The 5E Model of Teaching
Grade 8
<table>
<thead>
<tr>
<th>“5E’s”</th>
<th>Consistent with Model</th>
<th>Inconsistent with Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engage</td>
<td>• Asks question such as “why did this happen? What do I already know about this?”  &lt;br&gt;• Shows interest in the topic</td>
<td>• Asks for the “right” answer  &lt;br&gt;• Offers the “right” answer  &lt;br&gt;• Insists on answers or explanations  &lt;br&gt;• Seeks on solution</td>
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<td>Explore</td>
<td>• Thinks freely but within limits of the activity  &lt;br&gt;• Tests predictions and hypotheses  &lt;br&gt;• Forms new predictions and hypotheses  &lt;br&gt;• Tries alternatives and discusses them with others  &lt;br&gt;• Records observations and ideas  &lt;br&gt;• Suspends judgement</td>
<td>• Passive involvement  &lt;br&gt;• Works quietly with little or no interaction with others  &lt;br&gt;• “Plays around” indiscriminately with no goal in mind  &lt;br&gt;• Stops with one solution</td>
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<tr>
<td>Explain</td>
<td>• Explains possible solutions or answers to others  &lt;br&gt;• Listens critically to others’ explanations  &lt;br&gt;• Questions others’ explanations  &lt;br&gt;• Listens to and tries to comprehend explanations offered by teacher  &lt;br&gt;• Refers to previous activities  &lt;br&gt;• Uses recorded observations in explanations</td>
<td>• Proposes explanations from “thin air”, with no relationship to previous experiences  &lt;br&gt;• Brings up irrelevant experiences and examples  &lt;br&gt;• Accepts explanations without justification  &lt;br&gt;• Does not attend to other plausible explanations</td>
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<td>Elaborate</td>
<td>• Applies new labels, definitions, explanations and skills in a new but similar situation  &lt;br&gt;• Uses previous information to ask questions, propose solutions, make decisions and design experiments  &lt;br&gt;• Draws reasonable conclusions from evidence  &lt;br&gt;• Records observations and explanations  &lt;br&gt;• Checks for understanding among peers</td>
<td>• “Plays around” with no goal in mind  &lt;br&gt;• Ignores previous information or evidence  &lt;br&gt;• Draws conclusions from “thin air”  &lt;br&gt;• In discussion, uses only labels provided by teacher</td>
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<td>Evaluate</td>
<td>• Answers open-ended questions by using observations, evidence, and previously accepted explanations  &lt;br&gt;• Demonstrates understanding or knowledge of concept or skill  &lt;br&gt;• Evaluates his or her own progress and knowledge  &lt;br&gt;• Asks related questions that would encourage future investigations</td>
<td>• Draws conclusions without using evidence or previously accepted explanation  &lt;br&gt;• Offers only “yes” or “no” answers and memorized definitions or explanations as answers  &lt;br&gt;• Fails to express satisfactory explanations in his or her own words  &lt;br&gt;• Introduces new, irrelevant topics</td>
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The standards for scientific inquiry, literacy and numeracy are integral parts of the content standards for each grade level in this cluster.

**Grades 6-8 Core Scientific Inquiry, Literacy and Numeracy**

*How is scientific knowledge created and communicated?*

<table>
<thead>
<tr>
<th>Content Standards</th>
<th>Expected Performances</th>
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<tbody>
<tr>
<td><strong>Scientific Inquiry</strong></td>
<td><strong>C INQ.1</strong> Identify questions that can be answered through scientific investigation.</td>
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<tr>
<td>♦ Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena.</td>
<td><strong>C INQ.2</strong> Read, interpret and examine the credibility of scientific claims in different sources of information.</td>
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<tr>
<td>♦ Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation.</td>
<td><strong>C INQ.3</strong> Design and conduct appropriate types of scientific investigations to answer different questions.</td>
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<tr>
<td>♦ Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists.</td>
<td><strong>C INQ.4</strong> Identify independent and dependent variables, and those variables that are kept constant, when designing an experiment.</td>
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<tr>
<td><strong>Scientific Literacy</strong></td>
<td><strong>C INQ.5</strong> Use appropriate tools and techniques to make observations and gather data.</td>
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<td>♦ Scientific literacy includes speaking, listening, presenting, interpreting, reading and writing about science.</td>
<td><strong>C INQ.6</strong> Use mathematical operations to analyze and interpret data.</td>
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<td>♦ Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media.</td>
<td><strong>C INQ.7</strong> Identify and present relationships between variables in appropriate graphs.</td>
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<tr>
<td><strong>Scientific Numeracy</strong></td>
<td><strong>C INQ.8</strong> Draw conclusions and identify sources of error.</td>
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<tr>
<td>♦ Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.</td>
<td><strong>C INQ.9</strong> Provide explanations to investigated problems or questions.</td>
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<td><strong>C INQ.10</strong> Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.</td>
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<tr>
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<tr>
<td><strong>Forces and Motion – What makes objects move the way they do?</strong></td>
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<tr>
<td>8.1 - An object’s inertia causes it to continue moving the way it is moving unless it is acted upon by a force to change its motion.</td>
<td>C 22. Calculate the average speed of a moving object and illustrate the motion of objects in graphs of distance over time.</td>
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<tr>
<td>◆ The motion of an object can be described by its position, direction of motion and speed.</td>
<td>C 23. Describe the qualitative relationships among force, mass and changes in motion.</td>
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<tr>
<td>◆ An unbalanced force acting on an object changes its speed and/or direction of motion.</td>
<td>C 24. Describe the forces acting on an object moving in a circular path.</td>
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<tr>
<td>◆ Objects moving in circles must experience force acting toward the center.</td>
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<tr>
<td><strong>Heredity and Evolution – What processes are responsible for life’s unity and diversity?</strong></td>
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<tr>
<td>8.2 - Reproduction is a characteristic of living systems and it is essential for the continuation of every species.</td>
<td>C 25. Explain the similarities and differences in cell division in somatic and germ cells.</td>
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<tr>
<td>◆ Heredity is the passage of genetic information from one generation to another.</td>
<td>C 26. Describe the structure and function of the male and female human reproductive systems, including the process of egg and sperm production.</td>
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<tr>
<td>◆ Some of the characteristics of an organism are inherited and some result from interactions with the environment.</td>
<td>C 27. Describe how genetic information is organized in genes on chromosomes, and explain sex determination in humans.</td>
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<tr>
<td><strong>Earth in the Solar System – How does the position of Earth in the solar system affect conditions on our planet?</strong></td>
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<tr>
<td>8.3 - The solar system is composed of planets and other objects that orbit the sun.</td>
<td>C 28. Explain the effect of gravity on the orbital movement of planets in the solar system.</td>
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<tr>
<td>◆ Gravity is the force that governs the motions of objects in the solar system.</td>
<td>C 29. Explain how the regular motion and relative position of the sun, Earth and moon affect the seasons, phases of the moon and eclipses.</td>
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<tr>
<td>◆ The motion of the Earth and moon relative to the sun causes daily, monthly and yearly cycles on Earth.</td>
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<tr>
<td><strong>Science and Technology in Society – How do science and technology affect the quality of our lives?</strong></td>
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<td>8.4 - In the design of structures there is a need to consider factors such as function, materials, safety, cost and appearance.</td>
<td>C 30. Explain how beam, truss and suspension bridges are designed to withstand the forces that act on them.</td>
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<tr>
<td>◆ Bridges can be designed in different ways to withstand certain loads and potentially destructive forces.</td>
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Grade 8
Physical Science
Forces and Motion

Content Standard

The student will understand what makes objects move the way they do.

Focus Questions:
How is the motion of an object described?
What is acceleration?
How is the speed of an object calculated?
What are the laws of motion?
What is the law of conservation?
What causes the motion of an object to change?
How do unbalanced forces change an object's speed and direction?
How does the design of bridges allow them to withstand certain loads and potentially destructive forces?

Essential Understandings:
- Motion is an object's position, direction and speed.
- Acceleration measures how fast velocity changes and can be calculated from velocity and time.
- Speed measures how fast position changes (V=RxT).
- Force = mass x acceleration.
- There are 3 laws of motion, called Newton's Laws.
- The law of conservation states that energy can be neither created nor destroyed.
- An unbalanced force acting upon an object causes its motion to change.
- Bridges can be designed to withstand forces that act upon them.

Suggested Activities:
Build a roller coaster.
Attend a field trip to Lake Compounce.
Use a model car to investigate potential energy.
Chart velocity time graphs.
Create a journal to record findings from experiments.
Perform the Come Back Can experiment.
Investigate acceleration and slope.
Investigate inertia as related to object sizes.
Make model bridges.
Explore internet to acquire relevant data and to implement suggested activities.

<table>
<thead>
<tr>
<th>SCIENTIFIC THINKING PROCESSES</th>
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<tbody>
<tr>
<td>Observing:</td>
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<tr>
<td>Observe Newton's 3 Laws of Motion in action</td>
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<tr>
<td>Comparing:</td>
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<tr>
<td>Compare speed as related to different size objects</td>
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<tr>
<td>Compare different forces needed to change object's position</td>
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<tr>
<td>Relating:</td>
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<tr>
<td>Relate speed, direction and position of an object</td>
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<tr>
<td>Applying:</td>
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<tr>
<td>Apply Newton's 3 Laws of Motion in labs and classroom activities</td>
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<tr>
<td>Predicting:</td>
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<tr>
<td>Predict how different forces will affect model bridge construction</td>
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<tr>
<th>EMBEDDED TASK</th>
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<tr>
<td>All students will perform the Shipping and Sliding experiment in order to assess understanding of inquiry and the nature of Science through questioning using the 5E Model of Teaching.</td>
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Teacher Notes

Additional Focus Questions:
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Additional Scientific Thinking Processes:
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Additional Essential Understandings:
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Additional Suggested Activities:
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Resources:
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Grade 8
Life Science
Heredity and Evolution
Genetics

Content Standard

The student will understand that reproduction is a characteristic of living system and it is essential for the continuation of a species.

Focus Questions:
What is genetics?
How is genetic information passed from generation to generation?
What is the main function of chromosomes and DNA?
How do environmental factors influence an organism's characteristics?
What is cell division?
What are the structures and functions of the male & female reproductive systems?

Essential Understandings:
- Heredity is the passage of genetic information from one generation to another.
- Heredity occurs in patterns and can be predicted.
- Meiosis is a special type of cell division.
- Amino acids combine to form proteins.
- DNA and RNA are necessary to make proteins.
- Some cells have simpler structures than human cells.
- Changes in DNA can produce variations in organisms.
- Genetic information is organized in genes on chromosomes.
- Chromosomal make-up determines the sex of humans.
- Some characteristics of an organism are inherited while others result from interactions with the environment.
- The male and female reproductive systems have different structures and functions.
- Reproduction is essential for the continuation of a species.
Suggested Activities:
Chart individual characteristics using a Punnetts Square.
View human hair, skin, pores, cheeks, ribosomes, DNA, RNA, bacteria, and virus slides under the microscope.
Construct a cell and compare how models can differ.
Construct double helix of DNA.
Design a family pedigree.
Perform fingerprinting experiment.
Create a journal to record findings from experiments.
Explore internet to acquire relevant data and to implement suggested activities

SCIENTIFIC THINKING PROCESSES

| Observing:     | Observe distinct characteristics of individuals |
|               | Research history of genetics                     |
| Organizing:    | Explore structures of a DNA molecule             |
| Relating:      | Relate differences in features to cell proteins. |
|Inferring:      | Identify components of a DNA molecule            |
|Predicting:     | Predict what characteristics their offspring may have |
Teacher Notes

Additional Focus Questions:

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Additional Scientific Thinking Processes:

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Additional Essential Understandings:

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Additional Suggested Activities:

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Resources:

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The student will understand that the Solar System is composed of planets and other objects that orbit the Sun.

Focus Questions:
What is gravity and how does it govern the motions of objects in the Solar System?
How does the motion of the Earth and Moon affect periodic cycles on Earth?
What are the major characteristics and the phases of the moon?
What is an eclipse?
What man-made satellites are used to transmit information to Earth?

Essential Understandings:
- Gravity is a property of matter that produces an attraction between all bodies.
- The real or imaginary line through the center of an object around which it rotates is its axis.
- Rotation is the action of spinning on an axis.
- Revolution is the action of a celestial body traveling in an orbit.
- The path followed by an object in its revolution around another object is its orbit.
- There are two types of eclipses: lunar and solar.
- Satellites are objects that orbit the Earth or other celestial bodies.
  The moon is the Earth's satellite.
- A tide is the rhythmic rise and fall of the surface of the sea that occurs twice each day and is due to gravitational pull between the Moon and Earth.
- There are three basic motions of ocean water (up/down of waves, steady movement of ocean currents, rise and fall of tides).
Suggested Activities:
Create solar and lunar journals in order to record observations.
Investigate a rectified globe.
Form human Sundial.
Investigate reasons for seasons.
Make a model of the Moon phases.
Model eclipses of all types and sizes.
Investigate motion of the Sun.
Explore radio reception.
Create a scale model of the Solar System.
Explore internet to acquire relevant data and to implement suggested activities

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<td><strong>Observing:</strong> Recognize the apparent motion of the Sun</td>
</tr>
<tr>
<td>Observe position of the Moon over time</td>
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<tr>
<td><strong>Inferring:</strong> Infer the reasons for the seasons</td>
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<td><strong>Predicting:</strong> Predict the affect of the position of a satellite on the transmission of radio waves</td>
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