## Course Description

Students enrolled in Science 10: Science for Sustainable Societies will consider the integral roles science and technology play in their lives and communities. Throughout the course, students examine how scientific concepts and theories are applied to sustain the environmental limits of the natural resources we chemically transform and use as well as consider sustainability-related issues relevant to their lives.

The social and environmental contexts of advancement of science and technology are the central focus of the course. A contemporary approach for teaching physical sciences is applied so that students may become familiar with evolving theories and principles shaping how science is applied to design creative solutions. The connections that exist between matter and energy are explored.

## Unit 1: Electricity

- Outcome 1.1: Static Electricity
- Students will learn qualitatively and quantitatively about electric charge from electrons, protons, and electrical sources in nature (such as lightening).
- Students will be able to qualitatively analyze electric fields. This includes analyzing and drawing electric field diagrams.
- Outcome 1.2: Electric Circuits
- A quantitative analysis of current, voltage, resistance, and power using Ohm's Law (and its variations). Students will apply Ohm's Law in series and parallel circuits of varying complexity and create circuit schematics using conventional components.
- Outcome 1.3: Electrification (this unit may be covered through a student project as opposed to taught directly)
- A look at renewable vs. non-renewable technology and power generation.


## Unit 2: Nuclear Technology

- Outcome 2.1: Atomic Theory and Model of the Atom
- Students will learn about the model of the atom from its earliest convention to contemporary models (the quantum mechanical model).
- Students will get an introduction to electron arrangement in atoms including energy levels, sublevels, and orbitals.
- Outcome 2.2: The Periodic Table of the Elements
- Students will learn why and how the elements are arranged in the periodic table. This will include an introduction to trends and patterns of physical and chemical properties, and electron organization.
- Outcome 2.3: Radiation
- Students will learn about atomic nuclei (protons and neutrons), isotopes, and a general overview of the strong, weak, and electromagnetic fundamental forces.
- Students will learn about ionization of atoms and the harmful types ionizing radiation including alpha, beta, and gamma radiation. This includes topics of background radiation, sources of radiation, and nuclear safety.
- Students will learn about radioactivity concepts such as half-life, fusion, fission, and their applications.


## Unit 3: Chemistry Foundations

- Outcome 3.1: Classification of Matter
- Students will learn about pure substances, types of mixtures, and physical and chemical changes.
- Outcome 3.2: Chemical Bonding
- Students will learn about covalent, ionic, and metallic bonds. Including how they form, writing their formulas, and the properties associated with that type of bond to create the compound. This includes molecular, ionic, and metallic compounds. *This outcome may be broken into multiple assessments.
- Outcome 3.3: Chemical Reactions
- Students will be introduced to the concept of the mole and apply Avogadro's number to solve quantitative problems in chemistry.
- Students will learn how to balance and complete simple chemical reactions, such as synthesis, decomposition, single displacement, double displacement, and combustion. The concept of conservation of matter will be applied.
- Students will be able to identify mole ratios from a balanced chemical reaction and apply them to solve problems.


## Unit 4: Climate Change and Action

The learning of the climate change topics may be through a student-lead climate action project as opposed to formal teacher instruction. An introduction (or review) of climate science will be given based on the National Academy of Science publication Climate Change: Evidence and Causes (2020) and Climate Literacy: The Essential Principles of Climate Science by The United States Global Change Research Program (2009). Students will be given a copy of both resources.

Within such a project students will demonstrate an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology (STSE). This will include relating their project to the United Nations Sustainability Development Goal 13 (Climate Action) and one of goal 7 (Affordable and Clean Energy), 9 (Industry, Innovation, and Infrastructure), or 12 (Responsible Consumption and Production).

Assessment for this unit will likely break down into Science and Engineering Practices and Climate Science as students develop, implement, and conclude their project. More details will be shared closer to the time of implementation (towards the last month of the course).

Grade Scale - Each assessed outcome will use the following guide.

| Expert: <br> Demonstration of a deep/thorough understanding of the concept | 6 | - Chose an appropriate strategy. <br> - Successfully applied the necessary background skills and proper concepts to complete solutions. <br> - Solutions contained no minor mistakes, or a summative contains at most two. <br> - Clearly and concisely explained how to solve the problem using appropriate vocabulary, diagrams, and a coordinate system. "Did I show my work?" <br> - Evaluated the reasonableness of my answer. "Does this make sense for the situation?" <br> - Concept understood to a high degree to teach it to someone else. <br> - Concept can be applied to new problems. |
| :---: | :---: | :---: |
|  | 5 | - Chose an appropriate strategy. <br> - Solution(s) contained an error(s) related to a background skill. <br> - The concept can be explained using appropriate vocabulary. <br> - The concept can be applied successfully in known problems. |
| Apprentice: Good/Satisfactory understanding of the concept | 4 | - Chose an appropriate strategy. <br> - A solution contained a concept error. A summative contained at most two such errors. <br> - Minor mistakes and background skill errors are common. <br> - Explanations of a problem contained mostly appropriate terminology. <br> - Mistakes were identified and corrected after referring to a key. <br> - More practice is needed solving this type of problem. |
|  | 3 | - Chose an appropriate strategy. <br> - Solution(s) contained a combination of concept errors, errors related to background skills and minor mistakes. <br> - A lack of necessary background skills to solve problems. <br> - Notes, examples, or help was needed to solve problems. <br> - Explanations did not contain proper terminology. <br> - Help from an expert is required solving this type of problem. |
| Novice: <br> Minimal-to-no understanding of the concept | 2 | - Incorrect strategy(ies) chosen for a problem(s). <br> - Step-by-step instructions are required to solve problems. <br> - Tasks could not be performed to an acceptable standard. <br> - Consistent extra help from an expert is required. |
|  | 1 | - Basics of what was needed to solve the problem was not known. <br> - Solution left blank; first step not known. <br> - Teaching by an expert is required. |

## Determining a Percentage Mark

| Learning <br> Category | Overall <br> Grade | Only shortly before report cards will <br> a percentage mark be determined |  |  |
| :--- | :---: | :---: | :---: | :---: |
|  | 6 | $95-100$ |  |  |
|  | 5 | 86 | 90 | 94 |
| Apprentice | 4 | 73 | 80 | 85 |
|  | 3 | 60 | 66 | 72 |
| Novice | 2 | 50 | 56 | 59 |
|  | 1 | 0 | 25 | 49 |

Students can track their progress and it will be placed in PowerSchool. The overall grade is guided with the calculation of the median and mean of all grades.
*Reassessing outcomes is encouraged, and time will be made available during the semester.

## Overall Course Grade

> Calculate your median by arranging your grades from lowest to highest. The grade in the middle is likely your overall grade. If there is no exact middle number, average the two middle numbers.
$>$ Calculate your mean by adding all the grades up and divide by how many there are.
$>$ Use a pencil, if you are writing your grades here because grades will fluctuate over the semester.

Median $=$ $\qquad$ Mean = $\qquad$
Example Percent Determinations

| Median | Mean | Percent | Reason |
| :---: | :--- | :---: | :--- |
| 4 | $3.8-4.2$ | $80 \%$ | Median and mean match or are close |
|  | 4.3 or higher | $85 \%$ | Mean is much higher than median |
| 4 | 3.7 or lower | $73 \%$ | Mean is much lower than median |

