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Investigating
SCIENCE

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Investigating *SCIENCE*

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ISBN-13: 978-0-13208062-0

ISBN-10: 0-13-208062-1

Printed and bound in Canada

2 3 4 5 6 TC 13 12 11 10 9

PUBLISHER: Reid McAlpine

MANAGING EDITOR: Lee Ensor

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DIRECTOR OF PUBLISHING: Yvonne Van Ruskenveld (Edvantage Press)

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DESIGN: Alex Li

COMPOSITION: Carolyn E. Sebestyen

ILLUSTRATORS: Kevin Cheng, Crowle Art Group, Imagineering Media Services, Jane Whitney

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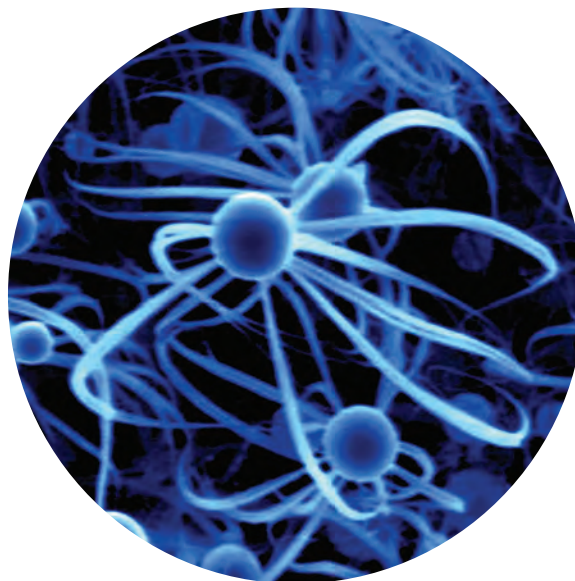
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You are about to begin a scientific exploration using *Investigating Science 9*. To assist you in your journey, this book has been designed with the following features to help you.

1. Unit Overview — what you will learn

The book is divided into four units. Each unit opens with a large photograph that captures one of the ideas that will be covered in the unit.

Unit Contents

- 1 Ecosystems are complex, self-regulating systems of organisms and their abiotic environments.**
 - 1.1 Ecosystems
 - 1.2 Nutrient Cycles and Energy Flow
 - 1.3 Interactions in Ecosystems
- 2 Human activity affects the sustainability of ecosystems.**
 - 2.1 Human Use of Ecosystems
 - 2.2 Assessing the Impact of Human Activities on Ecosystems
- 3 Governments, groups, and individuals work to promote sustainable ecosystems.**
 - 3.1 Government Action to Protect Canada's Ecosystems
 - 3.2 Environmental Stewardship

Unit Task

You will be part of a team that is designing a totally sustainable community to be built in your area. You will look into how resources are currently used in your area, and research ways to lessen the impact on your local ecosystems.

Essential Question

How do human activities, both positive and negative, affect the sustainability of ecosystems?

The unit **Contents** lists the Chapters, Key Ideas, and sections in the unit. The orange DI box indicates essential lessons that have additional differentiated instruction support in the Teacher's Resource.

An introduction to the **Unit Task** is provided below the unit Contents. This task is revisited at the end of each chapter, providing you with an opportunity to review key ideas covered in the chapter that will be required to successfully complete the Unit Task.

2. Exploring — adds interest

This spread is an introduction. It has an interesting real-world example to introduce the unit.

Exploring

Cootes Paradise

The lush green of Cootes Paradise hangs up against the hard edge of the city of Hamilton. Cootes Paradise is a wetland located beside the city of Hamilton. A wetland is an area in which the soil is saturated with water for at least part of the year. Wetlands provide a home for many different species of fish, plants, insects, and birds. Many people also use wetlands for camping, fishing, and wildlife viewing.

Pollution and urban development have affected Cootes Paradise, but another factor has taken its toll on the wetland—pesticides. These fish feed in the shallow waters by pulling up the roots of water plants, damaging the plants and making the waters as they go. This makes it difficult for water plants and other fish species to survive. Almost 80 percent of the water plants in the marsh have disappeared. This was never supposed to happen.

Taking Action

In 1983, the municipal government of Hamilton and the local community joined together to take on the challenge of restoring Cootes Paradise. One of the many things they did was to install a dike at the entrance to Cootes Paradise. It allows small fish to enter the wetland but prevents large fish from entering. The large fish are then captured and inspected. Wetland fish species are returned to Cootes Paradise, but adult carp are not. The dike project has been a tremendous success and wetland plant and fish species are recovering.

Pesticide Use Across the Country

Household Using Pesticides per Year or Less

Province/Territory	Year	Number of Pesticides
Canada	1994	~100
Canada	2007	~80
Alberta	1994	~100
Alberta	2007	~80
British Columbia	1994	~100
British Columbia	2007	~80
Manitoba	1994	~100
Manitoba	2007	~80
Ontario	1994	~100
Ontario	2007	~80
Quebec	1994	~100
Quebec	2007	~80
Saskatchewan	1994	~100
Saskatchewan	2007	~80
Atlantic	1994	~100
Atlantic	2007	~80

Science, Technology, Society and the Environment

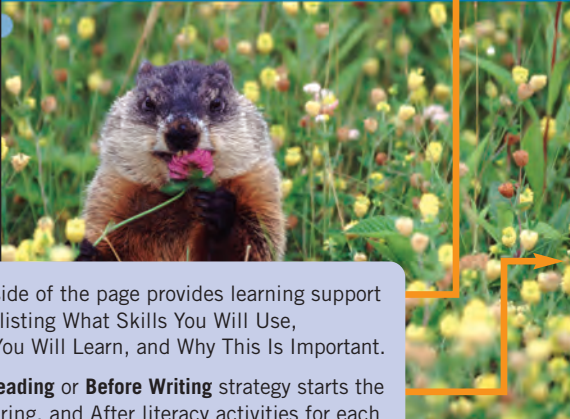
- Why does such a pesticide issue exist?
- Which one of the regions in the graph is the lowest? Which one is the highest?
- Which province had the highest pesticide use in 1994 and 2007?
- Which province had the lowest pesticide use in 1994 and 2007?
- Which province had the most change in pesticide use from 1994 to 2007?
- Did pesticide use in this country increase or decrease between 1994 and 2007?

This activity connects the themes of Science, Technology, Society, and the Environment to what you are learning.

3. Chapter Introduction — organizes the topics

Each chapter starts with an engaging visual designed to motivate your interest and provide discussion opportunities for the class.

1 Ecosystems are complex, self-regulating systems of organisms and their abiotic environments.



Skills You Will Use

In this chapter, you will:

- Interpret data from undisturbed and disturbed ecosystems and graph the results, and explain the importance of biodiversity for all sustainable ecosystems.

Concepts You Will Learn

In this chapter, you will:

- Describe the complementary processes of photosynthesis and cellular respiration with respect to the flow of energy and the cycling of matter within ecosystems, and explain how human activities can disrupt the balance achieved by these processes.
- Describe the limiting factors and explain how these factors affect the carrying capacity of an ecosystem.
- Identify Earth's four spheres: biosphere, hydrosphere, atmosphere, and geosphere, and describe how these spheres interact to maintain sustainability and biodiversity.

Why It Is Important

There are many different ecosystems on Earth. If we know how an ecosystem functions as a system, we can analyze how human activities sometimes disrupt ecosystems and make them unsustainable. We can then help to repair or restore ecosystems.

Science Reading

Visualize to Understand

Good readers picture words and whole phrases of text in their minds. Preview the key terms and main understandings in Section 3.1 and use the words or parts of words you know to begin constructing a picture of ecosystems.

Key Terms

- abiotic • atmosphere • biodiversity • biosphere • biotic • carrying capacity • cellular respiration • ecosystem • energy pyramid • hydrosphere • limiting factor • lithosphere • nutrient cycle • photosynthesis • population

The right side of the page provides learning support for you by listing What Skills You Will Use, Concepts You Will Learn, and Why This Is Important.

A **Before Reading** or **Before Writing** strategy starts the Before, During, and After literacy activities for each chapter.


4. Sections — engaging information on the topics

There are two or three sections in each chapter. Each section starts with a reading and a Quick Lab activity.

1.1 Ecosystems

Here is a summary of what you will learn in this section:

- Ecosystems are systems of organisms and their abiotic environments.
- Ecosystems include biotic (living) and abiotic (non-living) components.
- Ecosystems include biotic (living) and abiotic (non-living) components.
- The biosphere is composed of the atmosphere, hydrosphere, and lithosphere.



Planet Earth

High above the clouds, the International Space Station offers a breathtaking view of Earth (Figure 3.1). Canadian astronaut Terry Williams has been privileged to see that view first-hand. After returning to Earth, he had this to say about his experience:

"I am truly in awe of the beauty of the planet, and it's something I've been able to experience in so many different environments, whether in space, underwater, camping, hiking, climbing mountains or whatever. For me, it's a sense of planetary stewardship."

Stewardship is a way of acting that involves taking personal responsibility for the management and care of something. Planetary stewardship means working to take care of the whole world. A core common term for this is environmental stewardship. The environment is all the living and non-living things that exist on Earth as well as their interactions with each other. The beautiful blue sphere that astronauts have photographed from space helps us to remember that the resources for our environment are limited. All life depends on what is contained on that sphere. While the view from space is new to us, the idea of the importance of environmental stewardship is far from new.

Quick Lab

Representing Canadian Biodiversity

There are many different types of organisms in Canada. To track the 1990s biodiversity, similar systems are placed into categories. For example, type, size, and how can be grouped under "mammals," in this activity you will track a visual representation of the 14 categories of organisms shown in Table 3.1.

Table 3.1 Canadian Biodiversity

Category	Number of Species
Mammals (e.g., bear)	4,500
Reptiles and amphibians (e.g., snake, frog)	13,500
Fish (e.g., trout)	22,000
Crustaceans (e.g., shrimp)	40,000
Mollusks (e.g., clam)	70,000
Arachnids (e.g., spider)	12,000
Birds (e.g., hawk)	10,000
Insects (e.g., fly)	800,000
Arachnids (e.g., spider)	70,000
Fungi and lichens (e.g., mushroom)	100,000

Each section includes a summary of what you will learn in the section.

The **Quick Lab** activity is a short, informal learning experience using simple materials and equipment.

During Reading and **During Writing** literacy activities provide you with an opportunity to consolidate your understanding.

The **Learning Checkpoint** allows you to check your understanding of what you have just read.

Words Matter helps you understand a term by describing its origin.

Understanding Check Features

Check for understanding in various ways: Read, think, and discuss. Use the text to check your understanding. Use the text to check your understanding. Use the text to check your understanding.

Table 3.2 Selected Element Names and Symbols

English Name	Symbol	Non-English Name and Meaning
Hydrogen	H	Hydro (water) + gen (forming)
Helium	He	Helios (sun)
Lithium	Li	Lithos (stone)
Boron	B	Boros (to pierce)
Carbon	C	Char (burnt)
Nitrogen	N	Nitros (nitric acid)
Oxygen	O	Oxy (acid) + gen (forming)
Fluorine	F	Fluor (to melt)
Sulfur	S	Sulfur (to burn)
Chlorine	Cl	Chloros (green)
Argon	Ar	Argos (lazy)
Neon	Ne	Neos (new)
Sodium	Na	Natrium (salt)
Potassium	K	Potash (plant food)
Calcium	Ca	Calx (lime)
Strontium	Sr	Strontian (town)
Yttrium	Y	Ytterby (town)
Zinc	Zn	Zinc (to purify)
Bromine	Br	Bromos (stench)
Iodine	I	Iodos (purple)
Barium	Ba	Baros (heavy)
Lanthanum	La	Lanthanos (to throw)
Cerium	Ce	Ceria (earthenware)
Praseodymium	Pr	Prasios (green)
Neodymium	Nd	Neodimos (new)
Europium	Eu	Europa (continent)
Gadolinium	Gd	Gadolin (town)
Terbium	Tb	Terby (town)
Dysprosium	Dy	Dyspros (difficult)
Homium	Ho	Holmia (town)
Erbium	Er	Erbium (town)
Thulium	Tm	Thule (land)
Ytterbium	Yb	Ytterby (town)
Lutetium	Lu	Lutetia (town)
Hafnium	Hf	Hafnia (town)
Tantalum	Ta	Tantalos (god)
Tungsten	W	Tungsten (hard)
Rhenium	Rh	Rhenus (river)
Osmium	Os	Osmia (beehive)
Iridium	Ir	Iridos (rainbow)
Ruthenium	Ru	Ruthenia (land)
Rhodium	Rh	Rhodos (island)
Palladium	Pd	Palladia (town)

- Learning Checkpoints**
- What would happen if the atmosphere were not there?
 - Give an example of a natural resource that is being used up.
 - What would happen if the atmosphere were not there?
 - What would happen if the atmosphere were not there?
 - What would happen if the atmosphere were not there?

Some Common Elements

Human history has long been influenced by the availability of certain elements. Iron, for example, occurs naturally in Earth's crust in iron ores. As early as 3000 years ago, humans began to extract iron from these ores. Iron was used to make tools and weapons. Iron was also used to make coins. Iron was used to make ships. Iron was used to make bridges. Iron was used to make everything.

Iron (Fe)

Iron is quite common, and once separated from ore, it can be used for a wide range of items. Iron is very strong, and when combined with carbon to make steel, it is even stronger (Figure 3.24). Another advantage of steel is that it can be made fairly resistant to corrosion. In contrast, plain iron corrodes easily in moist air, forming an orange compound known as rust.

Like most metals, iron is a shiny grey and can be melted and shaped when heated. It is hard enough to keep a sharp edge, a property that people have used for centuries in order to make tools and household items.



4. Sections — engaging information on the topics (continued)

Skill Builder Activity reviews or reinforces certain skills necessary for completing some of the activities.

Example Problems show the detailed steps in solving problems.

Practice Problems model the example problem and provide opportunities for further practice. Use these problems to check if you understand the concept being discussed.

Just-in-Time Math provides an opportunity to review some of your math skills before using those skills in an activity.

Check and Reflect questions provide opportunities for you to review the main ideas you have learned in each section.

At the end of the section is a **Take It Further**. This is an additional way to study one of the ideas in the section.

You will find many photos and illustrations to help explain or clarify many of the ideas in the unit.

The **Chapter Review** contains questions relevant to the whole chapter. Answering the questions will help you consolidate what you have learned in the various parts of the chapter.

The **Unit Task Link** provides you with an opportunity to review key ideas covered in the chapter that will be required to successfully complete the Unit Task.

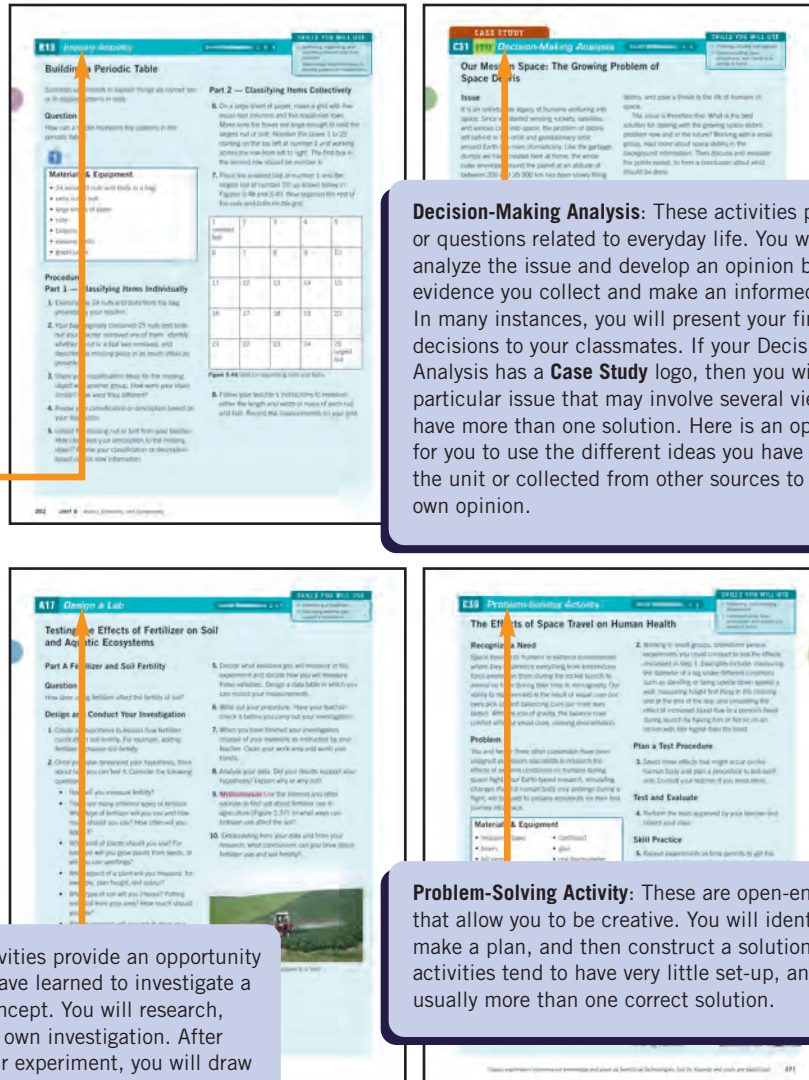
After Reading or After Writing literacy activities provide you with an opportunity to consolidate your understanding

5. Activities — develop your science skills

There are five main types of activities: Inquiry Activities, Quick Labs, Decision-Making Analyses, Problem-Solving Activities, and Design a Lab activities. The Quick Lab was discussed on page xix.

Inquiry Activity: These activities provide the opportunity for you to work in a lab setting. You will develop scientific skills of predicting, observing, measuring, recording, inferring, analyzing, and many more. In these activities, you will investigate many different phenomena found in our world.

Design a Lab: These activities provide an opportunity to apply the skills you have learned to investigate a question related to a concept. You will research, plan, and carry out your own investigation. After collecting data from your experiment, you will draw conclusions and report on your findings.



6. Unit Summary — a review of what you've learned

At a glance, you can find all of the key concepts you have learned within the unit. You can also read the summary of ideas in each section of the unit as well as review vocabulary and key visuals. These pages can help you organize your notes for studying.

[illegible]

7. Unit Task – lets you demonstrate learned skills

The task requires you to apply some of the skills and knowledge that you have acquired during the unit.

UNIT
A Task

Building a Sustainable Community

Getting Started

Designing your own village and being more sustainable about everything are two simple ways to move towards a more sustainable lifestyle. Imagine if your entire community adopted such practices at a big scale. There are communities that do. They even have a name – eco-villages. Eco-villages are self-sufficient, sustainable communities designed to have a minimal impact on surrounding landscapes. Eco-villages typically control food and fuel consumption, eco-friendly by the way, work, and play in a rural setting to minimise consumption, which reduces energy consumption. Having a short commute to work or school can be a more satisfying than spending hours in a car in traffic.

A green-roofed house in Delftland, an eco-village in Holland.

Your Goal

The group's task involves three steps:

1. First, you will investigate in what ways certain aspects of your own community may be environmentally unsustainable.
2. Then, you will research changes that can be made to make some of these aspects more sustainable.
3. Finally, you will use your research to design a completely sustainable community for your village.

Criteria for Success

You will work effectively and cooperatively as part of a team designing a new village. You will accomplish specific tasks on the team, such as:

- building
- goal setting
- technological
- waste management
- waste reduction
- innovation/creativity!

You will research aspects of the eco-village setting to give you an insight and collaborate with the other team members to build the Village.

For the sake of expedience you agreed to research, you will:

- outline the ways the community/institution is unsustainable
- outline specific changes that will increase the sustainability of the community/institution

What You Need to Know

Most eco-villages share several key characteristics, including the following:

- use of renewable energy sources
- agriculture that is friendly towards to reduce risk conditions
- homes built using techniques and materials that have a minimal impact on the environment
- homes that have the capacity to produce water, and sewage solutions without relying on a combination system

What You Need

- computer with internet access

Procedure

1. In your group, brainstorm aspects of your local community that are unsustainable. Organize your thoughts into the following categories: buildings, food, technology, water, waste, and recreation. Brainstorm possible concerns with:
2. Current building design and construction practices
3. Current food production and consumption patterns
4. Energy demand of global, national, and local areas
5. Local water demand and use, local peak use for water usage on agriculture, industry, and local recreation
6. How we use your community's resources, money, and materials
7. Local ecological issues that may hinder change or fragmentation on pollution

Buildings can bring environmental care to the village through being green. In terms of use, the use of energy is reduced, less water and chemicals being used.

2. Decide which report site each person will assume. Use the results of the group investigation to report to your final of expertise to create a group of experts.
3. **Minimum:** Do an internet search into eco-knowledge such as "eco-village," "sustainable community," "permaculture," to find information related to the concept of sustainable community or are researching.
4. As a group, decide on the final building for your village. Keep in mind that your village should be as self-sufficient as possible. Your location should then be ready access to building materials, waste, pieces of equipment and landscape.
5. Distribute your own team to design an eco-village that incorporates some of each expert's ideas.
6. Consider how to present your design ideas. You will create a design at a PowerPoint presentation, a scene, a video game, or use some other method!

Present your eco-village design.

Assess Your Work

1. Do you think building a completely sustainable community is possible? Explain.
2. What were the advantages and disadvantages of having a group of experts create the eco-village concept?

Permaculture, modern group houses are of growing interest.

122 UNIT 4 Sustainable Communities

UNIT 4 Task 1/21

The Unit Review is an opportunity to review the concepts, skills, and ideas you have learned in the unit.

Key Terms Review
This is a chance to review the important terms in the unit

[illegible]

Connect Your Understanding
Questions that require you to use the ideas in more than one chapter in your answers

Skills Practice
Questions related to specific skills
you have learned in the unit

UNIT 1 Review (continued)

57. The graph shows how the population of a foreign-born group on an island. How would you explain the changes in population?

Year	Population
1950	0
1960	100,000
1970	200,000
1980	300,000
1990	400,000
2000	500,000

58. A population of worms was also introduced in the same island that had the caribbeans in question 57. The following table contains soil population data. Use the graph and data from the table to develop a hypothesis that explains the fluctuations in the deer population and the island's carrying capacity.

Year	Soil Population
1950	100
1960	150

59. The population of fish in Canada and Ontario reflects data on fish catches as shown in the following table:

Year	Total Commercial Landings	Total Recreational Landings
1990	780,000	60,000
1995	820,000	60,000
2000	850,000	50,000
2005	880,000	40,000
2010	910,000	30,000
2015	940,000	20,000
2020	970,000	10,000

(a) Graph both sets of data. Analyze the trend of the graph(s) that have been caught.

(b) Predict how many fish would be caught in 2025 and 2030.

(c) Propose an explanation for the decreasing commercial catch in Canadian waters.

(d) Based on the graph of total annual harvest from the graph of total annual harvest from approaches, will the fish levels of Canada then be met?

(e) Add the extra data to the table below in your notebook.

Year	Commercial Catch	Recreational Catch
2002	800,000	50,000
2003	820,000	45,000
2004	840,000	40,000

Revisit the Big Ideas and Fundamental Concepts

Questions that revisit the Big Ideas and Fundamental Concepts covered in the unit

Science, Technology, Society, and the Environment

Questions that revisit the Science, Technology, Society, and the Environment covered in the unit

Revisit the Big Ideas and Fundamental Concepts

Questions that revisit the Big Ideas and Fundamental Concepts covered in the unit

Science, Technology, Society, and the Environment
Opportunities to express your thoughts about ideas related to Science, Technology, Society, and the Environment issues discussed in the unit

Opportunities to express your thoughts about ideas related to Science, Technology, Society, and the Environment issues discussed in the unit

Reflection
Opportunities to express your thoughts about ideas you have discovered in the unit

9. Other Features — bring science to life

Here are other features you will find in each unit. Each one has a different purpose and is designed to help you learn about the ideas in the unit.

Investigating Careers in Science
Here you will find profiles of great Canadians in science as well as careers in science based on the different types of science studied in each unit.



Science Everywhere
This feature presents interesting information about concepts covered in the unit.

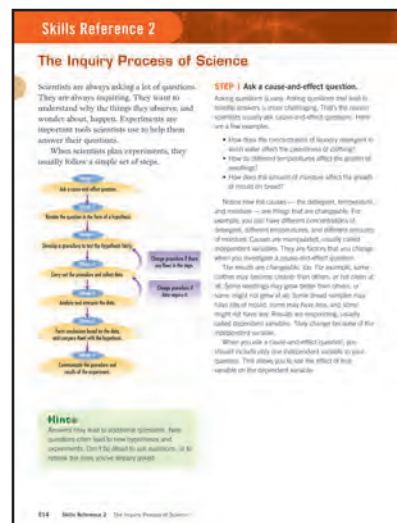


Cool Ideas
This feature is written by Discovery Channel *Daily Planet* host Jay Ingram to connect concepts covered in the unit to findings coming from current research.



10. Skills Reference — provides skills information and practice

These pages provide references to lab safety and other basic scientific skills that will help you as you do the activities. Remember to check the Skills Reference when you need a reminder about these skills.



Now it is time to start. We hope you will enjoy your scientific exploration using *Investigating Science 9!*

Biology UNIT A: Sustainable Ecosystems	Chemistry UNIT B: Atoms, Elements, and Compounds
Big Ideas <ul style="list-style-type: none"> • Ecosystems are dynamic and have the ability to respond to change, within limits, while maintaining their ecological balance. • People have the responsibility to regulate their impact on the sustainability of ecosystems in order to preserve them for future generations. 	Big Ideas <ul style="list-style-type: none"> • Elements and compounds have specific physical and chemical properties that determine their practical uses. • The use of elements and compounds has both positive and negative effects on society and the environment.
Fundamental Concepts <ul style="list-style-type: none"> • Systems and Interactions • Sustainability and Stewardship • Change and Continuity 	Fundamental Concepts <ul style="list-style-type: none"> • Matter • Structure and Function • Sustainability and Stewardship
Overall Expectations <ol style="list-style-type: none"> 1. assess the impact of human activities on the sustainability of terrestrial and/or aquatic ecosystems, and evaluate the effectiveness of courses of action intended to remedy or mitigate negative impacts 2. investigate factors related to human activity that affect terrestrial and aquatic ecosystems, and explain how they affect the sustainability of these ecosystems 3. demonstrate an understanding of the dynamic nature of ecosystems, particularly in terms of ecological balance and the impact of human activity on the sustainability of terrestrial and aquatic ecosystems 	Overall Expectations <ol style="list-style-type: none"> 1. assess social, environmental, and economic impacts of the use of common elements and compounds, with reference to their physical and chemical properties 2. investigate, through inquiry, the physical and chemical properties of common elements and compounds 3. demonstrate an understanding of the properties of common elements and compounds, and of the organization of elements in the periodic table

Earth and Space Science UNIT C: The Study of the Universe	Physics UNIT D: The Characteristics of Electricity
<p>Big Ideas</p> <ul style="list-style-type: none"> • Different types of celestial objects in the solar system and universe have distinct properties that can be investigated and quantified. • People use observational evidence of the properties of the solar system and the universe to develop theories to explain their formation and evolution. • Space exploration has generated valuable knowledge but at enormous cost. 	<p>Big Ideas</p> <ul style="list-style-type: none"> • Electricity is a form of energy produced from a variety of non-renewable and renewable sources. • The production and consumption of electrical energy has social, economic, and environmental implications. • Static and current electricity have distinct properties that determine how they are used.
<p>Fundamental Concepts</p> <ul style="list-style-type: none"> • Matter • Energy • Systems and Interactions • Structure and Function • Change and Continuity 	<p>Fundamental Concepts</p> <ul style="list-style-type: none"> • Energy • Systems and Interactions • Structure and Function
<p>Overall Expectations</p> <ol style="list-style-type: none"> 1. assess some of the costs, hazards, and benefits of space exploration and the contributions of Canadians to space research and technology 2. investigate the characteristics and properties of a variety of celestial objects visible from Earth in the night sky 3. demonstrate an understanding of the major scientific theories about the structure, formation, and evolution of the universe and its components and of the evidence that supports these theories 	<p>Overall Expectations</p> <ol style="list-style-type: none"> 1. assess some of the costs and benefits associated with the production of electrical energy from renewable and non-renewable sources, and analyze how electrical efficiencies and savings can be achieved, through both the design of technological devices and practices in the home 2. investigate, through inquiry, various aspects of electricity, including the properties of static and current electricity, and the quantitative relationships between potential difference, current, and resistance in electrical circuits 3. demonstrate an understanding of the principles of static and current electricity

Science Safety Procedures

You will be doing many activities in this book.

When doing an activity, it is very important that you follow the safety rules below. Your teacher may have safety instructions to add to this list.

Before You Begin

1. Read and make sure you understand the instructions in the text or in any handouts your teacher may provide. Follow your teacher's direction always. Never change or start an activity without approval.
2. Watch for "Caution" notes such as the one below. These notes will tell you how to take extra care as you work through the activity. Make sure you understand what the cautions mean.









CAUTION: Tie back long hair, and be careful around open flames. Do not touch calcium metal with your bare hands as the metal will react with moisture in your skin.

3. Learn to recognize the safety symbols and the warning symbols for hazardous materials as seen on the next page. These include WHMIS symbols. WHMIS is the Workplace Hazardous Materials Information System.
4. Keep your work area uncluttered and organized.
5. Know the location of fire extinguishers and other safety equipment.
6. Always wear safety goggles and any other safety clothing as requested by your teacher or identified in this book.
7. If you have long or loose hair, tie it back. Roll up long sleeves.
8. Inform your teacher if you have any allergies or medical conditions or anything else that might affect your work in the science classroom.
9. Review the Material Safety Data Sheet (MSDS) for any chemicals you use in the lab. See an example of one on the next page.








Wear proper safety equipment when doing science activities.

Safety Symbols

-  When you see this symbol, wear goggles or safety glasses while doing the activity.
-  This symbol tells you that you will be using glassware during the activity. Take extra care when handling it.
-  When you see this symbol, wear an apron while doing the activity.
-  When you see this symbol, wear insulated gloves to protect your hands from heat.
-  This symbol tells you that you will be working with sharp objects. Take extra care when handling them.
-  When you see this symbol, wear gloves while doing the activity.
-  This symbol tells you that you will be working with wires and power sources. Take extra care when handling them.
-  This symbol tells you that you will be working with fire. Make sure to tie back loose hair. Take extra care around flames.

WHMIS Symbols

-  compressed gas
-  biohazardous infectious material
-  dangerously reactive material
-  corrosive material
-  oxidizing material
-  flammable and combustible material
-  poisonous and infectious material causing immediate and serious toxic effects
-  poisonous and infectious material causing other toxic effects

<h2>Material Safety Data Sheet</h2>			
NFPA Classification	DOT / TDG Pictograms	WHMIS Classification	PROTECTIVE CLOTHING
Health  Flammability  Reactivity  Specific Hazard 			
Section I. Chemical Product and Company Identification			
PRODUCT NAME/ TRADE NAME Sulfuric Acid			
SYNONYM Oil of vitriol, Dipping acid, Sulphuric acid		MSDS NUMBER:	
CHEMICAL NAME Sulfuric acid		REVISION NUMBER	
CHEMICAL FAMILY Inorganic acid.		MSDS prepared by the Environment, Health and Safety Department on:	
CHEMICAL FORMULA H ₂ SO ₄		24 HR EMERGENCY TELEPHONE NUMBER:	
MATERIAL USES Agricultural use: Manufacture of chemical products. Industrial applications: Manufacture of inorganic products.			

In Canada, manufacturers of all hazardous products used in workplaces, including schools, must provide information sheets about their products. The Material Safety Data Sheet (MSDS) identifies the chemical and physical hazards associated with each substance. It includes physical data, such as melting point and boiling point, toxicity, health effects, first aid, and spill and leak cleanup procedures. WHMIS regulations require employers to make these sheets available to employees who use hazardous substances in their work. The above is an example of an MSDS for a substance that you might use in a science activity.

During the Activity

- 10.** Report any safety concerns you have, or hazards you see (such as spills) to your teacher.
- 11.** Don't chew gum, eat, or drink in your science classroom.
- 12.** Never taste anything in science class.
- 13.** Never smell any substance directly. Instead, gently wave your hand over it to bring its vapours toward your nose.



- 14.** Handle all glassware carefully. If you see cracked or broken glass, ask your teacher how to dispose of it properly.
- 15.** Handle knives and other sharp objects with care. Always cut away from yourself, and never point a sharp object at another person.
- 16.** Heat solids and liquids only in open heat-resistant glass containers and test tubes. Use tongs or protective gloves to pick up hot objects.

- 17.** When you heat test tubes, make sure that the open end is pointing away from you and anyone else in the room.



- 18.** When heating a substance, make sure the container does not boil dry.
- 19.** If any part of your body comes in contact with a chemical, wash the area immediately and thoroughly with water. If you get anything in your eyes, do not touch them. Wash them immediately and continuously with water for 15 min. Inform your teacher.
- 20.** Keep water or wet hands away from electrical outlets or sockets.
- 21.** Use tools safely when cutting, joining, or drilling. Make sure you know how to use any tools properly.
- 22.** Use special care when you are near objects in motion, gears and pulleys, and elevated objects.
- 23.** Make sure equipment is placed safely so that people will not knock it over or trip.

over it. Report any damaged equipment to your teacher immediately.

- 24.** Treat all living things with respect. Follow your teacher's instructions when working with living things in the classroom or on a field trip.

When You Finish the Activity

- 25.** Make sure you close the containers of chemicals immediately after you use them.
- 26.** Follow your teacher's instructions to safely dispose of all waste materials.

- 27.** Always wash your hands well with soap, preferably liquid soap, after handling chemicals or other materials. Always wash your hands after touching plants, soil, or any animals and their cages or containers.
- 28.** When you have finished an experiment, clean all the equipment before putting it away. Be careful with hot plates and equipment that have been heated as they may take a long time to cool down.

Learning Checkpoint

Your teacher will give you a copy of an MSDS for bleach solution. Use this MSDS to answer questions 1–8.

- 1.** List three synonyms for the name "bleach."
- 2.** Bleach solution has two ingredients. What are they? Which of these ingredients is hazardous?
- 3.** Find the hazard identification section. Under "Emergency Overview," there is a short summary. Find the summary, and record it.
- 4.** Read the list of potential health effects. Copy down the potential health effect caused by eye contact.
- 5.** Find the section under "First Aid Measures," and record the instructions for what to do in case of eye contact.
- 6.** If a fire were to break out near bleach, should the bleach itself be considered a fire hazard? What special equipment is required to fight a fire in which bleach is present?
- 7.** Suppose someone drank bleach. Should the first aid procedure include inducing vomiting to get the solution out of the person? What other treatments are possible?
- 8.** Find out what is meant by the term "chronic exposure."
- 9.** Why is it important for all students to follow the safety rules in a science class?
- 10.** List precautions used in the science laboratory to minimize the following risks.
 - (a) poisoning
 - (b) scalding
 - (c) eye damage
- 11.** List the steps you should take before starting a science activity.
- 12.** Draw a sketch of your classroom or science lab indicating the location of all emergency equipment and exits.