The prescribed learning outcomes and the suggestions for instruction, assessment, and learning resources contained within *Senior 2 Science: A Foundation for Implementation* provide teachers with a plan for helping students achieve the learning outcomes identified in *Senior 2 Science: Manitoba Curriculum Framework of Outcomes* (2001). 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 1 outline the intended learning to be achieved by the student by the end of the course. 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 2 contains **Suggestions for Instruction** directly related to the achievement of the specific learning outcomes contained in the first column.

- Column 3 assists teachers with **Suggestions for Assessment** of the specific learning outcomes.

- Column 4 cites **Suggested Learning Resources** recommended 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 column two or three.

The pages that follow provide detailed clarification on reading the four-column format.
### Prescribed Learning Outcomes

<table>
<thead>
<tr>
<th>Students will...</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S2-2-01</strong> Relate an element’s position on the periodic table to its combining capacity (valence). Include: alkali metals, alkaline earth metals, chalcogens, halogens, noble gases</td>
</tr>
<tr>
<td>GLO: D3, D4, E1</td>
</tr>
</tbody>
</table>

### Suggested Time for Instruction

**1 hour**

#### Notes for Instruction

A review of atomic structure and Bohr models, as well as the design of the periodic table from Senior 1, may be a starting point for this cluster. A knowledge chart or sort and predict activity may be used (see *SITH 9.25, 10.23*).

Bohr diagrams are useful to illustrate the number of electrons found within the valence shells, and to help students visualize how atoms lose, gain, or share electrons to fill their valence shells and become stable.

Introduce electron (Lewis) dot diagrams as an alternative means of representing atoms and their valence electrons. They are valuable tools for describing, predicting, and explaining compound formation. Have students draw electron dot diagrams for the first 20 elements on the periodic table. It is strongly recommended that details of the periodic table not be memorized. However, the characteristics of the periodic table do provide a powerful conceptual and organizational tool.

#### Student Learning Activities

**Class Discussion**

Examine how the periodic table and Bohr models are used to determine the combining capacity of selected element groups. Have students brainstorm answers to questions such as “Why do elements of the same group have similar properties?” and “What is it about the properties of metals and non-metals that allow one to predict the types of compounds they are likely to form?”

Knowing the number of valence electrons will help students predict the formation of compounds.

**Visual Displays/Collaborative Teamwork** S2-0-2c, 5c

Students or student groups create posters illustrating Bohr models and electron (Lewis) dot diagrams for the first three elements found within the alkali metal, alkaline earth metal, chalcogen, halogen, and noble gas families. The displays can be exhibited in the room for future reference. See Appendix 2.1 for Lewis dot diagrams.

**Journal Entry S2-0-7f**

Students complete a Word Cycle of terms related to this topic (see *SITH 10.21*).
Suggestions for assessing specific learning outcome(s)

Suggestions for learning resources including print and information technology resources

**Senior 2, Cluster 2: Chemistry in Action**

**SUGGESTIONS FOR ASSESSMENT**

**Rubrics/Checklists**
See Appendix 6 for a variety of rubrics and checklists that can be used for self-, peer-, and teacher-assessment.

**Visual Display S2-0-2c, 5e**
Students or student groups present their posters. Repetition occurring for the number of valence electrons found within each of the families should be noted.

**Journal Writing S2-0-7f**
Assess journal entries using a Journal Evaluation form (see SYSTH 13.21).

**Pencil-and-Paper Tasks**
Students
- draw Bohr models of atoms when provided with their atomic mass and atomic number
- draw electron (Lewis) dot diagrams of atoms
- predict the number of valence electrons present in an atom from its position on the periodic table
- identify the location of the following families on the periodic table: alkali metals, alkaline earths, chalcogens, halogens, noble gases
- predict whether an atom will lose, gain, or share electrons, based on its position on the periodic table
- explain why atoms lose, gain, or share electrons
- complete a Word Cycle of the following terms: valence, period, noble gas, periodic table, atom, metals, halogens, atomic number, family (see SYSTH 10.21)

**SUGGESTED LEARNING RESOURCES**

**Science 10**
5.5 Elements and the Periodic Table
BLM 5.5a Periodic Table of the Elements

**Science Power 10**
5.1 Looking for Patterns in Chemical Reactivity
BLM 5-2 Periodic Table Scavenger Hunt
BLM 5-3 Anatomy of an Atom
BLM 5-6 Electron Shells
BLM 5-9 Reviewing the Periodic Table of the Elements

**SYSTH**
9.25 Knowledge Chart
10.21 Word Cycle
10.23 Sort and Predict
13.21 Journal Evaluation

**Appendices**
2.1 Lewis Dot Diagrams
6.1 Rubric for the Assessment of Class Presentations

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**Teacher Background**
Elements in the same group have similar properties because they have the same number of electrons in their outer shell. The outer electron shell of an atom is also known as the valence shell. The electrons in this shell are called valence electrons.

The arrangement of the valence electrons is key to understanding the formation of compounds. Chemical bonds form when atoms combine with other atoms by transferring or sharing electrons in an attempt to fill their valence electron shells.

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References to blackline masters (BLM) in print resources

References to *Senior Years Science Teachers’ Handbook* to differentiate instruction

Background information and/or definitions for teachers, often beyond what students are required to know; safety information
Guide to Reading Specific Learning Outcomes

S1-4-05 Collect, interpret, and analyze meteorological data related to a severe weather event. Include: meteorological maps, satellite imagery, conditions prior to and following the event.
GLO: C2, C6, C8, D5

Entry-Level Knowledge
In Grade 5, students observed and measured local weather conditions and analyzed the data collected. Students may have had exposure to meteorological maps through television and newspaper articles, as well as discussion on personal experiences with conditions prior to and following severe storms in the previous learning outcome.

Notes for Instruction
This specific learning outcome can be significantly linked to SLO S1-4-04, which deals with the dynamics of severe weather events. A more “integrative” approach would have students use the context of a particular weather event to foster motivation to gather the relevant synoptic data, such as temperature, precipitation, and cloud cover records. In addition, the readily available satellite imagery databases allow for the observational information to be correlated to space platform images (i.e., visible, infrared, water vapour wavelengths satellite images). It may be important to introduce the fundamentals of remote sensing (e.g., Doppler radar) prior to their use in analyzing particular events. See Appendices 4.17, 4.18, and 4.19 for detailed student learning activities in these areas. Activate prior knowledge of this learning outcome with a “refresher” examination of weather maps and symbols. A Knowledge Chart could be used (see XISTF 9.23).
Discuss the types of data collected by meteorologists, and the technologies used. Take advantage of current and/or local weather events available in print and electronic media. The Environment Canada website has current weather data and maps, as well as satellite and radar images for all regions of Canada (see <http://weatheroffice.ec.gc.ca/canada_e.html> or <www.mbe.ec.gc.ca/>).

Examples: Provides ideas of what could be included (non-mandatory)
None given in this outcome.

Include: Indicates a mandatory component of the specific learning outcome

Cross-reference to general learning outcomes (See Appendix 6.11)