ontario, Erie, Huron, Michigan, and Superior

marine - relating to water or to the ocean, such as marine life or marine environments

ocean currents – large, regular movements of water in the ocean such as the Gulf Stream

polar ice-caps – large glacier caps of ice covering the north and south poles of the Earth

precipitation – water that has gathered in the clouds and falls to earth as rain, hail, sleet, or snow

salinity - the concentration or amount of dissolved salts in water

salt water – water that contains a high concentration of dissolved salts, such as ocean water

sustainability – the ability to meet the needs of the present generation without compromising the ability of future generations to meet their needs

tides – the rising and falling of the ocean level due to the different gravitational pulls of the sun and the moon

water cycle – the movement of water through different states of matter

water table – the level below the earth's surface at which the ground becomes saturated with water.

watershed – an area surrounded by high land in which all water runs to a common destination such as a river

Teacher Resource





Word Wall for Science and Technology: Grade 8, Life Systems

Cells, Tissues, Organs and System

cell membrane	cell reproduction	cell specialization
cell wall	chloroplast	chromosomes
cytoplasm	diffusion	magnification
micro-organism	multi-cellular	nucleus
organ system	organism	organelles
osmosis	selectively permeable men	nbrane
tissue	unicellular	

Word Cards with Definitions

chloroplast - a green organelle, found in most plants, that controls photosynthesis

organism - a life form that exists by the characteristics of living things osmosis - movement of water particles across a membrane



Life Systems (Grade 8) – Definitions

- cell membrane outer layer that controls what goes in and out of a cell
- cell reproduction how a cell makes more copies of itself (mitosis)

cell specialization - when cells change shape and form to do special jobs

cell wall – a rigid outer layer, found only in plants, to support the cell

chloroplast - a green organelle, found in most plants, that controls photosynthesis

chromosomes - genetic (thread-like) structures in the nucleus

cytoplasm – a jelly-like fluid that holds the organelles in place inside the cell membrane

diffusion – movement of particles from an area of high concentration to an area of lower concentration

magnification – how much larger something appears to be when seen through the 2 lenses of a microscope (calculation = eye piece x objective)

micro-organism - living things that can only be seen with a microscope

multi-cellular - describes an organism with many cells

nucleus - the control centre of all activities inside the cell

organ system – a group of organs that work together within an organism

organism – a life form that exists by the characteristics of living things

organelles - structures within a cell that have specific functions

osmosis - movement of water particles across a membrane

selectively permeable membrane - controls by size what particles can pass through it

tissue – similar cells that function together to do a job

unicellular – describes an organism made of only one cell



Word Wall for Science and Technology: Grade 8, Energy and Control

Energy and Control

additive	concave	convex
diffuse	electromagnetic radiation	focus
incident	lens	luminous
non-luminous	normal	opaque
plane	ray	real image
refraction	regular	subtractive
translucent	transparent	virtual image
visible spectrum		

Word Cards with Definitions

concave - a mirror or lens that curves inward near the centre convex - a mirror or lens that curves outward near the centre plane - a flat surface



Energy and Control (Grade 8) - Definitions

additive - the process of adding colours of light together to produce new colours

concave - mirror or lens that curves inward near the center

convex - a mirror or lens that curves outward near the center

diffuse – when light reflects off an irregularly shaped surface resulting in light going in many different directions

electromagnetic radiation – all types of radiation produced by moving electric charges, such as light, infrared, ultraviolet, X-rays, microwaves, and radio waves

focus – the name of the spot where parallel rays of light are brought together to a common point by a lens or a mirror

incident - light that falls on an object

lens – a transparent optical device with curved sides that is used to bring light rays together, or to spread them apart

luminous – a body that produces its own light (ie. a burning match is luminous)

non-luminous – a body that can only be seen by reflected light; it does not produce its own light (i.e. a textbook is non-luminous)

normal – the line that is at right angles (i.e. 90°) to a surface

opaque – a material that does not transmit any incident light; all of the light falling on this material is either absorbed and/or reflected

plane - a flat surface

ray – a pencil-thin beam of light

real image – an image in which light is actually arriving at the image location

refraction - the bending of light as it passes from one material to another

regular – when light reflects off a flat surface resulting in the reflected light all going in the same direction



Energy and Control (Grade 8) – Definitions (continued)

subtractive – the process of absorbing or taking away colours from light in order to produce new colours

translucent – a material that transmits some incident light; the remaining light falling on this material is either absorbed and/or reflected

transparent – a material that transmits all light falling on it

virtual image – an image in which light is not actually arriving at the image location

visible spectrum – the range of colours that are visible to the human eye (ie. "ROY G BIV" - red, orange, yellow, green, blue, indigo, violet)

Word Wall for Science and Technology: Grade 8, Matter and Materials

Fluids

Archimedes' Principle	Bernoulli's Principle	buoyant force
compression	density	fair test
flow rate	fluid	fluid mechanics
gas	hydraulic devices	hydraulics
hydrometer	incompressibility	liquid
particle theory	pneumatic devices	pneumatics
pressure	viscosity	

Word Cards with Definitions

flow rate - how fast a fluid moves through a tube

gas - physical state of matter where a substance has no definite shape or volume hydrometer - an instrument used to measure the density of liquids







Matter and Materials (Grade 8) - Definitions

Archimedes' Principle – the buoyant force on an object is equal to the weight of the fluid that the object displaces

Bernoulli's Principle -a law that states that, for a fluid that is flowing steadily, its pressure is low when its velocity is high and its pressure is high when its velocity is low.

buoyant force – the upward force on objects submerged in fluids. (For some objects it can be sufficient to overcome completely the force of gravity and cause the object to float.)

compression - the reduction of the volume of an object under external pressure

density – the mass per unit volume of a substance (density = mass/volume)

fair test – investigation carried out under strictly controlled conditions to ensure accuracy and reliability of results.

flow rate - how fast a fluid moves through a tube

fluid – any matter that has no fixed shape, can flow, and takes the shape of its container. Both liquids and gases are fluids.

fluid mechanics - the study of the science of fluids

gas – physical state of matter where a substance has no definite shape or volume

hydraulic devices – devices that transmit forces through pressure changes in liquids

hydraulics – systems that use the pressure of liquids to function (the study of pressure in liquids)

hydrometer – an instrument used to measure the density of liquids

incompressibility – the property of some substances that can't be compressed under pressure

liquid – a fluid that takes the shape and fills the volume of its container

particle theory – a theory used to explain heat and pressure that suggests that all matter is made of tiny moving particles too small to be seen

pneumatic devices – devices that transmit forces through pressure changes in gases

pneumatics – systems that use the pressure of gases to function (the study of pressure in gases)

pressure – the force acting perpendicular to a unit area (pressure = force/area)

viscosity – the physical property of a liquid that limits its ability to flow Teacher Resource



Word Wall for Science and Technology: Grade 8, Structures and Mechanisms Mechanical Efficiency

tackle	efficiency	effort force
	friction	fulcrum

geargear ratiohydraulicleverlinkageload forcemachinemechanical advantagemechanism

pulley velocity velocity ratio

pneumatic

wheel and axle

block and

force

piston

Word Cards with Definitions

force - a push or a pull

gear - a toothed wheel that is used to speed up or slow down motion linkage - two or more levers linked together

pressure


Structures and Mechanisms (Grade 8) – Definitions

block and tackle - a system of pulleys and ropes that is used for lifting heavy objects

efficiency – it is a measure of how much useful work we are getting out of our machine (it is also the percentage ratio of the mechanical advantage to the velocity ratio)

effort force – it is the force that is being put out or applied in order to lift an object

force – a push or pull

friction – it is the force that resists motion as a result of two surfaces coming into contact with one another

fulcrum – the point around which a rigid object pivots or rotates

gear – a toothed wheel that is used to speed up or slow down motion

gear ratio – it is the ratio of the number of teeth in gears in a two gear system; the number of teeth in the gear on which force is being exerted comes first in the ratio

hydraulic – a system in which an enclosed liquid is used to transmit force

lever – a machine which consists of a rigid material that pivots around a point (the fulcrum)

linkage – it is two or more levers linked together

load force – it is the force exerted by the object that we are trying to lift (the load)

machine – any mechanical device that makes work easier for us

mechanical advantage - it is the ratio of the load force to the effort force

mechanism – a system of parts working together in a machine that changes an input motion and force into a desired output motion and force

piston – a metal cylinder that slides up and down inside a tube as a result of an applied force

pneumatic – a system in which an enclosed gas is used to transmit force

pressure – defined as force per unit area (ie. force/area)



Structures and Mechanisms (Grade 8) – Definitions (continued)

pulley – a machine that is a wheel and axle mechanism that is used to change the direction of the force or motion

velocity – includes both the magnitude or speed of the object as well as the direction the object is moving in

velocity ratio – the ratio of the distance moved by the effort force to the distance moved by the load force

wheel and axle – a machine that consists of a large diameter disk (the wheel) which is attached to a shaft (axle) that also turns as the wheel rotates

Word Wall Games

Be a Mind Reader Game: Word Walls can be used to play motivating games. This game can be played individually or in teams. The teacher thinks of a word wall word and gives five clues to that word. Your clues could include parts of the definition, synonyms or how it is used. Students number their papers from 1 to 5 and try to "read the teacher's mind". By the time the teacher gives the fifth clue, everyone in the class should guess the word and have it written down on their papers.

Word Jar Game: Place all word wall cards in a jar. Students break into 2 teams. Teams alternately send members to the jar to select a word and state its definition. Award 2 points for each correct team definition. The opposing team can earn 1 point if they can correctly define the word if the original team fails to correctly define the word.

Word Mixer Game: Play a "mixer" game with the students. Some students will receive word wall words. The remaining half of the class receives the definitions. Students move around the room trying to find their partner. Variation: Some words may have more than one meaning, hence there may be more than two students partnering.

Word Mimes Game (especially suitable for Earth and Space): Students are divided into two teams. Students select a word from the word wall, and attempt to act out the meaning of the word.

Word Game: Teacher determines the number of words to focus upon from the Word Wall. Students make a grid of 8 squares (e.g., a 4 x 2 matrix, similar to a bingo card) on a blank sheet of paper. Each square must be large enough for words to be written. There are two options for filling in the grid:

Option 1 - A student begins the game by calling out a word from the word wall. Classmates respond by writing the word in any space on their grid. Some teachers have students spell them as they write them, to ensure accuracy. The student who gave the first word calls on another classmate to select a second word, which all students again write in a space on their grid. As students select words from the wall and write them in their grids, the teacher writes the same words on a piece of paper and places them in a pile. This process continues until the students have all the spaces on their grids filled. Then, the teacher begins to draw words from the pile. Students mark or stamp the words in the same way (e.g., with a checkmark) until someone marks all words in a straight or diagonal line as in bingo and calls, "Wordo".

Option 2 - Instead of having all students add the same words to their grids, have students fill in their grids with any words from the wall, so that everyone has different words on their cards. Then, either the teacher calls words from the wall until a winner is declared, or students call out a word from their card, that is marked by other students that have included the same word on their own cards.



Reading Different Text Forms: Reading Informational Texts

Grade 8 Science and Technology (Mechanical Efficiency)

Informational text forms are written to communicate information about a specific subject, topic, event or process. These texts use subject specific vocabulary, organizational patterns and diagrams to express ideas clearly and make them easier to read. Providing students with an approach to reading informational texts helps them to become more effective readers.

Purpose

- Become familiar with the elements and organization of informational texts used in the text example.
- Explore a process for reading informational texts, using a range of strategies for before, during and after reading.

Payoff

Students will:

- become more efficient at "mining" the text for information.
- practise reading strategies using the organizational patterns and diagrams to assist and consolidate understanding.

Tips and Resources

- Some of the features of informational texts are headings, subheadings, introductions, and diagrams. These work together to draw readers into the text at different levels. For example, the diagram after each text section provides a visual to help students consolidate their understanding.
- Many informational texts are divided into sections that add meaning, by description or definition. For example, the sections each describe or define the classes of levers.
- Many informational texts use visual elements (such as typeface, size of type, and diagrams) to emphasize important words and concepts. Different texts use these features in different ways to effectively present information.
- How you read informational text will depend on your purpose for reading. If you want to find specific
 information in a textbook, you might examine the headings and subheadings, and then skim through the
 section looking for key words and phrases related to the topic (i.e. third class of lever). Once you have
 located the appropriate section, a closer reading will help you to find the information and supporting
 details.
- See Student Resource, Tips for Reading Information Texts.
- See Teacher Resource, Questions to Guide Reading: Levers.
- See Student/Teacher Resource, Levers.

Further Support

- See strategies for *before reading*, such as **Previewing a Text**, and **Analysing the Features of a Text** in *Think Literacy: Cross-Curricular Approaches, Grades* 7 – 12. Refer to these to support and reinforce the ideas described here.
- See Think/Pair/Share in Think Literacy: Cross-Curricular Approaches, Grades 7 12.



Reading Different Text Forms: Reading Informational Texts

Grade 8 Science and Technology (Mechanical Efficiency)

What teachers do

Before

Before reading, help students to connect new content and ideas to their prior knowledge by encouraging them to think about what they already know about the topic or the type of reading material (see Student/Teacher Resource, *Levers*). For example:

- Ask students to **brainstorm** related ideas, concepts and vocabulary, **recall** previous experiences and feelings related to the subject, recall what they have learned about the topic, or **list questions** they might have about the topic.
- Provide students with related experiences, discussion topics, readings, or background information to **increase background knowledge.**
- Pose questions to students before they read, to help them **determine a purpose** for reading.
- Invite students to ask questions about the content.
- Model (using a "think aloud") how to **predict** the content based on the features of text, specialized vocabulary, illustrations, introductory information or personal experiences. **Skim, scan** and **sample**

the text to make informed predictions.

• Identify and pre-teach unfamiliar vocabulary and concepts that appear in the text.

During

During reading, help students to connect the information and ideas in the text to what they already know as they monitor their understanding. (*Monitoring their understanding* means recognizing when confusion occurs and identifying strategies that help to regain meaning.) For example:

- Have students describe and model the different reading strategies they might use, such as predicting, questioning, activating prior knowledge, inferring, monitoring, adjusting, rereading, and decoding.
- Model (using "think aloud") strategies for pausing and thinking about the text. Encourage students to **chunk** the text, **read**, **pause**, **think**, and **ask questions** or **make notes** about the section of text.
- Demonstrate how to **use a graphic organizer** to **categorize** and select main ideas, important details, and questions as you read. For example, comparison charts, T-charts, or Venn diagrams can help students to identify the ideas being compared and how they are similar and different.
- Invite students to **visualize** the concepts as they read. Have partners share and compare the visualizations.
- Provide students with **focus** questions, such as the following:
 - What are the main ideas?
 - How has the writer organized them?
 - How does the writer support the main ideas?
 - What is the writer's viewpoint?
 - Is this a useful source of information?

After

After reading, help students to **consolidate** and **extend** their understanding of the content. For example:

- Ask partners to **restate** or **paraphrase** what they have read, and **note similarities and differences** in the retelling.
- Model how to **summarize** the reading selection (using a "think aloud") by identifying the essence of the text, choosing the most important information, and organizing the information to convey the **key ideas** of the selection.
- Have students suggest possible diagrams or **graphic organizers** to illustrate connections among the topics, main ideas, supporting details, and prior knowledge.
- Review the process that students used for reading informational text. See Student Resource, *Tips for Reading Informational Texts.*



Student Resource

Tips for Reading Informational Texts

Before Reading

- Set a purpose for reading. Ask yourself why you are reading this particular text.
- Look over the text to see which elements appear (such as headings, subheadings, illustrations, captions, and more).
- Examine the titles, headings, and subheadings, and scan for words that stand out.
- Look for words and phrases that might give you clues about how the information is organized.
- Read any overviews, summaries or questions. In a shorter piece, read the opening and concluding sentences or paragraphs.
- Examine each illustration and read the titles or captions.
- Recall what you already know about the topic.
- Record some questions you might have about the topic.

During Reading

- Divide the reading task into smaller chunks (chunking the text into paragraphs, chunking sections by sub-headings, etc.). Read a chunk, pause and think about what you read, and write a brief one-sentence summary or brief point-form notes to help you remember important and interesting information.
- Read quickly, then slowly. Skim the sections you think will support your purpose for reading. When you find specific information you want, slow down and read it word by word. You may need to reread the passage several times.
- Read the selection and jot down thoughts, responses to your questions and new questions that occur to you.

After Reading

- Read the selection again to confirm the main idea and supporting details.
- Make connections to what you already know about the topic. How does the information you have read add to or alter what you knew about the topic?
- Record your thinking about the text. For example, write a summary, complete a graphic organizer, create a sketch, or orally retell to yourself or a friend.

Questions to Guide Reading: Levers

	Questions to ask		Possible answers
Before			
•	Look at the headings, bold print and italicized words to predict what this passage will be about.	•	Classes or types of levers, the bold words give us information about the parts and the italicized word gives a location of a part in relationship to the other
•	How is the information organized?	•	It is organized into paragraphs, diagrams or sections by class of lever.
•	What do you already know about levers?	•	Answers may vary.
Du	ring		
•	What is the main idea in the first paragraph?	•	The type of lever will be determined by the location of the fulcrum with reference to the load and effort.
•	Read the next section, how does the diagram help you to understand the text above it?	•	It is a visual representation.
•	Continue to read slowly and look at the diagram for understanding. Copy the diagram for each type of lever and label. You may write dot jot or point-form notes and include an example from the text or one of your own.	•	Students read and make dot jot (point form) notes at their own pace.
Aft	er		
•	Think/Pair/Share with a partner to tell, in your own words, the difference between each type of lever.	•	Students paraphrase as they discuss to check their understanding of the classes of levers.
•	Are there any questions about the three types of levers and how they work?	•	Questions may vary.
•	Create a chart to share the examples of each class of lever in the body.	•	Students apply the knowledge they have gained from the reading and check their understanding. Some possible examples: first class-neck nodding head forward; second class-standing on tip toes; third class-elbow and arm lifting weights.





Student/Teacher Resource

Levers

A lever is a simple machine that makes work easier. A lever has an arm that rotates around a fixed point. This fixed point is called a **fulcrum** \triangle . The location of the fulcrum in relationship to the **load** $\boxed{10ad}$ that is being moved and the **effort** \bigcirc that is causing the movement determines the type of lever.

First class levers

With a first class lever the **fulcrum** or pivot point is *between* the **effort** and the **load**. A playground teeter-totter or see-saw is an example of a first class lever. One end will lift up as far as the other end is pushed down. If the load and the effort are uneven then changing the distance of the load from the fulcrum will change the effort needed to lift the load. Two children who are unequal in size can play on a teeter-totter by adjusting where they sit on the arm of the lever.



Second class levers

With a second-class lever the **load** is located *between* the **effort** and the **fulcrum**. A wheelbarrow is an example of a second-class lever. The handles of the wheelbarrow are the arms of the lever. The effort is exerted on these handles in an upward direction. The wheel acts as the fulcrum or pivot point for this type of lever.





Third class levers

With a third class lever the **effort** is exerted *between* the **load** and the **fulcrum**. Sweeping with a broom, shooting a puck with a hockey stick or using a fishing pole are all examples of third class levers. The force is applied in the direction that you want to move the load. A third class lever requires a greater force on the lever but the movement is very fast.



Where are your personal levers?

Our own bodies can provide examples of the three types of levers. Give an example of where in your body you can find a first, second and third class lever.



Reading Different Text Forms: Reading Informational Texts

Grade 8 Science and Technology (Optics)

Informational text forms are written to communicate information about a specific subject, topic, event or process. These texts use subject specific vocabulary, and organizational patterns to express ideas clearly and make them easier to read. Providing students with an approach to reading informational texts helps them to become more effective readers.

Purpose

- Become familiar with the elements and organization of informational texts used in the text example.
- Explore a process for reading informational texts, using a range of strategies for before, during and after reading.

Payoff

Students will:

- become more efficient a "mining" the text for information.
- practise reading strategies using the organizational patterns to assist in understanding.

Tips and Resources

- Some of the features of informational texts are headings, subheadings, introductions, and diagrams or flow charts. These work together to draw readers into the text at different levels. For example, the flow chart after each text section provides a visual to help students consolidate their understanding.
- Many informational texts are divided into sections that add meaning by description or definition. For example, the sections each describe or define a source of light.
- Many informational texts use visual elements (such as typeface, size of type, and flow charts) to
 emphasize important words and concepts. Different texts use these features in different ways to
 effectively present information.
- How you read informational text will depend on your purpose for reading. If you want to find specific
 information in a textbook, you might examine the headings and subheadings, and then skim through the
 section looking for key words and phrases related to the topic (i.e. Phosphorescence). Once you have
 located the appropriate section, a closer reading will help you to find the information and supporting
 details.
- See Student Resource, Tips for Reading Informational Text.
- See Teacher Resource, Questions to Guide Reading: What is Light?
- See Student/Teacher Resource, What is Light? What are the Sources for Visible Light?

Further Support

 See strategies for before reading, such as Previewing a Text, and Analysing the Features of a Text in Think Literacy: Cross-Curricular Approaches, Grades 7 – 12. Refer to these to support and reinforce the ideas described here.



Reading Different Text Forms: Reading Informational Texts

Grade 8 Science and Technology (Optics)

What teachers do

Before

Before reading, help students to connect new content and ideas to their prior knowledge by encouraging them to think about what they already know about the topic or the type of reading material (see Student/Teacher Resource, *What is Light? What are the Sources of Visible Light?*). For example:

- Ask students to brainstorm related ideas, concepts and vocabulary, recall previous experiences and feelings related to the subject, recall what they have learned about the topic, or list questions they might have about the topic.
- Provide students with related experiences, discussion topics, readings, or background information to **increase background knowledge**.
- Pose questions to students before they read, to help them **determine a purpose** for reading.
- Invite students to ask questions about the content.
- Model (using a "think aloud") how to **predict** the content based on the features of text, specialized vocabulary, illustrations, introductory information or personal experiences. **Skim, scan** and **sample** the text to make informed predictions.
- Identify and pre-teach unfamiliar vocabulary and concepts that appear in the text.

During

During reading, help students to connect the information and ideas in the text to what they already know as they monitor their understanding. (*Monitoring their understanding* means recognizing when confusion occurs and identifying strategies that help to regain meaning.) For example:

- Have students describe and model the different reading strategies they might use, such as predicting, questioning, activating prior knowledge, inferring, monitoring, adjusting, rereading, and decoding.
- Model (using "think aloud") strategies for pausing and thinking about the text. Encourage students to **chunk** the text, **read**, **pause**, **think**, and **ask questions** or **make notes** about the section of text.
- Demonstrate how to **use a graphic organizer** to **categorize** and select main ideas, important details, and questions as you read. For example, comparison charts, T-charts, or Venn diagrams can help students to identify the ideas being compared and how they are similar and different.
- Invite students to **visualize** the concepts as they read. Have partners share and compare the visualizations.
- Provide students with **focus** questions, such as the following:
 - What are the main ideas?
 - How has the writer organized them?
 - How does the writer support the main ideas?
 - What is the writer's viewpoint?
 - Is this a useful source of information?

After

After reading, help students to **consolidate** and **extend** their understanding of the content. For example:

- Ask partners to **restate** or **paraphrase** what they have read, and **note similarities and differences** in the retelling.
- Model how to **summarize** the reading selection (using a "think aloud") by identifying the essence of the text, choosing the most important information, and organizing the information to convey the **key ideas** of the selection.
- Have students suggest possible diagrams or **graphic organizers** to illustrate connections among the topics, main ideas, supporting details, and prior knowledge.
- Review the process that students used for reading informational text. See Student Resource, *Tips for Reading Informational Texts.*



Student Resource

Tips for Reading Informational Texts

Before Reading

- Set a purpose for reading. Ask yourself why you are reading this particular text.
- Look over the text to see which elements appear (such as headings, subheadings, illustrations, captions, and more).
- Examine the titles, headings, and subheadings, and scan for words that stand out.
- Look for words and phrases that might give you clues about how the information is organized.
- Read any overviews, summaries or questions. In a shorter piece, read the opening and concluding sentences or paragraphs.
- Examine each illustration and read the titles or captions.
- Recall what you already know about the topic.
- Record some questions you might have about the topic.

During Reading

- Divide the reading task into smaller chunks (chunking the text into paragraphs, chunking sections by sub-headings, etc.). Read a chunk, pause and think about what you read, and write a brief one-sentence summary or brief point-form notes to help you remember important and interesting information.
- Read quickly, then slowly. Skim the sections you think will support your purpose for reading. When you find specific information you want, slow down and read it word by word. You may need to reread the passage several times.
- Read the selection and jot down thoughts, responses to your questions and new questions that occur to you.

After Reading

- Read the selection again to confirm the main idea and supporting details.
- Make connections to what you already know about the topic. How does the information you have read add to or alter what you knew about the topic?
- Record your thinking about and responses to the text. For example, write a summary, complete a graphic organizer, create a sketch, or orally retell to yourself or a friend.

Questions to Guide Reading: What is Light?

Questions to ask			Possible answers		
Bef	ore Why are we going to read this particular section?	•	We want to know about light. We want to know about the different types and how they occur. Note: Answers will vary with prior knowledge and experiences.		
Dur	ing				
•	Read the first section of the passage. What is the main idea?	•	Light is energy. Natural and artificial light sources are chemical, electric, nuclear and thermal energy.		
•	What information do the bold headings give you?	•	The bold headings identify the sources of visible light and tell us where to look to find more information.		
•	Read aloud the section on incandescent sources. In your own words how is light produced?	•	Incandescent light is produced when an object is heated to a high temperature.		
•	Look at the flow chart in this section. What is a flow chart? How do we read it? In your own words explain what is happening; refer to the text above it.	•	A flow chart shows how something changes or the process. You read it by following the direction of the arrows. This flow chart tells us that electrical energy (light bulbs), chemical energy (fire), or thermal energy (sun) can produce a lot of heat energy, which in turn is converted to visible light energy.		
•	Continue to read each section slowly and relate it to the flow chart.	•	Students read for detail and refer to the flow chart to follow the process.		
After					
•	What are the main ideas from each section? Give an example of each from your own experience. Students may use a T-chart as an organizer for this information, with source of light and example as the headings.	•	Students identify each source of light in their own words followed by an example using a simple T-chart as an organizer.		





What is Light? What are the Sources of Visible Light?

What is Light?

Light is an energy form that you can detect with your eyes. Light energy comes from other forms of energy such as *chemical* energy, *electric* energy, *nuclear* energy and *thermal* energy.

What are the Sources of Visible Light?

Light can come from both natural and artificial sources.

Incandescence

An object heated to a very high temperature will emit (give off) *incandescent* light. Examples of incandescent light are light bulbs, the sun, fire, or molten metal.



Electrical Discharge

Electrical discharges passing through a gas can emit light. A good example of this is in a thunderstorm. An electrical discharge passes through the Earth's atmosphere creating light in the form of lightning. "Neon lights" are colourful electric signs that make use of this property.





Phosphorescence

Materials called phosphors will absorb energy and then release it later. Glow-in-the-Dark fabric is a product that shows this property. Watch or clock dials that are visible in the dark demonstrate phosphorescence. These light sources can also be radioactive.



Fluorescence

Fluorescent sources of light absorb energy and then release it rather than storing it for later use as with phosphorescent sources. Fluorescent light bulbs found in many classrooms and offices are an example of this source of light.



Chemiluminescence

This type of light source is the result of a chemical reaction. Generally, there is no increase in heat with chemiluminescence. Emergency glow sticks are an example of chemiluminescence. Two different chemicals are enclosed in a tube. When the tube is bent, to break the barrier between the two chemicals they meet and the reaction between the two chemicals gives off light energy.





Bioluminescence

This is the process used by many living creatures to emit light. A chemical reaction takes place inside the body of the organism to give off light energy. Fireflies and many deep-sea fish demonstrate bioluminescence.



Visible light, which is the light you are able to see, comes to us from many sources. The transfer of energy can be simple or complex. There are several possible sources for visible light including: **incandescence**, **electric discharge**, **phosphorescence**, **fluorescence**, **chemiluminescence** and **bioluminescence**.



Reading Different Text Forms: Reading Graphical Texts (Table)

Grade 8 Science and Technology (Cells, Tissues, Organs and Systems)

Graphical text forms (such as diagrams, photographs, graphs, charts, and tables) are intended to communicate information in a concise format and illustrate how one piece of information is related to another.

Purpose

- Become familiar with the elements and features of graphical texts.
- Explore a process for reading graphical texts, using a range of strategies for before, during and after reading.

Payoff

Students will:

- become more efficient at "mining" graphical texts for information and meaning.
- practise essential reading strategies and apply them to different course-related materials.

Tips and Resources

Sometimes a complicated idea or concept can be communicated more easily through a chart. Many informational texts include graphics to supplement the main ideas and provide clues to the important

- print features (such as typeface and size of type, titles, headings, subheadings, italics, labels and captions)
- design features (such as colour, shape, line, placement, and focal point)
- organizational patterns (such as sequential, categorical, and explanatory).
- Each graphical text uses these elements and features in different ways to effectively present information in a condensed format. For example, a chart or table may illustrate key information and show how pieces of information relate to each other. A table uses columns and rows to organize the information and may include a title that describes the main idea or subject, and a caption to explain the purpose of the table. The information in a table can be read horizontally and vertically. Tables are often used to help the reader quickly grasp key information (such as number patterns).
- Many of the strategies for reading informational and literacy texts can also be used effectively to read graphical texts.
- See Student Resource, *Tips for Reading Graphical Texts.*
- See Student/Teacher Resource, The Parts and Purposes of Plant and Animal Cells.
- See Teacher Resource, Questions to Guide Reading: The Parts and Purposes of Plants and Animal Cells.

Further Support

• See strategy Reading Graphical Texts, Think Literacy: Cross-Curricular Approaches, Grades 7 – 12.



Reading Different Text Forms: Reading Graphical Texts (Table)

Grade 8 Science and Technology (Cells, Tissues, Organs and Systems)

What teachers do

Before

Before reading, help students to connect new content and ideas to their prior knowledge by encouraging them to think about what they already know about the topic or the type of graphical text

(See Student/Teacher Resource, The Parts and Purposes of Plant and Animal Cells). For example:

- Ask students to brainstorm related ideas, concepts and vocabulary, recall previous experiences and feelings related to the subject, recall what they have learned about the topic, or list questions they might have about the topic.
- Provide students with related experiences, discussion topics, readings, or background information to increase background knowledge.
- Pose questions to students before they read, to help them determine a purpose for reading.
- Invite students to ask questions about the graphic's purpose and the information in it.
- Model (using a "think aloud") how to **predict** the content based on the features of graphic, specialized language, related written information, or personal experiences. **Skim, scan** and **sample** the text to make informed predictions.
- Identify and pre-teach unfamiliar vocabulary and concepts that appear in the text.

During

During reading, help students to connect the information and ideas in the graphical text to what they already know as they monitor their understanding. (*"Monitoring their understanding,"* means recognizing when confusion occurs and identifying strategies that help to regain meaning.) For example:

- Have students describe and model the different reading strategies they might use, such as predicting, questioning, activating prior knowledge, inferring, reading slowly, and rereading.
- Model (using "think aloud") strategies for pausing and thinking about the text. Encourage students to examine parts of the text, **read**, **pause**, **think**, and **ask questions** or **make notes** about how this information relates to other parts of the text.
- Demonstrate how to paraphrase the information presented. For example, use the sentence stem "This means...".
- Invite students to **organize** the information in a different way. Ask students to share and compare their interpretations.
- Provide students with **focus** questions, such as the following:
 - What is the purpose of this graphic?
 - What information is provided?
 - Is all important information included? What information is missing?
 - How is the information organized?
 - How does this information relate to what you already know about the topic?
 - Is this a useful source of information?

After

After reading, help students to **consolidate** and **extend** their understanding of the content. For example:

- Ask partners to restate or paraphrase what they have read, and note similarities and differences in the rephrasing.
- Model (using a "think aloud") how to **make connections** between prior knowledge and what the text is saying.
- Have students suggest possible ways to **check the accuracy and reliability** of the information presented.
- Review the process that students used for reading graphical texts, including strategies for before, during and after reading. See Student Resource, *Tips for Reading Graphical Texts.*



Student Resource

Tips for Reading Graphical Texts

Before Reading

- Set a purpose for reading. Ask yourself why you are reading this particular text.
- Look over the text to determine what type it is and which elements are used.
- Examine the titles, headings, captions and images. Start with the title. The title tells you what the graphic is about. The captions may also use words and phrases from the text to show how the graphic is related to the information in the written text (e.g., "Figure 1.6").
- Recall what you already know about the topic or subject.
- Record some questions you might have about the information presented.

During Reading

- Read all the labels and examine how they are related to the graphic. Each label has a purpose. The most important labels may be in capital letters, bold type, or a larger font.
- Follow the arrows and lines. They may be used to show movement or direction, or connect to the things they name.
- Look for the use of colour or symbols to emphasize important words and information. Some graphical texts have a legend or a key to explain the meaning of specific symbols and colours.
- Study the image carefully. See if you recognize the details in the image. Read the text near the picture to find an explanation of the information in the graphic. Use the figure number or title and key words to find and read the related information in the written text.
- Identify the relationships among the visuals and information presented.

After Reading

- Interpret the information conveyed in any of the graphics (e.g., diagrams, charts, graphs, maps). Ask yourself why this information might be important.
- Rephrase information orally or in writing. Imagine that you are explaining the graphic to someone who has not read it.
- Create your own graphical text (e.g., graph, map, diagram, table, flow chart) to represent the important information.

Questions to Guide Reading: The Parts and Purposes of Plant and Animal Cells

Questions to ask	Possible answers
Before	
• What type of graphic is this?	• It is a table.
 What is the purpose of this table? How do you know? 	 It organizes the information for us and helps us to compare the parts and purposes of plant and animal cells. The title and headings of the column tell us the purpose.
• Why did the author choose this type of graphic?	 There is a lot of information and it gives us a quick visual comparison and guide to the parts and their purpose for both cell types.
During	
How can you read this table?	 Look up the cell part column and read down to the part you are interested in and then read across to its purpose. You can look down the plant or animal column if you are on only interested in what parts each one has or has not. You can just look at the cell part and purpose if that is all that interests you.
• Preview the instructions below the table.	 Students paraphrase to ensure understanding. Students will need to know the location and shape or size of the cell part to complete a diagram.
After	
 How does this visual help you understanding of the ideas in this topic? 	 Answers will vary. Students should recognize that plant and animal cells share many of the same features.
What patterns do you see? Why are there differences?	 Plant cells have all of the parts listed on the table. Only plants have chloroplasts, which are a necessity for photosynthesis. Animal cells do not have chloroplasts and only some have a cell wall.



Student/Teacher Resource

The Parts and Purposes of Plant and Animal Cells

Cell Part	Plant Cells	Animal Cells	Purpose
Cell Membrane	*	*	Surrounds and protects the contents of the cell.
Cell Wall	*	Some	Usually found in plants and unicellular organisms. They are thicker than membranes. Provide support for the cell.
Nucleus	*	*	Controls all the cell activities.
Vacuoles	*	*	Storage locations for food, waste and other substances that the cell can't use immediately.
Endoplasmic Reticulum	*	*	A membrane that is used to transport materials within the cell or to the outside of the cell.
Mitochondria	*	*	The energy producing part of the cell.
Cytoplasm	*	*	Distributes food and oxygen throughout the cell, supports other parts inside the cell. The liquid inside the cell.
Chloroplasts	*	No	Photosynthesis takes part in the chloroplasts. They are only found in green plants and a few unicellular organisms.

Plant and animal cells have many similarities and a few differences.

Use the table above to identify features found in both plant and animal cells and their purposes. What further information do you require to be able to draw a diagram of a plant cell and of an animal cell?



Reading Different Text Forms: Reading Graphical Texts (Diagram)

Grade 8 Science and Technology (Water Systems)

Graphical text forms (such as diagrams, photographs, graphs, charts, and tables) are intended to communicate information in a concise format and illustrate how one piece of information is related to another.

Purpose

- Become familiar with the elements and features of graphical texts.
- Explore a process for reading graphical texts, using a range of strategies for before, during and after reading.

Payoff

Students will:

- become more efficient at "mining" graphical texts for information and meaning.
- practise essential reading strategies and apply them to different course-related materials.

Tips and Resources

- Sometimes a complicated idea or concept can be communicated more easily through a chart. Many
 informational texts include graphics to supplement the main ideas and provide clues to the important
 concepts in the text. Some of the features of graphical texts include:
 - print features (such as typeface and size of type, titles, headings, subheadings, italics, labels and captions);
 - design features (such as colour, shape, line, placement, and focal point).;
 - organizational patterns (such as sequential, categorical, and explanatory).
- Each graphical text uses these elements and features in different ways to effectively present information in a condensed format. For example, a chart or table may illustrate key information and show how pieces of information relate to each other. A table uses columns and rows to organize the information and may include al title that describes the main idea or subject, and a caption to explain the purpose of the table. The information in a table can be read horizontally and vertically. Tables are often used to help the reader quickly grasp key information (such as number patterns).
- Many of the strategies for reading informational and literacy texts can also be used effectively to read graphical texts.
- See Student Resource, *Tips for Reading Graphical Texts.*
- See Student/Teacher Resource, *Lake Effect Snow*.
- See Teacher Resource, Questions to Guide Reading: Lake Effect Snow.

Further Support

- See Reading Graphical Texts, Think Literacy: Cross-Curricular Approaches, Grades 7 12.
- See Think/Pair/Share, Think Literacy: Cross-Curricular Approaches, Grades 7 12.



Reading Different Text Forms: Reading Graphical Texts (Diagram)

Grade 8 Science and Technology (Water Systems)

What teachers do **Before** Before reading, help students to connect new content and ideas to their prior knowledge by encouraging them to think about what they already know about the topic or the type of graphical text. For example: Ask students to **brainstorm** related ideas, concepts and vocabulary, **recall** previous • experiences and feelings related to the subject, recall what they have learned about the topic, or list questions they might have about the topic. Provide students with related experiences, discussion topics, readings, or background • information to increase background knowledge. Pose questions to students before they read, to help them **determine a purpose** for reading. Invite students to ask guestions about the graphic's purpose and the information in it. Model (using a "think aloud") how to **predict** the content based on the features of graphic. specialized language, related written information, or personal experiences. Skim, scan and sample the text to make informed predictions. Identify and pre-teach unfamiliar vocabulary and concepts that appear in the text. • Durina During reading, help students to connect the information and ideas in the graphical text to what they already know as they monitor their understanding. ("Monitoring their understanding," means recognizing when confusion occurs and identifying strategies that help to regain meaning.) For example: Have students describe and model the different reading strategies they might use, such as • predicting, questioning, activating prior knowledge, inferring, reading slowly, and rereading. Model (using "think aloud") strategies for pausing and thinking about the text. Encourage ٠ students to examine parts of the text, read, pause, think, and ask questions or make notes about how this information relates to other parts of the text. Demonstrate how to paraphrase the information presented. For example, use the sentence stem "This means...". Invite students to organize the information in a different way. Ask students to share and • compare their interpretations. Provide students with **focus** questions, such as the following: What is the purpose of this graphic? What information is provided? -Is all of the important information included? What information is missing? How is the information organized? How does this information relate to what you already know about the topic? Is this a useful source of information? After After reading, help students to consolidate and extend their understanding of the content. For example: Ask partners to restate or paraphrase what they have read, and note similarities and differences in the rephrasing. Model (using a "think aloud") how to make connections between prior knowledge and what the • text is saving.

- Have students suggest possible ways to **check the accuracy and reliability** of the information presented.
- Review the process that students used for reading graphical texts, including strategies for before, during and after reading. See Student Resource, *Tips for Reading Graphical Texts*.



Student Resource

Tips for Reading Graphical Texts

Before Reading

- Set a purpose for reading. Ask yourself why you are reading this particular text.
- Look over the text to determine what type it is and which elements are used.
- Examine the titles, headings, captions and images. Start with the title. The title tells you what the graphic is about. The captions may also use words and phrases from the text to show how the graphic is related to the information in the written text (e.g., "Figure 1.6").
- Recall what you already know about the topic or subject.
- Record some questions you might have about the information presented.

During Reading

- Read all the labels and examine how they are related to the graphic. Each label has a purpose. The most important labels may be in capital letters, bold type, or a larger font.
- Follow the arrows and lines. They may be used to show movement or direction, or connect to the things they name.
- Look for the use of colour or symbols to emphasize important words and information. Some graphical texts have a legend or a key to explain the meaning of specific symbols and colours.
- Study the image carefully. See if you recognize the details in the image. Read the text near the picture to find an explanation of the information in the graphic. Use the figure number or title and key words to find and read the related information in the written text.
- Identify the relationships among the visuals and information presented.

After Reading

- Interpret the information conveyed in any of the graphics (e.g., diagrams, charts, graphs, maps). Ask yourself why this information might be important.
- Rephrase information orally or in writing. Imagine that you are explaining the graphic to someone who has not read it.
- Create your own graphical text (e.g., graph, map, diagram, table, flow chart) to represent the important information.

Questions to Guide Reading: Lake Effect Snow

	Questions to ask		Possible answers
Be	fore		
•	Why are we going to read this particular section?	•	We want to know about lake effect snow as it relates to our experiences.
•	What do we know about the topic?	•	Answers may vary since different areas of the province have varying degrees of lake effect snow.
•	Why are there words in italics?	•	These are important words to our understanding of the process.
•	Where would you find the meaning of the words in italics?	•	Words with their meanings are found in the glossary at the back of the book or in a dictionary.
Dι	ıring		
•	Read the first line of the first paragraph. On a map locate the Great Lakes and your present location in relation to the closest lake.	•	Answers will vary.
•	Read the first paragraph slowly for detail.	•	Students read the first paragraph slowly for detail.
•	With your finger, follow the diagram as you reread each sentence in the first paragraph. Think/Pair/Share to follow the process.	•	Students reread and talk about the process with a partner.
•	Have a student paraphrase, "reading aloud", the process of lake effect snow as everyone follows the diagram.	•	A student or students will use their own words to explain lake effect snow using the diagram.
•	Read the next paragraph slowly for detail.	•	Students read for detail.
•	What are the important points? How did the organization of the text help you?	•	Students list the 3 points. The bullets help to organize the information so that you can see that there are 3 different factors or important points.
After			
•	Would you describe your snowfall in an average year as light, moderate or heavy?	•	Students should reach a consensus according to their location.
•	Using the information in the second paragraph to explain any lake effect snow pattern in your location.	•	Students apply the information from the second paragraph to explain the pattern based on their location.
•	Choose 3 cities on any of the Great Lakes (ensure that there is a variety of choice). Predict their snowfall using the information from the reading passage. Give reasons.	•	Students should use the factors affecting intensity and the diagram in their explanation.







Student/Teacher Resource

Lake Effect Snow

In the winter *cold winds* from the Northwest blow over the Great Lakes. As these winds travel over the open water they pick up *moisture* and heat from the water. Only twice in recent memory has Lake Ontario frozen over completely, in 1934 and in 1976. The reason that Lake Ontario and the other Great Lakes rarely freeze over is that they are very deep. Since these large bodies of water rarely freeze over completely, there is almost always open water for the wind to blow over. When the moist laden winds reach land again, they drop the excess moisture in the form of snow. This snowfall is known as **lake effect snow**.

The *intensity* of lake effect snow depends on several factors:

- the *difference in temperature* between the air passing over the lake and the temperature of the lake surface;
- the distance that the air travels over the water surface;
- the **wind speed** affects how far inland the snow is carried.

Lake Effect Snow





Reading Different Text Forms: Following Instructions

Grade 8 Science and Technology (Fluids)

Students are expected to read and follow instructions in Science and Technology or Science especially for experiments. This strategy asks students to examine different types of instructions, their features and elements, and how the features, language and organizational patterns can be used to help the reader understand and complete a task.

Purpose

- Provide students with strategies for reading, interpreting and following instructions to complete a specific task.
- Learn how instructions are organized.

Payoff

Students will:

- identify purpose for reading instructions.
- develop a process for reading and following instructions.

Tips and Resources

- Instructions give detailed step-by-step information about a process or procedure (e.g., directions, recipes, experiments, manuals, tests). They are sometimes called procedures or how-tos. Most instructions use organizational patterns, language, and features (charts, bold or italic type, headings, numbers, lists) to help the reader identify the task and the best way to complete it; however, some instructions are complicated without any features to help the reader determine the sequence of steps.
- Student/Teacher Resource, Investigation: Making a Hydrometer.
- Teacher Resource, Questions to Guide Reading: Making a Hydrometer.

Further Support

- Provide students with a list of typical signal words and task prompts and suggestions/strategies for responding to them (e.g. place, fill, mark, repeat, record).
- Provide students with flow charts, diagrams and timelines to help track successful completion of oral or written instructions.
- Create a class framework for reading instructions such as:
 - preview
 - highlight and annotate
 - think aloud and visualize
 - reread
 - go step-by-step
 - read the diagrams or charts
 - ask questions
- See Following Instructions, Think Literacy: Cross-Curricular Approaches, Grades 7 12.



Reading Different Text Forms: Following Instructions

Grade 8 Science and Technology (Fluids)

What teachers do

Before

- Select a set of instructions typical for science, science and technology related to a current topic or process.
- Ask students to **recall** an important occasion, when they had to follow a set of instructions (e.g., an exam, making a table, fixing a bike, installing software). Discuss what was challenging and easy about following the instructions.
- Ask students to recall what they know about effective instructions.
- Make a list of the elements and features of instructions with the class.
- Make copies of another set of instructions and cut them into slips of paper with a step on each slip (unnumbered). Place one set of jumbled instructions in as many envelopes as there are groups or pairs. Provide partners or small groups with an envelope, and ask students to **recreate** the instructions and discuss the decisions they made. Identify the strategies they used to determine the task and the sequence.
- Provide students with a copy of the selected instructions. Model for students how to **preview** the instructions (e.g., looking at title, organization, some of the signal words [sequence of steps and process verbs], graphics, illustrations, summary, materials list).

During

- Model reading the introductory material (see Student/Teacher Resource, *Investigation: Making a Hydrometer*) and the first 2 or 3 steps aloud, noting the **signal words** and what they tell the reader to do.
- Ask students to continue reading the instructions to **identify** the task to be completed. Suggest that students imagine themselves completing the instructions.
- Ask small groups to **discuss** the **strategies** they used to read the instructions and determine what they were expected to do.

After

- **Clarify** any confusing sections of the instructions. Use a flow chart to **outline** the steps, if necessary.
- Have students individually or in pairs **complete** the instructions. **Compare** the completed tasks.
- Discuss how students figured out what to do.
- Identify confusing or challenging parts and suggest additional strategies.



Questions to Guide Reading: Making a Hydrometer

What teachers do			What students do		
Before					
•	Review the elements of an experiment.	•	Students identify the elements such as the problem, hypothesis, materials, procedure, observation, conclusion and application.		
•	Review the meaning of the words density, solute, solvent and solution.	•	Students identify the title and the problem. Students note the set up of the experiment (e.g., headings, numbers or steps, bulleted items, chart for observations).		
•	Provide the students with a copy of the experiment and model how to preview the instructions.				
•	Drawing on students' prior knowledge, what is a hydrometer and where might they have seen it in use?	•	A hydrometer is used to measure density of liquids. Answers may vary for its uses.		
During					
•	Read the instructions aloud with the students, noting the signal words—place, fill, add, repeat, and mark.	•	Students note the signals, highlight or underline, and clarify what they tell the reader to do.		
•	Using think/pair/share strategy, students paraphrase to identify the task to be completed and what they are expected to do.	•	Students use their own words to clarify the instructions in the experiment. Students may create a diagram to assist in visualizing the steps.		
Af	ter				
Q.	Are there any sections of the instructions that are unclear or confusing?	A.	Students may create a diagram to assist in visualizing the steps.		
•	Have students complete the experiment and questions individually or in pairs.	•	Think/Pair/Share or small problem solving groups may be used as a strategy.		
•	Compare the completed tasks, record observations and answer questions. Use the application questions to encourage students to make connections to their experiences or predict further uses of a hydrometer.	•	Note hydrometers are used to measure the density of liquids. They are used in the brewing industry and in the food preparation industry to determine sugar concentrations. A hydrometer can be used to determine the difference in density between light and regular cooking oils.		

Student/Teacher Resource



Investigation: Making a Hydrometer

Problem:

Can you make a homemade hydrometer?

Apparatus and Materials:

- a new unsharpened pencil with an eraser
- a small piece of modelling clay
- at least four test tubes or tall flasks of the same size and shape
- permanent markers, various colours
- water
- salt or sugar

Procedure:

 Prepare three different solutions of salt and water or sugar and water: Solution #1 – 5mL salt or sugar/100mL water Solution #2 – 20mL salt or sugar/100mL water Solution #3 – 40mL salt or sugar/100mL water Shake well to dissolve. Label the solutions #1, #2 and #3.

2. Using permanent marker, place marks at 1 cm intervals the complete length of the

- 2. Using permanent marker, place marks at 1 cm intervals the complete length of the pencil starting at the eraser end.
- 3. Place a small piece of modelling clay around the non-eraser end of the pencil.
- 4. Fill test tube or flask 2/3 full of water (at least 10 cm).
- 5. Place the end of the pencil with the clay into the test tube or flask.
- 6. Adjust the piece of clay so that the pencil stands upright in the water (may need to remove some clay, add some clay or distribute the piece more evenly around the end of the pencil).
- 7. With a permanent marker, mark the water level on the pencil.
- 8. Fill a second test tube or flask to the same depth with solution #1. Place the pencil/hydrometer into the test tube or flask and mark the solution level on the pencil.
- 9. Repeat step #8 with solution #2.
- 10. Repeat step #8 with solution #3.



Student/Teacher Resource

Investigation: Making a Hydrometer (continued)

Observations:

Complete the chart with your observations.

Water with salt or sugar	Water level
Water only	
5 mL salt or sugar (solution #1)	
20 mL salt or sugar (solution #2)	
40 mL salt or sugar (solution #3)	

Conclusions and Applications:

- 1. As the density of the liquid increases how does the position of the homemade hydrometer change?
- 2. If the salt or sugar solutions had been mixed prior to the lesson and left for you to use but not labelled how would you distinguish between the solutions?
- 3. What would happen if the liquid in the test tube were less dense than water?
- 4. How could the food preparation industry use this information?

THINK LITERACY: Subject-Specific Examples Science & Technology, Grade 7-8 Science, Grade 9 Applied

CONTENTS: Science, Grade 9 Applied

READING STRATEGIES

Getting Ready to Read: Extending Vocabulary (Creating a Word Wall)	109
Reading Different Text Forms: Reading Informational Texts (Space)	125
Reading Graphical Texts – Graphs (Chemistry)	131
Reading Graphical Texts – Schematic Diagram (Electricity)	137
Reading Graphical Texts – Flow Chart (Reproduction)	143
Following Instructions (Chemistry)	149


Getting Ready to Read: Extending Vocabulary (Creating a Word Wall)

Grade 9 Science, Applied

Students are required to learn, on average, over 2 000 words each year in various subject areas. Those who have trouble learning new words will struggle with increasingly complex tasks that they encounter in the middle and senior school years. A word wall is a wall, chalkboard or bulletin board listing key words that will appear in a new unit of study, printed on card stock and taped or pinned to the wall/board. The word wall is usually organized alphabetically. Purpose

Identify unfamiliar vocabulary and create a visible reference in the classroom for words that will appear often in a topic or unit of study.

Payoff

Students will:

- practise skimming and scanning an assigned reading before dealing with the content in an intensive way. Students will then have some familiarity with the location and with various elements of the text.
- develop some sense of the meaning of key words before actually reading the words in context.
- improve comprehension and spelling because key words remain posted in the classroom.

Tips and Resources

- Word Anticipation Guide: A Word Anticipation Guide allows students to use prediction skills based on context when learning new vocabulary. As students are asked to predict word meaning, they are also asked to confirm their predictions by conferencing with a partner and looking the word up using another source. Consider using the Word Anticipation Guide template found in Student Resources.
- Word Splash Activity: The Word Splash is a visually appealing, random arrangement of key words from the Word Wall around a specific topic. Students could examine the words and write a paragraph predicting the main idea of the unit. Refer to the Student Resources for a sample Word Splash.
- Word Development Guide: The language of science includes special terms that are recognized as belonging to primarily specific fields, as well as words that in the context of science are used in new or distinctive ways. Introducing vocabulary carelessly or too soon may result in an ample vocabulary, but only cosmetic understanding of terms for students. To facilitate learning by engaging more of the brain to enhance retention, two senses - writing words and drawing images - are used. Refer to the Student Resources for a Word Development Guide template.
- Word Connections: Word wall words can be mapped to show connections and relationships. Refer to Student Resources for a Word Connections template and a sample Grade 9 model. The teacher should field-test the word selection prior to instruction, as this activity is not applicable to all word wall words.
- Word Wall Games: Refer to Teacher Resources for strategies on how to use word walls.
- Word Wall Words: Refer to Teacher Resources for strand specific words and definitions.
- There are classroom environments (particularly secondary) where bulletin board or blackboard space is at a premium. Some classrooms are also used for multiple subjects. This may make the development and maintenance of a word wall challenging. Consider the purchase of a portable word wall from commercial suppliers (~\$35). Words are written on cards, and placed in see-through pockets of the word wall chart. These charts can be temporarily fastened to a blackboard or bulletin board, and rolled up/taken down each class. Be sure to write the words large enough so students at the back of the room can see them clearly. Do not laminate cards, as glare can result. Alternately, use a display board (similar to those used in Science Fair projects), and attach strips of Velcro to each panel of the board. Attach Velcro also to each word card.
- Students can create graphic organizers/visual words from the word wall to facilitate understanding. Smart Ideas is Ministry-licensed software that could be used for this purpose. Alternately, students could use online sources to collect graphics to represent and further clarify word wall words.
- To align instructional strategies, and assessment and evaluation, be sure to include word wall words in evaluation. Scaffold concept maps and Power notes using word wall words as a beginning. Consider use of cloze activities (fill in the blank), using word wall words, for evaluation purposes. As the unit and year progresses, have students develop sentences and information paragraphs using word wall words.

Further Support

- The use of colour is very helpful to visual learners. Example: Teacher generated word wall words could be one colour, student suggestions could be another colour.
- All words from one unit could be in the same colour, with cross-strand or other unit words in another colour. Use different colours for different concepts (e.g., use blue for water words, orange for energy words, green for plant words, etc.).
- Use the Internet to find free software to produce use of word match, word search, crossword puzzles and vocabulary bingo.



Getting Ready to Read: Extending Vocabulary (Creating a Word Wall)

Grade 9 Science, Applied

	What teachers do	What students do	
Be	fore		
•	Before class, preview the text for key vocabulary. Prepare strips of card stock (approximately 4"×10") for words. Divide students into groups of 3. Provide stick-on notes, markers, and masking tape or pins for each group of students. Explain to students that together the class will find key vocabulary in the assigned text, and will help each other to understand and spell the key vocabulary by creating a "word wall" in the classroom that they can refer to for the duration of that particular topic. Distribute Student Resource, <i>Skimming and</i> <i>Scanning to Preview Text</i> , and read and clarify the techniques with students.	 With their group, find an appropriate space where they can talk face-to-face and write down the words. Find the chapter or get a copy of the assigned text. Follow along on the handout as the teacher reviews skimming and scanning. 	
Dı	ıring		
• • •	Ask students to skim the text to get a general sense of what is in it and where it is located. Engage students in some general discussion of the topic, making a few brief notes on the board about big ideas. Direct the students to independently scan the text for unfamiliar words. Ask students to create a personal list of 10 unfamiliar words. Direct the students to small groups and ask the groups to compare personal lists and create a group master list. Distribute eight pieces of card stock (approx. 4"×10"), markers and pieces of masking tape to each group.	 Skim the text, looking at illustrations and subtitles to get a general idea of the topic of the text. Scan the text for words they do not know, marking them with stick-on notes (optional) and then making a personal list of the words. Compare personal lists. Choose the words for a group master list. In each group, print the key vocabulary words in large letters on card stock and tape or pin them to the blackboard or bulletin board, preferably alphabetically. 	
•	ter Lead some discussion of the words and ask students to speculate on their meaning. If appropriate, describe prefixes and suffixes that are unique or common to the subject area. Ask each group to look up the meaning of their words and then to explain the meaning to the rest of the class.	 Use the glossary in the textbook dictionary(ies) to find the meaning of the words. Present their words to the rest of the class. Add the meaning of the words to the cards in smaller letters. 	



Student/Teacher Resource

Word Connections Template

Word Connections	A mind map shows how all of the words
	for a concept are connected or related.

Title	1. Title the mind map.
nue:	2. Use the following words to complete the mind map.
	3. Put each word on the mind map.
	 4. Draw arrows to show the relationship between the words. Each arrow must be labeled to show how the words are connected or related.

Word Connections Sample – Grade 9





Student Resource

Word Anticipation Guide

Name: _____

Date: _____

Word	What I Think It Means	Think, Pair, Share	Actual Meaning
14 (14			2
4			
	2		
i.	×		
	*		
			2
		1.	143
		n.	
		-	<u>и</u> .

R

Student Resource





Student Resource

Word Splash Activity



This word splash is a random arrangement of key words around the topic we will be studying. Examine the words and write a paragraph predicting the main idea of the unit. Your prediction must be supported. Use your textbook or a dictionary if you do not know the meaning of some of the words.

Word Wall for Science: Grade 9 Applied, Earth and Space

Earth and Space

asteroid	astronomical unit	astronomy
black hole	comet	constellation
fusion	galaxy	light year
luminous	meteor	meteorite
microgravity (free fall)	non-luminous	planet
revolution	rotation	satellite
star	supernova	

Word Cards with Definitions

asteroid - a small body composed primarily of rock that moves in outer space

luminous - a body that produces its own light (ie. The Sun is a luminous body)

supernova - an exploding star





Earth and Space (Grade 9 Applied) – Definitions

asteroid – a small body composed primarily of rock that moves in outer space

astronomical unit (AU) – a unit of measurement defined as being the distance from the Sun to the Earth; it is used to measure large distances in the Solar System

astronomy - the study of bodies in space and of the physical universe as a whole

black hole – a point in space in which the force due to gravity is so great that even a beam of light can't escape

constellation – a pattern imposed by humans upon a collection of stars, these patterns often resemble humans or animals

comet - a body made primarily of ice and dust; when it orbits the Sun it exhibits a long tail caused by the heating effect of the Sun

fusion – the process whereby the nuclei of atoms join together; a great deal of energy is released in this process (ie. this is how stars radiate energy)

galaxy – a large collection of gas, dust, planets, and stars held together by mutual gravitational attraction

light year – the distance that light will travel in a year $(9.46 \times 10^{12} \text{ km})$

luminous – a body that produces its own light (i.e. the Sun is a luminous body)

meteor – a small body composed primarily of rock that enters the Earth's atmosphere; this body causes a bright streak of light in the sky as result of friction with air

meteorite – what remains of small body of rock (meteor) originally from outer space after it hits the Earth's surface

microgravity (free fall) – a process in which it looks as if there is no gravity acting on an object; in reality, all objects are falling at the same rate

non-luminous – a body that can only be seen by reflected light; it does not produce its own light (ie. the Earth is a non-luminous body)

planet – a large body orbiting around a star; this body does not produce its own light

revolution – the motion of a body as it orbits another more massive body (ie. the moon revolves around the Earth, but the Earth revolves around the Sun)

rotation – the turning or motion of a body around a central axis going through the body (ie. the Earth rotates about an axis going roughly from the North Pole to the South Pole)

satellite – any body that orbits around another body (ie. the moon is a satellite of the Earth)

star – a large body in space that produces its own light

supernova – an exploding star



Word Wall for Science: Grade 9 Applied, Biology

Reproduction

asexual reproduction	cell division	cell membrane
cloning	chromosome	DNA
embryo	fertilization	fetus
gene	genetic engineering	hermaphrodite
mitosis	nucleus	propagation
sexual reproduction		

Word Cards with Definitions

asexual reproduction involves one parent producing genetically identical offspring

gene - is made of DNA and is linked together to form a chromosome, each gene is responsible for one specific function within a cell nucleus - the control centre of all functions inside the cell





Biology (Grade 9 Applied) - Definitions

asexual reproduction – involves one parent producing genetically identical offspring

cell division – process in which the genetic information is copied and passed on to each new cell

cell membrane - the cell structure in plants and animal cells that covers the entire cell, and controls the movement of materials in and out of the cell - the gatekeeper

chromosomes – thread-like structures, found in the nucleus, that control the internal functions of a cell

cloning - the process of creating an identical offspring from a single cell or tissue

DNA (deoxyribonucleic acid) – the chemical unit of genetic information, which is organized into packages called genes

embryo – a fertilized egg that has become more than a 100 cells in size through many cell divisions

fertilization – when the chromosomes in a sperm cell combines with the chromosomes an egg cell (producing a zygote)

fetus – (translates into young one) a point in the growth and development when an embryo no longer looks like a of a clump of cells but begins to look like its parents

gene – made of DNA and linked together to form a chromosome, each gene is responsible for one specific function within the cell

genetic engineering – a technology used to transfer genetic information from a cell in one organism to a cell in another organism

hermaphrodite - an organism that creates both male and female sex cells

mitosis – a process of copying and dividing the genetic material before the cell splits into 2 new cells

nucleus - the control centre of all functions inside the cell

propagation – to create more organisms from existing organisms (asexual or sexual reproduction)

sexual reproduction – involves 2 parents producing genetically different offspring

Word Wall for Science: Grade 9 Applied, Chemistry

Exploring Matter

atom	characteristic property	chemical symbol
chemical formula	chemical change	compound
electron	element	families of elements
metal	molecule	neutron
nucleus	periodic table	physical change
proton	pure substance	relative mass
subscript number		

Word Cards with Definitions

electron - a negative part of the atom that spins in layers around the centre

neutron - part of the centre of an atom without any charge proton - part of the centre of an atom having a positive charge





Chemistry (Grade 9 Applied) - Definitions

atom – the smallest piece of matter with no charge, found in elements
characteristic property – a property by which one substance can be distinguished from another
chemical symbol – 1 or 2 letters used to represent names of elements
chemical formula – symbols and (subscript) numbers combined to represent the parts of a compound
chemical change – a process in which new substances with new properties are formed
compound – pure substance made of one kind of molecule
electron – a negative part of the atom that spins in layers around the centre
element – a pure substance that is made of only one kind of atom
families of elements – groups linked with similar chemical properties in the periodic table
metal – substances that share the same physical properties, such as conducting heat
molecule – a structure with 2 or more atoms combined
neutron – part of the centre of an atom without any charge
nucleus – the central part of an atom having a positive charge
periodic table – a chart of all the elements as they relate chemically to each other
physical change – a change in the state or form of a substance
proton – part of the centre of an atom having a positive charge
pure substance – matter that contains only one kind of atom or molecule
relative mass – how much matter is in one atom of a pure substance compared to the mass in another atom of a different pure substance

subscript number - the number of atoms for each element found in a chemical formula

Word Wall for Science: Grade 9 Applied, Physics

Electricity

ampere (A)	cell	charge
circuit	conductor	current (I)
efficiency	electron	electricity
energy	fuse	grounding
insulator	joule (J)	load
ohm (Ω)	parallel circuit	potential difference (V)
resistance (R)	series circuit	volt (V)

Word Cards with Definitions

ampere (A) - the unit used for measuring electric current joule (J) - the unit used for measuring energy series - a circuit arrangement in which electrons all have to follow the same path





Physics (Grade 9 Applied) - Definitions

ampere (A) - the unit used for measuring electric current

cell - a device that changes one form of energy (i.e, solar, electrochemical) into electrical energy

charge - a measure of the electrical condition of an object in which it either has a surplus of electrons (a negative charge), or a shortage of electrons (a positive charge)

circuit - a complete path that allows electrons to flow

conductor - a material that allows charge (electrons) to easily flow through it

current (I) - a measure of the rate of flow of charge (electrons) in a conductor

efficiency - the degree to which electrical energy is converted to useful energy by the electrical device

electron - a negatively charged particle that orbits the nucleus of the atom

electricity - produced when electrons flow

energy - a measure of how much work can be done; it is measured in joules (J)

fuse - a safety device that will melt a lower current than that which will melt the wiring in a circuit

grounding - the flow of electrons either into or out of an object so that the final electrical condition of the object is neutral

insulator - a material that does not allow the passage of electrons

joule (J) - the unit used for measuring energy

load - that part of an electrical circuit on which the electricity performs work and the electrical energy is converted into another form of energy

ohm (Ω) - the unit measuring resistance

parallel circuit- a circuit arrangement in which the electrons have more than one pathway available to them

potential difference (V) - a measure of the work per unit charge between two points in a circuit

resistance (R) - a measure of how difficult it is for electrons to flow in a circuit; defined as potential difference (V) over current (I)

series circuit- a circuit arrangement in which electrons all have to follow the same path

volt (V) - a unit of potential difference

['] **R**

Teacher Resource

Word Wall Games

Be a Mind Reader Game: Word Walls can be used to play motivating games. This game can be played individually or in teams. The teacher thinks of a word wall word and gives five clues to that word. Your clues could include parts of the definition, synonyms or how it is used. Students number their papers from 1 to 5 and try to "read the teacher's mind". By the time the teacher gives the fifth clue, everyone in the class should guess the word and have it written down on their papers.

Word Jar Game: Place all word wall cards in a jar. Students break into 2 teams. Teams alternately send members to the jar to select a word and state its definition. Award 2 points for each correct team definition. The opposing team can earn 1 point if they can correctly define the word if the original team fails to correctly define the word.

Word Mixer Game: Play a "mixer" game with the students. Some students will receive word wall words. The remaining half of the class receives the definitions. Students move around the room trying to find their partner. Variation: Some words may have more than one meaning, hence there may be more than two students partnering.

Word Mimes Game (especially suitable for Earth and Space): Students are divided into two teams. Students select a word from the word wall, and attempt to act out the meaning of the word.

Teacher determines the number of words to focus upon from the Word Wall. Students make a grid of 8 squares (e.g. a 4 x 2 matrix, similar to a bingo card) on a blank sheet of paper. Each square must be large enough for words to be written. There are two options for filling in the grid:

Option 1 - A student begins the game by calling out a word from the word wall. Classmates respond by writing the word in any space on their grid. Some teachers have students spell them as they write them, to ensure accuracy. The student who gave the first word calls on another classmate to select a second word, which all students again write in a space on their grid. As students select words from the wall and write them in their grids, the teacher writes the same words on a piece of paper and places them in a pile. This process continues until the students have all the spaces on their grids filled. Then, the teacher begins to draw words from the pile. Students mark or stamp the words in the same way (e.g., with a checkmark) until someone marks all words in a straight or diagonal line as in bingo and calls, "Wordo".

Option 2 - Instead of having all students add the same words to their grids, have students fill in their grids with any words from the wall, so that everyone has different words on their cards. Then, either the teacher calls words from the wall until a winner is declared, or students call out a word from their card, that is marked by other students that have included the same word on their own cards.



Reading Different Text Forms: Reading Informational Texts

Grade 9 Science, Applied (Space)

Informational text forms are written to communicate information about a specific subject, topic, event or process. These texts use subject specific vocabulary, organizational patterns and diagrams to express ideas clearly and make them easier to read. Providing students with an approach to reading informational texts helps them to become more effective readers.

Purpose

- Become familiar with the elements and organization of informational texts used in the text example.
- Explore a process for reading informational texts, using a range of strategies for before, during and after reading.

Payoff

Students will:

- become more efficient at "mining" the text for information.
- practise reading strategies using the organizational patterns and diagrams to assist and consolidate understanding.

Tips and Resources

- Some of the features of informational texts are headings, subheadings, introductions, and diagrams. These work together to draw readers into the text at different levels. For example, the diagram after each text section provides a visual to help students consolidate their understanding.
- Many informational texts are divided into sections that add meaning, by description or definition. For example, the sections each describe what we know about Mars using the technology of the time.
- Many informational texts use visual elements (such as typeface, size of type, and diagrams) to emphasize important words and concepts. Different texts use these features in different ways to effectively present information.
- How you read informational text will depend on your purpose for reading. If you want to find specific
 information in a textbook, you might examine the headings and subheadings, and then skim through the
 section looking for key words and phrases related to the topic. Once you have located the appropriate
 section, a closer reading will help you to find the information and supporting details.
- See Student Resource, Tips for Reading Information Texts.
- See Teacher Resource, Questions to Guide Reading: Exploring Mars.
- See Student Resource, Anticipation Guide: Exploring Mars.
- See Student/Teacher Resource, Exploring Mars.

Further Support

- See strategies for *before reading*, such as **Previewing a Text**, and **Analysing the Features of a Text** in *Think Literacy: Cross-Curricular Approaches, Grades 7 – 12.* Refer to these to support and reinforce the ideas described here.
- See Anticipation Guide in Think Literacy: Cross-Curricular Approaches, Grades 7 12.
- See Think/Pair/Share in Think Literacy: Cross-Curricular Approaches, Grades 7 12.



Reading Different Text Forms: Reading Informational Texts

Grade 9 Science, Applied (Space)

What teachers do

Before

Before reading, help students to connect new content and ideas to their prior knowledge by encouraging them to think about what they already know about the topic or the type of reading material (see Student/Teacher Resource, *Exploring Mars*). For example:

- Ask students to brainstorm related ideas, concepts and vocabulary, recall previous experiences and feelings related to the subject, recall what they have learned about the topic, or list questions they might have about the topic.
- Provide students with related experiences, discussion topics, readings, or background information to increase background knowledge.
- Pose questions to students before they read, to help them **determine a purpose** for reading.
- Invite students to ask questions about the content.
- Model (using a "think aloud") how to **predict** the content based on the features of text, specialized vocabulary, illustrations, introductory information or personal experiences. **Skim, scan** and **sample** the text to make informed predictions.
- Identify and pre-teach unfamiliar vocabulary and concepts that appear in the text.

During

During reading, help students to connect the information and ideas in the text to what they already know as they monitor their understanding. (*Monitoring their understanding* means recognizing when confusion occurs and identifying strategies that help to regain meaning.) For example:

- Have students describe and model the different reading strategies they might use, such as predicting, questioning, activating prior knowledge, inferring, monitoring, adjusting, rereading, and decoding.
- Model (using "think aloud") strategies for pausing and thinking about the text. Encourage students to **chunk** the text, **read**, **pause**, **think**, and **ask questions** or **make notes** about the section of text.
- Demonstrate how to **use a graphic organizer** to **categorize** and select main ideas, important details, and questions as you read. For example, comparison charts, T-charts, or Venn diagrams can help students to identify the ideas being compared and how they are similar and different.
- Invite students to **visualize** the concepts as they read. Have partners share and compare the visualizations.
- Provide students with **focus** questions, such as the following:
 - What are the main ideas?
 - How has the writer organized them?
 - How does the writer support the main ideas?
 - What is the writer's viewpoint?
 - Is this a useful source of information?

After

After reading, help students to **consolidate** and **extend** their understanding of the content. For example:

- Ask partners to **restate** or **paraphrase** what they have read, and **note similarities and differences** in the retelling.
- Model how to **summarize** the reading selection (using a "think aloud") by identifying the essence of the text, choosing the most important information, and organizing the information to convey the **key ideas** of the selection.
- Have students suggest possible diagrams or **graphic organizers** to illustrate connections among the topics, main ideas, supporting details, and prior knowledge.
- Review the process that students used for reading informational text. See Student Resource, *Tips for Reading Informational Texts.*



Student Resource

Tips for Reading Informational Texts

Before Reading

- Set a purpose for reading. Ask yourself why you are reading this particular text.
- Look over the text to see which elements appear (such as headings, subheadings, illustrations, captions, and more).
- Examine the titles, headings, and subheadings, and scan for words that stand out.
- Look for words and phrases that might give you clues about how the information is organized.
- Read any overviews, summaries or questions. In a shorter piece, read the opening and concluding sentences or paragraphs.
- Examine each illustration and read the titles or captions.
- Recall what you already know about the topic.
- Record some questions you might have about the topic.

During Reading

- Divide the reading task into smaller chunks (chunking the text into paragraphs, chunking sections by sub-headings, etc.). Read a chunk, pause and think about what you read, and write a brief one-sentence summary or brief point-form notes to help you remember important and interesting information.
- Read quickly, then slowly. Skim the sections you think will support your purpose for reading. When you find specific information you want, slow down and read it word by word. You may need to reread the passage several times.
- Read the selection and jot down thoughts, responses to your questions and new questions that occur to you.

After Reading

- Read the selection again to confirm the main idea and supporting details.
- Make connections to what you already know about the topic. How does the information you have read add to or alter what you knew about the topic?
- Record your thinking about and responses to the text. For example, write a summary, complete a graphic organizer, create a sketch, or orally retell to yourself or a friend.



Questions to Guide Reading: Exploring Mars

What teachers do	What students do	
Before		
• Why are we going to read this particular section?	• We want to know about how technology has helped us to understand more about space. We are looking at one very recent example-Mars.	
 How do we know what the big idea or main topic is? 	• The main heading is at the top in bold in a box with a sentence to explain in italics. It is about exploring Mars, based on what we have learned over the years.	
• What are some of the ideas to be covered in this topic and how do you know?	• There are subheadings in bigger, bolder print above new paragraphs. The smaller topics are what we thought about Mars a long time ago, what we know now and what we hope to discover by exploration.	
• What do you already know about this topic? Students complete the Student Resource, <i>Anticipation Guide: Exploring Mars.</i>	• Students respond based on their prior knowledge or predictions/inferences using photographs, captions and headings to complete the Student Resource Anticipation <i>Guide: Exploring Mars.</i>	
During		
• Read the Student/Teacher Resource, <i>Exploring Mars</i> . Using the sub-headings as an outline, write 2 or 3 important points from each section.	• Students use dot jot notes (point form) to write the important information.	
After		
 Use the Think/Pair/Share strategy to check your responses on the Anticipation Guide. What do you think? 	 Students work in pairs to check their understanding. Students respond to the question at the end of 	
	the text and discuss.	



Student Resource

Anticipation Guide: Exploring Mars

Before Reading

Part I - On the line before each statement, put a check mark next to any which you consider to be a correct fact.

Part II - Write 2 questions that you would like to learn about Mars, based on what you already know about this planet.

 1. It was once thought that shapes and colour variations on the surface of Mars were proof of a past civilization.

2. Mars appears to be red in colour because of its thick atmosphere.

3. The Spirit and Opportunity are the first 2 robots to explore Mars.

4. Mars and Earth, in their orbits around the sun, get close together every 5 years.

5. There is now evidence that ancient oceans once existed on this planet.

Part II - On the lines below, write your own 2 questions:

After Reading

Part III - <u>After reading the text</u>, compare your thinking about all 5 statements with information contained in the text. Now **correct** the statements that are wrong, on the line provided under each sentence.

THINK LITERACY: Subject-Specific Examples Science & Technology, Grade 7-8 Science, Grade 9 Applied

Student/Teacher Resource

EXPLORING MARS

What we know and what we hope to discover about this planet!

Soon after the invention of the telescope, astronomers noticed that Mars was the only planet that looked something like Earth. Just over 100 years ago, it was believed that canals were visible on the surface of Mars. This meant that there must have been, at one time, a Martian civilization managing their water supply to the deserts. Scientists also thought that the dark zones were vegetation.

This wasn't disproved completely until 1972 when the U.S. Mariner 9 spacecraft sent back images to Earth that showed no canals and no plant life. We look forward to learning more about this mysterious red planet as cutting edge technology allows us to actually see what is on the surface.

Features from afar

Mars is red because of the iron oxide (rust like) minerals that cover the surface of the planet as dusty sand. It has deserts, volcanoes, canyons, dark coloured regions, rocky plains and two ice caps. Both ice caps change size with different seasons and the deserts change patterns, as hurricane-like winds blow across the surface. It does have a thin atmosphere containing some clouds. Mars passes close to Earth every 26 months and it is during this time that we can see these features with a good telescope.



Mars is half the size of Earth and has two tiny moons. Courtesy <u>http://marsprogram.jpl.nasa.gov/</u>

Features from the surface

In 1996 the spaceships Viking 1 and 2 sent the first pictures of Mars from the surface of the planet. In 1997, the Pathfinder spacecraft and the robotic rover called Sojourner, sent detailed images of the landscape and sampled soil and rocks. Today, we have 2 robotic rovers, Spirit and Opportunity, which landed on opposite sides of the planet. Both robots can move 100m a day and carry the scientific equipment to view, analyze and communicate back to Earth.



Notice that there are 6 wheels and a solar panel. What does this tell you about the machine? Courtesy <u>http://marsprogram.jpl.nasa.gov/</u>

What might we learn this time?

The equipment used by the rovers, Spirit and Opportunity, can determine the age and chemistry of the rocks. The mission is to discover if there were large bodies of water on this planet in the past. If so, can any evidence of life, like fossils, be discovered by the robots in either location? Both robots are programmed to work for a few months on Mars. Future robots will travel the planet for a year or more. Looking further ahead, some robots may go to Mars to collect samples to be returned to Earth!

What do you think?

Should we, as a global community, continue to spend money on this type of space exploration?





Reading Different Text Forms: Reading Graphical Texts (Graphs)

Grade 9 Science, Applied (Chemistry)

Graphical text forms (such as diagrams, photographs, graphs, charts, and tables) are intended to communicate information in a concise format and illustrate how one piece of information is related to another.

Purpose

- Become familiar with the elements and features of graphical texts.
- Explore a process for reading graphical texts, using a range of strategies for before, during and after reading.

Payoff

Students will:

- become more efficient at "mining" graphical texts for information and meaning.
- practise essential reading strategies and apply them to different course-related materials.

Tips and Resources

- Sometimes a complicated idea or concept can be communicated more easily through a chart. Many informational texts include graphics to supplement the main ideas and provide clues to the important concepts in the text. Some of the features of graphical texts include:
 - print features (such as typeface and size of type, titles, headings, subheadings, italics, labels and captions);
 - design features (such as colour, shape, line, placement, and focal point);
 - organizational patterns (such as sequential, categorical, and explanatory).
- Each graphical text uses these elements and features in different ways to effectively present information in a condensed format. For example, a chart or table may illustrate key information and show how pieces of information relate to each other. A table uses columns and rows to organize the information and may include a title that describes the main idea or subject, and a caption to explain the purpose of the table. The information in a table can be read horizontally and vertically. Tables are often used to help the reader quickly grasp key information (such as number patterns).
- Many of the strategies for reading informational and literacy texts can also be used effectively to read graphical texts.
- See Student Resource, *Tips for Reading Graphical Texts.*
- See Student/Teacher Resource, *Flame Tests*.
- See Teacher Resource, Questions to Guide Reading: Flame Tests.

Further Support

- See Reading Graphical Texts, Think Literacy: Cross-Curricular Approaches, Grades 7 12.
- See Think/Pair/Share, Think Literacy: Cross-Curricular Approaches, Grades 7 12.



Reading Different Text Forms: Reading Graphical Texts (Graphs)

Grade 9 Science, Applied (Chemistry)

What teachers do

Before

Before reading, help students to connect new content and ideas to their prior knowledge by encouraging them to think about what they already know about the topic or the type of graphical text. For example:

- Ask students to **brainstorm** related ideas, concepts and vocabulary, **recall** previous experiences and feelings related to the subject, recall what they have learned about the topic, or **list questions** they might have about the topic.
- Provide students with related experiences, discussion topics, readings, or background information to increase background knowledge.
- Pose questions to students before they read, to help them **determine a purpose** for reading.
- Invite students to ask questions about the graphic's purpose and the information in it.
- Model (using a "think aloud") how to **predict** the content based on the features of graphic, specialized language, related written information, or personal experiences. **Skim, scan** and **sample** the text to make informed predictions.
- Identify and pre-teach unfamiliar vocabulary and concepts that appear in the text.

During

During reading, help students to connect the information and ideas in the graphical text to what they already know as they monitor their understanding. (*"Monitoring their understanding"* means recognizing when confusion occurs and identifying strategies that help to regain meaning.) For example:

- Have students describe and model the different reading strategies they might use, such as predicting, questioning, activating prior knowledge, inferring, reading slowly, and rereading.
- Model (using "think aloud") strategies for pausing and thinking about the text. Encourage students to examine parts of the text, **read**, **pause**, **think**, and **ask questions** or **make notes** about how this information relates to other parts of the text.
- Demonstrate how to paraphrase the information presented. For example, use the sentence stem "This means...".
- Invite students to **organize** the information in a different way. Ask students to share and compare their interpretations.
- Provide students with focus questions, such as the following:
 - What is the purpose of this graphic?
 - What information is provided?
 - Is all of the important information included? What information is missing?
 - How is the information organized?
 - How does this information relate to what you already know about the topic?
 - Is this a useful source of information?

After

After reading, help students to **consolidate** and **extend** their understanding of the content. For example:

- Ask partners to **restate** or **paraphrase** what they have read, and **note similarities and differences** in the rephrasing.
- Model (using a "think aloud") how to **make connections** between prior knowledge and what the text is saying.
- Have students suggest possible ways to check the accuracy and reliability of the information presented.
- Review the process that students used for reading graphical texts, including strategies for before, during and after reading. See Student Resource, *Tips for Reading Graphical Texts*.



Student Resource

Tips for Reading Graphical Texts

Before Reading

- Set a purpose for reading. Ask yourself why you are reading this particular text.
- Look over the text to determine what type it is and which elements are used.
- Examine the titles, headings, captions and images. Start with the title. The title tells you what the graphic is about. The captions may also use words and phrases from the text to show how the graphic is related to the information in the written text (e.g., "Figure 1.6").
- Recall what you already know about the topic or subject.
- Record some questions you might have about the information presented.

During Reading

- Read all the labels and examine how they are related to the graphic. Each label has a purpose. The most important labels may be in capital letters, bold type, or a larger font.
- Follow the arrows and lines. They may be used to show movement or direction, or connect to the things they name.
- Look for the use of colour or symbols to emphasize important words and information. Some graphical texts have a legend or a key to explain the meaning of specific symbols and colours.
- Study the image carefully. See if you recognize the details in the image. Read the text near the picture to find an explanation of the information in the graphic. Use the figure number or title and key words to find and read the related information in the written text.
- Identify the relationships among the visuals and information presented.

After Reading

- Interpret the information conveyed in any of the graphics (e.g., diagrams, charts, graphs, maps). Ask yourself why this information might be important.
- Rephrase information orally or in writing. Imagine that you are explaining the graphic to someone who has not read it.
- Create your own graphical text (e.g., graph, map, diagram, table, flow chart) to represent the important information.

Questions to Guide Reading: Flame Tests

Possible answers		Questions to ask	
		Before	Ве
ere is a graph, a box that could be a key or end, and a section with words under the bold e.	•	How is this page organized?	•
swers may vary.	how • ng in	Predict what this page may be about and how it would tie in with what we have been doing in class.	•
a bar graph and it is used as a visual nparison of information.	ne •	What type of graphic is this and why did the author choose to use it?	•
		During	Du
e y-axis list the colours (on the left), and icate the energy increases from red to blue (on right). The x-axis has the 10 samples, by nbers, that were tested.	ire •	What are the names of each axis? How are they related?	•
e names of the compounds.	•	What information is given in the key (the box)?	•
dents list the similar and different bars npounds based on bar length.	nes • are	Give the numbers with corresponding names of the bars that are similar and those that are different.	•
dents put the information in their own words I check understanding.	•	 Read slowly the text section "About Flame Tests". Paraphrase the information the section gives you. 	•
		After	Aft
resents similar patterns in the compounds that Itain the same metal, which you apply to Swer the question about the unknown sample #	the •	How does the graph help you understand the relationship between some elements?	•
dents record the patterns they see referring to key to make inferences.	ese	Think/Pair/Share the patterns you see. In your own words write an explanation of these patterns.	•
ould be in the form of a T-chart such as servations in an experiment.	ne •	Is there another way this information on the graph could be presented?	•
an be used in making fireworks.	•	Where could this knowledge be used?	•
 y-axis list the colours (on the left), and icate the energy increases from red to blue (right). The x-axis has the 10 samples, by nbers, that were tested. a names of the compounds. idents list the similar and different bars npounds based on bar length. dents put the information in their own words a check understanding. resents similar patterns in the compounds that the same metal, which you apply to swer the question about the unknown sample dents record the patterns they see referring key to make inferences. ould be in the form of a T-chart such as servations in an experiment. 	nes ese e	 What are the names of each axis? How are they related? What information is given in the key (the box)? Give the numbers with corresponding names of the bars that are similar and those that are different. Read slowly the text section "About Flame Tests". Paraphrase the information the section gives you. After How does the graph help you understand the relationship between some elements? Think/Pair/Share the patterns you see. In your own words write an explanation of these patterns. Is there another way this information on the graph could be presented? Where could this knowledge be used? 	• • • •





Student/Teacher Resource



About Flame Tests

When samples of metallic compounds are heated, the flame will change colour. The reason is the electrons in the metal atoms gain energy and jump to a higher energy level. Later when the electrons return to the original energy level, the extra *energy is converted to light*. The colour is a measure of the amount of energy (in the visible light spectrum) that was gained and then lost by the metal in the compound sample.

What would you predict is the metal in the unknown compound – sample # 10?



Reading Different Text Forms: Reading Graphical Texts (Schematic Diagram)

Grade 9 Science, Applied (Electricity)

Graphical text forms (such as diagrams, photographs, graphs, charts, and tables) are intended to communicate information in a concise format and illustrate how one piece of information is related to another.

Purpose

- Become familiar with the elements and features of graphical texts.
- Explore a process for reading graphical texts, using a range of strategies for before, during and after reading.

Payoff

Students will:

- become more efficient at "mining" graphical texts for information and meaning.
- practise essential reading strategies and apply them to different course-related materials.

Tips and Resources

- Sometimes a complicated idea or concept can be communicated more easily through a chart. Many informational texts include graphics to supplement the main ideas and provide clues to the important concepts in the text. Some of the features of graphical texts include:
 - print features (such as typeface and size of type, titles, headings, subheadings, italics, labels and captions);
 - design features (such as colour, shape, line, placement, and focal point);
 - organizational patterns (such as sequential, categorical, and explanatory).
- Each graphical text uses these elements and features in different ways to effectively present information in a condensed format. For example, a chart or table may illustrate key information and show how pieces of information relate to each other. A table uses columns and rows to organize the information and may include a title that describes the main idea or subject, and a caption to explain the purpose of the table. The information in a table can be read horizontally and vertically. Tables are often used to help the reader quickly grasp key information (such as number patterns).
- Many of the strategies for reading informational and literacy texts can also be used effectively to read graphical texts.
- See Student Resource, *Tips for Reading Graphical Texts.*
- See Student/Teacher Resource, Can you analyze this circuit?
- See Teacher Resource, *Questions to Guide Reading: Can you analyze this circuit?* These questions can be adapted for use with a variety of diagrams, depending on the instructional focus of your lesson.
- As a follow-up to the class discussion, students are to use their own words to paraphrase the information they have learned from the diagrams. Some suggested prompts are provided in the Teacher Resource, *Questions to Guide Reading: Can you analyze this circuit?*

Further Support

• See Reading Graphical Texts, Think Literacy: Cross-Curricular Approaches, Grades 7 – 12.

Reading Different Text Forms: Reading Graphical Texts (Schematic Diagram)

Grade 9 Science, Applied (Electricity)

What teachers do

Before

Before reading, help students to connect new content and ideas to their prior knowledge by encouraging them to think about what they already know about the topic or the type of graphical text (see Student/Teacher Resource, *Can you analyze this circuit?*). For example:

- Ask students to brainstorm related ideas, concepts and vocabulary, recall previous experiences and feelings related to the subject, recall what they have learned about the topic, or list questions they might have about the topic.
- Provide students with related experiences, discussion topics, readings, or background information to **increase background knowledge**.
- Pose questions to students before they read, to help them **determine a purpose** for reading.
- Invite students to ask questions about the graphic's purpose and the information in it.
- Model (using a "think aloud") how to **predict** the content based on the features of graphic, specialized language, related written information, or personal experiences. **Skim, scan** and **sample** the text to make informed predictions.
- Identify and pre-teach unfamiliar vocabulary and concepts that appear in the text.

During

During reading, help students to connect the information and ideas in the graphical text to what they already know as they monitor their understanding. (*"Monitoring their understanding,"* means recognizing when confusion occurs and identifying strategies that help to regain meaning.) For example:

- Have students describe and model the different reading strategies they might use, such as predicting, questioning, activating prior knowledge, inferring, reading slowly, and rereading.
- Model (using "think aloud") strategies for pausing and thinking about the text. Encourage students to examine parts of the text, **read**, **pause**, **think**, and **ask questions** or **make notes** about how this information relates to other parts of the text.
- Demonstrate how to paraphrase the information presented. For example, use the sentence stem "This means...".
- Invite students to **organize** the information in a different way. Ask students to share and compare their interpretations.
- Provide students with **focus** questions, such as the following:
 - What is the purpose of this graphic?
 - What information is provided?
 - Is all of the important information included? What information is missing?
 - How is the information organized?
 - How does this information relate to what you already know about the topic?
 - Is this a useful source of information?

After

After reading, help students to **consolidate** and **extend** their understanding of the content. For example:

- Ask partners to **restate** or **paraphrase** what they have read, and **note similarities and differences** in the rephrasing.
- Model (using a "think aloud") how to **make connections** between prior knowledge and what the text is saying.
- Have students suggest possible ways to **check the accuracy and reliability** of the information presented.
- Review the process that students used for reading graphical texts, including strategies for before, during and after reading. See Student Resource, *Tips for Reading Graphical Texts*.



Student Resource

Tips for Reading Graphical Texts

Before Reading

- Set a purpose for reading. Ask yourself why you are reading this particular text.
- Look over the text to determine what type it is and which elements are used.
- Examine the titles, headings, captions and images. Start with the title. The title tells you what the graphic is about. The captions may also use words and phrases from the text to show how the graphic is related to the information in the written text (e.g., "Figure 1.6").
- Recall what you already know about the topic or subject.
- Record some questions you might have about the information presented.

During Reading

- Read all the labels and examine how they are related to the graphic. Each label has a purpose. The most important labels may be in capital letters, bold type, or a larger font.
- Follow the arrows and lines. They may be used to show movement or direction, or connect to the things they name.
- Look for the use of colour or symbols to emphasize important words and information. Some graphical texts have a legend or a key to explain the meaning of specific symbols and colours.
- Study the image carefully. See if you recognize the details in the image. Read the text near the picture to find an explanation of the information in the graphic. Use the figure number or title and key words to find and read the related information in the written text.
- Identify the relationships among the visuals and information presented.

After Reading

- Interpret the information conveyed in any of the graphics (e.g., diagrams, charts, graphs, maps). Ask yourself why this information might be important.
- Rephrase information orally or in writing. Imagine that you are explaining the graphic to someone who has not read it.
- Create your own graphical text (e.g., graph, map, diagram, table, flow chart) to represent the important information.



Questions to Guide Reading: Can you analyze this circuit?

	What teachers do		What students do
Before			
•	Scan the diagram and quickly decide what it means.	•	We have a general idea of a simple circuit with a switch that has a power source, meters and lights.
•	What other clues are there to tell you what the graphic will be about?	•	There are symbols, numbers and a caption/question to consider.
•	What type of graphic is this?	•	This is a schematic diagram.
•	What is the purpose of this type of graphic?	•	The purpose is to display all of the features in a given circuit for analysis/comparison.
During			
•	Examine and identify all of the symbols. What do they mean? How do they relate to another? Where do you start to analyze the circuit? How do you know? Where is the end of the circuit? How do you know? Is there a specific direction to be followed? How do you know? Add arrows to the diagrams to indicate the flow of electrons	•	Students draw on prior knowledge to answer the questions about the circuit, which, in essence, is reviewing how to "read" a circuit.
•	How does this diagram help you to understand the question being asked?	•	It allows you to see all of the components when considering where the third light bulb will be added to the circuit.
•	What information does the caption/question give you?	•	Students should realize that this creates a series circuit inside a parallel circuit once they have placed the new bulb next to bulb #1.
After			
•	How would the altered circuit, in the question, look different?	•	Students add the extra light bulb #3 to the given diagram.
•	What relationships do you see? How does this visual help you understand?	•	This requires a comparison between the given (which is parallel) and the altered (a series within a parallel) circuits. Visually you can see the difference.
•	Do you now have all the information you need to solve this question? What information is missing? Do you have any questions?		



Student/Teacher Resource

Can you analyze this circuit?



Would the brightness of the light bulbs (#1 + #2) change if you added another light bulb (#3) next to the first one, on the same wire, in this circuit? Explain your thinking.



Reading Different Text Forms: Reading Graphical Texts (Flow Chart)

Grade 9 Science, Applied (Reproduction)

Graphical text forms (such as diagrams, photographs, graphs, charts, and tables) are intended to communicate information in a concise format and illustrate how one piece of information is related to another.

Purpose

- Become familiar with the elements and features of graphical texts.
- Explore a process for reading graphical texts, using a range of strategies for before, during and after reading.

Payoff

Students will:

- become more efficient at "mining" graphical texts for information and meaning.
- practise essential reading strategies and apply them to different course-related materials.

Tips and Resources

- Sometimes a complicated idea or concept can be communicated more easily through a chart. Many informational texts include graphics to supplement the main ideas and provide clues to the important concepts in the text. Some of the features of graphical texts include:
 - print features (such as typeface and size of type, titles, headings, subheadings, italics, labels and captions);
 - design features (such as colour, shape, line, placement, and focal point);
 - organizational patterns (such as sequential, categorical, and explanatory).
- Each graphical text uses these elements and features in different ways to effectively present information in a condensed format. For example, a chart or table may illustrate key information and show how pieces of information relate to each other. A table uses columns and rows to organize the information and may include a title that describes the main idea or subject, and a caption to explain the purpose of the table. The information in a table can be read horizontally and vertically. Tables are often used to help the reader quickly grasp key information (such as number patterns).
- Many of the strategies for reading informational and literacy texts can also be used effectively to read graphical texts.
- See Student Resource, Tips for Reading Graphical Texts.
- See Student/Teacher Resource, Reproduction.
- See Teacher Resource, *Questions to Guide Reading: Reproduction.*

Further Support

- See Reading Graphical Texts, Think Literacy: Cross-Curricular Approaches, Grades 7 12.
- See Think/Pair/Share, Think Literacy: Cross-Curricular Approaches, Grades 7 12.



Reading Different Text Forms: Reading Graphical Texts (Flow Chart)

Grade 9 Science, Applied (Reproduction)

What teachers do

Before

Before reading, help students to connect new content and ideas to their prior knowledge by encouraging them to think about what they already know about the topic or the type of graphical text (see Student/Teacher Resource, *Reproduction*). For example:

- Ask students to **brainstorm** related ideas, concepts and vocabulary, **recall** previous experiences and feelings related to the subject, recall what they have learned about the topic, or **list questions** they might have about the topic.
- Provide students with related experiences, discussion topics, readings, or background information to **increase background knowledge**.
- Pose questions to students before they read, to help them **determine a purpose** for reading.
- Invite students to ask questions about the graphic's purpose and the information in it.
- Model (using a "think aloud") how to **predict** the content based on the features of graphic, specialized language, related written information, or personal experiences. **Skim, scan** and **sample** the text to make informed predictions.
- Identify and pre-teach unfamiliar vocabulary and concepts that appear in the text.

During

During reading, help students to connect the information and ideas in the graphical text to what they already know as they monitor their understanding. (*"Monitoring their understanding"* means recognizing when confusion occurs and identifying strategies that help to regain meaning.) For example:

- Have students describe and model the different reading strategies they might use, such as predicting, questioning, activating prior knowledge, inferring, reading slowly, and rereading.
- Model (using "think aloud") strategies for pausing and thinking about the text. Encourage students to examine parts of the text, **read**, **pause**, **think**, and **ask questions** or **make notes** about how this information relates to other parts of the text.
- Demonstrate how to paraphrase the information presented. For example, use the sentence stem "This means...".
- Invite students to **organize** the information in a different way. Ask students to share and compare their interpretations.
- Provide students with focus questions, such as the following:
 - What is the purpose of this graphic?
 - What information is provided?
 - Is all of the important information included? What information is missing?
 - How is the information organized?
 - How does this information relate to what you already know about the topic?
 - Is this a useful source of information?

After

After reading, help students to **consolidate** and **extend** their understanding of the content. For example:

- Ask partners to **restate** or **paraphrase** what they have read, and **note similarities and differences** in the rephrasing.
- Model (using a "think aloud") how to **make connections** between prior knowledge and what the text is saying.
- Have students suggest possible ways to check the accuracy and reliability of the information presented.
- Review the process that students used for reading graphical texts, including strategies for before, during and after reading. See Student Resource, *Tips for Reading Graphical Texts*.


Student Resource

Tips for Reading Graphical Texts

Before Reading

- Set a purpose for reading. Ask yourself why you are reading this particular text.
- Look over the text to determine what type it is and which elements are used.
- Examine the titles, headings, captions and images. Start with the title. The title tells you what the graphic is about. The captions may also use words and phrases from the text to show how the graphic is related to the information in the written text (e.g., "Figure 1.6").
- Recall what you already know about the topic or subject.
- Record some questions you might have about the information presented.

During Reading

- Read all the labels and examine how they are related to the graphic. Each label has a purpose. The most important labels may be in capital letters, bold type, or a larger font.
- Follow the arrows and lines. They may be used to show movement or direction, or connect to the things they name.
- Look for the use of colour or symbols to emphasize important words and information. Some graphical texts have a legend or a key to explain the meaning of specific symbols and colours.
- Study the image carefully. See if you recognize the details in the image. Read the text near the picture to find an explanation of the information in the graphic. Use the figure number or title and key words to find and read the related information in the written text.
- Identify the relationships among the visuals and information presented.

After Reading

- Interpret the information conveyed in any of the graphics (e.g., diagrams, charts, graphs, maps). Ask yourself why this information might be important.
- Rephrase information orally or in writing. Imagine that you are explaining the graphic to someone who has not read it.
- Create your own graphical text (e.g., graph, map, diagram, table, flow chart) to represent the important information.

Teacher Resource

Questions to Guide Reading: Reproduction

Questions to ask		Possible answers
Be	fore	
•	What clues are there to help you make inferences as to what the graphic will be about?	• Bold print gives you the parts of a flower and arrows give you direction. It is the changes that a flower undergoes as it grows.
•	What type of graphic is this?	This is a flow chart.
•	What is the purpose of this type of graphic?	• It is a visual aid to show the order of events. In this case it is the life cycle of a flower.
•	What information is needed to help someone tell what this graphic is about?	• A title is needed, <i>The Life Cycle of a Plant</i> .
During		
•	Where is the beginning of the cycle? The end? Is there a specific direction to be followed? Give reasons.	 Students' responses should indicate an understanding of how to read a cycle graphic.
•	Start at the beginning and Think/Pair/Share the headings, captions and images. Paraphrase the information they give about the cycle of a plant.	Answers should be based on each step in the process.
•	What information or insight do the captions give you?	• They explain what the pictures cannot tell you and they help your understanding.
After		
•	Write a brief summary, in your own words, about the life cycle of a plant.	• Students may organize the information in a way that is best for them e.g., list.
•	How does this flow chart help you to understand the life cycle of a plant?	Answers may vary.
•	Where else have you seen the use of a flow chart? Record responses on a chart paper.	• Examples could be the water cycle, carbon dioxide cycle, etc.



Student/Teacher Resource

Reproduction

SEED

Seeds are easily stored, compact, and are usually dark brown (protective colouring). They survive in extraordinary

circumstances.



POLLINATION

Flowers are pollinated by insects, animals or the wind. Pollen contains the sperm cell that fertilizes the egg cell and a seed is created.







FLOWERS Most plants produce flowers containing ed

flowers containing eggs that need to be fertilized.



ROOTS & STEMS

Roots push down to anchor the new plants while they take up minerals and water from the soil and stems grow more leaves.



GERMINATION With water, the right temperature and the right location (e.g., soil), the seed begins to make a new plant.



LEAVES Leaves unfold to absorb sunlight to produce food for growth.





Reading Different Text Forms: Following Instructions

Grade 9 Science, Applied (Chemistry)

Students are expected to read and follow instructions in Science and Technology or Science especially for experiments. This strategy asks students to examine different types of instructions, their features and elements, and how the features, language and organizational patterns can be used to help the reader understand and complete a task.

Purpose

- Provide students with strategies for reading, interpreting and following instructions to complete a specific task.
- Learn how instructions are organized.

Payoff

Students will:

- identify purpose for reading instructions.
- develop a process for reading and following instructions.

Tips and Resources

- Instructions give detailed step-by-step information about a process or procedure (e.g., directions, recipes, experiments, manuals, tests). They are sometimes called procedures or how-tos. Most instructions use organizational patterns, language, and features (charts, bold or italic type, headings, numbers, lists) to help the reader identify the task and the best way to complete it; however, some instructions are complicated without any features to help the reader determine the sequence of steps.
- See Student/Teacher Resource, *Investigating the Properties of Change*.
- See Teacher Resource, Questions to Guide Reading: Investigating the Properties of Change.

Further Support

- Provide students with a list of typical signal words and task prompts and suggestions/strategies for responding to them (e.g., place, fill, mark, repeat, record).
- Provide students with flow charts, diagrams and timelines to help track successful completion of oral or written instructions.
- Create a class framework for reading instructions such as:
 - preview
 - highlight and annotate
 - think aloud and visualize
 - reread
 - go step-by-step
 - read the diagrams or charts
 - ask questions
- See Following Instructions, Think Literacy : Cross-Curricular Approaches, Grades 7 12.



Reading Different Text Forms: Following Instructions

Grade 9 Science, Applied (Chemistry)

What teachers do

Before

- Select a set of instructions typical for science, science and technology related to a current topic or process.
- Ask students to **recall** an important occasion, when they had to follow a set of instructions (e.g., an exam, making a table, fixing a bike, installing software). Discuss what was challenging and easy about following the instructions.
- Ask students to **recall** what they know about effective instructions.
- Make a list of the elements and features of instructions with the class.
- Make copies of another set of instructions and cut them into slips of paper with a step on each slip (unnumbered). Place one set of jumbled instructions in as many envelopes as there are groups or pairs. Provide partners or small groups with an envelope, and ask students to **recreate** the instructions and discuss the decisions they made. Identify the strategies they used to determine the task and the sequence.
- Provide students with a copy of the selected instructions. Model for students how to **preview** the instructions (e.g., looking at title, organization, some of the signal words [sequence of steps and process verbs], graphics, illustrations, summary, materials list).

During

- Model reading the introductory material (see Student/Teacher Resource, *Investigating the Properties of Change*) and the first 2 or 3 steps aloud, noting the **signal words** and what they tell the reader to do.
- Ask students to continue reading the instructions to **identify** the task to be completed. Suggest that students imagine themselves completing the instructions.
- Ask small groups to **discuss** the **strategies** they used to read the instructions and determine what they were expected to do.

After

- **Clarify** any confusing sections of the instructions. Use a flow chart to **outline** the steps, if necessary.
- Have students individually or in pairs **complete** the instructions. **Compare** the completed tasks.
- Discuss how students figured out what to do.
- Identify confusing or challenging parts and suggest additional strategies.



Teacher Resource

Questions to Guide Reading: Investigating the Properties of Change

What teachers do		What students do			
Be	Before				
•	Use the Think/Pair/Share strategy to have students recall a situation in which they had to follow a set of instructions. Create a list of elements and features of effective instructions, and record on chart paper or board.	 The list should include a title, a numbered or bulleted series of steps in sequence, clear organization and sub-headings. 			
•	What additional requirements does a scientific set of instructions include?	• Scientific instructions should include a question, hypothesis, materials, procedure, observations and a conclusion.			
•	Provide students with a copy of the instructions and model how to preview the instructions. Clues can be found by looking at the focus of the Analysis questions.	 Identify the title, read the introduction, check out the italicized or bold words for meaning, and note the sequence. 			
Dι	iring				
•	Read the instructions aloud with the students noting the signal words—place, fill, add, repeat, and mark.	• Students note the signals, highlight or underline and clarify what they tell the reader to do.			
•	Using Think/Pair/Share strategy, students paraphrase to identify the task to be completed and what they are expected to do. (The experiment will take 3 days to collect and record data for this chemical change.)	• Students use their own words to clarify the instructions in the experiment. Students may create a diagram to assist in visualizing the steps.			
After					
•	What parts of the instructions are not clear?	Answers may vary.			
•	Use a flow chart to outline the required steps.	• Students complete the organizer.			
•	Conduct the investigation, and compare results with another group.	• Think/Pair/Share format (as a group) for the investigation and results.			
•	What problems did you run into as you tried to follow the instructions? What strategies did you use to solve the problems?	Answers may vary.			

Student/Teacher Resource

R

INVESTIGATING THE PROPERTIES OF CHANGE

In this experiment, which will take 3 days to complete, you will make observations to use in deciding if a chemical or physical change has taken place.

Purpose

The purpose of this experiment is to investigate some properties of change. After reading the instructions, formulate a *hypothesis* that states what you believe will happen.

Materials

1 graduated cylinder 1 tall thin jar with a narrow neck (gas bottle) steel wool – moistened with water shallow pan filled with water permanent ink marking pen

Procedure

- 1. Take a clump of <u>wet</u> steel wool and push it into the bottom of the jar. Use a big enough piece so that it will stay wedged in place when the jar is put upside down.
- 2. Fill the jar to the very top with water and then pour this water into a graduated cylinder. Make sure the steel wool stays at the bottom of the jar.
- 3. Record the volume of water (mL) as this number represents the volume of air the jar can hold with the steel wool in place.
- 4. Invert the jar of air and steel wool into the pan of water. It will remain upside down in the water for the next 3 days. Tomorrow is day #1.
- 5. **Design an observation table** to record the data. Each day you will observe the appearance of the steel wool and with the marking pen, draw a line on the jar to indicate the level of the water.
- 6. In order to measure the amount of water that moved into the jar, after your last observation on day #3, you will need to take the jar out of the pan and fill it up to the final level line you have drawn. Measure the volume (mL) of water with the graduated cylinder. This represents how much air has *disappeared* over 3 days.

Analysis and Conclusion

- (1) Is this an example of a physical or chemical change? State the evidence to prove it.
- (2) Steel wool has the element iron in it. Where have you seen this kind of change happen in every day life?
- (3) Explain why the water moved up and into the jar. Why didn't all of the air disappear? (HINT what gases are in air?)

Challenge

Write the word equation for this change. What 2 elements are found in the product?