

Grade 8 Science



Grade 8

Cluster 1: Cells and Systems

Overview

In this cluster, students investigate living things through a focus on cells and systems. Cell theory provides the basis for exploring cells and unicellular and multicellular organisms. Students identify major events and technological innovations that have enabled scientists to increase our understanding of cell biology. Microscopes are used to observe and compare the general structure and function of plant and animal cells. Students examine important processes that take place within the cell, including the movement of nutrients and wastes across cell membranes. The need for specialization of cells and tissues in multicellular organisms is discussed, as are the structural and functional relationships among cells, tissues, organs, and systems. Investigations of the circulatory and respiratory systems highlight their importance to the body and lead to an understanding of how body systems function interdependently. Students identify components of the body's primary and secondary defense systems. They examine medical advances that enhance the human body's defence mechanisms, and research disorders and diseases that can affect body systems.

PRESCRIBED LEARNING OUTCOMES

SUGGESTIONS FOR INSTRUCTION

Students will...

8-1-01 Use appropriate vocabulary related to their investigations of cells and systems.

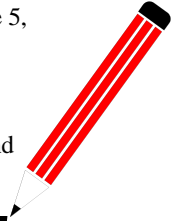
Include: cell theory, osmosis, diffusion, selective permeability, unicellular, multicellular, specialized cells and tissues, organs, systems, arteries, veins, capillaries, terms related to cell structure, heart structure, components of blood, and primary and secondary defense systems.

GLO: C6, D1

Teacher Notes

Students have had previous learning experiences related to this cluster in Grade 7, Cluster 1: Interactions within Ecosystems, and in Grade 5, Cluster 1: Maintaining a Healthy Body.

Refer to *Kindergarten to Senior 4 Physical Education/Health Education: Manitoba Curriculum Framework of Outcomes for Active Healthy Lifestyles* (2000) for related learning outcomes and teacher support.



➤ Introduce, explain, use, and reinforce vocabulary throughout this cluster.

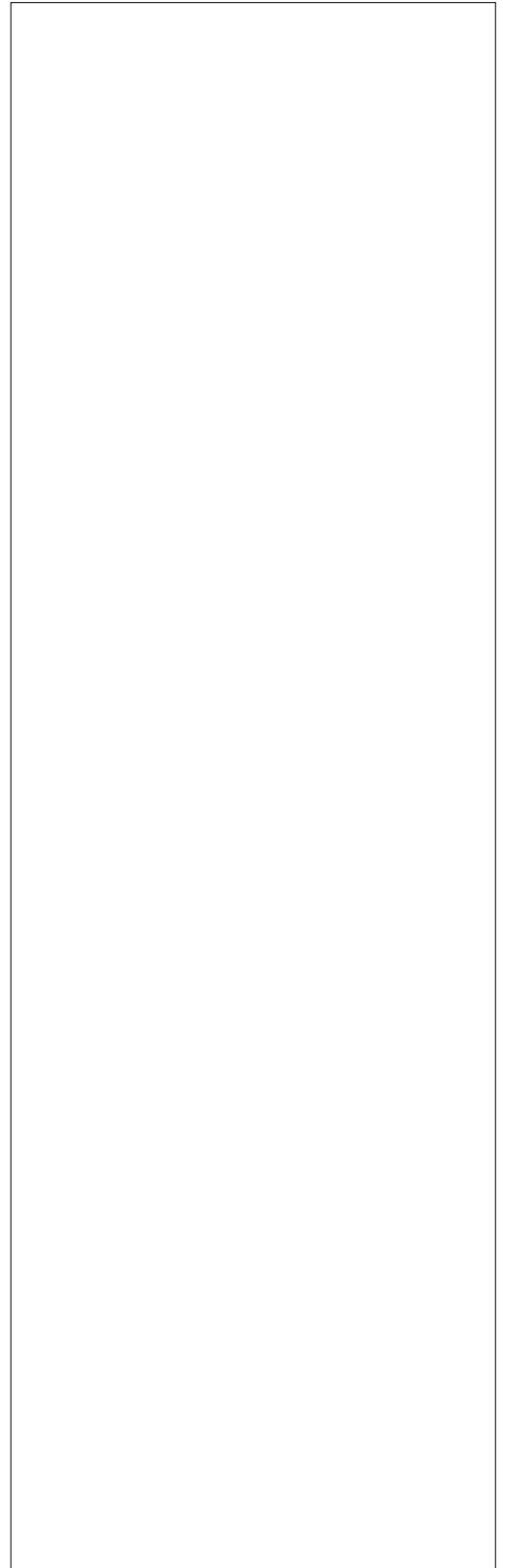
➤ **Three-Point Approach**

Have students, working in groups, use the Three-Point Approach (Simons, 1991) to research one or more of the identified terms related to types of vertebrates and invertebrates. Provide students with opportunities to share their findings with the class. Have students update this information throughout the study of this cluster.

(For a BLM of the Three-Point Approach for Words and Concepts, see *SYSTH*, Attachment 10.2, or *Success*, p. 6.101.)

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

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PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p>8-1-02 Identify characteristics of living things, and describe how different living things exhibit these characteristics.</p> <p>Include: composed of cells; reproduce; grow; repair themselves; require energy; respond to the environment; have a lifespan; produce wastes.</p> <p>GLO: D1, E1</p>
<p>8-0-2a c Access information, using a variety of sources. <i>Examples: libraries, magazines, community resource people, outdoor experiences, videos, CD-ROMs, Internet...</i> GLO: C6 (ELA Grade 8, 3.2.2)</p> <p>8-0-2b Develop and use criteria for evaluating information sources. Include: distinguish between fact and opinion. GLO: C6, C8 (ELA Grade 8, 3.2.2, 3.2.3; TFS 2.2.2)</p> <p>8-0-2c Make notes in point form, summarizing major ideas and supporting details and referencing sources. GLO: C6 (ELA Grade 8, 3.3.2)</p> <p>8-0-5f c Record, compile, and display observations and data, using an appropriate format. GLO: C2, C6 (ELA Grade 8, 3.3.1; Math: SP-III.2.8)</p>

SUGGESTIONS FOR INSTRUCTION

➤ **Characteristics of Living Organisms**

Have students use the Think-Pair-Share strategy (McTighe and Lyman, 1992) to answer the following question: What characteristics are shared by all living things?

When gathering student responses, group them into categories (e.g., living things are composed of cells, reproduce, grow, repair themselves, require energy, respond to the environment, have a lifespan, and produce wastes).

Have students research a variety of resources (using the Internet, print texts, CD-ROMs, videos, and/or viewing material through a microscope) to find examples of how a plant, a paramecium, and a human exhibit each of the life functions. Also provide students with opportunities to view plant or paramecium specimens/slides. Ask students to organize their information in chart form.

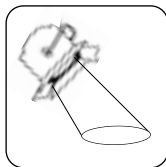
Example:

Characteristics of Living Organisms

Characteristics	Plant	Paramecium	Human
retrieves/uses energy	photosynthesizes	scoops up food in the gullet	ingests food in the mouth and processes it in the digestive system
grows and reproduces	reproduces by means of seeds, cuttings, and runners	splits into two new paramecia	reproduces by sexual means
responds to the environment	grows toward light	swims to catch food	uses the nervous system to receive information from outside the body and to send messages to other parts of the body
produces wastes	gives off extra water through transpiration	squirts out wastes and extra water through vacuoles and gives off carbon dioxide	gives off carbon dioxide and urea
has a lifespan	lives from months to hundreds of years (annual, biennial, perennial)	lives from hours to a few days	lives approximately 80 years
is made of cell(s)	consists of more than one cell	consists of only one cell	consists of more than one cell

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES



Is It Living?

Provide students with the following question:
Is fire a living thing, according to a scientist’s perspective? Explain.

Scoring Rubric	
Score	Criteria
4	The response is correct, complete, and detailed, indicating that fire is not a living thing because it does not exhibit all life characteristics (does not contain cells). It contains examples and/or elaboration to support the answer. It includes evidence of higher-order thinking.
3	The response is correct and complete, indicating that fire is not a living thing because it does not exhibit all life characteristics (does not contain cells). It contains examples and/or elaboration to support the answer.
2	The response is generally correct and complete. It may contain minor errors. It contains examples and/or elaboration to support the answer.
1	The response is partially correct but is incomplete and/or contains errors. It contains no examples or elaboration to support the answer.

Teacher Notes

The Western scientific view of the characteristics of living things may be in conflict with other views. Encourage students to discuss and respect other views and recognize that individuals can hold multiple views.



Nelson Science & Technology 8
(Section 1.1)

Sciencepower 8 (Sections 1.3, 2.3)

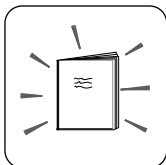
Native Science: Natural Laws of Independence (Teacher Reference)

Igniting the Sparkle: An Indigenous Science Education Model (Teacher Reference)

PRESCRIBED LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION
<p><i>Students will...</i></p>	
<p>8-1-03 Describe cell theory. Include: all living things are composed of one or more cells; cells are the basic unit of structure and function of any organism; all cells come from pre-existing cells; the activity of an organism as a whole depends on the total activity of all its cells. GLO: A2, D1, E2</p>	<p>➤ Cell Theory News Release</p> <p>Have students research information about the <i>cell theory</i>. Then have them use their findings to create a newspaper article that announces the discovery of the cell theory, discusses its major points, and identifies the scientists who are credited with its discovery.</p> <p>Sample News Release:</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;">Schleiden, Schwann, and Virchow Vow Cell Is the Basic Building Block of Life</p> <p>Scientists Schleiden, Schwann, and Virchow have studied living organisms for several years. With the help of the microscope they have determined that all living things are made of cells.</p> <p>According to Matthias Schleiden and Theodor Schwann, these cells seem to be the basic structural units within organisms. The two scientists also note that the well-being of the organism depends on the well-being of its cells.</p> <p>Due to the numerous and varied experiments and studies they have conducted, Schleiden and Schwann are confident in their hypothesis and have laid out the points in what they call the <i>cell theory</i>. Schleiden and Schwann have incorporated into the cell theory experimental observations and conclusions of the famous scientist Rudolf Virchow, who has observed that cells reproduce themselves.</p> </div>
<p>8-0-2a ◐ Access information, using a variety of sources. <i>Examples: libraries, magazines, community resource people, outdoor experiences, videos, CD-ROMs, Internet...</i> GLO: C6 (ELA Grade 8, 3.2.2)</p> <p>8-0-2b Develop and use criteria for evaluating information sources. Include: distinguish between fact and opinion. GLO: C6, C8 (ELA Grade 8, 3.2.2, 3.2.3; TFS 2.2.2)</p> <p>8-0-2c Make notes in point form, summarizing major ideas and supporting details and referencing sources. GLO: C6 (ELA Grade 8, 3.3.2)</p> <p>8-0-7g ◐ Communicate methods, results, conclusions, and new knowledge in a variety of ways. <i>Examples: oral, written, multimedia presentations...</i> GLO: C6 (ELA Grade 8, 4.4.1)</p>	
	<p>(For strategies to aid students in using a variety of information sources, determining the usefulness of information, constructing meaning, recording information, and referencing and evaluating sources, refer to 5-8 <i>ELA</i>, learning outcomes 3.2.2–3.2.5 and 3.3.2–3.3.3.)</p>

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES



Cell Theory News Release

When assessing students' news releases, look for indications of the following:

Rating Scale					
Criteria	Poor	Good	Excellent		
The news release					
• identifies main scientists and their contributions	1	2	3	4	5
• includes major points of the cell theory	1	2	3	4	5
• uses a format/approach suited to a news release	1	2	3	4	5

Nelson Science & Technology 8
(Section 1.1)

Sciencepower 8 (Section 1.1)

Science and Technology Breakthroughs
(Teacher Reference)

World of Scientific Discovery, 2nd ed.
(Teacher Reference)

PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p>8-1-04 Identify major events and technological innovations that have enabled scientists to increase our understanding of cell biology.</p> <p><i>Examples: invention of the light and electron microscopes, works of Robert Hooke, Anton van Leeuwenhoek, Matthias Schleiden and Theodor Schwann...</i></p> <p>GLO: A2, A4, B1, B2</p>
<p>8-0-2a C Access information, using a variety of sources. <i>Examples: libraries, magazines, community resource people, outdoor experiences, videos, CD-ROMs, Internet...</i> GLO: C6 (ELA Grade 8, 3.2.2)</p> <p>8-0-8a C Distinguish between science and technology. Include: purpose, procedures, products. GLO: A3</p> <p>8-0-8b C Describe examples of how scientific knowledge has evolved in light of new evidence, and the role of technology in this evolution. GLO: A2, A5, B1</p> <p>8-0-8d C Describe examples of how technologies have evolved over time in response to changing needs and scientific advances. GLO: A5, B1, B2</p> <p>8-0-8e C Provide examples of Canadian institutions and individuals who have contributed to science and technology, and describe their contributions. GLO: A1, A4, B1, B4</p> <p>8-0-8g C Discuss societal, environmental, and economic impacts of scientific and technological endeavours. Include: local and global impacts. GLO: A1, B1, B3, B5</p>

SUGGESTIONS FOR INSTRUCTION

➤ **Timeline of Developments in Cell Biology**

Have students gather research from the Internet, multimedia resources, and/or print texts to create a timeline of the major events and technological advancements that have enabled scientists to increase our understanding of cell biology. Ask students to include the following people and discoveries, as well as at least three other notable discoveries/people involved in cell biology: Robert Hooke, Anton van Leeuwenhoek, Matthias Schleiden, Theodor Schwann, Rudolf Virchow, cell theory, light microscope, electron microscope.

Note: Discuss with students why there is an absence of women who are associated with discoveries in cell biology.

Once the timeline is completed, have students use their science notebooks to reflect on the role technology has played in allowing scientists to increase their understanding of cell biology, and the impact of this increased understanding on society.

➤ **Science or Technology**

Challenge the class to distinguish between science and technology in terms of purpose, procedure, and product, using information and examples from their timelines created in the previous learning activity.

(Refer to Figure 1: Science and Technology: Their Nature and Relationship, *Grades 5 to 8 Science: Manitoba Curriculum Framework of Outcomes*, p. 2.5.)

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

Nelson Science & Technology 8
(Section 1.5)

Sciencepower 8 (Section 1.1)

Science and Technology Breakthroughs
(Teacher Reference)

World of Invention, 2nd ed. (Teacher
Reference)

World of Scientific Discovery, 2nd ed.
(Teacher Reference)

Medical Discoveries (Teacher
Reference)

PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p>8-1-05 Identify and compare major structures in plants and animal cells, and explain their function.</p> <p>Include: cell membrane, cytoplasm, mitochondria, nucleus, vacuoles, cell wall, chloroplasts.</p> <p>GLO: D1, E1</p>
<p>8-0-1c Identify practical problems to solve. <i>Examples: How can I make water flow uphill? Which type of bottled water should I buy?...</i> GLO: C3</p> <p>8-0-2a C Access information, using a variety of sources. <i>Examples: libraries, magazines, community resource people, outdoor experiences, videos, CD-ROMs, Internet...</i> GLO: C6 (ELA Grade 8, 3.2.2)</p> <p>8-0-3d C Develop criteria to evaluate a prototype or consumer product. Include: function, aesthetics, environmental considerations, cost, efficiency. GLO: C3</p> <p>8-0-3e C Create a written plan to solve a problem. Include: materials, safety considerations, three-dimensional sketches, steps to follow. GLO: C3, C6</p> <p>8-0-4b C Construct a prototype. GLO: C3</p> <p>8-0-5b C Test a prototype or consumer product, using predetermined criteria. GLO: C3, C5</p> <p>8-0-6d C Identify and make improvements to a prototype, and explain the rationale for the changes. GLO: C3, C4</p> <p>8-0-6e C Evaluate the strengths and weaknesses of a consumer product, based on predetermined criteria. GLO: C3, C4</p>

SUGGESTIONS FOR INSTRUCTION

➤ **Comparing Plant and Animal Cells**

Have students view videos or CD-ROM clips that show greatly magnified pictures of the cell and its parts. Provide students with a Compare and Contrast Frame (Matchullis and Mueller, 1994) and have them use it to identify the similarities and differences between plant and animal cells.

(For a BLM of a Compare and Contrast Frame, see *SYSTH*, Attachment 10.4, or *Success*, p. 6.103.)

➤ **Cell Model Construction**

Using the design process, have students create a model of a plant, animal, or protist cell. As a class, determine criteria for success (e.g., the model is three-dimensional, includes a key). Have students

- plan their model by creating a sketch of their chosen cell type, labelling the diagram with the major cell structures
- indicate the materials to be used in the construction of their model (e.g., modelling clay, polystyrene balls, paper, gelatin)
- present their finished model to the class

Students may use the “Design Project Report” (BLM 8-O) to record their work.

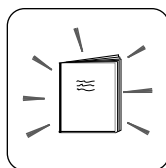
➤ **What Is My Function?**

Have students create flash cards for the structure and function of plant and animal cells, writing the function or job description of the cell structure on one side and the name of the cell structure on the other. The cards may also include a diagram. Pairs of students can use these cards to play the game, What Is My Function? They either state the function first and ask for the name of the cell structure or vice versa. Have students rotate around the room and play the game with different students.

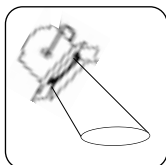
This game may also be played in two teams. Show a card with the name of a cell structure or the description of the cell’s function to one student from each team and then have both students draw the correct cell structure on the board.

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES



When assessing students' cell model construction, refer to "Design Project Report: Assessment" (BLM 8-P).



Job Advertisements

Have students create job advertisements that incorporate a job description for a plant or an animal cell.

Scoring Rubric	
Score	Criteria
3	The advertisement includes all key features of a plant or animal cell. It includes a realistic job description.
2	The advertisement includes the majority of the key features of a plant or animal cell. It includes a realistic job description.
1	The advertisement includes some of the key features of a plant or animal cell. The job description is not realistic.

Nelson Science & Technology 8 (Sections 1.3, 1.6)

Sciencepower 8 (Sections 1.2, 1.3)

Cells and Tissues (Video)

By Design: Technology Exploration & Integration (Design Process Reference and Tools)

Design and Technology System (Design Process Reference and Tools)

Mathematics, Science, & Technology Connections (Design Process Reference and Tools)

Teacher Notes

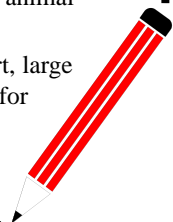
Background Information


The cell consists of the following structures:

- The *nucleus* is the control centre of the cell.
- The *cell membrane* is a living structure that surrounds a cell and allows certain materials in and out.
- *Cytoplasm* is a fluid-like material within a cell that supports the internal structure of the cell.
- *Mitochondria* are the location of energy production, converting nutrients and oxygen into useable energy.
- *Vacuoles* are storage structures for water, minerals, nutrients, and wastes.
- The *cell wall* (in a plant cell only) is the non-living cellulose structure that surrounds a cell and provides support.
- *Chloroplasts* (in a plant cell only), containing chlorophyll, are structures that convert light energy into usable chemical energy.

Both plant and animal cells have mitochondria, a cell membrane, cytoplasm, and a nucleus. The differences between plant and animal cells include the following:

- Plant cells have thick outer cell walls that provide support, large vacuoles for water and mineral storage, and chloroplasts for food production.
- Animal cells have a thin, flexible membrane, have many small vacuoles, and lack chloroplasts.



PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p>8-1-06 Demonstrate proper use and care of the microscope to observe the general structure of plant and animal cells.</p> <p>Include: preparing wet mounts beginning with the least powerful lens; focusing; drawing specimens; indicating magnification.</p> <p>GLO: C1, C2, D1</p>
<p>8-0-4e  Demonstrate work habits that ensure personal safety, the safety of others, and consideration for the environment. Include: keeping an uncluttered workspace; putting equipment away after use; handling glassware with care; wearing goggles when required; disposing of materials safely and responsibly. GLO: C1</p> <p>8-0-5c Select and use tools to observe, measure, and construct. Include: microscope, concave and convex mirrors and lenses, chemical indicators. GLO: C2, C3, C5</p>
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SUGGESTIONS FOR INSTRUCTION

➤ **Activating Prior Knowledge**

Note: The microscope was introduced in Grade 7, Cluster 1: Interactions within Ecosystems. Have students identify parts of a microscope on a diagram and list as many points related to the proper use and care of microscopes as they are able to. Then, as a class, identify all the parts and review proper use and care information. (Refer to “The Compound Microscope,” BLM 8-A.)

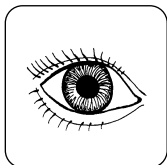
As a class, review basic skills of diagramming what students observe through a microscope and discuss how to determine the power of magnification used in viewing a slide.

➤ **Viewing Cells with a Microscope**

Have students view and diagram prepared slides of a typical plant cell and a typical animal cell (e.g., epithelial cell), as well as a live specimen of a plant cell (e.g., geranium leaf). Ask students to indicate the power of magnification used for each diagram. (Refer to “The Compound Microscope,” BLM 8-A.)

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

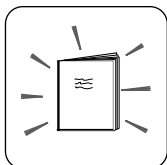
**Use and Care of a Microscope**

When assessing students' use and care of a microscope, look for indications of the following:

Checklist:

The student

- carries the microscope by the arm and base
- cleans the objective and ocular lenses with lens paper only
- places the slide on the stage and lowers the objective lens carefully (watches from the side of the microscope to ensure that the objective lens does not crush the slide) and focuses while looking through the ocular lens and raising the objective lens
- lowers the stage before changing from a lower objective lens to a higher objective lens and then watches from the side to ensure that the objective lens does not hit the stage
- properly cleans up work area and stores equipment as directed

**Drawing Diagrams of Plant and Animal Cells**

When assessing students' diagrams, look for indications of the following:

Checklist:

The student

- includes titles
- prints labels
- connects labels to the object with a straight line
- indicates the power of magnification used when viewing a slide

Nelson Science & Technology 8
(Section 1.4)

Sciencepower 8 (Section 1.1)

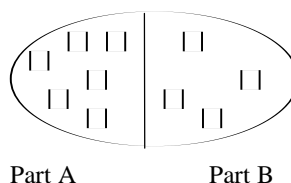
PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p>8-1-07 Describe the movement of nutrients and wastes across cell membranes and explain its importance.</p> <p>Include: osmosis, diffusion, selective permeability.</p> <p>GLO: D1</p>
<p>8-0-4c Work cooperatively with team members to carry out a plan, and troubleshoot problems as they arise. GLO: C7 (ELA Grade 8, 5.2.2)</p> <p>8-0-4e Demonstrate work habits that ensure personal safety, the safety of others, and consideration for the environment. Include: keeping an uncluttered workspace; putting equipment away after use; handling glassware with care; wearing goggles when required; disposing of materials safely and responsibly. GLO: C1</p> <p>8-0-4f Identify WHMIS hazard symbols that provide information on the safety of substances. GLO: C1</p> <p>8-0-5a Make observations that are relevant to a specific question. GLO: A1, A2, C2</p> <p>8-0-5c Select and use tools to observe, measure, and construct. Include: microscope, concave and convex mirrors and lenses, chemical indicators. GLO: C2, C3, C5</p> <p>8-0-7a Draw a conclusion that explains investigation results. Include: explaining the cause and effect relationship between the dependent and independent variables; identifying alternative explanations for observations; supporting or rejecting a prediction/hypothesis. GLO: A1, A2, C2 (ELA Grade 8, 3.3.4)</p>
<i>(continued)</i>

SUGGESTIONS FOR INSTRUCTION

➤ **High and Low Concentration**

Ask a group of students to stand close together in one corner of the classroom and have the remaining students spread throughout the room. Have students identify which part of the room has the highest concentration of students. (The corner with the group of students has the highest concentration.)

Show students the following diagram and have them decide which portion of the oval has a higher concentration of squares. (Part A has the higher concentration.)



➤ **Diffusion**

Have students investigate diffusion, following these steps:

- Place a few of drops of food colouring in a Petri dish or a beaker of water. Record your observations in your science notebook, using three diagrams: one at the start, one after a minute, and one at the completion of the observation period of several minutes.
- *Diffusion* is the movement of a substance. Using the words *high concentration* and *low concentration*, describe the movement of the food colouring in the Petri dish or beaker. (The dye moved from an area of high concentration to an area of low concentration.)

➤ **Osmosis**

Have students investigate *osmosis*, following these steps:

- Put dried raisins in a beaker and add just enough water to cover them.
- Cover the beaker with a Petri dish or plastic wrap.
- Observe what happens over time (one to two days).
- Record your observations in your science notebook, using diagrams that show the raisins at the start and at the completion of the observation period. (The raisins expand as the water crosses through the outer skin or membrane.)
- Indicate on your diagrams the direction the water moved. Include evidence to support your answer. (Water moved into the raisins. Less water in the beaker and fuller raisins provide evidence.)

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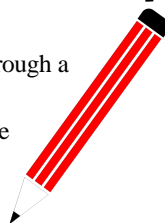
SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

Teacher Notes

Background Information

- *Diffusion* is the movement of particles from an area of high concentration to an area of low concentration.
- *Osmosis* is the movement of a solvent (commonly water) through a selectively permeable membrane.
- *Selective permeability* refers to a membrane that allows some substances to pass through it but not others.



Nelson Science & Technology 8
(Sections 1.7-1.10)

Sciencepower 8 (Section 2.1)

Science Safety: A Kindergarten to Senior 4 Resource Manual for Teachers, Schools, and School Divisions (Teacher Reference)

PRESCRIBED LEARNING OUTCOMES

SUGGESTIONS FOR INSTRUCTION

Students will...

8-1-07 (continued)

(continued)

➤ **A Challenge**

Pose the following problem to students:

- How is it possible to get granulated sugar into a beaker that is covered by filter paper? (Dissolve the sugar in water and pour it through the filter.)
- Why was the sugar not able to go through the filter initially? (Its particles were too big.)

➤ **Osmosis and Selectively Permeable Membranes**

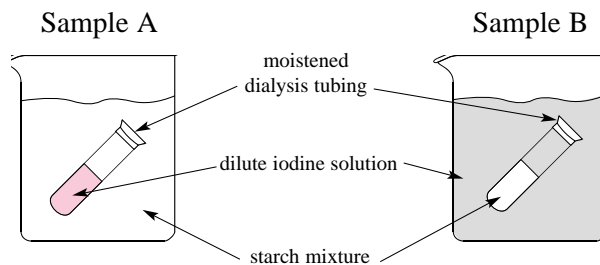
To observe how Lugol's iodine solution (a chemical indicator) reacts with starch, have students, wearing rubber gloves, place a few drops of iodine solution on a gram of starch. (The starch turns blue/black.)

Safety Precaution: Concentrated iodine is corrosive. Ensure that students are familiar with the WHMIS (Workplace Hazardous Materials Information System) symbols and information provided on chemicals. Check WHMIS Material Safety Data Sheets for further details related to safe handling of iodine. For general safety information, including information on WHMIS symbols, see *Science Safety: A Kindergarten to Senior 4 Resource Manual for Teachers, Schools, and School Divisions*, 1997.

Part A

Have students perform the following investigation:

- Pour dilute iodine solution into a test tube and cover the end with a moistened piece of single-layered dialysis tubing, using a rubber band to keep the tubing in place.
- Place the test tube into a beaker of corn starch and water mixture.
- Set up a second test by putting dilute iodine solution into a beaker and a corn starch mixture into a test tube whose end is covered with dialysis tubing.

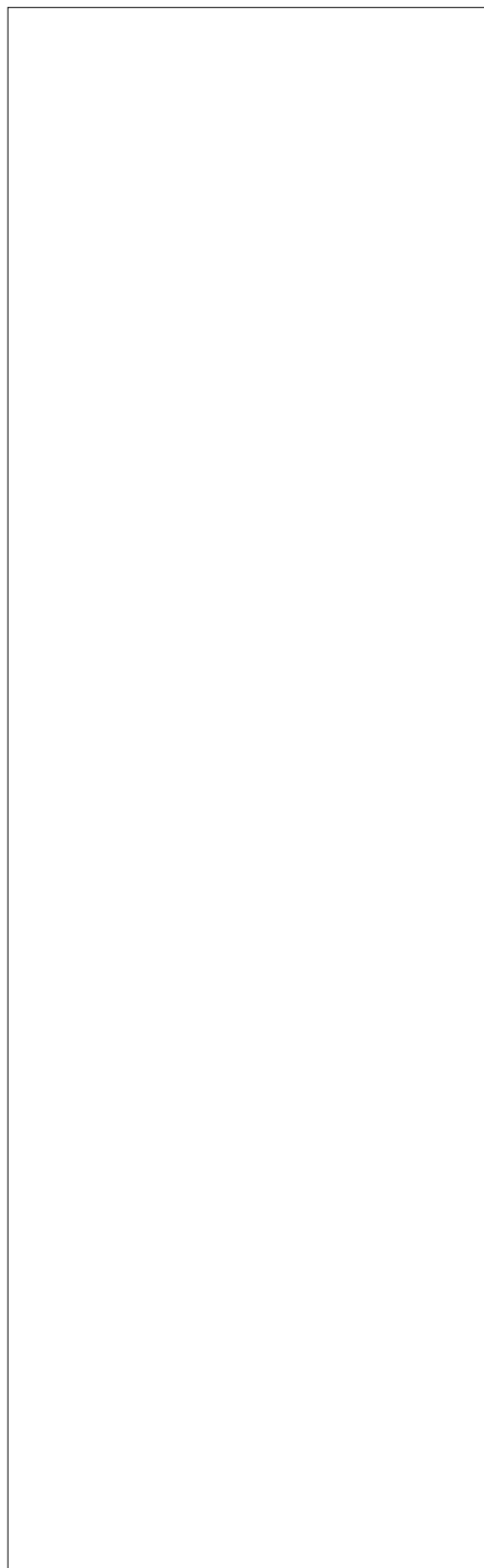


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SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

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PRESCRIBED LEARNING OUTCOMES

SUGGESTIONS FOR INSTRUCTION

Students will...

8-1-07 (continued)

(continued)

After students have observed the reactions of the two mixtures, have them answer the following questions in their science notebooks:

1. Using the words *high concentration* and *low concentration*, explain the movement of the iodine solution. (In both samples, the iodine solution went from an area of high concentration to an area of low concentration: Sample A—from the test tube to the beaker; Sample B—from the beaker to the test tube.)
2. What was the proof of the direction of movement? (In Sample A, proof of the movement of the iodine solution from the test tube to the starch mixture in the beaker was that the starch mixture turned black but the iodine solution did not. In Sample B, proof of the movement of the iodine solution from the beaker into the starch mixture in the test tube was that the starch mixture turned black.)
3. What is a possible reason why the starch did not move into the iodine solution? (The starch particles were bigger than the pores in the dialysis tubing.)

Part B

To observe how Benedict’s solution reacts with sugar, demonstrate the following:

- Pour 400 mL of distilled water into a 600 mL beaker.
- Fill half a test tube with the water and add several drops of Benedict’s solution.
- Gently heat the solution over a flame or in a water bath. A positive indication of sugar is given when the colour of the solution changes to a reddish-orange.

Safety Precaution:
Ensure that the test tube has a “spurt cap” on it to prevent the hot liquid from escaping. Hold the test tube a safe distance away from students.

The following part of the experiment can be done as a teacher demonstration or as an investigation by groups of students:

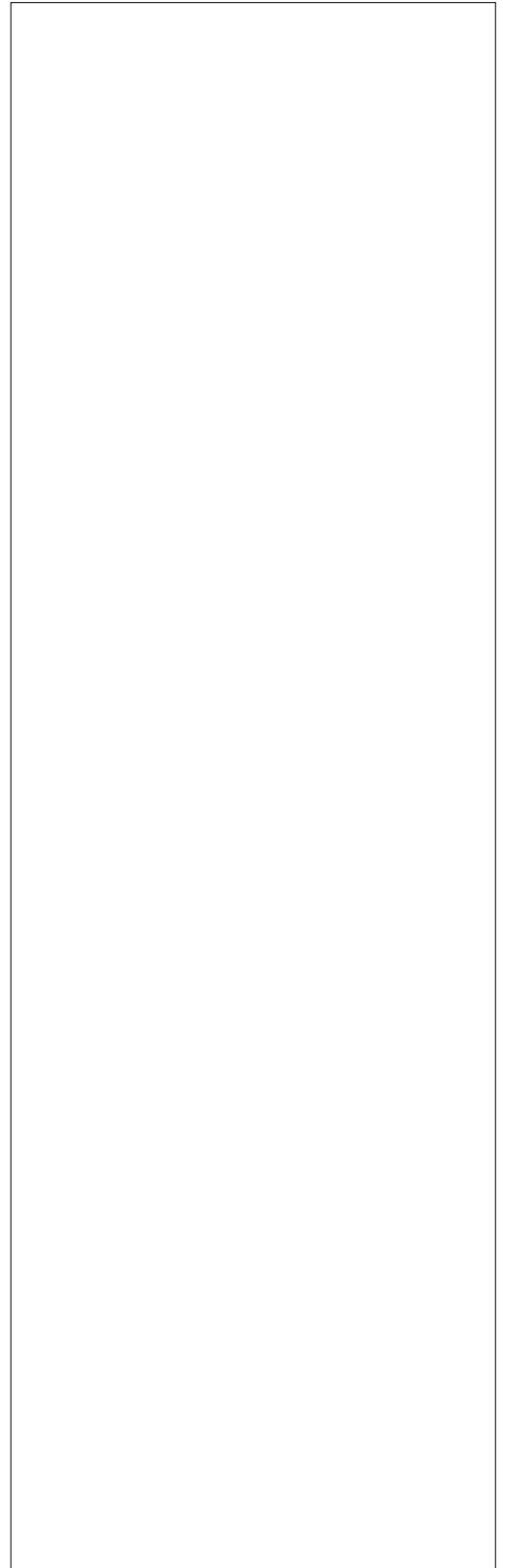
- Fill a 6 cm length of dialysis tubing with corn syrup and tie it off, leaving about 10 cm of string.
- Tie the dialysis tubing to a pencil in such a way that it hangs in the water. Leave it set up overnight.

(continued)

(continued)

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

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PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p>8-1-07 (continued)</p>

SUGGESTIONS FOR INSTRUCTION

(continued)

- The next day, observe differences in the dialysis tubing. (It looks “bloated.” Water has moved into the tubing.)
- Test the water for glucose by using a glucose indicator slip or Benedict’s solution (as per earlier directions). If the test is negative, with no sugar present, wait one more day and then retest, recording your observations.

Have students answer the following questions in their science notebooks:

1. *Osmosis* is the movement of water across a membrane. Using the words *high concentration* and *low concentration*, explain the movement of water in the above experiment. (The water moved from an area of high concentration to an area of low concentration.)
2. Why was the corn syrup not able to cross the dialysis tubing, a semipermeable membrane, at first? (Its particles were too large to go through the pores in the membrane.)
3. What eventually enabled the sugar to cross the dialysis tubing membrane? (The sugar dissolved in the water that moved into the tube and then was able to pass through the semipermeable membrane.)
4. Identify which substance *diffused* in this experiment. (The corn syrup diffused.)
5. Was equilibrium achieved in the concentration of corn syrup inside and outside the tubing? Support your answer with evidence from your observations. (Equilibrium was achieved. The solution in and out of the dialysis tubing was the same colour.)
6. Using your analysis of diffusion and osmosis, explain how nutrients and wastes move into and out of a cell. Include a description of water’s role in the movement of certain substances. (Nutrients move into a cell by diffusion. They move from an area of high concentration to an area of low concentration. Wastes diffuse out of the cell. They move from an area of high concentration to an area of low concentration. Water helps some nutrients move across a membrane by first dissolving the substance so that the nutrients may cross the semi-permeable membrane.)

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES



Extended Response

Provide students with the following:

Osmosis and Diffusion




Predict the direction of the movement of substances in the following situations. Indicate whether each situation illustrates *osmosis* or *diffusion* and explain why. Use diagrams.

1. dried prunes soaking in a bowl of water
2. a carrot in rain-soaked ground
3. a drink mix poured into a container of water
4. perfume being sprayed in a corner of a room

Look for:

1. osmosis
2. osmosis
3. diffusion
4. diffusion

PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
8-1-08 Differentiate between unicellular and multicellular organisms. GLO: D1, E1
8-0-2a  Access information, using a variety of sources. <i>Examples: libraries, magazines, community resource people, outdoor experiences, videos, CD-ROMs, Internet...</i> GLO: C6 (ELA Grade 8, 3.2.2)

SUGGESTIONS FOR INSTRUCTION

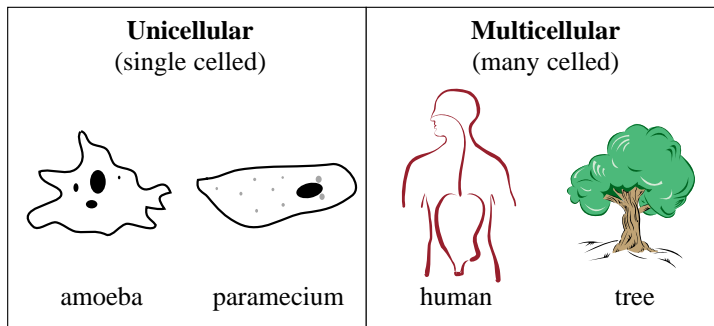
➤ **Comparison of Unicellular and Multicellular Organisms**

Have students observe examples of unicellular and multicellular organisms by viewing videos, live specimens (e.g., using pond water as a source), CD-ROM clips, and other media. Ask students to draw or paste pictures of unicellular organisms on one half of a piece of paper and pictures of multicellular organisms on the other half. Have students place a title on each side, along with a brief statement that describes the differentiation between the two types of organisms (i.e., single celled, many celled).

Safety Precaution: Pond water, especially water from a fish or turtle tank, may contain harmful bacteria and/or protists. Discuss with students the importance of keeping hands and writing utensils away from their mouths when dealing with pond water. Ensure that students wash their hands with soap and warm water after handling water samples.

Example:

Unicellular and Multicellular Organisms



SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

Refer to the assessment strategy suggested for learning outcome 8-1-09.

Nelson Science & Technology 8
(Sections 1.12, 1.13)

Sciencepower 8 (Section 1.2)

PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p>8-1-09 Describe why cells and tissues are specialized in multicellular organisms, and observe examples.</p> <p>Include: specialization is needed because all cells in a complex organism do not have access to the external environment.</p> <p>GLO: C2, D1</p>
<p>8-0-4e C Demonstrate work habits that ensure personal safety, the safety of others, and consideration for the environment. Include: keeping an uncluttered workspace; putting equipment away after use; handling glassware with care; wearing goggles when required; disposing of materials safely and responsibly. GLO: C1</p> <p>8-0-5a C Make observations that are relevant to a specific question. GLO: A1, A2, C2</p> <p>8-0-7f C Reflect on prior knowledge and experiences to construct new understanding and apply this new knowledge in other contexts. GLO: A2, C4 (ELA Grade 8, 1.2.1)</p>

SUGGESTIONS FOR INSTRUCTION

➤ **Where Is the Water?**

Spruce, elm, aspen, and poplar trees are examples of trees that grow several metres high. Have students use the Think-Pair-Share strategy (McTighe and Lyman, 1992) to determine which part of the tree takes in water for the whole tree to use. (root)

Have students discuss what might be needed to transport water to the very top of the tree.

➤ **Transport in Plants**

Have students observe transport in plants, following these steps:

- Cut off the bottom 2 cm of the root tip of a carrot.
- Place the carrot into a beaker with 5 mL of coloured water.
- Wait overnight.
- Remove the carrot from the dyed water and cut the carrot lengthwise.
- Draw a diagram of your observations in your science notebook.

Have students answer the following questions in their science notebooks:

1. Did the coloured water go up evenly through all the cells in the carrot or did it travel only in some cells? (some cells)
2. Using research, identify the specialized cell structure that allows the transport of water to cells that are not near the water at the root tip of a carrot. (xylem)
3. Why do multicellular organisms need to have specialized cells? (Specialization is needed because not all cells in a complex organism have access to the external environment. All cells need to receive nutrients and oxygen and get rid of wastes.)
4. What are some specialized cells within the human body? (blood, nerve, muscle)
5. Using a microscope, view some prepared slides of specialized cells and diagram them. (Examples: muscle, blood, bone, nerve, epithelial.)

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

**Extended Response**

Provide students with the following:

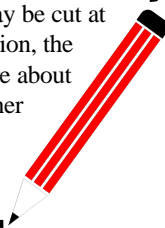
**Cell Specialization**

Explain why cells and tissues are specialized in multicellular organisms. Use examples to support your answer.

Scoring Rubric	
Score	Criteria
4	The response is correct and detailed. It contains examples to support the answer. It includes evidence of higher-order thinking.
3	The response is correct and complete. It contains examples to support the answer.
2	The response is generally correct and complete, but may contain minor errors. It contains limited examples to support the answer.
1	The response is partially correct but is incomplete and/or contains major errors. No examples are provided.

Teacher Notes

Further investigation into osmosis and the transport of water in plants can be done by observing a stalk of celery or a white carnation with the cut stem ends placed in coloured water. After a day or two, the celery may be cut at intervals and xylem tubes may be seen. In the case of the carnation, the colour of the flower itself will change. Students may also inquire about the cause of the water rising up the tube. Direct students to further research topics such as transpiration in plants, osmotic pressure, and capillary and adhesive properties of water.



Nelson Science & Technology 8
(Sections 1.12, 1.15)

Sciencepower 8 (Section 2.4)

Cells and Tissues (Video)

PRESCRIBED LEARNING OUTCOMES

SUGGESTIONS FOR INSTRUCTION

Students will...

8-1-10 Describe structural and functional relationships among cells, tissues, organs, and systems.

GLO: D1, E2

➤ **Levels of Organization**

Show students slides or pictures of cells, tissues, organs, and systems. Highlight the progression in levels of organization from cell to system.

Example:

1. Cells (e.g., muscle cells) have a particular structure and function.
2. Groups of similar cells form tissues (e.g., muscle tissue) that perform a specific function.
3. Groups of different tissues form organs (e.g., heart) that work together to perform a particular function.
4. Groups of different organs work together in organ systems (e.g., cardiovascular system) to perform a specific function.
5. Groups of different systems work together in an organism to perform all life processes.

➤ **Analogy**

Have students develop and describe an analogy for the levels of organization (from cells to systems).

Example:

1. Individual students play specialized positions (e.g., quarterback, defensive lineman) on a football team. (cells)
2. Groups of players form the offensive line with the function of scoring a goal. (tissue)
3. The offensive and defensive lines work together as a team. (organ)
4. Two teams play each other as part of a game. (system)
5. All the games are part of a league. (organism)

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

**Extended Response**

Have students complete a Word Cycle (Szabos, 1984) showing the relationships among the following: *cell, tissue, organ, organ system, cell structure, unicellular organism, multicellular organism, and cell theory.*



(For a BLM of a Word Cycle, see *SYSTH*, Attachment 10.1, or *Success*, p. 6.99.)

Scoring Rubric	
Score	Criteria
3	All connecting phrases succinctly and accurately explain the relationships among terms.
2	Most connecting phrases accurately explain the relationships among terms.
1	Several connecting phrases are missing or show a lack of understanding of the relationships among terms.

Nelson Science & Technology 8
(Section 1.12)

Sciencepower 8 (Section 3.1)

Cells and Tissues (Video)

PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p>8-1-11 Describe the structure and function of the heart and the path of blood to and from the heart through its four chambers.</p> <p>Include: atria, ventricles, septum, valves, aorta, pulmonary artery, pulmonary veins, superior vena cava, inferior vena cava.</p> <p>GLO: D1, E1</p>
<p>8-0-2a  Access information, using a variety of sources. <i>Examples: libraries, magazines, community resource people, outdoor experiences, videos, CD-ROMs, Internet...</i></p> <p>GLO: C6 (ELA Grade 8, 3.2.2)</p> <p>8-0-9e  Be sensitive and responsible in maintaining a balance between the needs of humans and a sustainable environment.</p> <p>GLO: B5</p>
<p>(continued)</p>

SUGGESTIONS FOR INSTRUCTION

➤ **The Heart**

Have students view videos, virtual dissections, and/or CD-ROM clips about the heart. Ask them to label a diagram of the heart with the following terms: *atria, ventricles, septum, valves, aorta, pulmonary artery, pulmonary veins, superior vena cava, and inferior vena cava.*

Have students answer the following questions in their science notebooks:

1. The heart acts like a _____ to push blood through the circulatory system. (pump)
2. What type of tissue is the heart made of? (muscle)
3. _____ open and close entryways into the ventricles and the pulmonary artery and aorta. (valves)
4. Which ventricle pumps the blood to the body? (left)
5. What is the name of the largest artery? (aorta)

Teacher Notes

Heart Observation Stations

Learning outcome 8-1-11 does *not* require students to participate in dissecting a heart. However, the following suggested learning activities provide students with opportunities to examine the parts of a heart by viewing a previously dissected pig heart.

Provide alternative learning experiences for those students who do not wish to view an actual heart. Various Internet sites (such as <http://www.heartlab.rrri.on.ca/dissect/dissection.html>) show pictures of pig or sheep heart dissections, along with dissection instructions.

Preparation

To set up the heart observation stations, obtain and dissect a pig heart. Review safety precautions with students and stress the importance of treating the pig heart in a respectful manner.

- *Heart Specimens:* Pig hearts can be obtained for a nominal fee at a meat packing plant. These specimens often have clots of blood in them and may have part of the aorta and/or an atrium removed. Pig hearts from a scientific supplier are cleaned and intact. If using prepared specimens, be sure to rinse hearts to remove some of the chemical preservatives.
- *Heart Dissection:* One suggested method of dissection is cutting across the apex of the pig heart and observing the differences in the muscle thickness of each ventricle.
- *Safety Precautions:* Discuss with students the importance of lab safety when dealing with dissected materials (see *Science Safety: A Kindergarten to Senior 4 Resource Manual for Teachers, Schools, and School Divisions, 1997*, pp. 11.5-11.6).



(continued)

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

Refer to the assessment strategy suggested for learning outcome 8-1-12.

Nelson Science & Technology 8
(Section 1.22)

Sciencepower 8 (Sections 3.3-3.4)

PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p>8-1-11 (continued)</p>

SUGGESTIONS FOR INSTRUCTION

(continued)

➤ **Heart Observation Stations**

Work with small groups of students at the following heart observation stations.

Station 1: Observing a Pig Heart

Have students, using their diagrams from the previous learning experiences, make labelling flags by putting dissection pins through small pieces of paper. Have them flag/label as many of the parts of the previously dissected pig heart as they can.

OR

Have students, using their diagrams, make labelling flags from small pieces of paper and tape them to the corresponding parts of a commercially purchased heart model.

Station 2: Pathway of Blood through the Heart

Have students trace the pathway of blood through the heart, beginning with the vena cava (superior or inferior) and ending with the aorta, and record its path in their science notebooks. Ask students to indicate where the blood is oxygenated (high in oxygen) and where it is deoxygenated (low in oxygen).

Station 3: Listening to the Heart

Have students listen to their own heartbeats and those of a classmate. (Having a partner of the same sex usually prevents any uneasiness with a stethoscope.)

Have students attempt to discern between the sounds of the atria contracting (soft beat-lub) and the sounds of the ventricles contracting (harder beat-dub). Ask students to determine their heart rate by counting the number of beats per minute.

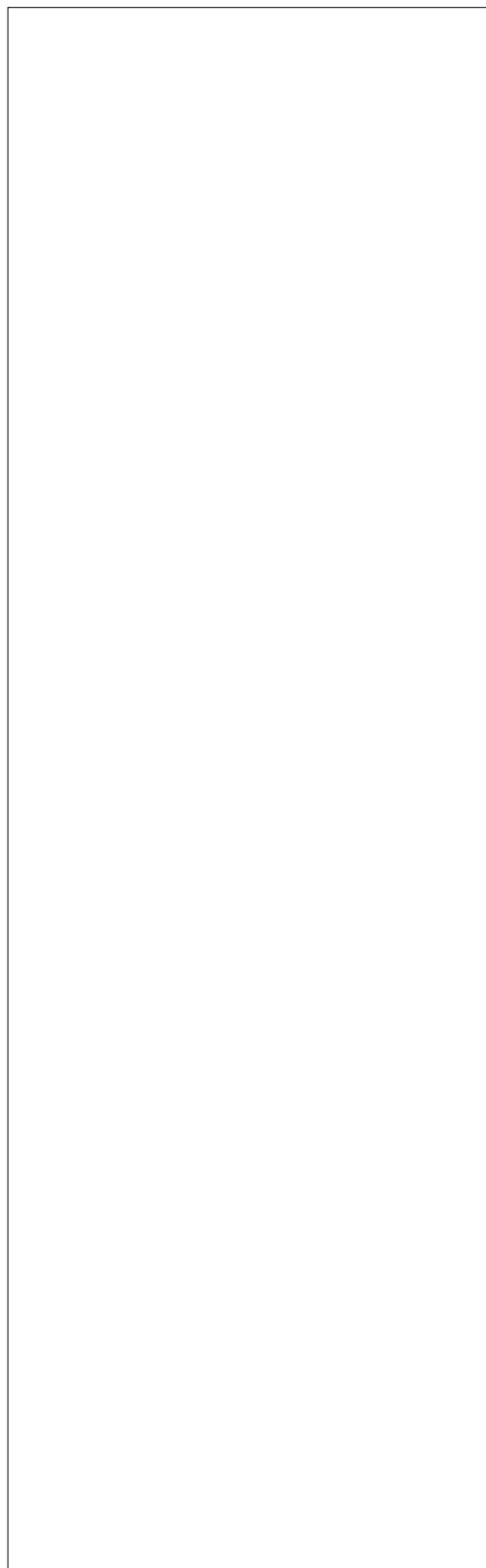
Safety Precaution: Remind students to exercise extreme caution when using a stethoscope. They should not talk into stethoscopes or bang them while someone is using them. This could lead to serious ear damage.



Station 4: Heart Puzzles

Have students complete heart and circulatory system puzzles. Puzzles, worksheets, and information pamphlets can be obtained from the Heart and Stroke Foundation of Manitoba (telephone: 204-949-2000).

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

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PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p>8-1-12 Compare and contrast the structure and function of arteries, veins, and capillaries. GLO: D1, E1</p>
<p>8-0-7f  Reflect on prior knowledge and experiences to construct new understanding and apply this new knowledge in other contexts. GLO: A2, C4 (ELA Grade 8, 1.2.1)</p> <p>8-0-7g  Communicate methods, results, conclusions, and new knowledge in a variety of ways. <i>Examples: oral, written, multimedia presentations...</i> GLO: C6 (ELA Grade 8, 4.4.1)</p>

SUGGESTIONS FOR INSTRUCTION

➤ **Blood Vessels**

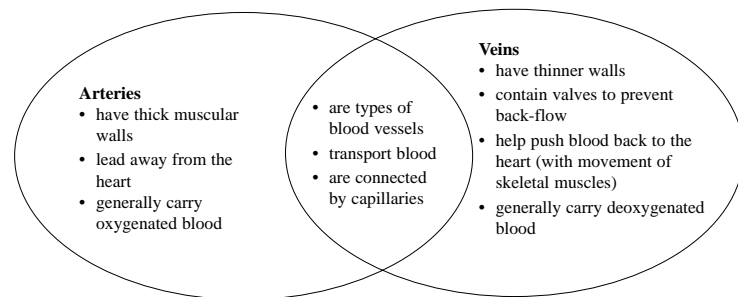
Use explicit instruction to

- introduce the concept that blood vessels are the passageways in the transport (circulatory) system
- describe the structure and function of the three main types of blood vessels (arteries, veins, and capillaries)

Have students use a Compare and Contrast sheet or a Venn diagram to illustrate their understanding of the similarities and differences between veins and arteries and ask them to include a cross-section diagram for each.

(For a BLM of a Compare and Contrast sheet, see *SYSTH*, Attachment 10.4, or *Success*, p. 6.103.)

Example:



Have students answer the following questions about capillaries in their science notebooks:

1. Describe the characteristics of a capillary. (It is one cell thick and links arteries to veins.)
2. What is the role of the capillary? (It is the location of diffusion/osmosis of nutrients, gases, and wastes.)

Teacher Notes

Links can be made to Grade 8, Cluster 3: Fluids, as well as to learning outcome 8-1-07.



SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES



Restricted Response

(Learning outcomes 8-1-11 and 8-1-12)

Provide students with the following:

Nelson Science & Technology 8
(Section 1.22)

Sciencepower 8 (Section 3.3)

Circulatory System

Name the

1. smallest blood vessel where gas and nutrient/waste exchange occurs ⊖ _ _ _ _ _
2. blood vessel that has a thin wall, has valves, and carries blood back to the heart _ _ _ ⊖ _
3. blood vessel that has thick muscular walls and carries blood away from the heart _ ⊖ _ _ ⊖ _ _
4. thick muscular portion of the heart that pumps blood into arteries _ _ _ _ _ ⊖ _ _
5. type of tissue of which the heart is made _ ⊖ ⊖ _ _ _
6. the sound that is heard through a stethoscope when listening to the heart ⊖ _ _ _ _
7. structures within the heart that close off the passageways between ventricles, atria, and blood vessels _ ⊖ _ _ _ ⊖
8. group of organs working together to perform a function _ ⊖ _ ⊖ _ _
9. largest artery in the body _ ⊖ _ _ _
10. upper chambers of the heart _ ⊖ ⊖ _ _
11. artery and vein that transports blood to and from the lungs _ _ _ _ ⊖ _ _ _ _ ⊖


Use the circled letters to form hidden words:

_ _ _ _ _

Look for:

- | | |
|--------------|---------------|
| 1. capillary | 7. valves |
| 2. vein | 8. system |
| 3. artery | 9. aorta |
| 4. ventricle | 10. atria |
| 5. muscle | 11. pulmonary |
| 6. lub dub | |

Hidden words: circulatory system

PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p>8-1-13 Identify components of blood and describe the function of each.</p> <p>Include: red blood cells carry oxygen; white blood cells fight infection; platelets clot blood; plasma is the liquid part of blood that transports blood cells, dissolved material, nutrients, and waste products.</p> <p>GLO: D1</p>
<p>8-0-2a  Access information, using a variety of sources. <i>Examples: libraries, magazines, community resource people, outdoor experiences, videos, CD-ROMs, Internet...</i></p> <p>GLO: C6 (ELA Grade 8, 3.2.2)</p>

SUGGESTIONS FOR INSTRUCTION

➤ **Viewing Components of Blood**

Provide students with a list of the major components of blood (*red blood cells, white blood cells, platelets, and plasma*) and have them use print and/or electronic resources to obtain information about the function of each component. This would be an opportunity for students to practise using search tools on the Internet.

In addition, have students use a microscope to view prepared slides of blood cells. Ask them to organize their information and observations for each component of blood using the Three-Point Approach (Simons, 1991).

(For a BLM of the Three-Point Approach for Words and Concepts, see *SYSTH*, Attachment 10.2, or *Success*, p. 6.101.)

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

**Restricted Response**

Note: This learning activity may be used as an Exit Slip. Provide students with the following:

Vocabulary Review

Choose the word or phrase from the list below that best describes the definition.

red blood cell	white blood cell	platelets	plasma
----------------	------------------	-----------	--------

1. _____ the fluid portion of blood that transports blood cells, nutrients, wastes, dissolved gases, hormones, and antibodies.
2. _____ contain(s) hemoglobin and carries oxygen.
3. _____ combat(s) infections.
4. _____ clot(s) blood.

Look for:

1. plasma
2. red blood cell
3. white blood cell
4. platelets

Nelson Science & Technology 8
(Section 1.15)

Sciencepower 8 (Section 3.4)

PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
8-1-14 Describe, using examples, how individual systems in the human body function interdependently. GLO: D1, E2
8-0-7f c Reflect on prior knowledge and experiences to construct new understanding and apply this new knowledge in other contexts. GLO: A2, C4 (ELA Grade 8, 1.2.1)

SUGGESTIONS FOR INSTRUCTION

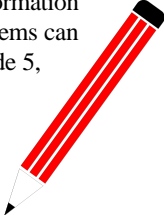
➤ **Web of Life**

Have students place the names of the major body systems in a circle around the edge of a blank piece of paper. Ask them to make as many connections as possible among the systems by joining them with lines and writing on the lines how the systems are related.

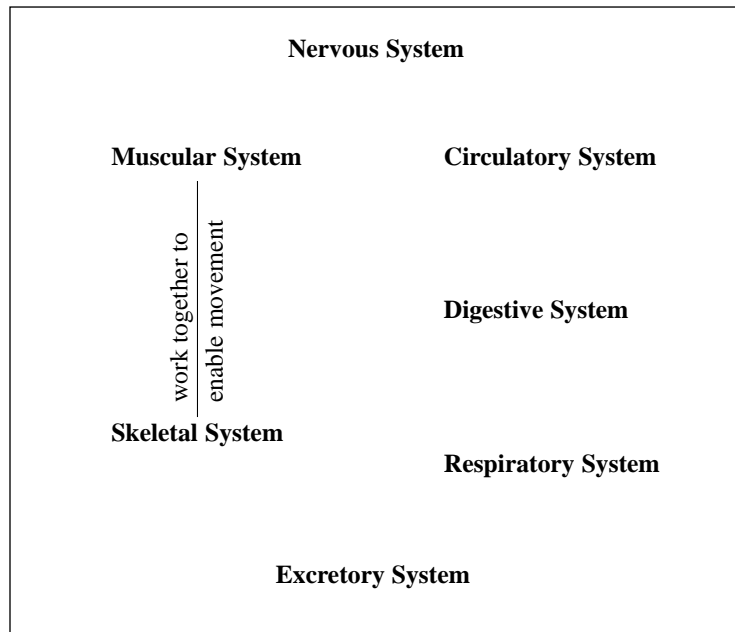
Example:

Teacher Notes

Background information on the body systems can be found in Grade 5, Cluster 1: Maintaining a Healthy Body.

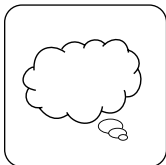


Word Web



SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES



Journal Reflection

Have students reflect on the following in their science journals:



Interdependence

1. Why is it important for you to be aware of how your body systems are interdependent?
2. Why is it important for your doctor to be aware of how body systems are interdependent?

Nelson Science & Technology 8
(Section 1.21)

Sciencepower 8 (Section 3.3)

PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p>8-1-15 Compare heart rate and respiratory rate before, during, and after various physical activities; explain the observed variations; and discuss implications for overall health. GLO: B3, C2, D1, E3</p> <p>8-0-1a ☐ Formulate specific questions that lead to investigations. Include: rephrase questions to a testable form; focus research questions. GLO: A1, C2 (ELA Grade 8, 3.1.2; Math: SP-I.1.8)</p> <p>8-0-1b ☐ Select and justify a method to be used in finding the answer to a specific question. GLO: C2 (ELA Grade 8, 3.2.3; Math: SP-II.1.8)</p> <p>8-0-3a ☐ Formulate a prediction/hypothesis that identifies a cause and effect relationship between the dependent and independent variables. GLO: A2, C2 (Math: SP-I-1.8)</p> <p>8-0-3b Identify the independent and dependent variables in an experiment. GLO: A2, C2</p> <p>8-0-3c ☐ Create a written plan to answer a specific question. Include: apparatus, materials, safety considerations, steps to follow, and variables to control. GLO: C2 (ELA Grade 8, 3.1.4)</p> <p>8-0-4a ☐ Carry out procedures that comprise a fair test. Include: controlling variables, repeating experiments to increase accuracy and reliability. GLO: C2</p> <p>8-0-4c ☐ Work cooperatively with team members to carry out a plan, and troubleshoot problems as they arise. GLO: C7 (ELA Grade 8, 5.2.2)</p> <p>8-0-4e ☐ Demonstrate work habits that ensure personal safety, the safety of others, and consideration for the environment. Include: keeping an uncluttered workspace; putting equipment away after use; handling glassware with care; wearing goggles when required; disposing of materials safely and responsibly. GLO: C1</p> <p>8-0-5a ☐ Make observations that are relevant to a specific question. GLO: A1, A2, C2</p> <p>8-0-5c Select and use tools to observe, measure, and construct. Include: microscope, concave and convex mirrors and lenses, chemical indicators. GLO: C2, C3, C5</p> <p>8-0-5e ☐ Estimate and measure accurately using SI and other standard units. Include: determining volume by displacement of water. GLO: C2, C5 (Math: SS-IV.1.6, SS-III.1.5, Math: SS-III.1.6, SS-I.1.5)</p>
<i>(continued)</i>

SUGGESTIONS FOR INSTRUCTION

➤ **Effects of Activity Level on Heart and Respiratory Rates**

Part A: Finding a Pulse

Have students find their pulse using their index and middle fingers, not the thumb. Good locations for finding the pulse include the underside of the left wrist (down from the thumb to the wrist area), the carotid arteries in the neck (just below the jawbone), and the temple. Students can calculate their pulse rate by counting their pulse for 10 seconds and then multiplying by six.

Part B: Designing an Experiment

Have students plan and conduct an experiment to answer the following question: How does activity level affect heart rate and respiratory rate? Ask students to graph their data.

Sample Data Table:

Heart and Respiratory Rates

Activity	Sitting	Standing	Running on the spot for two minutes	Four minutes after running
Heart Rate				
Respiratory Rate*				

*Calculate the respiratory rate by counting how many breaths are taken in 10 seconds and then multiplying by six.

For instructional and assessment suggestions to aid students in understanding the process of collecting data, grouping data, displaying data, and drawing conclusions from data, refer to *Grades 5 to 8 Mathematics: A Foundation for Implementation*, Statistics and Probability, pp. C26-C43, and Appendix (Teacher Information: Venn, Tree, and Carroll Diagrams; and Graphs, Tables, and Lists).

Have students answer the following questions in their science notebooks:

1. Why does your respiratory (breathing) rate increase as your activity level increases?
(Muscles need oxygen to create energy to move. When your activity level increases, your breathing rate increases so that you can get more oxygen.)

(continued)

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SUGGESTIONS FOR ASSESSMENT

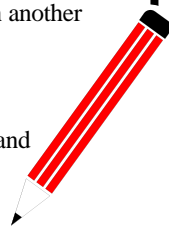
SUGGESTED LEARNING RESOURCES

Teacher Notes

This learning activity provides an opportunity to demonstrate the link between the respiratory and circulatory systems. Emphasize that the harder the body works, the greater the demand for oxygen and “nutrients” from the cells will be. Therefore, the respiratory system will need to work faster to provide more oxygen and dispose of increased amounts of carbon dioxide. In order for the respiratory system to achieve this, the circulatory (transport) system also must work faster. Both of these can be measured by recording pulse rate and respiratory rate.

Allow students with health concerns to opt out of the physical portion of Part B of the suggested learning activity and provide them with another student’s data or fictitious data.

Refer to *Kindergarten to Senior 4 Physical Education/Health Education: Manitoba Curriculum Framework of Outcomes for Active Healthy Lifestyles* (2000) for related learning outcomes and teacher support.



Sciencepower 8 (Section 3.0)

PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
8-1-15 (continued)
<p>8-0-5f C Record, compile, and display observations and data, using an appropriate format. GLO: C2, C6 (ELA Grade 8, 3.3.1; Math: SP-III.2.8)</p> <p>8-0-6a Construct graphs to display data, and interpret and evaluate these and other graphs. <i>Examples: circle graphs...</i> GLO: C2, C6 (ELA Grade 8, 3.3.1; Math: SP-III.2.7; TFS: 4.2.2–4.2.6)</p> <p>8-0-6b C Interpret patterns and trends in data, and infer and explain relationships. GLO: A1, A2, C2, C5</p> <p>8-0-6c C Identify strengths and weaknesses of different methods of collecting and displaying data, and potential sources of error. GLO: A1, A2, C2, C5 (ELA Grade 8, 3.3.3)</p> <p>8-0-6f C Identify how the original plan evolved and justify the changes. GLO: C2, C3 (ELA Grade 8, 3.3.4)</p> <p>8-0-7a C Draw a conclusion that explains investigation results. Include: explaining the cause and effect relationship between the dependent and independent variables; identifying alternative explanations for observations; supporting or rejecting a prediction/hypothesis. GLO: A1, A2, C2 (ELA Grade 8, 3.3.4)</p> <p>8-0-7b C Critically evaluate conclusions, basing arguments on fact rather than opinion. GLO: C2, C4</p> <p>8-0-7h C Identify and evaluate potential applications of investigation results. GLO: C4</p>

SUGGESTIONS FOR INSTRUCTION

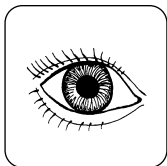
(continued)

2. Why does your heart rate increase as your activity level increases?
(As your activity level increases, your cells need more oxygen and nutrients to fuel your muscles. This means that the circulatory system has to transport more oxygen and nutrients to the muscle cells and, therefore, the heart has to beat faster.)
3. What are some factors, other than increased activity level, that might affect your breathing rate?
(Breathing rate can be affected by a variety of factors: respiratory system illnesses such as colds, asthma, pneumonia, and emphysema; other illnesses that require more oxygen for cells; smoking, which may cause passageways to work less effectively and, therefore, work harder to acquire oxygen; stress and anxiety.)
4. What potential sources of error may have occurred while you were collecting data?
(Perhaps you could not find your pulse, were taking your pulse with your thumb, the pulse became weak and you lost sensation of it, or you lost count.)
5. The heart rate you recorded while sitting is called your basal or resting heart rate. Why might not everyone have the same basal heart rate?
(Differences in basal heart rate may be due to factors such as physical condition, health, and metabolism.)
6. Why might heart rates differ from student to student after they run for two minutes?
(Heart rates may vary, depending on the physical condition, health, running pace, etc. of the individual runners.)
7. How soon your heart rate returns to normal depends on your physical condition. What are some things you can do to keep your heart healthy and in good condition?
(You can exercise, maintain a healthy diet, avoid smoking, and so on.)

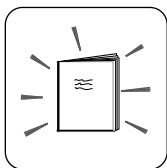
SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

Refer to the following BLMs for assessing Part B: Designing an Experiment.



“Conducting a Fair Test: Observation Checklist”
(BLM 8-Q)



“Experiment Report: Assessment Checklist”
(BLM 8-S)

A large, empty rectangular box with a thin black border, intended for listing suggested learning resources.

PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p>8-1-16 Identify components of the primary and secondary defence systems of the human body, and describe their roles.</p> <p>Include: primary defence system—skin, tears, ear wax, saliva, gastric juices, cilia hairs; secondary defence system—white blood cells, antibodies.</p> <p>GLO: D1, E2</p> <p>8-1-17 Identify medical advances that enhance the human body’s defence mechanisms and describe their effects on society.</p> <p><i>Examples: vaccines, antibiotics...</i></p> <p>GLO: A5, B1, B2, B3</p>
<p>8-0-1c Identify practical problems to solve. <i>Examples: How can I make water flow uphill? Which type of bottled water should I buy?...</i> GLO: C3</p> <p>8-0-1d ☐ Select and justify a method to be used in finding a solution to a practical problem. GLO: C3 (Math: SP-II.1.8)</p> <p>8-0-2a ☐ Access information, using a variety of sources. <i>Examples: libraries, magazines, community resource people, outdoor experiences, videos, CD-ROMs, Internet...</i> GLO: C6 (ELA Grade 8, 3.2.2)</p> <p>8-0-2b Develop and use criteria for evaluating information sources. Include: distinguish between fact and opinion. GLO: C6, C8 (ELA Grade 8, 3.2.2, 3.2.3; TFS 2.2.2)</p> <p>8-0-2c Make notes in point form, summarizing major ideas and supporting details and referencing sources. GLO: C6 (ELA Grade 8, 3.3.2)</p> <p>8-0-3d ☐ Develop criteria to evaluate a prototype or consumer product. Include: function, aesthetics, environmental considerations, cost, efficiency. GLO: C3</p> <p>8-0-3e ☐ Create a written plan to solve a problem. Include: materials, safety considerations, three-dimensional sketches, steps to follow. GLO: C3, C6</p> <p>8-0-4b ☐ Construct a prototype. GLO: C3</p> <p>8-0-5b ☐ Test a prototype or consumer product, using predetermined criteria. GLO: C3, C5</p> <p>8-0-6d ☐ Identify and make improvements to a prototype, and explain the rationale for the changes. GLO: C3, C4</p>

SUGGESTIONS FOR INSTRUCTION

➤ **Research Project**

Have students brainstorm ways in which the body defends itself and ways in which medical advances enhance the body’s defence mechanisms. (Students have had cluster-related experience in Grade 5, Cluster 1: Maintaining a Healthy Body.) Compile student responses into a class chart. Add other applicable components (see the “Include” portion of learning outcome 8-1-16 and the “Examples” portion of learning outcome 8-1-17).

Have students work in groups to research an assigned component of the body’s defence system or a medical advance that enhances the body’s defence mechanism. Have students share their findings and compile them into a class reference resource (to be used in conjunction with the following learning experience).

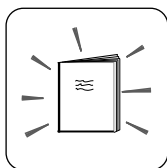
➤ **Creating a Board Game: Defend Your Health**

Using the design process, have students create a board game that incorporates information derived from the class research findings (about the body’s defence system and medical advances related to this system) from the previous learning experience. As a class, develop criteria to assess the game (e.g., type of game, number of players).

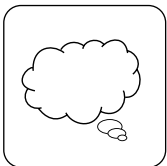
<p>8-0-7d ☐ Propose and justify a solution to the initial problem. GLO: C3</p> <p>8-0-7e ☐ Identify new practical problems to solve. GLO: C3</p> <p>8-0-7g ☐ Communicate methods, results, conclusions, and new knowledge in a variety of ways. <i>Examples: oral, written, multimedia presentations...</i> GLO: C6 (ELA Grade 8, 4.4.1)</p> <p>8-0-7h ☐ Identify and evaluate potential applications of investigation results. GLO: C4</p> <p>8-0-8b ☐ Describe examples of how scientific knowledge has evolved in light of new evidence, and the role of technology in this evolution. GLO: A2, A5, B1</p> <p>8-0-8d ☐ Describe examples of how technologies have evolved over time in response to changing needs and scientific advances. GLO: A5, B1, B2</p> <p>8-0-8g ☐ Discuss societal, environmental, and economic impacts of scientific and technological endeavours. Include: local and global impacts. GLO: A1, B1, B3, B5</p>

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES



Refer to “Design Project Report: Assessment” (BLM 8-P) when assessing students’ Defend Your Health board games.



Peer Assessment: Defend Your Health Board Game

Provide students with the following tool for peer assessment of board games:

Nelson Science & Technology 8
(Section 1.16)

Sciencepower 8 (Chapter 3—Ask an Expert)


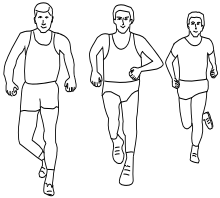


Peer Assessment of Board Game				
Board game developers: _____				
Peer assessors: _____				
Rating Scale				
Criteria	Poor	Good	Excellent	
• game instructions are clear and easy to follow	1	2 3	4	5
• game shows creativity	1	2 3	4	5
• game is aesthetically pleasing	1	2 3	4	5
• game content includes reference to	1	2 3	4	5
— all primary defense systems (skin, tears, ear wax, saliva, gastric juices, and cilia hairs)				
— secondary defense systems (white blood cells and antibodies)				
— vaccines and antibodies				
Constructive comments:				

PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p>8-1-18 Research and describe disorders/diseases that affect body systems, and identify possible preventative measures.</p> <p><i>Examples: liver disease, diabetes, multiple sclerosis, heart attack, stroke, high/low blood pressure, leukemia, anemia, high cholesterol...</i></p> <p>GLO: B3, C6, D1</p>
<p>8-0-2a Access information, using a variety of sources. <i>Examples: libraries, magazines, community resource people, outdoor experiences, videos, CD-ROMs, Internet...</i> GLO: C6 (ELA Grade 8, 3.2.2)</p> <p>8-0-2b Develop and use criteria for evaluating information sources. Include: distinguish between fact and opinion. GLO: C6, C8 (ELA Grade 8, 3.2.2, 3.2.3; TFS 2.2.2)</p> <p>8-0-2c Make notes in point form, summarizing major ideas and supporting details and referencing sources. GLO: C6 (ELA Grade 8, 3.3.2)</p> <p>8-0-4c Work cooperatively with team members to carry out a plan, and troubleshoot problems as they arise. GLO: C7 (ELA Grade 8, 5.2.2)</p> <p>8-0-4d Identify and assume various roles to achieve group goals. GLO: C7 (ELA Grade 8, 5.2.2)</p> <p>8-0-7g Communicate methods, results, conclusions, and new knowledge in a variety of ways. <i>Examples: oral, written, multimedia presentations...</i> GLO: C6 (ELA Grade 8, 4.4.1)</p> <p>8-0-7h Identify and evaluate potential applications of investigation results. GLO: C4</p>

SUGGESTIONS FOR INSTRUCTION

➤ **Synectics**

Place each of the following pictures on a separate card. Have students form small groups and give one picture to each group, asking students to list some qualities/characteristics about their picture (e.g., identify what it is made of, its use), make a connection between their picture and the human defense system, and share their findings with the class.

 <p style="text-align: center;">castle</p>	 <p style="text-align: center;">sports team</p>
 <p style="text-align: center;">sunscreen</p>	 <p style="text-align: center;">cucumber</p>

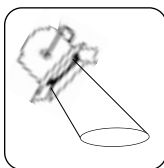
➤ **Research Project**

Have students, working in groups, use various forms of research materials (e.g., videos, health pamphlets, Internet resources, print texts, interviews) to obtain information about a disorder/disease that affects body systems. Ask students to present their findings in a short class presentation that incorporates visuals (e.g., a short film/video clip, pictures, audio/video clips of an interview, computer-generated presentation, pamphlets, sphygmomanometer [blood pressure cuff], stethoscope).

(For instructional and assessment suggestions to aid students in developing appropriate delivery skills for use in presentations, as well as public listening and viewing behaviours, refer to 5-8 ELA, learning outcomes 4.4.2–4.4.3.)

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES





Peer Assessment: Oral Presentation

Provide students with the following tool for peer assessment of research report presentations:

Peer Assessment of Research Report				
Presenters: _____				
Topic: _____				
Peer Assessor: _____				
Rating Scale				
Criteria	Poor	Good	Excellent	
The speaker				
• spoke so that everyone could hear	1	2	3	4 5
• described the condition/disease	1	2	3	4 5
• described factors that caused the condition	1	2	3	4 5
• described possible preventions	1	2	3	4 5
• used visuals	1	2	3	4 5
• kept the interest of the group	1	2	3	4 5
Constructive comments:				

Sciencepower 8 (Sections 2.3, 3.3-3.4, Chapter 3—Ask an Expert)

PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p>8-1-19 Describe functional similarities and differences of comparable structures and systems in different groups of living things.</p> <p><i>Examples: movement, food intake, and digestion of a unicellular organism, an invertebrate, and a vertebrate; gas exchange in plants versus animals...</i></p> <p>GLO: D1, E1</p>
<p>8-0-2a  Access information, using a variety of sources. <i>Examples: libraries, magazines, community resource people, outdoor experiences, videos, CD-ROMs, Internet...</i></p> <p>GLO: C6 (ELA Grade 8, 3.2.2)</p> <p>8-0-5f  Record, compile, and display observations and data, using an appropriate format. GLO: C2, C6 (ELA Grade 8, 3.3.1; Math: SP-III.2.8)</p>

SUGGESTIONS FOR INSTRUCTION

➤ **Comparing Living Things**

Ask students to research print and electronic texts for information on how systems and structures in different organisms compare to each other. Have them organize their information in chart form.

Example:

Comparison of Structures and Systems in Living Organisms

	Paramecium	Frog	Geranium Plant	Human	Invertebrate
Movement					
Food Intake					
Digestion					
Gas Exchange					

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

Nelson Science & Technology 8
(Sections 1.13, 1.18-1.19, 1.21-1.23)

Sciencepower 8 (Sections 3.2-3.3)

Notes