

## SCIENTIFIC INQUIRY AND THE INTERMEDIATE LEVEL SCIENCE CURRICULUM

The process of scientific inquiry, formalized in the scientific method, is integrated into the intermediate level science curriculum at all grades. The key ideas, performance indicators, and major understandings of this process appear below.

**Key Idea 1:** The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.

- S1.1** Formulate questions independently with the aid of references appropriate for guiding the search of explanations of everyday observations.
  - S1.1a** formulate questions about natural phenomena
  - S1.1b** identify appropriate references to investigate a question
  - S1.1c** refine and clarify questions so that they are subject to scientific investigation
- S1.2** Construct explanations independently for natural phenomena, especially by proposing preliminary visual models of phenomena.
  - S1.2a** independently formulate a hypothesis
  - S1.2b** propose a model of a natural phenomenon
  - S1.2c** differentiate among observations, inferences, predictions, and explanations
- S1.4** Seek to clarify, to assess critically, and to reconcile with their own thinking the ideas presented by others, including peers, teachers, authors, and scientists.

**Key Idea 2:** Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.

- S2.1** Use conventional techniques and those of their own design to make further observations and refine their explanations, guided by a need for more information.
  - S2.1a** demonstrate appropriate safety techniques
  - S2.1b** conduct an experiment designed by others
  - S2.1c** design and conduct an experiment to test a hypothesis
  - S2.1d** use appropriate tools and conventional techniques to solve problems about the natural world, including measuring, observing, describing, classifying, and sequencing.
- S2.2** Develop, present, and defend formal research proposals for testing their own explanations of common phenomena, including ways of obtaining needed observations and ways of conducting simple controlled experiments.
  - S2.2a** include appropriate safety procedures

- S2.2b** design scientific investigations (e.g., observing, describing, and comparing; collecting samples; seeking more information; conducting a controlled experiment; discovering new objects or phenomena; making models)
- S2.2c** design a simple controlled experiment
- S2.2d** identify independent (manipulated), dependent (responding), and constants in a simple controlled experiment
- S2.2e** choose an appropriate sample size and number of trials
- S2.3** Carry out their research proposals, recording observations and measurements (e.g., lab notes, audiotape, computer disk, videotape) to help assess the explanation.
  - S2.3a** use appropriate safety procedures
  - S2.3b** conduct a scientific investigation
  - S2.3c** collect quantitative and qualitative data

**Key Idea 3:** The observations made while testing proposed explanations, when analyzed using conventional and invented methods, provide new insights into phenomena.

- S3.1** Design charts, tables, graphs, and other representations of observations in conventional and creative ways to help them address their research question or hypothesis.
  - S3.1a** organize results, using appropriate graphs, diagrams, data tables, and other models to show relationships
  - S3.1b** generate and use scales, create legends, and appropriately label axes
- S3.2** Interpret the organized data to answer the research question or hypothesis and to gain insight into the problem.
  - S3.2a** accurately describe the procedures used and the data gathered
  - S3.2b** identify sources of error and the limitations of data collected
  - S3.2c** evaluate the original hypothesis in light of the data
  - S3.2d** formulate and defend explanations and conclusions as they relate to scientific phenomena
  - S3.2e** form and defend a logical argument about cause-and-effect relationships in an investigation
  - S3.2f** make predictions based on experimental data
  - S3.2g** suggest improvements and recommendations for further study
  - S3.2h** use and interpret graphs and data tables
- S3.3** Modify their personal understanding of phenomena based on evaluation of their hypothesis.

Seventh Grade Textbook: Prentice Hall, Science Explorer: Life Science and “All-In One Teaching Resource Book”, 2009

**Number of days per topic is approximate, depending on how topics are interwoven and presented.**

## Middletown Scope and Sequence

**Subject Area:**

**Science**

**Quarter : 1**

**Grade: 7**

| Standards<br>Key Ideas/Major Understandings/Performance<br>Indicators/Competencies  | Plan #      | Resources<br>(Print, Visual, Technology, Manipulatives) | Assessment<br>(Evidence and<br>Scoring Guides)  |
|---|-------------|---|---|
| <b>MST1.SI.2.1</b> Students use conventional techniques and those of their own design to make further observations and refine their explanations, guided by a need for more information. <b>(2.1b,c)</b>                  | ~20<br>days | TB: Chapter 1<br>Unit 1 AIO: pages 4-33, 40-69          | TB: Review and Assess Study Guide Chapter 1 based on p. 28-31<br><br>Various Laboratory Investigations/Tests on the Scientific Method |
| <b>2.1b</b> Conduct and experiment designed by others.  |             |   |   |
| <b>2.1c</b> Design and conduct an experiment to test a hypothesis.  |             |   |   |
| <b>MST1.MA.1.1</b> Students extend mathematical notation and symbolism to include variables and algebraic expressions in order to describe and compare quantities and express mathematical relationships. <b>(1.1a,b)</b> |             |   |   |
| <b>1.1a</b> Identify dependent and independent variables (manipulated and responding variables).  |             |   |   |
| <b>1.1b</b> Identify relationships among variables including: direct, indirect, cyclic, constant; identify non-related material.  |             |   |   |
| <b>MST 1.SI.3.1</b> Students design charts, tables, graphs, and other representations of observation in conventional and creative ways to help them address their research question or hypothesis. <b>(3.1a, b)</b>       |             |   |   |
| <b>3.1a</b> Organize results, using appropriate graphs, diagrams, data tables, and other models to show relationships.  |             |   |   |
| <b>3.1b</b> Generate and use scales, create legends, and appropriately label axes.  |             |   |   |
| <b>ILS Core Curriculum Process Skills: General Skills 1:</b> Follow safety procedures in the classroom and laboratory.  |             |   |   |
| <b>ILS Core Curriculum Process Skills: General Skills 2:</b> Safely and accurately use the following measurement tools: metric ruler, balance, stopwatch, graduated cylinder, thermometer, spring scale, voltmeter        |             |   |   |
| <b>ILS Core Curriculum Process Skills: General Skills 3:</b> Use appropriate units for measured or calculated values.   |             |   |   |
| <b>MST3.P/F.7.2</b> Describe and represent patterns and functional relationships using tables, charts, and graphs, algebraic expressions, rules, and verbal descriptions.   |             |   |   |
| <b>ILS Core Curriculum Process Skills: General Skills 4:</b> Recognize and analyze patterns and trends.   |             |   |   |

## Middletown Scope and Sequence

**Subject Area:** Science                      **Quarter :** 1                      **Grade:** 7

| Standards<br>Key Ideas/Major Understandings/Performance<br>Indicators/Competencies   | Plan #      | Resources<br>(Print, Visual, Technology, Manipulatives)   | Assessment<br>(Evidence and<br>Scoring Guides)  |
|--|-------------|---|---|
| <b>ILS Core Curriculum: Process Skills: Living Environment Skills:1:</b> Manipulate a compound microscope to view microscopic objects.   | ~20<br>days | TB: Chapter 2, Sections 1, 3, and 4<br>Chapter 3, Sections 1-4<br><br>Unit 1 AIO: pages 101-144, 163-193<br><br><a href="http://www.plant.uga.edu/Extension/slidesstain.htm">http://www.plant.uga.edu/Extension/slidesstain.htm</a><br><a href="http://shs.westport.k12.ct.us/mjvl/biology/microscope/microscope.htm">http://shs.westport.k12.ct.us/mjvl/biology/microscope/microscope.htm</a><br><a href="http://www.greatscopes.com/act005.htm">http://www.greatscopes.com/act005.htm</a><br><br><a href="http://www.greatscopes.com/act005.htm">http://www.greatscopes.com/act005.htm</a><br><a href="http://www.biology4kids.com/files/cell_main.html">http://www.biology4kids.com/files/cell_main.html</a><br><a href="http://www.biology4kids.com/files/cell_nucleus.html">http://www.biology4kids.com/files/cell_nucleus.html</a><br><a href="http://www.biology4kids.com/files/cell_mito.html">http://www.biology4kids.com/files/cell_mito.html</a><br><a href="http://www.biology4kids.com/files/cell_chloroplast.html">http://www.biology4kids.com/files/cell_chloroplast.html</a><br><a href="http://www.biology4kids.com/files/cell2_main.html">http://www.biology4kids.com/files/cell2_main.html</a><br><a href="http://www.biology4kids.com/files/cell2_passivetran.html">http://www.biology4kids.com/files/cell2_passivetran.html</a><br><a href="http://www.biology4kids.com/files/cell2_activetran.html">http://www.biology4kids.com/files/cell2_activetran.html</a><br><br><a href="http://www.cellsalive.com/gallery.htm">http://www.cellsalive.com/gallery.htm</a><br><a href="http://sun.menloschool.org/~cweaver/cells/">http://sun.menloschool.org/~cweaver/cells/</a><br><a href="http://www.cod.edu/people/faculty/fancher/CellStructure.htm">http://www.cod.edu/people/faculty/fancher/CellStructure.htm</a><br><br><a href="http://www.life.uiuc.edu/plantbio/cell/">http://www.life.uiuc.edu/plantbio/cell/</a> | TB: Review and Assess Study Guide Chapter 2 based on p. 68-71<br><br>Chapter 3 based on p. 104-107<br><br>Various Laboratory Investigations/Tests on Cells and Cell Processes |
| <b>ILS Core Curriculum: Process Skills: Living Environment Skills: 2:</b> Determine the size of a microscopic object, using a compound microscope.   |             |   |   |
| <b>ILS Core Curriculum: Process Skills: Living Environment Skills: 3:</b> Prepare a wet mount slide.   |             |   |   |
| <b>ILS Core Curriculum: Process Skills: Living Environment Skills 4:</b> Use appropriate staining techniques.  |             |   |   |
| <b>MST4.LE.1.1</b> Students compare and contrast the parts of plants, animals, and one-celled organisms. <b>(1.1a-e and h)</b>   |             |   |   |
| <b>1.1a</b> Living things are composed of cells. Cells provide structure and carry on major functions to sustain life. Cells are usually microscopic in size.  |             |   |   |
| <b>1.1b</b> The way in which cells function is similar in all living things. Cells grow and divide, producing more cells. Cells take in nutrients, which they use to provide energy for the work that cells do and to make the materials that a cell or an organism needs.                     |             |   |   |
| <b>1.1c</b> Most cells have cell membranes, genetic material, and cytoplasm. Some cells have a cell wall and/or chloroplasts. Many cells have a nucleus.   |             |   |   |
| <b>1.1d</b> Some organisms are single cells; others, including humans, are multicellular.  |             |   |   |
| <b>1.1e</b> Cells are organized for more effective functioning in multicellular organisms. Levels of organization for structure and function of a multicellular organism include cells, tissues, organs, and organ systems.  |             |   |   |
| <b>1.1h</b> Living things are classified by shared characteristics on the cellular and organism level. In classifying organisms, biologists consider details of internal and external structures. Biological classification systems are arranged from general (kingdom) to specific (species). |             |   |   |

## Middletown Scope and Sequence

**Subject Area:**                      **Science**                                      **Quarter :**     **1**                                      **Grade:**     **7**

| Standards<br>Key Ideas/Major Understandings/Performance<br>Indicators/Competencies  | Plan # | Resources<br>(Print, Visual, Technology, Manipulatives)  | Assessment<br>(Evidence and<br>Scoring Guides) |
|---|--------|--|--|
| <b>ILS Core Curriculum: Process Skills: Living Environment Skills 9:</b> Identify structure and function relationships in organisms.  |        |  |  |
| <b>MST4.LE.5.1</b> Students compare the way a variety of living specimens carry out basic life functions and maintain dynamic equilibrium. <b>(5.1 a, b, c, g)</b>  |        | <a href="http://froggy.lbl.gov/cgi-bin/dissect">http://froggy.lbl.gov/cgi-bin/dissect</a> (frog dissection)  |  |
| <b>5.1c</b> All organisms require energy to survive. The amount of energy needed and the method for obtaining this energy vary among cells. Some cells use oxygen to release the energy stored in food.   |        |  |  |
| <b>MST4.I.LE.6.2</b> Students provide evidence that green plants make food and explain the significance of this process to other organisms. <b>(6.2 a-c)</b>  |        | <a href="http://www.biology4kids.com/files/plants_main.html">http://www.biology4kids.com/files/plants_main.html</a>  |  |
| <b>6.2a</b> Photosynthesis is carried on by green plants and other organisms containing chlorophyll. In this process, the Sun's energy is converted into and stored as chemical energy in the form of a sugar. The quantity of sugar molecules increases in green plants during photosynthesis in the presence of sunlight. |        | <a href="http://www.biology4kids.com/files/plants_photosynthesis.html">http://www.biology4kids.com/files/plants_photosynthesis.html</a>  |  |
| <b>6.2b</b> The major source of atmospheric oxygen is photosynthesis. Carbon dioxide is removed from the atmosphere and oxygen is released during photosynthesis.   |        | <a href="http://www.biology4kids.com/files/plants_structure.html">http://www.biology4kids.com/files/plants_structure.html</a>  |  |
| <b>6.2c</b> Green plants are the producers of food which is used directly or indirectly by consumers.   |        | <a href="http://www.biology4kids.com/files/plants_gymnosperm.html">http://www.biology4kids.com/files/plants_gymnosperm.html</a><br><a href="http://www.biology4kids.com/files/plants_angiosperm.html">http://www.biology4kids.com/files/plants_angiosperm.html</a> |  |