McGraw-Hill Ryerson

DISCOVERING SCIENCE 8

TEACHER'S RESOURCE

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DISCOVERING SCIENCE 8
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INTRODUCTION AND IMPLEMENTATION HANDBOOK

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Introducing the *Discovering Science 8* Program

Welcome to the *Discovering Science 8* program! These teacher and student resources are designed to provide 100% alignment with Newfoundland and Labrador's science curriculum. The resources have been created to address the knowledge, skills, and attitudes needed to help your students develop scientific literacy and empower them to critically examine issues and questions from technological, societal, and environmental perspectives.

The *Discovering Science 8* program is consistent with the vision expressed in the *Common Framework of Science Learning Outcomes, K–12: Pan-Canadian Protocol for Collaboration on Student Curriculum* (Council of Ministers of Education, Canada, 1997).

> Scientific literacy is an evolving combination of the science-related attitudes, skills, and knowledge students need to: develop inquiry, problem-solving, and decision-making abilities; become lifelong learners; and maintain a sense of wonder about the world around them. To develop scientific literacy, students require diverse learning experiences that provide opportunities to explore, analyze, evaluate, synthesize, appreciate, and understand the interrelationships among science, technology, society, and the environment that will affect their lives, their careers, and their futures.

Through varied text features, *Discovering Science 8* enables your students to develop their scientific literacy as they learn basic concepts relating to interactions within ecosystems; heat; characteristics of mixtures and solutions; and Earth's crust. Students will also develop skills in the processes of scientific inquiry. In *Discovering Science 8*, students learn scientific theories and conduct investigations that are related to the concepts and skills explored in each unit.

Meeting Your Goals in the Science Classroom with *Discovering Science 8*

In your science classroom, you must meet many goals as you present science skills and concepts and foster scientific literacy. These goals include:

- creating a safe laboratory environment
- implementing the principles of constructivism in the science classroom
- implementing differentiated instruction and recognizing multiple intelligences
- being aware of, and sensitive to, social considerations

The *Discovering Science 8* student textbook has been developed with these goals, as well as the curriculum, in mind. To help support the goal of creating a safe laboratory environment, the textbook includes an introductory section on Safety in the Science Classroom (pages xviii – xxi). In addition, each investigation and activity in the textbook contains specific, detailed information on the safety issues and safety precautions involved.

Discovering Science 8 Supporting Resources

- In addition to the textbook, the *Discovering Science 8* program includes valuable resources for you and your students in print and electronic format. Like the textbook, these resources were developed with the curriculum, the principles of scientific literacy, and the goals of you and your students in mind. This *Teacher's Resource* provides science background, planning, and implementation strategies, as well as tips for meeting your classroom goals.
- Our *Blackline Masters* (BLMs) provide you with additional materials you can use for vocabulary building, skill building, concept clarification, alternative activities for differentiated instruction, support for visual learners, assessment, and more. The BLMs are contained on the CD-ROM portion of this package and are modifiable using Microsoft Word™ software.

- Our *Computerized Assessment Bank* will assist you in the implementation of the *Discovering Science 8* program. The authors and consultants are confident that we have provided you with the best possible program to help ensure your students achieve excellence and a high degree of scientific literacy in their course of study. The variety of question styles will support differentiated instruction in your classroom. The assessment bank is also found on the CD-ROM.
- Our *website*, located at www.discoveringscience8.ca, provides links to sites that will help students see the connection between the real world and the new concepts and skills that they are learning.
  In addition, the site has links to materials that will assist you in delivering the course material. The first time you enter this site, use the following username and password:

  Username: Discovering8
  Password: 8_teacher

  Once you log in, you will be prompted to create your own unique username and password.

Meeting the challenge of developing excellent learning resources for today's broad range of needs has been done through a team effort by experienced teaching professionals. We believe our *Discovering Science 8* program will serve you and your students well.

Components of the *Discovering Science 8* Program

Student Resources

Discovering Science 8 student textbook
Website (www.discoveringscience8.ca)
- links to sites that support Internet Connect, Explore More features, and Integrated Resarch Investigations in the textbook
- links to interesting educational, and entertaining sites that support the curriculum

Teacher Support Materials

Teacher's Resource (print)
Teacher's Resource (CD-ROM)
- complete text of print Teacher's Resource in PDF format
- modifiable Blackline Masters in both English and French
- assessment checklists and rubrics

Computerized Assessment Bank (CD-ROM) in both English and French
- 1200 questions
- coded by topic and key word to the Newfoundland and Labrador learning outcomes
- variety of question types
- all answers provided
- user-friendly ExamView™ software

Website (www.discoveringscience8.ca)
- additional interactive on-line resources for teachers and parents
- links for teachers

Note: All web links are monitored and maintained by McGraw-Hill Ryerson to help ensure relevance and security.

Using *Discovering Science 8* in Your Classroom

SCIENCE CLASSROOM SAFETY

Safety awareness begins with regulations and guidelines outlined within the Newfoundland and Labrador Provincial Laboratory Safety Manual. Detailed safety practices can be found within this document and teachers are strongly encouraged to read and become familiar with this manual.

As the teacher, however, you have the ultimate responsibility for enforcing safety practices in your classroom. Be sure to set an example in the laboratory by observing all basic rules at all times. Always wear protective clothing and eyewear, and dispose of chemicals and other materials properly. Maintain high standards of cleanliness and organization in the science area.

Planning is essential to laboratory safety and success. That planning must include consideration for accident prevention and review of emergency procedures. The activities in the *Discovering Science 8* program are designed to minimize dangers in the laboratory. Even so, there are no guarantees against accidents. Careful planning and preparation, as well as being aware of hazards, will help keep accidents to a minimum.

Information on laboratory safety is available from the Newfoundland and Labrador Department of Education safety manual and includes detailed instructions on planning safe procedures and preventing accidents. Much of this information can be summarized in the phrase "Be prepared!" Know the rules and what common violations occur. Know your students and their abilities to follow instructions and evaluate potential hazards. Know where emergency equipment is stored and how to use it. Good laboratory housekeeping and management begin with observing the following guidelines and your local regulations.

In the Classroom/Science Laboratory

Follow your Newfoundland and Labrador Provincial Laboratory Safety Manual recommendations as well as local board regulations. Consider the following as you set up your science supplies:

1. Store chemicals properly.
   - Separate chemicals by reaction type.
   - Label all chemical containers, including purchase date, special precautions, and expiration date.
   - Discard outdated chemicals according to appropriate disposal methods.
   - Do not store chemicals above eye level.
   - Use wood shelving rather than metal. All shelving should be firmly attached to walls. Anti-roll lips should be placed on all shelves.
   - Store only those chemicals that you plan to use. Do not stockpile chemicals.
   - Keep flammable and toxic chemicals in special storage containers. Do not store more than 500 mL of flammable liquids in the laboratory at one time.
   - Ensure that you do not have chemicals that have been banned by your school board or province.
2. Store equipment properly.
   - Clean and dry all equipment before storing it.
   - Protect electronic equipment and microscopes from dust, humidity, and extreme temperatures.
   - Label and organize equipment so that it is easily accessible.
3. Provide adequate workspace for students to do investigations.
4. Provide adequate room ventilation.
5. Review safety and evacuation guidelines at the beginning of each term and from time to time throughout the term. Ensure that students with language difficulties have understood the information. Post the guidelines in a prominent place in the classroom.
6. Ensure that safety equipment is accessible and working properly. Ideally, safety equipment should include at least fire extinguishers, a safety blanket, and eyewash stations.
7. Provide containers for the disposal of chemicals, waste products, and biological specimens. Disposal methods must meet local guidelines.
8. Take special care when carrying out any activities that require a heat source.
   - Use hot plates instead of laboratory burners as much as possible for activities requiring a heat source.
   - Ensure that the room has an adequate number of electrical outlets, and use only approved extension cords.
   - Use a central shut-off valve for the gas supply, accessible only to you, if laboratory burners are used.
   - Never use open flames when a flammable solvent is in the same room. Thus, alcohol burners should *not* be used; alcohol in the presence of fire is a potentially dangerous situation.
   - Use hot water from the tap to make a hot-water bath as an alternative to using a hot plate or laboratory burner. Warn students that water from the tap can be hot enough to cause burns.

First Day of Class/Labs

1. With your students, discuss the safety rules on pages xviii–xxi of *Discovering Science 8*. Also discuss the *Discovering Science 8* symbols and WHMIS symbols shown on page xxi of the student textbook. See Skills Development for teaching strategies.
2. Review the safe use of equipment, chemicals, and biological specimens with your students.
3. Review the use and location of safety equipment and evacuation guidelines with students.
4. Discuss safe disposal of materials and laboratory cleanup policy.
5. Discuss proper attitude for working in the laboratory.
6. Document students' understanding of the above points.
   - Have students sign a safety contract (such as BLM G-1 on the CD-ROM, and return it to you.
   - Prepare and have students write a safety quiz. (BLM G-2 provides a review and quiz on WHMIS symbols.)
7. Review safety practices with students often during the school year.

Before Each Activity

1. Perform each activity yourself before assigning it to students in order to determine where students may have trouble.
2. Arrange the laboratory in such a way that apparatus and materials are easily accessible and supplies are clearly labelled. Avoid confusion in the area where materials are dispensed.
3. Prepare only the apparatus and materials needed to complete the assigned activity. This practice helps cut down or eliminate the problem of students doing unauthorized experiments.
4. Review the procedure with students. Emphasize cautions within the procedure.
5. Be sure all students know the proper procedures to follow if an accident should occur.

During the Activity

1. Make sure the laboratory is clean and free of clutter.
2. Insist that students wear safety glasses and lab coats when indicated.
3. Never allow students to work alone.
4. Never allow students to use a cutting device with more than one edge.
5. Be sure to shield systems that are under pressure or a vacuum. Use extreme caution if you use a pressure cooker for sterilization purposes. Turn off the heat source and allow pressure to return to normal before opening the cover.
6. Students should not point the open end of a heated test tube toward themselves or other students.
7. Remove broken or chipped glassware from use immediately. Clean up any spills immediately. Dilute spilled solutions with water before cleaning them up.
8. Be sure all glassware that is to be heated is of a heat-treated type that will not shatter.
9. Remind students that heated objects may look the same as objects at room temperature.
10. Prohibit eating and drinking in the laboratory.

After the Activity

1. Be sure that the laboratory is clean, including all work surfaces and equipment.
2. Be certain that students have disposed of any broken glassware and chemicals properly.
3. Be sure any hot plates and burners have been turned off.
4. Insist that each student wash his or her hands when the laboratory work is completed.

OVERVIEW OF THE INSTRUCTIONAL DESIGN

There are a number of definitions of constructivism in science education. The instructional design and strategies suggested in *Discovering Science 8* support an approach in which constructivism is "a social process of making sense of experience in terms of what is known." That guiding definition has three important points:

- Constructivism is a *social process*, meaning that students articulate their ideas and discuss them with one another.
- Students are *making sense of* experience through "hands-on" and "minds-on" activities in the classroom, and each student is given opportunities to make sense of events and phenomena.
- Finally, *what is known* refers to both what students already know (their pre-existing knowledge) and the accepted scientific concepts they are expected to learn through the curriculum.

The Role of Students in a Constructivist Classroom

In a constructivist classroom, students are active participants in their learning. They constantly modify their knowledge and skills as they are exposed to new concepts and experiences. Students are encouraged to assume responsibility for their own learning by actively making sense of their experiences. They are not simply passive recipients of scientific knowledge.

Students also develop an understanding that their learning requires modification of their pre-existing knowledge on the basis of valid reasoning. Their "meta-cognitive" awareness of this learning process is as important as their grasp of scientific concepts.

The Role of Teachers in a Constructivist Classroom

Just as students in a constructivist classroom are not passive recipients of information, you are not simply a transmitter of information. Neither, however, do you stand back passively and let students take charge. *Discovering Science 8* supports a balanced approach in which you set up most investigations and conduct discussions that enable your students to construct meaning based on experiences arising from their investigations.

You help your students express their pre-existing understanding of the topic at hand, engage the students in a discussion of the adequacy of their explanations, and introduce accepted scientific concepts and ideas for consideration and assessment. Students can then compare the effectiveness of their ideas to accepted scientific ideas, in a search for deeper understanding and growth. To develop the understanding that science investigations are not made up of closed questions with known answers, stress the idea that both students and scientists are involved in developing explanations.

The following chart details emphases of teaching strategies, based on research about how students best learn.

Constructivism as a Model for Learning

CHANGING EMPHASES[1]	
LESS EMPHASIS ON…	**MORE EMPHASIS ON…**
treating all students alike and responding to the group as a whole	understanding and responding to individual students' interests, strengths, experiences, and needs
rigidly following curriculum	selecting and adapting curriculum
focussing on student acquisition of information	focussing on student understanding and use of scientific knowledge, ideas, and inquiry processes
presenting scientific knowledge through lecture, text, and demonstration	guiding students in active and extended scientific inquiry
asking for recitation of acquired knowledge	providing opportunities for scientific discussion and debate among students
testing students for factual information at the end of the unit or topic cluster	continuously assessing student understanding
maintaining responsibility and authority	sharing responsibility for learning with students
supporting competition	supporting a classroom community with co-operation, shared responsibility, and respect
working alone as a teacher	working with other teachers to enhance the science program

Reference Cited

1. Texley, Juliana, and Ann Wild, eds. (1996) *Pathways to The Science Standards High School Edition*. National Science Teachers Association, Arlington, VA, p. 24.

In a constructivist classroom, you have an important role in ensuring that students understand reasons why their pre-existing knowledge may sometimes be inadequate to explain the events and phenomena under examination. Educational research has demonstrated that it is ineffective simply to tell students that their ideas are wrong. There needs to be a negotiation in which the new scientific concepts and ideas are shown to be more meaningful, valid, and effective.

An Instructional Model to Support the Constructivist Classroom

A three-phase approach can be used to implement constructivism in the classroom. The three phases are explore, develop, and apply. By using this approach, you can help your students build new knowledge into a comprehensive framework of facts, concepts, skills, and theories.

1. **Explore**

   The explore phase of the instructional model has three purposes: focus the students, activate prior knowledge, and determine preconceptions. To focus, motivate, and determine preconceptions, *Discovering Science 8* provides the following:

   - *Unit Opener*: The opening spread in each unit provides a colour picture that can be used for a class discussion. Teaching notes in this *Teacher's Resource* provide suggested questions to assist in starting the discussion. On the next two pages, the Getting Started provides two choices for introducing the unit to your class. The first choice is a short reading related to one or more concepts covered in the unit. The second choice is a short, informal Find Out activity. You may choose to do either, both, or neither to introduce the unit and to focus and motivate students.
   - *Chapter Opener:* This spread listing what students will learn, why it is important, and skills they will develop provides a context for the learning in the chapter. The Foldables™ activity at the beginning of each chapter can help students prepare for the lessons or sections in the chapter. Each Foldable activity provides an opportunity for students to prepare a unique study tool that can be used during one of the sections. Encourage students to create their own Foldable for different sections in the chapter.

- *Section Opener:* Key vocabulary terms (Key Terms) are listed at the start of each section or lesson next to the section summary. Both of these text features can be used to help focus students and prepare them for the section. A Find Out activity is usually located within the first few pages of each section. These activities can be used to engage students at the start of a lesson.

2. Develop

The develop phase provides the students with a variety of learning opportunities in which they can begin to develop their own understanding of the concepts under study. In *Discovering Science 8*, these opportunities include reading, hands-on activities, and features.

- *Reading:* Developing literacy skills is key to understanding concepts in science. *Discovering Science 8* provides highly visual and age-appropriate text to help students learn the concepts in the grade 8 curriculum. A formative assessment tool, called Reading Check, occurs every few pages. Each Reading Check contains questions directly related to the material just covered. Students who have difficulty answering these questions require additional support.
- *Activities: Discovering Science 8* provides more activities than can be done in a Science 8 class in a year. The intent is to provide you with choices from which you can select the activities that best meet your students' needs. Engaging students in hands-on activities not only motivates students but also assists them in restructuring their knowledge to explain scientific concepts.
- *Features:* There are five different types of features: Science Watch, www Science, Career Connect, Science Math Connect, and National Geographic. Each feature can be used to extend various concepts covered in the section.

3. Apply

The apply phase provides opportunities for students to demonstrate their understanding of the ideas covered in *Discovering Science 8*. Assessment opportunities are woven through each section, chapter, and unit. It is not intended that students answer every question in the text but rather that you select a series of questions that are appropriate for your students. End-of-unit assessment includes a performance-based assessment task in the Project and a research-based project in the Integrated Research Investigation.

Limits of Constructivism

When using the constructivist approach to teaching, keep in mind that learning science is not a purely individual process for explaining the world. Scientific knowledge, in other words, is more than personal belief reinforced by observation. That is why you need to be prepared to introduce valid scientific concepts to your students as they develop their frameworks of understanding.

For example, it is not generally effective for you to simply provide students with experiences of phenomena and expect them to arrive at accepted conclusions about science and technology. Students invariably "discover" what is apparent to them, not necessarily what would be an acceptable scientific idea. For a student to learn, therefore, experience alone is not enough. Students need access to different lenses—laws, models, and theories—through which to view phenomena, design tests, and interpret data. Teaching is often about getting students to see things in new ways, through new lenses.

Students' existing ideas about phenomena can affect all activities and processes associated with science and technology. How a student classifies objects or phenomena, for instance, depends on what categories for classification the student already has in mind. The emphasis on prompting students to activate and express their prior knowledge is therefore a critical classroom strategy.

DIFFERENTIATED INSTRUCTION

Today's classrooms reflect the diversity of a global world. In a single classroom, children vary in their racial, ethnic, linguistic, socio-economic, familial, and learning profiles. Each student brings his or her own unique set of abilities, perceptions, and needs into the classroom. Research and anecdotal observation confirm that children of the same age "have" differing levels of academic readiness, background knowledge, and experience.

These differences mean that students vary in what they already know, what they are ready to learn, the pace at which they are able to proceed through the curriculum, and the level of adult support they require for success. Students learn best when they are challenged to learn new concepts that are developmentally appropriate for them, that is, that are neither too easy nor too difficult (Flick, 2000). Given the diversity of students in modern inclusive classrooms, therefore, you are challenged to present materials at a variety of complexity levels, provide for flexible pacing, and be open to receive responses from students that reflect their abilities and their potential (Hertzog, 1998).

Definition

Differentiated instruction means offering several different learning experiences simultaneously within a classroom in response to students' varied needs, rather than a single task for all students regardless of appropriateness (Tomlinson, 1995). It is your response to the diverse makeup of your classroom. Learning activities and materials may be varied by difficulty and pace to challenge students at different readiness levels, by topic in response to students' interests, and by students' preferred ways of learning or expressing themselves. When you offer learning stations or centres, use math games of varying levels, or allow students to choose independent projects, you are diversifying instruction.

The key to a differentiated classroom is that all students are regularly offered *choices* and students are matched with tasks compatible with their individual learner profiles.

Curriculum should be differentiated in three areas:

1. Content: Multiple options for taking in information
2. Process: Multiple options for making sense of the ideas
3. Product: Multiple options for expressing what they know

Philosophy Behind Differentiated Instruction

Essentially, the aim of differentiated instruction is to maximize each student's growth by creating developmentally appropriate learning opportunities. This means meeting each student where he or she is, and helping the student to progress. However, it does not mean individualizing each and every student's program. Rather, a continuum of choices within open-ended activities allows small groups of students to work at their level.

Differentiated instruction, therefore, is based on the following beliefs.

- Students differ in their learning profiles.
- Curriculum needs to be varied in content, process, and product.
- Classrooms in which students are active learners, decision makers, and problem solvers are more natural and effective than those in which students are served a "one-size-fits-all" curriculum and treated as passive recipients of information.

Implementing Differentiated Instruction in Your Classroom

- **Differentiating Content:** Content can be described as the knowledge, skills, and attitudes we want children to learn. Differentiating content requires that students are given choices in topics of interest or are pre-tested so you can identify appropriate curriculum for groups of students.
- **Differentiating Process:** Varying learning activities or strategies provides appropriate methods for students to explore concepts. This is the most common way to differentiate process. It is important to give students alternative ways to approach concepts. For example, students may use graphic organizers, a listening centre, maps, diagrams, or charts to augment text. They may work in co-operative or flexible groupings. Teaching through songs, art, drama, and film in addition to text-based research allows for multiple ways of learning. Varying the complexity of a graphic organizer, diagram, film, etc., can very effectively facilitate differing levels of cognitive processing for students of differing ability.
- **Differentiating Product:** Differentiating the product means varying the complexity or type of product/response that students create to demonstrate mastery of the concepts. Allowing students to "show what they know" through multiple modalities allows students who struggle with written work to demonstrate mastery. Role-plays, demonstration experiments, posters, and computerized slide shows are alternatives to written reports that allow students with differing learning profiles to be successful.

The chart below summarizes the more common student needs and gives additional tips that may help you structure the learning environment to meet those individual needs.

	Description	Tips for Instruction
Learning Disabled	All learning disabled students have an academic problem in one or more areas, such as academic learning, language, perception, social-emotional adjustment, memory, or attention.	• Provide support and structure with clearly specified rules, assignments, and duties. • Establish learning situations that lead to success. • Practise skills frequently. • Use games and drills to help maintain student interest. • Allow students to record answers on tape, and allow extra time to complete tests and assignments. • Provide outlines or tape lecture material. • Pair students with peer helpers, and provide class time for pair interaction.
Behaviourally Disordered	Students with behaviour disorders deviate from standards or expectations of behaviour and impair the functioning of others and themselves. These students may also be gifted or learning disabled.	• Provide a clearly structured environment with regard to scheduling, rules, room arrangement, and safety. • Clearly outline objectives and how you will help students obtain objectives. • Seek input from students about their strengths, weaknesses and goals. • Reinforce appropriate behaviour, and model it for students. • Do not expect immediate success. Work for long-term improvement. • Balance individual needs with group requirements.
Physically Challenged	Students who are physically challenged fall into two main categories—those with orthopedic impairments and those with other health impairments. Orthopedically impaired students have the use of one or more limbs severely restricted, so the use of wheelchairs, crutches, or braces may be necessary. Students with other health problems may require the use of respirators or other medical equipment.	• Openly discuss with the student any uncertainties you have about when to offer aid. • Ask parents or therapists and the student what special devices or procedures are needed and if any special safety precautions need to be taken. • Allow physically disabled students to do everything their peers do, including participating in field trips, special events, and projects. • Help non-disabled students and adults understand physically disabled students.
Visually Impaired	Students who are visually impaired have partial or total loss of sight. Individuals with visual impairments are not significantly different from their sighted peers in ability range or personality. However, blindness may affect cognitive, motor, and social development, especially if early intervention is lacking.	• As with all students, help the student become independent. Some assignments may need to be modified. • Teach classmates how to serve as guides. • Limit unnecessary noise in the classroom. • Encourage students to use their sense of touch. Provide tactile models whenever possible. • Describe people and events as they occur in the classroom. • Provide taped lectures and reading assignments. • Team the student with a sighted peer for laboratory work.

	Description	Tips for Instruction
Hearing Impaired	Students who are hearing impaired have partial or total loss of hearing. Individuals with hearing impairments are not significantly different from their hearing peers in ability range or personality. However, the chronic condition of deafness may affect cognitive, motor, and social development if early intervention is lacking. Speech development may also be affected.	• Seat students where they can see your lip movement easily, and avoid visual distractions. • Avoid standing with your back to the window or light source. • Use an overhead projector so you can maintain eye contact while writing. • Seat students where they can see speakers. • Write all assignments on the chalkboard, or hand out written instructions. • If the student has an interpreter, allow both student and interpreter to select the most favourable seating arrangements.
English as a Second Language	Recent immigrants may speak English as a second language or not at all. The customs and behaviour of people in the majority culture may be confusing for some of these students. Cultural values may inhibit some of these students from full participation in class activities.	• Remember that students' ability to speak English does not reflect their academic ability. • Try to incorporate the students' cultural experience into your instruction. • Include information about different cultures in your curriculum to help build students' self-image. Avoid cultural stereotypes. • Encourage students to share their cultures in the classroom.
Gifted	Although no formal definition exists, these students can be described as having above-average ability, task commitment, and creativity. Gifted students rank in the top 5 percent of their class. They usually finish work more quickly than other students and are capable of divergent thinking.	• Make arrangements for students to finish selected subjects early and to work on independent projects. • Encourage students to express themselves in art forms such as drawing, creative writing, or acting. • Ask "what if" questions to develop high-level thinking skills. Establish an environment that is safe for risk taking and creative thinking. • Emphasize concepts, theories, ideas, relationships, and generalizations.

Johnson David, Roger Johnson, and Edythe Holubec, (1995) *Cooperative Learning in the Science Classroom*. Glencoe McGraw-Hill, New York, NY.

The Supporting Diverse Student Needs notes in the sections of this *Teacher's Resource* will give you further suggestions regarding differentiating instruction for specific groups of learners. Even so, the teaching strategies outlined here and throughout this *Teacher's Resource* are consistent with Pathways 1 and 2 as outlined in the brochure *Pathway to Programming and Graduation*, from the provincial Department of Education. Students who need more extensive adjustment of curriculum or teaching methods due to identified exceptionalities would benefit from an Individual Support Services Plan (ISSP) as per Department of Education policy.

MULTIPLE INTELLIGENCES

One educational framework that supports differentiated instruction is Multiple Intelligences (MI) theory (Gardner, 1993). MI recognizes that students have differing learning profiles, and that all are equally valuable and legitimate. For example, if it helps students to put the times tables into a song or rap because they are musical-rhythmic learners, as long as in the end the students master the skill/information, singing is considered to be as equally valid a way to learn as writing the facts with pencil and paper. Thus, MI provides a framework for differentiating process and

product *in ways that match a student's learning potentials.*

Another reason for considering MI pedagogy is that MI allows for teaching to diversity in an inclusive classroom in ways that traditional teaching methods cannot. "Traditional schools are designed for organized, left-brain learners who are book lovers. This type of learner, however, represents only one quarter of the population" (Rasmussen, 2000). In an MI classroom, students are given opportunities to learn and represent their knowledge in a variety of ways, which allows many more students to be a part of the learning community and be valued equally for their contributions. For instance, if learning takes place only through reading of non-fiction texts and written responses, students who are acquiring English as a second language or who have learning difficulties cannot participate fully in the learning. Instead, they have to be given adult support, or a different task/text, which stigmatizes them as unable. However, if students' intelligences are equally valued, then the student who is visual-spatial can be paired with the student who is verbal-linguistic to complete an activity as equal partners. One partner reads the text aloud, while the other creates a poster demonstrating the concept. MI also develops students' ability to self-direct their learning by encouraging them to develop their sense of self, know their strengths and weaknesses, see value in those strengths and weaknesses, and make choices about career directions more successfully.

All students have varying degrees of each intelligence. Relative strengths and challenges can help guide appropriate differentiation. Students can complete "challenge activities" in their non-preferred intelligences as part of a goal-setting process to develop these areas. Teachers must then be aware that during these activities students will require more support. At other times, students can be allowed to use their strengths to learn new material and "show what they know."

Multiple Intelligences: Definitions and Activities

In the above table, definitions for each of the intelligences and some suggested activities are delineated. *When planning science units, ask yourself whether you have included opportunities for students to process information and demonstrate their learning in a variety of ways.* Consult the Multiple Intelligences chart in the front matter of each unit of this Teacher's Resource for the MI coding of all activities.

For further information or details, see Lazear, 1998.

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INTELLIGENCE	DEFINITION	STUDENT LIKES…	LEARNING ACTIVITIES
Verbal-Linguistic	• the ability to develop verbal skills and sensitivity to the sounds, meanings, and rhythms of words	• reading literature, playing word games, making up poetry and stories, discussions, debating, and telling jokes	• have a debate • write a news article • interview a scientist about… • create a report
Visual-Spatial	• the ability to think in images and pictures, to visualize accurately and abstractly	• to draw, paint, design, and create • tasks that require visualizing, pretending, imagining, and forming mental images	• chart, map, cluster, or graph • illustrate, paint, sketch, sculpt • create a slideshow or photo album of your trip to… (e.g., space, Earth's core) • create a poster or flyer
Logical-Mathematical	• the ability to think conceptually and sequentially and to discern logical or numerical patterns	• to conduct experiments, solve puzzles and other problems, ask cosmic questions, and analyze circumstances and people's behaviour • working with numbers and mathematical formulas and operations, and the challenge of a complex problem to solve	• design and conduct an experiment • describe the patterns or symmetry in… • create a mathematical formula • develop a code for… • measure • classify
Body-Kinesthetic	• the ability to control one's body movements and to handle objects skillfully, to learn through tactile experience	• to perform a task after seeing someone else do it first • to demonstrate to someone else how to do something	• role play • build or construct a… • create movements to explain… • conduct a hands-on experiment
Musical-Rhythmic	• the ability to produce and appreciate rhythm, pitch, and timbre	• to study and work with music in the background • to play with sounds, beats, and rhythms	• create a rap or song that explains… • experiment with the effects of vibration on… • indicate the rhythmic patterns in… • use a tune to remember… • give a presentation with musical accompaniment

INTELLIGENCE	DEFINITION	STUDENT LIKES…	LEARNING ACTIVITIES
Intrapersonal	• the ability to be self-aware and in tune with inner feelings, values, beliefs, and thinking processes (reflection, meta-cognition)	• to work alone • time to be self-reflective • to be inwardly motivated rather than seek external rewards • to make connections to his/her own experiences	• describe one of your personal values about… • explain your experience with… • assess your own work/beliefs about… • reflect on…
Interpersonal	• the ability to detect and respond appropriately to the moods, motivations, and desires of others	• to learn through personal interactions • team activities • piggybacking ideas on others' thoughts • discussion	• use lab teams • write team positions on… • conduct a meeting to address… • participate in a service project • teach someone about… • write a sequel to…
Naturalist	• the ability to recognize and categorize plants, animals, and other objects in nature	• to study animals, plants, and almost any natural object • natural field experiments • to collect rocks, bugs, etc. • to be outdoors	• create observation notebooks • care for pets, plants, gardens, parks • use binoculars, telescopes, microscopes, or magnifiers to… • draw or photograph natural objects • classify natural objects
Existential	• the sensitivity and capacity to tackle deep questions about existence	• time to think • thinking about deeper messages in literature, film • community service	• design projects to answer "essential" or "big" questions • write a letter to an environmentalist group, newspaper, etc.

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CO-OPERATIVE LEARNING

Learning science is a social activity. Many students learn best working in co-operative learning groups that encourage communication on a variety of levels. Language and communication are important in developing and consolidating ideas.

This context of learning and doing science reflects the world outside the classroom. The effective use of co-operative skills is becoming increasingly necessary

Co-operative Learning Groups	Traditional Groups
• Shared leadership	• One leader
• Positive interdependence	• No interdependence
• Heterogeneous membership	• Homogeneous membership
• Instruction in co-operative skills	• Assumption of effective social skills
• Responsibility for all group members' achievement	• Responsibility for individual achievement
• Emphasis on task and co-operative relationships	• Emphasis only on task
• Support by teacher	• Direction by teacher
• One group product	• Individual products
• Group evaluation	• Individual evaluations

to cope successfully in the workplace. Because of the increasing importance of co-operative interaction, it is essential that educational strategies include these skills. Students need to learn how to listen, respond, agree, disagree, clarify, encourage, and evaluate. All these skills help teams work together productively.

Basic Elements of Co-operative Learning

The basic elements of a co-operative learning strategy are:

1. Students must perceive that they "sink or swim together."
2. Students are responsible for seeing that everyone in the group (as well as themselves) learns the assigned material.
3. Students must see that they all have the same goals.
4. Students must divide up tasks and share responsibilities equally among group members.
5. Ideally, students should be given one evaluation or reward applicable to all members of the group. This strategy can be modified for specific group or individual problems as described in the Troubleshooting section of this document.
6. Students share leadership while they acquire skills for collaborating during learning.
7. Students are held individually accountable for material worked on in co-operative groups.

Forming Groups

Groups should contain from two to five students. Heterogeneous groups that represent a mixture of abilities, genders, and ethnicity expose students to peers with ideas different from their own and help them learn to work with a variety of people.

At first, co-operative learning groups should work together for only a day or two or for short assignments. Once students gain more experience, assign longer assignments. Assessment Rubric 3, Co-operative Group Work Rubric, can also assist you in promoting co-operative group work.

Co-operative Learning in Your Classroom

Help students see for themselves the benefits of co-operative learning. Ask students to work for 5 or 10 min on something a bit too difficult for them to do alone. It could be identification of animal tracks, a list of health-related myths and facts that they must identify as true or false, or a complex crime that must be solved. Then ask them to work in a group of four to solve the same problem. Ask them to compare individual problem solving with co-operative problem solving.

Beginning Co-operative Learning Strategies

- **Study Buddies:** In groups of two, have each student question the other about the material being studied. Tell pairs they will receive bonus points if they score above a certain percentage.
- **Checkmates:** Have groups compare homework answers or class worksheet answers. Students should discuss answers that differ and come to an agreement on the best answers. Collect one paper per group. Do not tell the class in advance which paper you are planning to collect.
- **Turn to Your Neighbour:** After a teacher-led discussion of a topic, an explanation of directions, or assignment, ask students to turn to their neighbour and summarize the key points of what was said.
- **Jigsaw:** On a reading assignment of one or two pages that does not have sequential importance, divide up the reading among the members of a group of three or four. Each person reads his or her part of the assignment and then teaches it to the other group members. Quiz other group members to make sure that they understand the material. Do not divide up whole chapters or units until students have considerable experience in co-operative learning. This strategy can become an advanced co-operative learning task with larger blocks of material.
- **Brainstorming:** Use this strategy to generate a large number of ideas for discussion of a question. Ask students to make a group list. They should not evaluate the ideas until the list is complete. Encourage them to build on each other's ideas, go on sidetracks, and gather the silliest and weirdest ideas they can think up. Stress that all ideas are acceptable on a brainstorming list. Evaluation begins when students have no more ideas or the time is up.
- **Chalkboard Share:** Ask one member from each group to put the group's best idea or answer on the chalkboard. This strategy allows the groups still at work to consider the ideas on the board as well as their own and perhaps come to an even higher level of thinking.
- **Write a Note:** All members of a team of four write a note that begins, "What I understand about this lesson is… I am still having trouble with…" Ask students to trade notes with someone who is not having the same trouble and reply to the note. They should write the note as if they were writing a real note to friend.

Advanced Co-operative Learning Strategies

- **Group Interdependence:** For each group, prepare a set of four to five "clue cards" for one concept, including a distractor clue. For example, you could make a set of clues for the properties of gases, another for solids, and another for liquids. The sets are traded from one group to another as they figure them out. Instruct students: (a) not to allow anyone to see their clue; (b) to verbally communicate their clues to their group; (c) to decide which of the clues are distractors; and (d) to decide what concept the clues represent.

- **Peer Feedback:** Distribute one of the Assessment Checklists from the *Assessment* section. Students should evaluate another person's or group's performance task using the checklist. Encourage students to comment on what is good before saying anything negative. To avoid arguments, tell students to paraphrase comments so the person knows he or she has been understood.
- **Talking Chips:** Give each group member seven small pieces of paper. Each time someone speaks, he or she must give up a piece of paper. When a group member is out of paper, he or she can no longer speak until everyone has used all their pieces of paper. This strategy ensures that one group member does not dominate discussions.
- **Snowballing:** A pair of students answers worksheet questions or compares lab report conclusions or other written work. Two pairs come together to review and compare answers. Two groups of four come together and compare. One person from a group of eight writes answers or conclusions on the board.
- **Roundtable:** One group member has a pencil and paper. He or she reads a question out loud. Group members consult and refer to the textbook in order to agree on the answer. The group member who has the pencil and paper writes the answer. The answer sheet is passed to the next group member. Repeat the process until all questions are answered. One person in each group should check the answers using a key provided by the teacher. This strategy is especially useful for review questions.
- **Teammate Consulting:** Each student should have a worksheet. All pencils should remain in the middle of the table while group members read and discuss a question. When the group reaches agreement, everyone should pick up a pencil and write the answer to the question. Collect only one worksheet per group. This strategy is an excellent method of reviewing or answering questions for activities and investigations.
- **Group Visits:** Three students from each group take their completed work and visit another group. One student in each group remains and presents his or her group's work to the visitors. The visitors compare their work and note any differences. Students return to their original groups. A different group member then remains while the other three visit different groups. Visits continue until every student has visited three times and explained once. This strategy is useful for checking work.
- **Paraphrase First:** Each time a group member has contributed an idea, another group member must correctly restate the idea before another idea can be contributed.
- **Making Analogies:** Ask students to brainstorm ways a concept is like something in everyday life. For example, students may compare performing an experiment to producing a play. Analogy ideas should be brainstormed by the group. These ideas might be sequential processes such as production of a newspaper, baking a cake, or taking a vacation. If appropriate for the concept, give each group a large sheet of paper on which to make a labelled diagram of its analogy. The diagram should illustrate the everyday process with vocabulary labels from the scientific process. This strategy works well to help students understand a difficult scientific concept.
- **Group Contract:** Ask each group to make a list of specific behaviours that can be changed to improve their group. "We need to work together better" is not specific. Examples of specific behaviours include "Eric should come to class on time" or "Rachel should stop reading magazines." Beside each item, have students write how the change will be accomplished. The teacher then reads the contract and writes on it the number of points or rewards the group will gain by meeting their contract. At the end of the time period, each group should write a justification for the number of points they think they should receive.

Troubleshooting

- **A Student Resists Working in a Group:** In the rare case of determined opposition to working in a group, you may want to allow a student to work individually. The student may eventually reconsider. Alternatively, suggest that the student commit to a group for a limited time, perhaps three weeks. Monitor the group closely during this time. Encourage group members to offer possible solutions to the problem.
- **A Student Behaves Inappropriately:** Whenever possible, allow the group to deal with the problem. By intervening you give up your most powerful tool: peer influence. You also risk sending the message that the students are not capable of solving their own problems. When necessary, offer assistance in the form of specially designed group analysis questions.
- **Students Do Not Effectively Use Co-operative Skills:** Structure lessons so groups can identify their weak skills and practise them. Allow ample time for groups to evaluate their work using Assessment Checklist 21, Project Self-Assessment, and Assessment Checklist 22, Project Group Assessment. Encourage individuals or groups to commit to improving specific skills by forming a group contract as described in the preceding Advanced Co-operative Learning Strategies. Recognize and reward improvement. Keep in mind that giving or receiving praise or encouragement may be very difficult for students who have a reputation for being tough.

- **Group Members Do Not Share Equally in the Work:** Divide up materials so that each group member has information others need. Give the group only one worksheet. Assign each group member an essential role.

  Give each group member five slips of paper. For each contribution to the group task, a student must reliniquish a slip of paper. When a student has no more slips of paper, he or she may no longer contribute.

  If one group member consistently does not participate despite efforts by others to include him or her, take this into consideration when assigning the group mark so other group members are not penalized.
- **A Student's Ability Is Considerably Lower than That of Other Group Members:** Tailor the weaker student's task. Provide appropriate reference materials for him or her to use. You may want to adapt tests and quizzes or the scoring method you use, or automatically add points to the student's individual grade when using it to figure the group mark.
- **A Student Is Absent:** Have the group suggest appropriate make-up work. Approve the assignment. Consider combining groups if two or more students are absent from a group. Another option is to have floaters who are academically successful and skilled in using co-operative strategies fill in empty places.
- **A Student Is Chronically Absent:** Assign the student as an extra member to a group with a core that is usually present, or have the student fill in for absent students when he or she does come to class. Offer a permanent assignment when attendance improves.
- **Students Use "Put-downs," Ridicule, and Demeaning Remarks:** Ask the group to make a list of all the positive qualities they can think of for each group member. Ask them to make a written plan of action for dealing with their negative communication. Ask them what would be a good reward if they were able to improve in one week.
- **A Student Is Extremely Shy:** Use team-building, trust-building, and active listening activities that create an atmosphere of acceptance and respect for each other. Make complimenting, encouraging participation, and appreciating individual differences the co-operative skills that groups must practise. Assign shy students to a smaller group. Ask the group to take on task roles and assign the shy student the role of reader, recorder, or spokesperson.
- **A Student Is a High Achiever:** Reward the student for helping others. Ask him or her to work with a difficult partner and give the group a bonus for the difficult partner's success. Assign challenging roles that the student does not usually take. This student may do observations of the co-operative efforts of the entire class. Group the high achievers together occasionally to work on an especially fast-paced, challenging project. If necessary, reassure the student (and parents if necessary) that research shows that mastery and retention of academic material by high-ability students is found to be higher in co-operative than in competitive or individualistic learning situations.
- **A Student Actively Attempts to Sabotage Group Work or Products:** Reinforce daily any behaviour that is near the co-operative goal. Assign a co-operative skill tied to the disruptive behaviour. Write the skill on an overhead transparency beside the student's name. Tally the number of times the co-operative skill is used by the student, rewarding positive behaviour at the end of class. Choose a reward this student would like. Tell the group that they will receive this reward when they earn a certain number of points for taking positive steps to correct the behaviour. Use a student contract. Role-play the problem with the other students in the class and have a class discussion about how to solve the problem. As a last resort, ask the disruptive student to work alone until he or she is willing to practise co-operative skills.
- **The Noise Level Rises Too High:** Develop a signal that means "quiet." You may simply raise your hand, with students following your example as soon as they see you raise your hand. It may be a quick flick of the light switch or a bell. Have students practise the co-operative skill of working as a group to establish their own technique for keeping noise down early in the year, and if again noise is a problem. Assign the role of "noise monitor" to one member of each group. Educate your colleagues and principal about the difference between "noise" and "beehive of activity" in co-operative learning. Reward groups for keeping the noise level down.
- **Group Consistently Refuses to Work with a Particular Student:** Give the outcast student roles with leadership responsibility. Use careful strategies for grouping. Be sure one student in the group has some positive feelings about the outcast. Each day, ask the group to start by saying one positive comment to each person in the group. Use strategies for conflict resolution and structure the activities so the student is needed by the group for them to be successful. Strategies such as jigsaw and limiting materials and information may be included. Ask the group to practise skills such as honouring individual differences and showing appreciation and empathy.

READING INFORMATIONAL TEXT

If students can read narrative fiction with good comprehension, why do they so often need special instruction and support when reading informational text? Does reading a story require different skills than reading informational text? The answer to this question is, most definitely, yes.

The structure of a story is not the same as the structure of informational text. Therefore, the method of reading fiction is not the same as reading nonfiction. To begin, the former tends to be read quickly, with the reader filling in or guessing at unknown or hard-to-pronounce words. Reading nonfiction requires slow, deliberate pacing, as the student must carefully decode all new words and stringently process new ideas.

Why Students Need Assistance in Reading Informational Text

In stories, authors typically use such techniques as allowing different characters to present their responses to the same event. Through this form of repetition, readers gain a clearer understanding of the characters, settings, main ideas, and events.

Informational text, on the other hand, introduces new vocabulary connected to new concepts. The reader is expected to become familiar with all the new words and learn new concepts and new ways of thinking. To do this, most students need the help of a teacher to learn how to:

- slow their pace during the reading of informational text
- make connections between new ideas and previously learned ones
- extract main ideas from the density of ideas introduced and explained
- interpret visuals and graphic organizers
- apply the newly learned concepts to the world around them

Teaching students how to read instructions, scientific explanations, nonfiction narrative, and persuasive material, as well as to identify the text structures, should be a critical part of the curriculum lesson. Once the reader understands that each form has different expectations and objectives, then reader comprehension soars.

Helping Your Students Comprehend Informational Text

Comprehension of informational nonfiction comes from solid grounding in:

- knowing the purpose for reading a passage or chapter
- learning the key vocabulary associated with the new concepts
- activating prior knowledge so the new information can fit into an existing personal framework
- understanding that the text has its own unique organization, and using that particular organization to facilitate learning

These are not separate or distinct factors. They work together and reinforce each other. For example, new vocabulary must reflect the concepts to be learned. These concepts are determined by the teacher when the purpose for reading is set. Once the purpose is set, prior knowledge must be accessed so that the student can make connections between old and new information.

Literacy and the Organization of Informational Text

In this Information Age, more than 70 percent of the material we encounter is expository. "Students who learn to use the organization and structure of informational texts are better able to comprehend and retain the information found in them" (Goldman and Rakestraw, 2000; Pearson and Duke, 2002).

Giving students the reading tools to comprehend informational text is no longer a skill that can be offered only to some students in some classes. All students must be provided with these critical skills and strategies as part of a literacy program that prepares students for active participation in their communities and in their futures.

Understanding how informational text such as student textbooks are organized will give students the strategies needed to make sense of what, at first glance, might appear to be dense and overwhelming material. Students need instruction and practice to help them to:

- use a table of contents and an index
- recognize main ideas
- understand how details elaborate on a concept
- understand cause and effect structures
- explore the relationship of phenomena to other information
- demonstrate broader understanding of new ideas through graphic organizers

Comprehension occurs when students learn new vocabulary, understand the main concepts, and are able to demonstrate in a variety of ways that they have learned and internalized the content of the lesson.

Familiarizing Your Students with Their *Discovering Science 8* Textbook

Here are some features of the *Discovering Science 8* textbook that your students can use to sharpen their comprehension skills as they encounter informational text passages.

- **Table of Contents:** The table of contents, on pages iv–ix of the student textbook, lists units, chapters, and sections. It also includes activities and chapter reviews.

- **Tour of the Textbook:** Located on pages x–xvi of the student textbook, the tour explains in detail the key structural features of the textbook. Take the tour with your students to familiarize them with the organizational components of their textbook.
- **Section Summary:** The shaded beige box below the section title contains a summary of the science concepts that students will study in the section. This summary is essentially a précis or abstract of the lesson, so new terms may be used here but are not bolded or defined. Have students read the summary before they start the section, even though they may not know all the words. Then, when they finish the section, they can go back and reread the summary to make sure that they understand what they have studied in the section. Students can use the summaries as reviews for studying.
- **Reading Checks:** These features ask recall questions about the material that students have just read. They are designed to help students slow down and think about what they are reading. Encourage students to use Reading Checks to confirm their understanding of new terms and concepts before proceeding.
- **Visuals:** Encourage your students to pay attention to the visuals in their textbook, including tables and other graphic organizers. The visuals in a textbook, along with their captions, offer important clues to the main points that are discussed in the running text.
- **Headings and Subheadings:** Point out the headings and subheadings in a chapter section. These text elements also offer clues to the main points to be discussed in the text that follows.
- **Section and Chapter Reviews:** Each section and each chapter ends with a series of questions that you and your students can use to assess their understanding of the material. Encourage students to draw a network tree or a spider map to demonstrate their understanding of the new vocabulary they have encountered in the previous text passages. (Refer your students to Science Skill 10 on page 496 of the *Discovering Science 8* textbook.)
- **Key Terms:** At the beginning of each section and in the unit review are lists of the boldfaced Key Terms found in that section or unit.
- **Glossary:** The Glossary at the back of the student textbook lists and defines Key Terms that are arranged alphabetically. Pronunciation guides are included where appropriate. The definition includes a reference to the text section in which each Key Term first appears.
- **Index:** Ensure that your students know how to use the index, located at the back of their textbook.

In addition to the features in the student textbook, each section of this *Teacher's Resource* includes a Using Reading feature that suggests specific Pre-reading, During Reading, and After Reading techniques that students can use to enhance their comprehension of the material in the student textbook.

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References and Resources

CORRELATION TO THE NEWFOUNLAND AND LABRADOR GRADE 8 SCIENCE CURRICULUM

OUTCOMES	MCGRAW-HILL RYERSON DISCOVERING SCIENCE 8 NOTE: THE CURRICULUM OUTCOMES ARE FUNDAMENTAL TO THE MCGRAW-HILL RYERSON DISCOVERING SCIENCE PROGRAM. FOLLOWING ARE SOME POINTS IN THE TEXTBOOK WHERE THE CURRICULUM OUTCOMES ARE ADDRESSED. THIS IS NOT AN EXHAUSTIVE LIST.
WATER SYSTEMS ON EARTH'S SURFACE	
1.1 Describe major interactions among the hydrosphere, lithosphere and atmosphere	Section 1.1, Distribution of Water, pp. 8–13
1.2 Define water cycle	Section 1.1, Distribution of Water, pp. 8–13 Find Out Activity 1-1A, A Water Cycle Model, p. 10
1.3 Demonstrate the importance of choosing words that are scientifically appropriate by using these words in context. Include: (i) hydrologist (ii) oceanographer	Section 1.1, Distribution of Water, pp. 8–13 Section 1.2, Comparing Ocean Water and Fresh Water, pp. 14–21
1.4 Sketch and label a diagram of the water cycle	Find Out Activity 1-1A, A Water Cycle Model, p. 10
1.5 Distinguish between ocean water and fresh water. Include: (i) salinity (ii) density (iii) freezing point	Section 1.2, Comparing Ocean Water and Fresh Water, pp. 14–21 Find Out Activity 1-2A, Mini Distillation, p. 15 Conduct an Investigation 1-2B, Salinity's Effect on Water Density, pp. 18–19
1.6 Identify sources of fresh water. Including: (i) drainage basins (ii) ground water (iii) glaciers	Section 1.3, Sources of Fresh Water, pp. 22–33 Find Out Activity 1-3A, p. 29 Think About It 1-3C, p. 31
1.7 Describe how long periods of global warming affect glaciers and describe the consequent effects on the environment.	Section 1.3, Sources of Fresh Water, pp. 22–33 Find Out Activity 1-3B, How Can Global Warming Be Slowed, p. 30
1.8 Identify when the last ice age began and ended and what parts of North America were covered in ice.	Section 1.3, Sources of Fresh Water, pp. 22–33
1.9 Apply the concept of systems to show how a change in one component of a body of water causes change in other components in that system.	Find Out Activity 1-3A, p. 29 Section 3.1, Oceans and Climates, pp. 82–89
1.10 Provide examples of problems related to the oceans that cannot be completely resolved using scientific and technological knowledge.	Find Out Activity 1-3A, p. 29 Section 3.3, Human Impact on Water Systems, pp. 100–115 Think About It 3-3C, Not An Easy Decision, p. 112
1.11 Describe processes that lead to the development of ocean basins and continental drainage systems. (311-7) Include: (i) volcanic action (ii) plate tectonics (iii) erosion (iv) glaciation	Section 2.1, Ocean Basins, pp. 38–51 Find Out Activity 2-1A, How Ocean Basins Become Bigger, p. 39
1.12 Investigate technologies that have assisted scientists to research ocean basins. (111-3, 209-5) Include: (i) sonar (ii) satellites (iii) core sampling (iv) underwater photography/ videography (v) deep sea submersibles (vi) diving	Section 2.1, Ocean Basins, pp. 38–51
1.13 Provide examples of how technologies, used to investigate the ocean floor, have improved over time.	Section 2.1, Ocean Basins, pp. 38–51

CORRELATION TO THE NEWFOUNLAND AND LABRADOR GRADE 8 SCIENCE CURRICULUM	
1.14 Research underwater exploration technologies to note significant changes and improvements from past to present. Include: (i) diving vs. submersibles (ii) wire line depth probes vs. sonar	Section 2.1, Ocean Basins, pp. 38–51
1.15 Identify some strengths and weaknesses of technologies used to investigate the ocean floor.	Section 2.1, Ocean Basins, pp. 38–51
1.16 Recognize that no single data collection method provides a complete picture of the ocean floor.	Section 2.1, Ocean Basins, pp. 38–51
1.17 Using a diagram, illustrate a typical continental margin from coastal shoreline to mid-ocean ridge. Include: (i) continental shelf (ii) continental slope (iii) abyssal plain (iv) mid-ocean ridge	Conduct an Investigation 21-B, Getting to Know the Ocean Floor, p. 48
1.18 Provide examples of public and private Canadian institutions that support scientific and technological research involving the oceans. (112-5) Include: (i) Environment Canada (ii) Federal Fisheries (iii) Ocean Sciences Centre (iv) Centre for Cold Ocean Research C-CORE at Memorial University	Section 1.2, Comparing Ocean Water and Fresh Water, Teacher's Resource
1.19 Describe the interactions of the ocean currents, winds, and regional climates	Section 2.2, Ocean Currents, pp. 52–63 Section 3.1, Oceans and Climates, pp. 82–89
1.20 Define ocean current	Section 2.2, Ocean Currents, pp. 52–63
1.21 Identify the two types of ocean currents. Include: (i) surface currents, and (ii) deep water currents	Section 2.2, Ocean Currents, pp. 52–63
1.22 Identify and explain how temperature differences create deep water currents.	Section 2.2, Ocean Currents, pp. 52–63
1.23 Identify wind action as a cause of surface currents	Section 2.2, Ocean Currents, pp. 52–63 Find Out Activity 2-2A, Winds and Currents, p. 53
1.24 Identify and explain how other factors influence the formation and movement of ocean currents. Include: (i) salinity (ii) Earth's spin (Coriolis effect) (iii) shape of continents (iv) temperature	Section 2.2, Ocean Currents, pp. 52–63 Conduct an Investigation 2-2B, Temperature and Water Density, pp. 60–61
1.25 Identify local ocean currents. Include: (i) Labrador current (cold) (ii) Gulf Stream (warm)	Section 2.2, Ocean Currents, pp. 52–63
1.26 Carry out procedures in order to investigate how temperature differences cause deep water currents.	Section 2.2, Ocean Currents, BLM 1-22
1.27 Select appropriate methods and tools for collecting data	Conduct an Investigation 2-1B, Getting to Know the Ocean Floor, pp. 48–49 Conduct an Investigation 3-3B, Water Health Test, pp. 108–111
1.28 Use tools and apparatus safely	Section 2.2, Ocean Currents, BLM 1-21, Deep Ocean Currents
1.29 Interpret trends in data, and explain relationships among the variables	Section 2.2, Ocean Currents, BLM 1-21, Deep Ocean Currents
1.30 Communicate questions, and results using notes, and drawings	Section 2.2, Ocean Currents, BLM 1-21, Deep Ocean Currents
1.31 State a conclusion about the formation of deep water currents	Section 2.2, Ocean Currents, BLM 1-21, Deep Ocean Currents
1.32 Explain how waves and tides are generated.	Section 2.3, Waves and Tides, pp. 64–77
1.33 Define wave	Section 2.3, Waves and Tides, pp. 64–77

CORRELATION TO THE NEWFOUNLAND AND LABRADOR GRADE 8 SCIENCE CURRICULUM	
1.34 Identify that waves on the surface of water are the result of a transfer of energy from moving air to the water.	Section 2.3, Waves and Tides, pp. 64–77
1.35 Define and illustrate the following wave features: (i) wave length (ii) wave height (iii) crest (iv) trough	Section 2.3, Waves and Tides, pp. 64–77
1.36 Distinguish between ocean waves, swells, and breakers	Section 2.3, Waves and Tides, pp. 64–77
1.37 Identify that as waves approach a shoreline the wave length decreases and wave height increases	Section 2.3, Waves and Tides, pp. 64–77
1.38 Define tsunami	Section 2.3, Waves and Tides, pp. 64–77
1.39 Define tide	Section 2.3, Waves and Tides, pp. 64–77
1.40 Explain and illustrate how tides are generated by the gravitational pull of the moon.	Section 2.3, Waves and Tides, pp. 64–77
1.41 Define tidal range	Section 2.3, Waves and Tides, pp. 64–77
1.42 Distinguish between spring tides and neap tides	Section 2.3, Waves and Tides, pp. 64–77
1.43 Describe the processes of erosion and deposition in relation to the interaction of waves and tides with shorelines.	Section 2.3, Waves and Tides, pp. 64–77
1.44 Identify that wave and tide interactions with shorelines depend on: (i) shape of the shoreline (ii) slope of the shoreline (iii) type of rock material (iv) wave energy	Section 2.3, Waves and Tides, pp. 64–77
1.45 Define headlands and bays	Section 2.3, Waves and Tides, pp. 64–77
1.46 Explain how waves affect headlands and bays differently	Section 2.3, Waves and Tides, pp. 64–77
1.47 Investigate how shoreline slope and rock type determine the type of interaction between waves and shorelines	Conduct an Investigation 2-3B, Waves and Beaches, pp. 73–74
1.48 Research information, from various print and electronic sources, on the processes of erosion and deposition that result from wave action and water flow. (209-5, 311-11) Include: (i) beaches (ii) shoal (iii) sand bars (iv) sea caves (v) sea arches (vi) sea stacks	Section 2.3, Waves and Tides, pp. 64–77 Think About It 2-3A, By the Seashore, p. 72
1.49 Provide examples of various technologies designed to contain damage due to waves and tides.	Think About It 2-3B, Safeguarding Our Shorelines, p. 75
1.50 Investigate, using print and electronic media, recent and past events (storms or tides) that have affected local shorelines creating damage to property and the environment.	Think About It 2-3B, Safeguarding Our Shorelines, p. 75
1.51 Research technologies used to prevent or reduce wave action along shorelines where human development is occurring. Include: (i) breakwaters (ii) jetties/wharves (iii) vegetation	Think About It 2-3B, Safeguarding Our Shorelines, p. 75
1.52 Define heat capacity	Section 3.1, Oceans and Climates, pp. 82–89

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1.53 Describe how the heat capacity of water relates to climate.	Section 3.1, Oceans and Climates, pp. 82–89 Find Out Activity 3-1A, Learning How Liquids Lose Heat, p. 84
1.54 Describe how convection affects weather	Section 3.1, Oceans and Climates, pp. 82–89
1.55 Describe how oceans moderate climate	Section 3.1, Oceans and Climates, pp. 82–89 Think About It 3-1B, Currents and Climate, p. 87
1.56 Distinguish between the effects of El Ni–o and La Ni–a as global climatic influences	Section 3.1, Oceans and Climates, pp. 82–89
1.57 Recognize how Newfoundland and Labrador's close proximity to the Labrador Current and the Gulf Stream affect our climate. Include: (i) frequency of fog (ii) temperature fluctuations within short time frames	Section 3.1, Oceans and Climates, pp. 82–89 Think About It 3-1B, Currents and Climate, p. 87
1.58 Analyze factors that affect productivity and species distribution in freshwater and marine environments	Section 3.2, Living in Water, pp. 90–99
1.59 Describe species found in freshwater environments. Include: (i) lakes and ponds (ii) wetlands (iii) rivers and streams (iv) estuaries	Section 3.2, Living in Water, pp. 90–99
1.60 Describe species found in saltwater environments. Include: (i) pelagic zone (ii) benthic zone	Section 3.2, Living in Water, pp. 90–99
1.61 Select appropriate methods and tools for collecting data and information and for solving problems	Section 3.2, Living in Water, pp. 90–99
1.62 Interpret patterns and trends in data, and infer and explain relationships among the variables	Section 3.2, Living in Water, pp. 90–99
1.63 Prepare a presentation or report on the effect of abiotic factors on the distribution of species in freshwater and marine environments and evaluate processes used in planning and completing the task.	Conduct an Investigation 3-2B, Too Much of a Good Thing, pp. 96–97
1.64 Identify the effects of abiotic factors on plant and animal distributions in marine and freshwater ecosystems. (208-2, 306-3) Include: (i) temperature (ii) dissolved oxygen (iii) phosphates (iv) pH (v) turbidity (vi) pollution (vii) upwelling (marine) (viii) salinity (marine) (ix) ocean currents (marine)	Find Out Activity 3-2A, Abiotic Factors, p. 95 Conduct an Investigation 3-3B, Water Health Test, pp. 108–111
1.65 Predict and interpret trends in populations of a marine species from graphical data by interpolating and extrapolating data.	Conduct an Investigation 3-2B, Too Much of a Good Thing, pp. 96–97
1.66 Describe some positive and negative effects of marine technologies on ocean species.	Section 3.3, Human Impact on Water Systems, pp. 100–115
1.67 Discuss how new technologies have contributed to overfishing	Section 3.3, Human Impact on Water Systems, pp. 100–115
1.68 Discuss how the offshore oil industry impacts marine environments	Section 3.3, Human Impact on Water Systems, pp. 100–115
1.69 Discuss potential impacts aquaculture technologies have on marine environments	Section 3.3, Human Impact on Water Systems, pp. 100–115

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OPTICS	
2.1 Provide examples of ideas and theories of light used in the past to explain observed properties. (110-1) Include: (i) Pythagoras' belief that light consisted of beams (ii) Michelson's experiment to measure the speed of light	Section 4.1, The Nature of Light, pp. 132–137
2.2 Identify the speed of light as 3 x 108 m/s.	Section 4.1, The Nature of Light, pp. 132–137
2.3 Compare the speed of light to the speed of sound using thunder and lightning as an example.	Section 4.1, The Nature of Light, pp. 132–137
2.4 Provide examples of how scientific knowledge of light resulted in the development of early technologies. (111-1) Include: (i) microscope (ii) telescope	Section 4.1, The Nature of Light, pp. 132–137
2.5 Define light as a form of energy that can be detected by the human eye.	Find Out Activity, Light is Energy, p. 129 Section 4.2, Properties of Waves, pp. 138–147
2.6 Identify and describe properties of visible light. (308-8) Include the following properties, definitions and examples: (i) travels in a straight line (rectilinear propagation) e.g. shadow formation (ii) reflects (reflection) e.g. mirrors (specular) and dust (diffuse) (iii) refracts (refraction) e.g. bent stick effect (iv) disperses (dispersion) e.g. formation of a rainbow as light separates into its constituent colors. (v) travels through a vacuum (does not require a medium) e.g. light from sun and stars reaching earth through space (vi) travels to different degrees through transparent, translucent and opaque materials e.g. window pane, frosted window	Section 4.2, Properties of Waves, pp. 138–147 Section 4.3, Properties of Visible Light, pp. 148–155
2.7 Identify and evaluate potential applications of what was learned concerning refraction.	Section 4.3, Properties of Visible Light, pp. 148–155
2.8 Use a prism to observe the dispersion of light.	Section 4.3, Properties of Visible Light, pp. 148–155
2.9 Define the visible light spectrum.	Section 4.3, Properties of Visible Light, pp. 148–155
2.10 List the constituent colors of white light, in order of degree of refraction.	Section 4.3, Properties of Visible Light, pp. 148–155
2.11 Explain the importance of using the words frequency and wavelength correctly.	Section 4.2, Properties of Waves, pp. 138–147
2.12 Define frequency.	Section 4.2, Properties of Waves, pp. 138–147
2.13 Define wavelength.	Section 4.2, Properties of Waves, pp. 138–147
2.14 Relate the degree of refraction for each of the constituent colors to its wavelength (longest wavelength refracts the least).	Section 4.3, Properties of Visible Light, pp. 148–155
2.15 Describe the relationship between frequency and wavelength. Include: (i) high frequency waves have short wavelengths (ii) low frequency waves have long wavelengths	Section 4.2, Properties of Waves, pp. 138–147 Section 4.3, Properties of Visible Light, pp. 148–155
2.16 Compare properties of visible light to the properties of other types of electromagnetic radiation, including infrared, ultraviolet, X-rays, microwaves, and radio waves.	Section 4.4, Light and the Electromagnetic Spectrum, pp. 156–167 Find Out Activity 4-4B, p. 165 Find Out Activity 4-4C, p. 165
2.17 Describe the electromagnetic spectrum in terms of wavelength, frequency, and energy. Include, in order of decreasing wavelength (increasing frequency): (i) radio waves (ii) microwaves (iii) infrared (iv) visible light (v) ultraviolet (vi) x-rays	Section 4.4, Light and the Electromagnetic Spectrum, pp. 156–167

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2.18 Describe different types of electromagnetic radiation, including infrared, ultraviolet, X-rays, microwaves, and radio waves.	Section 4.4, Light and the Electromagnetic Spectrum, pp. 156–167
2.19 Provide examples of the use of each type of electromagnetic radiation. Include: (i) infrared: motion sensors (ii) radio waves: telecommunications (iii) microwaves: cooking food (iv) ultraviolet: sun tanning (v) x-rays: medical detection	Section 4.4, Light and the Electromagnetic Spectrum, pp. 156–167 Find Out Activity 4-4B, p. 165
2.20 Describe possible negative and positive effects of technologies associated with electromagnetic radiation.	Section 4.4, Light and the Electromagnetic Spectrum, pp. 156–167
2.21 Indicate that generally higher energy electromagnetic radiation is more harmful to humans.	Section 4.4, Light and the Electromagnetic Spectrum, pp. 156–167
2.22 Recognize that there are positive and negative effects of exposure to electromagnetic radiation. Include: (i) x-rays: positive-medical detection, negative-over exposure can lead to cancer (ii) ultraviolet: positive-used to treat jaundice in babies, negative-skin cancer (iii) radio waves: positive-improved telecommunications, negative-uncertain of long term exposure effects	Section 4.4, Light and the Electromagnetic Spectrum, pp. 156–167
2.23 Formulate operational definitions for incidence, reflection, and the normal.	Section 5.1, The Ray Model of Light, pp. 172–187
2.24 Define: (i) incident light ray (ii) reflected light ray (iii) normal (iv) angle of incidence (v) angle of reflection (vi) specular reflection (vii) diffuse reflection	Section 5.1, The Ray Model of Light, pp. 172–187
2.25 Describe applications of the laws of reflection in everyday life. (308-9B) Include: (i) specular reflection (ii) diffuse reflection	Section 5.1, The Ray Model of Light, pp. 172–187
2.26 Estimate angles of incidence and reflection.	Section 5.1, The Ray Model of Light, pp. 172–187 Find Out Activity 5-1C, When Light Reflects, p. 183
2.27 Recognize that the angle of incidence is equal to the angle of reflection.	Section 5.1, The Ray Model of Light, pp. 172–187
2.28 State the Laws of Reflection.	Section 5.1, The Ray Model of Light, pp. 172–187
2.29 Recognize that a ray diagram is a useful way to represent the behaviour of light.	Section 5.1, The Ray Model of Light, pp. 172–187 Section 5.2, Images in Plane Mirrors, pp. 188–195
2.30 Use mirrors effectively and accurately for investigating the characteristics of images formed.	Section 5.2, Images in Plane Mirrors, pp. 188–195
2.31 Define and delimit questions and problems to facilitate investigation.	Find Out Activity 5-2A, Reflections of Reflections, p. 188
2.32 State a conclusion, based on experimental data, and explain how evidence gathered supports or refutes an initial idea.	Conduct an Investigation 5-2B, Demonstrating the Law of Reflection, pp. 192–193
2.33 Construct ray diagrams to describe the formation of an image in a plane mirror. Include: (i) angle of incidence and angle of reflection are always equal (ii) the image and object distance are always equal	Section 5.2, Images in Plane Mirrors, pp. 188–195
2.34 Construct a classification key of mirrors.	Section 5.3, Images in Curved Mirrors, pp. 196–209

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2.35 Describe three types of mirrors. Include: (i) plane (ii) concave (iii) convex	Section 5.3, Images in Curved Mirrors, pp. 196–209
2.36 Provide examples of each type of mirror. Include: (i) bathroom mirror (plane) (ii) inside of a metal spoon (concave) (iii) safety mirror on the front of a school bus (convex)	Section 5.3, Images in Curved Mirrors, pp. 196–209
2.37 Use mirrors effectively and accurately for investigating the characteristics of images formed.	Section 5.2, Images in Plane Mirrors, pp. 188–195 Section 5.3, Images in Curved Mirrors, pp. 196–209
2.38 Describe the image size and image orientation using a variety of mirrors. Include: (i) plane (ii) convex (iii) concave	Section 5.3, Images in Curved Mirrors, pp. 196–209
2.39 Interpret patterns and trends in data, and infer and explain relationships among the variables.	Conduct an Investigation 5-3B, Real and Virtual Images, p. 207
2.40 Define the focal point, focal length and the principle axis.	Section 5.3, Images in Curved Mirrors, pp. 196–209
2.41 State a prediction and a hypothesis based on background information or an observed pattern of events.	Conduct an Investigation 5-2C, Applying the Law of Reflection, p. 194
2.42 Design an experiment and identify major variables.	Conduct an Investigation 5-1D, Follow That Refracted Ray!, pp. 184–185
2.43 Use mirrors effectively and accurately for investigating the characteristics of images formed.	Section 5.2, Images in Plane Mirrors, pp. 188–195 Section 5.3, Images in Curved Mirrors, pp. 196–209
2.44 Describe how three incident rays reflect on curved mirrors. Include: (i) rays traveling parallel to the principal axis (ii) rays traveling through the focal point. (iii) rays incident to the mirror at the centre of curvature.	Section 5.3, Images in Curved Mirrors, pp. 196–209
2.45 Describe the formation of images in curved mirrors.	Section 5.3, Images in Curved Mirrors, pp. 196–209
2.46 Construct ray diagrams showing the formation of images in curved mirrors. Include: (i) convex mirrors (ii) concave mirrors, when the object is in different positions. Include: • object between focal point and mirror • object between focal point and 2x focal length • object beyond 2x focal length	Section 5.3, Images in Curved Mirrors, pp. 196–209
2.47 Describe the characteristics of images formed using concave and convex mirrors. Include: (i) size (ii) upright or inverted (iii) real or virtual	Section 5.3, Images in Curved Mirrors, pp. 196–209
2.48 Differentiate between real and virtual images.	Section 5.3, Images in Curved Mirrors, pp. 196–209
2.49 Identify new questions and problems concerning light reflection that arise from what was learned.	Section 5.3, Images in Curved Mirrors, pp. 196–209
2.50 Work cooperatively and collaboratively with others to plan and safely construct an optical device using mirrors.	Project, Building an Optical Device, p. 256
2.51 Identify and correct practical problems in the way a constructed optical device functions.	Project, Building an Optical Device, p. 256
2.52 Identify questions to investigate involving refraction arising from practical problems and issues. (208-2) Include: (i) the bent stick effect (ii) apparent position of a fish under water	Section 6.1, Concave and Convex Lenses, pp. 214–227
2.53 Describe qualitatively how visible light is refracted.	Section 6.1, Concave and Convex Lenses, pp. 214–227

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2.54 Define the process of light refraction. Include: (i) incident ray (ii) refracted ray (iii) angle of incidence (iv) angle of refraction	Section 6.1, Concave and Convex Lenses, pp. 214–227
2.55 Indicate that the speed of light decreases as it travels from one medium to another of greater density, and vice versa.	Section 6.1, Concave and Convex Lenses, pp. 214–227
2.56 Estimate angles of incidence and refraction. (209-2) Include: (i) as light moves from a less dense medium to a more dense medium (ii) as light moves from a more dense medium to a less dense medium	Section 6.1, Concave and Convex Lenses, pp. 214–227 Find Out Activity 6-1A, Lenses and Light Rays, p. 215
2.57 Identify that a light ray traveling into a medium of greater density will bend towards the normal, and vice versa.	Section 6.1, Concave and Convex Lenses, pp. 214–227
2.58 Predict the effect of transparent media of varying densities on the angle of refraction of light. (208-5) Include: (i) vegetable oil (ii) water (iii) rubbing alcohol	Section 6.1, Concave and Convex Lenses, pp. 214–227 Conduct an Investigation 5-1D, Follow That Refracted Ray!, pp. 184–185
2.59 Construct a classification key of lenses.	Section 6.1, Concave and Convex Lenses, pp. 214–227
2.60 Describe two types of lenses. Include: (i) convex (ii) concave	Section 6.1, Concave and Convex Lenses, pp. 214–227
2.61 Provide examples of each type of lens. Include: (i) magnifying glass (convex) (ii) eye glasses (convex) (iii) eye glasses (concave)	Section 6.2, Human Vision, pp. 228–241 Section 6.3, Extending Human Vision, pp. 242–251
2.62 Describe how lenses correct near-sightedness and far-sightedness.	Section 6.2, Human Vision, pp. 228–241
2.63 Estimate focal length of a convex lens by finding its focal point.	Find Out Activity 6-1B, The Focal Length of a Convex Lens, p. 218
2.64 Define focal length.	Section 6.1, Concave and Convex Lenses, pp. 214–227
2.65 Rephrase questions related to refraction and lenses in a testable form.	Section 6.1, Concave and Convex Lenses, pp. 214–227
2.66 Describe how three incident rays refract through convex and concave lenses. Include the following incident rays: (i) traveling parallel to the principal axis (ii) traveling through the optical centre (iii) traveling through the focus	Section 6.1, Concave and Convex Lenses, pp. 214–227
2.67 Construct ray diagrams to describe the formation of an image in a double convex lens, when the object's distance changes. Include: (i) object between focal point and lens (ii) object between focal point and 2x focal length (iii) object beyond 2x focal length	Section 6.1, Concave and Convex Lenses, pp. 214–227
2.68 Construct ray diagrams to describe the formation of an image in a double concave lens, when the object's distance changes. Include: (i) object between focal point and lens (ii) object between focal point and 2x focal length (iii) object beyond 2x focal length	Section 6.1, Concave and Convex Lenses, pp. 214–227
2.69 Describe the general characteristics of the image for all cases. Include: (i) distance (ii) size (iii) orientation	Section 6.1, Concave and Convex Lenses, pp. 214–227

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2.70 Describe how optical technologies have developed through systematic trial-and-error processes constrained by the optical properties of the materials.	Section 6.1, Concave and Convex Lenses, pp. 214–227 Section 6.3, Extending Human Vision, pp. 242–251
2.71 Provide examples of optical technologies that enable scientific research and relate personal activities associated with such technologies. (109-10, 111-3) Include: (i) telescopes (refracting and reflecting) (ii) microscopes	Section 6.3, Extending Human Vision, pp. 242–251 Think About It 6-3B, Microscopes on the Job, p. 244
2.72 Provide examples related to optics that illustrate that scientific and technological activities take place individually and in group settings. (112-8) Include: (i) Galileo – telescope (individual) (ii) Newton – telescope (individual) (iii) Hubble Telescope (group) (iv) Laser technologies (group)	Section 6.3, Extending Human Vision, pp. 242–251
FLUIDS	
3.1 Identify questions to investigate arising from practical problems and issues involving fluids.	Find Out Activity, Fluid or Non-fluid, p. 265 Find Out Activity 7-1A, Magic Mud, p. 269
3.2 Define fluid	Section 7.1, Describing Fluids, pp. 268–277
3.3 Compare solids, liquids and gases in terms of shape and volume, and using the particle theory of matter. Include: (i) shape (ii) volume (iii) particle arrangement (iv) particle movement	Section 7.1, Describing Fluids, pp. 268–277
3.4 Identify examples of fluids in everyday life. Include: (i) compressed air in tires (ii) water (iii) syrup	Section 7.1, Describing Fluids, pp. 268–277
3.5 Define viscosity	Section 7.1, Describing Fluids, pp. 268–277
3.6 Relate the viscosity of a liquid to the amount of friction between particles.	Section 7.1, Describing Fluids, pp. 268–277
3.7 Identify examples of viscosity in everyday life. Include: (i) motor oil (ii) paints (iii) foods	Section 7.2, Viscosity and Flow Rate, pp. 278–285
3.8 Define flow rate	Section 7.2, Viscosity and Flow Rate, pp. 278–285
3.9 Identify examples of liquids with different flow rates. Include: (i) water (ii) dishwashing liquid (iii) corn syrup	Section 7.2, Viscosity and Flow Rate, pp. 278–285
3.10 Identify and relate personal activities and potential applications to fluid dynamics. (109-10, 112-7, 210-12). Include: (i) Pancake batter (ii) Motor oil	Section 7.2, Viscosity and Flow Rate, pp. 278–285 Section 7.3, Factors Affecting Viscosity, pp. 286–297
3.11 Compare the viscosity of various liquids.	Find Out Activity 7-2A, The Value of Viscosity, p. 280 Conduct an Investigation 7-2B, The Flow Rate of Liquids, pp. 282–283
3.12 Rephrase questions in a testable form and clearly define practical problems.	Find Out Activity 7-2A, The Value of Viscosity, p. 280
3.13 Identify and suggest explanation for discrepancies in data	Find Out Activity 7-2A, The Value of Viscosity, p. 280
3.14 Compile and display data using a bar graph	Conduct an Investigation 7-2B, The Flow Rate of Liquids, pp. 282–283
3.15 Design an experiment to test the viscosity of various common fluids and identify the major variables.	Conduct an Investigation 7-2B, The Flow Rate of Liquids, pp. 278–279
3.16 Carry out procedures controlling the major variables	Conduct an Investigation 7-2B, The Flow Rate of Liquids, pp. 282–283

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3.17 Describe factors that can modify the viscosity of a liquid. (307 7) Teachers could use a number of examples to explain the factors affecting the viscosity.	Section 7.3, Factors Affecting Viscosity, pp. 286–297 Find Out Activity 7-3A, Cool It!, p. 287
3.18 Explain a liquid's resistance to flow in terms of the particle theory of matter. Include: (i) strength of attraction between particles (ii) temperature (iii) concentration.	Section 7.3, Factors Affecting Viscosity, pp. 286–297
3.19 Work cooperatively with team members to design an experiment and identify major variables in order to investigate the effect of temperature and concentration on viscosity.	Find Out Activity 7-3A, Cool It!, p. 287 Conduct an Investigation 7-3E, The Effect of Concentration on Viscosity, pp. 295–296
3.20 Use a temperature-measuring technology effectively and accurately for collecting data in temperature-viscosity investigations.	Find Out Activity 7-3A, Cool It!, p. 287
3.21 Demonstrate knowledge of WHMIS standards, for example, by demonstrating the correct methods of disposal of various oils.	Conduct an Investigation 7-3D, The Effect of Concentration on Viscosity, pp. 295–296
3.22 Describe the relationship among the mass, volume, and density of solids, liquids and gases using the particle model of matter.	Section 8.1, Defining Density, pp. 302–309
3.23 Describe the relationship between state of matter (solid, liquid or gas) and density using the particle model of matter.	Section 8.1, Defining Density, pp. 302–309
3.24 Describe the relationship between mass, volume and density.	Section 8.1, Defining Density, pp. 302–309
3.25 Analyze quantitatively the density of various substances.	Section 8.2, Determining Density, pp. 310–323
3.26 Calculate the density of a material, given mass and volume	Section 8.2, Determining Density, pp. 310–323
3.27 Calculate the mass of a material, given density and volume	Section 8.2, Determining Density, pp. 310–323
3.28 Calculate the volume of a material, given density and mass	Section 8.2, Determining Density, pp. 310–323
3.29 Use instruments effectively and accurately for collecting data.	Conduct an Investigation 8-2B, Determining Density, pp. 316–319
3.30 Select appropriate methods and tools, and use them safely, in order to determine the volume of irregular shaped objects by water displacement.	Find Out Activity 8-2A, What is the Density of a Pencil?, p. 315
3.31 Identify, and suggest explanations for, discrepancies in data.	Conduct an Investigation 8-2B, Determining Density, pp. 316–319
3.32 Calculate the density of various objects. (210-9) Include: (i) irregular shaped objects (ii) liquids (iii) granular objects (iv) regular shaped objects	Find Out Activity 8-2A, What is the Density of a Pencil?, p. 315 Conduct an Investigation 8-2B, Determining Density, pp. 316–319
3.33 Explain the effects of changes in temperature on the density of solids, liquids, and gases and relate the result to the particle model of matter.	Section 8.3, Changes in Density, pp. 324–329 Think About It 8-3A, Lava Lamps, p. 325
3.34 Identify examples of density changes (resulting from a temperature change) in everyday life. Include: (i) hot air balloons (ii) warm vs. cool tire pressure (iii) water in its three states	Section 8.3, Changes in Density, pp. 324–329
3.35 Describe situations in life where the density of substances naturally changes or is intentionally changed. Include: (i) drying of wood (seasoning of wood) (ii) hot air balloons (iii) salt water being easier to float in	Section 8.3, Changes in Density, pp. 324–329
3.36 Describe the movement of objects in terms of balanced and unbalanced forces.	Section 9.1, Forces and Buoyancy, pp. 334–347

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3.37 Define force	Section 9.1, Forces and Buoyancy, pp. 334–347
3.38 Define balanced and unbalanced forces	Section 9.1, Forces and Buoyancy, pp. 334–347
3.39 Describe qualitatively the difference between mass and weight.	Section 9.1, Forces and Buoyancy, pp. 334–347
3.40 Describe the connection between weight, buoyancy, and sinking or floating.	Section 9.1, Forces and Buoyancy, pp. 334–347
3.41 Define buoyant force	Section 9.1, Forces and Buoyancy, pp. 334–347
3.42 Apply the concept of balanced and unbalanced forces to the buoyancy and weight of an object to explain why it sinks or floats.	Section 9.1, Forces and Buoyancy, pp. 334–347
3.43 Identify questions to investigate arising from practical problems involving density and buoyancy.	Section 9.1, Forces and Buoyancy, pp. 334–347
3.44 List examples of materials that may sink or float, depending on the application. Include: (i) wooden boats vs. a water logged stick (ii) metal block vs. metal boats (iii) a sealed, empty plastic bottle vs. a plastic bottle full of water	Section 9.1, Forces and Buoyancy, pp. 334–347
3.45 Define average density	Section 9.1, Forces and Buoyancy, pp. 334–347
3.46 Indicate that an object will float if it is less dense than the fluid in which it is immersed.	Section 9.1, Forces and Buoyancy, pp. 334–347 Find Out Activity 9-1A, The Amazing Floating Egg, p. 338
3.47 Indicate that an object will sink if it is denser than the fluid in which it is immersed.	Section 9.1, Forces and Buoyancy, pp. 334–347 Find Out Activity 9-1A, The Amazing Floating Egg, p. 338
3.48 Provide examples of technologies that have been developed because of our understanding of density and buoyancy. (111-1) Include: (i) personal flotation devices (ex. life jackets) (ii) submarines (iii) hot air balloons	Section 9.1, Forces and Buoyancy, pp. 334–347
3.49 Describe quantitatively the relationship between force, area, and pressure.	Section 9.2, Pressure, Hydraulics, and Pneumatics, pp. 348–363
3.50 Define pressure	Section 9.2, Pressure, Hydraulics, and Pneumatics, pp. 348–363
3.51 Define the Pascal (Pa) unit	Section 9.2, Pressure, Hydraulics, and Pneumatics, pp. 348–363
3.52 Define atmospheric pressure	Section 9.2, Pressure, Hydraulics, and Pneumatics, pp. 348–363
3.53 Calculate the pressure, given force and area	Section 9.2, Pressure, Hydraulics, and Pneumatics, pp. 348–363
3.54 Calculate the force, given pressure and area	Section 9.2, Pressure, Hydraulics, and Pneumatics, pp. 348–363
3.55 Calculate the area, given pressure and force	Section 9.2, Pressure, Hydraulics, and Pneumatics, pp. 348–363
3.56 Describe the science underlying hydraulic technologies.	Section 9.2, Pressure, Hydraulics, and Pneumatics, pp. 348–363
3.57 Define hydraulic system	Section 9.2, Pressure, Hydraulics, and Pneumatics, pp. 348–363
3.58 Identify a liquid as an incompressible fluid (ie. definite volume)	Section 9.2, Pressure, Hydraulics, and Pneumatics, pp. 348–363
3.59 Define pneumatic system.	Section 9.2, Pressure, Hydraulics, and Pneumatics, pp. 348–363
3.60 Identify a gas as a compressible fluid (ie. indefinite volume)	Section 9.2, Pressure, Hydraulics, and Pneumatics, pp. 348–363
3.61 State Pascal's law	Section 9.2, Pressure, Hydraulics, and Pneumatics, pp. 348–363
3.62 Identify examples of applications of Pascal's law. Include: (i) a car lift or hoist (ii) an hydraulic jack (iii) automobile braking system	Section 9.2, Pressure, Hydraulics, and Pneumatics, pp. 348–363
3.63 Identify questions to investigate arising from practical problems and issues.	Find Out Activity 9-3B, Lifting with Air, p. 367 Conduct an Investigation 9-3D, Putting on the Pressure, p. 371

CORRELATION TO THE NEWFOUNLAND AND LABRADOR GRADE 8 SCIENCE CURRICULUM	
3.64 Explain qualitatively the relationship among pressure, volume, and temperature when liquid and gaseous fluids are compressed or heated.	Section 9.3, Relationships among Pressure, Volume, and Temperature of Gases, pp. 364–373
3.65 Indicate that increasing the temperature of a gas results in an increase in volume (pressure being held constant)	Section 9.3, Relationships among Pressure, Volume, and Temperature of Gases, pp. 364–373
3.66 Indicate that increasing the pressure on a gas results in a decrease in volume (temperature being held constant)	Section 9.3, Relationships among Pressure, Volume, and Temperature of Gases, pp. 364–373
3.67 Indicate that increasing temperature of a gas results in an increase in pressure (volume being held constant)	Section 9.3, Relationships among Pressure, Volume, and Temperature of Gases, pp. 364–373
3.68 Interpret patterns and trends in data and infer and explain relationships among the variables	Think About It 9-3C, The Pressure is Rising, p. 369 Conduct an Investigation 9-3D, Putting on the Pressure, p. 371
3.69 Provide examples illustrating the relationship among pressure, volume and temperature when gaseous fluids are compressed or heated. Include: (i) propane cylinders (increase in pressure with a decrease in volume at constant temperature) (ii) heating an aerosol can can result in an explosion (increase in temperature resulting in an increase in pressure, at constant volume)	Section 9.3, Relationships among Pressure, Volume, and Temperature of Gases, pp. 364–373
CELLS, TISSUES, ORGANS AND SYSTEMS	
4.1 Compare the early idea that living organisms were made of air, fire and water with the modern cell theory.	Section 10.1, Characteristics of Life, pp. 390–401
4.2 Define cell	Section 10.1, Characteristics of Life, pp. 390–401
4.3 Describe the four characteristics common to living things. Include: (i) growth (ii) movement (locomotion) (iii) response to stimuli (iv) reproduction	Section 10.1, Characteristics of Life, pp. 390–401
4.4 Describe how optical technologies have developed through systematic trial and error processes constrained by the optical properties of the materials.	Section 10.1, Characteristics of Life, pp. 390–401
4.5 Identify and state the functions of the major parts of the compound microscope. (i) eyepiece (ii) objective lenses (iii) stage (iv) coarse adjustment knob (v) fine adjustment knob (vi) light source/lamp (vii) iris diaphragm (viii) base (ix) barrel (or tube) (x) arm (xi) revolving nosepiece	Section 10.1, Characteristics of Life, pp. 390–401
4.6 Use a light microscope to produce a clear image of cells.	Find Out Activity 10-1B, Observing Organisms in Pond Water, p. 397 Conduct an Investigation 10-2C, Observing Plant and Animal Cells, pp. 408–409
4.7 Identify and suggest explanations for discrepancies in data.	Conduct an Investigation 10-2C, Observing Plant and Animal Cells, pp. 408–409
4.8 Organize data using a format that is appropriate to the task.	Conduct an Investigation 10-2C, Observing Plant and Animal Cells, pp. 408–409
4.9 Estimate measurements of plant cells viewed with microscope.	Conduct an Investigation 10-2C, Observing Plant and Animal Cells, pp. 408–409
4.10 Demonstrate proper care in the use and storage of the compound microscope.	Conduct an Investigation 10-1A, Setting Up and Using a Microscope, pp. 394–395
4.11 Examine the field of view under low and medium power.	Conduct an Investigation 10-1A, Setting Up and Using a Microscope, pp. 394–395

CORRELATION TO THE NEWFOUNLAND AND LABRADOR GRADE 8 SCIENCE CURRICULUM	
4.12 Prepare and observe a wet mount slide.	Conduct an Investigation 10-1A, Setting Up and Using a Microscope, pp. 394–395
4.13 Illustrate and explain that the cell is a living system that exhibits the following characteristics of life. (304-4) Include: (i) growth (ii) movement/locomotion (iii) response to stimuli (iv) reproduction	Section 10.1, Characteristics of Life, pp. 390–401 Find Out Activity 10-1B, Observing Organisms in Pond Water, p. 397
4.14 Explain that it is important to use proper terms when comparing plant and animal cells.	Section 10-2, Focussing on Cells, pp. 402–415
4.15 Examine and explain the role of the following organelles: (i) cell wall (i) cell membrane (ii) chloroplast (iii) cytoplasm (iv) nucleus (v) vacuole (vii) mitochondria	Section 10-2, Focussing on Cells, pp. 402–415
4.16 Label organelles on diagrams of typical plant and animal cells.	Section 10-2, Focussing on Cells, pp. 402–415
4.17 State the cell theory	Section 10-2, Focussing on Cells, pp. 402–415
4.18 Work cooperatively with team members to develop and construct models of cells.	Conduct an Investigation 10-2B, Building a 3-D Cell, p. 407
4.19 Evaluate individual and group processes used in constructing models of cells.	Conduct an Investigation 10-2B, Building a 3-D Cell, p. 407
4.20 Distinguish between typical plant and animal cells.	Section 10-2, Focussing on Cells, pp. 402–415
4.21 Produce labeled drawings of each type of cell.	Section 10-2, Focussing on Cells, pp. 402–415
4.22 List three differences between plant and animal cells. Include: (i) plant cells have chloroplasts (ii) plant cells have cell walls, therefore they have a regular shape (iii) plant cells have fewer, and larger, vacuoles	Section 10-2, Focussing on Cells, pp. 402–415
4.23 Explain that growth and reproduction depend on cell division.	Section 10-2, Focussing on Cells, pp. 402–415 Find Out Activity 10-2D, Observing Root Tip Cells, p. 412
4.24 Explain that mitosis is the process of division of cells.	Section 10-2, Focussing on Cells, pp. 402–415
4.25 Relate the needs and functions of various cells and organs to the needs and functions of the human organism as a whole.	Section 11.1, Cell Organization, pp. 420–425
4.26 Explain that cells and organisms require the same basic necessities of life. Include: (i) oxygen (ii) nutrients (iii) waste removal	Section 11.1, Cell Organization, pp. 420–425
4.27 Explain structural and functional relationships between and among cells, tissues, organs, and systems in the human body.	Section 11.1, Cell Organization, pp. 420–425 Find Out Activity 11-1B, Looking at Animal Tissues, p. 423
4.28 describe these levels of organization found in living things. (i) cells (ii) tissues (iii) organs (iv) organ systems (v) organisms	Section 11.1, Cell Organization, pp. 420–425 Think About It 11-1A, Represent the Relationship, p. 421
4.29 Diagram the relationships between cells, tissues, organs, organ systems and organisms in a flow chart.	Think About It 11-1A, Represent the Relationship, p. 421
4.30 Evaluate individual and group processes used in presenting the roles of the main organ systems.	Find Out Activity 11-2A, Teamwork, p. 427

CORRELATION TO THE NEWFOUNLAND AND LABRADOR GRADE 8 SCIENCE CURRICULUM	
4.31 Identify the main function of the following organ systems in keeping organisms alive. (i) circulatory (ii) respiratory (iii) digestive (iv) excretory (v) nervous (vi) muscular	Section 11.2, Introducing Human Body Systems, pp. 426–431 Find Out Activity 11-2A, Teamwork, p. 427 Section 12.1, How Body Systems Are Connected, pp. 436–445
4.32 Describe the basic factors that affect the functions and efficiency of the human respiratory, circulatory, muscular, digestive, excretory, and nervous systems.	Section 12.2, Body Systems and Health, pp. 446–457
4.33 Explain the roles that diet, nutrition, exercise and stress have on the systems mentioned above.	Section 12.2, Body Systems and Health, pp. 446–457
4.34 Debate lifestyle choices such as diet choices, smoking, drinking alcohol, or sedentary lifestyle and their effects on body systems.	Section 12.2, Body Systems and Health, pp. 446–457
4.35 Illustrate examples of conflicting evidence related to how we should maintain and/or treat body systems.	Section 12.2, Body Systems and Health, pp. 446–457 Find Out Activity 12-2A, Health Watch, p. 452 Conduct an Investigation 12-2C, Debate: Conventional versus Alternative Medicine, pp. 454–455
4.36 Describe the science underlying various technologies used to assist or replace unhealthy organs or systems. Include: (111-5) (i) insulin pump (ii) artificial heart	Section 12.2, Body Systems and Health, pp. 446–457
4.37 Provide examples of scientific knowledge that have resulted in the development of technologies	Section 12.2, Body Systems and Health, pp. 446–457
4.38 Describe how a community's needs can lead to developments in science and technology	Section 12.1, How Body Systems Are Connected, pp. 436–445
4.39 Make informed decisions about applications of science and technology, taking into account environmental and social advantages and disadvantages	Section 12.2, Body Systems and Health, pp. 446–457 Conduct an Investigation 12-2C, Debate: Conventional versus Alternative Medicine, pp. 454–455
4.40 Propose a course of action on social issues related to science and technology, taking into account human and environmental needs	Section 11.1, Cell Organization, pp. 420–425
4.41 Design and carry out an experiment to compare and contrast heart rate and breathing rate in an individual during various levels of activity, and identify and control the major variables.	Conduct an Investigation 12-1B, The Effect of Activity on Heart Rate and Breathing Rate, pp. 442–443
4.42 Rephrase questions into testable form about the factors that affect physical fitness and health.	Conduct an Investigation 12-1B, The Effect of Activity on Heart Rate and Breathing Rate, pp. 442–443
4.43 State a hypothesis based on background information or an observed pattern of events.	Conduct an Investigation 12-1B, The Effect of Activity on Heart Rate and Breathing Rate, pp. 442–443
4.44 Carry out procedures controlling the major variables.	Find Out Activity 12-1A, Muscle Activity and Heat, p. 441 Conduct an Investigation 12-1B, The Effect of Activity on Heart Rate and Breathing Rate, pp. 442–443
4.45 Identify and suggest explanations for discrepancies in data.	Conduct an Investigation 12-1B, The Effect of Activity on Heart Rate and Breathing Rate, pp. 442–443
4.46 Compile and display data using tables and graphs.	Conduct an Investigation 12-1B, The Effect of Activity on Heart Rate and Breathing Rate, pp. 442–443
4.47 Suggest explanations for variations in the heart rate and the breathing rate of an individual during various levels of activity when the experiment is repeated.	Conduct an Investigation 12-1B, The Effect of Activity on Heart Rate and Breathing Rate, pp. 442–443

CORRELATION TO THE NEWFOUNLAND AND LABRADOR GRADE 8 SCIENCE CURRICULUM

4.48 Describe three examples of the interdependence of various systems of the human body. (304-10) Include: (i) circulatory/respiratory (ii) digestive/circulatory (iii) nervous/muscular	Section 12.1, How Body Systems Are Connected, pp. 436–445 Conduct an Investigation 12-1B, The Effect of Activity on Heart Rate and Breathing Rate, pp. 442–443
4.49 Provide examples of careers that are associated with the health of body systems.	Section 12.2, Body Systems and Health, pp. 446–457
4.50 Make informed decisions about applications of science and technology that are associated with human body systems taking into account personal and social advantages and disadvantages.	Find Out Activity 12-2B, Evaluating Energy Drinks, p. 453 Conduct an Investigation 12-2C, Debate: Conventional versus Alternative Medicine, pp. 454–455 Integrated Research Investigation, Advances in Biotechnology, p. 463

COURSE MATERIALS

The following chart lists the items you may wish to use for a class of 30 using the *Discovering Science 8* program. The activities can be carried out by pairs or small groups of students, unless the instructions clearly specify that students should work on their own. Suppliers of science lab materials and equipment are listed in the suppliers' section of this *Teacher's Resource*.

Item Description	Suggested Quantity	Needed for These Units
NON-CONSUMABLE		
Balance	6	1, 3
Basketball or volleyball with pump	1	3
Bicycle with shock absorbers	1	3
Binoculars	1 pair	2
Black light	6	2
Block of glass or transparent plastic	6	2
Blocks of wood (a variety of small sizes)	24	1
Bowls of various sizes, including large	6 sets	1, 3
Broom	1	1, 2, 3, 4
C clamp	6	2, 3
Calculator	30	1
Canadian currency bill	6	2
CD	6	2
Coiled metal spring	12	2
Coloured filters (red, blue, green)	6 sets	2
Compound microscope	15	1, 4
Cover slips	200	4
Data collection interface	6	4
Deep pan	6	1
Digital thermometer	6	4
Dish detergent bottle (clear plastic) with squeeze cap	3	3
Dissection tray	6	2
Drill, electric	1	3
Dumbbells (2.5 kg, 3.5 kg, and 5 kg)	6 of each	4
Dustpan	1	1, 2, 3, 4
Electric kettle	6	1
Eraser	30	1
Erlenmeyer flask	6	3
Fabric scraps	6	2
Field guide to aquatic organisms	6	1
Film canisters, with lids	30	3
Flashlight	6	2
Flat-topped desks (or tables)	6	1
Flex camera (optional)	1	4
Freezer	1	1, 2
Galileo thermometer	1	3

Item Description	Suggested Quantity	Needed for These Units
Glass or plastic marbles (large)	1 L	3
Glass or plastic sheet (at least 0.5 m x 0.3 m)	6	3
Glass pieces (with smooth edges)	6	2
Glass prism	6	2
Globe	1	1
Glue gu	1	3
Graduated cylinders (100 mL, 250 mL)	30 - 100 mL 15 - 250 mL	1, 3
Hole punch	1	1
Hot plate or other heat source	6	1, 3
Hydrometer	1	3
Iron ring	6	3
Kitchen spoon (metal)	30	2
Lab stand	6	3
Laser pointer	1	2
Light bulbs, unfrosted (and sockets connected for power source)	6	2
Long-handle dip net	6	1
Magnifying glass	10	1
Map of your area showing lakes, ponds, and wetlands	1	1
Masses (500 g, 1 kg, 2 kg)	6 of each	3
Measuring cup (250 mL)	6	1
Measuring spoons (5 mL, 15 mL)	6 sets	1, 3
Medicine droppers	30	1, 3, 4
Metal balls (small)	1 L	3
Metre stick	6	2
Microscope slides	60	4
Microscope slides of onion root tip, prepared	15	4
Microscope slides of human skin cells, prepared	15	4
Microscope slides of human bone, nerve, and muscle tissue, (and perhaps other tissue) prepared	1 of each	4
Microscope slides, prepared (other)	15	4
Mirrors (concave) with at least three different curvatures	6 sets	2
Mirrors (convex) with different curvatures	6 sets	2
Mirrors (plane, about 5 cm by 15 cm) with support stand	6	2
Mirrors, plane	12	2
Nail or other object with pointed end (small)	6	2
Newton force scales	2	3
Oven mitts or heat-resistant gloves	6 pair	1, 3
Paper clip	1 box	2, 3
Pencil (wooden)	30	1, 2, 3
Petri dishes	12	2
Photos of local lakes, ponds, and wetlands	5	1
Pie plate	6	2
Pipettes	30	3
plastic or glass pan (clear), or small aquarium	6	1
Plastic jar or cup with lid	6	3

Item Description	Suggested Quantity	Needed for These Units
Plastic pail or container	6	1
Plastic spoon	6	1
Plastic tubing, clear	6 m	3
Plastic tubs	3 total	3
Printed page	6	2
Prism, decorative to hang in window	1	2
Prisms (tinted, frosted, clear and colourless)	6 of each	2
Prod	6	2
Projector, if required	1	4
Protective gloves	6 pair	2
Protractor	30	2
Pushpin	30	2
Ray box	6	2
Rectangular pan	6	1
Refrigerator	1	1
Ring clamps	3	1
Ring stand	1	1
Rock (small)	6	1
Room with a window	1	2
Rubber gloves	15 pair	3
Scissors	6 pair	1, 2
Scoopulas or measuring spoons	20	4
Small materials to fill film canisters (for example, plastic beads, ball bearings, paper clips, feathers, coins)	2 L	3
Solar calculator without a backup battery or with the battery disabled	15	2
Sphygmomanometer	1	3
Sports equipment, various	20 pieces	4
Stirring rod	15	1, 3, 4
Stopwatch	6	3
Straight pin	30	3
Sturdy spoon or stir stick	6	3
Syringes (modified – with no needles)	50	3
Teaspoon	6	3
Television set with remote control	1	2
Temperature probe	6	4
Test kit to measure dissolved oxygen, nitrates, and/or phosphates (optional)	6	1
Test tubes	36	1
Thermometer (alcohol)	6	3, 4
Thermometer clamp	6	3
Thermometer for testing air and water temperature	6	1, 3
Tongs	15 pair	1, 3
Tuning fork	1	3
Tweezers	6	4
Unbreakable plates or metal pie plates	20	3
Video *Cosmic Zoom*, from National Film Board	1	4

Item Description	Suggested Quantity	Needed for These Units
Watch glass	15	1
Water testing kit	6	1
Wax blocks (thin and thick)	6 of each	2
White cardboard for screen	6	2
White light source	6	2
Wide-mouth flask	6	3
CONSUMABLE		
Apple juice or vinegar	300 mL	3
Adhesive tape (with frosty appearance, not clear)	1 roll	2
Aluminum foil	1 m	2
Art supplies, such as glue, paints, etc.	1 set for each group	1, 2, 4
Balloon (small, round)	60	3, 4
Beakers (50 mL, 100 mL, 250 mL, 500 mL, 600 mL, 1 L)	12 - 50 mL 6 - 100 mL 6 - 250 mL 12 - 500 mL 1 - 600 mL 30 - 1 L (6 with lids)	1, 2, 3, 4
Bleach solution (10%)	1 bottle for clean up	2
Bubble gum	30 pieces	3
Cardboard or manila card stock	10 pieces at least 20 cm x 30 cm	2
Chart paper (large)	1 pad	4
Cup (clear plastic)	30	2
Coloured markers (variety, including yellow)	6 sets	1, 2, 4
Coloured pencils (blue, red, and green)	6 sets	1
Cork	10	3
Corn syrup	1.5 L	3
Cornstarch	500 mL	3
Dishwashing liquid	750 mL	2, 3
Distilled water	100 mL	1
Drinking straws	150	1
Dry ice	500 g	3
Egg	7	3
Elastic band	12	3
Fertilizer (8-24-8, uncoloured)	100 mL	1
Food colouring	1 bottle each red, blue, green	3
Gel pens, assorted	15	2
Glycerol	3 L	3
Gravel	5 L	1
Honey	750 mL	3
Ice	15 L	1, 3
Index card	40	1, 2
Iodine solution	50 mL	4
Ketchup	500 mL	3
Labels from several energy drink products	15	4

Item Description	Suggested Quantity	Needed for These Units
Lava lamp	1 or more	3
Lens paper	100 sheets	4
Lenses (variety of convex and concave)	6 sets	2
Live specimens, for viewing through microscope	15	4
Masking tape	6 rolls	1, 2, 4
Milk	500 mL	2
Modelling clay	2 kg	1
Molasses	5 L	3
Mug	6	3
Newspapers and magazines with pictures of fluids	20	3
Onion	1	4
Paper, blank	60 sheets	2, 4
Paper, grid	100 sheets	1, 4
Paper, legal-sized	12 sheets	2
Paper, tracing	30 sheets	2
Paper ketchup tubs (small)	20	3
Paper towel	sufficient amount for clean up	2, 3, 4
Plastic cups (250 mL)	100	3
Plastic disposal bag	6	2
Plastic droppers	15	3
Plastic bread bags	15	3
Plastic pop bottles (600 mL and 1 L, with caps)	40	3, 4
Pond water	2 L	1, 4
Poster board	30 sheets	1
Products with a variety of viscosities (see Find Out Activity 7-2A)	1 container of each	3
Rice	1.5 L	3
Rubbing alcohol	1.5 L	2
Ruler (see-through, plastic)	30	1, 2, 3, 4
Salt	3 kg	1, 3
Salt, pickling	15 mL	3
Sand	10 L	1, 3
Sheep eye (preserved)	15	2
Shoe box with lid	30	1
Silocone lubricant or mineral oil	1 small bottle	3
Soap	enough for washing hands	3
Soil	5 L	1
SPF 30 sunscreen	1 bottle	2
Sphagnum moss	15 mL	1
Stiff white paper	15 sheets	2
String	6 m	2
Sugar	2 kg	3, 4
Tonic water	3 L	2
Toothpicks	1 box	3
Transparent plastic watertight tray (for example, the plastic top from a box of greeting cards)	12	2

Item Description	Suggested Quantity	Needed for These Units
Tubes of different diameters (or make tubes using tape and paper)	15	2
Variety of materials to represent body parts, such as rubber tubing, sponges, bean bags, vacuum hoses, etc.		4
Variety of materials for construction, such as yarn, beads, toothpicks, pipe cleaners, string, straws, foam, modelling clay, clear drying glue, scissors		4
Vegetable oil	6 L	1, 2, 3
Water	sufficient amount for activities and for clean up	1, 2, 3, 4
Waterproof markers or wax pencils	6	3
White sugar (5 mL each)	50 mL	4
Yeast (dry, active)	250 mL	4
Yellow highlighter	6	2

Lesson Planner

Chapter:_____ Section/Lesson: _____ Date: _____

Explore

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Introduction

- ☐ Foldables™
- ☐ Reading
- ☐ Activity # _____
- ☐ Did You Know
- ☐ *Teacher's Resource*
- ☐ www.discoveringscience8.ca
- ☐ Other _____

Develop

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Concept Development

- ☐ Reading
- ☐ Reading Check
- ☐ Activity # _____
- ☐ Activity # _____
- ☐ Activity # _____
- ☐ Internet Connect
- ☐ Explore More
- ☐ Feature
- ☐ www.discoveringscience8.ca
- ☐ Other _____

Apply

Assessment

- ☐ Check Your Understanding
- ☐ Chapter Review
- ☐ Unit Review
- ☐ *Teacher's Resource* BLM
- ☐ *Teacher's Resource* Quiz
- ☐ ExamView™ Quiz

Additional Resources

Assessment

- ☐ *Teacher's Resource*
- ☐ ExamView™
- ☐ www.discoveringscience8.ca
- ☐ Other

RECOMMENDED RESOURCES

General Resources

Books

Barton, Mary Lee, and Deborah L. Joran. *Teaching Reading in Science (A supplement to Teaching Reading in the Content Areas)*. Aurora, CO, McREL (Mid-continent Research for Education and Learning), 2001. (Available through www.ascd.org)

Bosak, Susan. *Science Is*. Firefly Books Incorporated, Toronto, ON, 1998.

Brown, Janet Harley, and Richard J. Shavelson. *Assessing Hands-On Science*. Corwin Press Inc., Thousand Oaks, CA, 1996.

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Wolfe, P. *Brain Matters: Translating Research into Classroom Practice*. Alexandria, VA, Association for Supervision and Curriculum Development, 2001.

Magazines and Journals

Dugger, W.E., Jr. "The Relationship between Technology, Science, Engineering, and Mathematics." *The Technology Teacher*. Vol. 53, no. 7 (1994).

Pappas, C. "Fostering Full Access to Literacy by Including Informational Books." *Language Arts*. Vol. 68, no. 6, 449–462, 1991.

The Reading Teacher. www.reading.org.

Science. www.sciencemag.org.

The Science Teacher. www.nsta.org.

Scientific American. www.scientificamerican.com.

SkyNews. www.skynewsmagazine.com.

Yes Mag, Canada's Science Magazine for Kids. www.yesmag.bc.ca.

Videos and Videodiscs

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Websites
Please see www.discoveringscience.ca for links to recommended Canadian websites.

Teaching Today can be found at www.glencoe.com/teachingtoday with information on the latest teaching tips and free web-based resources.

National Science Teachers Association (U.S.) can be found at www.nsta.org.

SCIENCE SUPPLIERS

This list of suppliers includes suppliers of science equipment and materials, and also suppliers of technology materials that may be useful to you and your students for Design an Investigation and for end-of-unit Projects, in which students are encouraged to use their own ideas and plans to design and build devices and/or systems that provide a solution to a problem or challenge.
Note: At the end of certain suppliers' names, some words in boldface indicate a specific, recommended product line.

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