What do I need to be able to do at the End of my Science 30 course?

Note: *This is not an official Alberta Education document. This document was developed by teachers as a self-assessment tool for students.*

Note: *Many of the learning outcomes are supported by examples. The examples are written in italics and* ***do not*** *form part of the required program but are provided as an illustration of how the outcomes might be developed.*

Note: *This document does not include program of studies attitude and ICT outcomes.*

Science 30 Learning Outcomes – Unit A: Living Systems Respond to Their Environment	
Knowledge — *Students will* construct knowledge and understandings of concepts in science, and apply these understandings to interpret, integrate and extend their knowledge.	
Outcome Attained	Description of Learning Outcome
☐	I can describe the principal structures and associated blood vessels of the heart; i.e., ventricles, atria, septum, valves (specific names of valves not required), aorta, vena cavae, pulmonary arteries and veins, coronary arteries
☐	I can describe the rhythmic contraction of the heart and its function in the general circulation of blood through pulmonary and systemic pathways
☐	I can describe the structure and function of blood vessels and the flow of blood through arteries, arterioles, venules, veins and capillaries
☐	I can describe the main components of blood (i.e., plasma, red blood cells, white blood cells, platelets, blood proteins that include antibodies, hemoglobin and hormones) and their role in the transportation of substances (*e.g., nutrients, wastes, gases, hormones),* blood clotting, the defence against pathogens and the distribution of thermal energy.
Science, Technology and Society (STS)—*Students will* develop an understanding of the nature of science and technology, the relationships between science and technology, and the social and environmental contexts of science and technology.	
☐	*I can describe how society provides direction for scientific and technological development e.g., *investigate and explain the relationship between exercise, lifestyle, diet, gender and cardiovascular health by examining blood pressure, heart rate and cholesterol levels*.
Skills—*Students will* develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively and for making informed decisions.	
☐	I can design an experiment to determine the effects of exercise, emotion, gender or chemicals such as caffeine on blood pressure and heart rate
☐	I can measure resting heart rate and blood pressure and determine the effects of exercise on both factors
☐	I can observe prepared slides or electronic images of human blood
☐	I can map blood flow through a mammalian heart

* Developed throughout the course in a variety of units and contexts

Science 30 Learning Outcomes – Unit A: Living Systems Respond to Their Environment	
Skills—*Students will* develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively and for making informed decisions.	
Outcome Attained	Description of Learning Outcome
☐	I can use appropriate International System of Units (SI) notation, fundamental and derived units and significant digits
☐	I can use appropriate numeric, symbolic, graphical and linguistic modes of representation to communicate ideas, plans and results
Knowledge - *Students will* construct knowledge and understandings of concepts in science, and apply these understandings to interpret, integrate and extend their knowledge.	
☐	I can describe how pathogens in the environment *(e.g., mosquito-borne parasites, bacteria, viruses)* enter the circulatory system and may have an adverse affect on health
☐	I can describe, in general terms, the function of various body mechanisms, including the skin and body secretions (i.e., tears and stomach acid), in preventing pathogens from entering body tissues
☐	I can describe, in general terms, how immunity to pathogens develops, how the immune system responds to a foreign antigen and the roles of macrophages, B cells, helper T cells, killer T cells, suppressor T cells, memory cells and antibodies
☐	I can explain the interrelationship of autoimmune diseases and the human immune system; *e.g., multiple sclerosis, arthritis, lupus*
☐	I can analyze how vaccines defend against disease-causing bacteria and viruses.
Science, Technology and Society (STS)—*Students will* develop an understanding of the nature of science and technology, the relationships between science and technology, and the social and environmental contexts of science and technology.	
☐	*I can describe how society provides direction for scientific and technological development *e.g., describe how vaccination programs are beneficial in controlling epidemics or dealing with concerns about the spread of possible infection, such as tetanus, smallpox and influenza* *e.g. describe how improvements to sanitation, personal hygiene and the availability of potable water have greatly reduced the incidence of communicable diseases and discuss the ongoing need for vigilance and research into modes of transmission of such diseases as typhoid, cholera and gastrointestinal diseases.*

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Science 30 Learning Outcomes – Unit A: Living Systems Respond to Their Environment	
Skills—*Students will* develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively and for making informed decisions.	
Outcome Attained	Description of Learning Outcome
☐	*I can formulate questions about observed relationships and plan investigations of questions, ideas, problems and issues *e.g., select appropriate procedures and instruments to investigate the various ways the human body protects itself from diseases* *e.g., design a study to test the effectiveness of a drug, incorporating the use of a placebo into a double-blind study*
☐	*I can conduct investigations into relationships among observable variables and use a broad range of tools and techniques to gather and record data and information *e.g. conduct research and synthesize information on the various ways the human body protects itself from diseases* *e.g. perform a biogeographical study to compare the incidence of disease, such as West Nile encephalitis, Ebola hemorrhagic fever or leprosy (Hansen's disease), in different regions of the world* e.g. *simulate an immune response, using a model and/or computer simulation*
☐	*I can analyze data and apply mathematical and conceptual models to develop and assess possible solutions *e.g., evaluate research on the development of a vaccine for the human immunodeficiency virus (HIV)* *e.g., evaluate the use of anecdotal versus statistical evidence in validating a scientific interpretation or conclusion* *e.g., evaluate implications of findings to questions, such as why some individuals choose not to be vaccinated or why the incidence of tuberculosis is rising* *e.g., assess both ethical and practical implications of using animals to test a drug or treatment intended for human application*
☐	*I can work collaboratively in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results *e.g., select and use multimedia capabilities to present findings on the effectiveness of vaccination on specific forms of disease, such as tuberculosis*

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Science 30 Learning Outcomes – Unit A: Living Systems Respond to Their Environment	
Knowledge - *Students will* construct knowledge and understandings of concepts in science, and apply these understandings to interpret, integrate and extend their knowledge.	
Outcome Attained	Description of Learning Outcome
☐	I can describe, in general, the behaviour of chromosomes during mitosis, meiosis and fertilization
☐	I can explain, with the aid of Punnett squares, the inheritance of single traits by applying current understanding of the gene, segregation and dominance
☐	I can distinguish autosomal from sex-linked patterns of inheritance
☐	I can describe the structure of DNA by: • identifying the structure of DNA as a double helix • listing the essential components of DNA as nucleotides • identifying the base pairings between the strands of the double helix
☐	I can explain the general process of DNA replication
☐	I can describe a primary function of DNA by describing how an amino acid sequence of a polypeptide (protein) is determined by the sequence of DNA triplet codes, i.e., use of a table of DNA triplets matched with amino acids
☐	I can describe the role of proteins in the human body as regulatory molecules (enzymes), as structural molecules and as a source of energy
☐	I can describe how mutations in DNA affect the proteins produced resulting in human diseases; *e.g., sickle-cell anemia, hemophilia, Huntington's disease, cystic fibrosis*
☐	I can describe, in general terms, genetic engineering and its application to gene therapy and the development of genetically modified organisms
☐	I can describe the development of resistance in bacteria and viruses, based on the concepts of mutation, plasmid transfer, transformation and natural selection.
Science, Technology and Society (STS)—*Students will* develop an understanding of the nature of science and technology, the relationships between science and technology, and the social and environmental contexts of science and technology.	
☐	*I can explain that science and technology are developed to meet societal needs and expand human capability
☐	I can assess the risks and benefits of genetic technology and the need for ethical considerations; *e.g., stem-cell research, access to genetic screening, genetically modified organisms*

* Developed throughout the course in different units and contexts

Science 30 Learning Outcomes – Unit A: Living Systems Respond to Their Environment	
Skills—*Students will* develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively and for making informed decisions.	
Outcome Attained	Description of Learning Outcome
☐	I can investigate, with the aid of a pedigree chart, the familial inheritance of a specific trait that is controlled by a single pair of genes
☐	I can interpret patterns and trends in data associated with autosomal and sex-linked inheritance
☐	I can predict, quantitatively, the probability of acquiring a particular trait in autosomal and sex-linked patterns of inheritance

Science 30 Learning Outcomes – Unit B: Chemistry in the Environment	
Knowledge - *Students will* construct knowledge and understandings of concepts in science, and apply these understandings to interpret, integrate and extend their knowledge.	
Outcome Attained	Description of Learning Outcome
☐	I can define acids and bases in terms of proton donors and proton acceptors
☐	I can differentiate among acids, bases, neutral ionic compounds, neutral molecular compounds and strong and weak acids, based on appropriate diagnostic tests
☐	I can describe the relationship between pH and hydronium ion concentration
☐	I can explain, qualitatively, how buffers maintain a relatively constant pH when a small amount of acid or base is added to an aqueous system
☐	I can explain the importance of maintaining a relatively constant pH in a living system; *e.g., the role of the hydrogen carbonate ion in maintaining the pH of blood, the evolution of the Arctic herb Artemisia tilesii in resisting acidic moisture by extracting calcium from the soil and pumping the calcium to its leaves*
☐	I can trace the historical use of acid-base indicators; *e.g., early Aboriginal methods of using extracts from natural substances*
☐	I can explain what is meant by buffering capacity; *e.g., soil or bedrock*
☐	I can outline the chemical reactions (*e.g., combustion reactions*) that produce air pollutants (i.e., sulfur dioxide and nitrous oxides) that, when combined with water, ultimately result in acid deposition
☐	I can describe impacts on the biotic and abiotic components of the environment caused by acid deposition; *e.g., lowered pH in water systems, accelerated corrosion, metal leaching from bedrock, the impact of leached metals on plants and the food chain*.
Science, Technology and Society (STS)—*Students will* develop an understanding of the nature of science and technology, the relationships between science and technology, and the social and environmental contexts of science and technology.	
☐	I can describe, in general terms, the uses of acids and bases in industry; *e.g., hydrochloric acid used to extract metals from ores; sulfuric acid used to make fertilizers, paints, plastics, dyes and detergents; and sodium hydroxide used to make soaps and drain and oven cleaners*
☐	I can identify and explain how human activities and natural events contribute to acid deposition in the environment.

Science 30 Learning Outcomes – Unit B: Chemistry in the Environment	
Skills—*Students will* develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively and for making informed decisions.	
Outcome Attained	Description of Learning Outcome
☐	I can design a procedure to identify acidic, basic, neutral ionic and molecular solutions
☐	I can design an experiment for determining the buffering capacity of local soil or pond samples
☐	I can use a pH meter and/or pH paper and indicators to measure the pH of solutions; *e.g., collect pH data to study an aquatic ecosystem*
☐	I can use indicators and a conductivity meter to differentiate between a strong acid and a weak acid
☐	I can perform a titration using a strong monoprotic acid and a strong monoprotic base
☐	I can use titration data to determine the concentration of a strong acid or a strong base
☐	I can research and plot on a map the distribution patterns of acid deposition as influenced by prevailing winds
☐	I can calculate pH from hydronium ion concentration and hydronium ion concentration from pH
☐	I can calculate the concentration of strong monoprotic acids and strong monoprotic bases from empirical data
☐	I can compare collected titration data with that of other individuals and groups
☐	I can use appropriate scientific conventions when communicating solutions to titration problems

Science 30 Learning Outcomes – Unit B: Chemistry in the Environment	
Knowledge - *Students will* construct knowledge and understandings of concepts in science, and apply these understandings to interpret, integrate and extend their knowledge.	
Outcome Attained	Description of Learning Outcome
☐	I can identify and name carbon compounds, using International Union of Pure and Applied Chemistry (IUPAC) nomenclature that contain up to three carbon atoms in the parent chain and a single occurrence of one type of functional group, including simple halogenated hydrocarbons *(e.g., 2-chloropropane)*, alcohols *(e.g., propan-1-ol)*, carboxylic acids *(e.g., propanoic acid)* and esters *(e.g., methyl propanoate)*
☐	I can describe the common uses of hydrocarbons, including simple halogenated hydrocarbons, alcohols, carboxylic acids and esters; *e.g., chlorofluorocarbons (CFCs) as refrigerants, as propellants and in the manufacture of plastic foam products; ethanol as a solvent and as a gasoline additive; ethanoic acid as vinegar; ethyl ethanoate as nail-polish remover*
☐	I can identify organic compounds commonly considered to be environmental pollutants; i.e., hydrocarbons, organic waste, CFCs, polychlorinated biphenyls (PCBs), dioxins and furans
☐	I can list the sources of, and analyze the hazards posed by, halogenated hydrocarbons and benzene derivatives
☐	I can identify and explain how human activities and natural events contribute to the production of photochemical smog, the depletion of the ozone layer and increased concentrations of organic compounds in the environment; *e.g., driving a car, use of CFCs, agricultural practices*
☐	I can explain the mechanism and significance of biomagnification.
Science, Technology and Society (STS)—*Students will* develop an understanding of the nature of science and technology, the relationships between science and technology, and the social and environmental contexts of science and technology.	
☐	I can explain how the introduction of environmental contaminants, i.e., herbicides, pesticides, dichlorodiphenyltrichloroethane (DDT), CFCs, $SO_2(g)$, $CO_2(g)$, particularly persistent organic pollutants (POPs), affects living systems globally
☐	I can interpret information describing biomagnification and environmental persistence of organic pollutants on biological systems; *e.g., lethal dose (LD, LD 50), PCBs, DDT*.
Skills—*Students will* develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively and for making informed decisions.	
☐	I can use current reliable information sources to analyze technologies used to reduce the release of POPs into the environment

Science 30 Learning Outcomes – Unit B: Chemistry in the Environment	
Knowledge - *Students will* construct knowledge and understandings of concepts in science, and apply these understandings to interpret, integrate and extend their knowledge.	
Outcome Attained	Description of Learning Outcome
☐	I can describe the risks and benefits of using chemical processes that may produce products and/or by-products that have the potential to harm the environment
☐	I can describe technologies used to reduce the production and emission of chemical compounds that have the potential to harm the environment; *e.g., activities related to internal combustion engines, smelting, pesticide production, sweetening of sour gas*
☐	I can describe alternatives to the use of chemical technologies; *e.g., bioremediation for contaminated soil, biological controls for pests, biodegradable products.*
Science, Technology and Society (STS)—*Students will* develop an understanding of the nature of science and technology, the relationships between science and technology, and the social and environmental contexts of science and technology.	
☐	I can explain the role of concentration in a risk-benefit analysis for determining the safe limits of particular substances; *e.g., pesticide residues, chlorinated or fluorinated compounds*
☐	*I can explain that the appropriateness, risks and benefits of technologies need to be assessed for each potential application from a variety of perspectives, including sustainability
Skills—*Students will* develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively and for making informed decisions.	
☐	I can plan an evaluation, including a risk-benefit analysis, of a chemical process or an issue related to its use
☐	I can describe procedures for the safe handling, storage and disposal of materials used in the laboratory, with references to WHMIS and consumer product labelling information
☐	I can debate the issue of whether protecting the environment should have priority over economic interests
☐	I can collect information from a wide selection of resources relating to a chemical process or an issue related to its use
☐	I can interpret data from water quality tests, such as pH, BOD, dissolved oxygen and organic compounds
☐	I can analyze alternatives to the use of chemical technologies; *e.g., bioremediation for contaminated soil, biological controls for pests, biodegradable products*
☐	I can evaluate methods used to reduce the incidence of acid deposition and photochemical smog; *e.g., reducing sulfur content in fuels, using catalytic converters in automobiles, smokestack scrubbers*
☐	I can consult and evaluate a wide variety of sources that reflect varied viewpoints on the risks and benefits of using particular chemicals; *e.g., the use of DDT in countries where malaria is a major cause of death*

*Developed throughout the course in different units and contexts

Science 30 Learning Outcomes – Unit C: Electromagnetic Energy	
Knowledge - *Students will* construct knowledge and understandings of concepts in science, and apply these understandings to interpret, integrate and extend their knowledge.	
Outcome Attained	Description of Learning Outcome
☐	I can define a field as a property of space around a mass, an electric charge or a magnet that causes another mass, electric charge or magnet introduced in to this region to experience a force
☐	I can compare the interaction between static electric charges with the interaction between magnetic poles and with the interaction between two masses at a distance
☐	I can compare the basic properties (source, direction and strength) of vector fields (gravitational, electric and magnetic), as determined by a test object
☐	I can describe gravitational and electric field strength at a given distance from a mass or a point charge, using the equations $\lvert g \rvert = Gm/r^2$ and $\lvert E \rvert = kq/r^2$
☐	I can describe the effect of a conductor moving through a magnetic field and inducing an electrical current
☐	I can describe the relationships, for up to three resistors, among power, current, voltage and resistance for series and parallel circuits, using the equations $V = IR$, $P = VI$, $P = I^2R$, $R_T = R_1 + R_2 + R_3$, and $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$
☐	I can describe electrical energy in kilowatt hours and joules, using the equation $E_e = Pt$ for electrical energy and the equation $P = VI$ for power
☐	I can distinguish between alternating current (AC) and direct current (DC) in terms of electron flow and electric field
☐	I can describe the operation of a transformer, in terms of the relationship among current, voltage and the number of turns in the primary and secondary coils, using the equation $N_p / N_s = V_p / V_s = I_s / I_p$
☐	I can describe the advantage of AC over DC for transmitting and using electrical energy
☐	I can compare the general design and function of a DC electric motor and a generator
☐	I can describe, in terms of design and electrical energy, the functioning of safety technologies; *e.g., circuit fuses and breakers, polarized plugs and ground wiring*.
Science, Technology and Society (STS)—*Students will* develop an understanding of the nature of science and technology, the relationships between science and technology, and the social and environmental contexts of science and technology.	
☐	I can describe, in general terms, examples of technological devices based on electrical current and describe their impact on daily life; *e.g., light bulbs, electrical devices and electromagnets in the home, the workplace and in industry*
☐	I can describe, in general terms, examples of technological devices based on electric and magnetic fields and describe their impact on daily life; *e.g., telephones, cellular telephones, CD players, photocopiers, electrostatic filters and scrubbers*
☐	*I can explain that technological development may involve the creation of prototypes, the testing of prototypes and the application of knowledge from related and interdisciplinary fields

* Developed throughout the course in different units and contexts

Science 30 Learning Outcomes – Unit C: Electromagnetic Energy	
Skills—*Students will* develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively and for making informed decisions.	
Outcome Attained	Description of Learning Outcome
☐	I can evaluate and select appropriate instruments for measuring current, voltage and resistance
☐	I can design an experiment and identify specific variables to measure current, voltage and resistance
☐	I can investigate the interactions between static electric charges, between magnetic poles and between two masses
☐	I can construct an electric circuit to measure current, voltage and resistance, using a voltmeter or an ammeter
☐	I can construct a simple electric generator or a DC motor
☐	I can draw diagrams to represent fields (*e.g., gravitational, electric or magnetic fields*), using field lines
☐	I can test and evaluate a self-constructed, simple electric generator or motor in terms of design, ruggedness and ability to perform a specific function
☐	I can calculate the values for $\left\|g\right\|$ and $\left\|E\right\|$, using the corresponding field-strength equations
☐	I can calculate the resistance of series and parallel circuits for a maximum of three resistors
☐	I can calculate values for power, current, voltage and resistance
☐	I can calculate the value of E_e, P, t, I, V, using the related equations
☐	I can calculate current voltage and the number of turns in the primary and secondary coils of electrical transformers.

Science 30 Learning Outcomes – Unit C: Electromagnetic Energy	
Knowledge - *Students will* construct knowledge and understandings of concepts in science, and apply these understandings to interpret, integrate and extend their knowledge.	
Outcome Attained	Description of Learning Outcome
☐	I can describe the range of the electromagnetic spectrum from long, low-frequency radio waves through microwaves, infrared (IR) light rays, visible light rays and ultraviolet (UV) radiation to very short, high-frequency waves, such as X-rays and gamma rays
☐	I can compare and contrast, to each other, the various constituents of the electromagnetic spectrum, on the basis of source, frequency, wavelength and energy, and their effect on living tissue; *e.g., UV radiation on human skin and photosynthetic organisms; gamma radiation on living cells; visible light on plants, phytoplankton and humans; artificial illumination on the growth of plants*
☐	I can recognize that Earth's atmosphere absorbs certain frequencies of EMR
☐	I can investigate and describe, qualitatively, the phenomena of reflection, refraction, diffraction and polarization of visible light
☐	I can compare and contrast the properties of radiation, from any region of the electromagnetic spectrum, with those of visible light; i.e., wavelength, frequency, speed, reflection, refraction, diffraction, penetrability
☐	I can investigate and describe the relationships of the variables in the universal wave equation $v = \lambda f$
☐	I can explain, in general terms, the design of telescopes that are used to gather information about the universe through the collection of as much EMR as possible; i.e., reflecting and refracting optical and radio telescopes
☐	I can explain that nuclear fusion in the sun, represented by the equation $^{2}_{1}\mathrm{H} + {}^{2}_{1}\mathrm{H} \rightarrow {}^{3}_{2}\mathrm{He} + {}^{1}_{0}\mathrm{n}$, produces a wide spectrum of EMR
☐	I can describe, in general terms, how a spectroscope can be used to determine the composition of incandescent objects or substances, and the conditions necessary to produce emission (bright line) and absorption (dark line) spectra, in terms of light source and temperature
☐	I can describe technologies used to study stars • spectroscopes used to analyze the distribution of energy in a star's continuous emission spectrum can be used to estimate the surface temperature of the star • Doppler-shift technology used to measure the ~~speed~~ velocity of distant stars provides evidence that the universe is expanding
☐	I can describe, in general terms, the evolution of stars and the existence of black holes, white dwarves and neutron stars.

Science 30 Learning Outcomes – Unit C: Electromagnetic Energy	
Science, Technology and Society (STS)—*Students will* develop an understanding of the nature of science and technology, the relationships between science and technology, and the social and environmental contexts of science and technology.	
Outcome Attained	Description of Learning Outcome
☐	I can identify examples of technologies that apply EMR to solve medical, communication, industrial and environmental problems; *e.g., use of UV radiation to kill bacteria; diagnostic use of MRIs and X-rays; use of radio waves, microwaves, fibre optics and infrared light in communications; use of remote-sensing technologies, including telescopes, space probes and satellites, in the study of the universe*
☐	I can explain, in general terms, how EMR-detection technologies have advanced scientific knowledge of our universe and the structure of matter
☐	* I can explain how the appropriateness, risks and benefits of technologies need to be assessed for each potential application from a variety of perspectives, including sustainability
Skills—*Students will* develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively and for making informed decisions.	
☐	I can design an experiment, identifying specific variables, to investigate the reflection, refraction or polarization of visible light
☐	I can calculate values for any of the variables in the universal wave equation
☐	I can create data tables from investigations into polarization, reflection or refraction of visible light or draw diagrams to illustrate these phenomena
☐	I can create a summary table or a diagram of spectral lines observed from gas discharge tubes
☐	I can observe and analyze the various spectra of an artificial light source, using a spectroscope, prism or diffraction grating

* Developed throughout the course in different units and contexts

Science 30 Learning Outcomes – Unit D: Energy and the Environment	
Knowledge - *Students will* construct knowledge and understandings of concepts in science, and apply these understandings to interpret, integrate and extend their knowledge.	
Outcome Attained	Description of Learning Outcome
☐	I can compare the energy consumption of contemporary society with that of traditional cultures and precontact Aboriginal societies, and investigate and analyze the exponential growth of global energy consumption in recent history
☐	I can compare Canada's per-capita energy consumption with developed and developing countries and identify factors that affect consumption; *e.g., economy, lifestyle, level of technology, geography, climate*
☐	I can apply the concept of sustainable development to increasing the efficient use of energy; *e.g., efficient use of energy in the home, in industry and in transportation*
☐	I can explain the need to develop technologies that use renewable and nonrenewable energy sources to meet the increasing global demand
☐	I can describe the environmental impact of developing and using various energy sources; i.e., conventional oil, oil sands, solar power, wind power, biomass, hydroelectricity, coal-burning power, nuclear power, geothermal
☐	I can describe how the Aboriginal perspective of an interconnected environment demonstrates the need to balance resource extraction with environmental impact.
Science, Technology and Society (STS)—*Students will* develop an understanding of the nature of science and technology, the relationships between science and technology, and the social and environmental contexts of science and technology.	
☐	I can investigate and assess the need for strategies (*e.g., co-generation, waste-energy recovery, electrical load scheduling)* and policies to increase energy efficiency as a means of balancing global energy demands with maintaining a viable biosphere.
Skills—*Students will* develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively and for making informed decisions.	
☐	I can identify questions to investigate that arise from science- and technology-related issues; *e.g., "Which energy sources and technologies best balance the need for global energy demand with acceptable environmental impacts?"*
☐	I can analyze data charts, tables and graphs on global energy consumption in the past, in the present and predicted for the future

Science 30 Learning Outcomes – Unit D: Energy and the Environment	
Knowledge - *Students will* construct knowledge and understandings of concepts in science, and apply these understandings to interpret, integrate and extend their knowledge.	
Outcome Attained	Description of Learning Outcome
☐	I can explain how Hess's Law, $\Delta H^\circ = \sum \Delta_f H^\circ$ (products) – $\sum \Delta_f H^\circ$ (reactants), leads to prediction of heats of combustion
☐	I can contrast the proportion of solar energy that creates wind and drives the water cycle with the small proportion captured by photosynthesis as chemical potential energy
☐	I can describe the conversion of solar energy into renewable forms (e.g., wind, hydropower, chemical potential energy by photosynthesis) and nonrenewable forms (e.g., coal, oil and gas) and further conversion into electrical and thermal energy
☐	I can describe the functioning of renewable energy technologies and assess their advantages and disadvantages, including active and passive solar-heating technologies, wind turbines, hydroelectric power, biomass energy, geothermal energy, hydrogen fuel cells
☐	I can explain the difference between fission and fusion and balance simple nuclear reaction equations to show the conservation of nucleons; *e.g.,* $^{1}_{0}\mathrm{n} + {}^{235}_{92}\mathrm{U} \rightarrow {}^{141}_{56}\mathrm{Ba} + {}^{92}_{36}\mathrm{Kr} + 3\,{}^{1}_{0}\mathrm{n};\ {}^{2}_{1}\mathrm{H} + {}^{2}_{1}\mathrm{H} \rightarrow {}^{3}_{1}\mathrm{He} + {}^{1}_{0}\mathrm{n}$
☐	I can describe the main types and sources of radioactive decay and resulting ionizing radiation; i.e., alpha (α), beta (β) and gamma (γ) decay
☐	I can describe mass-energy changes in fission and fusion reactions, as represented by the formula $E = mc^2$
☐	I can describe, in general terms, the operation of a fission reactor (*e.g., the Canadian Deuterium Uranium [CANDU] Reactor*) and the current state of fusion research
☐	I can trace the relationship between nuclear energy and geothermal energy
☐	I can compare and contrast conventional coal, oil-fired or hydroelectric power stations with nuclear power stations, in terms of purpose, process of energy conversions, design and function
☐	I can contrast, quantitatively, the orders of magnitude of energy produced by nuclear, chemical and phase changes
☐	I can explain the source of tides, in terms of gravitational attraction and the relative motions of the sun, moon and Earth
☐	I can describe the energy transformations involved in converting tidal energy to electrical energy and compare tidal power to hydroelectric power; *e.g., tidal generating stations at the Bay of Fundy, Canada and La Rance, France*.
Science, Technology and Society (STS)—*Students will* develop an understanding of the nature of science and technology, the relationships between science and technology, and the social and environmental contexts of science and technology.	
☐	I can evaluate the environmental and economic implications of energy transformation technologies; *e.g., nuclear, geothermal, fossil fuel, hydroelectric, wind, tidal power or hydrogen-cell power in a risk-benefit analysis*

Science 30 Learning Outcomes – Unit D: Energy and the Environment	
Skills—*Students will* develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively and for making informed decisions.	
Outcome Attained	Description of Learning Outcome
☐	I can calculate heats of combustion using Hess's Law; *e.g., calculate and compare fuels currently used with those used in the past*
☐	I can calculate mass-energy changes in fission and fusion reactions, using the equation $E = mc^2$
☐	I can investigate, quantitatively, the efficiency of a device, using energy input and energy output data; *e.g., solar collector, photovoltaic cell, fossil fuel or biomass burner, biogas generator*