**DISCOVERING SCIENCE 8**
**TEACHER'S RESOURCE**

# UNIT 1: WATER SYSTEMS ON EARTH

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McGraw-Hill Ryerson

# UNIT 1: OVERVIEW

Water is a precious natural resource. Without it, Earth could not support life. Because of its changing forms and its interactions with living and nonliving things, water on Earth is best regarded as a system. In Unit 1: Water Systems on Earth, students will learn about the movement of water through the water cycle; the movement of water in ocean currents and the effects of those currents on salinity, water temperature, and climates; and the ways that waves and tides can change a landscape.

By investigating some of the ways human activity affects the water cycle and the quality of water, students develop an appreciation of how important it is to protect global water resources and an awareness of some of the ways we can do that.

**Chapter 1: The water cycle plays a vital role on Earth.**
Water is everywhere on Earth: water vapour is found in the atmosphere, ice is found at both poles, even our bodies consist of mostly water. In this chapter, students consider the places we find water as a solid, as a liquid, and as a gas, and how water moves from one state to another. They learn about different properties of salt water and fresh water, for example, salt water is denser than fresh water, and it freezes at a lower temperature.

Not all parts of the ocean have the same salinity. Things like run-off, volcanoes, currents, freezing, and evaporation make some parts of oceans saltier than others. Although most plants and animals need fresh water to live, some are able to live in a saltwater environment. The ways in which the penguin lives without access to liquid fresh water are considered in this chapter.

Students learn about important sources of fresh water, such as lakes, ponds, wetlands, streams and rivers, ground water, and glaciers. A connection is established between some human activities and their effects on water systems, such as development that increases run-off, and burning fossil fuels, contributing to global warming. Students have the opportunity to investigate ways to decrease the effects of these activities.

**Chapter 2: Oceans control the water cycle.**
Oceans are the primary source of water in the water cycle. Their movements carry enormous amounts of water from one place to another. This movement of water causes changes in temperature, salinity, levels of nutrients, and it also causes changes to shorelines. Students begin their investigation of oceans by simulating the movement of the tectonic plates that created the ocean basins. The geology of Gros Morne National Park provided scientists with important evidence for the movements of these plates. Students learn how features of the ocean floor such as ridges, shelves, and slopes affect currents and nutrient levels. They also investigate some of the technologies that have allowed us to explore the features of the ocean floor.

Students investigate the behaviours of winds and surface currents using a simple ripple tank and read about the world's largest flume tank, at Memorial University. It is used to simulate underwater conditions, including currents, and to develop technologies that will function properly in those conditions. They learn how the moon's gravity (sometimes augmented by the sun's) causes ocean tides. Students conduct experiments to investigate effects of waves on shorelines and beaches, and research shoreline features that have been caused by water erosion and events that have caused significant damage to Newfoundland and Labrador shorelines.

**Chapter 3: Bodies of water influence climate and species distribution.**
Air or water currents that commonly move in one direction have a strong influence on climates. For example, the Labrador Current, a deep current that moves cold water from the arctic down along the coast of Newfoundland and Labrador, makes our climate cooler than that of Great Britain, near the warm Gulf Stream Current. As part of their consideration of the effects of current on climate, students explore the specific heat of water and draw conclusions about its capacity to carry heat. They also use maps and temperature records to investigate the effects of currents on climates around the world.

Currents play a role in underwater environments, too. Students learn about life in freshwater and saltwater environments and the abiotic and biotic factors that influence species distribution. Abiotic factors include temperature, the availability of oxygen, the amount of sunlight, and the speed of the current. One of the most important biotic factors influencing species distribution is the availability of nutrients. Students conduct an experiment to explore how fertilizers affect the growth of aquatic plants and draw conclusions about steps that we can take to reduce our impact on underwater environments by decreasing unnecessary introduction of phosphates into the water. Other human impacts on water systems are acid precipitation, water pollution including untreated oil waste, invasive species, overfishing, and aquaculture. Students will examine biotic and abiotic indicators in a local stream and in ocean water to draw conclusions about the water quality. They will also role play different points of view as they consider the potential impact on human populations and on the environment of a proposed new oil rig off the coast. In a culminating project for the unit, students have the opportunity to use all that they have learned to design an underwater community.

## MULTIPLE INTELLIGENCES CORRELATION FOR UNIT 1 ACTIVITIES AND INVESTIGATIONS

The table below identifies possible multiple intelligences that could be incorporated into activities and investigations in this unit. For more information about differentiated instruction and multiple intelligences, see the Introduction and Implementation section in this Teacher's Resource.

| MULTIPLE INTELLIGENCES: | VL | VS | BK | MR | LM | N | E | IA | IE |
|---|---|---|---|---|---|---|---|---|---|
| **UNIT 1: WATER SYSTEMS ON EARTH** | | | | | | | | | |
| Find Out Activity: The Many Ways People Use Water | ■ | ■ | | | | | | | ■ |
| ***Chapter 1: The water cycle plays a vital role on Earth.*** | | | | | | | | | |
| Find Out Activity 1-1A: A Water Cycle Model | ■ | ■ | | | | | | | ■ |
| Find Out Activity 1-2A: Mini Distillation | ■ | ■ | | | | | | | ■ |
| Core Lab Conduct an Investigation 1-2B: Salinity's Effect on Water Density | | ■ | | | ■ | | | | |
| Find Out Activity 1-3A: Tracking Run-off | ■ | ■ | | | | | | | |
| Find Out Activity 1-3B: How Can Global Warming Be Slowed? | ■ | ■ | | ■ | | | | | ■ |
| Think About It Activity 1-3C: How Much Water? | | ■ | | | ■ | | | ■ | |
| ***Chapter 2: Oceans control the water cycle.*** | | | | | | | | | |
| Find Out Activity 2-1A: How Ocean Basins Become Bigger | | ■ | | | | | | | |
| Conduct An Investigation 2-1B: Getting to Know the Ocean Floor | | | | | ■ | | | | |
| Find Out Activity 2-2A: Winds and Currents | | ■ | ■ | | | ■ | | | |
| Conduct An Investigation 2-2B: Temperature and Water Density | | ■ | | | ■ | | | | |
| Think About It Activity 2-3A: By the Seashore | ■ | ■ | ■ | ■ | | | | | |
| Conduct an Investigation 2-3B: Waves and Beaches | | ■ | | | | | | | |
| Think About It Activity 2-3B: Safeguarding Our Shorelines | ■ | | | ■ | | | | | ■ |
| ***Chapter 3: Bodies of water influence climate and species distribution.*** | | | | | | | | | |
| Find Out Activity 3-1A: Learning How Liquids Lose Heat | ■ | ■ | | | | | | ■ | |
| Think About It Activity 3-1B: Currents and Climate | | ■ | | | | | | | |
| Find Out Activity 3-2A: Abiotic Factors | ■ | ■ | ■ | ■ | ■ | | | | |
| Conduct an Investigation 3-2B: Too Much of a Good Thing | ■ | ■ | | | | | | | ■ |
| Think About It Activity 3-3A: How Do Your Actions Affect the Ocean? | | | | | | | | ■ | |
| Core Lab Conduct an Investigation 3-3B: Water Health Test | | | | | | ■ | | | ■ |
| Think About It Activity 3-3C: Not An Easy Decision | | | | | | | | ■ | ■ |
| Unit 1 Project: Being at Home at the Bottom: Designing an Underwater Community | | | | | | | | | ■ |
| Unit 1 Integrated Research Investigation: Wrestling Energy from Waves | ■ | ■ | | ■ | | | | ■ | ■ |

**Multiple Intelligence codes:**
VL = Verbal-Linguistic Intelligence; VS = Visual-Spatial Intelligence; BK = Body-Kinesthetic Intelligence; MR = Musical-Rhythmic Intelligence; LM = Logical-Mathematical Intelligence; N = Naturalist Intelligence; E = Existential Intelligence; IA = Intrapersonal Intelligence; IE = Interpersonal Intelligence

# Planning Chart for Activities and Investigations for Unit 1: Water Systems on Earth

| ACTIVITY/ INVESTIGATION | ADVANCE PREPARATION | APPARATUS/MATERIALS | TIME REQUIRED |
|---|---|---|---|
| **Unit 1: Water Systems on Earth** | | | |
| Find Out Activity: The Many Ways People Use Water | 1 hour before:<br>– Make copies of BLM 1-6, The Many Ways People Use Water (optional). | None | • 40–50 min<br>– 10 min for mind map<br>– 10 min for sharing category lists<br>– 20–30 min to write a paragraph |
| **Chapter 1: The water cycle plays a vital role on Earth.** | | | |
| Find Out Activity 1-1A: A Water Cycle Model | Constructing the model<br>1 day before:<br>– Collect materials.<br>If you plan to make, rather than purchase, ice, begin the day before to allow enough time for the water to freeze.<br>– Make copies of BLM 1-8, A Water Cycle Model.<br><br>1 hour before:<br>– You may wish to set up stations for the "hot" electrical appliances (electric kettle, hot plate), and for the "cold" appliances (refrigerator, freezer). Ensure that all electrical appliances are safely grounded and extension cords are taped down, if necessary. Have a clean-up station prepared for any spills. Remind students to clean up spills immediately to avoid slipping accidents and possible electric shocks. | For each group:<br>– electric kettle<br>– bowls of various sizes<br>– oven mitts or heat-resistant gloves<br>– ice<br>– hot plate<br>– modelling clay<br>– sand<br>– soil<br>– water<br>– refrigerator<br>– freezer<br>– BLM 1-8, A Water Cycle Model | • 30–40 min to plan a model<br>• 30–40 min to construct the model |
| Find Out Activity 1-2A: Mini Distillation | 1 day before:<br>– Collect materials.<br>You may wish to prepare a glass clean-up kit, such as a cardboard box, broom, and dustpan.<br>Ensure that all electrical appliances are safely grounded and extension cords are taped down, if necessary.<br>Have a clean-up station prepared for any spills. Remind students to clean up spills immediately to avoid slipping accidents and possible electric shocks. | For each student or group:<br>– 4 g salt<br>– microscope or magnifying glass<br>– watch glass<br>– laboratory balance<br>– 10 mL distilled water<br>– stirring rod<br>– 50 mL beaker<br>– 5 mL measuring spoon<br>– tongs<br>– hot plate or other heat source | • 30–40 min |
| Core Lab Conduct an Investigation 1-2B: Salinity's Effect on Water Density | 1 day before:<br>– Collect materials.<br>Prepare water samples.<br>You may wish to prepare a glass clean-up kit, such as a cardboard box, broom, and dustpan.<br>Have a clean-up station prepared for any spills. Remind students to clean up spills immediately to avoid slipping accidents.<br>– Make copies of BLM 1-10, Salinity's Effect on Water Density (optional). | For each group:<br>– 250 mL beaker or large jar<br>– 5 samples of clear water for each group:<br>– tap water (colourless)<br>– tap water (blue)<br>– slightly salty water (red, use about 30 g salt in 250 mL water)<br>– very salty water (colourless, use about 70 g salt in 250 mL water)<br>– very salty water (green)<br>– medicine dropper or pipette<br>– plastic spoon<br>– blue, red, and green coloured pencils | • 40–50 min |

| ACTIVITY/ INVESTIGATION | ADVANCE PREPARATION | APPARATUS/MATERIALS | TIME REQUIRED |
|---|---|---|---|
| Find Out Activity 1-3A: Tracking Run-off | 1 hour before:<br>– Photocopy BLM 1-11, Tracking Run-off for student groups. | For each group:<br>– BLM 1-11, Tracking Run-off | • 20–30 min |
| Find Out Activity 1-3B: How Can Global Warming Be Slowed? | 1 week before:<br>– Obtain the necessary supplies. If required, reserve computer lab and library time for students.<br><br>1 day before:<br>– Make copies of BLM 1-12, How Can Global Warming Be Slowed? (optional). | For each group:<br>– access to the library or Internet<br>– art supplies for brochure and/or access to the computer lab for website design | • 40 min for brainstorming<br>• another 40 min or more for brochure and website design |
| Think About It Activity 1-3C: How Much Water? | | For each student:<br>– graph paper<br>– two different colours of markers or pencil crayons | • 30–40 min |
| **Chapter 2: Oceans control the water cycle.** | | | |
| Find Out Activity 2-1A: How Ocean Basins Become Bigger | 1 hour before:<br>– Collect all materials. You may wish to assemble the desks or tables ahead of time or enlist students' assistance. | For each group:<br>– 2 flat-topped desks (or tables)<br>– 2 pieces of legal-size paper<br>– pencil<br>– calculator<br>– ruler | • 30–40 min<br>– 10 min for the activity<br>– 20–30 min for the questions |
| Conduct An Investigation 2-1B: Getting to Know the Ocean Floor | 1 week before:<br>– Collect materials. Ask students to bring shoeboxes with lids from home.<br><br>1 day before:<br>– Make copies of BLM 1-17, Getting to Know the Ocean Floor Data Table; BLM 1-18, What's Down There?; and BLM 1-19, Water Systems on Earth's Surface—Research Activity (optional).<br><br>1 hour before:<br>– You may wish to pre-cut the shoebox lids for students, to save time. | For each group:<br>– shoe box with lid<br>– a variety of small objects (such as little blocks of wood, erasers, rolled-up paper, and modelling clay)<br>– tape<br>– felt pen<br>– ruler<br>– scissors<br>– drinking straw<br>– graph paper<br>– pencil | • 40–60 min<br>– 10–15 min to prepare the model and data table<br>– 10–15 min for measuring<br>– 20–30 min to complete Analyze and Conclude and Apply questions |
| Find Out Activity 2-2A: Winds and Currents | 1 week before:<br>– Collect all materials. You may wish to ask students to bring in their own stone for this activity. If so, give them several days' notice to do so.<br><br>1 day before:<br>– Make copies of BLM 1-20, Winds and Currents (optional).<br><br>1 hour before:<br>– If you wish, prepare the circles of paper ahead of time. Or, have students assist. Have a clean-up station prepared for any spills. | For each individual or group:<br>– rectangular pan<br>– water<br>– 2 drinking straws<br>– stone<br>– 12 small circles of paper from a hole punch | • 30–40 min |
| Conduct an Investigation 2-2B: Temperature and Water Density | 1 day before:<br>– Make copies of BLM 1-23, Graphing Ocean Temperatures (optional).<br><br>1 hour before:<br>– Collect the materials. | For each student:<br>– 1 piece of graph paper<br>– pencil<br>– eraser | • 20–30 min |

| ACTIVITY/ INVESTIGATION | ADVANCE PREPARATION | APPARATUS/MATERIALS | TIME REQUIRED |
|---|---|---|---|
| Think About It Activity 2-3A: By the Seashore | 1 week before:<br>– Reserve time in the resource centre and/ or computer lab for students to research their topics and prepare their presentations.<br><br>1 day before:<br>– Make copies of BLM 1-27, By the Seashore—Shoreline Feature (optional). | None | • 80–120 min<br>– 40 min of research<br>– 40 min to create the presentation, or assign as homework<br>– 40 min to view presentations |
| Conduct an Investigation 2-3B: Waves and Beaches | 1 day before:<br>– Make copies of BLM 1-28, Waves and Beaches Activity (optional).<br><br>1 hour before:<br>– Collect all materials.<br>You may wish to prepare a glass clean-up kit, such as a cardboard box, broom, and dustpan.<br>Have a clean-up station prepared for any spills. | For each group:<br>– beaker or measuring cup (500 mL)<br>– clear plastic or glass pan or small aquarium<br>– ruler<br>– small block of wood<br>– clock or watch<br>– plastic pail or container<br>– beach mixture 1 (450 mL sand + 150 mL gravel)<br>– beach mixture 2 (450 mL gravel + 150 mL sand)<br>– water<br>– (optional) small rock | • 40–60 min |
| Think About It Activity 2-3CB: Safeguarding Our Shorelines | 1 month before:<br>– Collect articles in newspapers and magazines about shoreline erosion and protection for an in-class resource centre.<br><br>1 week before:<br>– Reserve time in the resource centre and the computer lab for students' research.<br><br>1 day before<br>– Make copies of BLM 1-29, Safeguarding Our Shorelines Activity (optional). | For each student or group:<br>– poster board<br>– markers or pencil crayons | • 90–100 min<br>– 10–20 min for brainstorming<br>– 40 min for research<br>– 40 min to prepare the presentation or poster |
| **Chapter 3: Bodies of water influence climate and species distribution.** | | | |
| Find Out Activity 3-1A: Learning How Liquids Lose Heat | 1 day before:<br>– Collect all materials.<br>– Make copies of BLM 1-32, Learning How Liquids Lose Heat Table and BLM 1-33, Learning How Liquids Lose Heat Grid Paper (optional).<br><br>1 hour before:<br>– Set up the apparatus.<br>You may wish to prepare a glass clean-up kit, such as a cardboard box, broom, and dustpan.<br>Ensure that all electrical appliances are safely grounded and extension cords are taped down, if necessary.<br>Have a clean-up station prepared for any spills. | – graph paper<br>– hot plate<br>– 600 mL beaker<br>– water<br>– 3 test tubes<br>– 3 thermometers<br>– 3 liquids: water, salt water, and vegetable oil<br>– 3 ring clamps<br>– ring stand<br>– watch or clock | • 30–40 min |
| Think About It Activity 3-1B: Currents and Climate | 1 day before:<br>– If you plan to conduct this activity as a class, enlarge the world map or create an overhead.<br>– Make copies of BLM 1-34, Currents and Climate Map. | For each student:<br>– BLM 1-34, Currents and Climate Map | • 30–40 min |
| Find Out Activity 3-2A: Abiotic Factors | 1 week before:<br>– Reserve time at the computer lab and resource centre or library.<br><br>1 day before:<br>– Make copies of BLM 1-37, Abiotic Factors (optional). | None | • 120 min<br>– 80 min for research<br>– 40 min to prepare a presentation |

| ACTIVITY/ INVESTIGATION | ADVANCE PREPARATION | APPARATUS/MATERIALS | TIME REQUIRED |
|---|---|---|---|
| Conduct an Investigation 3-2B: Too Much of a Good Thing | 1 week before:<br>– Obtain all materials.<br><br>2 days before:<br>– Prepare tap water and allow to sit for 2 days.<br><br>1 day before:<br>– You may wish to prepare a glass clean-up kit, such as a cardboard box, broom, and dustpan. Have a clean-up station prepared for any spills.<br>– Make copies of BLM 1-38, Too Much of a Good Thing (optional). | For each group:<br>– six 1 L beakers or canning jars<br>– 1 L beaker with lid<br>– 250 mL measuring cup<br>– graduated cylinder<br>– chlorine-free tap water (allow tap water to sit for 2 days for chlorine to evaporate)<br>– pond water<br>– 8-24-8 uncoloured fertilizer<br>– masking tape<br>– stirring rod<br>– index card<br>– felt marker<br>– test kit to measure dissolved oxygen, nitrates, and/or phosphates (optional)<br>– microscope (optional) | • 40–60 min for Procedure<br>• 2 weeks to complete investigation |
| Think About It Activity 3-3A: How Do Your Actions Affect the Ocean? | 1 hour before:<br>– Prepare copies of BLM 1-35, How Do Your Actions Affect the Ocean? (optional). | None | • 10–15 min in class time<br>• 1 day for students to complete table |
| Core Lab Conduct an Investigation 3-3B: Water Health Test | 2 weeks before:<br>– Research an appropriate local stream. One with a fairly high health level will be more interesting for field work. If required, send permission slips home with students.<br><br>1–2 days before:<br>– Collect materials.<br>– Make copies of BLM 1-44, Biotic Index Water Quality; BLM 1-45, A Fresh Water Case Study; BLM 1-46, Water Health Test Table; BLM 1-47, Water Health Abiotic Tests; and BLM 1-48, Water Health Test—Saltwater Environment (optional). You may want to include plastic sleeves for students to store their papers. | Lab A<br>For each group:<br>– field guide of aquatic organisms<br>– plastic spoon<br>– magnifying glass<br>– deep pan<br>– long-handle dip net<br>– thermometer for testing air and water temperature<br>– water testing kit<br><br>Lab B<br>For each group:<br>– rubber boots<br>– pencil<br>– notebook<br>– water testing kit | Lab A—Part 1<br>– 60 min for field work<br>Lab A—Part 2<br>– 60 min for field work<br>– 40–60 min for questions<br><br>Lab B<br>– 60 min for field work<br>– 120 min for questions |
| Think About It Activity 3-3C: Not An Easy Decision | 1 week before:<br>– If you wish, allow students time to research and formulate appropriate arguments for their assigned role. | None | • 30 min<br>– 10 min for set-up<br>– 15 min for debate<br>– 5 min for voting |
| Project: Being at Home at the Bottom: Designing an Underwater Community | You may wish to gather information about a real underwater community, such as the Aquarius Research Station. | None | • 15 min to introduce the project<br>• 1 week to research and prepare a presentation<br>• additional class time for presentations |
| Integrated Research Investigation: Wrestling Energy from Waves | Book library and/or computer lab time for student research. | None | • 15 min to introduce the project<br>• 2 weeks to conduct research and prepare poster<br>• 30 min for debate |

## TALKS AND TOURS

Speaker and field trip recommendations for Unit 1:

- Invite an oceanographer to visit the class after students have read Career Connect: Oceanographer on student textbook page 20 to answer any questions students may have, and talk about the education that enabled him or her to follow this career path.
- Memorial University's Marine Institute has five centres. One of them includes the flume tank that is described in the Science Watch on student textbook page 62. Others focus on other aspects of marine studies. It is possible to arrange tours.
- Organize a class walk through a local wetland to study the diversity. Contact your local wetland conservation authority to arrange for a guided class trip. If visiting a wetland is not possible, invite a naturalist to visit your classroom and provide information about wetland biodiversity.
- To help students make connections with the material on water quality, arrange for a student, parent, or other volunteer to talk with the class about aquarium maintenance, especially maintaining a water quality that allows the organisms in the aquarium to thrive.
- If possible, visit a shallow, healthy local stream with students to conduct the fieldwork portion of Conduct an Investigation Core Lab 3-3B: Water Health Test. While there, as well as collecting samples to test, take the opportunity to discuss with students some of the concepts they have learned about, for example, Where does the water in this stream come from? Where does it go? What species of plants and animals benefit from this stream? How?
- If possible, get involved in a local environmental day in your community, such as the TD Great Canadian Shoreline clean-up. Alternatively, organize your own.

## UNIT 1 BLACKLINE MASTERS

| CONTENT-RELATED BLACKLINE MASTERS | ASSESSMENT-RELATED BLACKLINE MASTERS |
|---|---|
| **Unit**<br>BLM 1-1, Unit 1 Summary<br>BLM 1-2, Unit 1 Key Terms<br>BLM 1-51, Unit 1 Review—Concept Map and Table<br>BLM 1-52, Unit 1 Test | Assessment Checklist 9, Oral Presentation<br>Assessment Checklist 11, Poster<br>Assessment Checklist 21, Project Self-Assessment<br>Assessment Checklist 22, Project Group Assessment<br>Assessment Rubric 3, Co-operative Group Work<br>Assessment Rubric 7, Scientific Research Planner<br>Assessment Rubric 8, Research Project<br>Assessment Rubric 9, Collecting Information<br>Assessment Rubric 10, Presentation<br>Assessment Rubric 11, Communication |
| **Chapter 1**<br>BLM 1-3, Chapter 1 Key Terms<br>BLM 1-6, The Many Ways People Use Water<br>BLM 1-7, The Water Cycle<br>BLM 1-8, A Water Cycle Model<br>BLM 1-9, Salt Water<br>BLM 1-10, Salinity's Effect on Water Density<br>BLM 1-11, Tracking Run-off<br>BLM 1-12, How Can Global Warming Be Slowed?<br>BLM 1-13, Chapter 1 Review | Assessment Checklist 1, Making Observations and Inferences<br>Assessment Checklist 6, Developing Models<br>Assessment Checklist 7, Scientific Drawing<br>Assessment Checklist 9, Oral Presentation<br>Assessment Checklist 11, Poster<br>Assessment Checklist 17, Science Math Connect<br>Assessment Checklist 19, Graph from Data<br>Assessment Checklist 21, Project Self-Assessment<br>Assessment Checklist 22, Project Group Assessment<br>Assessment Checklist 25, Safety Checklist<br>Process Skills Rubric 1, Developing Models<br>Process Skills Rubric 10, Measuring and Reporting<br>Assessment Rubric 2, Science Notebook<br>Assessment Rubric 3, Co-operative Group Work<br>Assessment Rubric 4, Scientific Drawing<br>Assessment Rubric 5, Conduct an Investigation<br>Assessment Rubric 8, Research Project<br>Assessment Rubric 9, Collecting Information<br>Assessment Rubric 10, Presentation<br>Assessment Rubric 11, Communication<br>Assessment Rubric 12, Using Tools, Equipment, and Materials |

# UNIT 1 BLACKLINE MASTERS

| CONTENT-RELATED BLACKLINE MASTERS | ASSESSMENT-RELATED BLACKLINE MASTERS |
|---|---|
| **Chapter 2**<br>BLM 1-4, Chapter 2 Key Terms<br>BLM 1-14, Earth's Oceans<br>BLM 1-15, Origin of the Oceans<br>BLM 1-16, On the Ocean Floor<br>BLM 1-17, Getting to Know the Ocean Floor Data Table<br>BLM 1-18, What's Down There?<br>BLM 1-19, Water Systems on Earth's Surface— Research Activity<br>BLM 1-20, Winds and Currents<br>BLM 1-21, Deep Ocean Currents<br>BLM 1-22, Properties of Ocean Water<br>BLM 1-23, Graphing Ocean Temperatures<br>BLM 1-24, A Day at the Beach<br>BLM 1-25, The Tide is High<br>BLM 1-26, How Well Do You Know the Ocean?<br>BLM 1-27, By the Seashore—Shoreline Feature<br>BLM 1-28, Waves and Beaches Activity<br>BLM 1-29, Safeguarding Our Shorelines Activity<br>BLM 1-30, Chapter 2 Review | Assessment Checklist 1, Making Observations and Inferences<br>Assessment Checklist 5, Investigating an Issue<br>Assessment Checklist 6, Developing Models<br>Assessment Checklist 7, Scientific Drawing<br>Assessment Checklist 9, Oral Presentation<br>Assessment Checklist 10, Computer Slide Show Presentation<br>Assessment Checklist 11, Poster<br>Assessment Checklist 17, Science Math Connect<br>Assessment Checklist 18, Data Table<br>Assessment Checklist 19, Graph from Data<br>Assessment Checklist 24, K-W-L<br>Process Skills Rubric 1, Developing Models<br>Process Skills Rubric 8, Interpreting Data<br>Process Skills Rubric 10, Measuring and Reporting<br>Assessment Rubric 2, Science Notebook<br>Assessment Rubric 3, Co-operative Group Work<br>Assessment Rubric 4, Scientific Drawing<br>Assessment Rubric 5, Conduct an Investigation<br>Assessment Rubric 7, Scientific Research Planner<br>Assessment Rubric 8, Research Project<br>Assessment Rubric 9, Collecting Information<br>Assessment Rubric 10, Presentation<br>Assessment Rubric 12, Using Tools, Equipment, and Materials |
| **Chapter 3**<br>BLM 1-5, Chapter 3 Key Terms<br>BLM 1-31, Understanding Water and Climate<br>BLM 1-32, Learning How Liquids Lose Heat<br>BLM 1-33, Currents and Climate Map<br>BLM 1-34, Organisms in Freshwater Environments<br>BLM 1-35, Rivers and Lakes<br>BLM 1-36, Abiotic Factors<br>BLM 1-37, Too Much of a Good Thing Data Table<br>BLM 1-38, How Do Your Actions Affect the Ocean?<br>BLM 1-39 Streams of Pollution<br>BLM 1-40, Understanding Air Pollution and Water Systems<br>BLM 1-41, Understanding the Effects of Pollution<br>BLM 1-42, People and Water<br>BLM 1-43, Biotic Index for Water Quality<br>BLM 1-44, A Fresh Water Case Study<br>BLM 1-45, Water Health Test Table<br>BLM 1-46, Water Health Abiotic Tests<br>BLM 1-47, Water Health Test—Saltwater Environment<br>BLM 1-48, Activities That Use Water<br>BLM 1-49, Chapter 3 Review | Assessment Checklist 1, Making Observations and Inferences<br>Assessment Checklist 4 Laboratory Report<br>Assessment Checklist 9, Oral Presentation<br>Assessment Checklist 10, Computer Slide Show Presentation<br>Assessment Checklist 11, Poster<br>Assessment Checklist 18, Data Table<br>Assessment Checklist 19, Graph from Data<br>Assessment Checklist 21, Project Self-Assessment<br>Assessment Checklist 22, Project Group Assessment<br>Assessment Checklist 24, K-W-L<br>Assessment Checklist 25, Safety Checklist<br>Process Skills Rubric 2, Hypothesizing<br>Process Skills Rubric 8, Interpreting Data<br>Process Skills Rubric 9, Questioning<br>Process Skills Rubric 10, Measuring and Reporting<br>Assessment Rubric 2, Science Notebook<br>Assessment Rubric 3, Co-operative Group Work<br>Assessment Rubric 5, Conduct an Investigation<br>Assessment Rubric 7, Scientific Research Planner<br>Assessment Rubric 8, Research Project<br>Assessment Rubric 9, Collecting Information<br>Assessment Rubric 10, Presentation<br>Assessment Rubric 11, Communication<br>Assessment Rubric 12, Using Tools, Equipment, and Materials |

# Teaching Notes
# for
# Pages 2 to 125 of the Student Textbook

## UNIT 1 OPENER, pp. 2–3

Unit 1 focusses on water systems on Earth and how Earth's water cycle interacts with atmospheric and topical changes on the planet as well as the planet's inhabitants. Students will learn how all water on Earth moves through the water cycle, how fresh and salt water are distributed, how features such as basins affect the movement of water, and how ocean waves, currents, tides, and winds interact. Students will also develop their understanding of freshwater and marine ecosystems and how living things both on land and in water environments interact with each other and their environments. Human activities also impact water systems, often negatively, and these effects will be studied and investigated.

### USING THE UNIT OPENER

As a class, have students consider the photograph on pages 2 and 3 of Churchill Falls in Labrador. Ask students to describe the photograph, and record their response on the board or on a flipchart. As a prompt, ask, "Do you see any houses or people?" (No, it is only wilderness.) "Where is the water coming from?" (a lake, a river, a glacier)

Then, have students read the caption for the photograph. Ask them to reconsider how Churchill Falls looks with a hydroelectricity development. If possible, bring in a photograph as a comparison.

Have them consider how this development would affect the river, the falls, the people, and the plants and animals that live in or near the river. Ask, "Do you think the hydroelectricity development was a good idea or a bad idea?" (There are no right or wrong answers; encourage students to support their opinions, but all opinions are valid.)

As a class, review the Key Ideas on page 3. Clarify any unfamiliar vocabulary with students.

Have students work in small groups and brainstorm answers to the following questions:

- What is the water cycle?
- What are sources of water on Earth?
- How does ocean water move?
- How do oceans affect the weather?
- In what ways do humans affect the water on Earth?

Review students' responses to these questions as a class. Explain that these are questions that will be answered in this unit.

## GETTING STARTED, pp. 4–5

### USING THE TEXT

Have students read page 4 individually. Read aloud to the class the following sentence: "Water is a part of every living thing, and every living thing—humans included—needs water to stay alive." Ask students to write a paragraph that explains what this statement means. As a prompt, ask, "How is water a part of every living thing? Is it true that every living thing needs water to survive?"

As a class, have students consider the last paragraph on page 4. Conduct a brainstorming session on the following question: "How can understanding Earth's water systems help us protect the quality of water on the planet?" Record students' responses on a flipchart that you can refer to later. As a culminating activity at the end of the unit, refer back to the chart. Ask students, now that they have an understanding of the planet's water systems, in what ways are they better able to protect Earth's water? How can they use their knowledge to help them know what to do?

### USING THE ACTIVITY

**Find Out Activity**

**The Many Ways People Use Water, p. 5**

**Purpose**

- Students relate the concept of water distribution and usage to their daily lives.

**Advance Preparation**

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 hour before | Make copies of BLM 1-6, The Many Ways People Use Water (optional). | None |

**Time Required**

- 40–50 min
  - – 10 min for mind map
  - – 10 min for sharing category lists
  - – 20–30 min to write a paragraph

**Science Background**

Canadians use a tremendous amount of water each day. According to Environment Canada, each Canadian uses an average of 329 L every day. Canada is second only to the United States in these numbers. Showers and baths use 35% of daily water consumption and toilet flushing accounts for another 30%. Compare these numbers to Kenyans who use only about 5 L of water per person each day.

### Activity Notes

- Have students work individually for this activity, and share their work as a class.
- You may wish to have students use BLM 1-6, The Many Ways People Use Water to complete their mind maps.
- Explain to students that they will conduct a similar activity in Chapter 3, Think About It Activity 3-3A How Do Your Actions Affect the Ocean?, and that they will refer back to their notes for this activity at that time.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.

### Supporting Diverse Student Needs

- Ensure that English language learners understand the activity, and clarify any misconceptions they may have. This activity provides an opportunity to help English language learners build their vocabulary of common verbs and nouns.
- This activity provides an opportunity for students to develop their intrapersonal skills by completing a task individually.
- In What Did You Find Out? question 2, allow students to present their paragraph in a variety of forms, such as a poem, song, or visual display.
- For enrichment, have students research water usage in Kenya and compare it to their own lives. Useful information is available through the Peace Corp. Interested students may wish to conduct a "Water Usage Challenge" to track how much water they use per day and see by how much they can reduce this amount.

### What Did You Find Out? Answers

1. Students' category lists should be similar but may reflect their different interests, or different categorizations of uses. For example, some students may list more recreational activities and some students may list more personal uses. Some students may list watering plants as a household use and others may list it as a personal use.
2. Students' paragraphs should clearly state which category they are writing about and should demonstrate consideration of the specific implications of water shortages on their lives in that area.

## CHAPTER 1 OPENER, pp. 6–7

### USING THE PHOTO AND TEXT

After reading the text on page 6, have students consider the photo of Earth from space. Ask them to consider what examples of water are visible in the photo (oceans, lakes, bays). Ask them if they can see other examples of water in the photo (snow on the Rocky Mountains, the glacier on Greenland). If they do not mention ice or water vapour, ask them if there is another example of water that is missing (hint: water in a state not yet mentioned, such as water vapour in clouds). You may wish to show students another image of North America showing cloud cover. Read aloud to the class (or have a student read) the chapter title, "The water cycle plays a vital role on Earth." Ask students what the word "vital" means (important, necessary). Explain that the word "vital" also means *essential to life*. Have students briefly discuss why the author may have chosen to use the word "vital" to describe the water cycle. (Water and how it moves on Earth is essential to life on Earth.)

### USING THE WHAT YOU WILL LEARN / WHY IT IS IMPORTANT / SKILLS YOU WILL USE

Ask for student volunteers to read the What You Will Learn points aloud. Ensure that students understand the points and define the terms as required. Terms such as "distributed", "circulates", and "connected" may require explanation.

Have students brainstorm reasons why water systems might be closely connected (rivers connect to oceans or lakes; rain runs into rivers, lakes, and oceans).

Ask students to read the Why It Is Important section. Ask students what they already know about the importance of water on Earth. (Water is essential to life, people's bodies are 65% water, we need rain for growing food, and we need water to drink.)

Have students read the Skills You Will Use points. Ask them for examples of when these skills might be important in everyday life (using maps when travelling on family trips; giving or understanding instructions; designing a scratch-built model or designing a model for a real building, such as a tree house or garden shed; researching information for school projects or for the best sports equipment to buy).

### USING THE FOLDABLES™ FEATURE

See the Foldables section of this resource. Creating the Foldable illustrated in each chapter of the student textbook will help students develop important reading and study skills.

## 1.1 DISTRIBUTION OF WATER

### BACKGROUND INFORMATION

Fresh water is essential to life. Although humans need water and some salt to live, we are unable to drink salt water. Salt water is so salty that our kidneys are unable to process it properly. To rid our bodies of the excess salt in salt water, we would actually have to urinate more water than we drank, and we would end up more dehydrated than we were before. Seawater contains 35 000 ppm of salt; fresh water contains less than 1000 ppm. Human blood is about one third as salty as seawater.

Earth's atmosphere is a layer of gases approximately 560 km thick that surrounds the planet and is kept in place by Earth's gravity. The mixture of gases that we call air is a combination of approximately 78% nitrogen, 21% oxygen, 1% argon, and trace amounts of other gases, including carbon dioxide, and an average of approximately1% of water vapour. The atmosphere is composed of layers: the thermosphere, the mesosphere; the stratosphere, which contains the ozone layer; and the troposphere, which is the closest to Earth's surface.

Earth itself is also composed of layers. The lithosphere is the rocky crust and part of Earth's upper mantle. The lithosphere layer runs underneath the mountains and oceans.

The hydrosphere is the combination of all forms of water on Earth. It includes water vapour, rain and snow in the atmosphere, oceans, lakes, rivers, and glaciers on the surface of the Earth and ground water in the lithosphere.

Water on Earth exists naturally in three states of matter: solid, as ice; liquid, as liquid water; and gas, as water vapour and steam. Liquid water is what makes Earth so special in the solar system. Although other planets and moons may contain water as a solid (ice), only Earth has liquid water, considered essential to life. (There is some evidence that liquid water may be present on Jupiter's moon, Europa, and also possibly on Saturn's moon, Titan. The presence of polar ice caps on Mars presents the possibility that it may have had liquid water and potentially sustained life long ago.)

### COMMON MISCONCEPTIONS

- Students may think that it is the taste of salt water that makes it impossible to drink. Explain that sea water is so salty that drinking it would make someone more thirsty than if they had no water at all. Tell students that salt is often used as a preservative in food because it draws the water out of the food and prevents it from spoiling. Salt cod is one example of this kind of preserving. Explain that too much salt in drinking water would act in a similar way, drawing the water out of our bodies.
- Students may think that Earth's atmosphere is pure oxygen. Explain that the atmosphere and air are actually a combination of gases.
- Students may think that the hydrosphere is an actual layer of Earth's surface or in Earth's atmosphere. Ensure that students understand that all of Earth's water, no matter its location or state, is part of the hydrosphere. This water includes water in the atmosphere, on the planet's surface, and in the lithosphere.
- Students may confuse the three most common states of matter (solid, liquid, gas) with the forms of water in these three states (ice, water, steam or water vapour). Help to clarify by presenting examples of other substances in various states of matter. Solid carbon dioxide, also called *dry ice*, is an example of a solid and students can watch it become a gas. Mercury in a thermometer is an example of a metal in liquid form.

### ADVANCE PREPARATION

- Purchase the necessary materials for Find Out Activity 1-1A, A Water Cycle Model, on pages 10 and 11. Ensure that you have sufficient supplies available for all student groups.
- If you plan to make ice rather than purchasing ice, set aside time the day before the activity to prepare.
- Consult the Unit front matter for a list of BLMs that can be used when teaching this section.

### INTRODUCING THE SECTION, p. 8

#### Using the Text

On the board, create a two-column chart with headings "salt water" and "fresh water." Ask students to list examples of water in the world (for example, oceans, lakes, glaciers). If students require prompting, have them refer to the photo of the Earth in the Chapter Opener. As students offer suggestions, ask whether the example is salt water or fresh water. Write the example in the appropriate column.

#### Using the Key Terms and Section Summary

At the beginning of each section in the student textbook are the Key Terms and section summary. Both can be used as a pre-reading strategy and a review tool. Before reading the text in the section, students should be able to define the Key Terms by scanning the text and using the Glossary. The Key Terms include terms from the curriculum outcomes and additional terms that are important for students to know and understand.

The section summary provides an overview of the key concepts being covered in the section. Students may not know all the concepts and terms described in the summary, but they can use this information to help guide them through their reading.

After reading the section, students can go back to the Key Terms and section summary to consolidate their understanding and identify areas that require clarification. At the end of the chapter or unit, students can use the Key Terms and section summary for review. BLM 1-2, Unit 1 Key Terms, and BLM 1-3, Chapter 1 Key Terms, can be used to assist students.

### Using a Demonstration

Students can shade squares on a 10 × 10 grid to develop a graphic representation of the relative amounts of fresh water and salt water on the Earth's surface. Shading 97 squares as salt water and 2 squares as fresh water tied up in glaciers reinforces the idea that there is not an over abundance of available fresh water. Alternatively, you could show students 1000 mL of water in a beaker, then pour out the relative amount that is not available fresh water and show students how little remains in the beaker.

## TEACHING THE SECTION, pp. 8–9

### Using Reading

#### Supporting Diverse Student Needs

- The student textbook reviews ten key Science Skills, beginning on page 468. As you have students read the textbook for the first time, consider reading Science Skill 8, Using Your Textbook as a Study Tool, on page 492 with them. Several tips are presented there to help students extract the information they need from the textbook. In particular, Using Your Textbook to Read for Information point 4 and Using Your Textbook Visuals can help students who have difficulty reading this section.

#### Pre-reading—Key Word Concept Map

Clarify the meaning of the Key Terms atmosphere, hydrosphere, lithosphere with students and discuss how these terms are related to the water cycle. Have students prepare a concept map showing these Key Terms and some ways they are connected. During reading, students can add new information and terms to their concept map. After reading, students can identify word concepts they wish to learn more about.

#### During Reading—Note Taking (Cornell Format)

Encourage students to take notes as they read through each paragraph. They can use the topic titles to generate questions and then take notes as a means of answering the questions.

#### After Reading—Reflect and Evaluate

Have students review their notes and select three facts they find the most interesting. Then, have them explain (in writing) why they found the information interesting. Alternatively, have them share their explanations in a class discussion.

Students can summarize their understanding of the water cycle using BLM 1-7, The Water Cycle.

## USING THE ACTIVITY

- Activity 1-1A on pages 10 and 11 of the student textbook is best used after students have completed the reading of the text to help them synthesize and apply their understanding of the concepts outlined in Section 1.1.
- Detailed notes on doing the activity follow.

## Find Out Activity 1-1A

### A Water Cycle Model, pp. 10–11

#### Purpose

- Students relate the concept of the water cycle to real world experience through planning and constructing a model of water as it changes states (among solid, liquid, and gas).

#### Advance Preparation

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| Constructing the model 1 day before | Collect materials. If you plan to make, rather than purchase, ice, begin the day before to allow enough time for the water to freeze.<br><br>Make copies of BLM 1-8, A Water Cycle Model. | For each group:<br>– electric kettle<br>– bowls of various sizes<br>– oven mitts or heat-resistant gloves<br>– ice<br>– hot plate<br>– modelling clay<br>– sand<br>– soil<br>– water<br>– refrigerator<br>– freezer<br>– BLM 1-8, A Water Cycle Model |
| 1 hour before | You may wish to set up stations for the "hot" electrical appliances (electric kettle, hot plate), and for the "cold" appliances (refrigerator, freezer). Ensure that all electrical appliances are safely grounded and extension cords are taped down, if necessary. Have a clean-up station prepared for any spills. Remind students to clean up spills immediately to avoid slipping accidents and possible electric shocks. | |

### Time Required

- 30–40 min to plan a model; 30–40 min to construct the model

### Safety Precautions

- Safety eyewear, lab coats, and gloves must be worn in accordance with provincial safety standards.
- Remind students to be careful when working with hot water and steam.
- Remind students that they can proceed with this investigation only after you have approved their plan and only under your supervision.

### Science Background

Although scientists have discovered five states of matter so far, only three states are relevant to this activity: solid, liquid, and gas. Students will explore the water cycle by watching water change states from solid water—ice, to liquid water, to gaseous water—steam.

### Activity Notes

- Have students work in groups for this activity. Encourage students who are more independent to work with students who require more support.
- Before students begin working in their groups, explain that in order to work in a group successfully, students will need to share roles and responsibilities fairly. They can each takes turns at each role or each person can choose a role.
- Remind students that they must submit the plan for their model for your approval before proceeding with constructing their model.
- To help students avoid confusing the states of matter (solid, liquid, gas) with water in its three forms (ice, water, water vapour or steam), encourage them to use correct scientific language when planning and constructing their model. For example, "water" could be referred to as "liquid water."
- Have student groups use BLM 1-8, A Water Cycle Model to plan their model. Students may wish to draft their model in their notebooks or on scrap paper and use BLM 1-8 for their final copy for your approval. If you plan to assess students on their models, let them know ahead of time and decide as a class what the criteria will be.
- Review the safety precautions with students before they proceed with constructing their models. Encourage students to include the relevant safety precautions in each step of their model plans.

### Supporting Diverse Student Needs

- Cooperative group work can help develop interpersonal and verbal-linguistic intelligence. Tell students that their group will have more success if they listen to everyone's ideas and consider individual differences and interests when assigning roles. When you approve the students' model (in step 3), check that work will be spread among group members in such a way as to give every member an opportunity to make a meaningful contribution.
- To help model metacognition, have students answer Evaluate 2 and 3 as a group, including as many ideas as possible.
- As an extension activity, have students research and plan a model of how to show the three states of matter of another substance, such as carbon dioxide.

### Evaluate Answers

1. (a) Students' answers could include the following: Yes, our model worked exactly as we expected; No, our model did not work out the way we thought it would.
   (b) Students' answers could include the following: Originally, we thought we would use the electric kettle to heat the liquid water and soil mixture and turn the water into a gas, but it was too messy, so we used a hot plate instead; We had the steam from the kettle rising into the air, but we could add a bowl over the steam and collect it instead.
2. (a) Students' answers could include the following: We used our knowledge of the states of matter: solid, liquid, and gas; We used our knowledge of how water changes states to develop our model.
   (b) Students' answers could include the following: We noticed that solid water (ice) must pass through the liquid state before it can turn into steam or water vapour (gas); We noticed that pure water froze more quickly than water mixed with soil did.
3. Students should provide an evaluation of the models of their classmates and compare their own model to those around them. They may prefer their own, or see ideas in others' models that they prefer.
4. Heat energy was required to make the water change state from solid to liquid and from liquid to gas in our model. Heat energy from the Sun is an important part of the water cycle.

## USING THE FEATURE

### www Science: The Salty Facts about Penguins, p. 12

Penguins are aquatic, flightless birds that live primarily in the southern hemisphere, but not always in cold regions. Some penguins live in temperate zones, such as the Galapagos penguin, which lives in the Galapagos Islands.

There are about 20 species of penguins in the world. The most familiar species is the emperor penguin, pictured in the student textbook. Emperor penguins are the largest of the penguins, standing an average of 1.1 m tall and weighing approximately 35 kg. Emperor penguins are only found in Antarctica.

Penguins do not actually drink salt water. All their water is supplied through their food sources, such as krill, fish, and squid. They use the supraorbital gland to remove the salt from their prey.

Use this feature to help students understand the difference between salt water and fresh water. Explain that although almost all animals need fresh water to survive, some animals have developed unique characteristics—adaptations—that allow them to survive without fresh water.

Explain that sea-dwelling mammals, such as seals and whales, also usually do not drink seawater. Like penguins, they obtain their water from the food they eat. They choose their prey carefully, selecting animals that are less salty than seawater.

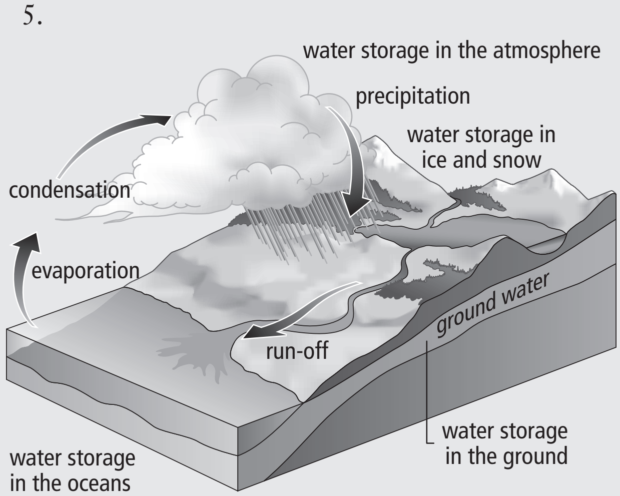
Encourage interested students to conduct additional research on animals with adaptations that help them live in a salt water environment, and ask them to present their findings to the class.

## SECTION 1.1 ASSESSMENT, p. 13

### Check Your Understanding Answers

#### Checking Concepts

1. 97%
2. Most of the world's fresh water is found frozen in ice sheets and glaciers at the North and South Poles.
3. Since most of the fresh water is frozen, only one third is liquid water that is available for use by humans.
4. Water must be heated or cooled to change from one state to another.
5.




#### Understanding Key Ideas

6. Three states in which water occurs include solid, liquid, and gas. Students' examples will vary. Examples: solid—iceberg, glacier; liquid—ocean, rain; gas—water vapour in the air (or atmosphere), fog
7. (a) evaporation
   (b) condensation
   (c)condensation
   (d) evaporation
8. As water moves through its cycle, it carries pollution from one place to another. For example, air pollution will be released into the air in one place, carried in water vapour in clouds, and fall as rain in another place. (Be sure students understand that the water particles actually form around these particles of pollution, then move through the atmosphere with them until they fall to Earth with the water as rain or snow.)

### Pause and Reflect Answer

Students should include the concept of an endless cycle or circle, and water returning to the state in which it began in their compositions, whether in words or represented graphically.

### Other Assessment Opportunities

- Consult the Unit front matter for a list of applicable Assessment BLMs.

## 1.2 COMPARING OCEAN WATER AND FRESH WATER

### BACKGROUND INFORMATION

Earth's oceans have an average salinity of about 35 000 ppm—salinity ranges from 32 000 to 37 000 ppm, due to runoff, evaporation, rainfall, and ice formation. The salt content comes from the gradual wearing down and dissolving of rocks and minerals over many years. Volcanoes and hydrothermal vents on the ocean floor also contribute to salinity by introducing salts or fresh water into the ocean.

Climate change is affecting the salinity of the oceans. As tropical oceans warm up, evaporation increases. This process concentrates the salt content, and oceans in tropical regions become saltier. Conversely, colder ocean regions, such as the Arctic and Antarctic, are becoming less salty as glaciers and icebergs melt.

The Dead Sea is a saltwater lake bordered on the west by Israel and the West Bank and on the east by Jordan. As well as being known for its incredibly high salt content, the Dead Sea is also 400 m below sea level and the lowest place on Earth.

While desalination is possible, it is an energy-intensive and expensive process. Few communities are able to support a large-scale process of desalination; however, as water resources become more scarce, desalination may become more feasible.

## COMMON MISCONCEPTIONS

- Students may think that all the world's oceans have the same salinity level. Explain to students that an ocean's salinity is affected by many factors including evaporation, rainfall, and ice formation, and that these factors can vary over time and in different areas.

## ADVANCE PREPARATION

- Purchase the necessary materials for Find Out Activity 1-2A, Mini Distillation, on page 15. Ensure that you have sufficient supplies available for all students.
- Purchase the necessary materials for Core Lab Conduct an Investigation 1-2B, Salinity's Effect on Water Density, on pages 18 and 19. Ensure that you have sufficient supplies available for all students.
- Consult the Unit front matter for a list of BLMs that can be used when teaching this section.

## INTRODUCING THE SECTION, pp. 14–15

### Using the Text

Ask students if they have heard of the Atlantic Ocean freezing completely over the winter. If some students in your class are not familiar with the Atlantic Ocean in winter, such as newcomers to the province, you may wish to bring in photos to display. (No, the ocean will not freeze completely over the winter.) Ask them why they think the ocean would not freeze completely. (Students' answers will vary. Some may suggest that the action of the waves prevents freezing or that the ocean is simply too large.) Explain to students that although waves, currents, and the ocean's size play a part in why it does not completely freeze in winter, another reason is its salinity.

### Using the Key Terms and Section Summary

At the beginning of each section in the student textbook are the Key Terms and section summary. Both can be used as a pre-reading strategy and a review tool. Before reading the text in the section, students should be able to define the Key Terms by scanning the text and using the Glossary. The Key Terms include terms from the curriculum outcomes and additional terms that are important for students to know and understand.

The section summary provides an overview of the key concepts being covered in the section. Students may not know all the concepts and terms described in the summary, but they can use this information to help guide them through their reading.

After reading the section, students can go back to the Key Terms and section summary to consolidate their understanding and identify areas that require clarification. At the end of the chapter or unit, students can use the Key Terms and section summary for review. BLM 1-2, Unit 1 Key Terms, and BLM 1-3, Chapter 1 Key Terms, can be used to assist students.

### Using the Did You Know, p. 14

Have students research on the Internet to find out the costs of "mining" ocean gold. (1 g of gold is worth approximately $30, but would cost nearly $1 million to retrieve.)

## TEACHING THE SECTION, pp. 16–17

### Using Reading

#### Supporting Diverse Student Needs

- Some students may find it helpful to use a Venn diagram to compare and contrast what they read about ocean water and fresh water. Strategies for using Venn diagrams and other graphic organizers can be found on pages 496 – 497 of the student textbook, Science Skill 10 Using Graphic Organizers.

#### Pre-reading—K-W-L (Know-Want to Know-Learned)

Ask students to record their answers to the question, "What are the differences between salt water and fresh water?" Then, have them review their answers and record any additional questions they may have about salt water and fresh water. Later, students can share their questions in a class discussion.

#### During Reading—Think-Pair-Share

Have students confirm, expand, and refine their ideas about this section by sharing ideas with a partner. Ask students to read the section of the student textbook independently, record their thoughts, and then share their ideas with a partner.

#### After Reading—Reflect and Evaluate

Have students review their notes and select three facts that were new to them. Then, have them explain (in writing) why each fact might be useful to someone. Alternatively, have them share their thoughts in a class discussion. As an extension, students can create a circle graph to show the relative amounts of different salts in ocean water using BLM 1-9, Salt Water.

**Reading Check Answers, p. 17**

1. Salinity is the amount of salt dissolved in a specific amount of water.
2. Ocean water near the equator is saltier than ocean water elsewhere due to the higher rate of evaporation.
3. Ocean salt can come from several sources: rain dissolves minerals in rocks, and volcanoes, and undersea volcanoes release salts into the water.
4. Density is the amount of mass of a substance in a certain unit volume.
5. Ocean water is more dense than fresh water because of its salt content.

## USING THE ACTIVITIES

- Find Out Activity 1-2A, Mini Distillation, on page 15 of the student textbook is best used after students have read page 14 of the section and are familiar with salinity.
- Core Lab Conduct an Investigation Activity 1-2B, Salinity's Effect on Water Density, on pages 18 and 19 of the student textbook is best used after students have read pages 16 and 17 of the student textbook and are familiar with density and its effects.
- Detailed notes on doing the activities follow.

## Find Out Activity 1-2A

### Mini Distillation, p. 15

**Purpose**

- Students investigate the process of desalination through a mini distillation activity.

**Advance Preparation**

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 day before | Collect materials. You may wish to prepare a glass clean-up kit, such as a cardboard box, broom, and dustpan. Ensure that all electrical appliances are safely grounded and extension cords are taped down, if necessary. Have a clean-up station prepared for any spills. Remind students to clean up spills immediately to avoid slipping accidents and possible electric shocks. | For each student or group:<br>– 4 g salt<br>– microscope or magnifying glass<br>– watch glass<br>– laboratory balance<br>– 10 mL distilled water<br>– stirring rod<br>– 50 mL beaker<br>– 5 mL measuring spoon<br>– tongs<br>– hot plate or other heat source |

**Time Required**

- 30–40 min

**Safety Precautions**

- Safety eyewear, lab coats, and gloves must be worn in accordance with provincial safety standards.
- Remind students to handle glass and hot equipment with care and to place it well away from the desk's edge.
- Have students keep away from the electrical cord and plug on electric appliances, such as a hot plate.

**Science Background**

Heat from the hot plate will cause the water in the watch glass to evaporate, leaving only the salt deposited on the glass. This is similar to the effect of the Sun's heat on salt water on Earth.

**Activity Notes**

- Review the safety precautions with students before they proceed with the activity.
- To conserve materials and save time, you may wish to have students work in small groups for this activity. All students should make their own notes.
- You may wish to perform this activity as a demonstration only. Ensure students observe carefully and take notes.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.
- Discuss where the water went when the salt was left. (It evaporated into water vapour in the air.)

**Supporting Diverse Student Needs**

- If you wish students to use a microscope, and they have limited experience with one, direct them to student textbook pages 394 and 395.
- Students could answer What Did You Find Out? question 4 in a diagram. This question may be challenging for some students. Consider holding a class discussion on this topic, especially about how water could be recaptured after turning to steam.
- As an enrichment activity, have students research what methods are used for desalination in communities around the world. If you wish, encourage students to share their findings with the class.

**What Did You Find Out? Answers**

1. (a) The residue is a white powder.
   (b) The residue is salt crystals.
2. Students may observe that the residue has smaller crystals than the original salt.
3. (a) It is about the same.
   (b) Students' answers could include the following: Yes, I expected that all the salt would be left behind; No, I thought everything would evaporate when we heated the water.

4. Some students may find this question challenging. The key concept here is that the water that evaporates leaves the salt behind. If the evaporating water can be captured and condensed, it will be pure water and not salty.

## Core Lab Conduct an Investigation 1-2B

### Salinity's Effect on Water Density, pp. 18–19

#### Purpose

- Students investigate how the salinity of water affects its density.

#### Advance Preparation

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 day before | Collect materials. Prepare water samples. You may wish to prepare a glass clean-up kit, such as a cardboard box, broom, and dustpan. Have a clean-up station prepared for any spills. Remind students to clean up spills immediately to avoid slipping accidents. Make copies of BLM 1-10, Salinity's Effect on Water Density (optional). | For each group:<br>– 250 mL beaker or large jar<br>– 5 samples of clear water for each group:<br>– tap water (colourless)<br>– tap water (blue)<br>– slightly salty water (red, use about 30 g salt in 250 mL water)<br>– very salty water (colourless, use about 70 g salt in 250 mL water)<br>– very salty water (green)<br>– medicine dropper or pipette<br>– plastic spoon<br>– blue, red, and green coloured pencils |

#### Time Required

- 40–50 min

#### Safety Precautions

- Safety eyewear, lab coats, and gloves must be worn in accordance with provincial safety standards.
- Remind students to hold glass apparatus securely and place them well away from the desk's edge.

#### Science Background

Earth's oceans do not have a uniform salt content. The salinity ranges from 32 000–37 000 ppm, with an average salinity of approximately 35 000 ppm. Although fresh water has a density of 1.000 g/L, the higher salinity makes salt water more dense than fresh water. In this activity, the food colouring will allow students to see how the denser salt water (green) sinks in fresh water and how the degree of salinity changes the density of salt water.

In Test 1, the very salty green water from the dropper will sink in the beaker of the less dense clear tap water. Students will be able to observe the green drops sinking. They will mix slightly as they descend and leave trails of green.

In Test 2, the less dense blue tap water will float on top of the denser colourless very salty water.

In Test 3, the use of the plastic spoon to add the colourless tap water to the top of the very salty green water should produce an obvious clear layer of water on top of the green salty water.

In Test 4, the lower density of the slightly salty red water will allow it to float in the very salty green solution. It should hang, suspended in the green solution before dispersing.

In Test 5, students will observe the red slightly salty drops of solution descending slowly into the colourless tap water.

In Test 6, stirring the water will mix the colourless tap water and the slightly salty red solution. Because just a few drops were stirred in, the water will become green.

#### Activity Notes

- Review the safety precautions with students before they proceed with the activity.
- For this activity, use about 70 g of salt in 250 mL of water for a very salty solution, and 30 g of salt in 250 mL of water for a slightly salty solution.
- Have students work in small groups for this activity. Students may wish to designate one "observer" for the entire activity, or take turns recording observations and conducting the investigation.
- You may wish to have students use BLM 1-10, Salinity's Effect on Water Density, to record their observations.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.
- After students have completed the questions, have them discuss their results as a class.

#### Supporting Diverse Student Needs

- Encourage students with written output challenges to participate in the observations by using sketches and diagrams.
- Visual-spatial learners will enjoy this activity. Students with logical-mathematical intelligence may enjoy predicting the investigation outcomes.
- If some students in your class have trouble seeing red and green, have them work with a classmate to observe results..
- Students could answer Conclude and Apply questions orally.
- For enrichment, students could be encouraged to consider other combinations of samples to test and predict the results.

### Analyze Answers

1. The very salty green water sank in the colourless tap water because salt water is more dense than regular tap water.
2. The blue tap water floated on top of the very salty water. The tap water has a lower density than the salty water solution, so it floated on top.
3. (a) (i) The slightly salty red solution moved upward, then was suspended in the very salty green water.
   (ii) The slightly salty red solution sank slowly in the colourless tap water.
   (b) The slightly salty red solution is only slightly less dense than the very salty green water and only slightly more dense than the colourless tap water, so it did not float or sink very quickly.
4. The different densities of the solutions meant that they would not mix by themselves.

### Conclude and Apply Answers

1. The more salt that is dissolved in water, the higher the density is of the solution.
2. Waters with different densities will not mix on their own. The higher density water will sink and the lower density water will float on top.
3. When fresh water meets ocean water, the fresh water will float on top of the denser ocean water.
4. Ocean currents and wind would cause fresh and salt water to mix.
5. River estuaries that meet oceans, and rain would cause fresh water and salt water to meet.

## USING THE FEATURE

### Career Connect: Oceanographer, p. 20

If possible, schedule a visit from a local oceanographer to answer students' questions.

Provide resources, such as brochures from relevant universities or Internet research time, on the education that is required to become an oceanographer and what kinds of career opportunities are available for people with this training.

Tell students that many organizations in Canada employ and support oceanographers and other scientists to help them conduct research about oceans. These include:

- Environment Canada
- Fisheries and Oceans, Canada
- Ocean Sciences Centre (operated in conjunction with Memorial University

You could ask interested students to find out more about what types of research these organizations do and how it is used, and report back to the class.

## SECTION 1.2 ASSESSMENT, p. 21

### Check Your Understanding Answers

### Checking Concepts

1. Ocean water is salty. Fresh water is not.
2. Salt occurs in the greatest amount in ocean water.
3. The salt in ocean water originally comes from rocks and volcanic eruptions.
4. As ocean water evaporates, the salt in the water is left behind, making the water that remains in the ocean salty.
5. (a) Ocean water is more dense than fresh water.
   (b) Water with a higher salinity is more dense.
6. The addition of salt to water lowers its freezing point to –1.9°C.

### Understanding Key Ideas

7. In order to "mine" valuable minerals from ocean water, you would have to evaporate enormous amounts of seawater to get tiny amounts of minerals.
8. To separate dissolved solids from ocean water, you could heat the water and cause it to evaporate, leaving the solids behind.
9. Oceans in tropical areas have higher salinities because the water evaporates faster, leaving a higher concentration of dissolved solids.
10. Oceans near the North and South Poles have higher salinities because there is little precipitation there.

### Pause and Reflect Answer

Students should note evaporation and ice formation or ice melting in their answer. They may also mention climate change, water "harvesting," and desalination industries as factors.

### Other Assessment Opportunities

- Consult the Unit front matter for a list of applicable Assessment BLMs.

# 1.3 SOURCES OF FRESH WATER

## BACKGROUND INFORMATION

Wetlands, including swamps, marshes, and bogs, are the "middle ground" between land and aquatic ecosystems. Wetlands are incredibly biodiverse and act as filters, trapping pollutants and sediment. Wetlands are very important for animal life, including humans. If you studied a map of the world, you would see that human settlements are primarily located around water sources, such as rivers. Wetland floodplains, such as the Nile River delta, support over 90% of the world's population. Approximately 14% of Canada is covered in wetlands. Newfoundland and Labrador contain 5% of Canada's wetlands.

Ground water is water from sources such as rain and snow that filters through the soil and collects when it reaches bedrock. The area where the water collects when it cannot seep down any farther is called the saturation zone. The top of this zone is called the water table. Depending on the level of precipitation of an area, how nearby lakes or oceans are located, and the composition of the soil, the water table may be a few metres below the surface of the Earth or a few hundred metres. Rural communities around the world dig or drill wells to reach the water table for a source of fresh water for themselves and their crops and livestock.

Both Greenland and Antarctica are frozen worlds, covered with kilometre-thick sheets of ice and enormous glaciers. Ice sheets are thick blankets of ice covering large areas of landmass. Seven eighths of the surface of Greenland is covered in a vast sheet of ice.

Glaciers, although sometimes also very large, are different from ice sheets. Glaciers move. In the case of Greenland's glaciers, the glacial ice is some of the fastest moving ice in the world. Scientists have clocked Kangerdlugssuaq Glacier, for example, at 14 km a year. And it is picking up speed as a result of climate change. In contrast, the Shirase glacier in Antarctica moves at a rate of approximately 2.6 km per year (1989 to 1991 data).

Kangerdlugssuaq Glacier in the east coast of Greenland is approximately 7 km wide, 30 km long, and 1 km deep. Greenland's glaciers carry ice from the larger ice sheet in the middle of the island to the oceans. Some of the ice from these glaciers and ice streams from the central ice sheet melt into Baffin Bay and affect water levels and salinity. Climate change is causing an increase in the volume of water draining into Baffin Bay and surrounding oceans. It is interesting to note that Newfoundland's icebergs originate from Greenland's glaciers.

Antarctica, at the other end of the world, is also covered in ice sheets and glaciers.

## COMMON MISCONCEPTIONS

- Students may think that wetlands are just land areas that happen to flood. Explain that wetlands are a distinct ecosystem with flora and fauna specific to the wetland area that could not survive in any other ecosystem.
- Students may think that glaciers are so large that they cannot move. Explain to students that glaciers slide down the slope of the land toward the ocean. Show students a map or globe with elevation and point out how coastal land slopes toward the ocean. Demonstrate this point by placing an ice cube on a flat surface, such as a plate. Show students that once the plate is tilted, representing the slope of the Earth toward an ocean, the ice cube slides down the plate. Use a textbook to prop one side of the plate to create the tilt. You can also demonstrate the effects of global warming on glacial movement by repeating the same demonstration, but this time heat the plate slightly by running it under hot water for a few moments, and then dry it. The heat of the plate will melt the ice cube more quickly and help it slide down the plate at a faster rate.

## ADVANCE PREPARATION

- Consult the Unit front matter for a list of BLMs that can be used when teaching this section.

## INTRODUCING THE SECTION, p. 22

Ask students to think back to the three states of matter of water—solid, liquid, and gas— that they worked with in Find Out Activity 1-1A, A Water Cycle Model, on pages 10 and 11. Ask them to consider fresh water in its solid and gas states. How easily can organisms such as humans, other animals, or plants use fresh water in these two states? (Some plants can use water vapour in the air to survive; Some animals, such as penguins, can survive without drinking water at all.) Point out to students that these examples are exceptions and that most organisms need liquid fresh water to survive. Have students consider how many organisms on Earth depend on the 1% available liquid fresh water.

Bring in photos of a local lake, pond, or wetland to help familiarize students with what these fresh water sources look like. Research some examples of local plant and animal life that depend on these areas. Bring in photos to display.

Visit www.discoveringscience8.ca.

Find satellite maps (or even detailed road maps) of your area, showing lakes, ponds, and wetlands. Using a large version, or an overhead of the map, demonstrate how to trace the water cycle through these areas.

If time allows, have students work in small groups and sketch a diagram of the local water cycle, using the map as a reference. Encourage students to label their map and add details, such as how precipitation, ground water, and glaciers affect their diagram.

### Using the Key Terms and Section Summary

At the beginning of each section in the student textbook are the Key Terms and section summary. Both can be used as a pre-reading strategy and a review tool. Before reading the text in the section, students should be able to define the Key Terms by scanning the text and using the Glossary. The Key Terms include terms from the curriculum outcomes and additional terms that are important for students to know and understand.

The section summary provides an overview of the key concepts being covered in the section. Students may not know all the concepts and terms described in the summary, but they can use this information to help guide them through their reading.

After reading the section, students can go back to the Key Terms and section summary to consolidate their understanding and identify areas that require clarification. At the end of the chapter or unit, students can use the Key Terms and section summary for review. BLM 1-2, Unit 1 Key Terms, and BLM 1-3, Chapter 1 Key Terms, can be used to assist students.

## Using the Did You Know, p. 23

Use the Did You Know? on page 23 to start a class discussion on the importance of fresh water supplies. Ask students to consider whether drilling a well 1 km deep is realistic. Then, ask them to consider how valuable water would have to become for 1 km-drilling to be considered. Interestingly, the technology for deep-Earth drilling has existed for decades. The Russian Kola Superdeep Borehole began drilling in 1970. It reached a record depth of 12 262 m in 1989 when it was forced to stop drilling due to temperatures of 180°C.

Refer students to the Did You Know? feature on page 25. Since the Athabasca Glacier is relatively accessible, it is actually a tourist attraction. It is possible to tour the glacier in an enormous tractor-treaded "Snow Coach." To show students the glacier's relative size, provide them with a visual cue. Bring in a photo of the Eiffel Tower that includes tourists, to show their relative size. Explain that the Eiffel Tower was completed in 1889 and was the world's tallest structure for 43 years (before losing its title to the United States' Chrysler Building). Have students imagine a wall of ice as tall as the Eiffel Tower using the photo as a guide.

The Did You Know? on page 26 of the student textbook connects the general information on drainage basins to a specific example that students may recognize. You may wish to bring in a large map of Newfoundland and Labrador that depicts the Churchill River and point out to students how large the drainage basin would be. Explain that the island of Newfoundland is a little less than twice as large as Churchill River's drainage basin. If possible, use an overhead with a $\frac{1}{2}$ scale outline of the island of Newfoundland and place it over the Churchill River watershed to show students its relative size.

## TEACHING THE SECTION, pp. 22–28

### Using Reading

#### Pre-reading—Predict-Read-Verify

Chunk the text into manageable sections by headings. Before reading, ask students to read the headings, analyze the visuals, and read the captions. Encourage students to use their background knowledge of the water cycle to predict what the "sources of fresh water" will be. After reading the section, students can verify or revise their predictions.

#### During Reading—GIST

As students read this section, have them write short summaries of the sections on fresh water sources. Encourage students to keep their summaries to 20 words or fewer.

#### After Reading—Semantic Mapping

Use semantic mapping to have students organize and recall the information presented in this section. Have students begin by using the student textbook headings to identify the core concept covered in this section. Next, ask students to create a semantic map for each core concept by linking ideas that clarify and provide further information to each concept with a series of lines. Alternatively, have students identify the key concepts in a class discussion. Then, have each student choose one concept and develop a semantic map about that one concept. Then, have students share their concepts with the class.

#### Supporting Diverse Student Needs

- Have students who have difficulty extracting information from the textbook or organizing it into a semantic map draft a map for one core concept, then compare what they have done with a classmate's map, and refine theirs as necessary, checking the textbook as they do. They can then repeat this process of drafting, sharing, and refining semantic maps for the other core concepts.

#### Reading Check Answers, p. 26

1. Four sources of fresh water on Earth are lakes, ponds, and wetlands; streams and rivers; ground water; and glaciers.
2. Groundwater is a source of fresh water from precipitation that trickles through the ground until it collects on a layer of bedrock.

3. Glaciers are formed from piles of accumulated snow that compress over time.
4. The last ice age ended 11 000 years ago.
5. Global warming is causing the Earth's glaciers to recede by melting and shrinking.

### Reading Check Answers, p. 28

1. A drainage basin is the area of land that drains into a body of water.
2. The Continental Divide is a chain of mountains, including the Rocky Mountains, that separates the Pacific drainage basin from the drainage basins to the east of the mountains.
3. Run-off is water that flows across the Earth's surface, rather than soaking into the ground.
4. The force of gravity pulls run-off to the lowest possible point.
5. Students should mention four of these factors: the nature of the ground material; the amount of rain; the lengths of time it rains; the slope of the land; and the amount of vegetation.

## USING THE ACTIVITIES

- Find Out Activity 1-3A, Tracking Run-off, on page 29 of the student textbook is best used after students have read the information on run-off and factors affecting run-off.
- Find Out Activity 1-3B, How Can Global Warming Be Slowed?, on page 30 of the student textbook is best used after students have completed reading the information on Glaciers and Global Warming. This activity will provide students with the opportunity to take an active role in reducing the global warming discussed in this section.
- Think About It Activity 1-3C, How Much Water?, on page 31 of the student textbook is best used when students have completed their reading of the Fresh Water System Links and understand the material on drainage basins.
- Detailed notes on doing the activities follow.

## Find Out Activity 1-3A

## Tracking Run-off, p. 29

### Purpose

- Students relate the concept of run-off to a hypothetical example of a new subdivision.

### Advance Preparation

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 hour before | Photocopy BLM 1-11, Tracking Run-off for student groups. | For each group:<br>– BLM 1-11, Tracking Run-off |

### Time Required

- 20–30 min

### Science Background

Removing all the vegetation, such as the trees and bushes, and adding hard surfaces, such as the shopping mall parking lot and the driveways of the homes, will increase the area's run-off dramatically. The positioning of the homes nearer the river with the shopping mall's parking lot above could flood the homes.

### Activity Notes

- Have students work in small groups for this activity.
- Distribute one copy of BLM 1-11, Tracking Run-off to each student group.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.
- Circulate as students work, providing suggestions and direction as required.
- Have student groups share their What Did You Find Out? answers with the class.
- Ask students to share their "Possible solutions" from their three-column table. Make jot notes on the board or a large sheet of chart paper. Then, ask students to return to their groups and, using the notes on the board, review and revise their response(s) for the What Did You Find Out? question 2 based on the combined ideas of their classmates.
- If time allows, you may wish to provide students with an opportunity to present their solutions in a town-hall-style forum. Propose to students that they are at the community's town hall meeting. Have some students act as the community leaders, some as developers, and some as engineers specializing in run-off.

### Supporting Diverse Student Needs

- This activity will be excellent comprehension practice for students with reading difficulties. Consider providing these students with a photocopy of the activity, and having them use a highlighter to mark the relevant passages for the "Proposed action by the community."
- Students with visual-spatial intelligence will enjoy this activity. They may wish to sketch their answer for What Did You Find Out? question 2. Students with verbal-linguistic intelligence may prefer to present their What Did You Find Out? answers to the class, rather than fill in the table.
- For enrichment, have students sketch a superior development plan for the community, using the sketch on page 29 and the same houses and shopping mall as in the original plan.

**What Did You Find Out? Answers**

1. Students' answers could include the following: If the community carries out all of its plans, without the bushes on the slope, the houses may flood as the water from the shopping mall parking lot flows down the river bank; The houses may flood when the river water level rises from all the extra run-off when the trees and bushes are cut down.
2. Students' answer could include suggestions to avoid cutting down some or any of the vegetation, changing the location of the houses, and changing the material of the parking lot to make it absorb more water and prevent run-off.

## Find Out Activity 1-3B

### How Can Global Warming Be Slowed?, p. 30

#### Purpose

- Through investigating, students identify contributors to global warming (uses of fossil fuels) in their community and ways to reduce reliance on fossil fuels.

#### Advance Preparation

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 week before | Obtain the necessary supplies. If required, reserve computer lab and library time for students. | For each group:<br>– access to the library or Internet<br>– art supplies for brochure and/or access to the computer lab for website design |
| 1 day before | Make copies of BLM 1-12, How Can Global Warming Be Slowed? (optional). | |

#### Time Required

- 40 min for brainstorming; another 40 min or more for brochure and website design

#### Activity Notes

- Have students work in groups for this activity.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.
- Tell students that this activity will involve brainstorming. Take a few minutes to remind students how to brainstorm appropriately. Make them aware that all ideas are valid and useful and that everyone should be encouraged to participate equally. If you wish, distribute BLM 1-12, How Can Global Warming Be Slowed? for students to record the results of their group's brainstorming.
- Ask students what they know about global warming. Students may feel some anxiety about what they have been hearing and reading about climate change. Use this forum as an opportunity to dispel any misinformation and confusion they may have. Explain that through this activity, they will have an opportunity to make changes and help others make changes that will slow the effects of global warming.
- Tell students that this activity will be completed in three parts. The first part will be a brainstorming session in their groups on how fossil fuels are used in their community. They may wish to use the library or the Internet to conduct research. Encourage them to make jot notes on what areas they would like to research during their brainstorming, and to use their notes as a reference when they are researching.

Explain to students that once they have identified how their community uses fossil fuels, the second part of the activity will be brainstorming for solutions. They will work in groups and think of ways to reduce their community's fossil fuel use. You may want students to work in the same groups as they did in Part 1 of the activity, or you may want them to form new groups to generate new ideas and a new group dynamic. Ensure that students understand that they will need to record their ideas and refer to them for Part 3 of the activity. Explain that they may wish to have one student act as scribe for their group, or they may want to take turns recording.

Once they have completed their solution brainstorming, students can then proceed to Part 3 of the activity—communicating to their community. Have each student group choose either a brochure or website format to share their findings with their community. Then, as a group, they will design the brochure or website. Encourage them to make the brochure or website appealing to their community and have a clear message. This activity may be an opportunity for a cross-curricular link to literacy with students learning about persuasive writing. Ensure you have appropriate art supplies available for students who are working on the brochure.

As an extension activity, you may wish to have students work together as a class and create a "live" Web page to be placed on the school website.

#### Supporting Diverse Student Needs

- Use visual references for the concepts in this activity for English language learners, such as photos of cars with exhaust, coal mining, and the Hibernia platform.
- Brochures and websites provide opportunities for many types of recording other than narrative text.

Provide students who have strong musical intelligence the opportunity to provide accompanying music or a song for the website, or to create a poem for the brochure.
- For enrichment, students could research in the library or on the Internet for alternatives to fossil fuels (e.g., solar, wind, geothermal) and share their findings with the class. Some students may wish to create the brochure using a computer design program or create a sample website. Provide computer lab time as required.

**Extension Answers**

Students may include information about legislation encouraging the use of energy-efficient vehicles, appliances, and light bulbs; reducing vehicle idling and instituting no-idle zones; encouraging carpool use; and educating people about ways to reduce the amount of carbon dioxide they introduce into the atmosphere.

## Think About It Activity 1-3C

### How Much Water?, p. 31

**Purpose**
- Students will investigate Canada's major drainage basins and rank them in terms of water volume.

**Advance Preparation**

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| | | For each student:<br>– graph paper<br>– two different colours of markers or pencil crayons |

**Time Required**
- 30–40 min

**Science Background**

The drainage basins east of the Rocky Mountains carry the majority of the water volume. The largest area does not correlate with the largest volume of water, or mean discharge. For example, the Atlantic drainage basin manages the largest volume of water, but is only half the size of the Hudson Bay drainage watershed.

**Activity Notes**
- Students can work individually for this activity.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.
- You may wish to have students use graph paper for this activity.
- Distribute the graph paper and two colours of markers or pencil crayons for each student. Have students assign one colour for the drainage basin area and another colour for the mean discharge and draw one bar graph showing the area for each drainage basin and one bar graph showing the mean discharge for each drainage basin.
- Circulate while students are completing their chart to answer questions or provide guidance.
- Once students complete the Analyze questions, review the results as a class.
- You may wish to create a transparency of the completed bar graphs as a reference. Refer to the bar graphs and point out the differences in rankings between area and mean discharge of the drainage basins. Have students refer to the illustration of the drainage basins on page 27 and reread pages 27 and 28, Factors Affecting Run-off. Then, ask students to consider why the rankings differ. (The Arctic drainage basin is as large as Hudson Bay, but mean drainage is half. This might be due to the colder Arctic temperature, which keeps the water frozen for most of the year and only drains in the summer months. The Atlantic drainage basin contains the Great Lakes region—that is why the mean drainage is so high compared to its area. The Pacific area gets more rainfall than other areas of Canada. This result might account for its high mean discharge.)

**Supporting Diverse Student Needs**
- Ensure English language learners understand the instructions before beginning the activity. The rest of the activity should be straightforward.
- Students with logical-mathematical and intrapersonal intelligences will enjoy this activity. Visual-spatial learners may benefit from transferring their results to a visual medium, such as a histogram (vertical bar chart).
- Some students may need to refer to a relief map of North America to answer Analyze question 2.
- If necessary, provide calculators for students to use to divide the large numbers.
- If necessary, provide a formula for calculating percentage of total output:

$$\text{percentage of total output} = \frac{\text{amount of discharge in one direction}}{\text{total amount of discharge}} \times 100.$$

- For enrichment, encourage students to formulate an equation using >, <, =, or ≠ that represents the relationship between drainage basin area and mean discharge.

**Analyze Answers**

1. The largest area does not have the largest mean discharge. The size of the discharge may be related to area, but also to the amount of rainfall received in that area and how much of the rainfall soaks into the Earth instead of running into rivers.
2. north (counting the Arctic and Hudson Bay drainage basins)
3. approximately 53%. This calculation cannot be done on a standard scientific calculator. Consider performing it as a teacher guided calculation.

## USING THE FEATURE

### Science Watch: Turning on the Fog Faucet, p. 32

When students have completed their reading of the feature, discuss the feature as a class. Ask,

- "Why might this technology be suited to our province?" (Fog and mist are common in Newfoundland and Labrador.)
- "What other areas of Canada might find this system useful?"
- "Can you think of a region in Canada where this method would not work as well?"

**Science Watch Answers**

1. Fog catchers' nets cause the mist and fog to condense on them and drip along the panels into storage tanks.
2. Fog catchers need areas with a lot of mist and fog but not enough fresh water from another source.
3. Students' answers could include the following: Yes, we get a lot of mist and fog in my area; No, my area has a lake and we have a lot of fresh water already.

## SECTION 1.3 ASSESSMENT, p. 33

### Check Your Understanding Answers

**Checking Concepts**

1. Snow that does not melt piles up and eventually compresses into ice.
2. Students' answers could include the following: There is not enough vegetation to absorb the rain or slow the rain so that the soil can absorb it; The rainfall was too heavy for the soil to absorb it; It rained for too long and the soil was saturated; The slope of the hill was too steep to allow the vegetation to absorb it in time; The hillside was paved or mostly rock.
3. Run-off is an important part of the water cycle because it helps to fill the lakes, streams, and rivers that then fill the oceans.
4. This refers to the water cycle and how water is always moving from one place to another through the water cycle.

**Understanding Key Ideas**

5. (a) Planting trees along the slopes would decrease the amount of run-off as more trees would absorb more water.
   (b) Making the slopes less steep would decrease the amount of run-off as the existing vegetation would have more time to absorb the water.
   (c) Adding roads and parking lots to one side of the slope would increase run-off as there would be no vegetation to absorb the water, and the paved surface would not absorb water either.
6. Water pollution in one part of a province, such as a river or stream, would flow into other water bodies into major drainage basins, carrying the pollution along with it, even as far as the ocean.
7. Alpine glaciers are located in mountain areas. Continental glaciers are massive and cover large areas of land.
8. Glaciers are important to all living things because they release water as meltwater in the summer months, they slow the passage of water through the water cycle, and they provide information about Earth's past climates.

### Pause and Reflect Answer

Students' answers should note that summer meltwater would be reduced with so few glaciers and that water would move through the water cycle much more quickly. Students may also note rising ocean waters and flooding rivers as glacial meltwater enters the water cycle.

### Other Assessment Opportunities

- Consult the Unit front matter for a list of applicable Assessment BLMs.c

## CHAPTER 1 ASSESSMENT, pp. 34–35

### PREPARE YOUR OWN SUMMARY

Students' summaries should incorporate the following main ideas:

1. Water Cycle
   - Water continuously moves through a cycle.
   - Water changes its state to move through this cycle; it evaporates and condenses, freezes and thaws.
   - The Sun's energy drives the water cycle by heating and evaporating the water into vapour in the air where it cools and falls back to Earth.
2. Differences Between Ocean and Fresh Water
   - Fresh water contains very small amounts of salt.
   - Salt water is more dense than fresh water.
   - Salt water has a lower freezing point than that of fresh water, –1.9ºC
3. Sources of Fresh Water
   - Lakes, ponds, wetlands, rivers, streams, and ground water are all sources of fresh water.
   - Glaciers are sources of fresh water, especially in the summer.
   - Fresh water collects into drainage basins, which empty into oceans.
   - Run-off can be affected by four factors: the nature of the ground material; the amount of rain; the length of time it rains; the slope of the land; the amount of vegetation.

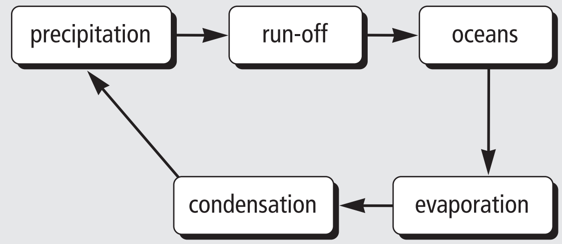
### CHAPTER REVIEW ANSWERS

#### Checking Concepts

1. (a) Approximately 71% of Earth's surface is covered in water.
   (b) Only about 3% of the Earth's water is fresh.
2. The Sun is the source of energy for the water cycle.
3. A person who studies water systems is called a hydrologist.
4. The Dead Sea is 9 times saltier than the ocean; the high density of the saltier water makes it easy to float in.
5. Divides, usually mountain ranges or other areas of high ground, separate drainage basins.
6. (a) Receding means melting and shrinking.
   (b) Ocean waters may rise.

#### Understanding Key Ideas

7. Students' flowcharts should show precipitation, run-off into oceans, evaporation, and condensation.




8. (a) Construction of a large shopping mall and parking lot would increase run-off as vegetation that would absorb precipitation is removed, and paved parking lots are created.
   (b) The building of a new subdivision would increase run-off as vegetation that would absorb precipitation is removed, and land is paved.
   (c) Logging a forest in a hilly area would increase run-off as the trees that would absorb the precipitation are removed.
9. Only the plants would control the run-off.
10. Controlling run-off can prevent flooding.
11. (a) Town A will have a summer water shortage because the water demand is very high in the summer, but precipitation is low.
    (b) Water demand in both towns is lowest in the winter—December and January. People probably aren't watering gardens or filling swimming pools at that time.
    (c) (i) Both towns have a drop in supply in the summer months.
    (ii) The summer months are hotter and drier. It may rain less in the summer, and the water evaporates more quickly.
12. The government must watch out for pollution that could contaminate the ground water.

#### Pause and Reflect Answer

Students should note that worldwide ocean levels could rise if the ice melts, threatening coastal areas. Meltwater would not be as available in the summer months. It is possible that such a large volume of fresh water added to the ocean could affect the ocean's salinity level and affect ocean currents.

## CHAPTER 2 OPENER, pp. 36–37

### USING THE PHOTO AND TEXT

Have students examine the photograph on page 36. Point out the waterfalls on the cliffs. Ask, "Is the water in the waterfalls fresh or salt water?" (fresh water) "Where might this waterfall water come from?" (rivers, run-off) Explain that just as we have basins like lakes and rivers on the land, the oceans have basins as well. Ocean basins will be covered in Section 2.1.

As a class, discuss students' perceptions of the ocean. You may wish to use a mind map strategy to connect their ideas, or simply list them on the board. Students may offer descriptions such as large, blue, cold, waves, and tides. Explain to students that we tend to think of the ocean as one large bathtub of water. However, the ocean is constantly in motion. Tell students that one way to think of the ocean is as a system of many, many rivers that overlap and intertwine. In the ocean, each river is a current with its own salinity and temperature within the ocean.

Have students refer back to Core Lab 1-2B, Salinity's Effect on Water Density. Have students consider, based on their experiences with this activity, what an ocean full of different currents would be like. Explain that students will study ocean currents in more depth in Section 2.2.

### USING THE WHAT YOU WILL LEARN / WHY IT IS IMPORTANT / SKILLS YOU WILL USE

Have students flip through the chapter and make a list of all the main section heads (in blue) and subsection heads (gold). Then, as a class, read the What You Will Learn section on page 37. Ask students to work with a partner and discuss whether the chapter's organization will help them learn the material listed in the What You Will Learn section. Ask them to explain in what way the chapter structure will help or, if not, how it could be organized differently.

As a class, read the Why It Is Important section. Ask, "Why do you think it is important to understand the relationship between human activities and the balance of nature?" (so we can protect nature, so we can better understand what we need to live, because it is interesting) Use this information as a starting point for a discussion on what students have learned so far and correct any misconceptions they may have.

### USING THE FOLDABLES™ FEATURE

See the Foldables Section of this resource.

## 2.1 OCEAN BASINS

### BACKGROUND INFORMATION

Pangea, or sometimes Pangaea, existed about 250 million years ago, during the Paleozoic and Mesozoic eras. At that time, all Earth's landmasses were grouped together into one large continent, or supercontinent. Slowly over time, the continents began to split and drift apart. The theory of continental drift was first published by Alfred Wegener in 1920. This theory later became refined to what we now know as plate tectonics.

Ocean ridges, also called mid-ocean ridges, are underwater mountain chains formed by plate tectonics. When the plates that form the Earth's crust pull apart, magma flows up and hardens, forming mountains. Ocean ridges typically have a valley at their centre, known as a rift. The mid-ocean ridge system is the longest mountain chain in the world—about 80 000 km! (This is almost twice the circumference of the Earth! It can be this long because it twists and turns.)

When two tectonic plates collide, one plate is forced beneath the other, forming an ocean trench. The Mariana Trench, or Mariana's Trench, is the deepest on Earth, extending 11 km below sea level. This point, the deepest part of the trench, is called Challenger Deep, and is geographically located near The Philippines. A soil sample of Challenger Deep surprised scientists as it revealed a multitude of life. Single-celled organisms called foraminifera, part of the kingdom protera, can live in this enormously pressured, sunless environment.

Large flat areas of ocean floor are covered with fine silt or sediment. About 40% of the ocean floor is covered by abyssal plain. The abyssal plain supports only minimal sea life, such as tube worms, unusual shellfish, and some deep-sea fish. The Atlantic Ocean has 14 abyssal plains, one of which is the Labrador plain, located between Labrador and Greenland.

Continental shelves and continental slopes are the areas of the continents that extend under the ocean waters, sloping gently or sometimes steeply away from the land to join the abyssal plains. Continental shelves have abundant sea life—nutrient-rich sediment from the land washes into the ocean and combines with warmer, shallow water and sunlight to make a rich area for many organisms, such as coral, sponges, sea stars, bristleworms, and thousands of others.

Students who have shown an interest in marine biology careers, such as oceanography in the Career Connect in Chapter 1, may be interested to learn that Newfoundland's Marine Institute of Memorial University offers a program for becoming an ROV operator.

Visit www.discoveringscience8.ca for additional resources related to the formation of ocean basins.

## COMMON MISCONCEPTIONS

- Students may think, from their study of drainage basins in Chapter 1, Section 1.3, that basins occur only on land. Explain that basins are low spots anywhere on Earth's surface, not just on land.
- Students may not be aware of the "new" ocean—The Southern Ocean—that surrounds Antarctica. Have students read the Did You Know? feature on page 38.
- Students may have difficulty understanding deep sea pressure and why humans cannot visit the ocean floor. Visit www.discoveringscience8.ca for more resources related to deep sea pressure. Section 9.1 includes a description and illustration of why pressure increases as you go deeper underwater. You may wish to refer to it now with students.

## ADVANCE PREPARATION

- Consult the Unit front matter for a list of BLMs that can be used when teaching this section.

## INTRODUCING THE SECTION, pp. 38–39

### Using the Text

Using a globe as a visual aid, show students that basins can occur anywhere on the surface of the Earth. A basin will occur anywhere there is a low spot compared to the surrounding area, whether that spot is on land or on the ocean floor. Have students recall from Chapter 1 where the water in drainage basins comes from (glaciers, precipitation, run-off, rivers, and lakes).

Have students work with a partner. Using their knowledge of water density from Chapter 1, ask student pairs to consider what would be inside a basin on the ocean floor. (colder water, saltier water) Ask them to consider how ocean basins might act as part of the water cycle.

Working with a partner, have students plan a trip from their home to Australia by boat. Have them plan their route by listing all the oceans they must travel through to reach their destination. If they finish quickly, ask them to plan a different route home. Will they have to cross the same oceans as before? As a class, have students share their routes with the class. Students can use BLM 1-14, Earth's Oceans, to show the location of each of the world's oceans.

### Using the Key Terms and Section Summary

At the beginning of each section in the student textbook are the Key Terms and section summary. Both can be used as a pre-reading strategy and a review tool. Before reading the text in the section, students should be able to define the Key Terms by scanning the text and using the Glossary. The Key Terms include terms from the curriculum outcomes and additional terms that are important for students to know and understand.

The section summary provides an overview of the key concepts being covered in the section. Students may not know all the concepts and terms described in the summary, but they can use this information to help guide them through their reading.

After reading the section, students can go back to the Key Terms and section summary to consolidate their understanding and identify areas that require clarification. At the end of the chapter or unit, students can use the Key Terms and section summary for review. BLM 1-2, Unit 1 Key Terms, and BLM 1-4, Chapter 2 Key Terms, can be used to assist students.

### Using the Did You Know, p. 43

Have students individually read the Did You Know? feature. As a class, ask students to speculate as to why scientists may have decided to make this change. On the board, make a two-column chart with the headings "Positives" and "Negatives." Have students brainstorm the potential outcomes of this change. You may prompt them with questions such as the following:

- How will this change affect maps?
- What effect might this change have on scientists studying Antarctica?

## TEACHING THE SECTION, pp. 40–47

### Using Reading

#### Pre-reading—Key Word Concept Map

Have students prepare a concept map of the headings in the section as a preview of what they will be learning. Have students start with the section title, "Ocean Basins," and then add the rest of the subsection and activity titles.

#### During Reading—Note Taking

Encourage students to take notes as they read through each subsection. They can use the topic titles to generate questions and then take notes as a means of answering those questions.

#### Supporting Diverse Student Needs

- If students have trouble visualizing how the continental plates move,distribute BLM 1-15, Origin of the Oceans (sets of labelled continent cut-outs) to pairs of students and have them work together to fit the continents together, as they were before they began drifting apart. This will appeal to visual-spatial learners, and build visual-spatial skills in all learners.

### After Reading—Reflect and Evaluate

Have students review their concept map from the Pre-reading activity. Using the same concept map, have them add bullet points under each heading on what key concepts are covered in the subsection. For example, under "How Ocean Basins Become Bigger," students may list:

- Earth's plates pull apart.
- Molten rock fills in rock.
- Can calculate rate of motion.

Students can summarize what they have learned about Features of the Ocean Floor using BLM 1-16, On the Ocean Floor.

### Reading Check Answers, p. 43

1. A basin is a low spot in the Earth's surface.
2. Scientists believe Earth's water came from ice in comets that struck the Earth.
3. In plate tectonics, pieces of Earth's surface, called plates, float over molten rock called magma.
4. ocean ridge—When two tectonic plates move apart, magma pushes up through the gap and cools, forming an undersea mountain ridge.
   trench—When an ocean plate collides with a continental plate, the ocean plate is forced underneath, forming a trench.
   abyssal plain—The wide, flat areas covered in sediment are abyssal plains.

### Reading Check Answers, p. 47

1. A continental margin is made of a continental shelf and a continental slope.
2. In sonar mapping, a ship sends sound waves to the ocean floor. Then, the time it takes the sound to reflect back is measured and the water depth is calculated.
3. In satellite mapping, large areas of the ocean can be surveyed in a short time.
4. Manned submersibles carry people down into the ocean. Remote-controlled submersibles can go down much deeper, but do not carry people. They can carry cameras and video equipment, and they are controlled by someone at the surface.

## USING THE ACTIVITIES

- Find Out Activity 2-1A, How Ocean Basins Become Bigger, on page 39 of the student textbook is best used after students have completed their reading of the subsection Origin of the Oceans.
- Conduct an Investigation Activity 2-1B, Getting to Know the Ocean Floor, on page 48 of the student textbook is best used after students have completed their reading of pages 40 to 47.
- Detailed notes on doing the activities follow.

## Find Out Activity 2-1A

### How Ocean Basins Become Bigger, p. 39

#### Purpose

- By investigating a model, students relate the concept of plate tectonics to ocean basins.

#### Advance Preparation

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 day before:<br><br>1 hour before: | Collect all materials. You may wish to assemble the desks or tables ahead of time or enlist students' assistance. | For each group:<br>– 2 flat-topped desks (or tables)<br>– 2 pieces of legal-size paper<br>– pencil<br>– calculator<br>– ruler |

#### Time Required

- 30–40 min
  - – 10 min for the activity
  - – 20–30 min for the questions

#### Science Background

Students will note that the strips of paper will move at a certain rate and make the connection to tectonic plates.

#### Activity Notes

- Have students work with a partner or in small groups for this activity.
- If students struggle with the activity or questions, complete the questions as a class discussion.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.
- Have students read the Origin of the Oceans section individually. Then, have students work in groups for the activity.

### Supporting Diverse Student Needs

- For students who have trouble following written instructions, demonstrate What To Do steps 1 to 6, then have them follow the steps.
- If necessary, provide calculators for students to use to divide large numbers.

### What Did You Find Out? Answers

1. (a) The two pieces of paper represent different tectonic plates.
   (b) The letter “X” represents the oldest rock. The “Y” rock is underneath, closer to the Earth and therefore younger.
2. Students’ calculations will vary, depending on the distances between “X” and “Y.” A sample answer would be the following: 20 cm is the distance between X and Y on one piece of paper.
   $\frac{20\text{ cm}}{10\text{ years}}$ = 2 cm. The rate of motion is 2 cm per year.
3. The plate on the other side may or may not have the same rate of motion. The plate on the other side could be moving at a different speed.
4. I would expect the rock to be about half the age at half the distance to X, assuming that the plate’s speed was constant.
5. $\frac{25\ 000\ 000\text{ cm}}{10\ 000\ 000\text{ years}}$ = 2.5 cm per year. This rate is slightly higher than the rate I calculated in question 2. Plates might move at different rates because they are not all the same size, or because they collide and slow down.

## Conduct an Investigation 2-1B

## Getting to Know the Ocean Floor, pp. 48–49

### Purpose

- Students investigate ocean floor mapping by mapping a model of the ocean floor of their own creation.

### Advance Preparation

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 week before | Collect materials. Ask students to bring shoeboxes with lids from home. | For each group:<br>– shoe box with lid<br>– a variety of small objects (such as little blocks of wood, erasers, rolled-up paper, and modelling clay)<br>– tape<br>– felt pen<br>– ruler<br>– scissors<br>– drinking straw<br>– graph paper<br>– pencil |
| 1 day before | Make copies of BLM 1-17, Getting to Know the Ocean Floor Data Table; BLM 1-18, What’s Down There?; and BLM 1-19, Water Systems on Earth’s Surface—Research Activity (optional). | |
| 1 hour before | You may wish to pre-cut the shoebox lids for students, to save time. | |

### Time Required

- 40–60 min
  - 10–15 min to prepare the model and data table
  - 10–15 min for measuring
  - 20–30 min to complete Analyze and Conclude and Apply questions

### Safety Precautions

- Instruct students to use extra care when working with scissors.

### Science Background

Sound Navigation Ranging (SONAR) uses sound waves reflected back from underwater objects to determine how far away they are. The idea of using sound to locate ships in the water dates back to artist and inventor Leonardo da Vinci in 1490; however, it was in WWII with the appearance of submarines that sonar research began in earnest.

In sonar, a “ping” of sound from an underwater speaker is reflected off an underwater object. Microphones underwater record the echo. The time the echo takes to return tells you how far away the object is.

With sonar mapping, complex calculations are required to decipher reflections from many objects in many directions, such as an underwater mountain range.

Like sonar, satellite imagery maps the ocean floor in small segments and then knits the images together to a complete map. Satellite technology can also be adapted to show other imagery, such as infrared, which will map heat.

Ships must be cautious in their use of sonar; sonar's sound waves may interfere with whales' own internal sonar system causing them to become disoriented.

#### Activity Notes

- Have students work with a partner for this activity.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.

As a follow-up, divide students into groups and assign each group an investigative ocean technology to research, for example, sonar. Provide groups with a set of questions, for example, When was your technology invented?, What is it mostly used for?, How has it changed since it was invented?, and What is one example of something that was discovered using your technology? Groups could present their answers using a format of their choice.

#### Supporting Diverse Student Needs

- For students with poor fine-motor skills, have shoeboxes and straws already calibrated and cut for this activity. Have students place objects in the box.
- For students who have trouble recording information, distribute BLM 1-17, Getting to Know the Ocean Floor Data Table; and BLM 1-18, What's Down There?.
- Students could answer Conclude and Apply questions orally, even in informal interviews as they work.
- To reinforce the learning in this activity for visual learners, obtain a version of the toy that uses a series of small pegs to copy shapes of things such as hands and faces, and allow students to manipulate it.
- For enrichment, have students redo the activity based on their responses to Conclude and Apply question 2.
- Students with a high level of interest in submersibles can be directed to research this subject in detail and report their findings to the class. One very interesting program is the Monterey Bay Aquarium Research Institute (MBARI).
- Students who are interested in learning more about investigative ocean technology can complete BLM 1-19, Water Systems on Earth's Surface—Research Activity.

#### Analyze Answers

2. Students' answers may vary. Sample answers include the following: The ruler was a better measuring device since I did not have to estimate the measurement. The straw was a better measuring device because I could take measurements every 1 cm along the box bottom and detect smaller bumps.
3. Students' answers may vary. Sample answer: The ruler was more accurate, but since it was wider, I missed measuring some of the details. The straw was more flexible and I could more easily interpret the measurements with it.

#### Conclude and Apply Answers

1. This method only gives measurements every 2 cm (or 1 cm), so a lot of detail is missed.
2. We could use a thin wire, and take measurements every 1 mm.
3. This method of measurement does not give a clear picture of the model ocean floor because the measurements are 2 cm apart, so a lot of detail is missed, and it only shows the surface across one line.
4. If we measured across several lines on the box bottom we would improve accuracy.
5. The size of my cross-section picture is much smaller than the actual ocean floor model. It only shows the bottom surface along one line.

## USING THE FEATURE

### Science Watch: Gros Morne National Park: Tablelands Provide Evidence of Plate Tectonics, p. 50

Explain to students that a large percentage of the Earth's mantle is made of peridotite. When scientists discover a large amount of peridotite on Earth's surface, it means that a portion of the Earth's mantle pushed upward to the surface.

Canada boasts 15 UNESCO sites; nine sites are natural and six are cultural. To learn more about UNESCO world heritage sites, including Gros Morne, visit www.discoveringscience8.ca.

## SECTION 2.1 ASSESSMENT, p. 51

### Check Your Understanding Answers

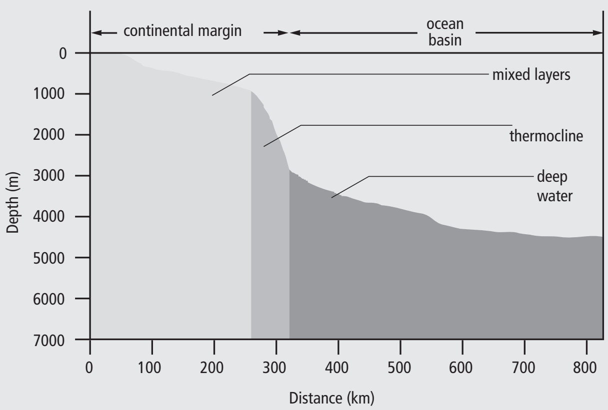
#### Checking Concepts

1. (a) Earth's five major oceans are the Pacific, Atlantic, Indian, Southern, and Arctic.
   (b) The Pacific Ocean is the largest and the Arctic Ocean is the smallest.
2. The water that formed the oceans came from the ice in comets that struck the Earth and from water vapour thrown into the atmosphere during volcanic eruptions.

3. The wide flat areas of ocean basins are called abyssal plains.
4. Ocean ridges are the places on the ocean floor where two tectonic plates are moving apart.
5. A trench is formed where one tectonic plate is forced underneath another on the ocean floor.
6. The steep side of the edge of a continent is called the continental slope.

### Understanding Key Ideas

7. The process of plate tectonics slowly moved the continents to their current location.
8. Water trapped inside volcanic materials was released into the atmosphere as water vapour during eruptions.
9. (a) A ridge is an underwater mountain range formed when two tectonic plates are forced apart.
   (b) A trench is a deep rift in the ocean floor that is formed when two tectonic plates collide and one is forced underneath the other.
10.




11. Scientists can explore the deep ocean using deep sea cameras and video, sonar mapping, satellites, and submersibles.

### Pause and Reflect Answer

(a) 2.5 cm per year × 12 years = 30 cm in my lifetime
(b) 2.5 cm per year × 100 years = 250 cm (or 2.5 m) in 100 years

### Other Assessment Opportunities

- Consult the Unit front matter for a list of applicable Assessment BLMs.

## 2.2 OCEAN CURRENTS

### BACKGROUND INFORMATION

If an object is moving in a straight line, but the observer is rotating, the object will appear to the observer to be following a curved path. For example, if you draw a straight line with one hand while you rotate the paper you are drawing on with the other hand, the resulting line will be curved in relation to the paper. In 1835, Gaspard-Gustave de Coriolis coined the term "Coriolis effect" to describe this phenomenon. While forces such as wind may more ocean water in a straight line, the Earth is rotating, so relative to the Earth's surface, the water follows a curved path. In the Northern hemisphere, the Coriolis effect causes currents to curve clockwise. In the southern hemisphere, it causes currents to curve counterclockwise. For more on the Coriolis effect, visit www.discoveriingscience8.ca

Water temperature in bodies of water such as oceans, lakes, and ponds does not decrease at a constant rate as we decrease in depth. Intuitively, one would think that as we travel farther from the surface and sunlight, the water will get cooler at a regular, measurable rate. This belief is not the case. Ocean and lake water has three distinct layers. The surface, or mixed, layer is warmed by the Sun during the day and cools by night. Below this layer is the thermocline. The temperature of the thermocline decreases with depth much more rapidly that than would expect. Its temperature is unaffected by the Sun and does not change from day to night. Below the thermocline is the deep water layer with a temperature approaching near 0°C (in ocean water).

### COMMON MISCONCEPTIONS

- Students may believe that the Coriolis effect determines whether water in a sink or toilet drains clockwise in the northern hemisphere and counter-clockwise in the southern hemisphere. Explain that this belief is a commonly-held misconception. You may wish to have students design an experiment to test this theory at home. Have students create a table to record their observations of sink drainage in their homes over a few days. Then, have students share their results.
- Students may think that because winds move clockwise in the northern hemisphere, major storms, such as hurricanes, also spin clockwise. Explain to students that there are many forces at work, not only winds. Although the Coriolis effect plays a role, air pressure differences force the storm to spin counterclockwise. However, the lack

of Coriolis effect at the equator is the main reason why storms generally do not form within about 290 km of the equator.

## ADVANCE PREPARATION

- For Find Out Activity 2-2A, Winds and Currents, gather the materials in advance. You may wish to ask students to bring in their own stone for this activity. If so, give them several days to do so. If you wish, prepare the circles of paper ahead of time. Or, have students assist in this preparation.
- Consult the Unit front matter for a list of BLMs that can be used when teaching this section.

## INTRODUCING THE SECTION, pp. 52–53

### Using the Text

Have students individually read the introductory paragraph on ocean currents. As a class, remind students of the perceptions of the ocean they listed at the beginning of this chapter. Have them study the map of the major ocean currents and think of the ocean is as a system of many rivers that overlap and intertwine, each with its own salinity and temperature within the ocean.

Ask students to locate Newfoundland and Labrador on the map (Figure 2.13). Ask them to identify the two currents closest to Newfoundland and Labrador. (the Gulf Stream and Labrador Current) Ask students to identify currents that they think would carry cold water, and currents that they think would carry warm water. Have them explain what makes them think that some carry warm water and some cold.

Have students read the rest of pages 54 and 55 individually. Then, as a class ask them to study the map once again and note the colours of the Labrador Current and the Gulf Stream. (The Labrador Current is blue and the Gulf Stream is red.) Knowing that the intersection of a warm and a cool current produces weather effects, such as fog, have students find another such example on the map. (Near Japan, the cool Oyashio Current meets the warmer Kuroshio Current. Or, on the west coast of Africa, the warm Guinea Current meets the cooler Benguela Current.) Have them speculate what the weather conditions might be like in these places. Do they think the fishing might be good there, like the Grand Banks fishing is? Why or why not?

### Using the Key Terms and Section Summary

At the beginning of each section in the student textbook are the Key Terms and section summary. Both can be used as a pre-reading strategy and a review tool. Before reading the text in the section, students should be able to define the Key Terms by scanning the text and using the Glossary. The Key Terms include terms from the curriculum outcomes and additional terms that are important for students to know and understand.

The section summary provides an overview of the key concepts being covered in the section. Students may not know all the concepts and terms described in the summary, but they can use this information to help guide them through their reading.

After reading the section, students can go back to the Key Terms and section summary to consolidate their understanding and identify areas that require clarification. At the end of the chapter or unit, students can use the Key Terms and section summary for review. BLM 1-2, Unit 1 Key Terms, and BLM 1-4, Chapter 2 Key Terms, can be used to assist students.

## USING THE ACTIVITY

### Find Out Activity 2-2A
### Winds and Currents, p. 53

**Purpose**

- Students investigate the effects of wind and surface currents on objects.

**Advance Preparation**

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 week before | Collect all materials. You may wish to ask students to bring in their own stone for this activity. If so, give them several days' notice to do so. | For each individual or group:<br>– rectangular pan<br>– water<br>– 2 drinking straws<br>– stone<br>– 12 small circles of paper from a hole punch |
| 1 day before | Make copies of BLM 1-20, Winds and Currents (optional). | |
| 1 hour before | If you wish, prepare the circles of paper ahead of time. Or, have students assist. Have a clean-up station prepared for any spills. | |

**Time Required**

- 30–40 min

**Safety Precautions**

- Safety eyewear, lab coats, and gloves must be worn in accordance with provincial safety standards.

- Remind students that they should never eat or drink anything in a science class. [bullet] Remind students to clean up spills immediately to avoid slipping accidents.

### Science Background

Students will notice that winds cause currents in water and that the water flows in the same direction as the wind is blowing. When the water reaches land, it will be diverted. The small pieces of paper will allow students to see the effect of the wind on the water more clearly.

### Activity Notes

- Review the safety precautions with students before they proceed with the activity.
- To conserve materials and save time, you may wish to have students work in small groups for this activity.
- You may wish to have students use BLM 1-20, Winds and Currents to record their observations.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.
- Remind students to show arrows and labels on their sketches to clearly illustrate the movements of the paper.
- Remind students that this model is based on gentle blowing. If they blow too hard, their results may be affected.
- If the pieces of paper become waterlogged, replace them and continue the activity.

### Supporting Diverse Student Needs

- Encourage students who have difficulty expressing their thoughts in writing to work with a scribe for the What Did You Find Out? questions. Alternatively, students could provide a diagram for What Did You Find Out? questions 1 to 3. Question 4 could be answered in a class discussion.
- This hands-on activity is excellent for building visual-spatial, body-kinesthetic, and naturalist intelligences.
- For enrichment, have students redo the activity with variables, such as changes in water temperature and salinity. Do they achieve the same results?

### What Did You Find Out? Answers

1. The wind made the water move in the same direction I was blowing.
2. Two winds coming from opposite directions made a lot of waves in the middle of the pan.
3. The object made the paper go around it; some on one side and some on the other.
4. When surface currents reach an island, they divert; some go around one way, some go around the other.

## TEACHING THE SECTION, pp. 54–59

### Using Reading

#### Pre-reading—K-W-L (Know-Want to Know-Learned)

Have students work with a partner to develop answers to the question, "What do I know about ocean currents?" Then, have them review their answers and record questions they have about ocean currents. Have students share their questions as a class, and have them use chart paper to group their questions into categories. For example, Category 1: temperature of ocean currents; Category 2: location of ocean currents. Post the chart where it can be referred to easily. As students work through the section, prompt them to return to the chart and see if some of the questions they had can now be answered.

#### During Reading—Think, Pair, Share

Have students confirm, expand, and refine their ideas about ocean currents by sharing responses with a partner. Instruct students to read pages 54 to 56 (Surface Currents) independently, record their thoughts, and then pair up with another student to discuss and share their ideas. Explain to students that partners must work together to come up with one shared summary to share with the class. Then, have them do the same for pages 56 to 59 (Deep Currents).

#### Supporting Diverse Student Needs

- Have students who have difficulty summarizing text work in a small group and create their summaries as write arounds. One student writes one key idea about surface currents (or deep currents) from the text, then another student adds one more, until the summary is complete. Students can each choose one point from their summary to share with the class, giving every student an opportunity to make a meaningful contribution.

#### After Reading—Reflect and Evaluate

Have students review their notes and select three facts they find the most interesting. Then, have them explain (in writing) why they found the information interesting. Alternatively, have them share their explanations in a class discussion. Refer back to the chart of questions from the pre-reading activity. Have students identify which of the questions that they wrote about ocean currents were answered by reading this section. What questions would require a little more research to answer? What category or categories of questions were answered the most completely?

BLM 1-21 Deep Ocean Currents includes a simple experiment students can do to observe the behaviour of warm and cool water when they meet. Students can use BLM 1-22 Properties of Ocean Water to summarize what they have learned about temperature and density currents.

**Reading Check Answers, p. 56**

1. An ocean current is a large amount of ocean water moving in a particular and unchanging direction.
2. Three factors that produce ocean surface currents are wind, the rotation of the Earth, and the shapes of the continents.
3. Ocean currents are directly related to the prevailing winds.
4. The spin of the Earth causes currents to curve clockwise in the northern hemisphere and counterclockwise in the southern hemisphere. This is called the Coriolis effect.
5. Continents deflect east-west currents either to the north or to the south.

**Reading Check Answers, p. 59**

1. Density currents are sinking masses of cold water that flow downward and move along the ocean floor.
2. Students' sketches should show the mixed layer as relatively narrow, the thermocline as thicker than the mixed layer, and then deep water down to the ocean floor.
3. Fresh water can enter the ocean in several ways. Students should list two of these sources: from a river, from glacial melting, and from precipitation.
4. Upwelling is a vertical movement of water from the ocean floor to the surface.
5. Upwelling brings nutrients from the ocean floor to the surface, helping plant life to grow, and attracting fish.

## USING THE ACTIVITIES

- Activity 2-2A, Winds and Currents, on page 53 of the student textbook is best used when students have concluded their reading of the introductory material on pages 52 and 53.
- Activity 2-2B, Temperature and Water Density, on page 60 of the student textbook is best done after students have completed reading about deep currents on pages 56 to 59.
- Detailed notes on doing the activities follow.

## Conduct an Investigation 2-2B

### Temperature and Water Density, pp. 60–61

**Purpose**

- Students investigate the relationship between water temperature and density.

**Advance Preparation**

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 day before | Make copies of BLM 1-23, Graphing Ocean Temperatures (optional). | For each student:<br>– 1 piece of graph paper<br>– pencil<br>– eraser |
| 1 hour before | Collect the materials. | |

**Time Required**

- 20–30 min

**Science Background**

Colder water has a higher density and will sink. Students' graphs will show a correlation between temperature and depth with a declining slope; as the depth of the water increases, the temperature will decrease.

**Activity Notes**

- You may wish to have students use BLM 1-23, Graphing Ocean Temperatures to record their observations.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.
- You may wish to provide students with rulers to help them keep their lines neat.

**Supporting Diverse Student Needs**

- Ensure that students with reading difficulties understand the instructions before proceeding. The activity itself should be straightforward.
- You may wish to encourage students with Logical-Mathematical intelligence to calculate the slope of the line.
- Distribute BLM 1-23 for students with weak graphing skills to use.
- For enrichment, have students extrapolate what would happen in Core Lab Conduct an Investigation Activity 1-3A, Salinity's Effect on Water Density if some of the samples were heated or cooled. If time allows, encourage students to choose one example and predict the results. You may wish to encourage students to calculate the slope of the line.

**What Did You Find Out? Answers**

1. As water temperature decreases, water depth increases.
2. No, the change in water temperature does not decrease at a constant rate.
3. (b) The temperature difference is the greatest between 400–800 m.
4. (a) Cold water is denser. Water increases in density as its temperature decreases until just about freezing.
   (b) As water becomes denser, it sinks. Less dense water, that is warmer water, will float.
   (c) The cold water of the Labrador Current will sink below the warmer water of the Gulf Stream.

### Using the Did You Know, p. 55

Have students read the Did You Know? on page 55. Explain to students that the largest river in the world is the Amazon River, which moves about 1 300 000 $m^3$ per second. (Note that the Nile River was considered the longest river but the discovery of a new Amazon tributary in 2007 means the Nile may lose its title.)

In contrast, Canada's Mackenzie River is the world's 12th largest river and has an average discharge of 10 300 $m^3$ per second.

## USING THE FEATURE

### Science Watch: World's Largest Flume Tank, p. 62

This feature provides an excellent opportunity for students to link the Career Connect in Chapter 1 to an interesting real world example that is also close to home. If students show interest in Memorial University's Marine Institute, have them research the flume tank in more depth and report their findings back to the class.

Lead students in a class discussion on how a flume tank would be helpful in creating efficient and safe designs for ships, oil platforms, or even ocean-front buildings.

## SECTION 2.2 ASSESSMENT, p. 63

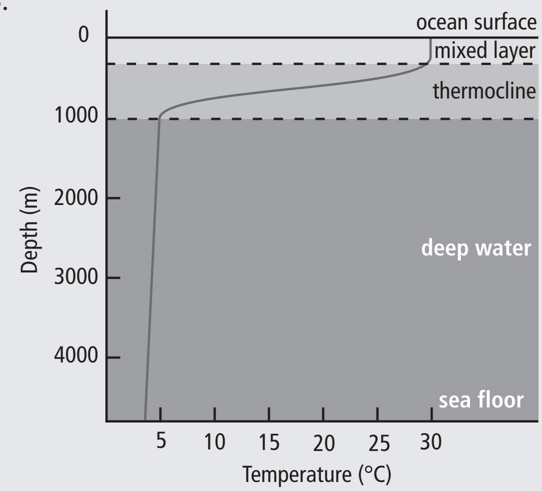
### Check Your Understanding Answers

**Checking Concepts**

1. The three main causes of an ocean's surface currents are wind action, Earth's rotation, and the shape of the continents.
2. (a) North of the equator, winds and currents will be deflected clockwise.
   (b) South of the equator, winds and currents will be deflected counter-clockwise.
3. The thermocline is the layer of ocean water 200 m to 1000 m below the surface where the water temperature declines rapidly.
4. When cold, dense ocean water meets warmer less dense ocean water, the mixing of the two currents creates heavy fog.
5. Upwelling can occur when strong offshore winds push surface water away from the shore, and cold deep water rushes up to replace it, such as on the Grand Banks.

**Understanding Key Ideas**

6.




7. Density currents are produced when masses of cold water sink and then move along the ocean floor.
8. Surface currents occur up to a depth of 200 m. Surface current movement is caused by wind action, the rotation of the Earth, and the shape of continents. Deep water currents' movement is caused by the temperature and salinity of the water.
9. Ocean water density changes in different parts of the ocean due to differences in salinity and temperature. Ocean water in tropical areas or at the North and South poles will be denser due to a higher salinity, for example.
10. Upwelling areas are good for fish because nutrients from the ocean floor are brought to the surface and cause water plants to thrive. These plants attract fish to the area.

### Pause and Reflect Answer

Students should consider the effects on ocean- and lake-dwelling organisms, such as fish, coral, and sponges that live on the sea floor, and frogs and other amphibians that hibernate in ponds and lakes over the winter. These organisms would die off each winter if water froze from the bottom up.

### Other Assessment Opportunities

- Consult the Unit front matter for a list of applicable Assessment BLMs.

## 2.3 WAVES AND TIDES

### BACKGROUND INFORMATION

Most ocean waves, often referred to as ocean surface waves, are created by wind action. Tsunamis, a special type of wave, are not wind-related, but caused by geological events, such as underwater earthquakes and volcanic eruptions.

Waves are affected by the speed of wind, the distance the wind has blown over open water, called fetch, and the length of time the wind has been blowing.

Weathering is the chemical or physical breakdown of rocks and other materials. Erosion is the carrying away of rocks, sand, or soil by wind, precipitation, run-off, or waves. Wave action at a coastline causes both processes to occur together and changes the shape of the land. Although weathering and erosion both occur naturally, human agricultural and land-use practices, such as clear-cutting and overgrazing, are increasing erosion.

### COMMON MISCONCEPTIONS

- Students may confuse erosion and weathering. Explain that weathering is the physical or chemical breakdown of materials into small components. Erosion, on the other hand, is the carrying away of the materials to another location.
- Students may believe that a tsunami is just a big surface wave. Have students reread page 66 on tsunamis.

### ADVANCE PREPARATION

- Collect all materials for Conduct an Investigation Activity 2-3B, Waves and Beaches.
- Book research time in the resource centre or computer lab for students for Think About It Activity 2-3B, Safeguarding Our Shorelines.
- Consult the Unit front matter for a list of BLMs that can be used when teaching this section.

### INTRODUCING THE SECTION, pp. 64–65

### Using the Text

After students have completed reading pages 64 and 65 ("Ocean Waves," but not "Breaking Waves") individually, have a class discussion on the scale of waves. Encourage students to describe their experiences with waves and the size of waves they may have seen. Ask them to speculate why the waves were so high. Was it a windy day? Was there a storm nearby? Encourage students to use Key Terms in their descriptions.

Use this opportunity to clarify any misconceptions that students may have about waves. Ensure that students are aware that tsunamis are created from a geological event, not by winds or currents, although hurricane-based waves can be as high as a tsunami. Point out that the December 26, 2004, tsunami had waves up to 30 m high. That height is twice that of Cabot Tower. If possible, bring in a scale model to promote visual-spatial intelligence.

### Using the Key Terms and Section Summary

At the beginning of each section in the student textbook are the Key Terms and section summary. Both can be used as a pre-reading strategy and a review tool. Before reading the text in the section, students should be able to define the Key Terms by scanning the text and using the Glossary. The Key Terms include terms from the curriculum outcomes and additional terms that are important for students to know and understand.

The section summary provides an overview of the key concepts being covered in the section. Students may not know all the concepts and terms described in the summary, but they can use this information to help guide them through their reading.

After reading the section, students can go back to the Key Terms and section summary to consolidate their understanding and identify areas that require clarification. At the end of the chapter or unit, students can use the Key Terms and section summary for review. BLM 1-2, Unit 1 Key Terms, and BLM 1-4, Chapter 2 Key Terms, can be used to assist students.

### Using the Did You Know, p. 67

Have students read the Did You Know? on page 67. Working with a partner or in a small group, have students brainstorm a list of the 10 countries with the longest coastlines. Encourage them to refer to a map, atlas, or globe, if they wish. Then, have groups compare their lists.

Then, show this ranking on the board or on an overhead:

| LONGEST COASTLINES | | |
|---|---|---|
| RANKING | COUNTRY | LENGTH (KM) |
| 1 | Canada | 202 080 |
| 2 | Indonesia | 54 716 |
| 3 | Greenland | 44 087 |

| LONGEST COASTLINES | | |
|---|---|---|
| RANKING | COUNTRY | LENGTH (KM) |
| 4 | Russia | 37 653 |
| 5 | Philippines | 36 289 |
| 6 | Japan | 29 751 |
| 7 | Australia | 25 760 |
| 8 | Norway | 25 148 |
| 9 | United States | 19 924 |
| 10 | New Zealand | 15 134 |

Tell students that these measurements are based on a book, *The CIA 2008 World Factbook*, and that other books and websites show different measurements. For example, mention that the Natural Resources Canada website quotes 243 000 km as the length of Canada's coastline. Encourage students to speculate as to why the numbers might differ from source to source. (difficult to measure accurately; countries might exaggerate to get on the top-10 list; countries may be in dispute about who owns particular areas; numbers may or may not include islands as part of the coastline, such as in the case of Norway; political boundaries may change over time, such as in the case of Russia)

Have students speculate how the lengths of coastlines may change due to global warming.

## TEACHING THE SECTION, pp. 65–71

### Using Reading

#### Pre-reading—Key Word Concept Map

This section contains Key Terms that may be unfamiliar to many students. Before they begin reading, have a student read each Key Term and invite volunteers to explain to the class what they understand about that term. If no one has any understanding at all of a term, have a student look up the definition in the Glossary.

#### Supporting Diverse Student Needs

- Explain to students that words in boldface in the textbook are Key Terms that are important to understand in order to understand the meaning of the text. Each Key Term is defined in the glossary. Have students who need practice using a glossary work with a classmate and each look up two of this section's Key Terms to share with their partner.
- Remind students that Science Skill 10, on pages 496–497 of the textbook includes information about making a spider map, a type of semantic map.

#### During Reading—GIST

Have students read the text under each heading and summarize the ideas presented. Challenge students to reduce each passage to just 20 words that capture the gist of the text, and to use as many of the Key Terms in their summaries as possible.

#### After Reading—Semantic Mapping

Use semantic mapping, or mind mapping, to help students organize and recall the information presented in this section. Have students begin by using the student textbook headings to identify the core concepts covered in the section. Next, ask students to create a semantic map for each core concept by linking ideas that clarify and provide further explanation to each concept with a series of lines.

Students can use BLM 1-24, A Day at the Beach and BLM 1-25, The Tide is High to reinforce what they have learned about waves and tides. Students can use BLM 1-26, How Well Do You Know the Ocean? to summarize what they have learned in the entire chapter.

#### Reading Check Answers, p. 69

1. A swell is a smooth wave.
2. As a wave approaches the shore, its wavelength decreases and its height increases. It collapses on shore as a breaker.
3. A tsunami is caused by earthquakes, volcanic eruptions, or landslides on the ocean floor.
4. Shoreline erosion can be from longshore currents running along the shore and taking away sediment and sand, waves wearing away at rocks on the shore, and the action of seawater on minerals in rocks, eroding them by chemical action.
5. Waves erode a shoreline unevenly creating bays in the areas where the rocks erode more quickly and also creating headlands in between the bays.

#### Reading Check Answers, p. 71

1. Spring tides occur when Earth, the Moon, and the Sun are in line. Neap tides occur when the Sun and the Moon are at right angles to each other. Spring tides have a higher than average tidal range. Neap tides have a lower than average tidal range.
2. A tidal range is the difference in level between a high tide and a low tide.
3. Tidal action is the result of the Moon's gravitational pull on Earth.
4. A shoreline with a narrow V-shaped bay will have higher tides than a bay that is wider and has a larger mouth.

## USING THE ACTIVITIES

- Think About It Activity 2-3A, By the Seashore, on page 72 of the student textbook is best used when students have completed their reading of the How Waves Change Shorelines section, pages 66 to 69, and have read the www Science Feature on page 76.
- Conduct an Investigation Activity 2-3B, Waves and Beaches, on, or mind mapping, of the student textbook is best used after students have completed Think About It Activity 2-3A, By the Seashore, on page 72.
- Think About It Activity 2-3B, Safeguarding Our Shorelines, on page 75 is best used as a culminating activity when students have had time to process and absorb their learning.
- Detailed notes on doing the activities follow.

### Think About It Activity 2-3A

**By the Seashore, p. 72**

#### Purpose

- Students relate the processes of erosion and deposition to shoreline features.

#### Advance Preparation

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 week before | Reserve time in the resource centre and/or computer lab for students to research their topics and prepare their presentations. | None |
| 1 day before | Make copies of BLM 1-27, By the Seashore—Shoreline Feature (optional). | |

#### Time Required

- 80–120 min
  - 40 min of research
  - 40 min to create the presentation, or assign as homework
  - 40 min to view presentations

#### Activity Notes

- You may wish to have students work with a partner or in small groups for this activity.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.
- Remind students that they must record their source material and that they must rewrite their research material for their presentation in their own words. If your school has a policy on plagiarism, you may wish to take this opportunity to review it with the class.
- Students can use BLM 1-27, By the Seashore—Shoreline Feature to help structure their research about a shoreline feature and how it was created.

#### Supporting Diverse Student Needs

- Newcomers to your local area may enjoy relating this activity to where they came from. Encourage them to share their knowledge of their former shoreline features with the class.
- Encourage students to express themselves creatively for their presentation. Students with strong visual-spatial intelligence may wish to create charts and use photos. Students with verbal-linguistic skills may enjoy crafting a poem. Musically inclined students may wish to add background music, and body-kinesthetic learners may wish to add dance or use some other physical representation to demonstrate the formation of the shoreline feature they have chosen.
- For enrichment, have interested students research beach erosion renewal projects on the Internet. Have them report their findings back to the class.

### Conduct an Investigation 2-3B

**Waves and Beaches, pp. 73–74**

#### Purpose

- Students investigate how waves affect beaches by controlling variables of slope, size, and shape.

#### Advance Preparation

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 day before<br><br>1 hour before | Make copies of BLM 1-28, Waves and Beaches Activity (optional).<br><br>Collect all materials.<br>You may wish to prepare a glass clean-up kit, such as a cardboard box, broom, and dustpan.<br>Have a clean-up station prepared for any spills. | For each group:<br>– beaker or measuring cup (500 mL)<br>– clear plastic or glass pan or small aquarium<br>– ruler<br>– small block of wood<br>– clock or watch<br>– plastic pail or container<br>– beach mixture 1 (450 mL sand + 150 mL gravel)<br>– beach mixture 2 (450 mL gravel + 150 mL sand)<br>– water<br>– (optional) small rock |

#### Time Required

- 40–60 min

### Safety Precautions

- Safety eyewear, lab coats, and gloves must be worn in accordance with provincial safety standards.
- Remind students to clean up spills immediately to avoid slipping accidents.
- Tell students to report any glass breakage immediately. Have them use the glass clean-up kit you have prepared. Remind them never to touch broken glass, but to use the broom and dustpan provided.
- Have students wash their hands thoroughly after completing the investigation.

### Science Background

Stronger wave action will erode the beach more rapidly than more gentle waves because stronger waves carry more energy that can be used to erode the beach. Beach mixture 1 with the higher amount of sand will erode more quickly as the sand will more easily be washed away.

### Activity Notes

- Review the safety precautions with students before they proceed with the activity.
- To conserve materials and save time, you may wish to have students work in small groups for this activity.
- You may wish to set up one or both of beach mixture 1 and beach mixture 2 stations and have students move between the two.
- Remind students that they need to use gentle, constant motion for Step 4 or their results will be unreliable (and messy).
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.

### Supporting Diverse Student Needs

- Encourage students with written output challenges to use a scribe for their observations. They should be able to draw the diagrams on their own. You may wish to encourage students to use a computer drawing program to make more detailed diagrams of their observations.
- Students who have trouble organizing their thoughts in writing can use BLM 1-28, Waves and Beaches Activity, to record their observations.
- This activity is an excellent opportunity for building visual-spatial intelligence. Encourage students to draw detailed diagrams with labels and to chronicle their observations carefully.
- To model creative thinking, students could use think-pair-share to answer Conclude and Apply questions 1 and 2.
- You may wish students to answer questions 4 and 5 in a class discussion, or orally, individually.
- For enrichment, have students add an obstruction to the beach, such as a small rock, and redo the investigation. How did this addition change their observations?

### Analyze Answers

1. A mostly sand beach erodes more quickly from wave action than a mostly gravel one.
2. A steeper slope erodes more quickly than a less steep slope.
3. The mass of a grain of sand is much less than the mass of a piece of gravel. The waves need less energy to move sand than gravel, so more sand is carried away by the waves than gravel.

### Conclude and Apply Answers

4. A large storm would have a negative effect on a sandy beach and cause a significant amount of erosion.
5. To prevent a beach from eroding, the community could build a headland, add some heavier material to the beach, such as rocks, or change the slope of the beach.

## Think About It Activity 2-3B

### Safeguarding Our Shorelines, p. 75

### Purpose

- Through investigating in the resource centre and on the Internet, students find out how shorelines in Newfoundland and Labrador are changing and have changed historically, and what is being done to protect them now.

### Advance Preparation

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 month before | Collect articles in newspapers and magazines about shoreline erosion and protection for an in-class resource centre. | For each student or group:<br>– poster board<br>– markers or pencil crayons |
| 1 week before | Reserve time in the resource centre and the computer lab for students' research. | |
| 1 day before | Make copies of BLM 1-29, Safeguarding Our Shorelines Activity (optional). | |

### Time Required

- 90–100 min
  - – 10–20 min for brainstorming
  - – 40 min for research
  - – 40 min to prepare the presentation or poster

### Science Background

Students may investigate the vulnerability of Placentia to flooding, aggravated by recent urban development, and the shoreline defences constructed by the Department of Municipal Affairs; the coastal protection measures implemented in the flood-prone Burin Peninsula (or the 1929 tsunami in the Grand Banks that caused the loss of 28 lives on the Burin Peninsula); the frequent washouts on the highway across the mouth of Holyrood Pond, and the gravel ridge and sea wall that have been constructed there; or other similar events and technologies.

### Activity Notes

- To make the most efficient use of resources, you may wish to have students work with a partner or in small groups for this activity.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.
- Remind students that they must record their source material and that they must rewrite their research material for their presentation or poster in their own words. If your school has a policy on plagiarism, you may wish to take this opportunity to review it with the class.

### Supporting Diverse Student Needs

- Cooperative group work helps develop interpersonal and verbal-linguistic intelligence. Meet with groups to approve plans for their displays, and to ensure that all group members will have a chance to contribute in a meaningful way. Students who wish to customize their presentations or posters in What to Do point 4 with music, poetry, or other creative features should be encouraged to do so as long as the requirements of the question are also included.
- For enrichment, have students create a presentation or poster of technologies that might help to prevent the damaging effects of these events (in What to Do point 3) as well and share their research with the class.

## USING THE FEATURE

### www Science: Wave-Weathered Wonders, p. 76

This feature provides an excellent opportunity for students to share their own experiences with wave-weathered wonders of Newfoundland and Labrador. Provide a forum for students to share and listen. Encourage students to be active, engaged listeners and to ask appropriate, thought-provoking questions.

## SECTION 2.3 ASSESSMENT, p. 77

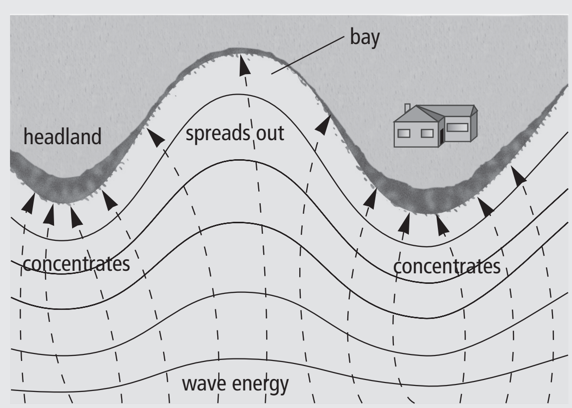
### Check Your Understanding Answers

#### Checking Concepts

1. Sea stacks can be formed from eroded headlands or when a sea arch collapses.
2. Shorelines are in a constant state of change from waves that erode and redeposit sediments.
3. The cycle of tidal movement is linked to the motion of the Moon. The Moon's motion is a predictable cycle.
4. A tidal bore is a wave produced when a rising tide enters a long V-shaped bay, such as the bay of Fundy. A tsunami is caused by activity at the ocean floor, such as an earthquake. It has nothing to do with tides.
5. Tsunamis strike land at up to 800 km/h and have a wavelength of up to 150 km. The size and speed of the wave means the destructive force is spread over a large area.
6. Tidal ranges vary in different areas due to the shape of the shoreline. A V-shaped bay will have a larger tidal range than an open shoreline will.
7. The tidal range for Corner Brook is 1.45 m – 0.58 m = 0.87 m.

#### Understanding Key Ideas

8. Ocean waves are similar to other kinds of waves in that they have height, wavelength, and speed of motion.
9. 




Headlands extend farther out into the ocean than other parts of the shoreline, so they receive the main force of the waves.

10. As a wave approaches the shore, its wavelength decreases and its height increases, then it collapses on shore as a breaker.
11. It is the Moon's gravitational pull on Earth that causes the tides.
12. A resident at coastal town A would have to wait 6 days for a near noon tide (12:10).
13. The tidal range of the Gulf of Mexico is smaller than the Bay of Fundy because the Gulf has a narrow opening with a wide open bay so a rising tide spreads out a lot. Since the Bay of Fundy is V-shaped, the rising tide enters the wide opening and then piles up inside along the narrow end of the Bay.

### Pause and Reflect Answer

Students' sketches should show an understanding that if the moon were closer to Earth, it's gravitational pull would increase, and the size of tides would increase.

### Other Assessment Opportunities

- Consult the Unit front matter for a list of applicable Assessment BLMs.

## CHAPTER 2 ASSESSMENT, pp. 78–79

### PREPARE YOUR OWN SUMMARY

Students' summaries should incorporate the following main ideas:

1. Ocean Basins
   - The continents are moving on the surface of Earth due to plate tectonics.
   - Water on Earth originated from water vapour released from volcanic eruptions and from icy comets striking Earth's surface.
   - When continental plates move apart, they form ocean ridges, like underwater mountain ranges.
   - When continental plates collide, one is forced underneath the other forming a trench.
   - The flat, wide-open ocean floors between the ridges and trenches are the sediment-covered abyssal plains.
   - Continental margins are the sloped edges of continents under the ocean. They are composed of the continental shelf and continental slope.
   - The ocean floor can be mapped by sonar, satellite technology, and piloted or remotely operated submersibles, as well as photographed by deep sea cameras.
2. Ocean Currents
   - Ocean currents are masses of warm or cold moving ocean water.
   - Three factors influence surface ocean currents: wind, the rotation of the Earth, and the shape of the continents.
   - Deep current movement is affected by temperature and salinity.
   - Upwellings are the vertical movement of water from the ocean floor to the surface.
3. Waves and Tides
   - Ocean waves are caused by winds.
   - When waves reach the shore, the trough slows but the crest continues until the wave topples forward into a breaker.
   - Tsunamis are giant waves that are caused by underwater earthquakes, landslides, or volcanic eruptions.
   - Wave action erodes shorelines, wearing out softer rocks and creating bays while harder rock areas become headlands. Waves also deposit or carry away sediment, such as sand.
   - The gravitational pull of Earth's Moon causes tides. Spring tides are the largest and occur when Earth, the Sun, and the Moon are in a line. Neap tides are the smallest and occur when the Sun and the Moon are at right angles.

### CHAPTER REVIEW ANSWERS

#### Checking Concepts

1. The ocean floor is not flat because tectonic plates cause ocean ridges and trenches in the ocean floor.
2. Three factors that affect ocean surface currents are wind action, Earth's rotation (the Coriolis effect), and the shape of the continents.
3. Winds form as a result of masses of air moving rapidly from one area to another due to uneven heating of Earth's surface.
4. Ocean waves form when winds blow across the surface of the water.
5. Some people who make their living from the sea need to know when there would be a low tide so they can gather the exposed shellfish that would normally be underwater.
6. As the trough of the wave reaches the shore, it is slowed down by friction, but the crest continues. The crest "outruns" the trough and topples forward or "breaks."

7. The limestone shoreline will change more quickly than the granite one because limestone is a softer rock and will erode more quickly.
8. Ocean trenches are found on the sea floor where two tectonic plates have collided and one has been forced underneath the other.

**Understanding Key Ideas**

9. Trenches form at the edge of some continents because the continental plate will collide with another plate.
10. If Earth had two moons, there would be two high tides and two low tides each day. The tidal range would probably be smaller, since the gravitational pull from each moon would be in a different direction.
11. The areas of a coastline that erode faster form bays and the areas that resist erosion become the headlands.
12. Spring tides occur when the Earth, Moon, and Sun are all in a line. These tides are the largest. Neap tides occur when the Sun and the Moon are at right angles to each other. These tides are smaller.
13. Wave action causes rock fragments to rub against each other until they eventually become grains of sand. Where the shoreline is a gentle slope, waves will deposit the sand, eventually forming a beach.
14. Satellites can record data using radar, infrared light, or other technologies to measure features on the ocean floor.
15. Density currents are caused by cold temperatures or higher salinity that increase ocean water density and cause it to sink and move along the ocean floor.
16. Sample 2 came from near the ocean floor because it has the lowest temperature and highest density.
17. An upwelling is the vertical movement of water from the ocean floor to the ocean surface.
18. The sediment on the abyssal plains comes from the continents, brought to the oceans by rivers.
19. Salinity can be decreased by the addition of fresh water from rivers emptying into oceans, by icebergs and glaciers melting, and in areas with high levels of precipitation. Salinity increases in areas with hot, dry climates where ocean water evaporates, or in cold areas, where there is little precipitation.
20. The Atlantic Ocean is getting wider as the Pacific ocean shrinks due to the movement of tectonic plates.
21. Scientists can take pictures of the ocean floor by using deep sea photography and videography cameras that are placed in remote-controlled submersibles.
22. Strong winds blowing over the surface of the water cause the warm surface water to move away from shore. Colder deep water moves up to take its place. This is called upwelling.
23. An earthquake on the ocean floor could create a tsunami. Tsunamis are so large and travel so fast and far, they can crash against the coastlines of several countries.
24. The lining up of the Sun, Moon, and Earth causes spring tides, which are the largest tides.
25. Before satellites were available, scientists used sonar mapping to determine the shape of the ocean floors.
26. When the heated air rises, cooler air moves into its place and the moving masses of air create wind that blows horizontally across Earth's surface.
27. When ocean water evaporates, it increases the salinity of the water that remains. This result increases the density of the water, causing it to sink.
28. The Gulf Stream meets the Labrador Current at Grand Banks. When these two currents meet, it creates an ideal location for nutrients for marine life.
29. A shoreline that is shaped like a V, such as the Bay of Fundy, will produce a large tidal range.

## CHAPTER 3 OPENER, pp. 80–81

### USING THE PHOTO AND TEXT

Have students study the photograph on page 80. Encourage them to offer suggestions on what the image is. (sea anemone) Ask students to consider how the photograph is related to the unit title, "Bodies of water influence climate and species distribution." Ask, "Why might the author have chosen this particular photograph for this chapter?" (It is colourful; it shows an unusual species.)

Ask students to speculate what climate this organism would prefer. Ask, "How could you find out the answer?" (research on the Internet or resource centre, read the chapter)

Bring in a photograph of a different organism that lives in an aquatic environment, such as a frog. Create a Venn diagram on the board or a flipchart, and have students compare and contrast the needs of the two organisms—the sea anemone and the frog. Students might consider such needs as light, depth of water, temperature, fresh water, type of nutrients needed, and so on.

To prompt students' discussion, ask,

- Would the sea anemone prefer colder or warmer water? What about the frog?
- Would the frog thrive in salt water?

Have students read the opening text on page 80 individually.

### USING THE WHAT YOU WILL LEARN / WHY IT IS IMPORTANT / SKILLS YOU WILL USE

Read the What You Will Learn, Why It Is Important, and Skills You Will Use sections aloud to students. Define unfamiliar terms as required.

Have students work in three large groups. Assign a brainstorming question based on the What You Will Learn bullet points to each group:

- How might winds and ocean currents influence regional climates?
- What ways might human activities alter the water cycle?
- How might water quality problems in marine environments affect all living things?

Have students record their ideas and share them with the class. Explain that when they are finished the chapter, they will revisit their lists and evaluate how close their guesses were to what they have learned.

### USING THE FOLDABLES™ FEATURE

See the Foldables section of this resource.

## 3.1 OCEANS AND CLIMATE

### BACKGROUND INFORMATION

Ocean currents have a marked effect on climate. Coastal areas located near a warm ocean current will have milder winters, even though they may be geographically located near the Arctic Circle.

Honningsvåg, for example, in the North Cape area, is farther north than most communities in Greenland, and has an average July temperature of about 10°C. The southern portion of Greenland has an average July temperature of just 6°C.

### COMMON MISCONCEPTIONS

- Students may believe that latitude is the primary or only factor in determining whether an area has a cold or warm climate. Using a large map of the world's ocean currents, have students use a ruler to line up coastal countries with familiar climates. For example, Norway and Greenland, Newfoundland, and Great Britain.
- Students may think that warm currents stay near the equator and cold currents stay near the Arctic or Antarctic. Again, refer students to the current map. Explain that, although the water temperature may cool slightly over long distances, warm currents travel thousands of kilometers and stay warmer than the surrounding ocean waters. Cold currents similarly stay cold, even as they pass though warmer ocean waters.

### ADVANCE PREPARATION

- Collect materials for Find Out Activity 3-1A: Learning How Liquids Lose Heat.
- Prepare a large-scale map of the world's ocean currents to which students can refer during class.
- Consult the Unit front matter for a list of BLMs that can be used when teaching this section.

### INTRODUCING THE SECTION, p. 82

#### Using the Text

To introduce the section, reserve time in the school's computer lab or prepare a large map that shows country names and larger cities. As a class, ask students to choose a coastal country with a familiar climate and a latitude between 40˚ North and 90˚ North. (France, Spain, Japan) Have students use a ruler or a piece of string to "connect" the country to the corresponding latitude in Canada. Ask students to explain any differences between the climate of the chosen country and the climate of the corresponding place in Canada when they are both the same distance from the equator. (Ocean currents affect climate.) Students may need to do some research to find out the climate of their chosen country.

Remind students of the discussion on ocean currents in Chapter 2, Section 2, when they considered the ocean currents map and looked for places with intersecting warm and cool currents. As a class, relate their thoughts on the Section 2.2 activity and the corresponding latitude activity (above). Clarify any misconceptions and encourage students to use the key terms in their discussion, and to keep the discussion in mind as they read Warm and Cold Currents.

### Using the Key Terms and Section Summary

At the beginning of each section in the student textbook are the Key Terms and section summary. Both can be used as a pre-reading strategy and a review tool. Before reading the text in the section, students should be able to define the Key Terms by scanning the text and using the Glossary. The Key Terms include terms from curriculum outcomes and additional terms that are important for students to know and understand.

The section summary provides an overview of the key concepts being covered in the section. Students may not know all the concepts and terms described in the summary, but they can use this information to help guide them through their reading.

After reading the section, students can go back to the Key Terms and section summary to consolidate their understanding and identify areas that require clarification. At the end of the chapter or unit, students can use the Key Terms and section summary for review. BLM 1-2, Unit 1 Key Terms, and BLM 1-5, Chapter 3 Key Terms, can be used to assist students.

## TEACHING THE SECTION, pp. 82–87

### Using Reading

#### Pre-reading—K-W-L (Know-Want to Know-Learned)

Have students record their answers to the question, “What do I know about how ocean currents affect climate?” Then, have them review their answers and record questions they have about how ocean currents and climate are connected. Later, students can share their questions and what they learned with the class.

#### During Reading—Elaborative Interrogation

Have students generate “why” questions from key points in the student textbook. For example, Britain is warmer than Hudson Bay, although they are on the same latitude. Question: Why is Britain warmer than Hudson Bay? Have students review the student textbook to answer their own questions. Alternatively, students can exchange questions.

### Supporting Diverse Student Needs

- Advise students who have difficulty identifying important information in text to read the Reading Check questions that follow each section of text. Students can use these questions to help identify what the most important information is. Students could work in a group to read each Reading Check question, then see who can find an answer to share with the group first. Point out that answers to the questions will not always be given explicitly in the text, but the information students need to formulate an answer will be there.
- Oral-linguistic learners may benefit from describing how the process of convection illustrated in Figure 3.3 creates weather patterns aloud to a classmate.

#### After Reading—Reflect and Evaluate

Have students select three facts from the section that they found the most interesting. Then, ask them to write a statement about why they found these facts interesting. Have students share their facts and how each fact relates to climate, with the class in a class discussion. Students can summarize what they have learned about the effects of oceans on climate using BLM 1-31, Understanding Water and Climate.

#### Reading Check Answers, p. 83

1. Weather describes the short-term conditions in the atmosphere at a specific place and time. Climate describes weather conditions for a particular region averaged over a long period of time, about 30 years.
2. Water’s high specific heat capacity means it takes a large amount of heat to increase its temperature a small amount.
3. Cold currents moderate summer temperatures on land by drawing heat from the air.
4. Warm currents moderate winter land temperatures by transferring heat to the air.

#### Reading Check Answers, p. 87

1. Convection is the process of heat transfer in air.
2. The heat transfer causes weather as the air constantly moves up and down as winds blow it from place to place.
3. El Niño is caused by the decline in trade winds over several months. This event causes warm water to stay in place, and prevents colder water from upwelling.
4. La Niña is the opposite of El Niño; the trade winds increase causing continuous upwellings of cooler water.

## USING THE ACTIVITIES

- Find Out Activity 3-1A, Learning How Liquids Lose Heat, on page 84 of the student textbook is best used after students have completed their reading of pages 82 and 83.
- Think About It Activity 3-1B, Currents and Climate, on page 87 of the student textbook is best used after students have completed their reading of pages 85 and 86, and reviewed their responses to the Reading Check questions on page 83.
- Detailed notes on doing the activities follow.

## Find Out Activity 3-1A

### Learning How Liquids Lose Heat, p. 84

#### Purpose

- While observing a teacher demonstration of this activity, students relate the concept of how liquids lose heat to the high specific heat capacity of three different liquids.

#### Advance Preparation

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 day before | Collect all materials.<br>Make copies of BLM 1-32, Learning How Liquids Lose Heat (optional). | – graph paper<br>– hot plate<br>– 600 mL beaker<br>– water<br>– 3 test tubes<br>– 3 thermometers<br>– 3 liquids: water, salt water, and vegetable oil<br>– 3 ring clamps<br>– ring stand<br>– watch or clock |
| 1 hour before | Set up the apparatus.<br>You may wish to prepare a glass clean-up kit, such as a cardboard box, broom, and dustpan.<br>Ensure that all electrical appliances are safely grounded and extension cords are taped down, if necessary.<br>Have a clean-up station prepared for any spills. | |

#### Time Required

- 30–40 min

#### Safety Precautions

- Prepare a glass clean-up kit, such as a cardboard box, broom, and dustpan.
- Ensure that all electrical appliances are safely grounded and extension cords are taped down, if necessary.
- Have a clean-up station prepared for any spills.

#### Science Background

Due to water's high specific heat capacity, students will observe that water and salt water will take longer to heat and longer to cool than vegetable oil.

#### Activity Notes

- Because of the need to handle hot test tubes and a beaker of very hot water, this activity is best done as a teacher demonstration.
- You may wish to have students use BLM 1-32, Learning How Liquids Lose Heat to record their observations.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.

#### Supporting Diverse Student Needs

- Review the observation table with students who have reading difficulties ahead of time to ensure they know what to listen for and record.
- Creating this graph is an excellent activity for visual-spatial learners. For those who have trouble creating a graph, distribute BLM 1-32.
- To model graph interpretation, discuss answers to What Did You Learn? as a class, and have students refer to their graphs to justify each answer.
- For enrichment, have students predict the results of the activity and record their predictions.

#### What Did You Learn? Answers

1. The vegetable oil heated up the quickest.
2. The plain water took the longest to cool down.
3. The graph suggests that plain water has the highest specific heat capacity, then the salt water, and then the vegetable oil.

## Think About It Activity 3-1B

### Currents and Climate, p. 87

#### Purpose

- Students investigate the relationship between currents and climate by comparing the climates and latitudes of various cities.

### Advance Preparation

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 day before | If you plan to conduct this activity as a class, enlarge the world map or create an overhead. Make copies of BLM 1-33, Currents and Climate Map, or an overhead. | For each student:<br>– BLM 1-33, Currents and Climate Map |

### Time Required

- 30–40 min

### Science Background

Students will discover that ocean currents affect climate significantly and that latitude alone is not indicative of the climate of coastal areas.

### Activity Notes

- You may wish to have students work with a partner for this activity.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.
- When students have completed the activity, ask them to compare their results to their notes from the chapter opening activities. Ensure that the relationship between climate and ocean currents is now clear by conducting a class discussion.
- Provide students with copies of BLM 1-33, Currents and Climate Map, to complete this activity. Alternatively, you could create an overhead transparency of this map to focus class discussion.

### Supporting Diverse Student Needs

- You may wish to assign a scribe for students with written output difficulties for this activity.
- If some students in your class have trouble distinguishing the red and blue arrows on the map, have them work with a classmate to analyze the map.
- Visual-spatial learners will enjoy this activity. Suggest to students that they create a list for What To Do step 2. Then, they can refer to their list to help them answer What To Do steps 3, 4, and 5.
- For enrichment, have students select two coastal cities on the same latitude to compare and research their climates and nearby ocean currents. Have them share their results with the class.

### What to Do Answers

2. Happy Valley-Goose Bay, NL: Labrador Current (cold); St. John's, NL: Labrador Current (cold) and Gulf Stream (warm); Prince Rupert, BC: Alaska Current (warm); Bergen, Norway: North Atlantic Drift (warm); Perth, Australia: West Australia Current (cold); Brisbane, Australia: East Australia Current (warm)
3. Happy Valley-Goose Bay is beside a cold current, and Prince Rupert is beside a warm current.
4. St. John's, NL is beside a cold current as well as a warm current. The cold current may have more of an influence in winter, making the winter weather in St. John's colder than in Bergen. In summer the warm current may be stronger, so St. John's has warmer temperatures than Bergen does.
5. They are closer to the equator than the other cities on the map are. Perth might be slightly colder because it is beside a cold ocean current.

## USING THE FEATURE

### Science Watch: Newfoundland and Labrador: "If you don't like the weather, just wait a few minutes.", p. 88

Encourage students to share their personal experiences with local weather conditions. Ask, "In your experience, are the quotations accurate?" Encourage a class discussion on the subject. Use the opportunity to remind students about active listening techniques.

## SECTION 3.1 ASSESSMENT, p. 89

### Check Your Understanding Answers

### Checking Concepts

1. Specific heat capacity is the amount of heat it takes to increase the temperature of a substance.
2. Since water has a high specific heat capacity, oceans act as heat reservoirs in the winter, remaining warmer than nearby land and influencing local weather and, over time, climate.
3. Weather can be described in terms of temperature, wind speed and direction, air pressure, and moisture.
4. Weather describes short-term conditions in the atmosphere at a specific time and place. Climate describes weather conditions in a particular region over a long period of time, about 30 years.
5. Events such as El Niño can affect people in other parts of the world because changing winds and ocean currents result in different weather patterns along their path. When a

part of the Pacific Ocean becomes warmer, then the currents that pass through that part become warmer, and carry that warmer water to other parts of the world. This process results in changes in temperature and rainfall.

6. The warm Gulf Stream Current passes by Great Britain. Due to the high specific heat capacity of water, the ocean around Britain stays warmer in winter resulting in mild, wet winters.

**Understanding Key Ideas**

7. Some currents are warm because they originate from the equator; others are cold because they originate from either the Arctic or Antarctic.
8. The colder Labrador Current acts as a heat sink for Newfoundland and Labrador in the summer, absorbing heat from the air, and moderating the temperature.
9. The cold Labrador Current and the warm Gulf Stream Current meet near Newfoundland and Labrador, very often creating fog.
10. Prince Rubert, BC, has a warmer climate because it is affected by the warm ocean currents nearby. The climate in Happy Valley-Goose Bay, in Labrador, is affected by the cold Labrador Current.

### Pause and Reflect Answer

Students' answers should reflect their knowledge of specific heat capacity and currents. Students should explain how the warm currents that act as moderating influences on areas farther away from the equator would not be able to do so if water lost its heat too quickly.

### Other Assessment Opportunities

- Consult the Unit front matter for a list of applicable Assessment BLMs.

## 3.2 LIVING IN WATER

### BACKGROUND INFORMATION

The water cycle and the relationships between water-based organisms and land-based organisms are very complex. A study of old-growth forests in British Columbia, for example, revealed a nitrogen isotope found only in the deep Pacific Ocean. The isotope started its journey in the bodies of salmon. When the salmon leave the ocean to spawn, they travel up freshwater rivers and are hunted by grizzly and black bears. The bears and other predators take the salmon into the forest, eat part of them, and leave the rest for smaller predators and scavengers. In this way, the nitrogen-rich salmon fertilize the forest.

Oceans are an important part of the world's oxygen supply. Plants such as phytoplankton are responsible for creating 40 percent of the world's oxygen.

Algae, although part of the phytoplankton group because it photosynthesizes, is technically neither plant nor animal. A certain amount of algae growth is a natural part of an ecosystem. Algae blooms occur when algae grow rapidly and unsustainably, usually due to a high level of phosphates introduced by humans though fertilizers or detergents. Algae blooms absorb all available oxygen in a water body—either salt or fresh water—killing other organisms present. Some algae blooms are so vast, their chlorophyll can be seen by satellite. Some algaes present health hazards for humans, as they produce neurotoxins.

Bioluminescence, or "living light," is the ability of certain organisms to light up parts of their bodies to attract prey, scare away predators, or attract mates. On land, fireflies, glowworms, and even some species of fungi are examples of bioluminescent organisms. In the oceans, many species of plankton, jellyfish, and deep-ocean organisms, such as anglerfish, are bioluminescent. This ability is not generally seen in freshwater organisms. Bioluminiscent organisms transform chemical energy into light energy to produce this effect. To create bioluminescence, organisms release two chemicals, which, when combined, produce light energy. The process is similar to the glow sticks often seen at concerts or used for camping. When the seal between the chemicals is broken, the light stick begins to glow with a blue-green light, a colour that most marine creatures can detect.

Many kinds of abiotic factors influence an environment. Examples include temperature, wind, soil composition, climate, sound waves, and pressure (when dealing with deep ocean environments).

### COMMON MISCONCEPTIONS

- Students may believe that algae blooms are the result of "pollution" in lakes and oceans, such as sewage. Explain that algae feed on phosphates, a chemical present in fertilizers and many detergents and also presented naturally. When biotic matter, including sewage, decomposes, it produces phosphorus.
- Students may think that only animals, such as deep-sea fish or fireflies, can be bioluminescent. Explain that both plants and animals have this special ability.

## ADVANCE PREPARATION

- Collect all materials for Conduct an Investigation 3-2B: Too Much of a Good Thing.
- Contact your local wetland conservation authority to arrange for a guided class trip or a naturalist visit.
- Ask students who have an aquarium if they would be able to bring it in, or could speak to the class about aquarium maintenance.
- Consult the Unit front matter for a list of BLMs that can be used when teaching this section.

## INTRODUCING THE SECTION, pp. 90–93

### Using the Text

If possible, bring in a small aquarium to have students observe algae in the tank prior to beginning Conduct an Investigation 3-2B, Too Much of a Good Thing. If the aquarium contains algae-eating organisms, such as catfish or snails, provide opportunities for students to observe the tank and help care for it. Alternatively, ask a student or parent with an aquarium to visit the class and discuss how they maintain the aquarium. Beforehand, have students prepare questions for the guest.

Before reading Freshwater Environments on pages 90 to 93 individually, have students review their notes from Section 1.3: Sources of Fresh Water. Reviewing their notes will help them synthesize their earlier knowledge with their new learning.

Organize a nature walk through a local wetland to study the diversity. Protected wetlands, such as the Codroy Valley International Wetland, or the Corner Brook wetlands in Newfoundland, offer guided tours. If organizing a nature walk is not possible, invite a naturalist to visit and provide information about wetland biodiversity or have students research a local wetland in the library or online and report their findings to the class. You may wish to have students review their notes from Section 1.3 on wetlands before beginning this activity.

### Using the Key Terms and Section Summary

At the beginning of each section in the student textbook are the Key Terms and section summary. Both can be used as a pre-reading strategy and a review tool. Before reading the text in the section, students should be able to define the Key Terms by scanning the text and using the Glossary. The Key Terms include terms from the curriculum outcomes and additional terms that are important for students to know and understand.

The section summary provides an overview of the key concepts being covered in the section. Students may not know all the concepts and terms described in the summary, but they can use this information to help guide them through their reading.

After reading the section, students can go back to the Key Terms and section summary to consolidate their understanding and identify areas that require clarification. At the end of the chapter or unit, students can use the Key Terms and section summary for review. BLM 1-2, Unit 1 Key Terms, and BLM 1-5, Chapter 3 Key Terms, can be used to assist students.

## TEACHING THE SECTION, pp. 90–94

### Using Reading

#### Pre-reading—Key Word Concept Map

Have students prepare a concept map of key words related to living in different water environments. Students should include the Key Terms and any other terms that they think are relevant. Before reading, new words can be pre-taught or clarified. During reading, students can add information about each key word to their map, as well as adding additional key words. After reading, students can identify concepts they wish to learn more about.

#### Supporting Diverse Student Needs

- Students who have difficulty organizing their thoughts in writing can use BLM 1-34, Organisms in Freshwater Environments, to record what they know about organisms living in freshwater environments, then update the table once they have read this section.

#### During Reading—Note Taking (Cornell Format)

Encourage students to take notes as they read through each paragraph. They can use the topic titles to generate questions and then take notes as a means of answering the questions. They can add important points and links to their concept map.

#### After Reading—Reflect and Evaluate

Have students review their notes and select three facts they find the most interesting. Then, have them explain (in writing) why they found the information interesting. Alternatively, have them share their explanations in a class discussion.

After reading Freshwater Environments on pages 90 to 93, conduct a class discussion. Encourage students to share their experiences with local (fresh) waterways. Have them identify the particular waterway they are discussing. (lake or pond, river or stream, wetland, estuary) What organisms have they seen there? Encourage the use of Key Terms in their descriptions to reinforce new vocabulary.

Students can review what they have learned about Rivers and Lakes using BLM 1-35, Rivers and Lakes.

**Reading Check Answers, p. 94**

1. Four types of freshwater environments are lakes and ponds, rivers and streams, wetlands, and estuaries.
2. Students should mention three of these four ways wetlands are important: acting as filters for removing pollutants from the water; holding a lot of water, which prevents flooding; offering resting places for migrating birds; and helping to keep shorelines stable and prevent erosion.
3. Estuaries are ideal locations for plants and animals due to the accumulation of nutrients from land, rivers, and oceans.
4. The greatest abundance of marine organisms is found in the top 180 m of water.
5. Bioluminescence is the ability of some organisms to light up part of their bodies through a chemical reaction.

## USING THE ACTIVITIES

- Find Out Activity 3-2A, Abiotic Factors, on page 95 of the student textbook is best used when students have completed their reading of Freshwater and Saltwater Environments on pages 90 to 94.
- Conduct an Investigation Activity 3-2B, Too Much of a Good Thing, on pages 96–97 of the student textbook is best used when students have completed Find Out Activity 3-2A, Abiotic Factors, on page 95, and have completed their presentations.
- Detailed notes on doing the activities follow.

### Find Out Activity 3-2A

**Abiotic Factors, p. 95**

#### Purpose

- Through researching, students investigate the effect of abiotic factors on the distribution of a species in a freshwater or saltwater environment.

#### Advance Preparation

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 week before | Reserve time at the computer lab and resource centre or library. | None |
| 1 day before | Make copies of BLM 1-36, Abiotic Factors (optional). | |

#### Time Required

- 120 min
  – 80 min for research
  – 40 min to prepare a presentation

#### Activity Notes

- Have students work in small groups of three or four for this activity.
- As a class, read aloud the What to Do steps, and ensure they are clear before students begin. Remind students that, as is noted in step 3, each group member must contribute to the research. Encourage them to design a presentation that also includes each group member.
- Explain to students that the information they research in this activity will be useful for an upcoming activity in Section 3.3 involving field work (Conduct an Investigation Core Lab 3-3B, Water Health Test, pp. 108–111).
- Remind students that they must get your approval before choosing an organism that does not appear on the list. You may wish to assign a different species to each student group to avoid overlapping subject areas.
- Reserve time at the library and computer lab for students to conduct their research.
- You may wish to assign the presentation preparation as a homework assignment to be completed outside of regular class time. Otherwise, set aside sufficient time for students to prepare their presentations.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.
- You might wish to provide students with copies of BLM 1-36, Abiotic Factors, to help them organize the results of their research into the influence of non-living factors on organisms.

#### Supporting Diverse Student Needs

- Include English language learners in a group of students who will support and encourage them.
- Group presentations offer opportunities for a wide range of learning styles. Students with musical-rhythmic, body-kinesthetic, and verbal-linguistic intelligences can take advantage of this open-ended activity to create something unique, for example, adding music, poetry, or dance. Students with visual-spatial and logical-mathematical intelligences may wish to add data tables, charts, or graphs to enhance their presentation.
- For enrichment, students may wish to research an additional species comparatively and add it to their presentation.
- Have books at a variety of reading levels available.

## Conduct an Investigation 3-2B

### Too Much of a Good Thing, pp. 96–97

**Purpose**

- Students investigate the effect of fertilizers on the growth of aquatic plants.

**Advance Preparation**

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 week before | Obtain all materials. | For each group:<br>– six 1 L beakers or canning jars |
| 2 days before | Prepare tap water and allow to sit for 2 days. | – 1 L beaker with lid<br>– 250 mL measuring cup<br>– graduated cylinder |
| 1 day before | You may wish to prepare a glass clean-up kit, such as a cardboard box, broom, and dustpan.<br>Have a clean-up station prepared for any spills.<br>Make copies of BLM 1-37, Too Much of a Good Thing Data Table (optional). | – chlorine-free tap water (allow tap water to sit for 2 days for chlorine to evaporate)<br>– pond water<br>– 8-24-8 uncoloured fertilizer<br>– masking tape<br>– stirring rod<br>– index card<br>– felt marker<br>– test kit to measure dissolved oxygen, nitrates, and/or phosphates (optional)<br>– microscope (optional) |

**Time Required**

- 40–60 min for Procedure; 2 weeks to complete investigation

**Safety Precautions**

- Safety eyewear, lab coats, and gloves must be worn in accordance with provincial safety standards.
- Remind students that fertilizers are toxic substances, and to avoid getting them on their skin. They should wear protective safety goggles, a lab coat, and gloves during this investigation.
- Prepare a glass clean-up kit, such as a cardboard box, broom, and dustpan.
- Have a clean-up station prepared for any spills. Remind students to clean up spills immediately to avoid slipping accidents.

**Science Background**

As was noted in the Background Information for this section, algae blooms occur when algae grows rapidly and unsustainably, usually due to a high level of phosphates introduced by humans though fertilizers or detergents. Most pond water contains some algae. By adding fertilizer, the algae will be encouraged to multiply rapidly.

The second number in a fertilizer's designation shows the proportion of phosphorus in the fertilizer. 8-24-8 is high in phosphorus. Phosphorus is often present in the form of phosphate.

**Activity Notes**

- Review the safety precautions with students before they proceed with the activity.
- Have students work in small groups for this activity. To save time, you may wish to prepare the solutions beforehand.
- You may wish to have students use BLM 1-37, Too Much of a Good Thing Data Table to record their observations.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.
- Review with students the criteria for forming a hypothesis. Students can refer to Science Skill 2 on page 474.
- As a class, review students' observations and conclusions. Use this forum to correct any misconceptions that may have arisen and to ensure that students are familiar with the expected results.

**Supporting Diverse Student Needs**

- Pair English language learners with more fluent English speakers, using a buddy system.
- For students who have trouble following written instructions or organizing written responses, provide the table on BLM 1-37.
- For enrichment, have students research the effects of recent algae blooms in their community or in the world and report their findings back to the class.

**Analyze Answers**

1. Beaker F was the clearest; beaker E was the most turbid.
2. The more fertilizer that was added to the beaker, the higher the level of growth of the algae.
3. Students' answers may vary. Some students may consider the fertilizer to be pollution, but others may think of pollution only as industrial toxins.
4. The dependent variable was the growth of the algae. The independent variable was the amount of fertilizer.

**Conclude and Apply Answers**

5. Manufacturers have removed phosphates from their soaps and detergents to avoid contaminating aquatic systems.
6. Students should note in their paragraphs that too much fertilizer in an aquatic habitat causes too much growth of algae and unbalances the ecosystem.

## USING THE FEATURES

For the Did You Know? feature on page 91, engage students' interest by discussing the Main River in Newfoundland, a Canadian Heritage River. The Main River is known for its unusually large volume of Atlantic salmon. It is also known to have balsam fir that live to three times their normal age—260 years old! You may wish to introduce the idea of the salmon forest described in the Background Information of this section. Explain that the salmon leave the ocean and travel through the Main River to spawn. While they travel, they are preyed upon by other animals, such as the endangered Newfoundland marten. The predators take the salmon into the forest to eat. Scavengers, such as birds and small rodents eat what is left. The salmons' bodies contain a special kind of nitrogen found only in the oceans. This nitrogen acts as an amazing fertilizer for trees. Could this fertilizer be the reason why the balsam fir thrive in the Main River area?

Have students consider the shape of the salmon. Provide a photograph reference, if required. Ask, "Is the salmon well-suited to fast-moving water?"

The first Did You Know? feature on page 92 discusses sphagnum moss. Canada has about 8 percent of the world's harvest of sphagnum moss. Students may not be aware that most potting soils contain sphagnum moss. If time allows, conduct a demonstration to test the Did You Know? fact. Or, you may wish to have students volunteer to demonstrate this fact. In a beaker, measure a small amount of sphagnum moss (5 mL). Then, slowly add 100 mL of water to the beaker. Have students observe the sphagnum moss and water. How much of the water is absorbed?

The Did You Know? feature on page 93 notes that Lake Melville estuary is Newfoundland and Labrador's largest estuary. As an extension of Hamilton inlet, on the Labrador coast, it provides a watershed for both the Churchill and Naskaupi rivers. Provide a map or access to the Internet and have students locate the Lake Melville estuary. Have students study the map and locate the drainage basin that Lake Melville is part of. You may wish to have students reread page 26 of Chapter 1 on drainage basins as a review.

### National Geographic: Visualizing Bioluminescence, p. 98

Tell students that bioluminescence, or "living light," is the ability of certain organisms to light up parts of their bodies to attract prey, scare away predators, or attract mates. The organism produces two chemicals, which, when combined, produce light energy. The process is similar to the glow sticks often seen at concerts or used for camping. When the seal between the chemicals is broken, the light stick begins to glow. Most bioluminescent marine organisms create a blue-green light, a colour that most marine creatures can detect.

Have students brainstorm what land-based organisms are bioluminescent. (fireflies, glowworms, and even some species of fungi) Oddly, this ability is not generally seen in freshwater organisms.

## SECTION 3.2 ASSESSMENT, p. 99

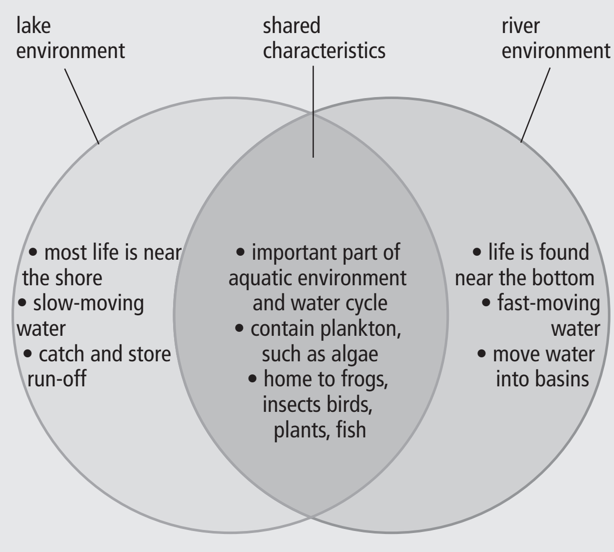
### Check Your Understanding Answers

**Checking Concepts**

1. The two types of plankton are phytoplankton and zooplankton. Phytoplankton use photosynthesis to produce nutrients; zooplankton are tiny animals that eat phytoplankton.
2. The two types of plankton are the first link in the lake or pond food chain, and provide food for many organisms.
3. (a) A wetland is a lowland area that is saturated with water for part or all of the year.
   (b) Wetlands play an important role in the whole environment, acting as filters for pollutants, helping to prevent flooding, providing a resting point for migrating birds, and minimizing erosion.
4. Canada is home to one quarter of the world's wetlands.
5. An estuary is a wetland that builds up where a river meets the ocean.

**Understanding Key Ideas**

6.



7. Deep-ocean organisms use bioluminescence to find food, attract a mate, or scare away predators.
8. Answers may vary. Students may refer to the phosphates in fertilizers from farming, or phosphates in detergents, as being responsible. They may also point to manufacturers' pollution.

### Pause and Reflect Answer

Students' answers should reflect their understanding of the wetland loss due to urban development—both industrial and residential, as well as the use of ATVs as recreational vehicles. They may mention such factors as rerouting rivers and streams, paving watersheds, altering the shoreline, pollution from fertilizers and ships, and removing organisms from the environment (by fishing or hunting).

### Other Assessment Opportunities

- Consult the Unit front matter for a list of applicable Assessment BLMs.

## 3.3 HUMAN IMPACT ON WATER SYSTEMS

### BACKGROUND INFORMATION

Acid precipitation includes rain, snow, sleet, fog, or other kinds of precipitation that is contaminated by sulphur or nitrogen compounds from industrial pollution. Once these chemicals enter the water system, carried by winds, they can damage or kill land- and water-based organisms. Acid precipitation, also called acid deposition, can be carried hundreds or thousands of kilometres by winds.

Fisheries and Oceans Canada defines aquaculture as "the farming of fish, shellfish and aquatic plants in fresh or salt water." Aquaculture operations are present in every province in Canada and also in the Yukon Territory. Although 73 species are legalized for aquaculture farming in Canada, Newfoundland and Labrador's aquaculture industry is involved in the "farming" of mainly Steelhead Trout, Atlantic Salmon, Blue Mussels, and Atlantic Cod. Atlantic salmon is by far the leader. 85% of Canada's aquaculture produce is destined for export, primarily to the United States. Globally, Canada's market share of aquaculture is relatively small. In 2000, Canada's aquaculture was valued at $404.2 million compared to the $50.9 billion of the global market.

Newfoundland and Labrador's aquaculture industry ranks fourth in Canada, less than Prince Edward Island's 6%. With the economic hardships of overfishing striking Newfoundland and Labrador communities, aquaculture provides a new, growing industry.

Aquaculture concerns include the quantity of feed required to "harvest" farmed fish. Since the fish that most North Americans prefer to eat are carnivores (e.g., salmon, trout, cod), these fish require an enormous amount of protein to thrive. It takes, for example, 20 kg of smaller, wild-caught fish to produce 1 kg of tuna. (Tuna are "ranched" not farmed—wild tuna are corralled and then fed in ocean pens.) This process is a huge drain on ocean fish, removing the smaller fish from the food chain. Other concerns include damage to coastal habitats from aquaculture waste, diseases introduced to wild species such as parasitic sea lice, and escape of aquaculture species into the wild that may threaten indigenous species.

Invasive and foreign species can be introduced to an ecosystem in many ways. When you think about it, most of the farm animals we are familiar with are foreign, that is, non-indigenous, to Canada. However, invasive species are a major concern. They are introduced either accidentally, or in some cases deliberately, to a foreign ecosystem. They out-compete indigenous species for food and resources and may have no local predators. One example of a deliberate introduction of a foreign species to an ecosystem is in Australia. In 1859, Thomas Austin released 24 wild rabbits on his property for hunting. Their population quickly grew out of control and they are now considered the main cause of species loss in Australia, out-competing other wildlife for food and wiping out crops and orchards. In 1991, the rabbit population was estimated to be 200 to 300 million.

Bilge and ballast water from shipping can introduce invasive species, such as green crabs. Called the cockroaches of the sea, green crabs were first sighted in Placentia Bay in 2007 and quickly overtook native populations of red crab, consuming indigenous shellfish and even lobsters. Baiting, netting, and even chasing by divers are current control methods. Green crabs are considered to be in the top 100 most invasive species.

Trawling is one of the most destructive of fishing practices. Contributing to overfishing, it also destroys the ocean floor, killing coral and incidentally trapping and killing other marine life, called bycatch. The sediment trails of trawlers can even be seen from space as trawlers leave kilometre-long trails of ocean-floor debris in their wake.

### COMMON MISCONCEPTIONS

- Students may not know of the environmental concerns of aquaculture. Explain that although aquaculture is an economic benefit and one solution to overfishing, it is not perfect. Concerns include the following: a large amount of fish is required to feed the farmed fish leading to additional overfishing issues; damage to coastal habitats is caused by aquaculture waste; diseases are introduced to wild species such as parasitic sea lice; and aquaculture species can escape into the wild and may threaten indigenous species.

## ADVANCE PREPARATION

- Find photographs in the library or on the Internet of beluga whales.
- Research your community's household hazardous waste program.
- Research an appropriate local stream. One with a fairly high health level will be more interesting for field work.
- Research classroom debate strategies and manners for Activity 3-3C.
- Research how your class might get involved in a local community clean-up day or another environmental event, such as the TD Great Canadian Shoreline Cleanup.
- Research local non-profit organizations dedicated to monitoring and restoring the health of rivers and streams. See how your class might become involved. Or, arrange for a speaker from one of these organizations or an Aboriginal Elder to visit the class and discuss the importance of river health with students.
- Consult the Unit front matter for a list of BLMs that can be used when teaching this section.

## INTRODUCING THE SECTION, p. 100

### Using the Text

Read the opening text aloud as a class. Clarify any terms or concepts that are unclear to students.

As a class, discuss where students' drinking water comes from at home and at school. Is it a municipal water supply? If so, from where does the municipality get the water? Or, do students get water from a well? Have students think about their community, where the drinking water comes from, and where the used water goes. Then, after reading the section opener information, have them work in groups and brainstorm different ways their drinking water is affected by human activities in their community.

Assign Think About It Activity 3-3A, How Do Your Actions Affect the Ocean? When complete, have students share their table with the class. On the board or a flipchart, consolidate the class results into one table.

### Using the Key Terms and Section Summary

At the beginning of each section in the student textbook are the Key Terms and section summary. Both can be used as a pre-reading strategy and a review tool. Before reading the text in the section, students should be able to define the Key Terms by scanning the text and using the Glossary. The Key Terms include terms from the curriculum outcomes and additional terms that are important for students to know and understand.

The section summary provides an overview of the key concepts being covered in the section. Students may not know all the concepts and terms described in the summary, but they can use this information to help guide them through their reading.

After reading the section, students can go back to the Key Terms and section summary to consolidate their understanding and identify areas that require clarification. At the end of the chapter or unit, students can use the Key Terms and section summary for review. BLM 1-2, Unit 1 Key Terms, and BLM 1-5, Chapter 3 Key Terms, can be used to assist students.

### Using the Activity

**Think About It Activity 3-3A**

**How Do Your Actions Affect the Ocean?, p. 100**

#### Purpose

- Students consider how their day-to-day activities affect oceans.

#### Advance Preparation

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 hour before | Prepare copies of BLM 1-38, How Do Your Actions Affect the Ocean? (optional). | None |

#### Time Required

- 10–15 min in class time; 1 evening for students to complete table

#### Science Background

Students should discover that a great number of their daily activities are connected to, and can affect, ocean health. For example, brushing their teeth in the morning may introduce phosphates into the water. The water they use is taken from watersheds and removed, temporarily, from the drainage basin.

#### Activity Notes

- You may wish to have students use BLM 1-38, How Do Your Actions Affect the Ocean? to record their activities.

- As a class, read aloud the instructions for the activity. Use examples of daily activities, such as washing the dishes or playing soccer, and discuss how these activities may affect the ocean to help students understand what is required for this activity. Refer students back to the Find Out Activity in Getting Started on student textbook page 5 and the water uses they listed in that activity.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.
- When students have completed their tables, conduct a class discussion and have students share their answers.

#### Supporting Diverse Student Needs

- Students can brainstorm their examples in a group, then each contribute one thing from their group's list to a class list. In this way, every student has a chance to make a meaningful contribution.
- This activity will help build intrapersonal intelligences as students will complete this activity individually, outside the classroom.
- For enrichment, have students enlist the help of other members of their family, chronicling the entire family's water usage activities.

## TEACHING THE SECTION, pp. 101–107

### Using Reading

#### Pre-reading—K-W-L (Know-Want to Know-Learned)

Ask students to record their answers to the question, "What do I know about human activities that can affect water systems?" Then, have them review their answers and record questions they have about the ways in which humans can affect water systems. Later, students can share their questions and what they have learned as a class.

#### During Reading—GIST

Have students read the text under each section subheading and summarize the ideas presented. Challenge students to reduce each passage to 20 words that capture the gist of the text.

#### After Reading—Semantic Mapping

Use semantic mapping to help students organize and recall the information presented in this section. Have students begin by using the student textbook headings to identify the core concepts covered in the unit. Next, ask students to create a semantic map for each core concept by linking ideas that clarify and provide further explanation to each concept with a series of lines.

Students can use BLM 1-39, Streams of Pollution to summarize the causes and effects of water pollution. They can use BLM 1-40, Understanding Air Pollution and Water Systems to summarize how pollution enters water systems through the water cycle; and BLM 1-41, Understanding the Effects of Pollution and BLM 1-42, People and Water to draw conclusions about the long-range effects of water pollution. Have students look back at the questions they wrote before reading. For which ones have they found answers?

#### Supporting Diverse Student Needs

- After students have completed BLMs 1-39, 1-40, and/or 1-41, have them identify any responses that they are unsure about. With a classmate, have them review the text for 2 min, looking for information to help compete or clarify each response. If they have not found the information in 2 min, they can flag the question, then ask the rest of the class, or you, to identify the information that will help them. As well as helping students find the responses, this will model the process of extracting key information from texts.

#### Reading Check Answers, p. 103

1. Point source pollution comes from a specific area; non-point source pollution comes from many different sources.
2. Students' answers may vary. Examples of point-source pollution include: a landfill leak, a factory or mill's waste water, oil spills, underground storage containers for gas stations, and waste water treatment plants. Examples of non-point source pollution include: pesticides and fertilizers from lawns, farmer's fields, and golf courses; animal waste from parks and farms; and run-off from streets and driveways.
3. Most of the ocean's pollution is found along the coast because that is where most of the world's population lives.
4. Acid precipitation is created when fossil fuels are burned and release nitrogen oxides and sulphur dioxides. These chemicals combine with water and form sulphuric acid and nitric acid, which fall to Earth as acid precipitation.
5. Winds carry atmospheric pollution from industrial areas to lakes, forests, and oceans.

#### Reading Check Answers, p. 107

1. Seismic testing for oil destroys fish eggs and larvae, causes fish to leave an area, and disrupts migration paths of whales.

2. Most of the oil that ends up in the ocean comes from run-off from cities and farms, untreated waste disposal from factories and businesses, and recreational boating.
3. Invasive species can disrupt the existing food web of an area.
4. Students should mention two of these three types of technologies: factory freezer trawlers, radar technology, and deep-sea trawlers.
5. One positive aspect of aquaculture is that it is a way to reduce fishing pressure on wild fish. One negative aspect of aquaculture is that farmed fish can escape and cause damage or spread diseases and parasites among wild fish in the oceans.

## USING THE ACTIVITIES

- Think About It Activity 3-3A, How Do Your Actions Affect the Ocean?, on page 100 of the student textbook is best used as an introductory activity. Detailed information about this activity can be found in Introducing the Section.
- Conduct an Investigation Core Lab Activity 3-3B, Water Health Test, on pages 108 to 111 of the student textbook is best used when students have completed their reading and are familiar with the concepts on pages 100 to 107.
- Think About It Activity 3-3C, Not an Easy Decision, on page 112 of the student textbook is best used when students have completed Conduct an Investigation Core Lab Activity 3-3B, Water Health Test, on pages 108 to 111 of the student textbook.
- Detailed notes on doing the activities follow.

## Core Lab Conduct an Investigation 3-3B

### Water Health Test, pp. 108–111

### Purpose

- Students investigate the water quality of a local stream or a marine environment.

### Advance Preparation

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 2 weeks before | Research an appropriate local stream. One with a fairly high health level will be more interesting for field work. If required, send permission slips home with students. | Lab A<br>For each group:<br>– field guide of aquatic organisms<br>– plastic spoon<br>– magnifying glass<br>– deep pan<br>– long-handle dip net<br>– thermometer for testing air and water temperature<br>– water testing kit |
| 1–2 days before | Collect materials. Make copies of BLM 1-43, Biotic Index for Water Quality; BLM 1-44, A Fresh Water Case Study; BLM 1-45, Water Health Test Table; BLM 1-46, Water Health Abiotic Tests; and BLM 1-47, Water Health Test—Saltwater Environment (optional). You may want to include plastic sleeves for students to store their papers. | Lab B<br>For each group:<br>– rubber boots<br>– pencil<br>– notebook<br>– water testing kit |

### Time Required

Lab A—Part 1
– 60 min for field work
Lab A—Part 2
– 60 min for field work
Lab A—parts 1 and 2
– 40–60 min for questions
Lab B
– 60 min for field work
– 40–60 min for questions

### Safety Precautions

- Safety eyewear, lab coats, and gloves must be worn in accordance with provincial safety standards.
- Caution students never to attempt this activity without teacher supervision as some streams may be dangerous. Remind students to stay out of the

water or to stay in very shallow water at all times. You may have students wear life jackets during their field work.
- In this activity, students will be working with live organisms. Caution students to take care to use only the materials supplied to handle the organisms and to treat the organisms with respect.
- Have students wash their hands after they complete their field work.

### Science Background

The presence of indicator species, particularly low tolerance species such as mayfly nymphs or riffle beetles, provides a barometer of pollution level and stream health. If these indicator species are present, pollution levels are very low and the stream is healthy. If the indicator species are absent, the stream may be contaminated.

### Activity Notes

- To help students prepare for this activity, you might first have them work through BLM 1-44, A Fresh Water Case Study, to analyze how various factors affect the health of a freshwater ecosystem.
- Have students work in groups of 4 or 5.
- If field work is not possible, you may wish to obtain stream and/or ocean samples for classroom study.
- Before introducing the activity, you may wish to have students review student presentations from Find Out Activity 3-2A, Abiotic Factors, on page 95.
- Review the safety precautions with students before they proceed with the activity.
- You may wish to have students use BLM 1-45, Water Health Test Table; BLM 1-46, Water Health Abiotic Tests; and BLM 1-47, Water Health Test—Saltawater Environment to record their observations. BLM 1-43, Biotic Index for Water Quality provides the biotic index that appears on page 110 of the textbook in a format that can more easily be carried to a local stream.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.
- It may be helpful to review the contents and use of the water testing kit in the classroom before proceeding to the field.
- If students will be bused to the field work locations, use the travel time to review the safety precautions, procedure, or key terms.
- Ensure that student groups are working far enough apart from each other to disturb the water as little as possible.
- Organisms will have different ranges of tolerance with respect to the abiotic factors that are being measured but generally organisms will be stressed when the pH is less than 5 and greater than 8.5, when dissolved oxygen levels are less than 5 mg/L and phosphates are greater than 10 micrograms per litre.

### Supporting Diverse Student Needs

- Have students who have strong reading and writing skills partner with students who have reading or writing challenges as a scribe or a guide, using a buddy system. Remind the students who are acting as scribes or guides to ensure their partner understands the activity clearly.
- Group field work provides an excellent opportunity for students to develop interpersonal and naturalist intelligences. For Lab A, you could divide each group into subgroups based on learning styles and abilities. Have one subgroup collect evidence of biotic factors (using predominantly naturalistic and visual-spatial skills) and the other collect evidence of abiotic factors (using predominantly logical-mathematical skills). All students in a group should work together to analyze the results and prepare the presentation.
- To ensure accurate reading of measuring tools, tell students to have each measurement confirmed by a second group member.
- Students and teachers with an interest in this topic may wish to pursue a water monitoring program. Learn more at www.discoveringscience8.ca.

## Lab A—Freshwater Environment

### Analyze—Bioindicator Species Answers

1. Students' answers could include between 5–10 different species.
2. Students' answers could include between 1–3 of each species.
3. –4. Students' answers could include a high quality water rating of 23–30, an intermediate water quality rating of 17–20, a poor to intermediate water quality rating of 10–16, or a very poor water quality rating of 0–10.

### Analyze—Abiotic Factors Answers

5. Students' answers will vary, but should include justification for their rating, based on factors including dissolved oxygen, turbidity, pH, and phosphates.
6. Students' presentations should include a listing of the species they identified, quantity of each species, the total biotic index calculation, and the water quality ratings.

**Conclude Answers**

7. All groups should answer within the same range, but there may be some outliers in biotic quality factors, due to sampling differences, and some differences of interpretation of abiotic factors.
8. Bioindicator species are very sensitive to pollution, so they are better at detecting changes in water quality. Different water systems may have different temperatures or oxygen levels, but may still be equally healthy.

### Lab B—Saltwater Environment

Explore the Trading Books for Boats program developed by ACAP Humber Arm, an oceanography program for western Newfoundland. For more information, visit www.discoveringscience8.ca.

**Analyze Answers**

1. Students' answers should include justification for their rating based on factors including pH and dissolved oxygen.
2. Students' presentations should include details of their testing results in some form of visual display, such as a chart or table, their analysis of their results, and their conclusion, based on those results.

**Conclude Answers**

3. All groups should answer within the same range, but there may be some differences of interpretation of abiotic factors. A few groups may have different results, possibly due to errors in gathering samples.

## Think About It Activity 3-3C

### Not an Easy Decision, p. 112

**Purpose**

- Through debate, students investigate decision-making about a fictional off-shore oil rig from many different stakeholder points of view.

**Advance Preparation**

| WHEN TO BEGIN | WHAT TO DO | APPARATUS/MATERIALS |
|---|---|---|
| 1 week before | If you wish, allow students time to research and formulate appropriate arguments for their assigned role. | None |

**Time Required**

- 30 min
  – 10 min for set-up
  – 15 min for debate
  – 5 min for voting

**Activity Notes**

- Review good debating manners with students before they begin and outline your expectations.
- You may wish to assign roles to students one week before the class debate will be held and allow students time to research and then formulate more structured and detailed arguments for the point of view they will assume.
- If you plan to assess students' work in this activity, discuss your assessment criteria with them beforehand.

**Supporting Diverse Student Needs**

- English language learners could be assigned the role of moderator for this activity.
- A debate provides students with an opportunity to build and develop both interpersonal and intrapersonal intelligences as students interact as a group, but speak as individuals in their assigned roles.
- To give each student a good start in preparing for their role, have each group brainstorm four or five key points for each person's argument. Then, students can research evidence individually to support each point.
- Have research materials at a variety of reading levels available.
- For enrichment, have students research their role and design a persuasive poster to promote their role's point of view.

**Analyze Answers**

1. Students' answers will vary depending on the groups. In many cases, the numbers will be equal.
2. Students' answers will vary depending on the groups. Some students may be impressed by particularly compelling performances, or some students may find a particular side more convincing than the other.
3. Students' answers may include money for oil companies, jobs for communities, or votes for elected officials.

## USING THE FEATURES

### Using the Did You Know, p. 102

The Did You Know? on page 102 refers to the beluga whale. Bring in photographs of the beluga whale for students to examine. Explain that the beluga whale is a pure white whale common to the Arctic and Subarctic. It is in the same family as the horned Narwal. Its high-pitched vocalizations have earned it the nickname "sea canary." There are approximately 100 000 beluga whales in the wild; they are considered a vulnerable species, although no longer endangered. Incidents of cancer among beluga whales are rising, however. This increase is thought to be connected to the whales' congregation at estuaries with larger concentrations of human-caused pollution. To see a live beluga in the classroom, visit the Vancouver Aquarium's Beluga-cam and spend time with Qila and her calf, born June 10, 2008.

### Science Watch: Pollution in the Open Ocean, p. 113

If there is a clean-up day or another environmental day in your community, such as the TD Great Canadian Shoreline Cleanup, research how your class might get involved. Or, organize a classroom clean-up walk or a clean-up of the shoreline or a local park.

#### Science Watch Answers

1. The Sargasso Sea is calm due to a loop of ocean currents.
2. Debris in the harbour of our community can be transported by ocean currents to the Sargasso Sea.

### Science Watch: Think Globally, Act Locally: Watching Our Waterways, p. 114

Research local non-profit organizations dedicated to monitoring and restoring the health of rivers and streams. See how your class might become involved. Alternatively, invite a speaker from one of these organizations or an Aboriginal Elder to visit the class and discuss the importance of river health with students.

#### Science Watch Answers

1. Rivers are used for transporting goods from the interior to the coast, for irrigating farmland and orchards, and for recreation.
2. It provides a habitat for plants and animals.
3. Students' answers may include the idea that you need to think of the water all over the world and then take care of the water in your own community.

## SECTION 3.3 ASSESSMENT, p. 115

### Check Your Understanding Answers

#### Checking Concepts

1. Humans can affect water quality directly (point sources) or indirectly (non-point sources).
2. Human activities that affect the quality of water in a water system include the following: using water systems for dumping sewage, garbage, industrial waste, and waste water; landfill leaks; gas station storage containers; run-off from roads; pesticides and fertilizers from farmland and lawns; animal waste from parks and farms.
3. (a) Point source pollution comes from a specific area; non-point source pollution comes from many different sources.
   (b) point sources: landfill leaks; waste water from a factory or mill; oil spills; underground storage containers for gas stations; sewage systems; waste water treatment plants
   non-point sources: run-off from roads; pesticides and fertilizers from farms, lawns, and golf courses; and animal waste from parks and farms
4. Point source pollution is easier to control because it can be traced back to the source of the contamination. Non-point source pollution comes from many different sources and is difficult, if not impossible, to trace.
5. Acid precipitation can affect people far away from where it falls by entering waterways and contaminating them, killing plants and animals.

#### Understanding Key Ideas

6. Using oceans as garbage dumps means that garbage gets washed up on coastlines, beaches, and estuaries. Garbage that floats, such as plastic, can kill sea life.
7. Factory freezer trawlers, deep-sea trawlers, and radar technology allow fishers to catch enormous amounts of fish at a time, often with significant bycatch.
8. Students' answers may include the following: If a species, such as the green crab, is suddenly added to an ecosystem, it can upset the ecosystem's natural balance by eating a significant number of another species, without having a natural predator itself. If a species is suddenly taken away, the balance will also be upset as this species could be the food source for other species, or it could be a predator for another species.

### Pause and Reflect Answer

Students can use BLM 1-48, Activities That Use Water to record their ideas. Students' tables will differ, based on what they feel are essential or non-essential water uses. You may wish to conduct a class discussion to compare students' tables and assessments on essential vs. non-essential water use.

### Other Assessment Opportunities

- Consult the Unit front matter for a list of applicable Assessment BLMs.

## CHAPTER 3 ASSESSMENT, pp. 116–117

### PREPARE YOUR OWN SUMMARY

Students' summaries should incorporate the following main ideas:

1. Oceans and Climate
   - Weather can be described in terms of temperature, wind speed and direction, air pressure, and moisture. Climate can be described as weather conditions in a particular region over a long period, usually 30 years.
   - Ocean currents influence climates.
   - Water has a high specific heat capacity, which affects weather systems near the shoreline.
   - Convection of air creates weather over oceans.
2. Living in Water
   - Freshwater environments include lakes and ponds, rivers and streams, and wetlands and estuaries.
   - Plankton—phytoplankton and zooplankton—are freefloating organisms that form the first link in the food chain.
   - A wetland is a low area saturated with water for all or part of the year. Canada has one quarter of the world's wetlands.
   - An estuary is a wetland that builds up where a river meets the ocean. Water in an estuary is brackish.
   - Bioindicator species are small organisms that are sensitive to pollution and can tell us about the water quality in a body of water.
3. Human Impact on Water Quality
   - Water pollution comes from both point and non-point sources.
   - Acid precipitation comes from toxins that are released into the air that combine with water. Acid precipitation slowly kills plant and animal life in lakes, forests, and oceans.
   - Most of the oil in the ocean comes from run-off from cities and farms, waste from factories and businesses, and recreational boating, rather than oil rigs. Seismic testing for oil deposits is dangerous to sea life.
   - Invasive species, such as the green crab, disrupt an ecosystem's food web.
   - Overfishing is mainly due to new technologies, such as sonar and deep-sea trawlers, which allow fishers to catch exceptionally large amounts of fish.
   - Aquaculture, or fishfarming, is a way to reduce pressure on wild fish, but escaped fish, diseases, and parasites in farmed fish are causing problems.

### CHAPTER REVIEW ANSWERS

#### Checking Concepts

1. Students' answers could include the following: the vegetation in wetlands acts as a filter for removing pollutants; wetlands help to prevent flooding; wetlands are resting places for migrating birds; wetlands help prevent shoreline erosion; wetlands are home to many endangered species; wetlands are the habitat of the pitcher plant.
2. Estuaries are ideal environments for many of Newfoundland and Labrador's plants and animals. They are also important for the reasons listed in the answer to question 1.
3. Marine organisms live mainly in the uppermost zone of the ocean because this area is where sunlight can penetrate.
4. A point source of pollution is one that comes from a small, specific area.
5. Three non-point sources of pollution are run-off from roads and farms; pesticides and fertilizers from lawns, farmer's fields, and golf courses; and animal waste from parks and farms.
6. We are polluting water faster than the pollutants can decompose.
7. Acid precipitation becomes part of the water cycle when nitrogen oxides and sulfur dioxides are released into the air. These chemicals combine with water to create acid precipitation, which falls on land, rivers, and oceans.
8. Acid precipitation can slowly kill plant and animal life on land and in the waters.

#### Understanding Key Ideas

9. St. John's, NL's January temperature is affected by the warm Gulf Stream Current.
10. If people were allowed to go on the island all the time, they could frighten the birds away, damage nesting sites or food sources for the birds, or leave garbage that could harm the birds.

11. Pouring used oil along the side of the highway could kill local plants and animals, and could cause oil to eventually end up in the oceans through run-off where it would harm marine life.
12. To determine if the river in my community were polluted, I would do the following:
Step 1: Take a sample of the bottom sediment of the river, and check in shallow parts under gravel or rocks.
Step 2: Examine the sediment with a magnifying glass.
Step 3: Identify and record any bioindicator organisms I found.
Step 4: Return the organisms to their natural habitat.
Step 5: Calculate the total biotic index.
13.

| OCEAN POLLUTION | | |
|---|---|---|
| SOURCE OF POLLUTION | POINT OR NON-POINT | SUGGESTION FOR SOLVING PROBLEM (SAMPLE RESPONSES) |
| 1. Urban run-off | Non-point | Educate people not to dump used oil in the sewers. |
| 2. Garbage from boats | Point | Have fines for people who throw garbage off boats. |
| 3. Treated sewage | Point | Make sure the treatment plant is cleaning the sewage enough. |
| 4. Agricultural run-off | Non-point | Encourage farmers to avoid using fertilizers and pesticides. |
| 5. Air pollution | Non-point | Set fines for companies that produce air pollution. |
| 6. Industrial waste | Point | Set fines for companies that dump their waste into the ocean. |
| 7. Oil spills | Point | Add more safety measures to prevent oil spills. Research better ways to clean up oil spills. |

14. Pollution in the air could be carried by wind and the pollution could turn into acid precipitation and pollute the water.
15. Seismic testing kills aquatic life, such as eggs and larvae, scares away fish, and changes migration patterns of whales.

### Pause and Reflect Answer

Students should use correct letter format and include information about pollution and water contamination affecting everyone's drinking water.

## PROJECT

### Being at Home at the Bottom: Designing an Underwater Community, p. 120

#### Purpose

- Students work in groups to research a location for a theoretical underwater community.

#### Time Required

- 15 min to introduce the project
- 1 week to research and prepare a presentation
- additional class time for presentations

#### Science Background

The only (current) underwater research facility in the world is the National Oceanic and Atmospheric Administration's (NOAA) Aquarius research station. Aquarius "aquanauts" conduct undersea research about $5\frac{1}{2}$ km off the coast of Florida, at a depth of 18 m. The Aquarius habitat is capable of maintaining a crew of six scientists for one- to two-week missions.

There have been many other underwater and ocean-floor habitats, some dating back to Jacques-Yves Cousteau's Continental Shelf Station, or Conshelf, launched in 1962. The Conshelf projects were located off the coast of France, near Marseilles.

The United States Navy program, SEALAB, was launched in 1962 and again in 1965 with SEALAB II. SEALAB II was 62 m in depth, off the coast of California. Astronaut/aquanaut Scott Carpenter stayed in SEALAB II for a record total of 30 days.

In 1969, SEALAB III was lowered to 185 m. The habitat began to leak and one aquanaut died trying to make repairs.

The US Virgin Islands was home to yet another undersea project, called Tektite. In 1969 and again in 1970, scientists studied both human physiology in undersea environments in Tektite I and oceanography by Tektite II in 1970. Interestingly, Tektite II had an all-female crew. The Tektite I crew stayed a record 58 days in the 15 m habitat.

#### Activity Notes

- Have students work in groups for this activity. You may wish to assign the groups to ensure there is a balance of skill sets and learning styles in each group.
- Explain how you plan to evaluate this activity with students before they start. You may wish to hand out copies of the assessment criteria so students are aware of how they will be evaluated.
- As an introduction to this project, you may wish to show students the news footage of the Aquarius research station.

- As a class, discuss what it would be like to live under the ocean. Ask, "How would you get there? How would you maintain a comfortable temperature and have enough air? What kinds of things could you study on the ocean floor? How would the things you want to study affect the location of the habitat?"
- Discuss how ocean-floor research might be similar to space research. Using a Venn diagram on the board, a flipchart, or overhead, compare ocean-based research to space-based research. Have students explain the similarities and differences.

### Supporting Diverse Student Needs

- You may wish to assign a scribe for English-language learners for this activity.
- This activity helps strengthen interpersonal intelligence through group work.
- For enrichment, have students sketch a design of their research facility.

### Report Out Answers

1.–2. Students' projects should show the results of their research, list references they accessed, and provide details on the location of their facility, what would be studied and why, the number of people in their community and their skills and occupations, and an emergency plan.

### Other Assessment Oppo.rtunities

- Consult the Unit front matter for a list of applicable Assessment BLMs.

## INTEGRATED RESEARCH INVESTIGATION

### Wrestling Energy from Waves, p. 121

### Purpose

- Students research a source of ocean energy and display their results in a poster.

### Time Required

- 15 min to introduce the project
- 2 weeks to conduct research and prepare poster
- 30 min for debate

### Activity Notes

- Explain how you plan to evaluate this activity with students before they start. You may wish to hand out copies of the assessment criteria so they are aware of how they will be evaluated.
- Provide library and/or computer lab time for students to research their energy sources. Alternatively, assign this investigation as homework.
- For the debate, you may wish to provide the option of having students role-play the factors. For example, the environment factor could be personified as an oceanographer. Assign, or have students volunteer for roles, including each factor identified in the student textbook, as well as research, presentation, and moderation roles.

### Supporting Diverse Student Needs

- You may wish to assign a scribe for English-language learners for this activity.
- This activity helps strengthen intrapersonal intelligence through individual work as well as interpersonal intelligence through the debate. Visual-spatial learners will enjoy the artistic element of creating the poster. You might have students provide additional elements to accompany their poster, such as a presentation, song, musical composition, or poem.
- For enrichment, have students research another ocean-based energy source of their choosing.

### Other Assessment Opportunities

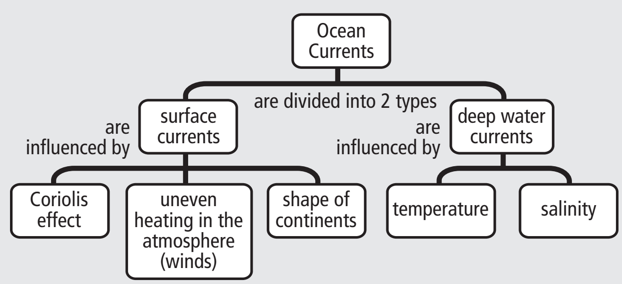
- Consult the Unit front matter for a list of applicable Assessment BLMs.

## UNIT 1 REVIEW ANSWERS, pp. 122–125

Students can use BLM 1-50, Unit 1 Review—Concept Map and Table to record their answers to questions 1 and 2.

### Visualizing Key Ideas

1.




### Using Key Terms

2.

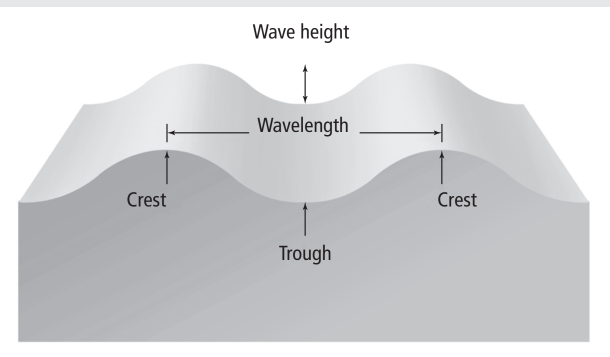
| FOUND ONLY IN THE OCEANS | FOUND ON LAND AND IN THE OCEANS |
|---|---|
| (a) abyssal plain | |
| (b) continental slope | |
| | (c) mountains |
| | (d) volcanoes |
| | (e) tectonic processes |

3.

| POINT SOURCE OF POLLUTION | NON-POINT SOURCE OF POLLUTION |
|---|---|
| (a), (d), (e) | (b), (c) |

## Checking Concepts

4. Most of Earth's fresh water is frozen in ice sheets and glaciers.
5. Salinity is the main difference between ocean water and lake water. Ocean water is salt water and lake water is fresh water.
6. Water seeps through the ground and collects when it hits a layer of bedrock, forming ground water.
7. They are melting and shrinking.
8. Most glaciers today are receding, or getting smaller.
9. The large flat areas of ocean basins are called abyssal plains.
10. Three types of technology that help us explore ocean basins are radar technology, satellite technology, and submersibles.
11. Three factors that affect surface currents are wind action, the rotation of the Earth (the Coriolis effect), and the shapes of the continents.
12. When cold, dense water meets warm, less dense water, the mixing of the two creates fog.
13. (a)–(d)




(a) wavelength—the distance from one crest to another
(b) wave height—the height of a wave from its crest to its trough
(c) crest—the highest part of a wave
(d) trough—the lowest part of a wave

14. Weather can be described in terms of temperature, wind speed and direction, and precipitation. Climate can be described as weather conditions that are averaged over a long period of time, usually 30 years.
15. Warm ocean currents affect climate by transferring their heat to the atmosphere. Cold currents also affect the climate by drawing heat from the air.
16. A wetland is a lowland area that is saturated with water for part or all of the year.
17. The burning of fossil fuels releases toxic chemicals into the air. The chemicals combine with water to form sulfuric and nitric acid, which then falls as acid precipitation.
18. Problems that humans have created in the Atlantic Ocean include the following: water pollution, acid precipitation, effects of the offshore oil industry on marine life, invasive species, overfishing, and aquaculture.

## Understanding Key Ideas

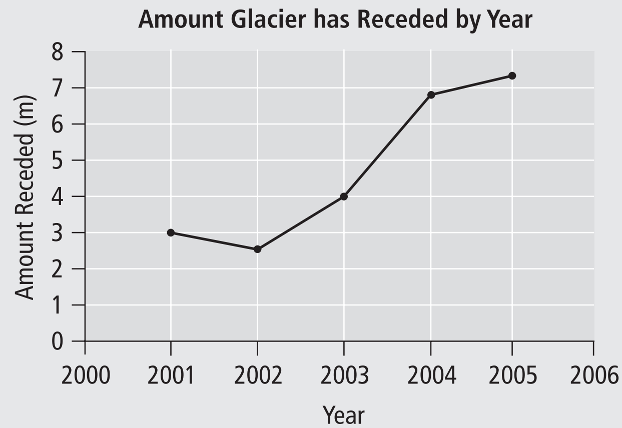
19. Waves can change shorelines by both physical and chemical erosion. Wave action creates headlands and bays, such as in Northern Bay, Newfoundland and Labrador, and sea stacks, such as at the East Coast Trail.
20. A headland reaches farther out to sea than a bay. The shoreline would resemble a wavy line with the headlands curving out and the bays curving in.
21. Since water has a high specific heat capacity and therefore takes a long time to heat up and cool down, large bodies of water act as heat reservoirs in winter, remaining warmer than nearby land.
22. (a) Weather can be described in terms of temperature, wind speed and direction, and precipitation. Climate is weather conditions that are averaged over a long period of time, usually 30 years.
    (b) Student's answers may vary. Allow any reasonable answer that is justified using information from the unit. For example, students may speculate that Earth may experience a drought without the ocean currents moving warm water from the equator to colder areas where the interaction with colder water forms fog or other types of precipitation.

23.

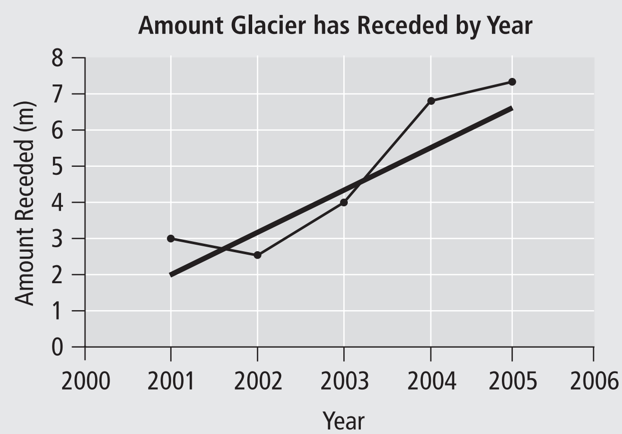
| WETLANDS AND ESTUARIES | SIMILAR | DIFFERENT |
|---|---|---|
| salinity | | wetlands are fresh water; estuaries are brackish |
| location | | wetlands are located near lakes and rivers; estuaries are located near oceans |
| wildlife and vegetation | abundant and important for both | |
| saturated with water | both; for most of the year | |
| filter pollutants | both | |

24. When the water evaporates, it collects in the atmosphere and eventually falls back into the ocean (directly, or through drainage basins). Also, meltwater from glaciers and icebergs also returns to the ocean.
25. The present locations suggest that South America and Africa were touching 200 million years ago.
26. Students' answers will vary, but should include these points:
    As water at the surface cools, it falls, causing other deep water to move out of its way. As warm water at the suface is moved, it can cause upwelling, or upward movement of deep water. As fresh water enters the ocean from a river, it falls because it is denser than salt water. The salt water moves up because it is less dense. As the sun evaporates fresh water at the surface, the water becomes more salty and falls, causing other deep water to move out of its way.
27. Weather along a coast is affected by the body of water. Water has a high specific heat capacity and heats up and cools down slowly. If there is a warm current in the water, it will make the winter temperatures on land warmer than they would be if the land were not near water. If there is a cool current nearby, it can make the summer temperatures cooler than they would be without the body of water.
28. Students should mention such factors as pollution, pH, oxygen levels, temperature, turbidity, availability of food, number of predators, and water speed.

29. (a)




(b) The slope indicates that the general trend is to recede more each year.
(c) Some years may have been warmer than others.
(d) Lines, slopes, and rates will vary slightly, but should be close to the following:




$$\text{Slope} = \frac{(6.6 - 2)}{(2005 - 2001)} = \frac{4.6}{4} = 1.2$$

The glacier has been receding at an average rate of 1.2 m/year.
(e) approximately 1667 years