

DOCUMENT ORGANIZATION

The prescribed learning outcomes and the suggestions for instruction, assessment, and learning resources contained within *Senior 1 Science: A Foundation for Implementation* provide teacher educators with a plan for achieving the student learning outcomes identified in *Senior 1 Science: Manitoba Curriculum Framework of Outcomes* (2000). The document is organized by clusters; Cluster 0: Overall Skills and Attitudes is followed by the four “thematic” clusters. In addition, the appendices comprise Student Learning Activities, Teacher Support Materials, and Blackline Masters. These complementary materials are designed to support, facilitate, and enhance student learning and assessment by being closely linked to the learning outcomes and the skills and attitudes.

Guide to Reading the Specific Learning Outcomes and the Four-Column Format

- The Prescribed Learning Outcomes identified in column one outline the intended learning to be achieved by the student by the end of the course of instruction. They include the specific learning outcomes related to the thematic cluster in addition to the learning outcomes related to Cluster 0: Overall Skills and Attitudes selected to correspond to the Suggestions for Instruction.
- Column two contains Suggestions for Instruction directly related to the achievement of the specific learning outcomes contained in the first column.
- Column three assists teachers with Suggestions for Assessment of the specific learning outcomes.
- Column four cites suggested approved Learning Resources intended to guide and support instruction, the learning process, and student assessment.
- Teacher Background information provides planning hints, special interest material, and depth of treatment on certain issues related to the learning outcomes. These are incorporated as text boxes in either column two or three.

The pages that follow provide detailed clarification on reading the four-column format.

The Four-Column Format

Prescribed learning outcome statements that define what students are expected to achieve at the end of each grade

Suggestions for student learning experiences directly related to the attainment of specific learning outcomes

Suggested time for instruction

Learning outcomes related to thematic clusters

Learning outcomes related to Cluster 0, Overall Skills and Attitudes, selected to correspond to Suggestions for Instruction

Senior 1 Science: A Foundation for Implementation

PRESCRIBED LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION (2 HOURS)
<p><i>Students will...</i></p> <p>S1-1-03 Describe various types of asexual reproduction that occur in plant and animal species. <i>Examples: fission, budding, sporulation, vegetative propagation, regeneration...</i> GLO: D1, E1</p>	<p>➤ Entry-Level Knowledge Students have studied the difference between unicellular and multicellular organisms in Grade 8, but have not examined reproduction.</p> <p>➤ Notes for Instruction Most students will have some life experience with asexual reproduction. Encourage them to share their experience with the class through guided discussion or question and answer. Different methods of vegetative reproduction will be studied in greater detail in outcome S1-1-04.</p>
<p style="text-align: center;">Skills and Attitudes Outcomes</p> <p>S1-0-2c. Summarize and record information in a variety of forms. Include: paraphrasing, quoting relevant facts and opinions, proper referencing of sources. (ELA: S1: 3.3.2) GLO: C2, C4, C6; TFS: 2.3.1, 4.3.4</p> <p>S1-0-4e. Work cooperatively with group members to carry out a plan, and troubleshoot problems as they arise. (ELA: S1: 3.1.3, 5.2.2) GLO: C2, C4, C7</p> <p>S1-0-5c. Record, organize, and display data using an appropriate format. Include: labelled diagrams, graphs, multimedia. (ELA: S1: 4.1.1, 4.1.2) GLO: C2, C5; TFS: 1.3.1, 3.2.2</p> <p>S1-0-7e. Reflect on prior knowledge and experiences to develop new understanding. (ELA: S1: 4.2.1) GLO: C2, C3, C4</p>	<p>➤ Student Learning Activities</p> <p>Collaborative Teamwork S1-0-4e Students use a Jigsaw or Roundtable to learn about the various types of asexual reproduction. <i>Expert Groups:</i> Each student group investigates one form of asexual reproduction (regeneration, budding, sporulation, fission, vegetative propagation), and then shares its findings with the rest of the class. (See <i>Success for All Learners</i>, Chapter 5)</p> <p>Visual Displays S1-0-2c, 5c Students draw diagrams or create posters describing various types of asexual reproduction. (See Appendix 1.3) Students complete Three-Point Approach frames to demonstrate their understanding of vocabulary. (See <i>SYSTH</i>, page 10.9)</p> <p>Journal Writing S1-0-7e Students reflect on ways in which the process of regeneration may be useful to humans. (See <i>SYSTH</i>, Chapter 13) Students prepare a glossary of new words and their meanings for quick reference. Students reflect and respond to the following questions:</p> <ul style="list-style-type: none"> • How has your understanding of reproduction changed since the beginning of this unit? • What new questions do you have about reproduction? • What new discoveries in this cluster surprise you?

1.6

Suggestions for assessing specific learning outcome(s)

Suggestions for learning resources including print and information technology resources

Senior 1, Cluster 1: Reproduction

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

Rubrics/Checklists

Rubrics or checklists can be used for peer-, self-, or teacher-assessment.

Written Quiz/Test

Students

- identify examples of asexual reproduction based on their observations of microscope slides, pictures, or diagrams.
- describe different types of asexual reproduction.
- differentiate among alternative forms of asexual reproduction.
- explain why cutting individual starfish into pieces will increase the starfish population.

Visual Displays S1-0-2c, 5c

Students or student groups prepare visual displays of the various types of asexual reproduction. The displays may include:

- posters
- diagrams
- information technology presentations

Journals

Assess journal entries using a Journal Evaluation rubric. (See *SYSTH*, page 13.21)

Science 9

- 5.4 The Importance of Cell Division, p. 148
- 5.8 Reproduction and Cell Division, p. 159
- 6.5 Regeneration, p. 186
- 6.9 Cloning, p. 194

TSM-3 Cooperative Learning

Sciencepower 9

- 1.3 The Cell Cycle in Your Body, p. 24
- 1.4 Asexual Reproduction In Bacteria, Protists, Fungi, and Animals, p. 29
Investigation 1-D: Be a Biologist: Assess Asexual Reproduction, pp. 31–36
- 1.5 Asexual Reproduction In Plants, pp. 24–25

- BLM 1-23 Investigation 1-D: Be a Biologist: Assess Asexual Reproduction
- BLM 1-24 Mitosis and Cell Division in an Amoeba
- BLM 1-25 Asexual Reproduction Crossword

Appendices

- 1.3 Blackline Master Types of Asexual Reproduction

SYSTH

- 3.7 Cooperative Learning and Science
- 10.9 Building a Scientific Vocabulary
- 13 Writing to Learn Science

Success for All Learners

- 5 Flexible Grouping
- 5.3 Individual, Small-Group, and Whole-Class Work

References to blackline masters (BLM) and Teacher Support Materials (TSM) in print resources

Teacher Background

Some examples of organisms that use various methods of asexual reproduction include:

- *regeneration*: starfish, planaria
- *budding*: sponges, hydra
- *sporulation*: bread mould, wheat rust
- *fission*: amoebas, bacteria
- *vegetative propagation*: poplars, strawberries

Note: Reproduction refers to the processes by which a new generation of cells or multicelled individuals is produced. Sexual reproduction requires meiosis, formation of gametes, and fertilization (with the exception of parthenogenesis). Asexual reproduction refers to the production of new individuals by any mode that does not involve formation of gametes.



Background information and/or definitions for teachers, often beyond what students are required to know; safety information

Guide to Reading Specific Learning Outcomes

Senior 1 Science: A Foundation for Implementation	
PREScribed LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION (3 HOURS)
<p><i>Students will...</i></p> <p>S1-1-11 Observe, collect, and analyze class data of single trait inheritance. <i>Examples: hand clasping, earlobe attachment, tongue rolling...</i> GLO: C2, D1</p> <p>S1-1-12 Differentiate between dominant and recessive traits. Include: genotype and phenotype GLO: D1, E1, E2</p>	<p>Entry-Level Knowledge Students have not previously studied genetics and heredity but may be familiar with the inheritance of some traits such as eye colour.</p> <p>Notes for Instruction Outcomes S1-1-11 and S1-1-12 can be learned together. Discuss examples of human dominant and recessive traits, including: <ul style="list-style-type: none"> • eye colour: brown = dominant, blue = recessive • chin shape: cleft = dominant, smooth = recessive • earlobes: free = dominant, attached = recessive See Appendix 1.6 for additional traits. Use diagrams/overheads to show that dominant traits are identified with upper case letters and recessive traits with lower case (e.g., dimples = D, no dimples = d). Differentiate between genotype and phenotype. Demonstrate how dominant genotype produces the dimple phenotype and recessive genotype results in the non-dimple phenotype. Use Punnett squares to predict the results of a cross. See the Appendix for additional examples of discussing traits inherited by several students may be by their natural parents.</p>
<p>Skills and Attitudes Outcomes</p> <p>S1-0-1a Propose questions that could be tested experimentally. (ELA: S1: 3.1.2) GLO: C2</p> <p>S1-0-1b Select and justify various methods for finding the answers to specific questions. (Math: S1: A-1) GLO: C2</p> <p>S1-0-2c Summarize and record information in a variety of forms. Include: paraphrasing, quoting relevant facts and opinions, proper referencing of sources. (ELA: S1: 3.3.2) GLO: C2, C4, C6; TFS: 2.3.1, 4.3.4</p> <p>S1-0-3a State a testable hypothesis or prediction based on background data or on observed events. GLO: C2</p> <p>S1-0-4e Work cooperatively with group members to carry out a plan, and troubleshoot problems as they arise. (ELA: S1: 3.1.3, 5.2.2) GLO: C2, C4, C7</p> <p>S1-0-5c Record, organize, and display data using an appropriate format. Include: labelled diagrams, graphs, multimedia (ELA: S1: 4.1.1, 4.1.2) GLO: C2, C5; TFS: 1.3.1, 3.2.2</p>	<p>Student Learning Class Discussion Students use their knowledge to discuss the inheritance of traits. They would like to know how traits are inherited. Examples of traits that are inherited are brown eyes, freckles, and sexual orientation.</p> <p>Journal Students discuss the inheritance of traits.</p>

PREScribed LEARNING OUTCOMES

Students will...

S1-1-11 Observe, collect, and analyze class data of single trait inheritance.
Examples: hand clasping, earlobe attachment, tongue rolling...
GLO: C2, D1

S1-1-12 Differentiate between dominant and recessive traits.
Include: genotype and phenotype
GLO: D1, E1, E2

Skills and Attitudes Outcomes

S1-0-1a. Propose questions that could be tested experimentally.
(ELA: S1: 3.1.2) GLO: C2

S1-0-1b. Select and justify various methods for finding the answers to specific questions.
(Math: S1: A-1) GLO: C2

S1-0-2c. Summarize and record information in a variety of forms.
Include: paraphrasing, quoting relevant facts and opinions, proper referencing of sources.
(ELA: S1: 3.3.2) GLO: C2, C4, C6;
TFS: 2.3.1, 4.3.4

S1-0-3a. State a testable hypothesis or prediction based on background data or on observed events.
GLO: C2

S1-0-4e. Work cooperatively with group members to carry out a plan, and troubleshoot problems as they arise.
(ELA: S1: 3.1.3, 5.2.2) GLO: C2, C4, C7

S1-0-5c. Record, organize, and display data using an appropriate format.
Include: labelled diagrams, graphs, multimedia
(ELA: S1: 4.1.1, 4.1.2) GLO: C2, C5;
TFS: 1.3.1, 3.2.2

First digit indicates grade; second digit indicates cluster number; third digit(s) indicates specific learning outcome number

Example: Provides ideas of what could be included (non-mandatory)

Include: Indicates a mandatory component of the specific learning outcome

Cross-reference to general learning outcomes. (See Appendix)

Cross-reference to other areas: mathematics (Math), English language arts (ELA), Technology as a Foundation Skill Area (TFS)