Name _____ Date _____

Safety in Your Science Classroom

Safety in Your Science Classroom

Use with textbook pages xii–xv.

Following these safety rules and procedures will help keep you and others safe.

Before you begin…

- Be aware of your environment. Listen carefully to instructions, know where fire extinguishers, first-aid kits, and other safety apparatus is located, and tell your teacher if you have any allergies or other conditions that may affect your work.
- Read the activity. Be sure you understand the instructions, or ask for help.
- Protect yourself. Wear lab aprons, safety goggles, and other protective clothing, as recommended. Tie back long hair and remove scarves and long necklaces.
- Set yourself up for success. Make sure your work area is clear. Gather materials safely and place them where they will not cause a hazard.

While you work…

- Do not taste anything, or draw anything into a tube with your mouth. Never smell a substance directly. Instead, waft the fumes toward you with your hand.
- Carry materials carefully. Make room for other students who may be carrying equipment.
- Handle sharp objects with care. Always cut away from yourself, dispose of broken objects with care, and let your teacher know if anything breaks or has a sharp or jagged edge.
- Respect electricity. Make sure your hands are dry when using electrical equipment, pull on the plug—not the cord—to unplug electrical equipment, place cords where people will not trip over them, and report any damaged equipment or frayed cords to your teacher.
- Protect against fire and burns. When heating an item, use heatproof containers and wear safety goggles. Point the open end of a container being heated away from you and others. If you do receive a burn, tell your teacher and apply cold water to the burn immediately.
- Read safety symbols on all materials.


Flammable and Combustible Material


Compressed Gas


Oxidizing Material


Corrosive Material


Poisonous and Infectious Material Causing Immediate and Serious Toxic Effects


Poisonous and Infectious Material Causing Other Toxic Effects


Biohazardous Infectious Material


Dangerously Reactive Material

- If part of your body comes into contact with a substance, wash it immediately and thoroughly with water. If you get anything in your eyes, wash them with water for 15 minutes and tell your teacher.
- Treat living creatures humanely and return them to their natural environment.
- Do not use power tools unless you have specialized training in using them safely.

When your work is complete…

- Clean up. Clean equipment before you put it away, and wash your hands thoroughly. Clean up spills, and dispose of materials according to your teacher's directions.

Name _____ Date _____

Safety in Your Science Classroom

Applying Knowledge

1. These 10 symbols appear in your Science Links textbook to alert you to possible dangers. Beside each symbol, write the letter of its descriptor, then write one example of what you might do when you see that symbol. One example is completed for you.

 C Follow the teacher's instructions to dispose of leftover materials.

 _____

 _____

 _____

 _____

 _____

 _____

 _____

 _____

 _____

A. **Clothing Protection Safety** A lab apron should be worn.
B. **Chemical Safety** Chemicals used can cause burns or are poisonous if absorbed through the skin.
C. **Disposal Alert** Care must be taken to dispose of materials properly.
D. **Electrical Safety** Take care when using electrical equipment.
E. **Eye Safety** A danger to the eyes exists. Wear safety goggles.
F. **Fire Safety** Take care around open flames.
G. **Fume Safety** Chemicals or chemical reactions could cause dangerous fumes.
H. **Sharp Object Safety** A danger of cuts or punctures caused by sharp objects exists.
I. **Skin Protection Safety** The use of caustic chemicals might irritate the skin, or contact with micro-organisms might transmit infection.
J. **Thermal Safety** Use caution when handling hot objects.

Name _____ Date _____

Topic **1.1** Summary

What are ecosystems and why do we care about them?

Textbook pages 8–17

Before You Read

What do you think of when you hear or read the term ecosystem? What is an ecosystem? Record your thoughts on the lines below.

_____

_____

Reading Check

1. What are the two main components of an ecosystem?

_____

_____

_____

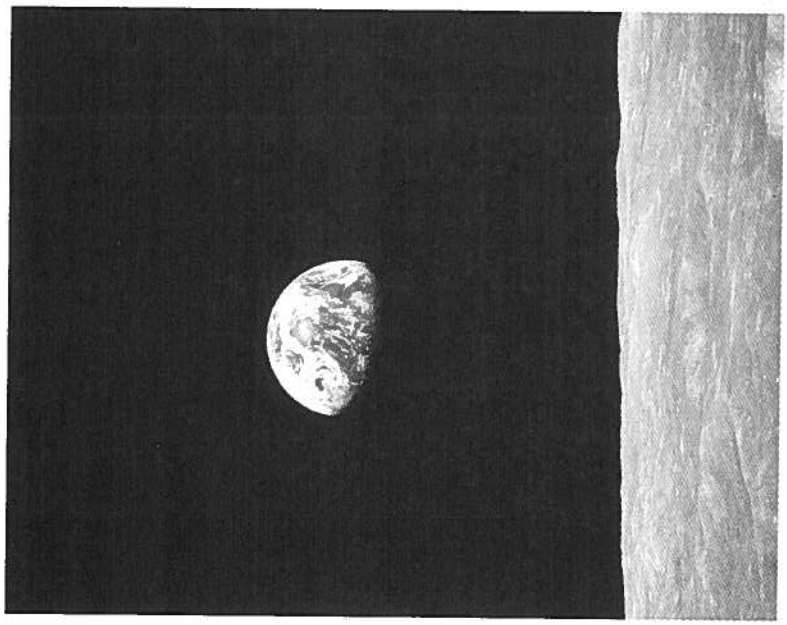
Reading Check

2. What are two changes that could affect the balance in an aquatic environment?

_____

_____

_____



What is ecology?

Ecology is a science that tries to explain the connections between everything on Earth. Scientists called ecologists study how living things interact with each other and with everything in their environment.

What is an ecosystem?

An **ecosystem** is all of the non-living and living parts of a certain place. In an ecosystem, **abiotic** parts, such as oxygen, water, nutrients, light and soil, support the life functions of **biotic** components, such as plants, animals, and micro-organisms. Ecosystems can be small. Examples of small ecosystems include a pond or a spruce tree. Ecosystems also can be large. Examples of large ecosystems include an ocean and even the whole Earth.

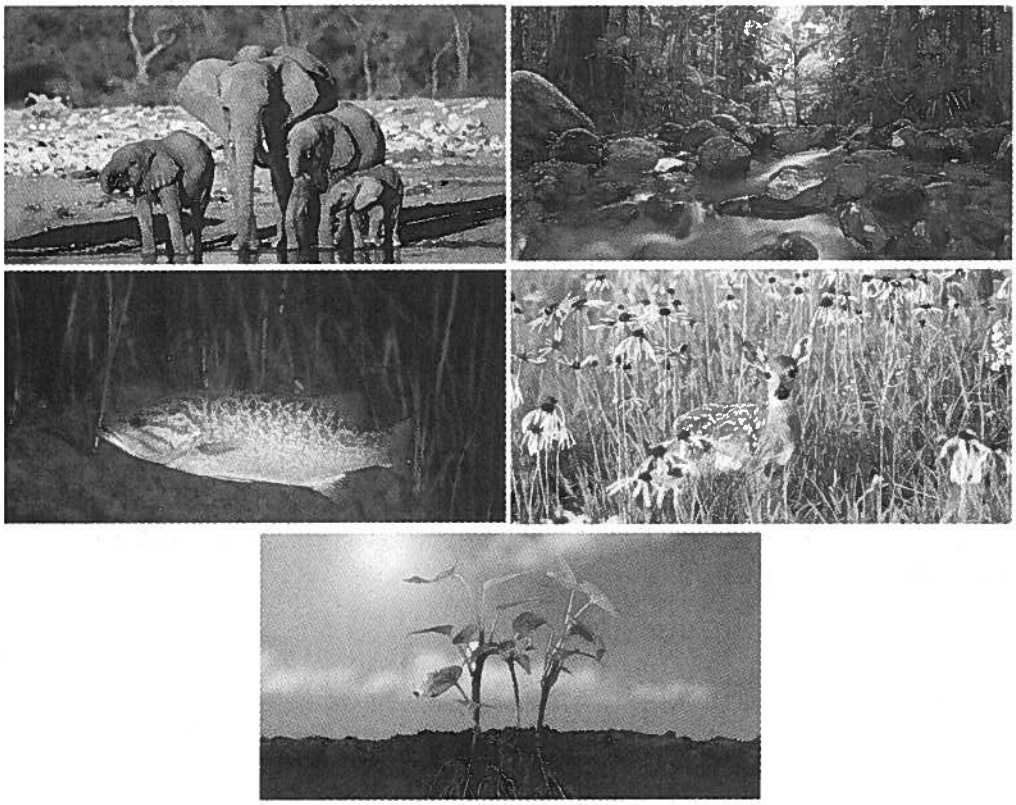
Name Date

Topic **1.1** Summary

How do biotic and abiotic parts interact?

If you think about a pond ecosystem, you will realize that the plants depend on water and soil to survive. These abiotic parts give the plants their basic needs for water and nutrients. What other abiotic parts can you think of that might affect the survival of the plants?

Terrestrial ecoystems are land-based ecosystems such as a desert or city. **Aquatic ecosystems** are water-based ecosystems such as a lake or an ocean. These ecosystems are linked. The interactions that occur between the biotic and abiotic parts of an ecosystem create a balance. This allows the ecosystems to be healthy. Any activity that causes change to either the living or non-living parts of an ecosystem can upset this balance.



Abiotic and biotic parts of an ecosystem	
Abiotic	**Biotic**
sunlight heat soil nutrients water oxygen	plants animals micro-organisms

Name _____ Date _____

Cloze Activity
Topic 1.1

Use with textbook pages 8–17.

Ecosystems and Ecology

Vocabulary	
abiotic	ecosystem
aquatic	environment
balance	healthy
biotic	interact
ecology	terrestrial

Use the terms in the vocabulary box to fill in the blanks. Use each term only once.

1. _____ is a science that tries to explain the connections between everything on Earth.
2. Ecologists study how living things _____ with each other and with everything else in their _____.
3. A pond, a forest, a desert, an ocean, a human body, and Earth itself are examples of an _____ .
4. The living things such as trees, micro-organisms, and animals that live in a forest are the _____ parts of the ecosystem.
5. All of the non-living things such as soil, water, and nutrients found in a forest are the _____ parts of the ecosystem.
6. An ant colony and a city are both examples of a land-based, or _____, ecosystem.
7. A river and an ocean are both examples of a water-based, or _____, ecosystem.
8. The balance between abiotic and biotic parts of an ecosystem keep the ecosystem _____.
9. Human activities such as cutting down a forest near a stream can upset the _____ in an ecosystem.

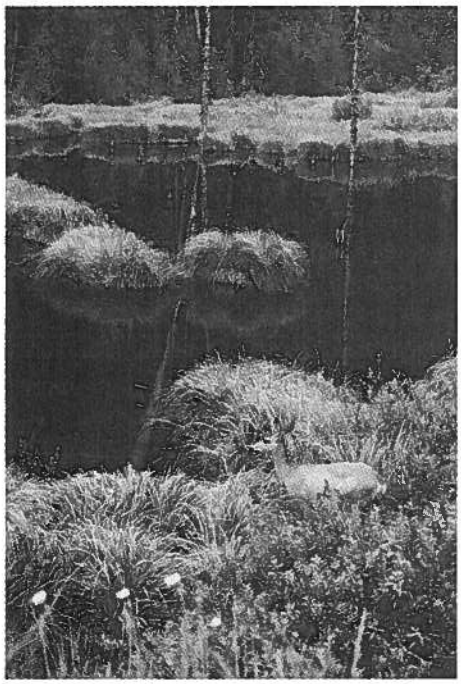
Name _____ Date _____

Applying Knowledge
Topic 1.1

Use with textbook pages 12–13.

Abiotic and biotic parts of an ecosystem

This photograph represents a typical ecosystem found in Ontario. Examine the photograph and answer the questions below.



1. List at least three abiotic components of this ecosystem.

_____

_____

2. List at least three biotic components of this ecosystem.

_____

_____

3. Give two examples that illustrate interactions that occur between the abiotic and biotic parts of this ecosystem.

_____

_____

4. Suggest a human activity that could upset the balance in this ecosystem. Explain your answer.

_____

Name Date

Assessment
Topic 1.1

What are ecosystems and why do we care about them?

Use with textbook pages 8–17.

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ abiotic	**A.** means water
2. _____ aqua	**B.** a land-based ecosystem
3. _____ aquatic ecosystem	**C.** a system that is made up of all the interacting biotic and abiotic parts of a certain place
4. _____ biotic	**D.** all the living things in an ecosystem
5. _____ ecologist	**E.** means land or earth
6. _____ ecosystem	**F.** all the non-living things in an ecosystem
7. _____ terra	**G.** a water-based ecosystem
8. _____ terrestrial ecosystem	**H.** a scientist who studies the connections between everything on Earth

9. List three basic things for a spruce tree needs to survive.

_____

_____

_____

10. What are the factors that contribute to the size and shape of an ecosystem?

_____

_____

_____

11. What is the difference between the terms abiotic and biotic?

_____

_____

_____

_____

12. What must occur in order for an ecosystem to stay healthy?

_____

_____

_____

_____

Name _____ Date _____

Topic **1.2** Summary

How do interactions supply energy to ecosystems?

Textbook pages 18–27

Before You Read

In this topic, you will explore how ecosystems get energy, and how living things interact to get energy from their food. What are the main differences between a food chain and a food web? Record your ideas below.

_____

_____

Reading Check

1. What product from photosynthesis is used to fuel cellular respiration?

_____

_____

_____

Reading Check

2. Why do consumers further along a food chain receive less and less energy?

_____

_____

_____

How does energy flow in an ecosystem?

The energy that living things depend on to live originally comes from the Sun. Green plants capture the light energy from the Sun and change the light energy into chemical energy in a process called **photosynthesis**. The chemical energy created is stored as sugar, or glucose. Oxygen is produced as well. Most living things on Earth use the oxygen to break down the glucose and release the stored energy. This breaking-down process is called cellular respiration. **Cellular respiration** also produces carbon dioxide. Plants then use carbon dioxide to carry out photosynthesis. Photosynthesis and cellular respiration work together as a cycle to sustain life.

How do living things get their energy from food?

Living things that produce their own food are called **producers**. Producers such as green plants use photosynthesis to convert light energy into chemical energy. **Consumers** eat producers to obtain the energy they need to survive.

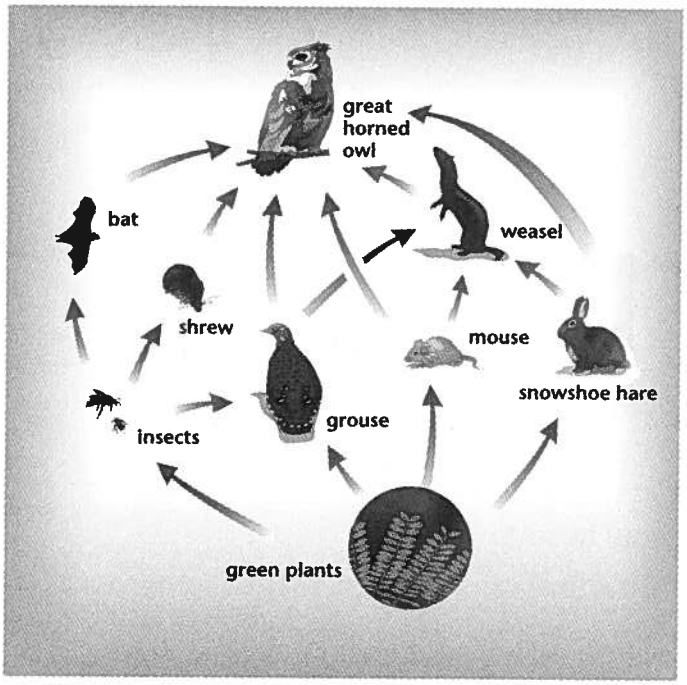
Ecologists use two different models to illustrate the flow of energy and feeding relationships in an ecosystem: food chains and food webs. **Food chains** show the flow of energy from plant to animal and from animal to animal. Plants are the producers; consumers eat the plants and other organisms. Interconnected food chains form a **food web**. Many animals are part of more than one food chain in an ecosystem because they eat or are eaten by several organisms.

Name _____ Date _____

Topic **1.2** Summary

How is energy lost in a food chain?

In a food chain, only a small amount of energy is transferred to the next level. The original food energy is used for growth and photosynthesis. Some energy is lost in the form of heat. Even more energy is lost in waste material. Only 10 percent of the food energy from a producer is passed on to a consumer. Only 10 percent of that energy is passed onto the next consumer. ✔



Energy for ecosystems

Photosynthesis

plants
carbon dioxide, sunlight
stores energy (glucose)

Cellular respiration

all living organisms
oxygen, glucose
releases energy

flow of energy
consumer
producer
food chain

flow of energy through food web
all organisms connected to each other
many food chains

Name _____ Date _____

Comprehension
Topic 1.2

Use with textbook pages 18–27.

Energy flow

Answer the questions below.

1. What happens to the light energy from the Sun during the process of photosynthesis?

_____

2. What types of living things use photosynthesis to make their food?

_____

3. What other forms of energy are produced from the chemical energy used during cellular respiration?

_____

4. Which living things use the process of cellular respiration to release their stored energy?

_____

5. How do producers make their food?

_____

6. How do animals get the energy they need to live?

_____

7. How does the flow of energy move through a food chain?

_____

8. Give an example of how the change of one organism in a food chain could affect an entire food web.

_____

9. What percentage of food energy is transferred between a producer and consumer?

_____

Name _____ Date _____

Applying Knowledge
Topic 1.2

Use with textbook pages 20–21.

Photosynthesis and cellular respiration

Complete the following table to compare photosynthesis and cellular respiration.

	Photosynthesis	Cellular Respiration
1. How is energy changed during the process?		
2. What substances are used during the process?		
3. What substances are produced during the process?		
4. Write the word equation for the process.		
5. Give two examples of why the process is important.		
6. What types of living things use the process?		

Name _____ Date _____

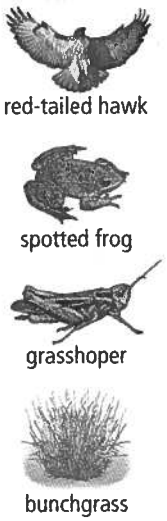
Interpreting Illustrations
Topic 1.2

Use with textbook pages 22–23.

Food chains and food webs

Use the diagrams to help you answer the questions.

Food Chain



1. What is the producer in this food chain?

   _____

2. How does the producer obtain its energy?

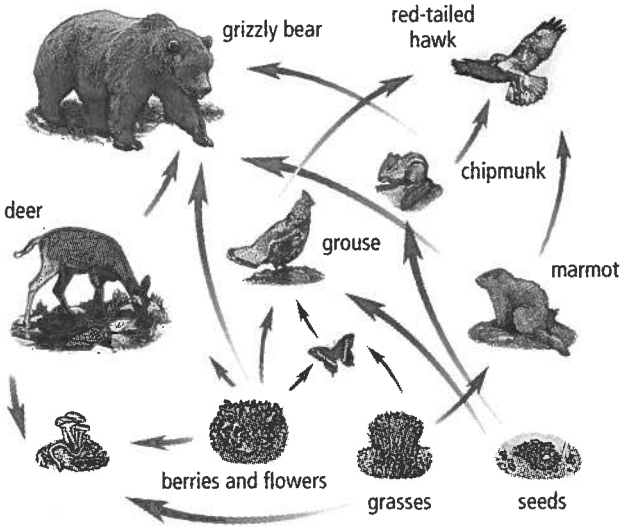
   _____

3. What are the consumers in this food chain?

   _____

4. Draw lines to show the path of energy through this food chain. Show where heat energy is lost at various points in the food chain.

Food Web



5. What term describes a chipmunk that eats seeds or fruit?

   _____

6. How does the grizzly bear get energy to survive?

   _____

7. If the berries and flowers were removed from the food web, which animals would be affected?

   _____

Name _____ Date _____

Assessment
Topic 1.2

How do interactions supply energy to ecosystems?

Use with textbook pages 18–27.

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ cellular respiration	**A.** energy-rich food compound that stores chemical energy
2. _____ consumer	**B.** any living thing that gets the energy it needs by making its own food
3. _____ food chain	**C.** a model that describes how the energy that is stored in food is transferred from one living thing to another
4. _____ food web	**D.** a series of chemical changes that let living things release the energy stored in sugars to fuel all life functions
5. _____ glucose	**E.** to keep or keep going, as an action or a process
6. _____ photosynthesis	**F.** a series of chemical changes that let green plants capture the Sun's light energy and transform it into chemical energy
7. _____ producer	**G.** a model that describes how energy in an ecosystem is transferred through two or more food chains
8. _____ sustain	**H.** any living thing that gets the energy it needs by eating producers or other consumers.

9. Where does the energy stored in food originate?

_____

10. What process do green plants use to make their own food?

_____

11. What process is used by living things to release chemical energy stored in glucose?

_____

12. What are the different ways that producers and consumers get the energy they need to live?

_____

_____

_____

Name _____ Date _____

Topic **1.3** Summary

How do interactions in ecosystems cycle matter?

Textbook pages 28–39

Before You Read

Like other organisms, you rely on nutrients to stay healthy. Based on your current understanding, create a definition of what you think a nutrient is. Write your definition on the lines below.

_____

_____

Reading Check

1. What is a cycle?

_____

_____

_____

Reading Check

2. Name a human activity that can cause changes to **nutrient cycle**.

_____

_____

_____

How are nutrients cycled in ecosystems?

Decomposers are consumers that get their energy by consuming dead plant and animal matter. Soil insects, earthworms, moulds, mushrooms and certain kinds of bacteria are all decomposers. When they digest waste, they release certain **nutrients** and return them to the environment in usable forms. The nutrients include carbon, nitrogen, iron and other chemicals, and they are used by producers and consumers to carry out their life functions. This process means that nutrients are being used and reused in a constant **cycle**.

How are oxygen and carbon cycled in ecosystems?

During the process of photosynthesis, producers such as plants take in carbon dioxide to make high-energy sugars and release oxygen into their surroundings. The sugar and oxygen are then cycled through the process of cellular respiration. Organisms take in the oxygen and use it to release the energy stored in the sugar. Water and carbon dioxide are given off as products of this reaction. The carbon dioxide is used again by plants for photosynthesis. This cycle allows carbon and oxygen to be used over and over.

Name _____ Date _____

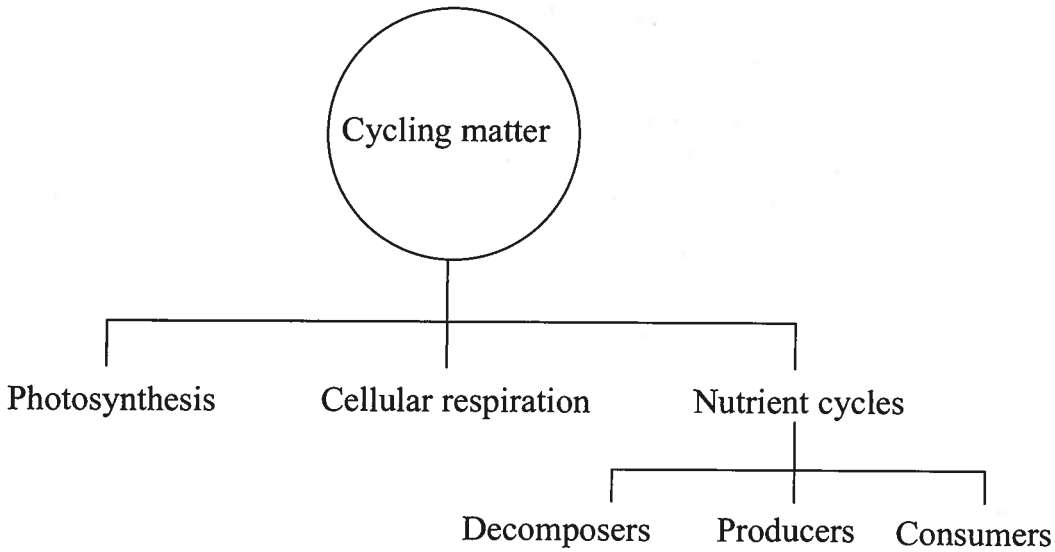
Topic **1.3** Summary

How do human activities affect nutrient cycles?

The amount of carbon dioxide produced and released by photosynthesis and cellular respiration is usually balanced. However, human activities such as burning trees and natural gas for fuel increases the amount of carbon dioxide in the air. Removing trees from an area also increases the levels of carbon dioxide. The extra carbon dioxide traps heat in the atmosphere and leads to global warming, the slow rise of temperature on Earth. Think about the activities in your daily life that add to the increase in carbon dioxide. What activities could you change to reduce your impact on this carbon cycle? ✔

The nitrogen cycle is also affected by human activities. Nitrogen-based fertilizers are often used to make plants grow faster. But fertilizer can be carried into aquatic ecosystems. The extra nitrogen in the water can cause an algal bloom, or the very quick growth of algae. An algal bloom does not allow sunlight through the water, and deprives some aquatic organisms of oxygen, thereby killing them and anything that feeds on them. Eventually, that causes the death of the aquatic ecosystem. Is there an aquatic ecosystem close to your home that may have been affected by increased nitrogen levels? How could this damage be prevented?

How ecosystems cycle matter



Name _____ Date _____

Cloze Activity
Topic 1.3

Use with textbook pages 28–39.

Interactions in ecosystems

Vocabulary	
algal bloom	nitrogen
carbon	nutrient cycle
cellular respiration	photosynthesis
consumers	producers
decomposers	proteins
global warming	sugar
iron	water

Use the terms in the vocabulary box to fill in the blanks. Use each term only once.

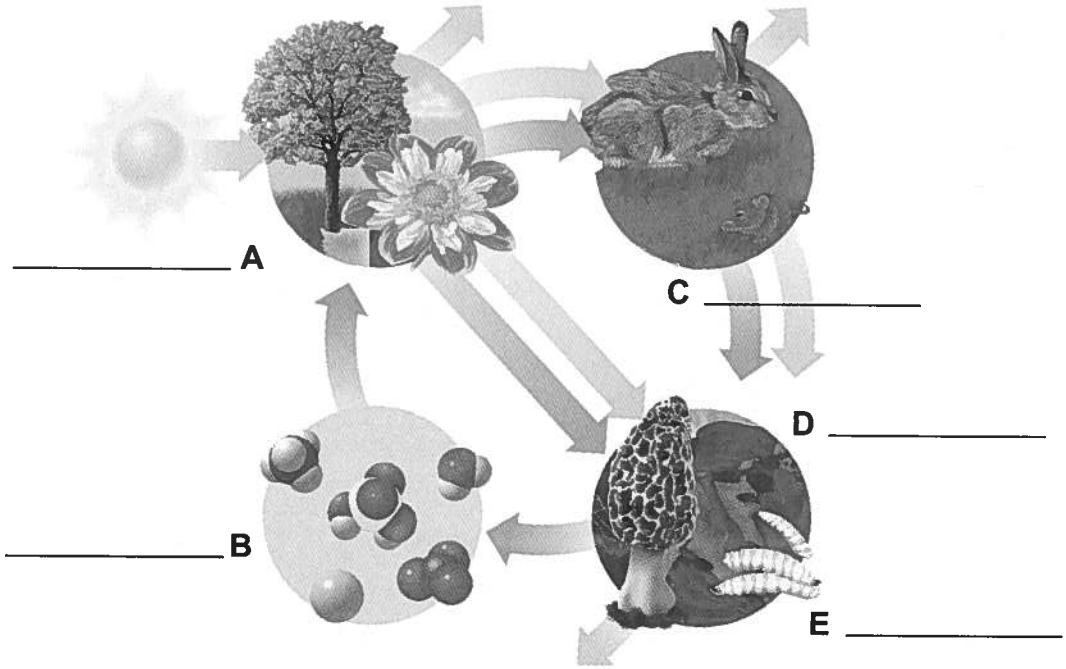
1. _____ get their food energy by digesting wastes such as urine, feces, and the bodies of dead organisms.
2. _____, _____, _____ and other chemicals are examples of nutrients used by living things.
3. When _____ and _____ die, decomposers return the nutrients to the environment.
4. The pattern of continual use and reuse of nutrients that living things need is called _____.
5. _____ and _____ play a key role in the cycling of matter such as carbon and oxygen in ecosystems.
6. Producers use the carbon dioxide to make high-energy carbon-containing substances such as _____.
7. Organisms release _____ into their surroundings during cellular respiration.
8. Human activities like removing trees to make space for homes, buildings and farmlands are factors linked to the occurrence of _____.
9. Nitrogen is a major part of cells and a key building block for _____.
10. An _____ is caused by too much of a nutrient, such as nitrogen, entering an aquatic environment.

Name _____ Date _____

Applying Knowledge
Topic 1.3

Use with textbook pages 30–35.

The cycling of nutrients



On the diagram above, label the following terms: consumers, decomposers, heat, non-living nutrient substances, producers.

Use the general model of a nutrient cycle to answer the questions below.

1. How does the process of photosynthesis contribute to this model of a nutrient cycle?

_____

_____

2. How does the process of cellular respiration contribute to this model of a nutrient cycle?

_____

_____

3. How is the process of decomposition related to this diagram?

_____

_____

4. How do human activities affect a nutrient cycle?

_____

_____

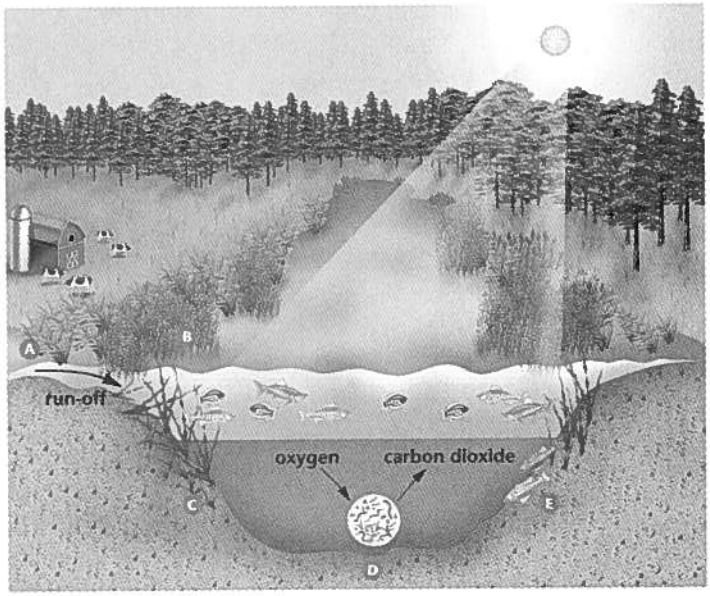
Name _____ Date _____

Interpreting Illustrations
Topic 1.3

Use with textbook page 35.

Nitrogen cycle and algal blooms

Use the diagram to answer the questions below.



Why is the nitrogen important?

_____

_____

What is happening at B?

_____

_____

What is happening at C?

_____

_____

What is happening at E?

_____

_____

What could be the cause of the changes to this aquatic ecosystem?

_____

_____

Name _____ Date _____

Assessment
Topic 1.3

How do interactions in ecosystems cycle matter?

Use with textbook pages 28–39.

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ algal bloom	**A.** any substance that a living thing needs to sustain life
2. _____ cycle	**B.** the pattern of continual use and reuse of a nutrient
3. _____ decomposer	**C.** a natural or synthetic material spread on or worked into to soil to increase its capacity to support plant growth
4. _____ drought	**D.** organism that obtains energy by consuming dead plant and animal matter
5. _____ fertilizer	**E.** overgrowth of algae caused by excess nitrogen in an aquatic ecosystem
6. _____ global warming	**F.** an increase in the average temperature of Earth's atmosphere, especially a sustained increase sufficient to cause climatic change
7. _____ nutrient	**G.** a pattern of change that repeats itself forever
8. _____ nutrient cycle	**H.** a lack of rain for a long time

9. What is the difference between evaporation and condensation?

_____

_____

_____

10. Give three examples of decomposers.

_____

_____

_____

11. What two gases are recycled by the processes of photosynthesis and cellular respiration?

_____

_____

12. What happens when extra carbon dioxide builds up in the atmosphere?

_____

_____

Name _____ Date _____

Topic **1.4** Summary

What natural factors limit the growth of ecosystems?

Textbook pages 40–49

Before You Read

No ecosystem has an unlimited supply of things that organisms need. What are some factors that could affect the survival of organisms in a particular ecosystem? Write your ideas on the lines below.

_____

_____

Reading Check

1. Is it possible for a population to increase forever? Explain your answer.

_____

_____

_____

Reading Check

2. When the European starling was introduced to North America, its population increased rapidly. The Eastern bluebird population dropped dramatically. What is a possible reason for this decrease?

_____

_____

_____

How do resources limit growth in ecosystems?

Carrying capacity describes the largest population size that an ecosystem can support. Resources available to an ecosystem will determine how large or small the population can be. If the resources are unlimited, then the population can keep growing larger and larger. However, if the resources become limited then reproductive rates will decrease and more of the population will die. The result will be a decrease in the population. You can think of it this way: when resources increase the population increases and when resources decrease the population decreases.

The factors that can limit populations in ecosystems are often the same. **Limiting factors** such as oxygen supply, food supply, amount of disease present, number of **predators**, and amount of space available can all affect the survival of organisms in an ecosystem. A change in any of these factors can change the ability of a particular plant or animal to survive.

How do abiotic factors affect populations?

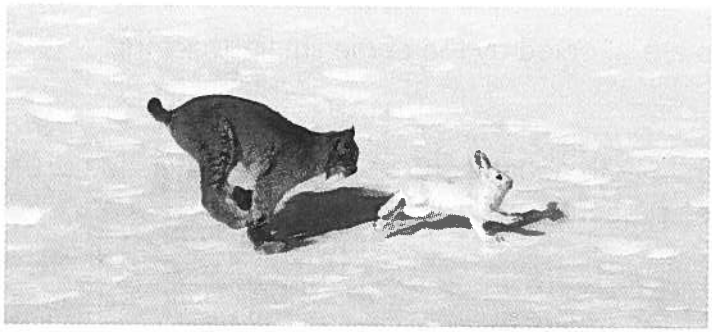
Abiotic or non-living factors including things like water, living space, nutrients, shelter, sunlight, and weather can limit the size of a population. The survival of aquatic plants and fish is often dependent upon the levels of oxygen available to them. Land-based, or terrestrial, ecosystems are usually dependent on the amount of water available to them. Have there been any changes to your local ecosystem that could be threatening the plants and animals that live near you?

Name _____ Date _____

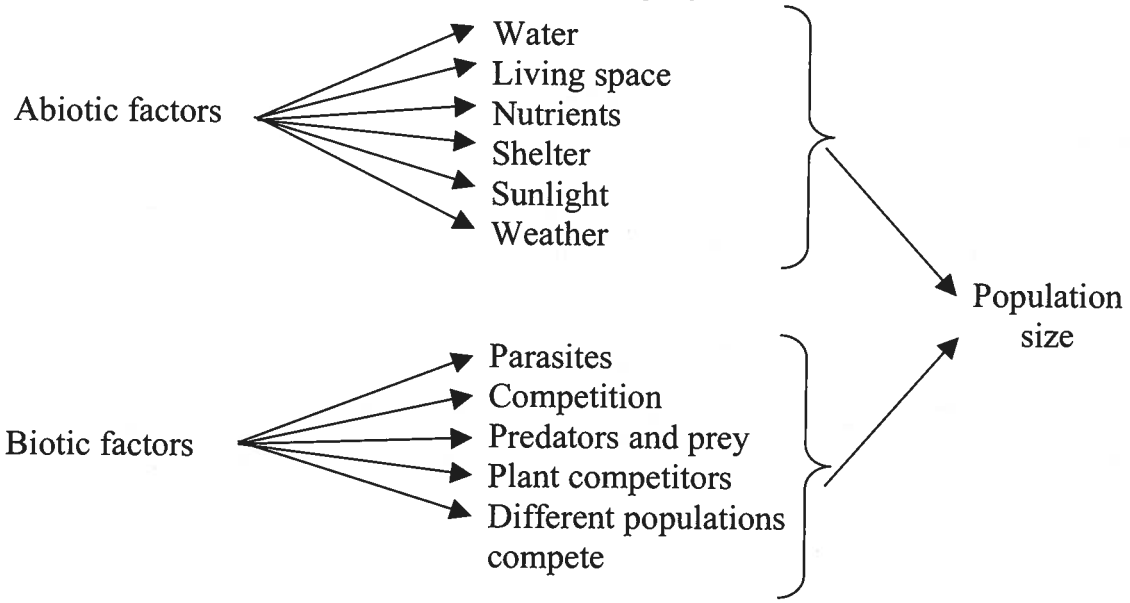
Topic **1.4** Summary

How do biotic factors affect populations?

Biotic or living factors such as **parasites**, competitors, and predators can affect the size of a population. Parasites live on or in other living things. They will weaken that organism or **host**. An example of a parasite is a tick that attaches itself to a host to feed on the host's blood. Another biotic factor is the **competition** that can occur between members of the same population. For example white-tailed deer will compete with each other for food, water, shelter, and living space. Predators will hunt, kill, and eat other animals, thereby decreasing the population of the **prey**. An example of this is the lynx that hunts the snowshoe hare for food. Predation has a beneficial effect on both populations. The lynx gets the food it needs and the weaker members of the snowshoe hare population are eliminated. This creates less competition for the remaining snowshoe hares. Different populations can compete for the same resources, too, as happens with the snowshoe hare and the deer. How they interact affects both of their populations. ✔



How abiotic and biotic factors affect population size



Name _____ Date _____

Comprehension
Topic 1.4

Use with textbook pages 40–49.

Factors limiting size of populations

True or False?

Read the statement given below. If the statement is true, write "T" on the line in front of the statement. If it is false, write "F" and then rewrite the statement so it is true.

1. _____ Statistics gathered from 1950 to the present show that the global human population has been increasing at a rapid rate.

   _____

2. _____ The term carrying capacity refers to the smallest population size an ecosystem can sustain.

   _____

3. _____ When resources are reduced for a population, more members of the population will be born, and fewer members of the population will die.

   _____

4. _____ Most ecosystems are affected by the same limiting factors.

   _____

5. _____ Population growth in both aquatic and terrestrial ecosystems is usually limited by the amount of oxygen present.

   _____

6. _____ In an aquatic ecosystem, if the oxygen supply is decreased and the food supply is decreased then the populations of fish will increase.

   _____

7. _____ Both abiotic and biotic factors can limit the size of populations in ecosystems.

   _____

8. _____ Individual members of a population compete with each other for resources such as nutrients, shelter, light, water, and living space.

   _____

9. _____ Animals are the only things that compete for resources in their ecosystem.

   _____

Name _____ Date _____

Applying Knowledge
Topic 1.4

Use with textbook pages 44–45.

Relationships in populations

• competition • parasitism • predation

Use the above terms to identify the following descriptions. Then explain each relationship.

1. Spotted knapweed releases chemicals into the soil. These chemicals prevent the growth of other plants and allow the plant to spread quickly.

   Term: _____

   Explanation: _____

   _____

2. Lynx hunt snowshoe hares. When the lynx population increases the snowshoe hare population decreases.

   Term: _____

   Explanation: _____

   _____

3. The mountain pine beetle is killing British Columbia's lodgepole and white pine trees.

   Term: _____

   Explanation: _____

   _____

4. Some Ontario lakes have both brook stickleback and nine-spine sticklebacks. Both of these species favour shoreline habitats, where they consume a variety of invertebrates.

   Term: _____

   Explanation: _____

   _____

5. Brainworms cause a degenerative condition in moose. Symptoms include stumbling movements and apparent confusion. The condition often leads to death.

   Term: _____

   Explanation: _____

   _____

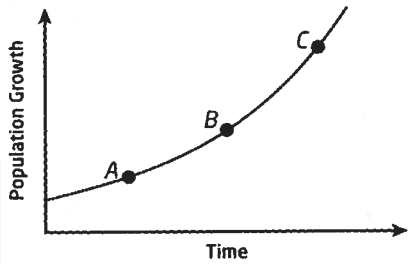
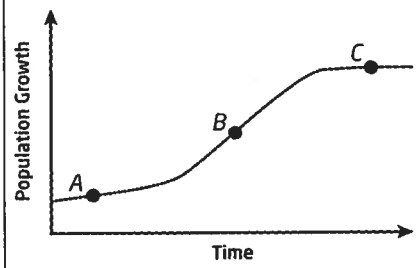
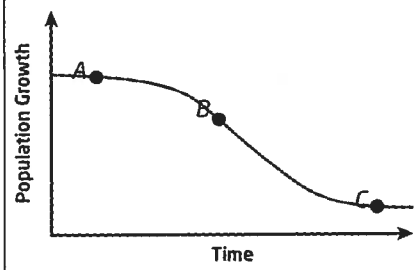
Name _____ Date _____

Extension Activity
Topic 1.4

Use with textbook pages 42–43.

Graphs showing population trends

Interpret the following three graphs. Describe what is happening at each lettered point and predict what will happen next. Provide a reason for each statement and prediction. Sections of the first graph have been filled in for you.

	Point	Description	Reason
	A	Increasing slowly	Few animals so reproduction is slow.
	B		
	C		
	Prediction for future		In time, limiting factors will control the population growth.
	A		
	B		
	C		
	Prediction for future		
	A		
	B		
	C		
	Prediction for future		

Name _____ Date _____

Assessment
Topic 1.4

What natural factors limit the growth of ecosystems?

Use with textbook pages 40–49.

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ carrying capacity	**A.** a harmful interaction between two or more organisms that can occur when organisms compete for the same resource
2. _____ competition	**B.** any condition that affects the growth of a population
3. _____ host	**C.** any organism that exists by hunting and eating other organisms
4. _____ limiting factor	**D.** the largest population size that an ecosystem can sustain
5. _____ parasite	**E.** an animal hunted for food
6. _____ predator	**F.** an available supply of matter that can be drawn on when needed
7. _____ prey	**G.** a living plant or animal from which a parasite obtains nutrition
8. _____ nutrients	**H.** an organism that lives in or on, and takes its nourishment from, another organism

9. What happens to the carrying capacity of an ecosystem when resources become limited?

_____

_____

_____

10. Give two examples of limiting factors for an aquatic environment.

_____

_____

11. What abiotic factors can limit the size of populations in an ecosystem?

_____

_____

_____

_____

12. How does the predator-prey relationship between lynx and rabbits benefit each species?

_____

_____

_____

_____

Name _____ Date _____

Topic **1.5** Summary

How do human activities affect ecosystems?

Textbook pages 50–61

Before You Read

Human activities have consequences for the health of your local ecosystem and Earth as a whole. Name a particular activity occurring in your local ecosystem that you think might affect the ecosystem. Describe the activity and the possible consequences. Record your thoughts on the lines below.

_____

_____

Reading Check

1. How can the construction of a building affect the local ecosystem?

_____

_____

_____

Reading Check

2. What are two changes that could affect the balance in an aquatic environment?

_____

_____

_____

How do human activities affect the health of ecosystems?

Ecosystems are affected by any change that occurs to them. A simple thing like removing a tree can affect the non-living and living parts of the local ecosystem. The area under the tree will now get more sunlight and the soil conditions will change. The birds and insects that used the tree for a home will now be displaced. Do we really think about the consequences for all parts of an ecosystem before we change something in our environment? Do we take time to consider how we can affect the health of an ecosystem?

Some of the human activities that can affect an ecosystem include constructing roads, buildings, and dams. Each of these activities can lead to changes in surface soil, the shape of the land, and the course of drainage or waterways. Manufacturing will alter soil and plant life, consume energy, and create waste. As consumers we also consume energy and generate waste that needs to be recycled. Do we really think about how we are affecting the ecosystem when we make "advancements" for humans?

Name _____ Date _____

Topic **1.5** Summary

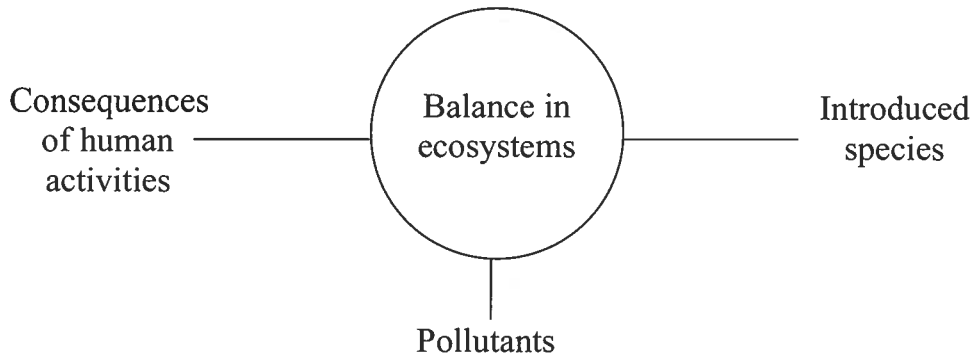
How do introduced species affect an ecosystem?

Native species are plants and animals that naturally inhabit an area. **Introduced species** or foreign species are species that are introduced into an ecosystem by humans, either intentionally or accidentally. They do not naturally inhabit the ecosystem. Some introduced species can dramatically change or destroy ecosystems while others do not cause harm. The European starling is an example of an introduced species that has thrived in its new ecosystem. The starling has been able to survive and reproduce better than the native starling. Purple loosestrife quickly takes over wetlands where it is introduced and completely replaces the native vegetation. Such a dominant species in an ecosystem decreases the number of species, or the **species diversity**, of the ecosystem. On the other hand, apple and corn crops introduced to Ontario do not negatively affect the ecosystem, since both consumers and disease keep their populations in balance. ✔

How do watersheds connect terrestrial and aquatic ecosystems?

A **watershed** is any area of land that drains into a body of water. Watersheds support many living organisms, and provide us with water for drinking, irrigation, recreation, industrial uses, and more. The land or terrestrial ecosystem could be a city or a natural area. Waste from the land will eventually feed into a body of water or aquatic ecosystem like a pond, a river, a lake, or the ocean. Whatever happens on the land or in the water can affect the ecosystem we live in. Do we take time to think about the wastes or toxins we constantly put into our land or waterways? We have to remember that they are linked to each other and that everything on Earth is interconnected.

Factors affecting the ecosystem



Name _____ Date _____

Cloze Activity
Topic 1.5

Use with textbook pages 50–61.

How we affect the ecosystem

Vocabulary	
abiotic	recycled
air	resources
balance	soil
biotic	waste
change	water
decrease	watersheds
impact	wetland
native	

Use the terms in the vocabulary box to fill in the blanks. Use each term only once.

1. Human populations have a greater_____ on ecosystems than populations of most other living things do.
2. In some cases, ecosystem _____is so disrupted that living things that once thrived in a certain place can no longer get the_____ they need to survive.
3. Human activities always cause _____to ecosystems.
4. These changes always have consequences for the_____ and_____ parts of the ecosystem.
5. During manufacturing, the production process creates wastes that can pollute _____, _____ , and _____.
6. Consumers who buy goods generate _____that must be disposed of or _____ .
7. European starlings destroy crops and out-compete_____ birds for nesting sites.
8. Species diversity in an ecosystem tends to _____ when an introduced species becomes well-established.
9. Purple loosestrife quickly takes over a _____ ecosystem.
10. All _____ connect terrestrial ecosystems with aquatic ecosystems.

Name _____ Date _____

Applying Knowledge
Topic 1.5

Use with textbook pages 56–57.

Effects of human activities on ecosystems

Summarize the possible consequences on an ecosystem as a result of each of the following human activities.

Human activity	Consequences
Construction of roads and buildings	_____ _____ _____ _____
Dam-building	_____ _____ _____ _____
Manufacturing	_____ _____ _____ _____
Consumption of goods	_____ _____ _____ _____
Another type of human activity that would have consequences _____	_____ _____ _____ _____

Name _____ Date _____

Comprehension
Topic 1.5

Use with textbook pages 54–55.

Impact of introduced species on ecosystems

Answer the questions below.

1. Where did the European starling come from?

_____

2. How was the European starling introduced to North America?

_____

3. Explain the term introduced species.

_____

_____

4. Give two examples of species introduced to Ontario that have not caused harm to their new ecosystems.

_____

5. What limiting factors can keep introduced species populations in balance?

_____

6. Why is purple loosestrife known as the beautiful killer?

_____

7. Zebra mussels were discovered in Lake St. Clair near Detroit in 1988. Zebra mussels have now spread to all the Great Lakes and are showing up in inland waterways and lakes throughout North America. The mussels feed by filtering tiny organisms or fine particles of organic material from currents of water that pass through them. They attach themselves to hard surfaces such as rocks, boat hulls, and docks. What are some of the consequences of the spread of zebra mussels to the Ontario's aquatic ecosystems?

_____

_____

_____

_____

Name _____ Date _____

Assessment
Topic 1.5

How do human activities affect ecosystems?

Use with textbook pages 50–61.

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ consequences	**A.** any substance, such as certain chemical or waste products, that renders the air, soil, water, or other natural resource harmful or unsuitable for a specific purpose
2. _____ diversity	**B.** any species that has been introduced into and lives in an ecosystem where it is not found naturally
3. _____ introduced species	**C.** any area of land (either natural or human-made or both) that drains into a body of water
4. _____ pollutants	**D.** the effect, result, or outcome of something that happened earlier
5. _____ species diversity	**E.** the number and variety of different species of living things in an area
6. _____ watershed	**F.** a point or way in which things differ

7. Explain how human populations can have a greater impact on ecosystems than populations of most other living things.

_____

_____

_____

8. What type of impact can an invasive species have on a native species population?

_____

_____

_____

9. Describe what happens to species diversity in an ecosystem when an introduced species becomes well established.

_____

_____

_____

10. How could pollutants work their way into your local watershed?

_____

_____

_____

Name _____ Date _____

Topic **1.6** Summary

How can our actions promote sustainable ecosystems?

Textbook pages 62–67

Before You Read

What do you think of when you hear or read the term sustainability? What does this term mean? Record your thoughts on the lines below.

_____

_____

Reading Check

1. What happens when a population in an ecosystem exceeds its carrying capacity?

_____

_____

_____

How can we commit to sustainability?

The Haudenosaunee, also know as the Iroquois, speak of the need to remember to walk softly on our sacred mother, the Earth. They also state that we must consider the effects of our actions on the ability of next generations to live a good life. When the living and non-living parts of an ecosystem can get the resources they need without putting future generations at risk we say that the ecosystem is **sustainable**. **Sustainability** ensures that the population stays within the carrying capacity of the ecosystem. Do we always take time to consider the needs of future generations? Do we really look at the growth of our cities and reflect on what impact these changes will have for the future?

Reading Check

2. As a consumer, what types of questions can you ask about a product to ensure it contributes to a more sustainable ecosystem?

_____

_____

_____

What is the link between biodiversity and sustainability?

Biodiversity is the number and variety of organisms found in a specific region. It can also refer to the diversity of ecosystems within and beyond that ecosystem. An ecosystem that is sustainable will have a high degree of biodiversity. A balance or **equilibrium** will exist between its living and non-living parts. All of these parts are interconnected.

Name Date

Topic **1.6** Summary

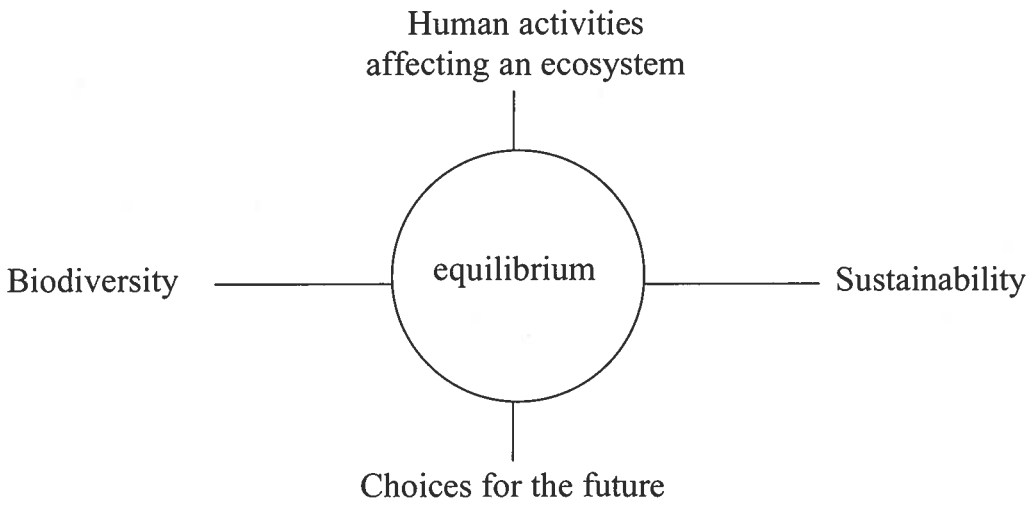
How can our actions maintain or rebuild sustainable ecosystems?

We can put many demands on nature, and threaten the sustainability of ecosystems, through our activities. Plants and animals in a particular ecosystem can be greatly impacted by activities such as overhunting, introduction of non-native species, and destruction of natural habitats by urban expansion, logging, or mining. Many communities have seen the harm done to their local ecosystems and are adopting programs to rebuild them. Setting up nature reserves, protecting wildlife, establishing nesting sites for birds, and rethinking methods of urban development are some of the ways communities are responding to the issues. Are you aware of a program in your community that is rebuilding an ecosystem? Remember ecosystems can be small and large.

What actions can you choose to benefit the future of ecosystems?

As individuals, each of us has the ability to bring about change. Making good choices as a consumer, volunteering for a cause, and considering your responsibilities as a citizen of your community are just some of the ways to start change. Do you know someone who has made a commitment for change? What can you do?

Keeping equilibrium in an ecosystem



Name _____ Date _____

Cloze Activity
Topic 1.6

Use with textbook pages 62–77.

Sustainability

Vocabulary	
abiotic	high
balance	individuals
biocontrol	smart growth
biodiversity	society
biotic	sustainability
change	wetland
climate change	

Use the terms in the vocabulary box to fill in the blanks. Use each term only once.

1. When the citizens of Sydney Australia were concerned about _____, they encouraged people and businesses to shut down their lights for one hour.
2. _____ is a way of believing, thinking, and acting that takes into account the effects that our actions will have on future generations.
3. An ecosystem's size and the number of populations it supports is limited by the _____ and _____ parts of that ecosystem.
4. The term _____ describes the great diversity of Earth's species and the great diversity of Earth's ecosystems at the same time.
5. A sustainable ecosystem must maintain a _____ between its diverse living parts and its non-living parts.
6. An ecosystem that is in equilibrium tends to have a _____ degree of biodiversity.
7. The Alfred Bog in Northern Ontario is a _____ that has been designated a nature reserve to protect this diverse and important ecosystem.
8. An example of _____ is the introduction of a beetle from Europe to control the spread of purple loosestrife.
9. _____ is a strategy that concentrates growth in the centre of a city rather than in outlying areas.
10. Change in _____ starts with change in _____. Each one of us has tools and gifts that can help us bring about _____.

Name _____ Date _____

Applying Knowledge
Topic 1.6

Use with textbook pages 68–69.

Maintaining or rebuilding ecosystems

We can harm ecosystems when we forget to think about the consequences of our activities. We also have the power to heal them.

The following are examples of activities that have impacted the health of their ecosystems in many different ways. Describe the consequences of these activities and the efforts of local communities to maintain or rebuild the ecosystem.

Activities	Consequences	Efforts to maintain or rebuild the ecosystem.
Mining in the Alfred Bog, Ontario.		
Overhunting of native elk populations in Ontario		
Introduction of purple loosestrife		
Trees removed by logging		
Urban sprawl		

Name _____ Date _____

Assessment
Topic 1.6

How can our actions promote sustainable ecosystems?

Use with textbook pages 62–77.

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ biocontrol	**A.** maintaining an ecosystem so that present populations can use resources without risking the ability of future generations to get the resources that they need
2. _____ biodiversity	**B.** any species that has been introduced into and lives in an ecosystem where it is not found naturally
3. _____ carrying capacity	**C.** the number and variety of different species of living things in an area.
4. _____ equilibrium	**D.** the largest population size that an ecosystem can sustain
5. _____ introduced species	**E.** use of living things to control introduced species
6. _____ species diversity	**F.** a strategy that concentrates growth in the centre of a city
7. _____ smart growth	**G.** a state of balance in an ecosystem
8. _____ sustainability	**H.** all the diversity of species that live an ecosystem, as well as all the diversity of ecosystems within and beyond that ecosystem

9. Explain the relationship that exits between sustainability and the carrying capacity of an ecosystem.

_____

_____

_____

10. What is a sustainable ecosystem?

_____

_____

_____

11. Give an example of how a community has adopted a program to help a particular ecosystem.

_____

_____

_____

12. What type of actions could you implement to benefit ecosystems now and for the future?

_____

_____

Name _____ Date _____

Unit 1

Literacy Test Preparation

Read the selection below and answer the questions that follow it.

Toxins, the environment, and your health

Toxic substances, or toxins, are everywhere in our environment. Toxins are substances that may harm the environment and or the health of living organisms such as plants, animals, and humans. They are generally synthetic chemicals like chlorinated solvents or inorganic chemicals like lead, arsenic, mercury, or asbestos. The list is endless. The impact of a toxic substance will depend on the type of substance, length of exposure, sensitivity of the exposed organism, and how the organism came into contact with the toxic substance.

You can be exposed to toxic substances in your food, or in water, air, and soil. Products you use in your home, school, or work can contain toxic substances. Studies looking at exposure to toxic substances have found links to cancer, asthma, Alzheimer's disease, birth defects, and reproductive problems.

An example of a toxic substance that has been linked to neurological problems, and even death, is mercury. It is a natural element found in rocks, plants, and water. Volcanoes, forest fires, and oceans release mercury into the atmosphere. Human activity such as waste incinerators, coal-fired power plants, and certain consumer products have increased the levels of mercury in the environment. This toxic substance can travel great distances in air and water currents, so it is possible to be exposed to mercury that was not even released in your community.

One of the problems associated with mercury is that it becomes more toxic as it moves through the food chain. In lakes or rivers, mercury is converted into methylmercury by bacteria and other processes. This toxic substance bioaccumulates as it moves from microorganisms, to fish, to fish-eating predators, to humans. Those at the top of the food chain will have accumulated increasing levels of methylmercury.

Recently, there have been major concerns raised about mercury use in consumer products. Batteries, paints, and switches are now becoming mercury-free. Mercury thermometers and thermostats are being phased out. In the past few years, consumers have been switching to energy efficient fluorescent light bulbs, but these bulbs contain small amounts of mercury. Now people are raising concerns about how the bulbs, and their mercury contents, are discarded.

Mercury is just one example of a toxic substance that exists in your environment. Toxic substances are part of our daily life, and we need to do our part to manage their use and reduce the risks to human health and the environment.

Name _____ Date _____

Unit 1

Multiple Choice

Select the best answer.

1. Toxic substances are found in

   A. plants only
   B. humans only
   C. plants and animals
   D. plants, animals, and humans

2. If a volcano erupted in British Columbia, what could be a consequence that could affect your local ecosystem?

   A. risk of a landslide
   B. decrease in atmospheric pressure
   C. increase in water vapour levels
   D. increase in atmospheric mercury levels

3. When metylmercury is introduced into a food chain, it

   A. breaks down micro-organisms
   B. converts into mercury
   C. bioaccumulates
   D. biodisintegrates

4. The following environmental concern in relation to fluorescent light bulbs is raised in this article:

   A. level of heat energy generated
   B. long-term effects on the environment
   C. increase in electro-magnetic emissions
   D. reduction in energy efficiency

Written Answer

5. Summarize this selection. Include a main idea and one point that clearly supports it.

_____

_____

_____

_____

_____

_____

_____

_____

Name _____ Date _____

Topic **2.1** Summary

In what ways do chemicals affect your life?

Textbook pages 94–103

Before You Read

How have chemicals affected your life today? List three ways that you have used or come in contact with chemicals so far today.

_____

_____

✔ *Reading Check*

1. What is matter?

_____

_____

_____

What is matter?

Matter is any anything that has mass and volume. **Mass** is the amount of matter in something. **Volume** is the amount of space that something takes up. This means that you yourself and everything around you is matter—the air you breathe, the food you eat, the clothes you wear, and the building you live in. Energy is not matter. Heat, sound, and sunlight—and all other forms of energy—are not matter. ✔

What is a chemical?

Everything in the world that isn't energy is a **chemical** or is made up of chemicals. Matter that is made up of a particular chemical or chemicals is called a **substance**. Our bodies are made of chemical substances: oxygen, carbon, hydrogen, nitrogen, and others.

Useful, hazardous, or both?

Many substances we use every day are both useful and hazardous. Salt makes our food taste better, but too much of it can harm our health. Gasoline burns in a car engine and moves the car forward so we can travel from place to place, but when it burns it also produces carbon dioxide, a greenhouse gas.

Substance	Useful characteristics	Hazardous characteristics
benzene (used to make polystyrene, nylon, synthetic rubber)	• Its chemical structure makes it useful in making many other chemicals.	• causes cancer • ignites easily: a fire hazard ✔
polyvinyl alcohol (PVA) (used to make safety glass, dissolvable plastic bags)	• strong and flexible • dissolves quickly • biodegradable	• none known

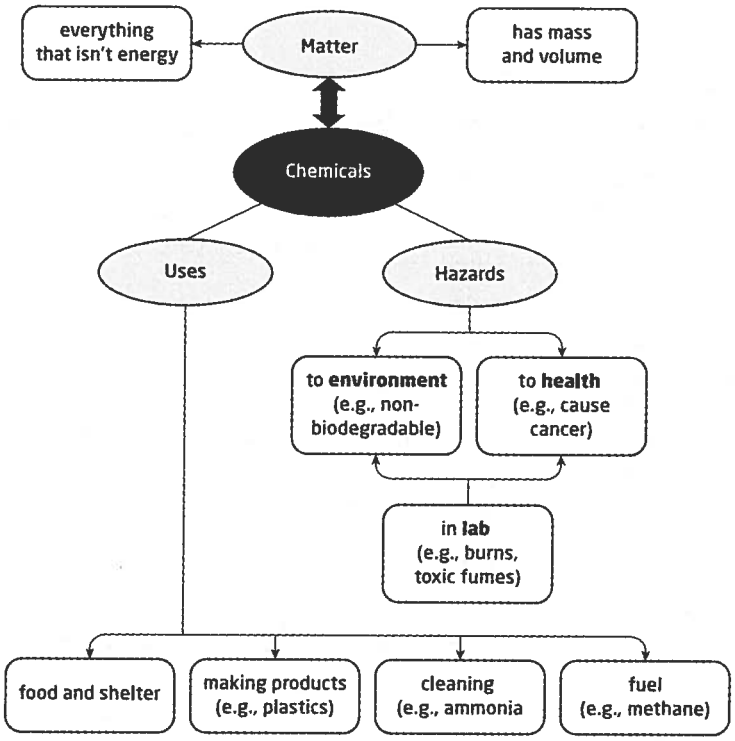
Name _____ Date _____

Topic **2.1** Summary

How can you handle chemicals safely in the classroom?

Learning about chemistry at school involves using chemicals in the science laboratory. Knowing how to use these chemicals safely and responsibly is very important. Important safety rules to remember include:

- Wear goggles to protect your eyes whenever you use glassware or chemicals that could splash.
- Use caution around an open flame. Never leave an open flame unattended.
- Some chemicals can cause chemical burns if touched. Avoid contact with these chemicals.
- Some chemicals are poisonous. Avoid touching or breathing them. Never taste chemicals.



Reading Check

2. What makes benzene hazardous?

_____

_____

_____

Reading Check

3. List one very important safety rule.

_____

_____

_____

Name _____ Date _____

Cloze Activity
Topic 2.1

Use with textbook pages 94–103.

Chemicals in your life

Vocabulary	
chemical	materials
decompose	matter
environment	polyvinyl alcohol (PVA)
fire	poisonous
gloves	safety goggles
hazardous	taste
lab apron	useful

Use the terms in the vocabulary box to fill in the blanks. You can use each term only once. You will not need to use every term.

1. _____ is everything in the universe that isn't energy.
2. The word _____ is really referring to matter.
3. Many substances we use everyday have both _____ and _____ characteristics.
4. Some chemicals are useful to people but harmful to the _____.
5. Regular plastic bags will not _____ over time.
6. Plastic bags made of _____ dissolve in water.
7. When working with chemicals you must always wear your _____ .
8. This symbol  means take care around _____ .
9.  means the substance is _____.
10. The acronym WHMIS stands for Workplace Hazardous _____ Information System.
11. Never _____ any chemical in the science lab.
12. Some chemicals may require you to wear a _____ and _____.

Name _____ Date _____

Interpreting Illustrations
Topic 2.1

Use with textbook pages 100–101.

What is wrong with this picture?

There are many unsafe situations in the science lab shown below. In the first column of the chart, identify seven unsafe situations. In the second column, describe an injury that might occur as a result of each situation.

Unsafe Situation	Possible Injury
1.	
2.	
3.	
4.	
5.	
6.	
7.	

Name _____ Date _____

Analyze the Information
Topic 2.1

Use with textbook pages 94–103.

Is it safe?

Read the text below and answer the questions.

"Why do they call it dry cleaning?" Sam wondered when she finished her first day of training at the dry cleaner's. "Sure, it cleans clothes, but there's nothing dry about it." Industry spokeswoman Shawn Turpin says, "The most common solvent used in dry cleaning today is PERC, a colourless, non-flammable, liquid, organic solvent." "PERC works better than water at removing oils and grease from clothes," reports Dr. Arid, a chemist at a dry cleaning firm. "Its chemical structure is like the chemical structure of oils and grease."

Inside cleaning machines, PERC solvent is pumped over the clothes then drained away. Drying evaporates any leftover solvent. The dirty solvent is filtered and re-used. "New machines use 50% less PERC," says Ms. Turpin. "It's a very responsible process." "I'm not sure this new job is safe," Sam complained. "I felt pretty dizzy my first week." Scientific research shows that exposure to high levels of PERC can affect the nervous system and cause dizziness, unconsciousness, and even death. Some reports suggest that it may also cause cancer.

1. Use the above information and the PMI chart below to help you decide if the pros associated with the dry cleaning process described outweigh the cons.

Plus	Minus	Interesting

2. Is this a process that should be removed from public use in order to decrease the effects it has on human health? Write a paragraph stating your opinion about this process. Include points from the information and PMI chart to support your opinion.

_____

_____

_____

Name _____ Date _____

Assessment
Topic 2.1

Chemicals in your life

Use with textbook pages 94–103.

Match each Term on the left with the Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ matter	**A.** everything that isn't matter
2. _____ chemical	**B.** means the same as "metal"
3. _____ substance	**C.** can protect from spills and splatters
4. _____ energy	**D.** means the same as "matter"
5. _____ lab apron	**E.** is a hazardous substance
	F. matter made up of a particular chemical
	G. has mass and takes up space

Match each Symbol on the left with the correct Warning on the right.

Symbol	Warning
6. 	**A.** Some chemicals are poisonous. Avoid touching or breathing them. Never taste chemicals.
7. 	**B.** Wear goggles to protect your eyes whenever you use glassware or chemicals that could splash.
8. 	**C.** Use caution around an open flame. Never leave an open flame unattended.
9. 	**D.** Some chemicals can cause chemical burns if touched. Avoid contact with these chemicals.

10. Give an example of

a) something that is matter

_____

b) something that is not matter

_____

11. Describe an environmental hazard of plastic bags.

_____

_____

12. When making a decision about which cleaning products you will use, what factors should you take into consideration?

_____

_____

13. Are all chemicals harmful? Explain your answer.

_____

_____

_____

_____

Name _____ Date _____

Topic **2.2** Summary

How do we use properties to help us describe matter?

Textbook pages 106–111

Before You Read

Colour is one property of matter. List two more properties of matter.

_____

_____

Reading Check

1. Which physical property makes sugar useful for sweetening beverages?

_____

How do we describe matter?

We describe matter and how it changes by describing its properties. There are two types of properties: physical properties and chemical properties.

What are physical properties?

A **physical property** is a feature of matter you can determine without changing the type of matter that something is. Physical properties include:

- **state** (solid, liquid or gas)
- **melting, freezing, and boiling point**
- **conductivity**—how well a substance lets heat or electrical current move through it
- **density**—how compact a substance is (calculated by dividing mass by volume)
- **lustre**—how well the surface of a substance reflects light
- **solubility**—how much of a substance dissolves in another substance
- **texture**—how the surface of a substance feels (rough, soft, or smooth)

The properties of a substance help to determine its usefulness. Metals have high lustre, so they are used to make mirrors. The metal tungsten is used as filaments in incandescent light bulbs because it has such a high melting point (3410°C). Rubber is often used as an *insulator*, which means that it does not conduct electricity well. This lack of conductivity helps to protect us from electric shocks.

Knowing the properties of substances can help you to tell them apart. For example, mercury is the only metal that is liquid at room temperature.

Name _____ Date _____

Topic **2.2** Summary

What are chemical properties?

A **chemical property** describes how a substance changes when it is exposed to another substance to produce something new with new properties. Chemical properties include **reactivity** with oxygen, an acid, or some other substance. **Combustibility** is the ability to catch fire and burn in air. **Decomposition** happens when a reaction breaks a substance down into the parts that make it up. When some dissolved substances are mixed, they form a solid, called a **precipitate,** which is a new substance.

You can observe chemical reactions in progress all around you. A cut apple turns brown when it is exposed to the oxygen in the air. Wood begins to burn when it is exposed to heat. Bubbles of carbon dioxide form in pancake batter when baking soda mixes with the acid in buttermilk. ✔

Is it a physical property or a chemical property?

A chemical property involves the formation of something new. These clues tell you that a new substance has been formed.

- The substance changes colour.
- Bubbles form, telling you a new gas has been produced.
- A new odour forms, telling you a new gas has been formed.
- A new solid (a precipitate) forms
- Energy in the form of heat, light, and/or sound is released when the substances are mixed.

Why is solubility a physical property?

When salt is placed into water, the salt particles get so small that you cannot see them any more. But the taste of plain salt and of salt water is the same. This tells you that the salt has not changed into a new substance. If you put the salt water on a stove and boiled away all the water, the original salt would remain in the pot. Solubility may appear to be a chemical property, but it is a physical property. ✔

Is it a chemical property or a physical property?

Answer the following questions

1. Do you see a permanent new colour?
2. Do you see bubbles or smell a new smell?
3. Did you see light or feel heat or hear sound?
4. Is there a new solid formed when two solutions are mixed?

If you have answered **YES** to any of these questions, then a new substance has been formed. The property is a **chemical** property.

If you have answered **NO** to **ALL** of these questions, then there is no new substance. The property is a **physical** property.

✔ ***Reading Check***

2. What chemical property makes wood not a very safe material to build a house with?

_____

✔ ***Reading Check***

3. What happens to salt particles when they are placed in water?

_____

_____

_____

Name _____ Date _____

Comprehension
Topic 2.2

Use with textbook pages 106–111.

Physical or chemical property?

In the second column of the table, indicate whether the property described is a physical or chemical property. In the next column, explain your choice.

Description	Physical or chemical property?	How do you know?
1. Nitrogen is a gas.		
2. Methanol burns easily in air.		
3. Baking soda reacts with vinegar, producing the gas carbon dioxide.		
4. Sulfur is yellow.		
5. An iron railing rusts.		
6. Wooden spoons are used to stir hot food.		
7. Juice crystals dissolve in water.		
8. A metal anchor sinks in water.		
9. Sandpaper is scratchy.		
10. Fishing lures use shiny metal to attract fish.		

11. **(a)** List a physical property of sugar and salt that is the same. _____

(b) List a physical property of sugar and salt that is different. _____

(c) Explain how you can tell the difference between these two substances in your kitchen.

12. One physical property of gasoline is _____. A chemical property of gasoline is _____.

Name _____ Date _____

Key Term Review
Topic 2.2

Use with textbook pages 106–111.

Chemical and physical properties

Vocabulary			
boiling point chemical combustibility combustible conductivity	decomposition less lustre melting point	more physical precipitate property	reacts with acid solubility state texture

Use the terms in the vocabulary box to fill in the blanks. You can use each term more than once. You will not need to use every term.

1. A _____ describes the characteristics of a substance.
2. If you can determine the property of a substance without changing the type of matter, it is a _____ property. When the substance interacts with a different substance and something new is made, you are observing a _____ property.
3. _____ describes how easily electricity or heat can move through a material.
4. Iron melts at 1535°C. This is the _____ of iron, which is a _____ property of iron.
5. When a solid floats on water, it is _____ dense than water.
6. _____ describes how the surface of a substance feels.
7. Whether a substance is a solid, liquid or gas describes a _____ property of the substance.
8. Rubber does not dissolve in water, so _____ is not a property of rubber.
9. A substance that catches fire and burns in air is said to be _____.
10. Magnesium is mixed with acid and bubbles form. This is a _____ property of magnesium.
11. _____ describes how well the surface of a substance reflects light.

Name _____ Date _____

Applying Knowledge
Topic 2.2

Use with textbook pages 106–111.

Useful properties

In the second column of the chart, describe one way in which the property makes the substance useful in daily life. An example is done for you.

Substance and property	How the property is useful
Glass is transparent.	Used in windows so that sunlight can come in
Plastic is flexible.	
Steel can be made into thin sheets.	
Copper can be pulled into thin wires.	
Wood floats.	
Sugar dissolves.	
Titanium is a strong metal.	
Windshield washer fluid has a freezing point of –40°C.	
Silk reflects light at many angles, making it shiny.	
Aluminum is a light metal.	
Vinegar slows the growth of bacteria.	
Bleach kills bacteria.	

Name _____ Date _____

Assessment
Topic 2.2

Properties of matter

Use with textbook pages 106–111.

Match each Term on the left with the Descriptor on the right. Each Descriptor may be used only once.	
Term	**Descriptor**
1. _____ solubility	**A.** can be solid, liquid, or gas
2. _____ state	**B.** measure of how easily electricity or heat can pass through
3. _____ lustre	**C.** the amount of one substance that can dissolve in another substance
4. _____ conductivity	**D.** the temperature at which a liquid becomes a gas
5. _____ boiling point	**E.** how well the surface of a substance reflects light

6. What is the temperature at which a solid changes into a liquid called?

_____

7. Explain why copper is used in electrical wires.

_____

_____

8. Explain how a physical property is different from a chemical property.

_____

_____

9. a) State two physical properties of wood.

_____

b) What is one chemical property of wood?

_____

c) Explain, using the properties of each substance, why tires are now made using rubber rather than wood.

_____

_____

_____

10. a) Crystals of iodine are reacted with ammonia, and a precipitate, nitrogen triiodide, forms. Identify a chemical property of iodine.

_____

b) Explain how you know it is a chemical property.

_____

_____

11. a) When dry, the nitrogen triiodide is touched with a feather. There is a loud *snap* and a cloud of purple vapour appears. The nitrogen triiodide has turned into nitrogen and iodine gas. Identify a chemical property of nitrogen triiodide.

_____

_____

b) Explain how you know it is a chemical property.

_____

_____

Name _____ Date _____

Topic **2.3** Summary

What are pure substances and how are they classified?

Textbook pages 112–119

Before You Read

What does the word "pure" mean to you?

_____

_____

Reading Check

1. What is a difference between a compound and a mixture?

_____

_____

_____

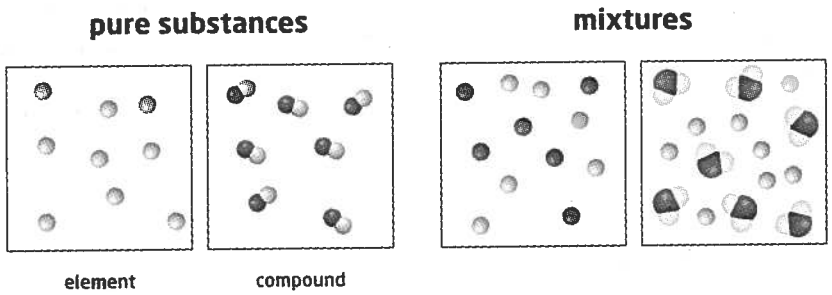
What are pure substances and mixtures?

A **pure substance** is made up of only one kind of particle. Each part of a pure substance has the same properties, because each pure substance is made up of its own type of particle. Each different pure substance has a different type of particle. Some pure substances are gold, hydrogen, and sodium chloride.

A **mixture** is made up of two or more different types of particles mixed together into one substance. Many mixtures are easy to identify—you can see the particles of the different substances in the mixture (for example, a pizza, a salad, or salt and pepper). But some mixtures look like there is only one type of particle because the particles of the different parts are so small they blend together (for example, soda pop, milk, and apple juice).

What are elements and compounds?

There are two types of pure substances, elements and compounds. A **compound** can be broken down into smaller parts using chemical reactions, but an **element** cannot. This is because compounds are made up of two or more elements. An example of a compound is calcium carbonate, which is made up of calcium, carbon, and oxyen.



Name _____ Date _____

Topic **2.3** Summary

Are there different types of elements?

There are many different types of elements, but most elements belong to one of two main groups: metals and non-metals.

Metals share these physical properties:

- **lustre**—how well the surface of a substance reflects light
- **malleability**—can be bent or hammered without breaking
- **ductility**—can be stretched into a wire without snapping
- **good conductors**—heat or an electrical current moves through them easily
- **solid at room temperature** (except for mercury, which is a liquid)

Many metals are a silvery grey colour. Some are soft while others are hard.

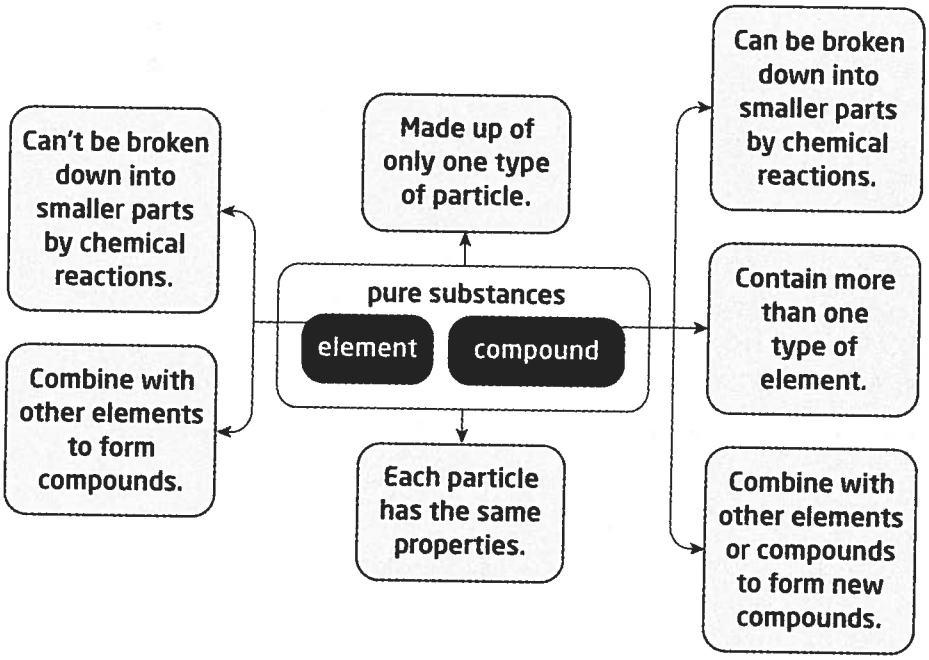
Non-metals do not share these properties. They are gases or brittle solids at room temperature (except bromine, which is a liquid). They are dull (not lustrous), malleable, or ductile, and they are poor conductors. They come in many different colours. Some are flexible while others are brittle. ✔

Reading Check

2. List two ways that a metal is different from a non-metal.

_____

_____



Name _____ Date _____

Applying Knowledge
Topic 2.3

Use with textbook pages 112–115.

Element, compound, or mixture?

Classify each substance as an element, compound, or mixture. Explain how you decided.

Substance	Classification	Explanation
1. tap water (H_2O)		
2. table salt (sodium chloride)		
3. aluminum		
4. sugar (sucrose)		
5. magnesium		
6. copper sulfate		
7. powdered orange drink		
8. chocolate chip cookie		
9. gold		
10. baking soda (sodium hydrogen carbonate)		

11. Draw a picture of the particles in each substance.

a) the element iron

b) the compound lithium bromide

12. Explain the difference between an element and a compound.

_____

_____

Name _____ Date _____

Cloze Activity
Topic 2.3

Use with textbook pages 116–117.

Metals and non-metals

Vocabulary	
compound	malleable
conductivity	metal
ductile	mixtures
elements	non-metal
liquid	pure substance
lustrous	

Use the terms in the vocabulary box to fill in the blanks. You can use each term more than once. You will not need to use every term. Some questions have more than one correct answer.

1. Substances that contain particles that are the same throughout are _____.
2. A metal that can be hammered into sheets is described as _____.
3. Oxygen and gold are examples of _____, which cannot be broken down or separated into simpler substances.
4. A _____ can be a solid, brittle, non-conductive and dull.
5. Mercury is the only metal that is a _____.
6. Sodium chloride is a _____ because it can be broken down into the _____ sodium and chlorine.
7. A substance that is _____ is a metal.
8. In many _____ you are able to see two different types of particles.
9. A pure substance that is made up of two or more types of atoms that are joined together is called a(n) _____.

Name _____ Date _____

Analyze the Information
Topic 2.3

Use with textbook pages 116–117.

Metal or non-metal?

Compare metals and non-metals by answering the questions below.

1. Two physical properties are show in the first column. Write each property in the correct column to show whether it is a property of metals or non-metals.

Physical properties	Metals	Non-metals
solid, liquid or gas / solid		
shiny / dull		
poor conductors / good conductors		
malleable / brittle		
ductile / not ductile		

2. Decide if the following elements are metals or non-metals. Explain how you made your decision.

Element	Metal	Non-metal	Explanation
oxygen			
lead			
sulfur			
zinc			
nickel			

3. Read the description and then decide if the substance is a metal or non-metal.

a) soft, non-conductor, yellow _____

b) hard, malleable, conducts heat _____

c) hard, shiny, green, brittle _____

d) soft, orange, flexible _____

e) silvery, lustrous, ductile _____

Name _____ Date _____

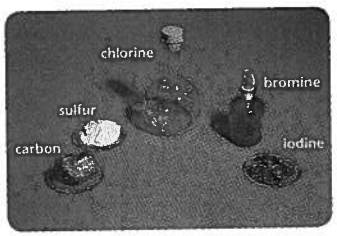
Assessment
Topic 2.3

Elements, compounds, and mixtures

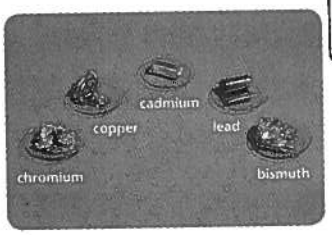
Use with textbook pages 112–119.

Match each Term on the left with the Descriptor on the right. Each Descriptor may be used only once.	
Term	**Descriptor**
1. _____ compound	**A.** an element that is dull and brittle
2. _____ element	**B.** contains only one type of atom
3. _____ pure substance	**C.** made up of only one type of particle
4. _____ metal	**D.** contains two or more different types of particles
5. _____ mixture	**E.** will have two or more different atoms joined together
6. _____ non-metal	**F.** an element that conducts electricity

7. Label the photographs below to show which one shows metals and which non-metals.



_____



_____

8. Draw a picture of the particles in each substance.

a) an element **b)** a mixture

9. List four physical properties of the metal titanium.

_____

_____

_____

_____

10. Classify each of the substance as either an "element" or "compound."

a) hydrogen _____

b) calcium chloride _____

c) nitrogen _____

d) hydrogen bromide _____

11. When cooking on the stove, which type of utensil is the best to use, a metal spoon or a wooden spoon? Explain your choice using the properties you have learned.

_____

_____

_____

Name _____ Date _____

Topic **2.4** Summary

How are properties of atoms used to organize elements into the periodic table?

Textbook pages 120–129

Before You Read

Elements are the building blocks of all matter on Earth. Elements are made up of atoms, and every atom is made up of subatomic particles: protons, neutrons, and electrons. What do you think gives elements their different properties?

_____

_____

Reading Check

1. What is the electrical charge on a proton, neutron, and electron?

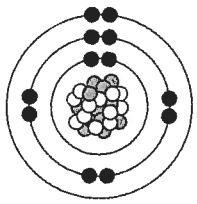
_____

_____

_____

Reading Check

2. Is this a calcium atom or a magnesium atom?.



_____

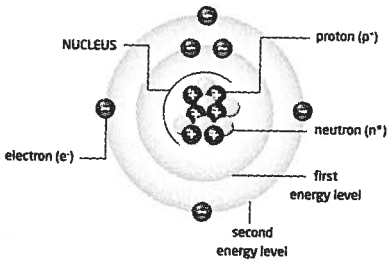
What makes elements different?

An **atom** is the smallest particle of an element that still has the properties of the element. The atoms in a piece of calcium are all the same, as are the atoms in a piece of aluminum foil—the atoms of each element are all identical. But the calcium atoms are different from the aluminum atoms—atoms of different elements are different from one another.

What's inside an atom?

Atoms are incredibly small—about a million times smaller than the thickness of a human hair. They are made up of unimaginably tiny subatomic particles: **protons, neutrons,** and **electrons.** Protons have a positive (+) electrical charge, and electrons have a negative (–) charge. Neutrons are electrically neutral.

An atom



Protons and neutrons are about a hundred thousand times smaller than an atom. They are grouped tightly together in a tiny region at the centre of the atom called the **nucleus**. The nucleus makes up nearly all the mass of an atom.

The rest of the atom is mostly empty space. Electrons, with just $\frac{1}{2000}$ of the mass of a proton or neutron, whirl through this space in energy levels around the nucleus. Two electrons can fit in the first energy level and 8 in the second. More electrons can fit into higher energy levels

Name Date

Topic **2.4** Summary

What makes atoms different?

Each element has its very own number of protons. For example, a calcium atom has 20 protons in its nucleus, while magnesium has only 12. For each proton there is an electron, so a calcium atom has 20 electrons in the space outside of the nucleus, and magnesium has 12. The number of protons in an atom is called the **atomic number** of the atom. Each atom has a unique atomic number that tells you the number of protons and the number of electrons in the atom. ✔

How is the periodic table organized?

The **periodic table** is a chart used to organize all of the elements known today. The rows of the table are called **periods.** Elements in the same period have the same number of energy levels: one energy level in period 1, two energy levels in period 2, and so on.

The columns are called **groups,** or families. The elements in a group have the same number of electrons in their outer energy level, and this gives these elements similar physical and chemical properties.

Metals are found on the left side of the table and non-metals on the right. The most reactive metals are at the bottom of the table; the most reactive non-metals are at the top. There are 8 elements that have some properties of metals and some of non-metals. These elements are called *metalloids*. ✔

✔ *Reading Check*

3. What do elements in the same period have in common?

_____

_____

4. What do elements in the same family have in common?

_____

_____

Elements in a group have similar properties.

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10	Group 11	Group 12	Group 13	Group 14	Group 15	Group 16	Group 17	Group 18
Period 1	H																	He
Period 2	Li	Be											B	C	N	O	F	Ne
Period 3	Na	Mg											Al	Si	P	S	Cl	Ar
Period 4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Period 5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Period 6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn

METALS

NON-METALS

reactivity of metals

reactivity of non-metals

Elements in a period have the same number of energy levels.

Name _____ Date _____

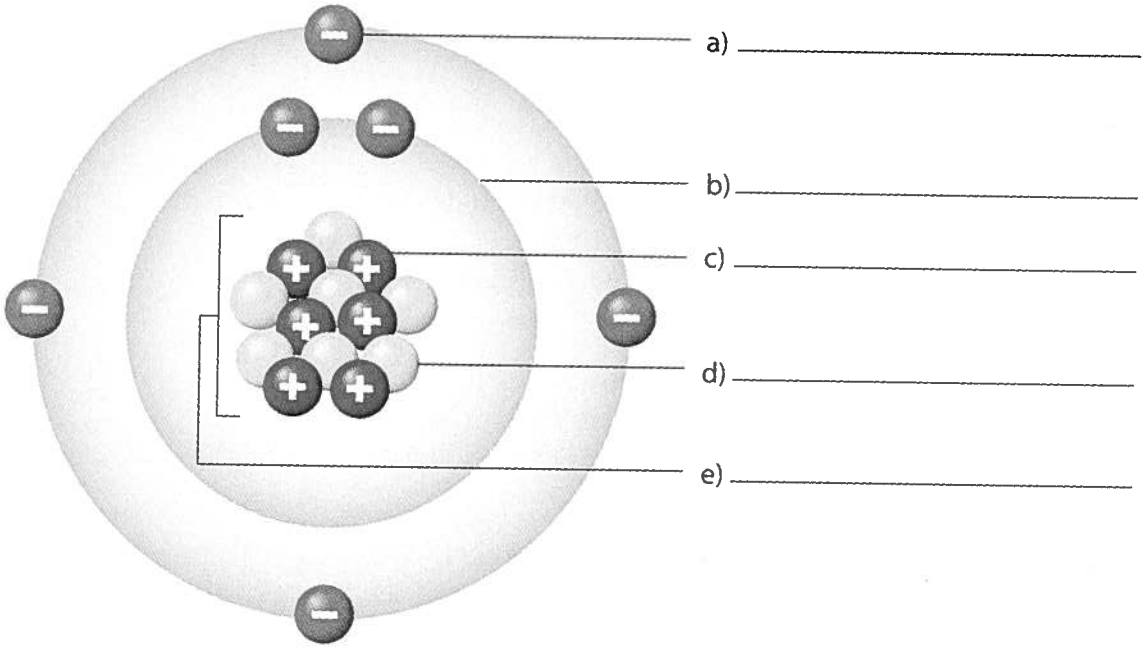
Comprehension
Topic 2.4

Use with textbook pages 122–123.

Atomic structure

1. Use the vocabulary terms that follow to label the parts of an atom. Place the correct term on the line next to each part of the atom. You will not need to use all the terms.

nucleus **proton** **neutron** **electron** **energy level**

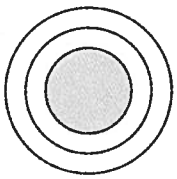


2. Complete the following table describing the three subatomic particles.

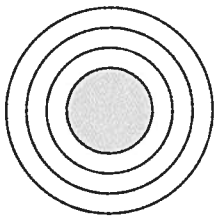
	Proton	Neutron	Electron
Electric charge			
Location in the atom			
Relative mass			

3. Two electrons can fit in the first energy level, 8 in the second, and up to 18 in the third. Draw the electrons in the correct energy levels.

a) Carbon has 6 electrons.



b) Argon has 18 electrons.



Name _____ Date _____

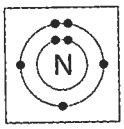
Interpreting Illustrations
Topic 2.4

Use with textbook pages 122–123.

Atomic numbers

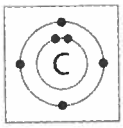
Fill in the blanks for each diagram. The first one has been partially completed to help you.

1.



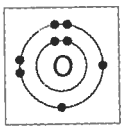
a) number of protons 7
b) number of electrons _____
c) atomic number _____
d) total number of energy levels 2

2.



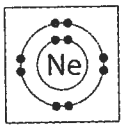
a) number of protons _____
b) number of electrons _____
c) atomic number _____
d) total number of energy levels _____

3.



a) number of protons _____
b) number of electrons _____
c) atomic number _____
d) total number of energy levels _____

4.



a) number of protons _____
b) number of electrons _____
c) atomic number _____
d) total number of energy levels _____

5. The four elements above are in the same period on the periodic table. What do you notice about the number of energy levels for elements belonging to the same period?

_____

_____

Name _____ Date _____

Analyze the Information
Topic 2.4

Use with textbook pages 124–128.

The periodic table

1. a) Colour the periodic table below to show the different regions for metals, non-metals, and metalloids.

☐ **Metals** ☐ **Non-metals** ☐ **Metalloids**

	1												13	14	15	16	17	18	
1	H	2																He	1
2	Li	Be											B	C	N	O	F	Ne	2
3	Na	Mg	3	4	5	6	7	8	9	10	11	12	Al	Si	P	S	Cl	Ar	3
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	4
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	5
6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	6

2. a) Where in the periodic table are the metals that are most reactive?

_____

b) Where in the periodic table are the non-metals that are most reactive?

_____

3. Find Potassium (**K**) and Calcium (**Ca**) on the periodic table.

a) Which period are these two elements in? _____

b) How many energy levels do atoms of potassium and calcium have? _____

c) Which group, or family, are these two elements in? _____

d) How many electrons are there in the outer shell of atoms of potassium and calcium? _____

4. a) Is the metal Francium (**Fr**) strongly reactive? Explain how you know.

_____

b) Is the non-metal Iodine (**I**) strongly reactive? Explain how you know.

_____

Name _____ Date _____

Assessment
Topic 2.4

Use with textbook pages 120–129.

Atoms and the periodic table

Match each Term on the left with the Descriptor on the right. Each Descriptor may be used only once.

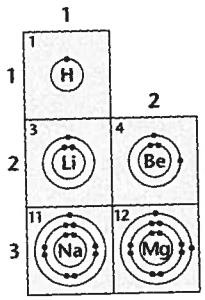
Term	Descriptor
1. _____ protons	**A.** centre part of an atom
2. _____ neutron	**B.** number of protons in an atom
3. _____ electron	**C.** subatomic particle that has no charge
4. _____ nucleus	**D.** rows on the periodic table
5. _____ atomic number	**E.** positively charged subatomic particle in the atom
6. _____ periods	**F.** columns on the periodic table
7. _____ families	**G.** subatomic particle found outside of the nucleus

8. An atom has nine protons.

a) What is the atomic number of the element? _____

b) How many electrons does the atom have? _____

9. Use the diagram to help you explain how atoms of sodium (**Na**) are the same as atoms of beryllium (**Be**), and how they are different.



_____

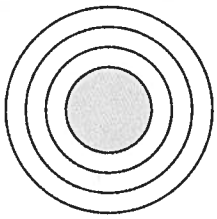
_____

_____

10. a) How many electrons can fit in the first energy level? _____

b) How many electrons can fit in the second energy level? _____

11. Aluminum has atomic number 13.



a) How many protons does aluminum have?

b) How many electrons does aluminum have?

c) Draw the electrons in the correct energy levels.

12. Draw a diagram of a boron atom. Boron has 5 protons, 6 neutrons, and 5 electrons.

13. Locate calcium (**Ca**) and magnesium (**Mg**) on the periodic table. Some products used to reduce acid indigestion contain substances made with calcium while others use substances made with magnesium. Use your knowledge of the periodic table to explain why both of these substances are effective at relieving acid indigestion.

H	
Li	Be
Na	Mg
K	Ca
Rb	Sr
Cs	Ba

_____

_____

_____

Name _____ Date _____

Topic **2.5** Summary

In what ways do scientists communicate about elements and compounds?

Textbook pages 130–139

Before You Read

An element is a pure substance that cannot be broken down or separated into anything simpler than it already is. Gold and carbon are examples of elements. What other elements can you name?

_____

_____

Reading Check

1. List three ways in which the letters for a chemical symbol can be written.

_____

_____

_____

What are chemical symbols?

Each of the elements has a chemical symbol for its name. Some elements have a chemical symbol with just one letter, for example H (hydrogen) and C (carbon). Other elements have chemical symbols with two letters. The second letter of the chemical symbol is sometimes the next letter in the name of the element; for example, Be (beryllium) and Si (silicon). Other times, the second letter is from another part of the word; for example, Mg (magnesium) and Cl (chlorine). Sometimes the two letters for an element symbol come from the element's name in another language. For example, potassium is K, from the Latin word *kalium;* sodium is Na, from the Latin word *natrium.*

Some Common Elements and their Chemical Symbols*

Beryllium	Be	**I**odine	I	**O**xygen	O
Calcium	Ca	iron	Fe	**P**hosphorus	P
Carbon	C	lead	Pb	potassium	K
Clorine	Cl	**Li**thium	Li	**Si**licon	Si
Cobalt	Co	**Mag**nesium	Mg	silver	Ag
copper	Cu	**Man**ganese	Mn	sodium	Na
gold	Au	mercury	Hg	**S**ulphur	S
Helium	He	**Ne**on	Ne	tin	Sn
Hydrogen	H	**N**itrogen	N	**Zin**c	Zn

* Elements with symbols that come from Latin names are shaded,

Name _____ Date _____

Topic **2.5** Summary

What are molecules?

A **molecule** is made up of two or more atoms that are joined together by a chemical bond. If the atoms joined together are of the same type, then the substance is an element. If the atoms joined together are of different types, then the substance is a compound. Almost all elements exist as atoms. A few elements, however, exist as molecules.

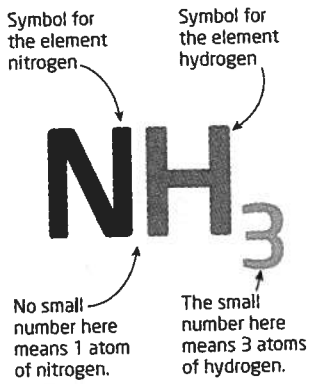
Some Elements That Exist as Molecules

Element	Symbol	Atoms in molecule	Formula
hydrogen	H	2	H_2
nitrogen	N	2	N_2
oxygen	O	2	O_2
chlorine	Cl	2	Cl_2
iodine	I	2	I_2
phosphorus	Cu	4	P_4
sulfur	Au	8	S_8

What are chemical formulas?

Chemical formulas represent elements that exist as molecules and all compounds. A chemical formula uses chemical symbols and numbers to show the type and number of atoms in the molecule. The chemical symbol is written first, and the number of atoms is shown with a subscript.

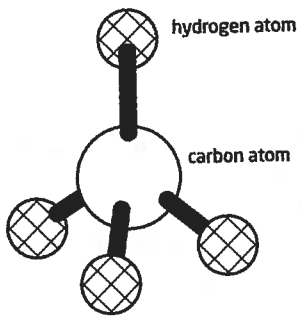
Formula for ammonia



Models of molecules

Models are used to represent how atoms combine to form compounds. Each sphere used in a model represents a different atom. Many models are coloured to show the different atoms, but when you draw models of molecules you can also just use different markings on the spheres to represent the different atoms.

Model of Methane, CH_4



Reading Check

2. How can you tell if a molecule is an element?

_____

_____

Reading Check

3. What do the small subscript numbers represent in a chemical formula?

_____

_____

_____

Name _____ Date _____

Assessment
Topic 2.5

Use with textbook pages 130–139.

Molecules and compounds

Match each Symbol or Formula on the left with the Chemical Name on the right. Each Chemical Name may be used only once.

Symbol or Formula	Chemical Name
1. _____ H_2	A. mercury
2. _____ CH_4	B. ammonia
3. _____ NaOH	C. oxygen
4. _____ Hg	D. carbon dioxide
5. _____ CO_2	E. carbon
6. _____ Cl_2	F. sodium hydroxide
7. _____ O_2	G. methane
8. _____ H_2O_2	H. hydrogen peroxide
9. _____ C	I. hydrogen
10. _____ NH_3	J. chlorine

11. Explain one rule about how a chemical symbol is written.

_____

_____

_____

12. What information does the chemical formula for fructose, $C_{12}H_{22}O_{11}$, tell you?

_____

_____

_____

13. The formula for baking soda was written as NAHCO3. Explain what was done incorrectly.

_____

_____

_____

14. Draw a picture of each molecule.

a) fluorine, F_2
b) methane, CH_4

15. Look at the nutrition label below. List the names of the elements that this food product contains.

Nutrition Facts
Per 1 burger (130g)

Amount	%Daily Value
Calories 200	
Fat 9g	14%
Saturated Fat 2 g + Trans Fat 1 g	15%
Cholesterol 70 mg	
Sodium 800 mg	33%
Carbohydrate 4g	1%
Fibre 0g	0%
Sugars 0g	
Protein 25 g	

Vitamin A	0%	Vitamin C	0%
Calcium	4%	Iron	2%

_____

_____

_____

Name _____ Date _____

Topic **2.6** Summary

What are some characteristics and consequences of chemical reactions?

Textbook pages 140–151

Before You Read

List some examples of evidence you know that tells you substances have interacted to produce new substances with new properties.

_____

Reading Check

1. What test can you use to see if oxygen gas has been produced in a reaction?

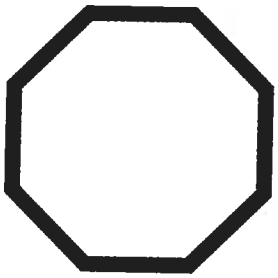
_____

_____

_____

Reading Check

2. Draw the symbol that warns of a product that can burn your skin or eyes.



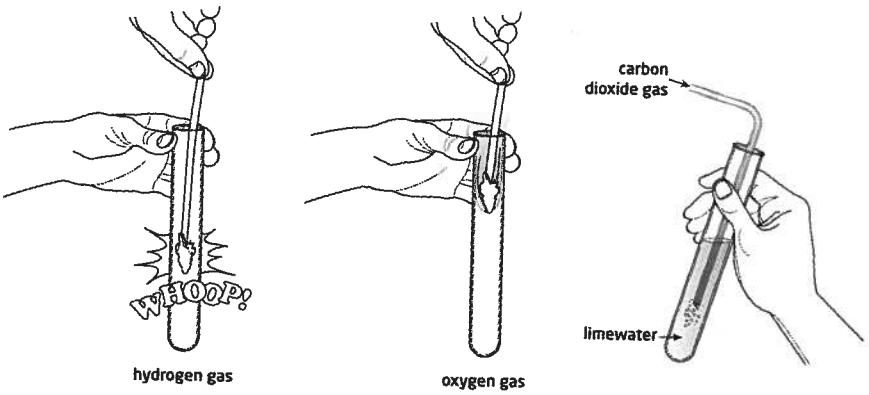
What are undesirable or desirable reactions?

Chemical reactions start with one set of pure substances (reactants) that interact with each other to produce new, different pure substances (products). In our lives the products of a desirable reaction include substances and energy we can use in our lives. As well, there are usually substances and energy produced that we do not want—undesirable reactions.

Many times the substance produced during reactions is one that we cannot smell or see—it is a gas. Some examples include hydrogen, oxygen, or carbon dioxide. For this reason, there are chemical tests that can be performed to identify the gas that is produced during a chemical reaction.

- **Test for hydrogen:** A flaming splint brought close to the gas will ignite the gas and a *whoop* sound will be heard.
- **Test for oxygen:** A glowing ember placed right into the gas will burst into a bright flame.
- **Test for carbon dioxide:** When mixed with limewater (calcium hydroxide dissolved in water), the lime water turns from clear to a milky white colour.

Chemical tests to identify unknown gases



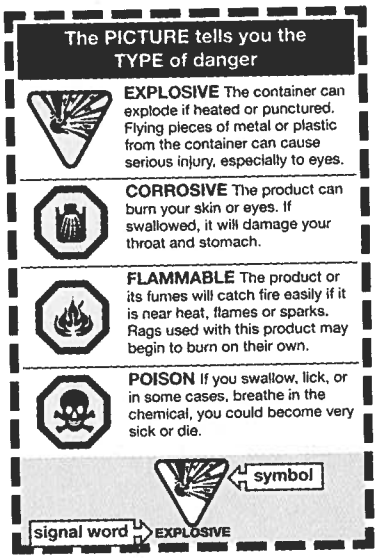
Name _____ Date _____

Topic **2.6** Summary

How can we identify household hazards?

Substances have many different properties. Some of these properties are useful to us, such as the ability of bleach to kill bacteria. Some of the same properties may make the substance dangerous to our health, such as the ability of bleach to poison humans.

Symbols found on household products are placed there to help us protect ourselves.



Reading Check

3. Why do people use products that are harmful to the environment?

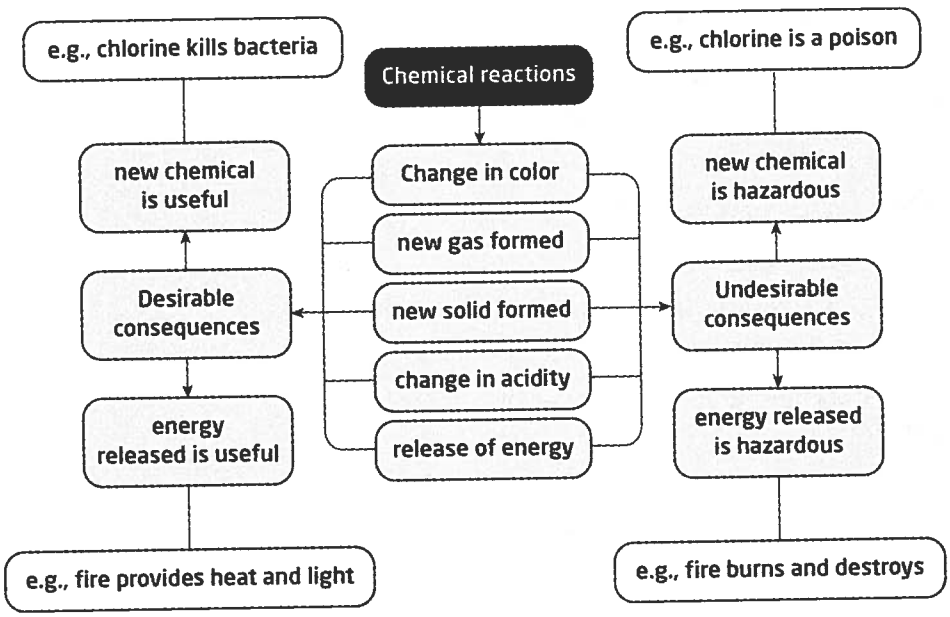
_____

_____

_____

What are the alternatives?

Many of the household products we use are hazardous not only to us but to our environment. Often people are simply unaware of the dangers these products pose to our environment. There are alternatives to cleaning products that are less harmful to the health of both humans and the environment. For example, you can use a mixture of vinegar and water to clean windows and mirrors instead of window cleaner, which contains ammonia, which is more dangerous to human health and the environment.



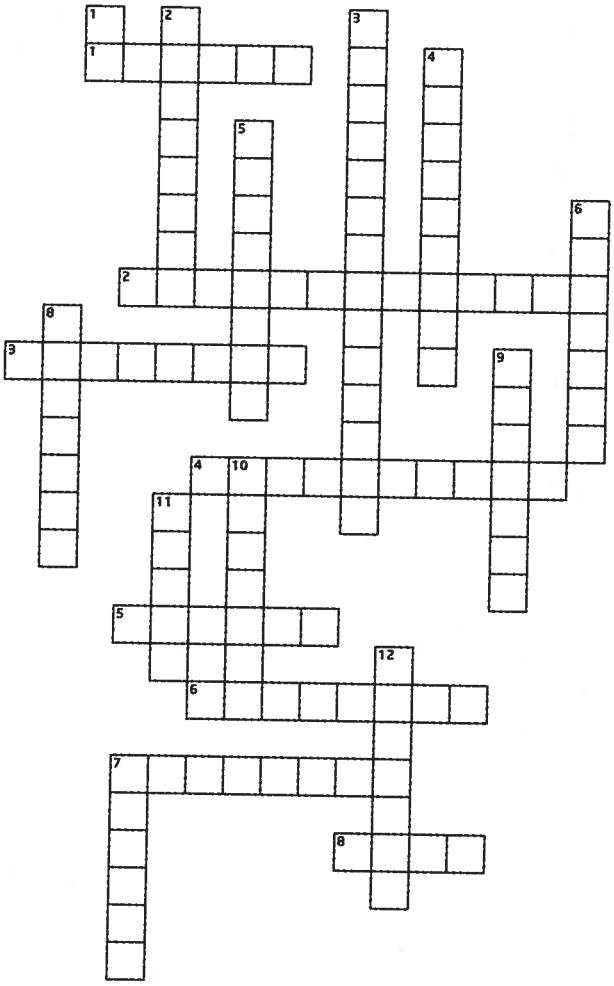
Name _____ Date _____

Key Term Review
Topic 2.6

Use with textbook pages 140–151.

Crossword puzzle

Complete the crossword puzzle to help you review the terms used in this unit.



ACROSS

1. this number tells you the number of protons in an atom
2. name of table that organizes of all the elements on Earth
3. dull, brittle, and non-conductive element
4. how well something interacts with another substance
5. every substance found around you
6. made up of two or more different types of atoms
7. type of property that describes what a substance looks like
8. type of substance made up of only one type of matter

DOWN

1. also called a "group" on the periodic table
2. two or more atoms joined together
3. the ability to catch on fire and burn on its own
4. allows heat and electricity to flow through it
5. type of property that describes how a substance interacts with something else
6. the simplest of all substances
7. a horizontal row on the periodic table
8. is able to dissolve in another substance
9. two or more types of matter that can be separated by physical means
10. the number of these is equal to the number of protons in an atom
11. lustrous, malleable heat conductor
12. where the protons and neutrons are found in the atom

Name _____ Date _____

Applying Knowledge
Topic 2.6

Use with textbook pages 144–145.

What are HHPS?

In the second column of the table, write the name of each Hazardous Household Products Symbol (HHPS). Then, choose the correct meaning of the symbol from the list below. Write the meaning in the third column.

- Swallowing, licking, or breathing this chemical could make you very sick or could kill you.
- This product can burn your skin or eyes. If swallowed, it will damage your throat or stomach.
- The container can explode if heated or punctured, causing serious injury, especially to eyes.
- This product or its fumes will catch fire easily if it is near heat, flames, or sparks.

HHPS	Name of symbol	What the symbol means
1. 		
2. 		
3. 		
4. 		

5. a) Circle the symbol that tells you that a container is dangerous.

b) What does the other symbol tell you?

_____

_____

_____

Name _____ Date _____

Comprehension
Topic 2.6

Use with textbook pages 140–151.

Desirable or undesirable reactions

Read the text below and then answer the questions.

It has been argued that one of the most useful reactions discovered in our lifetime is the production of ammonia. Ammonia can be used to make nitrates, which are part of fertilizer that is then used to grow the food we eat. In fact, one third of the world's population depends on fertilizer to make sure they have enough food to eat.

The problem with nitrate is that it dissolves in water, which means that extra nitrate that is not used by the plants can enter the water cycle. This does not usually cause problems for humans and other mammals, as a specific mechanism exists to prevent its build-up in the bloodstream, but fish and amphibians lack this mechanism. Even at dilute concentrations, ammonia is highly toxic to aquatic animals, and for this reason it is classified as dangerous for the environment.

Also, within a day or two of harvesting, some nitrates are converted into nitrites, which at high levels can decrease your ability to transport oxygen in your bloodstream, and your body does not get enough oxygen to perform all of the vital functions it needs to.

1. In the PMI chart below, record facts from the text that you find to be pluses, minuses and interesting.

Plus	Minus	Interesting

2. Do you think the use of fertilizer should be continued? Write your opinion, using details to support your opinion.

_____

_____

_____

_____

Name _____ Date _____

Assessment
Topic 2.6

Use with textbook pages 140–151.

Useful and hazardous reactions

Match each Term on the left with the Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ chemical reaction	**A.** means that the substance can burn your skin or eyes
2. _____ alternative	**B.** something someone wishes to make during a chemical reaction
3. _____ desirable product	**C.** the container of some products may do this if heated or punctured
4. _____ corrosive	**D.** when substances interact, producing new substances with new properties
5. _____ explode	**E.** These are different substances that may not be as harmful to our environment.

6. a) Describe the desirable product or energy in a fireworks display.

_____

_____

_____

b) Is there also an undesirable product that is harmful to the environment? Explain.

_____

_____

_____

7. a) What makes ammonia useful to us?

_____

_____

b) What makes ammonia harmful to us?

_____

_____

8. Give an example of a chemical reaction in which

a) a useful new substance is formed

_____

b) a harmful substance is formed

_____

9. Sketch the HHPS for a flammable substance.

10. a) Name a hazardous household cleaning product.

_____

b) Describe an alternative cleaning product.

_____

Name _____ Date _____

Unit 2

Literacy Test Preparation

Read the selection below and answer the questions that follow it.

The pros and cons of rubber

Think of all the things around you that are made of rubber: soles of shoes, door and window seals, tires and inner tubes, hoses and belts in cars, flooring in our hoses, protective coating for wire, rubber gloves, elastic bands, and erasers are just a few possibilities. Rubber is a flexible material that can be stretched and easily shaped. The most useful property of rubber is its ability to be stretched out of its original shape into a new shape but then return to its original shape without becoming deformed.

Not all rubber is created in the same way. The different chemical properties of the starting materials allow a variety of rubber products to be made to meet the various needs of society. The most common type of synthetic rubber is that used to make car tires. This rubber is made from a chemical called styrene-butadiene, which is a mixture of styrene and butadiene—chemicals that contain carbon. Rubber is formed in a chemical reaction that creates long chains of these two compounds. These reactants make the tires flexible yet hard. Tires can be formed into perfect circles so that they give a smooth ride in our vehicles. Rubber does slowly wear away from the constant contact with roads and highways, but the service rubber tires provide to us is invaluable. Think of old photographs you may have seen from many years ago when wheels were made of wood.

Before synthetic tires were produced for all of society to use, people used wood to make wheels to move their carts around. Wood could be shaped into a circle but lacked the flexibility and durability of rubber. Wood was more likely to break and be damaged than rubber. Travelling in those times was much different than it is today.

Although tires are widely used in our society, they do create problems for us when we are finished with them. Getting rid of synthetic rubber tires is a big problem. Rubber is not biodegradable, which means it will not break down into smaller pieces like many other products will. This means rubber tires are around forever. What do we do with all of these used tires? For many years, they were placed in garbage dumps with all of our other garbage. However, it was discovered that these tires were polluting the groundwater and the air, especially when they were burned—a common way that garbage was disposed of. Now, we must recycle or reuse tires in an environmentally friendly fashion—in fact there is a tire recycling charge when you have your tires changed at a garage. This money is used to make sure old tires go to places that are trying to find uses for recycled rubber; asphalt and rubber mats are some examples of how tires are being reused.

Name _____ Date _____

Unit 2

Multiple Choice

Select the best answer.

1. Which is the most useful property of rubber?

   A. It is heavy enough to take a beating on the roads.
   B. It can be made into a new shape but then goes back to its original shape.
   C. It is very flexible.
   D. It is bouncy.

2. Which properties of wood make it useful for making wheels?

   A. flexibility and durability
   B. brittleness and the fact that it floats
   C. ability to decompose and combustibility
   D. hardness and ability to be shaped

3. How would travelling with wooden wheels be different than traveling on rubber tires?

   A. The trip would be very smooth.
   B. You wouldn't feel many of the bumps in the road.
   C. You couldn't go very fast.
   D. You would be able to go long distances in a short period of time.

4. How can you dispose of tires in an environmentally friendly way?

   A. We should recycle and reuse our old tires.
   B. We should to throw tires in with our garbage.
   C. We should burn our old tires so they don't take up space in landfills.
   D. We should pile the tires in our backyard.

Written Response

5. Summarize how the properties of rubber make it useful. Include evidence from the selection.

_____

_____

_____

_____

_____

Name _____ Date _____

Topic **3.1** Summary

What do we see when we look at the night sky?

Textbook pages 168–181

Before You Read

How many types of celestial objects can you see in the night sky? Write down as many as you know on the lines below.

_____

_____

Reading Check

1. How can you find Polaris in the night sky?

_____

_____

_____

Reading Check

2. What is a light-year?

_____

_____

_____

What patterns do we see when we look at stars?

The **stars** in the sky at night appear to move from east to west. When we look north in the northern hemisphere, stars seem to rotate around a single point in the sky. This single point is a star called Polaris, also commonly known as the North Star.

As viewed from Earth, stars seem to make unchanging patterns in the night sky. These patterns look like familiar objects, which people long ago grouped and named. These groupings of stars into familiar patterns and shapes are called constellations. Polaris is the last star in the handle of a constellation called Ursa Minor (Little Bear).

What types of celestial objects are found in our universe?

Celestial objects found in our universe include moons, **planets**, stars, and collections of stars. A **solar system** is a group of planets circling a star. **Gravitational pull** keeps the planets moving in a circular pattern around the star. Our Sun is a star. Stars are made of superheated gases. They produce and give off light, heat, and other forms of energy. Stars vary in size and can be many different colours. A galaxy is a huge group of stars, gas, and dust held together by gravity. Our solar system is part of a **galaxy** we call the **Milky Way.**

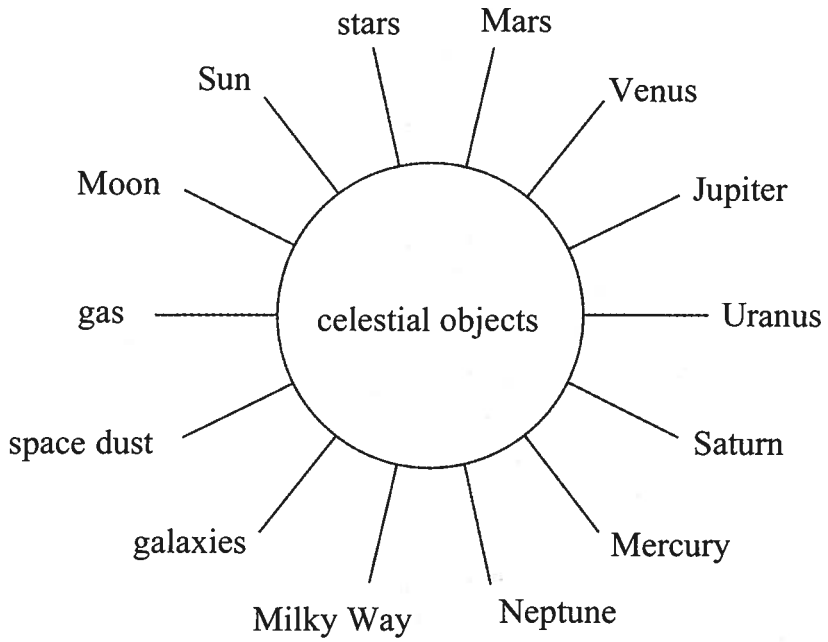
Name _____ Date _____

Topic **3.1** Summary

How can distances in space be measured?

Distances between most objects in space are so great that is hard to imagine them. **Astronomers** use **astronomical units** (AU) to measure the distances between planets in our solar system. The distance between the Sun and Earth, about 150 million km, is equal to 1 AU. The unit that is commonly used to describe distances between galaxies is the **light-year**. To understand this unit, think first about light. Scientists believe that light moves faster than anything else in the universe. Light moves at a speed of nearly 300 000 km/s. How fast is that? In the time it takes snap your finger, light can travel around the entire Earth more than seven times. The light from the Sun takes about eight minutes to reach Earth. A light-year represents the distance light travels in one year. Most stars and galaxies are hundreds, thousands and even millions of light-years away from us. Can you imagine that? Can anyone? The universe is huge! ✔

Celestial objects in our universe



Name _____ Date _____

Cloze Activity
Topic 3.1

Use with textbook pages 168–181.

What do we see in the night sky?

Vocabulary	
astronomical unit (AU)	gravitational pull
celestial	light-year
circumpolar	Polaris
Constellations	solar system
galaxy	star

Use the terms in the vocabulary box to fill in the blanks. Use each term only once.

1. The word _____ means sky.
2. _____ is the name of the fixed star that lines up with the North Pole of Earth's axis.
3. _____ are patterns formed by stars.
4. The term _____ refers to constellations that travel around a pole star.
5. _____ is the force of attraction that keeps planets moving in a circular pattern around the Sun.
6. The Sun, the planets, the moons, and other objects that orbit the Sun make up the _____.
7. A mass of superheated gases that produces and gives off light, heat, and other kinds of energy is called a _____.
8. A _____ is a collection of many millions of stars that are held together by gravity.
9. One _____ is equal to the distance between the Sun and Earth.
10. A _____ is the distance that light travels in one year.

Name _____ Date _____

Comprehension
Topic 3.1

Use with textbook pages 168–181.

Answer the questions.

Celestial objects of the universe

1. Which star is often used by people in the northern hemisphere to find directions at night?

_____

2. What characteristic classifies a constellation as circumpolar?

_____

3. What types of objects are considered celestial objects?

_____

4. What makes up our solar system?

_____

5. What characteristics can be used to classify stars?

_____

6. Name the galaxy in which our solar system is located.

_____

7. What is the distance between the Sun and Neptune?

_____

8. What is the distance between the Sun and Venus?

_____

9. How many kilometres can light travel in one year?

_____

10. What is the name of the large galaxy nearest to our Milky Way?

_____

Name _____ Date _____

Interpreting Illustrations
Topic 3.1

Use with textbook page 171.

Patterns of constellations

Use the constellation map above as a reference. Draw a diagram that represents each of the following circumpolar constellations. Briefly describe the shape or pattern of each constellation.

Ursa Minor Diagram: Description: _____ _____	**Draco** Diagram: Description: _____ _____
Ursa Major Diagram: Description: _____ _____	**Pegasus** Diagram: Description: _____ _____

Name _____ Date _____

Assessment
Topic 3.1

Use with textbook pages 168–181.

What do we see when we look at the night sky?

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ astronomical unit (AU)	**A.** the force of attraction that an object with a certain mass has on an object with less mass
2. _____ constellation	**B.** a massive ball of superheated gases that radiates heat and light
3. _____ galaxy	**C.** a collection of billions and billions of stars, gas, and dust
4. _____ gravitational pull	**D.** the system of planets, including Earth, moons, and other objects that orbit the Sun
5. _____ light-year	**E.** a measurement equal to the distance that light travels in one year
6. _____ solar system	**F.** all the celestial objects that we see in the sky
7. _____ star	**G.** a measurement equal to the distance between the Sun and Earth
8. _____ universe	**H.** a shape or pattern of stars in the night sky made by imagining that stars are joined together by lines

9. In which direction do the stars in the night sky seem to move?

_____

10. How many galaxies exist in the universe?

_____

11. If you were to use kilometres as a unit of measurement, what is the distance between the Sun and Earth?

_____

12. Why do astronomers use light-years when measuring distances between galaxies?

_____

_____

_____

_____

Name _____ Date _____

Topic **3.2** Summary

What are the Sun and the Moon and how are they linked to Earth?

Textbook pages 182–195

Before You Read

What do you know about how the Sun and the Moon and Earth all affect each other? Record your answers on the lines below.

_____

_____

Reading Check

1. How is Earth protected from charged particles?

_____

_____

_____

Reading Check

2. What is an eclipse?

_____

_____

_____

What is the nearest star to Earth? What is it like?

The Sun is the nearest star to Earth. The Sun is 1 AU, or 150 000 000 km from Earth. This huge sphere of mostly hydrogen gas is held together by strong gravitational forces. The temperature of the Sun ranges from 6000°C at the **photosphere** to 15 000 000°C at the core. The **nuclear fusion** reactions that take place at its core generate great amounts of energy. This energy can be in the form of radiowaves, microwaves, infrared waves, visible light, ultraviolet rays, and X-rays.

Why can Earth support life?

If Earth orbited closer to the Sun, our planet would be like a desert. If Earth orbited farther away, our planet would be a icy wasteland. Since Earth orbits in a zone called the "Goldilocks zone," the planet has ideal temperature ranges for life.

Earth is surrounded by a magnetic field called the **magnetosphere.** The magnetosphere prevents the **solar wind** and its charged particles from entering Earth's **atmosphere.** Earth's atmosphere acts as filter from harmful energy from the Sun. The atmosphere also acts as a blanket to trap heat from escaping back into space.

When some charged particles from the solar wind do enter Earth's atmosphere at the north and south poles, they cause **aurora**—also called the northern and southern lights.

Name _____ Date _____

Topic **3.2** Summary

Why does the Moon change at night?

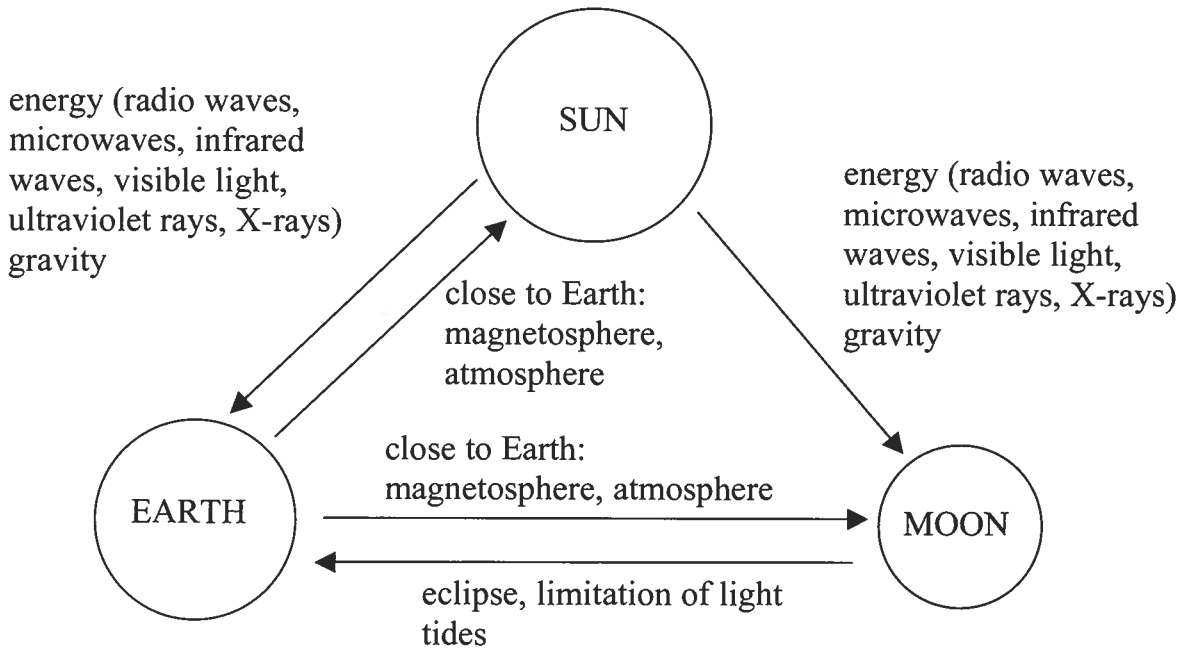
As you gaze into the night sky each evening, the amount of moonlight that you see will change. This moonlight is actually sunlight reflected back to Earth from the Moon's surface. The **phases of the Moon** are caused by the positions of the Moon orbiting around Earth. The same side of the Moon faces Earth all the time but, depending on where the Moon is in relation to Earth, we see more or less of that lit-up side.

What is an eclipse?

An **eclipse** is the total or partial blocking of sunlight that occurs when one object in space passes in front of another. There are two kinds: solar eclipses and lunar eclipses. Both kinds involve the interaction of the Sun, Earth, and the Moon.

In a **solar eclipse**, the Moon passes between the Sun and Earth, briefly blocking our view of the sun. A total solar eclipse happens when the full shadow of the Moon falls on Earth's surface. A partial solar eclipse happens when only part of the Moon's shadow falls on Earth's surface. In a **lunar eclipse**, Earth passes between the Sun and the Moon, briefly plunging the Moon into darkness as Earth's shadow moves across it. When the Moon lies fully in Earth's shadow, people see a total eclipse.

Earth, the Sun, and the Moon



Name _____ Date _____

Comprehension
Topic 3.2

Use with textbook pages 182–195.

How the Sun and Moon affect life on Earth

1. When was the Sun formed?

_____

2. What are effects of the strong gravitational forces found holding the mass of the Sun together?

_____

3. What protects life on Earth from the Sun's heat, light, and other types of solar energy?

_____

4. How does the magnetosphere protect life on Earth?

_____

5. How does Earth's atmosphere help keep temperatures within a stable range for supporting life?

_____

_____

6. Give an example of how the Moon can affect the lives of animals.

_____

7. What is moonlight?

_____

8. Explain what causes an eclipse.

_____

9. Why should you never look directly at the Sun during an eclipse?

_____

_____

Name _____ Date _____

Applying Knowledge
Topic 3.2

Use with textbook pages 184–189.

Comparing the Sun and the Moon

Complete the following table comparing characteristics of the Sun and the Moon.

	The Sun	The Moon
1. Ancient symbol		
2. Distance from Earth		
3. Size (diameter)		
4. Temperature range		
5. Rotation (number of days)	At the solar equator: At the solar poles:	

6. List the six different types of energy bands that are given off by the Sun.

_____

_____

7. How does the Sun affect the Moon's orbit?

_____

8. Who was the first astronaut to step on the surface of the Moon?

_____

Name _____ Date _____

Illustrating Concepts
Topic 3.2

Use with textbook pages 190–191.

Eclipses

Show what you know about eclipses. Draw diagrams as directed below.

1. Draw a diagram that shows what happens during a solar eclipse. Be sure to label the Sun, the Moon, and Earth.

2. Draw a diagram that shows what happens during a lunar eclipse. Be sure to label the Sun, the Moon, and Earth.

Name _____ Date _____

Assessment
Topic 3.2

What are the Sun and the Moon and how are they linked to Earth?

Use with textbook pages 182–195.

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ aurora	**A.** term which means moon
2. _____ lunar	**B.** the area of space that contains a planet's magnetic field
3. _____ lunar eclipse	**C.** light shows, created by solar wind, in Earth's upper atmosphere
4. _____ magnetosphere	**D.** streams of charged particles that travel through the solar system at great speed
5. _____ nuclear fusion	**E.** phenomenon where the Moon moves directly between the Sun and Earth, so that the Moon casts a shadow on part of Earth
6. _____ rotation	**F.** the process where two hydrogen atoms fuse together to form a helium atom, and great amounts of energy are released
7. _____ solar eclipse	**G.** the motion of a planet as it spins on its axis
8. _____ solar wind	**H.** phenomenon where the Earth moves directly between the Sun and Moon, so that the Earth casts a shadow on the Moon

9. What is nuclear fusion?

_____

_____

_____

10. Why is Earth so well-suited for life?

_____

_____

_____

11. What causes the phases of the Moon?

_____

_____

_____

12. What appearance does the Sun have to an observer during a total solar eclipse?

_____

_____

_____

Name _____ Date _____

Topic **3.3** Summary

What has space exploration taught us about our solar system?

Textbook pages 196–207

Before You Read

What objects make up our solar system? Write your answer on the lines below.

_____

_____

Reading Check

1. What does the term terrestrial mean?

_____

_____

_____

Reading Check

2. Name two types of solar system objects that are not planets, stars, or moons.

_____

_____

_____

What makes up our solar system?

Our solar system is composed of the inner planets, the outer planets, and chunks of rocky material circling the Sun.

The **inner planets** are Mercury, Venus, Earth, and Mars. These four planets have similar characteristics. They are terrestrial, or Earth-like. They all have a rocky, cratered surface. These planets are smaller and have higher surface temperatures than other planets. Mercury travels in an orbit faster than any other planet. Venus is the hottest planet. Earth is known as the living planet due to the existence of life. Mars has rust in its soil, and therefore has a distinctive red colour.

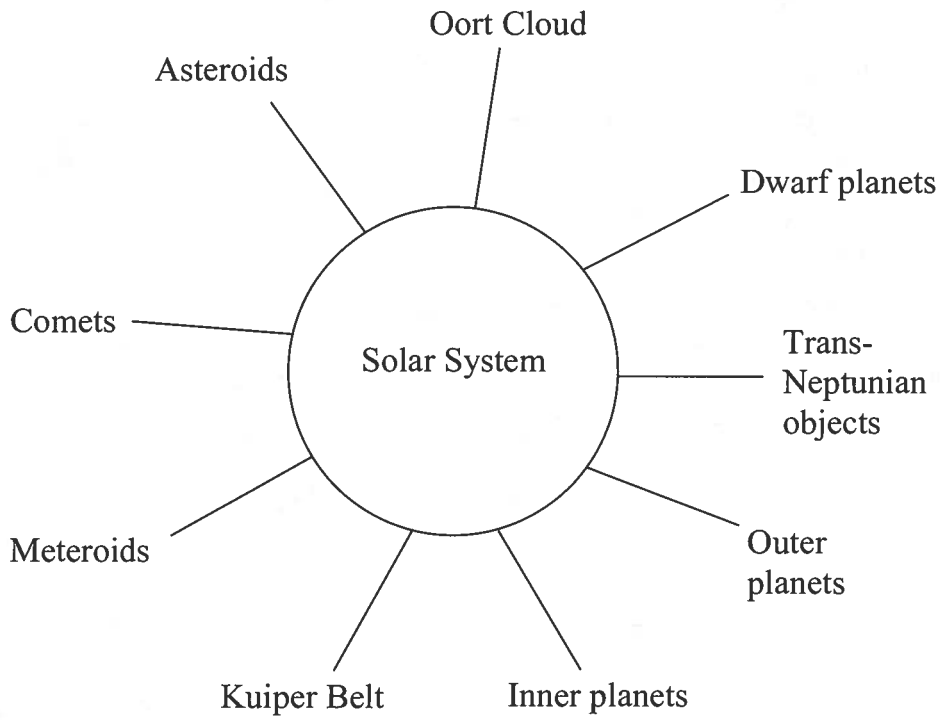
The **outer planets** are Jupiter, Saturn, Uranus and Neptune. These gas giants are known for their gaseous atmosphere, large size, and cool temperatures. Each of these planets is orbited by many moons. Jupiter is known as the giant planet. The rings surrounding Saturn are one of its most distinguishing features. Uranus tilts so much it appears to rotate sideways. Neptune is known as the deep-blue planet.

What other objects make up the solar system?

Stray rocky material and dust pound the planets and their moons. Between Mars and Jupiter, a ring of rocky material called asteroids orbit the Sun. Beyond the orbit of Neptune are rocky-icy chunks called trans-Neptunian objects. **Dwarf planets** can be found in the Kuiper Belt and the **Asteroid Belt**.

Rocky material left over from the formation of the solar system is found in an area at the outer reaches of the solar system called the Oort Cloud. From this region come **comets**, made up of rock and ice, that orbit the Sun. **Meteoroids** are chunks of rock, metal, or both that are shed from asteroids or comets. They can enter Earth's atmosphere. Any part of them that survives the atmosphere of Earth and lands on Earth's surface is called a **meteorite**. Craters found on Earth are evidence of rocky material and dust that have entered the Earth's atmosphere. ✔

The solar system and its parts



Name _____ Date _____

Cloze Activity
Topic 3.3

Use with textbook pages 196–207.

Getting to know the solar system

Vocabulary	
asteroid	Mars
Asteroid Belt	Mercury
Ceres	meteoroids
comets	moon
Earth	Neptune
Eris	Pluto
Halley's comet	Saturn
Haumea	trans-Neptunian
Jupiter	Uranus
Makemake	Venus

Use the terms in the vocabulary box to fill in the blanks. You may use the terms more than once.

1. Two rocky, inner planets are_____ , and_____ .
2. Two planets that are gas giants are_____ , and _____.
3. All the planets except Mercury and Venus have at least one _____.
4. _____ is the planet with the coldest average temperature, at -235°C.
5. The planet with the largest diameter (142 800 km) is_____.
6. _____ has the slowest rotation at 243 days while_____ has the fastest rotation at 9.8 hours.
7. It takes_____ an average of 84 years to orbit the Sun.
8. The atmosphere on _____ is mostly carbon dioxide (95 percent) and a small amount of oxygen.
9. The_____ is a ring of rocky chunks of various sizes that orbit the Sun between the orbits of _____ and _____.
10. Rocky chunks that orbit the Sun beyond the orbit of Neptune are called _____ objects.
11. The Kuiper Belt contains the dwarf planets _____ , and _____ .

Name _____ Date _____

Applying Knowledge
Topic 3.3

Use with textbook pages 198–201.

Features of inner and outer planets

Complete the following table to describe the general features of inner planets and outer planets.

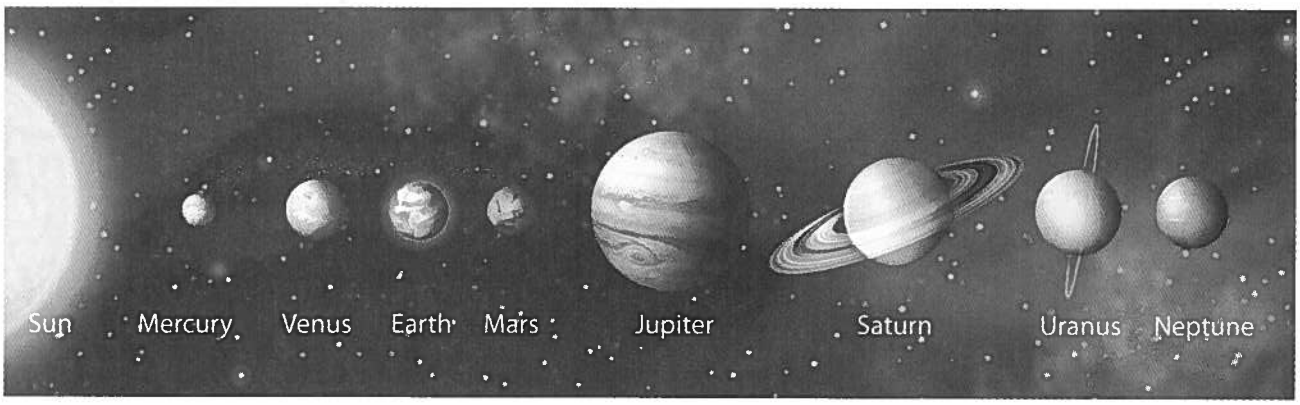
	Inner planets	Outer planets
1. Names of planets		
2. Also known as		
3. Type of surface		
4. Relative size		
5. Temperature		
6. Number of moons		
7. Presence of rings surrounding them		
8. Oxygen present in atmosphere		

Name _____ Date _____

Illustrating Concepts
Topic 3.3

Use with textbook pages 202–203.

Rocky chunks of the universe



1. On the diagram above, label where the following parts of the solar system are located.

Asteroid Belt

Kuiper Belt

Oort Cloud

2. What type of matter forms comets?

_____

_____

3. Where do comets come from?

_____

_____

4. What type of matter forms meteoroids?

_____

_____

Name _____ Date _____

Assessment
Topic 3.3

What has space exploration taught us about our solar system?

Use with textbook pages 196–207.

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ asteroid	**A.** chunks of loosely held rock and ice thought to come from Kuiper Belt and Oort Cloud
2. _____ comets	**B.** planets that have substantial gaseous atmospheres and gaseous surfaces
3. _____ dwarf planets	**C.** a rocky object located in the region between the orbits of Mars and Jupiter.
4. _____ gas giants	**D.** has a rocky, cratered surface
5. _____ inner planet	**E.** has many features in common with Earth
6. _____ meteoroids	**F.** chunks of rock, metal, or both that are shed from asteroids or comets
7. _____ outer planets	**G.** very cold and has no solid surface
8. _____ terrestrial planet	**H.** planet's gravitational pull is not strong enough to pull all the rocky debris around it out of the path of its orbit.

9. Which four planets are called the inner planets?

_____

_____

10. Which four planets are called the outer planets?

_____

_____

11. What is the difference between an asteroid and a meteoroid?

_____

_____

_____

12. What is the name of the comet that can be seen from Earth every 76 years?

_____

Name _____ Date _____

Topic **3.4** Summary

What role does Canada play in space exploration?

Textbook pages 208–217

Before You Read

What would you like to do if you could work with the Canadian space program? Explain your answer on the lines below.

_____

_____

Reading Check

1. What is the advantage of using a space probe to explore other planets?

_____

_____

_____

Reading Check

2. Name two risks astronauts would face during a space walk

_____

_____

_____

How has Canada contributed to the exploration of space?

Canadians have contributed to the exploration of space for many years. Past contributions include building an observatory to study magnetic fields, designing space capsules, and launching satellites.

Dr. Marc Garneau was the first Canadian in space and has taken part in three flights aboard NASA space shuttles. Colonel Chris Hadfield was the first Canadian to walk in space and has also worked during spacewalks to attach the *Canadarm* 2 to the International Space Station. Today, there are sixteen new recruits waiting for two positions in the space program. Have you ever dreamed of working space? Have you ever wondered what it would be like to live in space?

Canadians have designed probes and satellites to look into space. The *Phoenix Mars* ***Lander*** is a space probe that explored the surface of Mars. This probe carried a weather station designed by Canadians. A satellite-style telescope referred to as *MOST* (Microvariability and Oscillations of Stars) was designed to study the inside of stars that are similar to our Sun, but is now also being used to look for planets outside our solar system. Another satellite called *NEOSSat* (Near-Earth Object Surveillance Satellite) is used to keep watch for asteroids and for other satellites that may be getting too close to Earth.

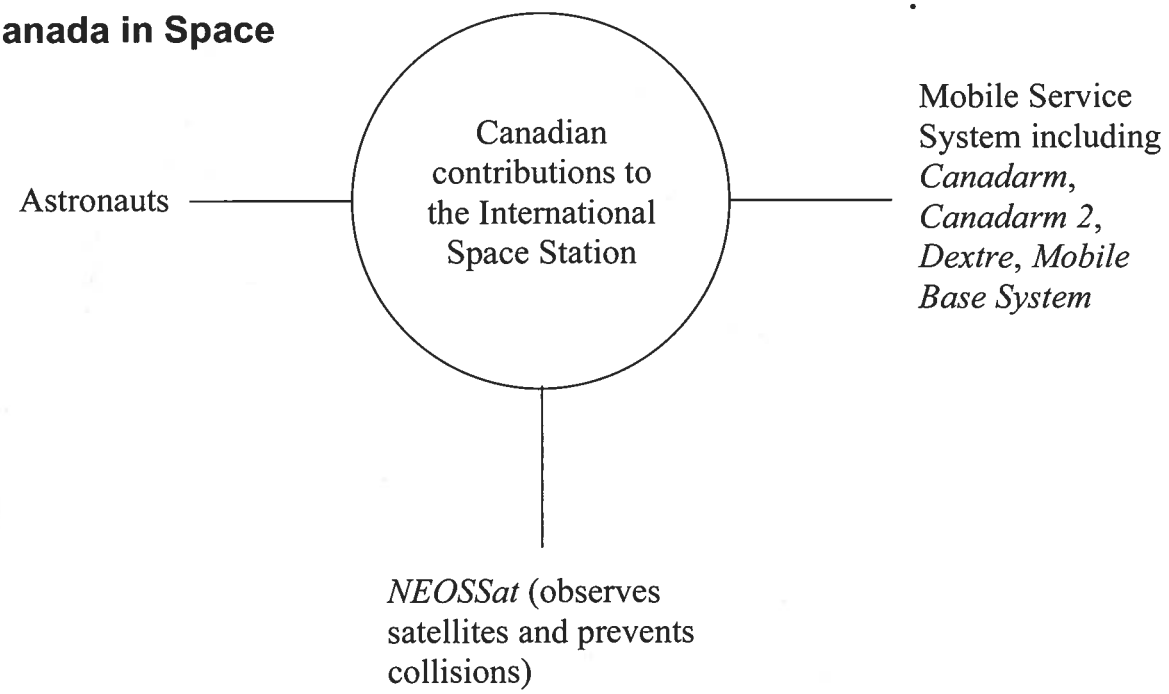
Name _____ Date _____

Topic **3.4** Summary

How have Canadians helped to build and maintain the International Space Station?

Space **robotics** designed and built in Canada were instrumental in construction of the International Space Station (ISS). *Canadarm2*, *Dextre,* and *Mobile Base System* are parts of the service system that maintain and fix the outer areas of the Space Station. *Canadarm2* allows astronauts to do repairs from inside the station or by remote control. The co-ordinated arms of *Dextre* attach to *Canadarm 2* and perform tasks like handling small objects or working with tools. The *Mobile Base System* is a moveable platform that can run the full length of the Space Station. It acts as a base for *Canadarm2* and *Dextre*, and as storage for items that astronauts use when they work outside the ISS. These advances have helped make a visit to space safer for today's astronauts and future space explorers. ✔

Canada in Space



Name _____ Date _____

Comprehension
Topic 3.4

Use with textbook pages 208–217.

Canadian contributions to space exploration

Answer the questions below.

1. How is the oldest scientific institution in Canada linked to space exploration?

_____

2. Name three Canadian astronauts who have adventured in space.

_____

_____

3. What does the term *MOST* stand for?

_____

4. Explain how *NEOSSat* is protecting or "standing on guard" for Canada.

_____

5. What major components of the *Mobile Service System* of the International Space Station were designed by Canadians?

_____

6. What design features of *Canadarm2* have made space repairs safer for astronauts?

_____

_____

7. What is *Dextre* designed to do?

_____

8. If the *Mobile Base System* of the International Space Station were damaged by an asteroid, what potential problems might astronauts face?

_____

_____

_____

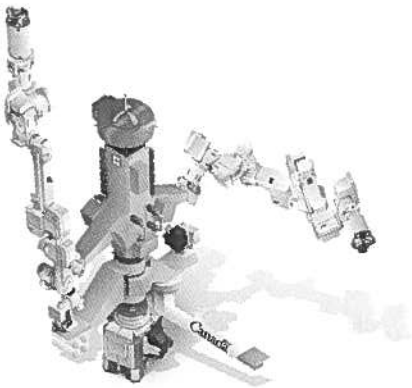
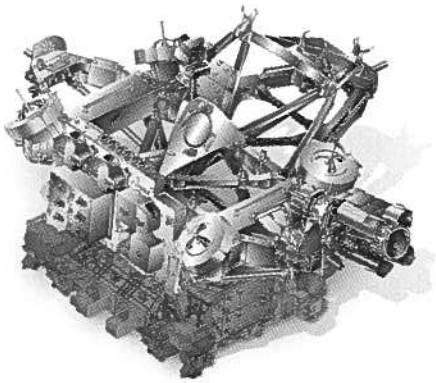
Name _____ Date _____

Applying Knowledge
Topic 3.4

Use with textbook pages 212–213.

Canadian built and designed robotics

Describe how each type of Canadian designed robotic equipment helps astronauts in their daily tasks at the International Space Station.

	Description:
Canadarm 2 	_____ _____ _____ _____ _____ _____
Dextre 	_____ _____ _____ _____ _____ _____
Mobile Base System 	_____ _____ _____ _____ _____ _____

Name _____ Date _____

Assessment
Topic 3.4

What role does Canada play in space exploration?

Use with textbook pages 208–217.

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ *Canadarm 2*	**A.** a small telescope-equipped satellite to monitor asteroids
2. _____ dexterous	**B.** a highly co-ordinated robot connected to *Canadarm 2*
3. _____ *Dextre*	**C.** a satellite-style telescope that orbits Earth
4. _____ *MOST*	**D.** robotic arm attached to International Space Station
5. _____ *NEOSSat*	**E.** space probe that landed on Mars
6. _____ *Phoenix Mars Lander*	**F.** term referring to one Mars day
7. _____ Sol	**G.** refers to skillful use of hands

8. How did Canadian technology contribute to the *Phoenix Mars Lander* mission?

_____

_____

_____

9. Give two advantages of the design features of *Canadarm 2* compared to the original *Canadarm*.

_____

_____

_____

10. Describe two ways the *Mobile Base System* helps astronauts complete their space missions.

_____

_____

_____

Name _____ Date _____

Topic **3.5** Summary

How do we benefit from space exploration?

Textbook pages 220–229

Before You Read

Exploring and learning about space costs billions of dollars each year. Should we spend that money on space exploration when there are problems to solve here on Earth?
Record your thoughts on the lines below.

_____

_____

Reading Check

1. Name one benefit and one risk of space exploration.

_____

_____

_____

Reading Check

2. Do humans have the right to change the environments of other planets? Explain?

_____

_____

_____

What technologies developed for space help us in our daily lives?

Space exploration has led to the development of many specialized products. Space helmets, shock-absorbing Moon boots, tracking devices, robots, and high-temperature space materials are just some of these products. Many of these products have been adapted for everyday uses. When these products or technologies are modified for another use they are known as spinoffs. Did you know that the shock-absorbing material of your running shoes came from Moon-boots? Or that the scratch-resistant coating on your sunglasses is similar to the windows on the space shuttle?

What are the benefits and risks of exploring space?

There are benefits and risks to exploring space. We need to "think globally, act locally." This means that we need to think about the consequences of space exploration. What do we gain? What are the negative effects?

We have gained valuable knowledge by sending probes, space shuttles, and satellites into space but our actions have raised other issues. For example, some of the probes contain **radioactive** materials which could be accidentaly released into Earth's atmosphere at lift-off. Do you think that this risk is worth taking?

Name _____ Date _____

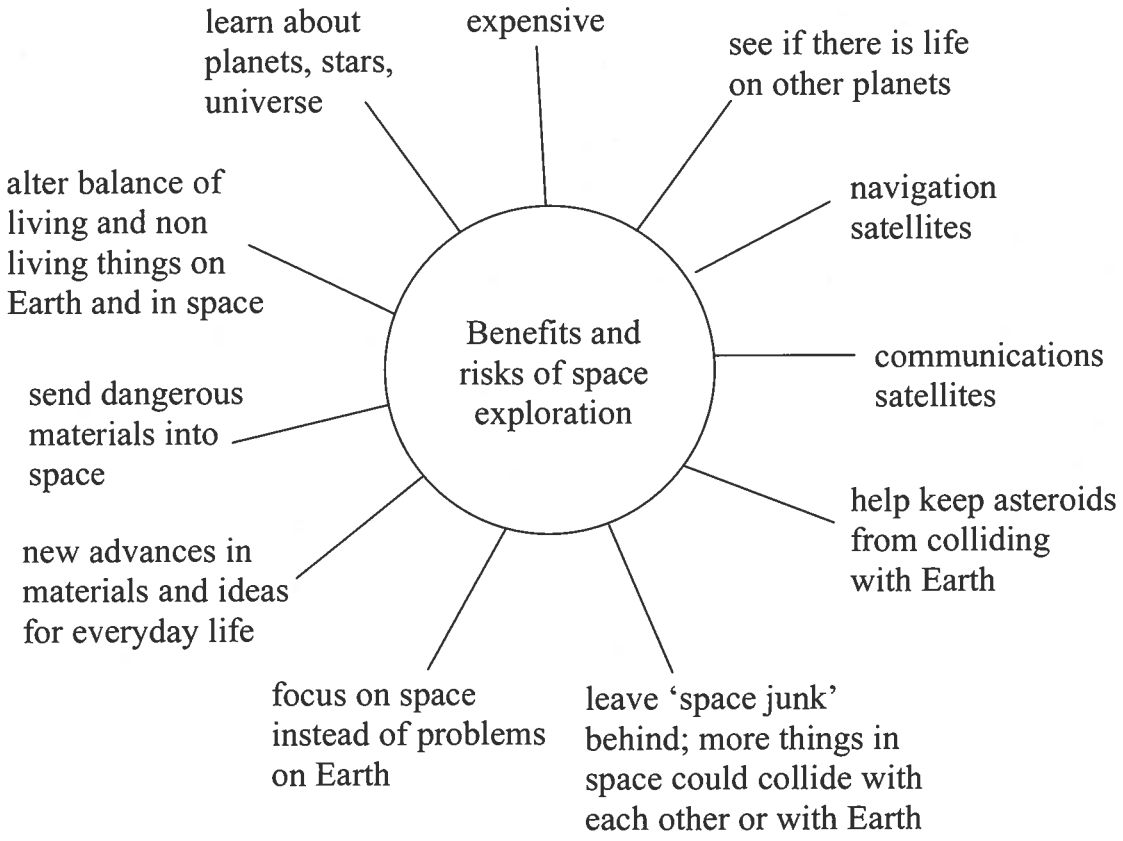
Topic **3.5** Summary

Some scientists believe that we should be exploring other worlds and changing them into environments that support Earth life. This process is called terraforming. Terraforming could allow humans to move to other planets or moons. How do you think such a change could affect the balance in the universe?

How has space exploration given us a deeper appreciation of ourselves and our planet?

Ancient observers gazed into the night sky and recorded patterns of stars, or **constellations.** Observations also led to the creation of the lunar **calendar** which represents the 29 days it takes for the Moon to go through its phases. These observations have helped sailors and explorers find their way home. Since the mid-1900s, we have sent cosmonauts into space, landed on the Moon, established the International Space Station, and sent probes to the outer edges of our solar system. Each of these events has allowed us to see our planet from a different perspective.

Benefits and risks



Name _____ Date _____

Cloze Activity
Topic 3.5

Use with textbook pages 220–229.

Exploring space

Vocabulary	
constellations	space shuttles
lunar	spinoff
Mars	terraforming
Neil Armstrong	transforming
Polaris	UPC codes
robots	*Voyager* probes
Saturn	water cycle
Sergei Krikalev	Yuri Gagarin

Use the terms in the vocabulary box to fill in the blanks. You will not need to use every term.

1. Various everyday products that use materials developed by the space industry are called _____ technologies.
2. _____ that were designed for space now fill dangerous jobs on Earth, such as handling hazardous chemicals or working with explosives.
3. Originally, _____ were designed to track each of the millions of tiny pieces needed to build a space capsule.
4. The Cassini-Huygens space probe sent to _____ and its moon system was carrying radioactive plutonium.
5. Some scientists believe that it is technologically possible to transform an alien environment into one that can support Earth life by a process called _____.
6. For humans to live on Mars, we would need to develop a _____, plant life to generate and sustain an atmosphere, and nutrient cycles to sustain the plants.
7. Over 15 000 years ago Cro-Magnon people used their observations of the night sky to draw the first _____ calendar.
8. Sailors and wanderers rely on predictable patterns of _____ and other celestial objects to find their way home
9. In 1961, the first person in space was _____.
10. The _____ are known for travelling further in space than any other human-made craft.

Name _____ Date _____

Applying Knowledge
Topic 3.5

Use with textbook pages 224–225.

Consequences of space exploration

What ideas do you have about the benefits and risks related to each issue? What are other issues that you think we should consider when we decide whether to explore space? Record your ideas in the chart.

	Benefits	Risks
Nuclear-powered planetary probes	_____ _____ _____ _____ _____	_____ _____ _____ _____ _____
Terraforming	_____ _____ _____ _____ _____	_____ _____ _____ _____ _____
Other issues: _____ _____ _____	_____ _____ _____ _____ _____	_____ _____ _____ _____ _____

Name _____ Date _____

Assessment
Topic 3.5

How do we benefit from space exploration?

Use with textbook pages 220–229.

Match each term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ Polaris	**A.** means land or earth
2. _____ plutonium	**B.** probe sent into space to observe and study outer planets furthest from Earth
3. _____ satellite	**C.** the pole star found in the Northern Hemisphere
4. _____ spinoff	**D.** a product or a technology that is originally developed for one use but is modified for other uses
5. _____ terra	**E.** an electronic device put in orbit around Earth to relay information
6. _____ terraforming	**F.** a radioactive element used in many nuclear processes
7. _____ *Voyager*	**G.** transforming an alien environment into one that can support Earth life

8. What special characteristic found in the eyes of birds of prey led to a product used by astronauts?

_____

_____

_____

9. Give two examples of spinoffs of space exploration.

_____

_____

10. What might be some difficulties that would be associated with terraforming a planet like Mars?

_____

_____

_____

_____

_____

_____

_____

Name Date

Unit 3

Literacy Test Preparation

Read the selection below and answer the questions that follow it.

NASA's return to the Moon

From 1968 to 1972, NASA's *Apollo* astronauts tested new spacecraft and journeyed to uncharted destinations. On July 20, 1969, *Apollo 11* commander Neil Armstrong stepped out of the lunar module and took "one small step" in the Sea of Tranquility, calling it "a giant leap for mankind." Six more missions followed that landed on the moon. They studied soil mechanics, meteoroids, seismic events, heat flow, lunar ranging (ways to measure the distance between Earth and the Moon), magnetic fields and, solar wind. The *Apollo* space mission program ended in 1972.

Robotic missions to the moon have found evidence of a watery past, suggesting that simple life forms may have developed long ago and may persist beneath the surface today. In 2009, NASA will send a robotic scout called the *Lunar Reconnaissance Orbiter* (LRO) to orbit the moon. This is the first part of several missions planned in NASA's Vision for Space Exploration. The Moon missions will enable us to investigate the many questions we have about the history of Earth, the solar system, and the universe—and our place in the world.

There are plans for astronauts to go on a future moon missions and stay on the moon for some time. They would search for resources and learn how to work safely in the harsh lunar environment. Some of the challenges that they will encounter are harmful radiation, electrified dust, and extreme temperatures.

Cosmic rays can cause serious health hazards, such as acute radiation sickness, or mutations in DNA which can increase the risk of cancer. Astronauts in Earth's orbit are protected from space radiation by Earth's magnetic field.

During the *Apollo* missions, lunar dust was found to stick to space suit material, metal, and even skin. The electrically charged dust is also abrasive because it formed from microscopic meteorites that strike the Moon's surface. Long term exposure to lunar dust can potentially lead to equipment failure and health issues for astronauts.

The Moon has no atmosphere to block some of the Sun's light or to help trap heat, so the temperature on the Moon's surface ranges from 123°C to -233°C. This extreme temperature range puts stress on the lunar equipment since objects expand and contract when heated and cooled. An instrument called *Diviner* will be used to create a temperature map of the lunar surface.

The objectives of the *Lunar Reconnaissance Orbiter* are to find safe landing sites, locate potential resources, and demonstrate new technology. These scientific explorations pave the way for a safe return of humans to the Moon and for future human exploration of our solar system.

Name _____ Date _____

Unit 3

Multiple Choice

1. The *Apollo 11* mission to the Moon is best known for
   A. discovering simple life forms on the Moon
   B. an astronaut setting foot on the surface of the Moon
   C. etensive mapping and photography of lunar surfaces.
   D. discovering water on the lunar surface

2. The *Lunar Reconnaissance Orbiter* has been designed to
   A. act as a space station
   B. land on the Moon
   C. orbit the Moon
   D. orbit Mars

3. Astronauts in Earth's orbit are protected from radiation by
   A. highly developed space suits
   B. Earth's ozone layer
   C. the lack of lunar dust in the atmosphere
   D. Earth's magnetic field

4. Lunar equipment can be damaged by
   A. lack of oxygen
   B. extreme temperatures
   C. atmospheric pressure
   D. cosmic rays

Written Answer

5. What are some of the hazards facing astronauts as they venture into space? Use specific details from the selection to support your answer.

_____

_____

_____

Name _____ Date _____

Unit **4**

Using Your Appendices

Science Skills Toolkit 9: Using Electric Meters

Use with textbook pages 362–364

Using an ammeter and a voltmeter

Electric meters come in two forms—analogue meters and digital meters. Analogue meters have a needle pointing to different scales, while digital meters display the numerical values directly.

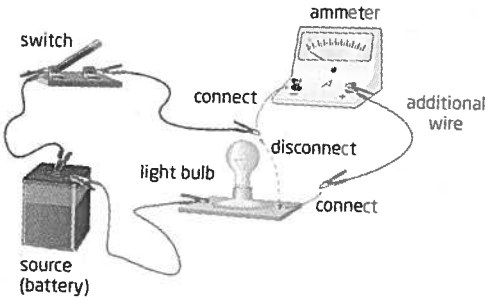
Here are tips for using electric meters:

- **Terminals of a meter**

All meters have two terminals: the negative terminal (–) is black and the positive terminal (+) is red. In order not to damage the meter, the rule is "positive to positive, and negative to negative." This means that you should be able to trace the connection from the positive terminal on the meter to the positive terminal on the source, and the negative terminal on the meter leads to the negative terminal on the source.

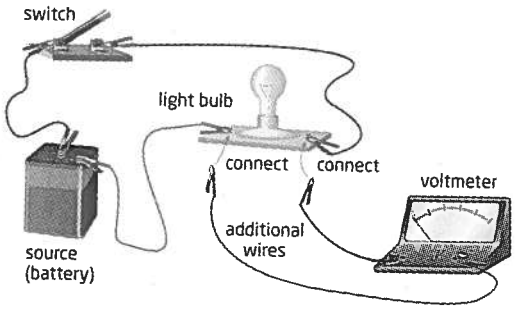
- **Connecting an ammeter**

An ammeter must be connected in the circuit to measure the current that runs through it. Disconnect one of the wires to make a gap in the circuit where the current is to be measured. This is where the ammeter needs to be inserted. Be sure to follow the rule "positive to positive, and negative to negative" when connecting the wires.



- **Connecting a voltmeter**

A voltmeter must be connected across the load to measure its potential difference. No disconnection of the circuit is required to connect the voltmeter. Simply connect the terminals of the voltmeter to the two connections on the load. Remember to use the rule "positive to positive, and negative to negative" to trace the wire connections back to the source.



- **Choosing a scale on the meter**

In order to get the most accurate reading, the meter needs to be set to the appropriate scale. To do this, first set the meter on the largest scale to obtain an approximate value. Then lower the scale progressively until the meter displays the highest possible reading without going off the scale.

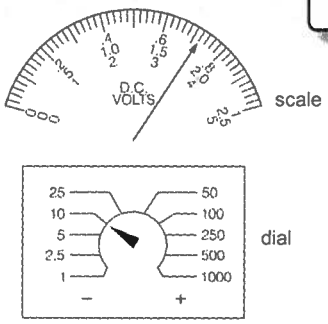
Name _____ Date _____

Unit **4**

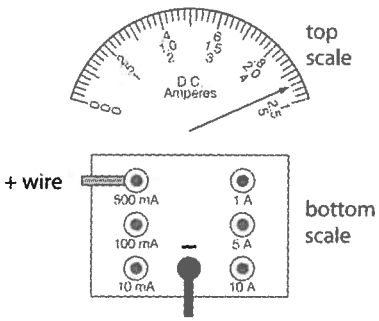
- **Reading an analogue meter**

This voltmeter has its dial set at 10V.

To determine the measured potential difference, look for a number at the far right of the scale with the same first digit as 10. The scale then has a maximum value of 1, and now the 1 represents 10V. To read the scale, multiply the number the needle is pointing to by 10. The needle is pointing to 0.72 so the voltmeter is reporting 7.2V.



This ammeter has the positive (+) wire connected to the 500 mA scale. To determine the current, look at the far right of the top scale for a number that has the same first digit as 500. The top scale then has a maximum value of 5, and now the 5 represents 500 mA. To read the scale, multiply the number the needle is pointing to by 100. The needle is pointing to 4.7, so the meter is reporting 470 mA of current.



Questions:

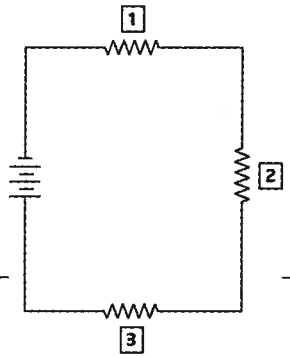
1. Identify whether each description applies to an ammeter or a voltmeter.
   - **a)** measures potential difference across a component in the circuit
   - **b)** measures the current that runs through it _____
   - **c)** requires the circuit to be disconnected in order to connect the meter _____
   - **d)** connects to the circuit without disconnecting any existing wires _____
2. What does the rule "positive to positive, and negative to negative" mean?

   _____

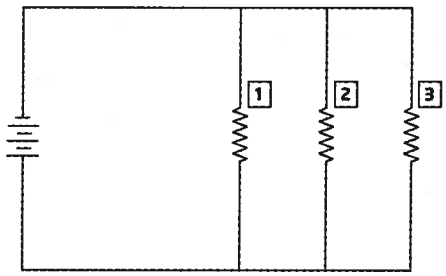
   _____

3. Re-draw the circuit diagrams to show the correct place to connect the electric meters. The symbol for an ammeter is —Ⓐ— and for a voltmeter is —Ⓥ—.

(a) An ammeter is used to measure the current through the last resistor in this series circuit.



(b) A voltmeter is used to measure the potential difference across the second resistor in this parallel circuit.



Name _____ Date _____

Topic **4.1** Summary

Sources of Electrical Energy

Textbook pages 244–251.

Before You Read

One source of electrical energy is water flowing through a dam. What other sources of electrical energy can you think of?

_____

_____

Mark the Text

Identify Concepts

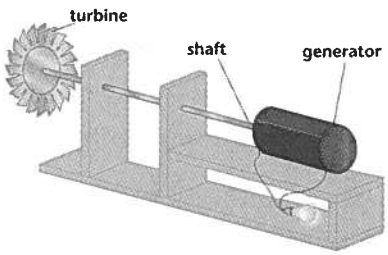
Highlight each question head in this section. As you read, highlight the answers to the questions using a different colour.

What are some different forms of energy?

Energy comes in many different forms, including kinetic energy (the energy of motion), chemical energy (energy stored in the bonds of atoms and molecules), nuclear energy (energy stored in the nucleus of an atom), and electrical energy (electricity). All forms of energy can be converted into other forms. In Canada, most electrical energy is made by converting kinetic energy using a device called a *generator*.

How does a generator work?

The key parts of a generator system are a *turbine*, a *shaft*, and the generator itself. When the turbine turns, it spins the shaft, which spins a rotor in the generator. The kinetic energy of the spinning rotor is converted into electrical energy inside the generator.



Reading Check

1. Name the three main sources of energy used to generate electrical energy in Ontario.

_____

_____

_____

What sources of energy are used to generate electrical energy?

Any form of energy that can be used to turn a turbine can be used to generate electrical energy. The three main sources of energy used to generate electrical energy in Ontario are:

- hydroelectric (moving water)
- thermoelectric (burning fossil fuels)
- nuclear (heat from nuclear reactions of uranium atoms) ✔

Name Date

Topic **4.1** Summary

What are renewable and non-renewable energy sources?

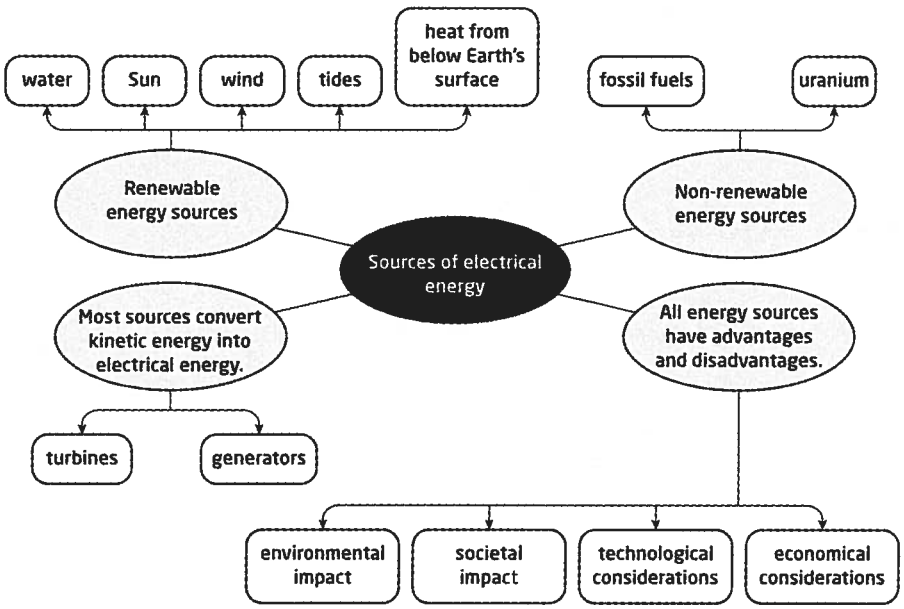
Renewable energy sources can be replaced or restocked within a human lifetime, or less. They include water, wind, the Sun, biomass, tides, and heat from below Earth's surface (geothermal energy).

Non-renewable energy sources, such as fossil fuels and uranium, cannot be replaced or restocked within a human lifetime. These sources of energy take from millions to billions of years to form. When all available supplies are used up, they are gone forever. ✔

What factors are considered when assessing an energy source?

Each energy source has advantages and disadvantages. Factors to consider when assessing an energy source include:

- impact on ecosystems (What are the effects of extracting and using the energy source?)
- impact on society (What are the effects on where and how people live?)
- the technology required (Is the technology available, energy-efficient, and cost-effective?)
- economic considerations (Are there abundant supplies of the energy source? Can the energy source be used everywhere?)



✔ *Reading Check*

2. What is the difference between renewable and non-renewable energy sources?

_____

_____

_____

Name _____ Date _____

Cloze Activity
Topic 4.1

Use with textbook pages 246–249.

Energy

Vocabulary	
biomass	nuclear
chemical	renewable
fossil fuels	shaft
generator	Sun
heat from below Earth's surface	thermoelectric
hydroelectric	tides
kinetic	turbine
moving water	uranium
non-renewable	wind

Use the terms in the vocabulary box to fill in the blanks. You will not need to use every term. You may use terms more than once.

1. Energy associated with movement or motion is called _____ energy.
2. Energy that is stored in the nucleus of an atom is called _____ energy.
3. Kinetic energy can be converted into electrical energy using a device called a _____.
4. The key parts of a generator system are a _____, _____, and _____.
5. Coal, oil, and natural gas are types of _____ that took millions of years to form on Earth.
6. Most electrical energy used in Canada is generated from three sources of energy: _____, _____, and _____.
7. _____ and _____ sources of energy both convert energy into heat that boils water into steam to spin a turbine.
8. An energy source that can be replaced or restocked within a human lifetime, or less, is called a _____ energy source.
9. Two examples of renewable energy sources are _____ and _____. Two examples of non-renewable energy sources are _____ and _____.

Name _____ Date _____

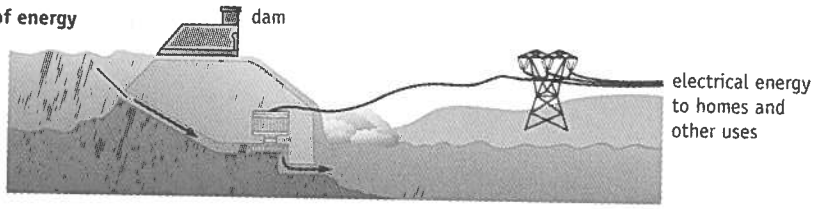
Interpreting Illustrations
Topic 4.1

Use with textbook pages 246–247.

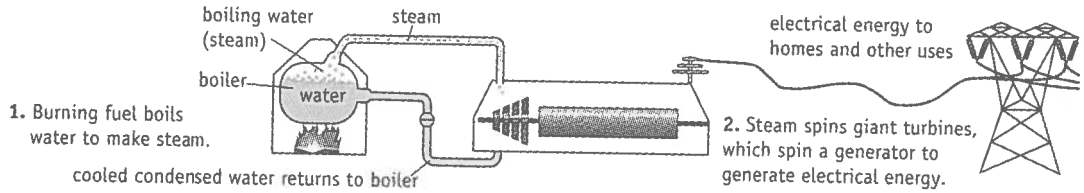
Resources for generating electrical energy

Examine the following diagrams, which show three ways to generate electrical energy.

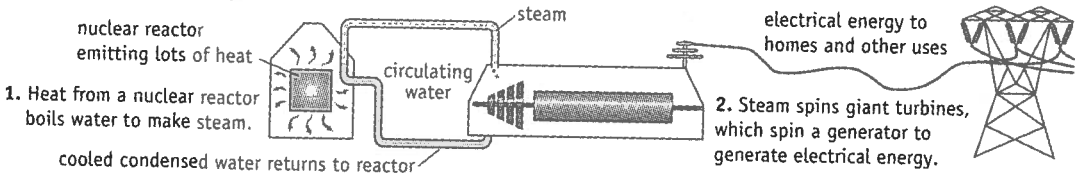
A Hydroelectric sources of energy



B Thermoelectric sources of energy



C Nuclear sources of energy



1. Label the **turbine** and the **generator** in diagrams A, B, and C.
2. Use checkmarks to show which of the three sources of energy have each of the characteristics listed. A characteristic may apply to more than one source of energy.

Characteristic	Source of energy		
	Hydroelectric	Thermoelectric	Nuclear
The process of generating electrical energy using these resources involves spinning turbines, which spin a generator.			
These resources convert the kinetic energy of moving water to spin giant turbines.			
Using these resources produces lots of heat that boils water into steam.			
Using these resources involves burning fossil fuels.			
The process of generating electrical energy using these resources involves circulating water through a closed system of pipes.			

Name _____ Date _____

Comprehension
Topic 4.1

Use with textbook pages 248–249.

Renewable or non-renewable?

For each of the following statements, identify whether it applies to a renewable energy source, a non-renewable energy source, or both.

1. This energy source can be replaced within a short period of time.

   _____

2. Fossil fuels and uranium are examples of this type of energy source.

   _____

3. Wind and the Sun are examples of this type of energy source.

   _____

4. The water cycle helps to make water this type of energy source.

   _____

5. This type of energy source has advantages and disadvantages.

   _____

6. This energy source takes millions to billions of years to form on Earth.

   _____

7. Once this energy source is used up, it will be gone forever.

   _____

8. Environmental, societal, technological, and economical factors must be considered when assessing this type of energy source.

   _____

Name _____ Date _____

Assessment
Topic 4.1

Sources of electrical energy

Use with textbook pages 244–251.

Match each Term on the left with the Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ geothermal	**A.** part of a generator system
2. _____ uranium	**B.** heat from below Earth's surface
3. _____ turbine	**C.** released from the splitting of uranium
4. _____ hydroelectric energy	**D.** took millions of years to form on Earth
5. _____ coal	**E.** formed in the explosions of stars before Earth formed
6. _____ fossil fuels	**F.** is generated by moving water
	G. uses steam to spin giant turbines
	H. a type of fossil fuel

7. Copy and complete the table below to compare three ways used to generate electricity. Place each of the following descriptions under the correct heading(s) in the chart. You can place a description under more than one heading.

- uses fossil fuels
- uses uranium
- uses water
- converts chemical energy to electrical energy
- converts kinetic energy to electrical energy
- converts nuclear energy to electrical energy
- falling water spins giant turbines
- steam spins giant turbines

Hydroelectric	Thermoelectric	Nuclear

8. a) What is the name of the device that converts kinetic energy into electrical energy?

_____

b) Name the three main parts of this device.

_____ _____ _____

9. a) What is the difference between a renewable and non-renewable energy source?

_____

_____

b) Give two examples of renewable energy resources.

_____ _____

c) Give two examples of non-renewable energy resources.

_____ _____

10. List two factors that should be considered when assessing an energy source for its advantages and disadvantages.

_____ _____

Name _____ Date _____

Topic **4.2** Summary

Charges and How They Behave

Textbook pages 252–263

Before You Read

Why does a balloon stick to the wall after you rub it on your hair or a sweater? Write your ideas on the lines below.

_____

_____

Mark the Text

Check for Understanding

As you read this section, be sure to reread any parts you do not understand. Highlight any sentences that help you develop your understanding.

Reading Check

1. What is true about the number of positive and negative charges in a charged object?

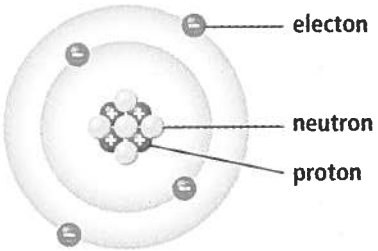
_____

_____

_____

What are the parts of an atom?

Atoms are made of protons, neutrons, and electrons. The protons are **positive charges** and the electrons are **negative charges**. Neutrons have no charge.



How do objects become charged?

When objects have equal numbers of positive and negative charges, they are **electrically neutral**. When different materials are rubbed together, some of the electrons (negative charges) may move from one material to the other. The numbers of positive and negative charges in the atoms of the materials become unbalanced, and the materials become electrically charged.

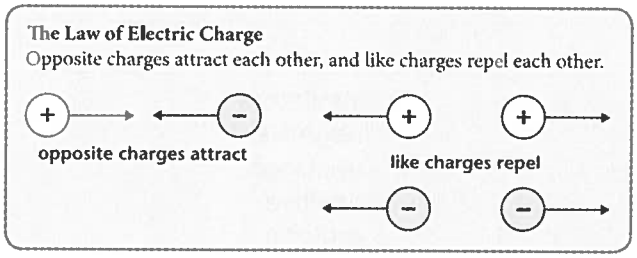
The material that gains electrons becomes negatively charged, because it has more electrons than protons (excess negative charges). The material that loses electrons becomes positively charged, because it has more protons than electrons (excess positive charges). **Static electricity** is a buildup of charges on a material. This kind of electrical charge is called "static" because it stays in one place.

Charges in a material that is neutral (uncharged)	Charges in a material that is positively charged	Charges in a material that is negatively charged
+ + – + – – – – + – + +	+ + + + + – – – + + + +	– – – + – + – – – + – +
equal protons and electrons	more protons than electrons	more electrons than protons

Name _____ Date _____

Topic **4.2** Summary

How do charged objects behave with other objects objects?



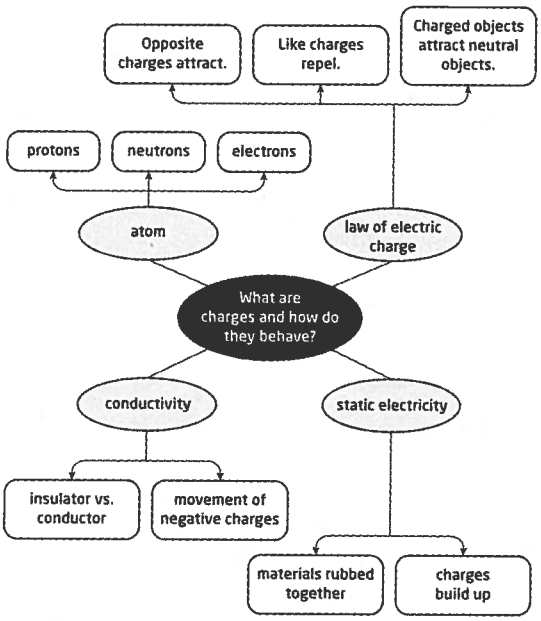
When an object becomes charged, you can observe pushing and pulling forces between the charged object and other objects. The **law of electric charge** states that "opposite charges attract each other, and like charges (charges that are alike, or the same) repel each other." This law can also be used to explain why charged objects attract neutral objects.

How easily do charges move in different materials?

Whether an electrical charge moves through a material depends on two things:

- the state of the material
- the type of material

In solid materials, only negative charges can move. In liquids, both negative and positive charges are able to move. A material that allows electrical charges to move through it is called a **conductor**. A material that does not allow charges to move through is called an **insulator**. How easily charges move through a material is called the material's **conductivity**. Most metals are good conductors, and most non-metals are insulators. ✔



✔ *Reading Check*

2. What is the difference between a conductor and an insulator?

_____

_____

_____

Name _____ Date _____

Cloze Activity
Topic 4.2

Use with textbook pages 254–258.

Charge it

Vocabulary	
anti-cling	insulators
atoms	negative
attract	neutrons
conductivity	positive
conductors	protons
electrically neutral	repel
electrons	static electricity

Use the terms in the vocabulary box to fill in the blanks. You can use each term more than once. You will not need to use every term.

1. _____ refers to an excess of charges that stay in place on a material.
2. All matter is made of tiny particles called _____.
3. The negative charges of an atom are called _____ and the positive charges are called _____.
4. When different materials are rubbed together, only the _____ are rubbed off from one material to the other.
5. The material that loses the electrons will have an overall _____ charge because it has more protons than electrons.
6. The material that gains the electrons will have an overall _____ charge because it has more electrons than protons.
7. An object is uncharged, or _____, when it has equal numbers of positive and negative charges.
8. The law of electric charge states that opposite charges _____ each other and like charges _____ each other.
9. A charged object and a neutral object will _____ each other.
10. How easily charges move through a material is called the material's _____.
11. Copper and gold allow electrons to move freely through them, so they are examples of _____. Glass and plastic do not allow electrons to move easily through them, so they are examples of _____.

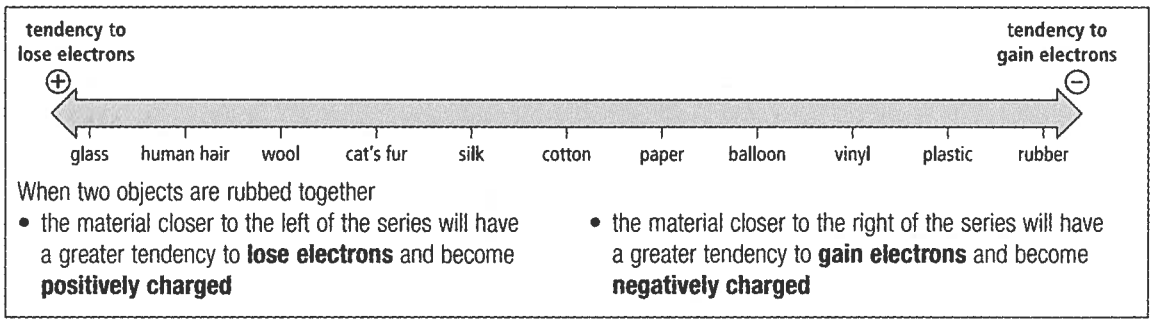
Name _____ Date _____

Applying Knowledge
Topic 4.2

Use with textbook pages 254–255.

Static charge detective

Examine the diagram. Some materials are more likely to lose electrons when they are rubbed against another material. Other materials are more likely to gain electrons.



Use the diagram above to answer the questions.

1. You use a plastic comb to comb your hair.

   The comb becomes _____ charged.

   The hair becomes _____ charged.

2. As you take clothes out of the dryer, a wool sock clings to a silk shirt.

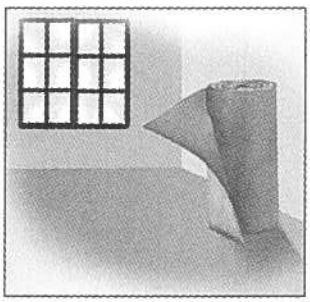
   The wool sock has become _____ charged.

   The silk shirt has become _____ charged.

3. You use a paper towel to rub off some dirt on a glass window.

   The glass window becomes _____ charged.

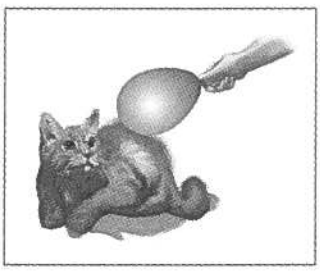
   The paper towel becomes _____ charged.



4. You rub a balloon along a cat's back, causing the cat's fur to stand up.

   The cat's fur has become _____ charged.

   The balloon has become _____ charged.



Name _____ Date _____

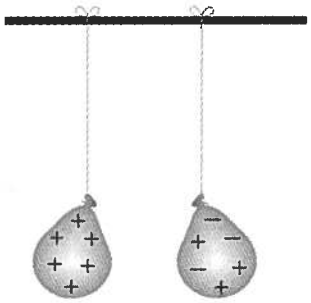
Interpreting Illustrations
Topic 4.2

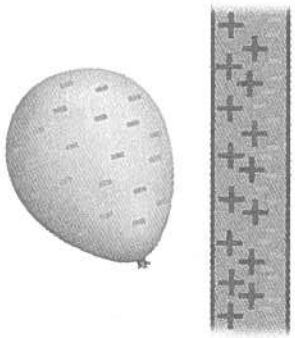
Use with textbook pages 256–257.

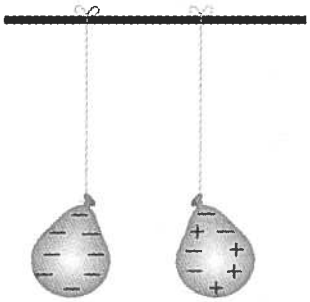
The law of electric charge

- Objects with the same charge repel each other.
- Objects with opposite charges attract each other.
- Charged objects attract neutral objects.

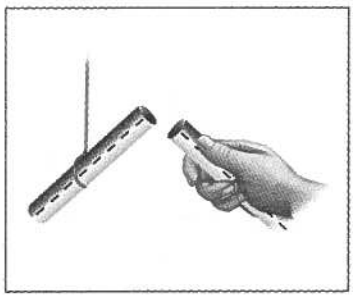
Analyze the situations below. Will the objects shown attract or repel each other?

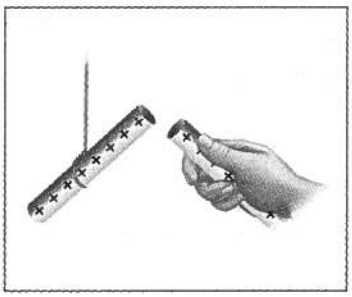


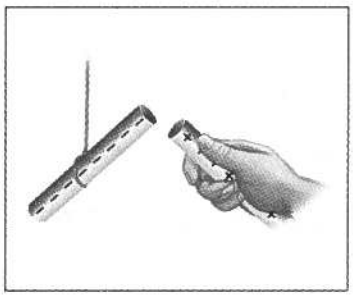




1. _____ **2.** _____ **3.** _____







4. _____ **5.** _____ **6.** _____

Name _____ Date _____

Assessment
Topic 4.2

Use with textbook pages 252–263.

Charges and how they behave

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ conductor	**A.** electrical charges that can be rubbed off a material
2. _____ electrically neutral	**B.** electrical charges that are left behind when negative charges are rubbed off a material
3. _____ insulator	**C.** an indication of how easily charges move within a material
4. _____ negative charges	**D.** having equal numbers of positive charges and negative charges
5. _____ positive charges	**E.** a material in which electrical charges can move easily
	F. a material in which electrical charges cannot move easily

6. State the law of electric charge.

_____

_____

7. Identify whether the object described is positively charged or negatively charged.

a) contains more positive charges than negative charges

_____

b) contains more negative charges than positive charges

_____

c) results from gaining electrons

_____

d) results from losing electrons

_____

e) will attract a positively charged object

_____

f) will attract a negatively charged object

_____

g) will repel a positively charged object

_____

h) will repel a negatively charged object

_____

8. a) What is the difference between a conductor and an insulator?

_____

_____

b) Give two examples of a conductor.

_____

_____

c) Give two examples of an insulator.

_____

_____

Name _____ Date _____

Topic **4.3** Summary

Charging and Discharging Objects

Textbook pages 264–273

Before You Read

Why might you get a shock when you walk across a carpet in wool socks and then touch a metal door handle? Record your thoughts on the lines below.

_____

_____

Mark the Text

Identify Definitions

As you read this section, highlight the definition of each word that appears in bold type.

Reading Check

1. Why is it important that the main parts of the electroscope are all conductors?

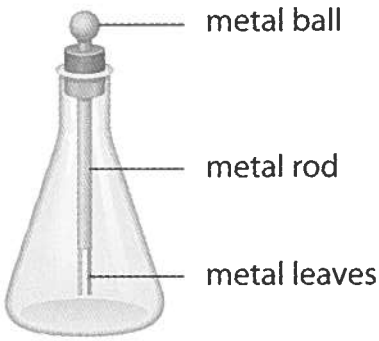
_____

_____

_____

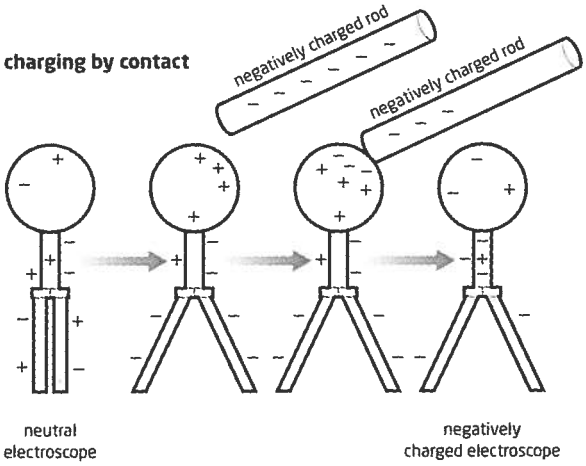
What is an electroscope?

An **electroscope** is a device that allows you to test whether an object is charged. The main parts of an electroscope are a metal ball, a metal rod, and metal leaves. The ball, rod, and leaves are all conductors. Conductors allow negative charges to move easily through them. When the metal leaves move apart, you know that they are charged.



What is charging by contact?

In **charging by contact,** a neutral object is touched with a charged object, and some of the charge moves onto the neutral object, turning it into a charged object. When an insulating material is charged by contact, the charge stays on the insulator at the point where it is touched.



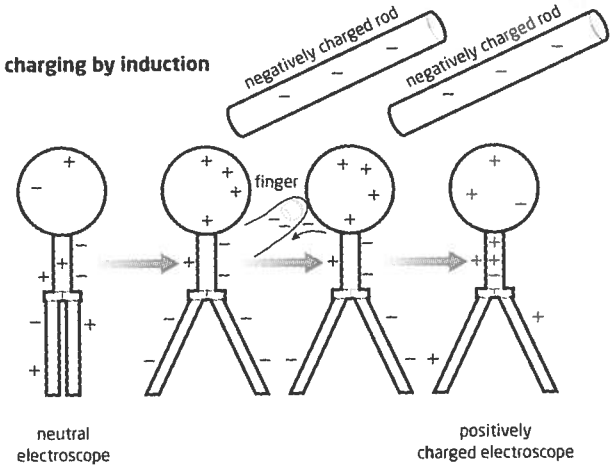
When a conducting material is charged by contact, the charge spreads out over the whole surface of the conductor.

Name _____ Date _____

Topic **4.3** Summary

What is charging by induction?

In **charging by induction,** a charged object is brought near but not touched to a neutral object. If the charged object is negatively charged, it repels the negative charges in the neutral object, which try to move away. The neutral object is still neutral, but now there is an excess of positive charge at one end (or side) of it and of negative charge at the other. The rod is kept near the neutral object, which is touched with a finger. Some of the negative charges being repelled by the negatively charged rod move onto the finger. Take away the finger and then the rod. The electroscope now has more positive than negative charges—it has become positively charged without anything touching it. (To give a negative charge by induction, you would start with a positively charged rod.)



Reading Check

2. Describe one difference between charging an object by contact and by induction.

_____

_____

_____

Reading Check

3. Name two ways to discharge an object.

_____

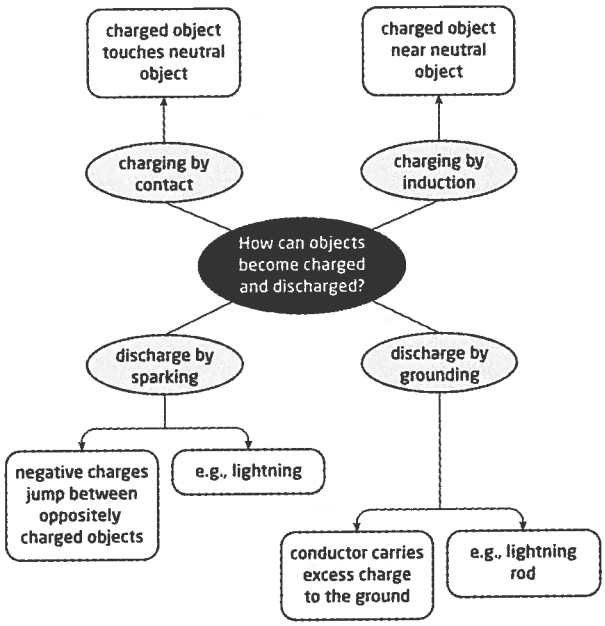
_____

How can a charged object be discharged?

A charged object is **discharged** when it loses its excess charges. This can occur in two ways: by sparking and by grounding.

A spark may occur between two objects if the attraction between the negative charges of one object and the positive charges of the other object is so great that charges jump between the objects. Lightning is an example of a spark that occurs between the negatively charged bottom of clouds and the positive charges on treetops and the ground.

In **grounding,** a conductor connected to the charged object carries excess charges to Earth's surface and into the ground. For example, a lightning rod is connected to a conductor that safely carries the charges down into the ground when the rod is hit by lightning.



Name _____ Date _____

Cloze Activity
Topic 4.3

Use with textbook pages 266–269.

Charging and discharging

Vocabulary	
attract	grounding
charges	induction
conductor	leaves
contact	repel
discharged	rod
electroscope	spark
ground	sparking

Use the terms in the vocabulary box to fill in the blanks. You can use each term more than once. You will not need to use every term.

1. A device that can test if an object is charged is an _____.
2. In charging by _____, a charged object touches a neutral object, and negative charges move from one object to the other.
3. In charging by _____, a charged object is brought near to a neutral object, but doesn't touch it.
4. All parts of the electroscope are metal because metal is a good _____.
5. When an electroscope is not charged, its metal _____ hang down.
6. When the metal leaves of an electroscope are charged with like charges, they _____ each other and move apart.
7. When a charged object loses its excess charges, it is said to be _____.
8. A _____ occurs when charges jump from one object to another.
9. When a conductor is connected to Earth's surface so that charges can flow safely to the ground, this is called _____.
10. Earth is a giant _____ that can absorb a lot of _____ without changing.
11. Lightning is an example of discharge by _____, while lightning rods connected to the ground with conductors is an example of discharge by _____.

Name _____ Date _____

Comprehension
Topic 4.3

Use with textbook pages 266–267.

Charging by contact or induction

1. Identify whether the situation describes charging by contact or induction.

a) You notice the build-up of dust on a computer screen when it is on.

_____

b) You walk across a carpet and experience a shock when you touch a metal doorknob.

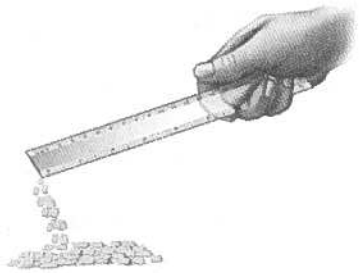
_____

c) You rub a balloon against your hair and bring it close to a pile of salt on the table. This causes the salt crystals to "jump up and dance."

_____

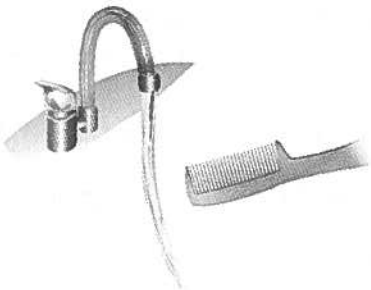
2. Identify whether the illustration shows charging by contact or by induction.

a)



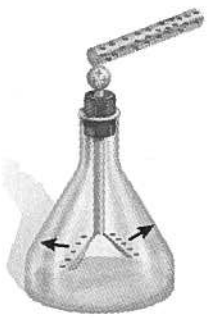
_____

b)



_____

c)



_____

Name _____ Date _____

Applying Knowledge
Topic 4.3

Use with textbook pages 266–267.

Electroscope detective

Law of electric charge
Opposite charges attract each other, and like charges repel each other.

Use the law of electric charge to explain the movement of charges in the following situations. Circle the correct word in each underlined pair of words.

1. A negatively charged rod is brought near the metal ball of an electroscope.

   Negative charges in the rod attract / repel the negative charges in the metal ball. The positive / negative charges in the ball move down into the metal leaves. The leaves now have the same charge / opposite charges, so they attract / repel each other and move apart / closer together.

2. A positively charged rod is brought near the metal ball of an electroscope.

   Positive charges in the rod attract / repel the negative charges in the metal ball. The positive / negative charges in the metal leaves move up into the metal ball. The leaves now have the same charge / opposite charges, so they attract / repel each other and move apart / closer together.

3. An electroscope is negatively charged, making the metal leaves move apart. A positively charged rod is then brought near the metal ball of the electroscope.

   The positive / negative charges in the metal leaves move up the metal rod into the metal ball because they are attracted to / repelled by the charges in the positively charged rod. This causes the metal leaves to lose some of their excess negative charges and they move closer together / farther apart.

Name _____ Date _____

Assessment
Topic 4.3

Charging and discharging objects

Use with textbook pages 264–273.

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. ____ charging by contact	**A.** When an object loses its excess charge, it is …
2. ____ charging by induction	**B.** connecting a conductor to Earth's surface so that charges can flow safely to the ground
3. ____ discharged	**C.** when a neutral object is charged by touching it with a charged object
4. ____ electroscope	**D.** when a neutral object is charged by bringing a charged object near to the object and then touching the object with a finger
5. ____ grounding	**E.** a device that can be used to test whether an object is charged
6. ____ spark	**F.** a device used to prevent lightning from damaging a building
	G. occurs when charges jump across the gap between oppositely charged objects

7. a) Draw a sketch of an electroscope and label its three main parts.

b) Explain why the metal leaves in an electroscope separate when a negatively charged rod is brought near the metal ball of the electroscope.

_____

_____

_____

8. Circle the correct words to describe what happens when you shuffle across a carpet to open a door.

a) Negative charges from carpet rub off onto socks. This is charging by contact / by induction.

b) Negative charges spread all over the body because it is an insulator / conductor.

c) Negative charges jump from finger to metal doorknob. The charges have been discharged by sparking / by grounding.

9. Explain how a lightning rod prevents a building hit by lightning from catching on fire.

_____

_____

_____

Name _____ Date _____

Topic **4.4** Summary

Electrical Circuits

Textbook pages 274–291

Before You Read

How can people control and use the movement of charges? Write your ideas on the lines below.

_____

_____

Mark the Text

Check for Understanding

As you read this section, stop and read again any parts you do not understand. Highlight all the sentences that help you get a better understanding.

Reading Check

1. What is potential difference?

_____

_____

What is current?

_____

_____

2. Which meter is used to measure potential difference?

_____

Which meter is used to measure current?

_____

What is an electrical circuit?

An **electrical circuit** is a closed path made of connecting wires, a source, and load(s).

The **source** provides the energy needed to operate any electrical device. This energy causes charges to move through the circuit. Examples of sources are a battery or electrical outlet.

A **load** is any device that converts electrical energy (carried by the charges) into another form of energy, such as heat or light. Examples of loads are a light bulb or a radio.

What are potential difference, current, and resistance?

Potential difference (*V*), or voltage, describes how the energy of each unit of charge changes as it passes through the source or a load. This change, or difference, in energy can be an increase or a decrease. As charges pass through a source, entering one end and exiting the other, they gain energy.
As charges pass through a load, they lose energy. Potential difference is measured in **volts (V),** using an instrument called a **voltmeter**.

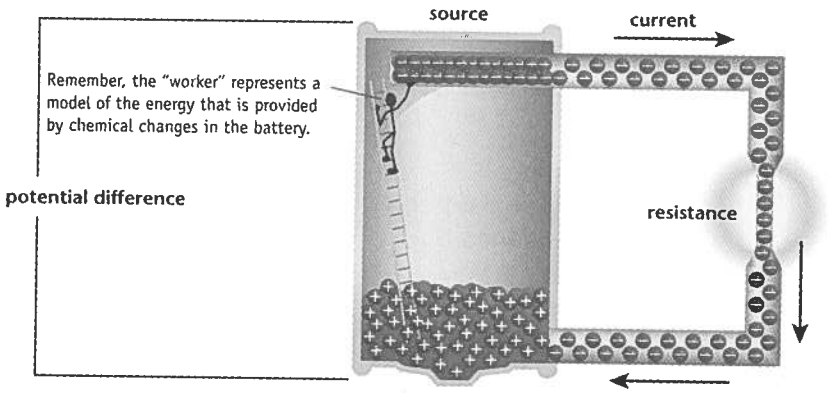
Current (*I*) is the moving charges in an electric circuit. Since charges cannot build up in a conductor, the amount of current flowing past every point in the wire is the same. The amount of current flowing through a wire is measured in **amperes (A),** using an instrument called an **ammeter**. A **switch** in the circuit helps control the flow of current. When it is closed, it allows charges to flow through. When it is open, it prevents charges from passing through.

A load resists the flow of current. This hindering of the movement of charges is called **resistance (*R*)**. Resistance is measured in **ohms (Ω)**.

Name _____ Date _____

Topic 4.4 Summary

The diagram below shows how the negative charges move through a circuit that consists of a battery, light bulb, and connecting wires.



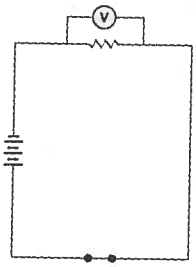
What is a circuit diagram?

Symbols are used to represent different components in a circuit. A picture drawn using these symbols to represent an actual circuit is called a **circuit diagram**.

Component of Circuit	Component Symbol
Source (battery)	
Conducting wire	
Load (resistance)	
Switch: open / closed	
voltmeter	V
ammeter	A

Reading Check

3. Name all of the components in the circuit diagram below.



_____

_____

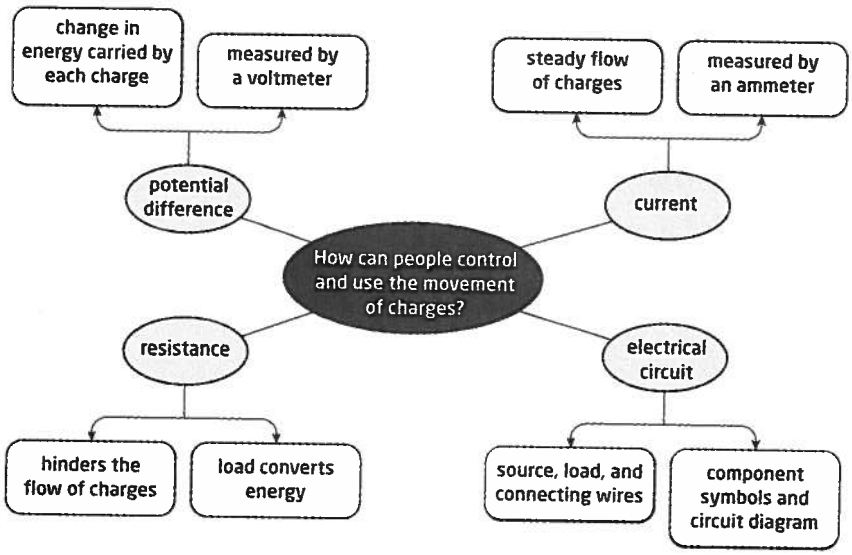
_____

_____

_____

What are the effects of potential difference and resistance on current?

If the potential difference across the source increases, while the resistance of the load remains the same, then each charge carries more energy and flows more easily, and the current becomes higher. If the potential difference across the source stays the same, while the resistance in the circuit increases, the current passing through a particular point in the wire becomes smaller.



Name _____ Date _____

Cloze Activity
Topic 4.4

Use with textbook pages 276–283.

Potential difference, current, and resistance

Vocabulary	
ammeter	ohms
amperes	potential difference
circuit diagram	resistance
current	source
electrical circuit	switch
energy	voltmeter
load	volts

Use the terms in the vocabulary box to fill in the blanks. You can use each term more than once. You will not need to use every term.

1. A constant source of electrical energy causes charges to move through a circuit. This flow of charges is called a _____.
2. When the electrical energy in a circuit reaches the _____, it is converted into a useful form.
3. The change in energy of an electric charge as it passes through the source or a load is called _____.
4. A(n) _____ is used to measure potential difference and a(n) _____ is used to measure current.
5. As charges move through a load, there is a hindering or _____ to the flow of current.
6. The units used for potential difference are _____, for current are _____, and for resistance are _____.
7. The _____ in a circuit is used to allow or prevent the flow of current.
8. In a _____, symbols are used to represent components in the actual circuit.

Name _____ Date _____

Applying Knowledge
Topic 4.4

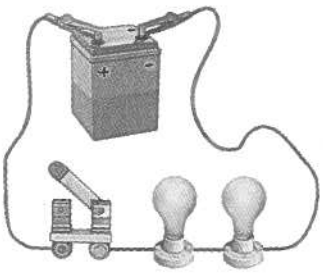
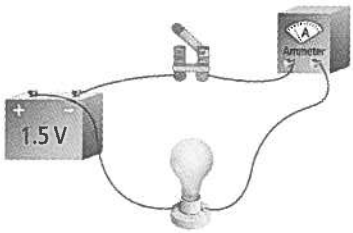
Use with textbook pages 280–281.

Circuit symbols and circuit diagrams

Match the Term in the first column with the correct Illustration and Circuit Symbol in the other two columns. Place the corresponding letter and Roman numeral in the blank spaces provided.

Term	Illustration	Circuit Symbol
1. bulb _____ _____	**A.** 	**I.** 
2. battery _____ _____	**B.** 	**II.** _____
3. open switch _____ _____	**C.** 	**III.** 
4. conducting wire _____ _____	**D.** 	**IV.** 

Use circuit symbols to draw circuit diagrams for each of the following.

5. 	**6.** 

Name _____ Date _____

Comprehension
Topic 4.4

Use with textbook pages 276–283.

True or false?

Read the statements given below. If the statement is true, write "T" on the line in front of the statement. If it is false, write "F" and rewrite the statement to make it true.

1. ___A load in a circuit transforms light energy into electrical energy.

_____

2. ___The wire through which electric current flows is a conductor.

_____

3. ___A switch supplies the energy in a circuit.

_____

4. ___Potential difference describes how the energy of each unit of charge changes as it passes through the source or a load.

_____

5. ___Current is measured in volts.

_____

6. ___An ammeter is used to measure the resistance in a circuit.

_____

7. ___Circuit diagrams use circuit symbols to illustrate actual electrical circuits.

_____

8. ___Resistance is the flow of charges in a circuit.

_____

9. ___With the potential difference across the source remaining unchanged, the current will decrease if the resistance increases.

_____

10. ___With the resistance in the circuit remaining the same, the current will decrease if the potential difference increases.

_____

Name _____ Date _____

Assessment
Topic 4.4

Electrical circuits

Use with textbook pages 274–291.

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ ammeter	**A.** the change in energy of a unit of charge
2. _____ current	**B.** the flow of charges in a conductor
3. _____ electrical circuit	**C.** a quantity that describes the hindering of the flow of charges
4. _____ load	**D.** formed by connecting a source, load, and wires into a closed loop
5. _____ potential difference	**E.** a device that supplies electrical energy to operate any electrical equipment
6. _____ resistance	**F.** a device that converts electrical energy into another form of energy
7. _____ source	**G.** a device that allows or prevents the flow of current in a circuit
8. _____ switch	**H.** a device used to measure the potential difference across a battery or load

9. Complete the chart below to compare potential difference, current, and resistance.

Quantity	Symbol	Unit
potential difference		volts (V)
current		
resistance	*R*	

10. Describe what happens to the negative charges in a simple circuit when

a) the switch is closed

_____

b) they travel through a load

_____

c) they travel through the source

_____

11. Draw a circuit diagram of a circuit that consists of a source, a resistor, connecting wires, and a voltmeter connected to measure the potential difference across the source.

12. Describe two ways in which potential difference and resistance affect current.

_____

_____

Name _____ Date _____

Topic **4.5** Summary

Series and Parallel Circuits

Textbook pages 292–303

Before You Read

Imagine a series of points on the circumference of a circle. Imagine a rectangle divided by parallel lines. How do you think the current will flow in a series circuit and a parallel circuit?

_____

_____

Create a Quiz

After you have read this section, create a five-question quiz based on what you have learned. Trade your quiz with a partner. Answer each other's questions.

Reading Check

1. What is the difference between a series circuit and a parallel circuit?

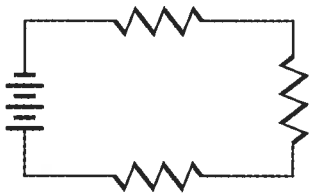
_____

_____

_____

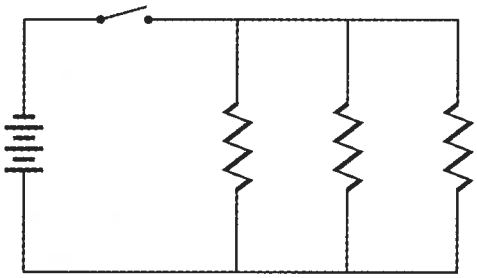
What is a series circuit?

A **series circuit** is an electrical circuit that has only one path on which the current can flow. The components in a series circuit are connected end to end, so the charges pass through every load before returning to the source.



What is a parallel circuit?

A **parallel circuit** is an electric circuit that has two or more paths for the current to follow. You can think of the loads in the parallel circuit as being placed side by side in separate pathways. Some of the charges move through one pathway of the circuit, while other charges move through the other pathways. All the charges return to the source after moving through the pathways.

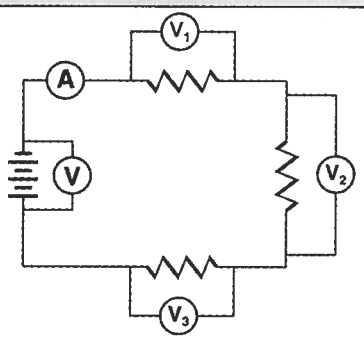
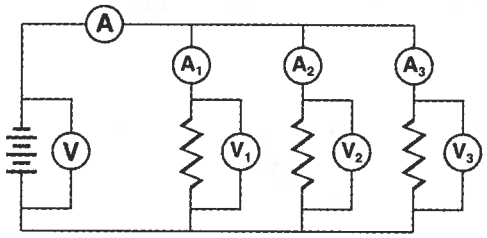


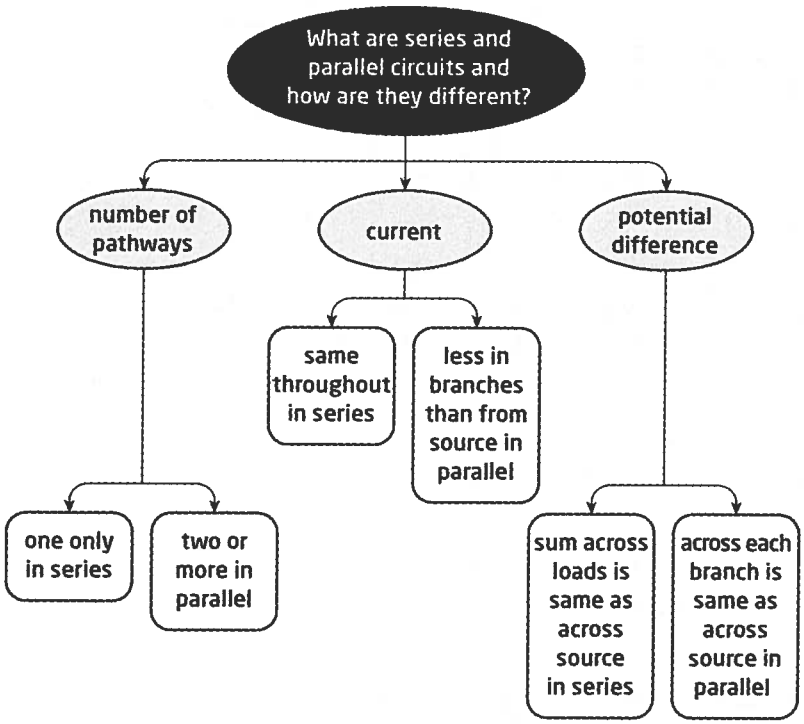
Name _____ Date _____

Topic **4.5** Summary

What happens to the current and potential difference in series and parallel circuits?

The table below summarizes the characteristics of series circuits and parallel circuits in terms of their current and potential difference.

Series circuit	Parallel circuit
	
Current The current in a series circuit is the same at every point in the circuit.	**Current** The current in each branch in a parallel circuit is less than the current through the source.
Potential difference The sum of the potential differences across each load in a series circuit equals the potential difference across the source.	**Potential difference** The potential difference across each branch in a parallel circuit is the same as the potential difference across the source.



Name _____ Date _____

Comprehension
Topic 4.5

Use with textbook pages 294–297.

Series or parallel?

For each of the following statements, identify whether it applies to a series circuit or a parallel circuit. Place a checkmark in the correct column of the chart.

Statement	Series circuit	Parallel circuit
1. The current is the same throughout the circuit.		
2. The potential difference across each load in the circuit is the same.		
3. There is only one pathway on which charges can flow.		
4. There is more than one pathway for current to flow on.		
5. There are points in the circuit where the charges split up and move through different branches.		
6. The sum of the potential differences across the loads equals the total potential difference across the source.		
7. The current in each branch is less than the current through the source.		
8. All of the loads must be on and working at the same time in order for current to flow through the circuit.		
9. When more loads are added to the circuit, the potential difference across each individual load remains the same.		
10. When more loads are added to the circuit, the potential difference across each individual load decreases.		
11. When more loads are added to the circuit, the current leaving the source decreases.		

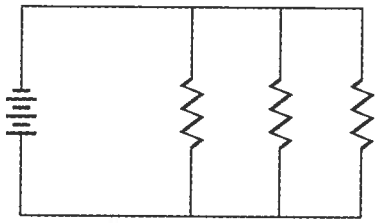
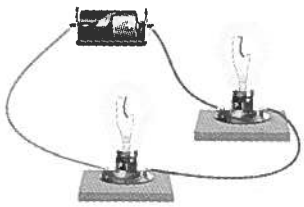
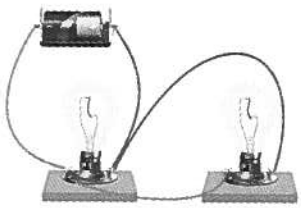
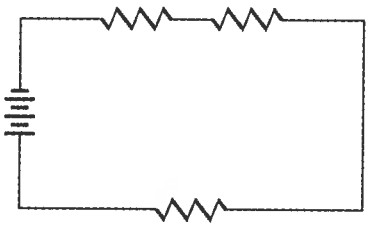
Name _____ Date _____

Illustrating Concepts
Topic 4.5

Use with textbook pages 294–295.

Is it in series or in parallel?

Match each Description on the left with the correct Circuit on the right.

Description	Circuit
1. _____ 3 resistors in series **2.** _____ 3 resistors in parallel **3.** _____ 2 light bulbs in series **4.** _____ 2 light bulbs in parallel	**A.**  **B.**  **C.**  **D.** 

Draw circuit diagrams as described below.

5. Draw a circuit diagram showing a battery and two resistors in series.	**6.** Draw a circuit diagram showing a battery and two light bulbs in parallel.

Name _____ Date _____

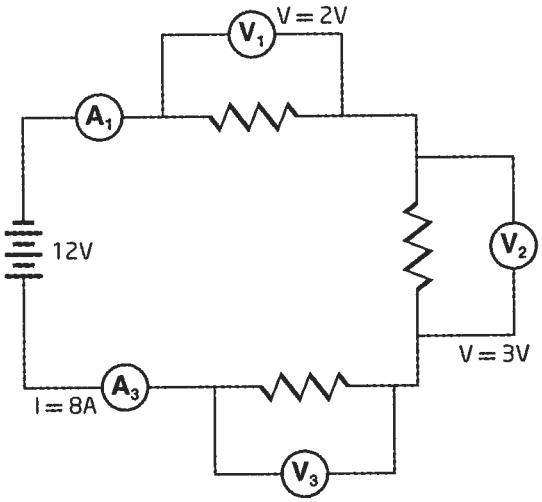
Applying Knowledge
Topic 4.5

Use with textbook pages 296–297.

Calculating current and potential difference

In Circuits 1 and 2 below, the readings on some of the ammeters and voltmeters are given. Determine the values of the rest of the meters.

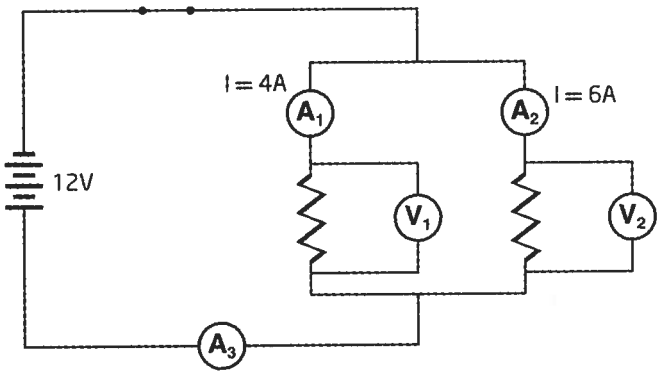
Circuit 1



1. The reading on ammeter A_3 is 8 A. What is the reading on ammeter A_1?

2. The battery provides a potential difference of 12 V. The reading on voltmeter V_1 is 2 V and on voltmeter V_2 is 3 V. What is the reading on voltmeter V_3?

Circuit 2



3. Ammeter A_1 reads 4 A and ammeter A_2 reads 6 A. What is the reading on ammeter A_3?

4. The battery provides a potential difference of 12 V. What are the readings on voltmeters V_1 and V_2?

Name _____ Date _____

Assessment
Topic 4.5

Use with textbook pages 292–303.

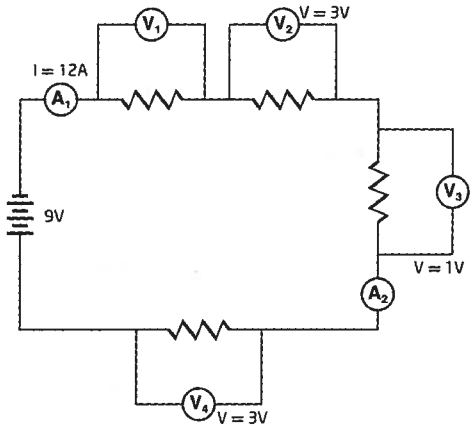
Series and parallel circuits

Match each Descriptor on the left with the Circuit on the right. Each Circuit may be used more than once.	
Descriptor	**Circuit**
1. _____ There is only one path on which the current can flow.	**A.** series circuit
2. _____ There are two or more paths for the current to flow on.	**B.** parallel circuit
3. _____ The current in each branch is less than the current through the source.	
4. _____ The current is the same at every point in the circuit.	
5. _____ The potential difference across each branch is the same as the potential difference across the source.	
6. _____ The sum of the potential difference across each load equals the potential difference across the source.	

7. Draw a circuit diagram showing a battery, a switch, and one resistor in series.

8. Draw a circuit diagram showing a battery and three resistors in parallel.

9. In the circuit below, the readings on some of the ammeters and voltmeters are given. Determine the values of the rest of the meters.



a) The battery provides a potential difference of 9 V. The reading on voltmeter V_2 is 3 V, on voltmeter V_3 is 1 V, and on voltmeter V_4 is 3 V. What is the reading on voltmeter V_1?

b) The reading on ammeter A_1 is 12 A. What is the reading on ammeter A_2?

Name _____ Date _____

Topic **4.6** Summary

Making Circuits Safe

Textbook pages 304–313

Before You Read

What features make an electrical circuit practical and safe? Write your ideas on the lines below.

_____

_____

Mark the Text

Summarize

As you read this section, highlight the main idea in each paragraph. Then write a short paragraph summarizing what you have learned.

Reading Check

1. What is the practical way to wire a building?

_____

_____

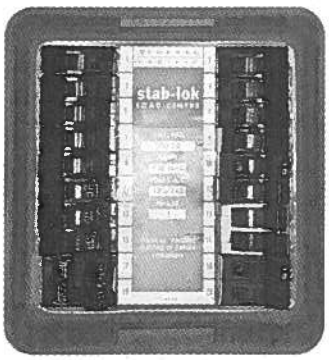
_____

What type of wiring is practical for a building?

In a series circuit, all of the loads must be on and working at the same time. This is not a practical way to connect all the electrical devices in a home. In a parallel circuit, different loads can be turned on without affecting the operation of other loads. However, if too many devices are connected and turned on in a parallel circuit, the conducting wire near the source may become too hot and start a fire. The practical way to wire a building is to use many different parallel circuits. ✔

What are circuit breakers and fuses?

The current that flows through a wire conductor in a circuit can become very high. Circuit breakers and fuses are safety devices that prevent fires when the wire becomes too hot. They do this by creating an opening in the circuit that stops the current from flowing.



circuit breaker panel

In a **circuit breaker**, a strip made of two metals bends when it gets too hot and causes a switch to open. After you have turned off or unplugged some of the electrical devices that caused the circuit breaker to trip, the switch can be reset to the closed position at the breaker panel.

fuse

In a **fuse**, a small wire burns and breaks apart when the current gets too high. A fuse that is "blown out" must be replaced with a new one. ✔

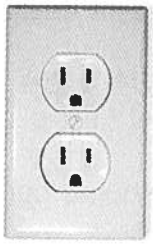
Name _____ Date _____

Topic **4.6** Summary

What other features help make home circuits safe?

Higher-voltage circuits, larger cords and cables, and grounding help make home circuits safe. Special outlets, surge protectors, and power bars are also safety devices found in the home. Some appliances, such as electric stoves and clothes dryers, need more current than a normal 120 V household circuit can supply. By doubling the potential energy to 240 V, a circuit can provide the same amount of energy while using half as much current. A 240 V outlet looks different than the typical 120 V outlet.

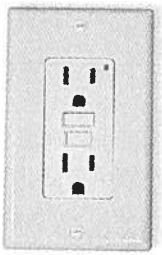
240 V outlet



three-hole outlet

The electrical cords on some appliances are larger than others. The electrical wiring inside the walls and the cables leading from the power company to the house are even larger. Their size allows them to carry more current without becoming too hot.

Grounding is another safety feature in parallel circuits. Every pair of wires in a parallel circuit consists of one hot wire and one grounded wire. The grounded wire directs any excess current to the ground. Some outlets are specially designed to prevent serious shocks from occurring. For example, the third hole in a three-hole outlet grounds the third prong on the plug, which is connected to the metal parts of an electrical device. A ground fault interrupter (or GFI) is a special type of outlet that is installed in bathrooms and other locations within 2 m of water. If water splashes onto you and the electrical device you are using, then current may leave the circuit and pass through you into the ground, giving you a terrible shock. The GFI is very sensitive and immediately opens the circuit when it detects a difference between the current entering one hole and leaving the other. ✔



GFI outlet

✔ ***Reading Check***

2. What happens in a circuit breaker to cause the current to stop flowing?

_____

_____

_____

3. What happens in a fuse to cause the current to stop flowing?

_____

_____

_____

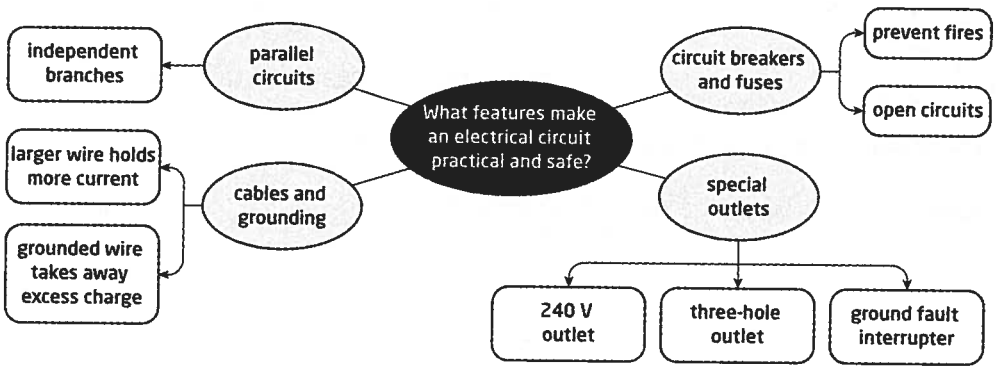
✔ ***Reading Check***

4. List three features that help make home circuits safe.

_____

_____

_____



Name _____ Date _____

Cloze Activity
Topic 4.6

Use with textbook pages 306–311.

Practical wiring in the home

Vocabulary	
circuit breaker	opening
closing	parallel
fuse	series
ground fault interrupter (GFI)	smaller
grounded	three-hole outlet
larger	240 V outlet

Use the terms in the vocabulary box to fill in the blanks. You can use each term more than once. You will not need to use every term.

1. Practical wiring in the home consists of several _____ circuits.
2. Circuit breakers and fuses prevent fires by _____ a circuit when the current is too high.
3. A _____ contains a small wire that melts when the current gets too high. A _____ contains a strip made of two metals that bends when it gets too hot.
4. To carry more current without becoming too hot, the cables leading from the power company into the home are _____ than a typical electrical cord on an appliance.
5. Some appliances need more current than other appliances. For example, stoves have a special plug that fits into a _____ .
6. The third hole in a _____ grounds the third prong on the plug of an electrical device.
7. A _____ is installed in bathrooms and other locations near water.
8. A GFI works by _____ the circuit when it detects a difference between the current entering one hole and leaving the other.
9. A GFI helps to save lives by working quicker than a _____ or a _____.

Name _____ Date _____

Comprehension
Topic 4.6

Use with textbook pages 308–309.

Circuit breaker or fuse?

For each of the following statements, identify whether it applies to a circuit breaker, a fuse, or both. Place a checkmark in the correct column of the chart.

Statement	Circuit breaker	Fuse	Both
1. It is a safety device that stops the current from flowing by creating a gap in the circuit.			
2. It is a safety device that prevents any circuit from carrying too much current and starting a fire.			
3. It contains a small wire that will melt and break apart when the current gets too high.			
4. It has a strip made of two metals that bends when the metals get hot and causes a switch to open.			
5. It can be reset by pushing the switch on the breaker panel back into place.			
6. Once it is "blown," it must be replaced with a new one.			

Name the electrical devices shown in the diagrams.

7.

_____

8.

_____

Name _____ Date _____

Comprehension
Topic 4.6

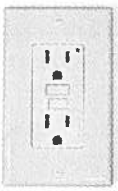
Use with textbook pages 310–311.

Cords, cables, and outlets

Match each Situation on the left with the Safety Device on the right. Each Safety Device may be used more than once.

Situation	Safety Device
1. _____ A stove needs to be connected to a high voltage circuit.	**A.** 240 V outlet
2. _____ An electric hair dryer is used in the bathroom near the sink.	**B.** larger cord or cable
3. _____ A computer is plugged into an outlet in the bedroom.	**C.** three-hole outlet
4. _____ The current travels from the power company to a home.	**D.** ground fault interrupter (GFI)
5. _____ A toaster or iron uses more current than other appliances.	
6. _____ A clothes dryer needs more current than a normal 120 V circuit can supply.	

7. Name the following three outlets.



_____ _____ _____

8. Explain why the situation shown in the illustration may be dangerous.

_____

_____

_____

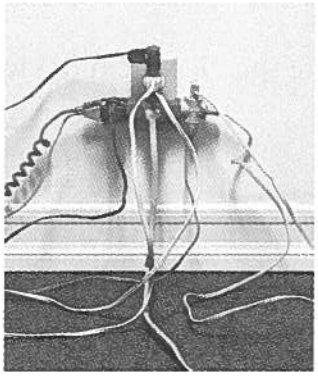
_____

_____

_____

_____

_____



Name _____ Date _____

Assessment
Topic 4.6

Use with textbook pages 304–313.

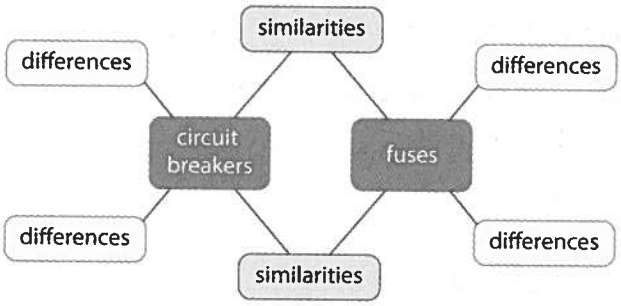
Making circuits safe

Match each Term on the left with the Illustration on the right. Each Illustration may be used only once.

Term	Illustration
1. _____ circuit breaker panel	**E.** 
2. _____ fuse	**F.** 
3. _____ ground fault interrupter	**G.** 
4. _____ three-hole outlet	**H.** 
5. _____ 240 V outlet	**I.** 
	J. 

6. Copy and complete the organizer below to compare all the features of circuit breakers and fuses that are the same and all the features that are different.

- small wire melts
- strip made of two metals bends
- prevents fire when the wire becomes too hot
- opens circuit to stop current from flowing
- can be reset
- must be replaced



7. Complete the following table to compare how the different devices improve safety.

Safety device	How it improves safety
high voltage circuit (240 V outlet)	
larger cords or cables	
grounded wire	
three-hole outlet	
ground fault interrupter	

8. The cord on an electric heater is larger than the cord on a clock radio. Why do you think this is so?

_____

_____

Name _____ Date _____

Topic **4.7** Summary

Conserving Energy

Textbook pages 314–323

Before You Read

How can we conserve electrical energy at home? Write your ideas on the lines below.

_____

_____

Mark the Text

In Your Own Words

Highlight the main idea in each paragraph. Stop after each paragraph and put what you just read into your own words.

Reading Check

1. What unit is used to measure energy?

_____

Reading Check

2. What does a time-of-use price depend on?

_____

_____

_____

How is energy measured?

Electrical energy used at home is measured in units called **kilowatt hours (kWh)**. One kilowatt is equivalent to one thousand watts (1 kW = 1000 W). Most appliances have a label on them with the number of watts they use. If an appliance with a rating of 1000 W is turned on for 1 hour, then 1 kWh of energy will have been used.

How are electrical meters changing?

A meter attached to the side of houses or apartment buildings is used to measure the amount of energy used. The cable that brings electrical energy into the building runs through the meter first. For the old-style meters, a worker from the power-supply company would come to read and record the numbers on the meters on a regular basis. Then, back at the main office, the computer would calculate the cost of the energy used for that month.

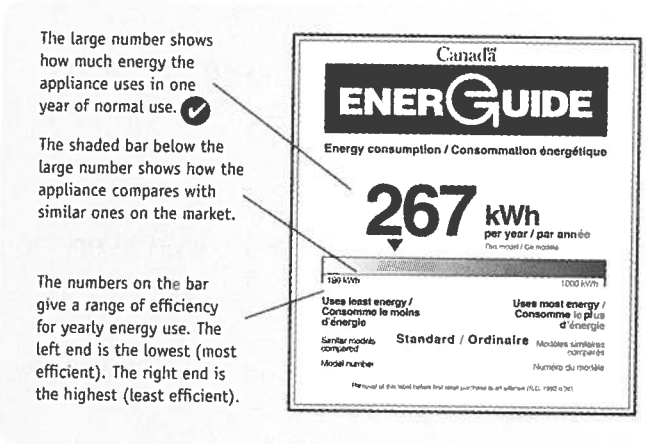
By the year 2010, new smart meters will replace the old-style meters. **Smart meters** keep track of the amount of energy used during each hour of the day and can send this data automatically to the power-supply company. Smart meters allow power-supply companies to charge different rates for different times of the day. **Time-of-use prices** are highest during on-peak use (when the most electrical energy is used), and lowest during off-peak use (when the least electrical energy is used). Periods between on-peak use and off-peak use are called mid-peak hours. The schedule for on-peak, mid-peak, and off-peak periods is different during the winter and summer.

Name _____ Date _____

Topic **4.7** Summary

How can people conserve energy?

People can conserve energy by using more energy-efficient appliances. The amount of energy an appliance uses in a typical year is shown on an **EnerGuide label**. Sometimes, an appliance that uses less energy costs more to buy than one that uses more energy, but over the life of the appliance, the lower energy bills will compensate for the difference in cost.



The Government of Canada has set standards of efficiency for electrical appliances. Those that meet or exceed these standards have the **ENERGY STAR* label** for easy identification.

What is a phantom load?

Another way to save electrical energy is to unplug devices when they are not being used. Some electrical devices remain in standby mode even when they are switched off. For example, the ability for a television to sense the signal from the remote is always on, even when the television itself is turned off. This use of electrical energy in standby mode is called a **phantom load**.

Reading Check

3. What information does the large number on an EnerGuide label indicate?

_____

_____

_____

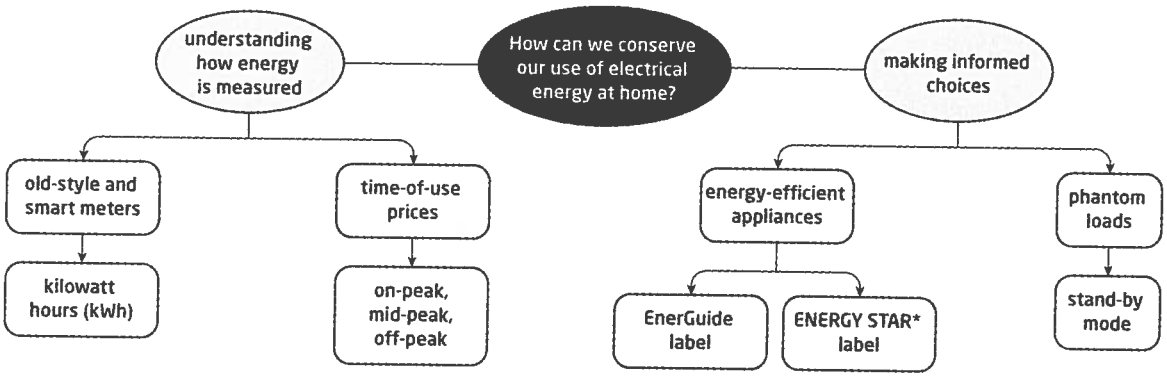
Reading Check

4. What is a phantom load?

_____

_____

_____



Name _____ Date _____

Cloze Activity
Topic 4.7

Use with textbook pages 316–319.

Using energy wisely

Vocabulary	
EnerGuide label	phantom load
ENERGY STAR* label	smart meters
kilowatt hours (kWh)	time-of-use prices
old-style meters	watts (W)

Use the terms in the vocabulary box to fill in the blanks. You can use each term more than once. You will not need to use every term.

1. The unit of measurement for energy is _____.
2. _____ measure the amount of energy used every hour in the home.
3. The power-supply company must send a person to read and record the numbers on _____.
4. _____ transmit the data automatically to the head office.
5. The use of _____ allow power-supply companies to charge different prices for different times of the day.
6. _____ depend on the time of day that the energy is used. Companies charge more during on-peak use and less during off-peak use.
7. A(n) _____ shows how much energy the appliance uses in a typical year.
8. A(n) _____ identifies appliances that meet or exceed the standards of energy efficiency.
9. The label that shows how the appliance compares with similar ones on the market is the _____.
10. The electrical energy used by a device when it is turned off is called a _____.

Name _____ Date _____

Applying Knowledge
Topic 4.7

Use with textbook pages 316–317.

Calculating an energy bill

House A has an old-style meter that continuously measures the amount of energy used in the building. House B has a smart meter that measures the amount of energy used during each hour of the day.

1. Calculate the cost of the energy used in each house using the formula:

   Cost of the energy used = (Number of kilowatt hours used) × (Charge for 1 kWh)

House A	House B
600 kWh of energy are used during the month at a rate of 6.6¢ per kWh.	100 kWh of energy are used during off-peak hours at a rate of 4.0¢ per kWh. 125 kWh of energy are used during mid-peak hours at a rate of 7.2¢ per kWh. 375 kWh of energy are used during on-peak hours at a rate of 8.8¢ per kWh.

2. House A and House B both used a total of 600 kWh. Which house paid more for its energy bill? _____

3. What could House B do next month to save more money on its energy bill?

   _____

   _____

Name _____ Date _____

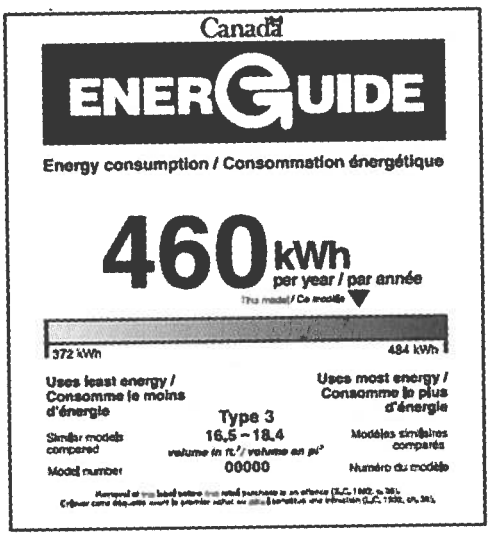
Analyze the Information
Topic 4.7

Use with textbook page 318–319.

Reading EnerGuide labels

The information displayed on EnerGuide labels can be used to compare the energy consumption of major appliances and heating and cooling equipment.

1. The EnerGuide label for an appliance shows how much energy the appliance uses in one year of normal use.

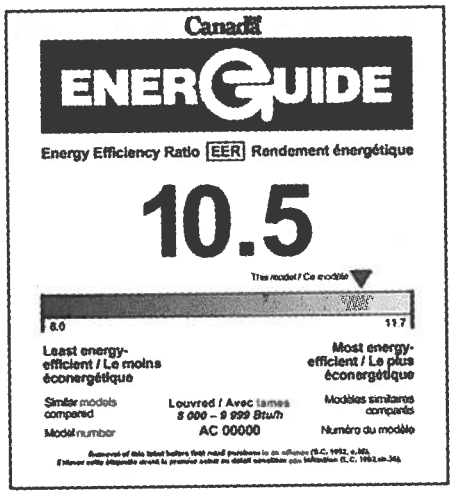


a) What is the estimated consumption of energy per year for this appliance?

b) Is the energy consumption of this model closer to that of the most efficient model or the least efficient model? _____

c) Underline the statement that is true:
- The lower the number of kilowatt hours, the more energy-efficient the appliance.
- The higher the number of kilowatt hours, the more energy-efficient the appliance.

2. The EnerGuide label for a furnace or air conditioner shows the energy efficiency ratio (EER) of the unit. The EER is based on a test procedure that manufacturers must follow.



a) What is the energy efficiency ratio of this air conditioner? _____

b) Is the energy efficiency of this model closer to that of the most efficient model or the least efficient model?

_____

c) Underline the statement that is true:
- The lower the EER, the more energy-efficient the air conditioner.
- The higher the EER, the more energy-efficient the air conditioner.

Name _____ Date _____

Assessment
Topic 4.7

Use with textbook pages 314–323.

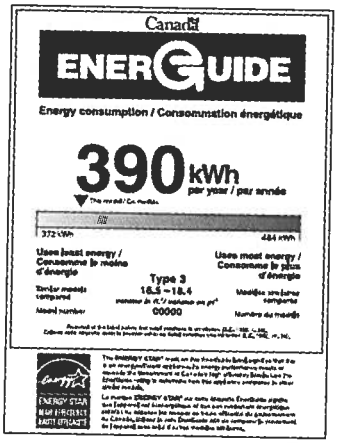
Conserving energy

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ EnerGuide label	**A.** identifies appliances that meet or exceed the standards of energy efficiency
2. _____ ENERGY STAR* label	**B.** requires a worker from the power-supply company to record the amount of energy used
3. _____ kilowatt hours	**C.** measures the amount of energy used every hour in a house or apartment building
4. _____ phantom load	**D.** different charges for energy used at different times of the day
5. _____ smart meter	**E.** unit of measurement for energy
6. _____ time-of-use prices	**F.** shows how an appliance compares with similar ones on the market
	G. electrical energy used by a device when it is turned off

7. If a house uses 525 kWh of energy and the power-supply company charges 6.6¢ per kWh, how much is the energy bill?

8. Use the EnerGuide label to answer these questions.



a) What is the estimated consumption of energy per year of the least efficient appliance that is similar to this one? _____

b) What is the estimated consumption of energy per year of the most efficient appliance that is similar to this one? _____

c) What is the estimated consumption of energy per year for this appliance? _____

d) How can you tell if this appliance is energy-efficient? _____

9. Explain how each of the following helps conserve energy.

a) buying an appliance with an ENERGY STAR* label on it

_____

_____

_____

b) unplugging an electrical device that has already been turned off

_____

_____

_____

Name Date

Unit 4

Literacy Test Preparation

Read the selection below and answer the questions that follow it.

A lightning strike can be deadly. It carries up to 100 million volts of electricity—that's more than 1 million times more powerful than typical household voltage. A lightning strike can cause burns or cardiac arrest when the current enters the body. People who survive a lightning strike often suffer long-term health effects such as memory loss, organ damage, or problems with the nervous system.

In Canada, lightning flashes occur approximately 2.7 million times in a year, about once every three seconds during the summer months of June to August. This data is based on observations collected from 1998–2002 by the Canadian Lightning Detection Network (CLDN). Eighty-three sensors set up across Canada detect the strength and location of the lightning flashes and then send the information to Environment Canada's weather centres, where it is mapped out onto a computer screen.

Data on "flash density"—the number of flashes per square kilometre per year of cloud-to-ground and cloud-to-cloud lightning—shows that Canada's lightning hot spots are southern Ontario, southern Saskatchewan, and the foothills of Alberta. The three Canadian cities that experience the most lightning are Windsor, Toronto, and Hamilton. Each year in Canada, lightning strikes kill from 6 and 10 people, injure about 70 others, and cause thousands of forest fires. Lightning is one of Canada's deadliest weather phenomenon in the summer.

Multiple Choice

Select the best answer.

1. How does lightning differ from typical household voltage?
   - **A.** the sound it makes
   - **B.** how powerful it is
   - **C.** its speed
   - **D.** it causes a shock
2. What is the best meaning for "phenomenon" in this selection?
   - **A.** occurrence
   - **B.** location
   - **C.** sensor
   - **D.** map
3. What does the Canadian Lightning Detection Network do?
   - **A.** map out the location of lightning strikes onto a computer screen
   - **B.** kills between 6 and 10 people, injures about 70 others, and causes thousands of forest fires.
   - **C.** carries up to 100 million volts of electricity
   - **D.** detect the strength and location of lightning flashes

4. Why would words be placed in parentheses in the first sentence of the last paragraph?
   A. to explain the cause of lightning
   B. to clarify what is "flash density"
   C. to show in what order are the cities with the most lightning activity
   D. to demonstrate that lightning travels at a faster speed than sound

5. What do "lightning hot spots" suggest to the reader?
   A. Lightning causes those places to experience higher temperatures than in other places.
   B. Lightning burned the ground in those spots where it struck.
   C. Lightning strikes those areas more than any other area in the country.
   D. Lightning only strikes those areas and nowhere else.

6. What idea connects the first and last sentences?
   A. deadly phenomenon
   B. lightning hot spots
   C. Canadian Lightning Detection Network
   D. flash density

Written Response

7. Use evidence from the selection to explain why lightning is called one of Canada's deadliest summer weather phenomena.

_____

_____

_____

_____

_____

_____