



Senior High

## **Canadian Advanced Senior High**

<b><u>Department:</u></b>	<b>Science</b>
<b><u>Course Development Date:</u></b>	<b>November 2017</b>
<b><u>Course Title:</u></b>	<b>Space and Earth Science</b>
<b><u>Grade:</u></b>	<b>12</b>
<b><u>Course Type:</u></b>	<b>University Preparation</b>
<b><u>Ministry Course Code:</u></b>	<b>SES4U</b>
<b><u>Credit Value:</u></b>	<b>1.0</b>
<b><u>Hours:</u></b>	<b>110</b>
<b><u>Ministry Curriculum Policy:</u></b>	<b>The Ontario Curriculum Grades 11 – 12 Science, revised 2008</b>
<b><u>Pre-requisite:</u></b>	<b>Science, Grade 10, Academic</b>

### **COURSE DESCRIPTION**

This course develops students' understanding of Earth and its place in the universe. Students will investigate the properties of and forces in the universe and solar system and analyze techniques scientists use to generate knowledge about them. Students will closely examine the materials of Earth, its internal and surficial processes, and its geological history, and will learn how Earth's systems interact and how they have changed over time. Throughout the course, students will learn how these forces, processes, and materials affect their daily lives. The course draws on biology, chemistry, physics, and mathematics in its consideration of geological and astronomical processes that can be observed directly or inferred from other evidence.

## **OVERALL EXPECTATIONS**

### **1. Astronomy (Science of the Universe)**

**By the end of this course, students will:**

1. how the understanding of the origin and evolution of the universe has been expanded by the development of technologies;
2. how scientific theories about the universe have been revised and improved by new evidence.

### **2. Planetary Science (Science of the Solar System)**

**By the end of this course, students will:**

1. the influence of other celestial bodies of the solar system on the existence of life;
2. the positive and negative effects of space exploration on society, the economy, and the environment;
3. about the hazards of space exploration.

### **3. Recording Earth's Geological History**

**By the end of this course, students will:**

1. that Earth is very old;
2. that Earth's atmosphere, hydrosphere, and lithosphere have undergone many changes over time;
2. the positive and negative effects of these changes on life.

### **4. Earth Materials**

**By the end of this course, students will:**

1. about the exploration for and extraction of materials from below the surface of Earth;
2. how these activities have positive and negative effects on the economy, society, and the environment;
3. the origins, characteristics, and uses of different types of rocks.

### **5. Geological Processes**

**By the end of this course, students will:**

1. about Earth's lithosphere;
2. how it is constantly changing as the result of natural phenomena and human activities;
3. how technologies have improved the ability of scientists to monitor and predict changes in the lithosphere.

## **Outline of Course Content**

### **Unit One – Astronomy (Science of the Universe)**

**20 hours**

**(Online components: 14 hours; Offline components: 6 hours)**

**Topics include:** using appropriate terminology related to astronomy, including, but not limited to: Doppler effect, electromagnetic radiation, protostar, celestial equator, ecliptic, altitude and azimuth, and right ascension and declination; locating observable features of the night sky using star charts, computer models, or direct observation, and record the location of these features using astronomical terms and systems; analyzing spectroscopic data mathematically or graphically to determine various properties of stars; using the Hertzsprung-Russell diagram to determine the interrelationships between the properties of stars and to investigate their evolutionary pathways; investigating properties of stars, including their distance from Earth, surface temperature, absolute magnitude, and luminosity; investigating the basic features of different types of galaxies including the Milky Way.

### **Unit Two – Planetary Science (Science of the Solar System)**

**20 hours**

**(Online components: 14 hours; Offline components: 6 hours)**

**Topics include:** explaining the composition of the solar system and describe the characteristics of each component; identifying and explaining the classes of objects orbiting the sun; explaining the formation of the solar system with reference to the fundamental forces and processes involved; identifying the factors that determined the properties of bodies in the solar system; identifying and explaining the properties of celestial bodies within or beyond the solar system, other than Earth, that might support the existence of life; comparing Earth with other objects in the solar system with respect to properties such as mass, size, composition, rotation, magnetic field and gravitational field.

### **Unit Three – Recording Earth’s Geological History**

**25 hours**

**(Online components: 17 hours; Offline components: 8 hours)**

**Topics include:** describing evidence for the evolution of life through the Proterozoic, Paleozoic, Mesozoic, and Cenozoic eras, using important groups of fossils that date from each era; describing various kinds of evidence that life forms, climate, continental positions, and Earth’s crust have changed over time; describing some processes by which fossils are produced and/or preserved; comparing and contrasting relative and absolute dating principles and techniques as they apply to natural systems; identifying and

describing the various methods of isotopic age determination, giving for each the name of the isotope, its half-life, its effective dating range and some of the materials that it can be used to date; explaining the influence of paradigm shifts in the development of geological thinking; explaining the different types of evidence used to determine the age of Earth and how this evidence has influenced our understanding of the planet's age.

#### **Unit Four – Earth Materials**

**25 hours**

**(Online components: 17 hours; Offline components: 8 hours)**

**Topics include:** identifying the physical and chemical properties of selected minerals, and describe the tests used to determine these properties; describing the formation and identify the distinguishing characteristics of igneous rocks; describing the formation of clastic and chemical sediments, and the characteristics of the corresponding sedimentary rocks; describing the different ways in which metamorphic rocks are formed and the factors that contribute to their variety; describing the role of Earth materials in the safe disposal of industrial and urban waste and toxic materials.

#### **Unit Five – Geological Processes**

**20 hours**

**(Online components: 14 hours; Offline components: 6 hours)**

**Topics include:** describing the types of boundaries between lithospheric plates, and explain the types of internal Earth processes occurring at each; describing the characteristics of the main types of seismic waves and explain the different modes of travel, travel times, and types of motion associated with each; comparing qualitative and quantitative methods used to measure earthquake intensity and magnitude; explaining how different erosional processes contribute to changing landscapes; identifying and describing types of sediment transport and the types of load as sediment is moved by each type of transport; describing the landforms produced by water, wind, or ice erosion; describing the sedimentary structures formed by wind, water, or ice deposition; identifying the major areas of tectonic activity in the world by plotting the location of major recorded earthquakes and active volcanoes on a map, and distinguish the areas by type of tectonic activity (e.g., Japan – convergent boundary; Iceland – divergent boundary; California – transform boundary); explaining the processes of continuous recycling of major rock types throughout Earth's history.

#### **Assessment and Evaluation**

The assessment techniques used in this course are Assessment as, for and of Learning. Their purpose is to provide students with opportunity for engage into self-directed ongoing learning, consistent student and teacher communication, consistent teacher

monitoring of student-learning and the instructional strategies have been successful in facilitating the acquisition of the skills described in the Ministry of Education's curriculum expectations for each unit. Assessment tools include but are not limited to: Group and individual presentations; story writing assignments; quizzes and written tests; organization of binders; student-teacher conferences; formal/informal teacher observation and on-going verbal feedback; oral presentations; instructional videos and independent work.

70% of the grade will be based on assessment for and of learning tests, quizzes and assignments evaluated throughout the course (term work).

30% of the grade will be based on evaluation in the form of an examination and/or project (summative evaluation).

Term work (70%)

Knowledge and Understanding	20 %
Thinking and Inquiry	20 %
Communication	15 %
Application	15 %

Final Evaluation (30%)

Culminating Activity	10%
Final Examination	20 %

Assessment for Learning (Growing Success) will implement the use of diagnostic assessments to determine the students' readiness skills for the ensuing lessons and skills required. Formative assessments, including frequent informal question and discussion during class, will take place in an ongoing and frequent manner to assure students' are acquiring and practicing skills.

Assessment as Learning (Growing Success) will be monitored to ascertain that students' are developing the ability to self-correct and to determine individual skills that are required for success and in determining individual learning styles. Students are provided with adequate time and resources to engage in individualized practice and learning of the materials.

Assessment of Learning (Growing Success) will be done upon completion of units and course to convey the success of the students' achievement of the content and concepts learned.

## Teaching/Learning Strategies

- Binder checks
- Cooperative learning groups
- Direct teaching/Socratic method
- Graphic organizers
- Think/pair/share
- Worksheets
- Individual practice of questions
- Viewing and responding to videos
- Questionnaires, Ticket out the Door
- Oral presentations
- Independent and group research projects
- Note-taking
- Mini-whiteboard activities

## Resources

**Textbook:** *Geology, the Environment and the Universe*. McGraw-Hill Ryerson (2013)

**Supplementary teaching materials:** worksheets organized by teacher.

## **Websites:**

- Gizmos: [www.explorellearning.com](http://www.explorellearning.com) and Online Assessments: b.socrative.com
- The Age of the Earth: <https://youtu.be/YpbevWvYg0>
- Latitude and Longitude:  
<https://www.youtube.com/watch?v=swKBi6hHHMA&feature=youtu.be>
- How to Determine The Epicenter of an Earthquake:  
<https://www.youtube.com/watch?v=TBss68oBmmk>
- Anatomy of a Volcano: <http://www.pbs.org/wgbh/nova/earth/volcano-parts.html>
- Classification of Igneous Rock: <http://study.com/academy/lesson/classification-of-of-igneous-rocks-textures-and-composition.html>
- Earth 100 Million Years from Now: <https://youtu.be/uGcDed4xVD4>
- Introductory video on Why Earth  
Science: <https://www.youtube.com/watch?v=jxbIJH4fTYo>
- Space and Earth Online Quiz: <https://www.quia.com/quiz/3208271.html>
- Introductory video on Latitude &  
Longitude: <https://www.youtube.com/watch?v=swKBi6hHHMA&feature=youtu.be>

- Fun game to review  
Weathering: <http://www.kineticcity.com/mindgames/warper/>
- Introduction to Unit 3: Geologic Time  
(22min): <https://www.youtube.com/watch?v=u2tL1PtfpGc>
- Video clips on Geologic Time Scale:
  - 1) <http://study.com/academy/lesson/geologic-time-scale-major-eons-eras-periods-and-epochs.html>
  - 2) <https://www.youtube.com/watch?v=Zn3EHRvm944>
- Laws of Relative Rock Dating: <https://youtu.be/M2Ex5DIjtfU>
- Absolute Dating: <https://www.youtube.com/watch?v=hg7JJ36kaNM>
- "Getting into the Fossil Record" Webquest -  
<http://www.ucmp.berkeley.edu/education/explorations/tours/fossil/>
- Early Earth and Plate Tectonics: <https://www.youtube.com/watch?v=QDqskltCixA>
- Origins of Oceans: <https://youtu.be/BvrzM-BavDg>
- Revealing Earth's Atmosphere: <https://youtu.be/1YAOT92wuD8>
- Formation of Atmosphere & Oceans Online Review:  
<https://www.ck12.org/book/CK-12-Earth-Science-Concepts-For-High-School/section/11.15/>
- Birth of Earth Video: <https://www.youtube.com/watch?v=rPwQj3f5osY!>
- Cenozoic Ice Age in California (Bay Area): <https://www.youtube.com/watch?v=GqNmG1NUKdY&feature=youtu.be>
- Astronomy and Planetary Science. Introductory video: <https://www.youtube.com/watch?v=gIbfYsQfNwS>
- Electromagnetic Spectrum using Prezi: <https://prezi.com/d-rg4lruny5h/electromagnetic-spectrum/>

- The Moon Video (7 mins): <http://www.space.com/19275-moon-formation.html>
- 1) <https://youtu.be/KUU7lyfR34o> (Bill Nye – Seasons)  
2) <http://www.dailymotion.com/video/x3cvnk6> (Bill Nye - Tides at 9:30)
- Formation of the Solar System. (Video - A planet's elliptical orbit around a star: <https://www.youtube.com/watch?v=M3-nQEyBHxg>)
- Video – Formation of the Solar System: <https://youtu.be/Uhy1fucSRQI>
- Video - Why are the Inner and Outer Planets Different? - <https://www.youtube.com/watch?v=YuZ2BfrMwXo>