



2019

# Curriculum

Grade 1-8

# Science

# S

ACADEMIC EXCELLENCE

CHRISTIAN VALUES

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## INTRODUCTION

This curriculum document shall hereby supersede all use of the Ontario curriculum in this particular subject area at Sudbury Christian Academy (SCA). After years of aiming to “meet and exceed” the Ontario curriculum, the SCA curriculum committee ultimately deemed it necessary to establish its own set of benchmarks. Several independent studies have shown Ontario standards to be in decline in recent years. SCA’s mandate as an independent school, therefore, should consistently be to exceed, not just to meet, the Ontario curriculum standards.

Further, the approaches embraced by SCA are not always in alignment with the Ontario curriculum. The Ontario Science curriculum (as of the time of this writing), is a strong document, but does not match with what we believe to be a superior resource in Purposeful Design Science. Thus, we have crafted a curriculum document in line with our excellent resources so we can a) demonstrate the strength of our program for parents, and b) deliver an excellent program to our students.

This document is deliberately simple and direct, outlining basic proficiency objectives for each grade without going into superfluous detail and philosophy. It includes a table for each grade level complete with four strands and corresponding objectives; descriptions of assignment types (e.g. lab reports, projects); and rubrics for evaluation. This curriculum document is a living document, continually updated to reflect the goals and objectives established by the SCA curriculum committee.

“Study to show thyself approved unto God, a worker who needeth not to be ashamed, rightly dividing the word of truth” (2 Timothy 2:15).

## **I. OUR PHILOSOPHY OF SCIENCE INSTRUCTION**

The Science curriculum at SCA will ...

- Follow the evidence using proper scientific inquiry
- Draw attention to evidence for intelligent design
- Emphasize *that* God created, not *how* God created
- Engage discussion of all theories (e.g. origin of species)
- Underscore the compatibility of faith and science

## **II. TEXTBOOKS AND RESOURCES**

Science teachers at SCA will utilize as their main resources ...

- Purposeful Design Science series from grade 1-6
- Nelson Science series from grade 7-8
- Trillium-approved Scholastic resources as needed to supplement

## **III. RESEARCH AND CITATION**

Students in grades 5 and 6 will be introduced to research concepts such as citation and plagiarism, and will learn to use parenthetical citation in accordance with the formatting standards of the American Psychological Association (APA). Students in grades 5-8 will be expected to provide properly formatted references, both parenthetical citation and reference lists, to identify their information source materials.

## **IV. STRANDS AND OBJECTIVES, GRADES 1-6**

The SCA Science program from grades one through six is divided into four strands: Life Science, Physical Science, The Human Body, and Earth and Space Science. These strands are organized differently from, but cover far more content than, the Ontario curriculum strands (i.e. Life Systems, Structures and Mechanisms, Matter and Energy, Earth and Space Systems).

### **A. Grade 1 Objectives By Strand**

#### **LIFE SCIENCE**

##### **Mammals**

- Students will distinguish between living and non-living things
- Students will recognize animals as a diverse group of living things
- Students will understand that mammals are a distinct group of animals
- Students will recognize some mammals that live in the woodlands
- Students will explore a mammal's ability to maintain body temperature
- Students will understand that technology can be used as a connection between people and the environment

### **Fish**

- Students will learn how the parts of a fish help it to survive its habitat
- Students will identify parts of a fish
- Students will recognize difference in fish design
- Students will learn that most fish lay eggs and what happens to the eggs
- Students will compare saltwater and freshwater
- Students will learn how some fish were designed with special colours and features that help them survive
- Students will demonstrate knowledge about fish

### **Birds**

- Students will learn that birds are part of God's creation
- Students will learn about some parts of a bird
- Students will study how the design of a bird's beak determines what it eats
- Students will understand that birds feet are suited for its environment
- Students will study different types of bird habitats
- Students will understand the life cycle of birds and why birds migrate
- Students will understand that the design of birds has led to the design of aircraft

### **Insects**

- Students will identify an insect as having three main body parts and six legs
- Students will identify the eyes, mouth, antennae, and legs of an insect
- Students will understand the variety of insect mouthparts, antennae, legs and wings
- Students will understand that insects change shape as they grow
- Students will understand that there is a great variety of insect species

## **PHYSICAL SCIENCE**

### **Movement**

- Students will recognize movement in their world
- Students will understand some ways that things move
- Students will understand that vibrations make sound and help us to hear
- Students will understand that some substances move more quickly than others

### **Machines**

- Students will relate to how machines make work easier
- Students will understand that the wheel and inclined plane help make work easier
- Students will understand that the lever and pulley help make work easier

## **THE HUMAN BODY**

### **Teeth**

- Students will recognize that God designed teeth and that there are three basic jobs teeth allow people to do
- Students will learn about sets of teeth and parts of a tooth
- Students will learn about types of teeth
- Students will understand the importance of keeping teeth healthy
- Students will identify the work of a dentist

### **Bones and Muscles**

- Students will learn that bones give people a shape and help people move
- Students will learn how bones protect the body
- Students will understand that the skeleton is made of bones and will recognize specific names of some bones
- Students will learn ways to keep bones healthy
- Students will understand that muscles and joints help people move

### **Heart and Blood**

- Students will learn that the heart pumps blood
- Students will discover the shape of their heart and where it is located
- Students will learn how cuts heal
- Students will learn ways to keep a healthy heart

### **Lungs and Air**

- Students will learn that people need oxygen and acquire it by breathing
- Students will discover parts of the body that help in breathing
- Students will learn how some living things take in air
- Students will learn some things, other than breathing, that lungs help people to do
- Students will study the importance of keeping their lungs healthy
- Students will understand the dangers of smoking
- Students will learn life-saving tips

### **Stomach and Food**

- Students will see examples of the origin of some foods
- Students will learn that food gives people energy to work and grow
- Students will apply knowledge of the Canada food guide
- Students will identify some organs of the digestive system and function of each

## **EARTH AND SPACE SCIENCE**

### **Seasons**

- Students will learn that seasons occur approximately the same time every year and become aware of the characteristics of each season
- Students will study some seasonal changes in plants
- Students will study examples of how some animals are affected by seasons
- Students will study the effects of seasons on people
- Students will study states of matter and temperature
- Students will understand evaporation and dissolving of substances
- Students will learn about the water cycle, clouds, precipitation, and storms
- Students will understand how technology can help people prepare for different kinds of weather

### **Space**

- Students will discover what causes day and night and will understand what causes shadows to change
- Students will identify where space is and become familiar with ways to observe space
- Students will discover the eight planets that orbit around the sun and become aware of the phases of the moon
- Students will discover that constellations are groups of stars that form patterns
- Students will study several events in the history of space exploration
- Students will learn about inventions made because of space science

## B. Grade 2 Objectives By Strand

### LIFE SCIENCE

#### Plants

- Students will associate plants with their various uses
- Students will examine the parts of a seed, order the stages in a plant's life cycle, and describe methods of seed dispersal
- Students will identify the things a plant needs for growth and for the process of photosynthesis; students will label three parts of a plant- roots, stems, and leaves- and will associate each part with its function
- Students will compare and contrast flowering plants and conifers
- Students will examine botanist George Washington Carver's life of service and write about how they can help others

#### Vertebrates

- Students will trace the backbones of several vertebrate images
- Students will classify various vertebrates as mammals, reptiles, or amphibians
- Students will classify domestic dogs, cats and guinea pigs as mammals and will discuss each animal's design
- Students will identify features of a camel and will match several of its body parts to their function
- Students will review five distinguishing characteristics of reptiles and will label a diagram with specific features of iguanas
- Students will compare and contrast reptiles and amphibians and order the Stages of an amphibian's life cycle
- Students will read about naturalist John James Audubon and use observation skills to make detailed drawings of birds

#### Invertebrates

- Students will classify animals as vertebrates or invertebrates and analyze unique characteristics of some invertebrates
- Students will observe earthworms and use scientific inquiry to investigate some earthworm's behaviour
- Students will differentiate between arachnids and insects and will make a model showing parts of a spider
- Students will construct a model to show parts of an ant and associate an ant's body parts with their function
- Students will label an image showing body parts and other physical characteristics of a land snail



### **Habitats**

- Students will associate animals with specific habitats
- Students will state characteristics of some evergreen forest animals and will sequence a simple food chain
- Students will state the characteristic layers of a tropical rainforest and relate rainforest animals to their place in the habitat
- Students will differentiate between examples of still and moving fresh water and draw wetland animals
- Students will observe a model of a desert habitat and identify animals designed to live in such a harsh climate
- Students will analyze characteristics of two polar regions and will analyze characteristics that allow two specific animals to survive and thrive in polar habitats
- Students will examine the effects of pollution, indicate ways to conserve resources, and associate reasons for endangerment with specific animals

## **PHYSICAL SCIENCE**

### **Energy**

- Students will define the term energy and indicate that three forms of energy are heat, light, and sound
- Students will distinguish between objects that show the energy of motion and those that do not
- Students will associate physical and chemical forms of stored energy with the energy of motion that results when the stored energy is released
- Students will observe the effects that height has on the amount of energy stored in suspended objects and will conclude that the greater the height the greater the stored energy
- Students will sequence steps of an energy chain to show how energy moves from one form to another
- Students will identify three fossil fuels and describe the origin of these fossil fuels
- Students will distinguish renewable energy sources from non-renewable sources and will name ways electricity is produced from the sun, wind, and water

### **Heat**

- Students will indicate that molecules move faster when heat energy increases and temperature is a measure of heat energy
- Students will illustrate how heat energy is transferred through radiation
- Students will associate dark colours with heat absorption and light colours with heat reflection
- Students will identify the means by which heat energy moves through solid objects as conduction
- Students will determine if a material is a good insulator or conductor of heat energy
- Students will recognize that heat transfer through liquids and gases is called convection
- Students will associate the three states of water with the terms water vapour, liquid water, and ice. They will recognize that heat causes foods to change

### **Light**

- Students will distinguish between light that is emitted and light that is reflected
- Students will observe shadows and illustrate shadows to show how light travels in straight lines
- Students will investigate ways in which light is either reflected or absorbed
- Students will differentiate between materials that are transparent, translucent, and opaque
- Students will define refraction and recognize that lenses bend light
- Students will recognize various ancient and modern sources of artificial light
- Students will order the colours of the visible spectrum

## **THE HUMAN BODY**

### **Sound and Hearing**

- Students will review the five senses. They will associate sound with hearing
- Students will identify how pitch is related to the speed of vibrations
- Students will label parts of an ear
- Students will order the steps of hearing and recognize that each part of the ear has a function in the hearing process
- Students will identify ways that technology can help people who are deaf or hard of hearing
- Students will identify ways of keeping their ears healthy and preventing hearing loss

### **Sight and Touch**

- Students will label the structure of the eye and identify the pathway light takes through the eye. They will recognize that God has provided natural protection for their eyes
- Students will discuss vision dysfunctions and how eyeglasses can help people see more clearly. They will recognize that some people cannot see colours well
- Students will explore devices that an eye doctor uses in the course of an eye exam and state the importance of taking proper care of eyeglasses
- Students will read about Helen Keller. They will comprehend that Braille letters enable blind persons to read
- Students will state how they are able to experience the sense of touch
- Students will identify various components of the skin
- Students will discuss good health habits for maintaining the health of the eyes and skin

### **Taste and Smell**

- Students will read about the sense of taste and distinguish between flavours
- Students will describe characteristics of the tongue and observe their taste buds
- Students will use their nose to distinguish various scents. They will read about how their nose senses molecules in the air
- Students will identify some parts and functions of the nose
- Students will acknowledge that germs spread through the air and by contact. They will perform a skit about ways to maintain a healthy mouth and nose
- Students will conduct an experiment to observe that things that smell good do not always taste good

## EARTH AND SPACE SCIENCE

### Weather

- Students will recognize God’s purposeful design of the weather and will highlight four factors involved in weather: the sun, the land, the water, the air
- Students will use Fahrenheit and Celsius scales to read and record temperatures
- Students will describe evaporation and condensation and how these terms relate to changes in state of water
- Students will describe how the condensation of water vapour causes dew and fog to form. They will distinguish between the formation of dew and formation of fog
- Students will use the words evaporation, condensation, and rain, snow, or ice, to label components of the water cycle
- Students will distinguish between three main types of clouds - cirrus, cumulus, and stratus
- Students will delineate characteristics of thunderstorms, tornadoes, hurricanes, and blizzards

### Oceans

- Students will label the five oceans on a map. They will recognize that storms and sunlight affect ocean colour
- Students will predict, observe, collect data, and summarize the effect that the salinity of water has on a carrot’s buoyancy
- Students will order the steps in the formation of an ocean wave
- Students will label landforms on the ocean floor
- Students will classify three categories of ocean animals and indicate some animals general location in the ocean
- Students will discuss how coral reefs form and how the habitat provides for aquatic animals
- Students will recognize three types of technology used in undersea exploration

## C. Grade 3 Objectives By Strand

## LIFE SCIENCE

### Ecosystems

- Students will examine the interactions and relationships that are part of an ecosystem
- Students will recognize jobs of an ecologist and name a way that ecologists study or improve the environment
- Students will identify producers, consumers, and decomposers and will give examples of how these organisms interact within an ecosystem
- Students will name predators, prey, and scavengers, and will explain their importance in maintaining balance within an ecosystem
- Students will demonstrate how animals compete with one another for food and will describe an organism’s role in an ecosystem
- Students will identify three ways animals are designed to adapt to their environment: hibernation, migration, camouflage

### **Life of Plants**

- Students will discuss the uses of plants and will name plant parts and the functions of each part
- Students will identify the gas exchange between plants and people and will observe effects of photosynthesis on a plant
- Students will identify the parts of a plant cell and discuss the microscope's importance to scientific investigation
- Students will identify specific flower parts, order the steps of pollination, and construct a flower model
- Students will identify ways plants grow and compare varieties of different plants within the same species
- Students will compare the advantages and disadvantages of aquaponic farming

### **Plant Variety**

- Students will link the form and function of plant characteristics to specific habitats
- Students will match root and stem forms to specific functions that help a plant survive in its habitat
- Students will compare and contrast various types of leaves
- Students will compare and contrast various types of flowers and match flower characteristics to pollinators
- Students will observe and identify the unique characteristics of simple plants
- Students will sort plants that are classified in specific groups because of the plants' characteristics

## **PHYSICAL SCIENCE**

### **Matter**

- Students will identify and compare properties of matter
- Students will determine the best standard of measurement to accurately measure types of matter
- Students will research cycles of matter
- Students will demonstrate three states of matter and will differentiate between the process by which matter changes from one state to another
- Students will separate mixtures into substances and will investigate two states of matter
- Students will experiment with combining different forms of matter in a chemical reaction to make new forms of matter

### **Motions and Force**

- Students will identify various types of motion
- Students will calculate speed
- Students will differentiate between the forces of friction and gravity
- Students will investigate Newton's First Law of Motion
- Students will distinguish between work and power and will analyze the roles of work and power in common tasks
- Students will identify simple machines and will describe how machines help complete work

## Electricity

- Students will demonstrate electricity and discuss uses of it that are all around them
- Students will observe and describe static electricity and will classify objects as either conductors or insulators
- Students will construct a circuit containing a switch
- Students will make a model of a series circuit and of a parallel circuit
- Students will compare and contrast incandescent fluorescent bulbs
- Students will distinguish between safe and unsafe uses of electricity

## Magnets

- Students will distinguish between materials that are magnetic and nonmagnetic
- Students will examine the interaction between poles on magnets
- Students will investigate how magnetic materials can produce magnetism
- Students will identify the lines- of- force pattern in two like magnetic poles and two unlike poles
- Students will use a compass to detect the earth's magnetic field
- Students will identify ways magnets are useful to people

## THE HUMAN BODY

### Musculoskeletal System

- Students will identify the bones used for specific movements
- Students will label the four layers of bones and discuss their functions
- Students will identify and locate three types of joints: hinge, pivot, and ball-and-socket
- Students will demonstrate the movement of skeletal muscles
- Students will identify the functions of smooth, cardiac, and facial muscles, and will classify movements as either voluntary or involuntary
- Students will analyze how prostheses can improve people's lives

### Nervous System

- Students will explain how the nervous system processes information
- Students will identify the function of sensory and motor nerves
- Students will identify the functions of the cerebrum, cerebellum, and brain stem
- Students will demonstrate use of the functions of the brain's left and right hemispheres. Students will test their short- term memory
- Students will identify involuntary functions of the nervous system
- Students will compare and contrast human and animal brains

### Health

- Students will identify stages in the human life cycle and what humans need to stay healthy
- Students will identify the functions and sources of nutrients
- Students will plan a menu that includes essential vitamins and minerals
- Students will analyze their own diet and determine which aspects are healthy and unhealthy
- Students will evaluate their own sleep and exercise habits and list ways to exercise
- Students will analyze their lifestyles and identify healthful and unhealthful habits

## EARTH AND SPACE SCIENCE

### Earth's Surface

- Students will identify and describe rocks and minerals
- Students will classify rocks as either sedimentary, igneous, or metamorphic
- Students will explain how rocks change form through the rock cycle
- Students will illustrate the four components of soil and analyze various types of soil
- Students will distinguish between the landforms of mountains, valleys, and plains
- Students will locate lakes, rivers, and coastlines on a map and identify their uses

### Changes in Earth's Surface

- Students will identify ways erosion gradually changes landforms
- Students will compare how landslides, avalanches, and mudslides can quickly erode landforms
- Students will demonstrate how a volcano erupts and identify the effects volcanoes have on landforms
- Students will identify the cause and many effects of earthquakes
- Students will examine how a tsunami forms and illustrates how it can cause changes to the earth's surface
- Students will identify instruments used to monitor landforms changes

### The Solar System

- Students will identify ways that scientists explore space
- Students will demonstrate a model of the planets and the sun in the solar system
- Students will differentiate among the characteristics of the four planets closest to the sun
- Students will identify the phases of the moon and compare characteristics of the moon and the sun
- Students will differentiate among the characteristics of the four outer planets
- Students will identify the benefits of space travel and the challenges astronauts face in space

### Stars and Constellations

- Students will examine how tools help astronomers study the universe
- Students will distinguish between asteroids, comets, and meteors by identifying the characteristics of each
- Students will identify characteristics of stars including size and colour
- Students will identify three shapes of galaxies and will illustrate the Milky Way galaxy
- Students will identify several specific constellations
- Students will explain how stars and other celestial bodies have been used for tracking time and for navigation

## D. Grade 4 Objectives By Strand

### LIFE SCIENCE

#### Design of Life

- Students will observe living things and identify their common characteristics
- Students will describe how organisms acquire materials and energy, and how they develop
- Students will state how various living things respond and adapt to their environment
- Students will draw pictures of their observations in order to identify the similarities and differences between three types of cells
- Students will label and describe the levels of organization of an organism, from cell to biosphere
- By conducting a series of experiments, students will determine whether yeast acquires materials and energy, responds, and adapts
- By conducting a series of experiments, students will determine whether yeast develops and reproduces and is made of cells. Then, based on their observations, they will determine if yeast is alive.
- Students will identify and describe the principles of commonality, uniqueness, and dependence among living things

#### Order of Life

- Students will investigate simple classification by using like like characteristics to group animals. They will compare specific grouping to that of random grouping
- Students will investigate various body plan characteristics used for classification and identify how a specific body design helps an organism thrive in its environment
- Students will demonstrate simple classification of animals using two separate criteria: acquisition of materials/energy development/reproduction
- Students will recognize animal responses to internal and external stimuli, evaluate animals based on the nature of their responses and identify types of stimuli
- Students will identify the living and nonliving factors of specific habitats. They will compare characteristics or organisms that live in specific habitats and determine the habitat most appropriate for a specific animal
- Students will analyze, compare, and identify an organism. They will explain the importance of appropriate criteria and the purpose of scientific classification
- Students will compare classification systems. They will determine how beliefs and purposes affect how a classification system is developed

#### Diversity of Life

- Students will identify unique features and combinations of features within a given set of animals. They will explain why some unique features are more significant than others
- Students will recognize the unique features of various body plans. They will describe examples of organisms that have similar body plans for different purposes and different body plans for similar purposes
- Students will research, organize and analyze the data, and describe the unique ways in which certain species acquire materials/energy and develop/reproduce
- Students will describe unique response features and behaviours of animals. They will demonstrate and evaluate an unusual communication stimulus and response
- Students will identify unique features of species that enable them to survive in unique habitats
- Students will evaluate how different organisms use different body parts for similar functions and how similar parts can be used for different functions
- Students will name different kinds of fossils and demonstrate how unidentified bones might fit together

### **System of Life**

- Students will identify systems and system functions by considering the individual parts and how these parts work together. They will explain systems within systems
- Students will demonstrate cooperation and competition in nature. They will describe relationships in populations and communities
- Students will analyze how a species is dependent upon and affected by its habitat and ecosystem
- Student will evaluate the factors that help to balance an ecosystem. They will illustrate and label the water and carbon cycles
- Students will identify and describe types of ecological imbalance. They will set up a water pollution simulation, determine pollution's effect on people, and propose ways to prevent it
- Students will investigate balance and imbalance in an ecosystem by analyzing and then describing cause and effect relationships between environmental changes and populations of organisms
- Students will identify specific ways that people help restore damaged ecosystems and prevent further damage from occurring

## **PHYSICAL SCIENCE**

### **Energy and Heat**

- Students will analyze sources of energy, not the movement and changes generated by energy, and identify functions achieved by the uses of energy
- Students will describe potential and kinetic energy and identify examples of each
- Students will identify and label kinetic and potential energy and describe how energy is transferred. They will describe how the transfer of energy demonstrates the principle of the conservation of energy
- Students will measure and explain the transfer of thermal energy
- Students will differentiate between heat and thermal energy. They will compare the three ways in which different forms of matter are heated
- Students will investigate the transfer of energy and how different materials absorb thermal energy
- Students will state in their own words the principles of physical science. They will investigate two of these principles by constructing and using an electroscope

### **Light and Sound**

- Students will identify some of the properties of waves, light, and sound
- Students will compare and contrast light and sound using wave parts and properties
- Students will contrast the speeds, types, and sources of waves for light and sound. They will model transverse and longitudinal waves
- Students will describe electromagnetic radiation and contrast the parts of the electromagnetic spectrum
- Students will analyze and describe how light and sound interact with matter like mirrors, lenses, and rough surfaces
- Students will construct simple instruments to identify some properties of light and sound
- Students will investigate how light and sound are used in communication and will demonstrate their knowledge of a communication code



### **Motion and Force**

- Students will identify and describe the kinds of motion and forces they have observed in moving objects
- Students will name three main types of motion and list several examples of each
- Students will describe the differences between contact and non-contact forces. They will list four types of contact and non-contact forces and give an example of each
- Students will demonstrate Newton's First Law of Motion and explain how it expresses the movement of common objects
- Students will state Newton's Second and Third Laws of Motion. They will demonstrate the effects of inertia and friction on objects
- Students will perform experiments to test Newton's laws in order to prove the acting forces and resulting movement of certain objects
- Students will identify the differences between relative and apparent motion

### **Matter and Its Uses**

- Students will compare the physical properties of various liquids, solids, and semi-solids
- Students will name and define the four main parts of an atom
- Students will construct a model to show how atoms combine to form molecules, and then will draw examples of atoms
- Students will evaluate differences in density and categorize physical and chemical properties
- Students will describe the physical properties of reactants and will differentiate between physical and chemical changes
- Students will construct a model of an atom. They will investigate different types of matter to further distinguish between physical and chemical change
- Students will assess how technology has impacted the world today. They will evaluate the relationship between technology and responsibility

## **THE HUMAN BODY**

### **Body Systems I**

- Students will classify levels of organization in living and nonliving systems
- Students will cite the three main parts and describe each of the three main functions of the cardiovascular system
- Students will name, describe, and illustrate the four main components of blood, as well as state the function of each component
- Students will compare and contrast the structure and function of the three types of blood vessels
- Students will recall the immune system's four lines of defense and differentiate between antibodies and vaccines
- Students will locate and record their own pulse rate and analyze how it changes with activity
- Students will illustrate their understanding of heart-healthy habits by preparing a written plan for a balanced diet and exercise

## **Body Systems II**

- Students will analyze and write about the relationship between body systems and teamwork
- Students will state a comparison between a factory and the human body. They will illustrate the basic concept of digestion
- Students will label the parts and model the functions of the digestive system
- Students will chart their respiration rates and construct a model of the lungs and diaphragm
- Students will label and define three parts of the urinary system and will describe the filtering process of kidneys after a teacher demonstration
- Students will gather, average, and compare data about their vital capacity and will relate the body systems' ability to adjust to changing conditions to the reduced oxygen levels at high elevation
- Students will chart their nutrition, exercise, and relaxation habits and review several body systems' interdependence in the context of osteopathic medicine

## **EARTH AND SPACE SCIENCE**

### **The Lithosphere**

- Students will analyze the different components of soil and explain how and why they settle in layers. They will hypothesize about what is inside the earth
- Students will name and categorize the layers of the earth
- Students will model the three basic types of plate boundaries. They will recognize different surface features resulting from plate tectonic activity
- Students will differentiate between physical and chemical weathering, and identify natural forces that contribute to it
- Students will name and describe the layers of a soil profile
- Students will demonstrate how movement at a transform boundary can cause an earthquake
- Students will explain the importance of conserving our resources and give specific examples of historical events, such as the Dust Bowl and deforestation
- Students will illustrate the four principles of Earth Science and will write about how the earth, its water, the atmosphere, and the universe act as a system

### **The Hydrosphere**

- Students will calculate the amount of water in several living and nonliving items and list important uses of water in their school
- Students will recount the composition and density of water and its ability to dissolve other substances
- Students will perform an experiment to observe the effects of evaporation. They will label pictures using at least two stages of the water cycle
- Students will substantiate how groundwater accumulates and what effects different soil types have on groundwater
- Students will give reasons to protect estuaries and describe how wind affects ocean currents
- Students will categorize the salinity of water and quantify the useable portion of the earth's water. They will determine water usage in their homes and describe methods of conservation
- Students will describe several ways that pollution affects a watershed and suggest how to prevent water pollution

### **The Atmosphere**

- Students will relate the movement of water to the movement of air due to differences in density
- Students will list at least two characteristics of each of the four main layers of the atmosphere
- Students will summarize the processes in which solar radiation heats the earth's surface and how heat is transferred throughout the troposphere
- Students will state the process by which clouds are formed and distinguish between three main cloud types and four forms of precipitation
- Using the terms *barometer*, *low pressure*, and *high pressure*, students will interpret how changes in air pressure cause specific weather conditions and will also compare and contrast three types of storms
- Students will construct barometers and will observe, record, and analyze barometric readings, comparing them with actual weather patterns
- Students will utilize factors such as latitude, wind patterns, altitude, bodies of water, and ocean currents to predict a region's climate

### **The Universe**

- Students will draw pictures to show the factors that determine the time of day and the seasons. They will design a model of a planet that can support life
- Students will compare and contrast the design and accuracy of at least three different types of instruments used by scientists to study the universe
- Students will experiment and determine the relationship between speed and distance in planetary motion, and will demonstrate the shape of satellite orbits
- Students will develop their own unit of measure and identify the three basic galaxy types
- Students will evaluate how distance affects observation and illustrate the structure of the universe
- Students will calculate, compare, and illustrate relative distances of the planets and Pluto from the sun
- Students will defend the Anthropic Principle by indicating at least five unique qualities that make life possible on Earth

## **E. Grade 5 Objectives By Strand**

### **LIFE SCIENCE**

#### **Natural Cycles**

- Students will analyze the benefits of a cycle by participating in an activity that requires recycling materials to achieve optimum performance
- Students will explain the cycling of important elements between the living and nonliving components of an ecosystem
- Students will summarize the stages of the water cycle
- Students will recount the main components of the carbon and oxygen cycle
- Students will identify the components of the nitrogen cycle and explain the importance of nitrogen to living things
- Students will graph and analyze data related to the nitrogen cycle, compare the strength of acids, and infer the effects of disrupting a biogeochemical cycle
- Students will discover the results of acid precipitation and formulate ways to prevent air pollution

### **Life Cycles**

- Students will relate the general definition of *cycle* to seven stages of the human life cycle
- Students will relate their understanding of three general concepts regarding life cycles to the specific life cycle of bacteria
- Students will analyze a fungal life cycle by examining a fungal life stage and the growth of mold
- Students will recount the life cycle of the flowering bean plant, compare variables which influence seed germination, and dissect a flower
- Students will name and summarize the stages in the salmon life cycle, associating each stage with one or more habitats
- Students will list the three life stages of brine shrimp. They will also control one variable in an experiment involving the cyst and nauplius stages of the brine shrimp's life cycle
- Students will cite causes and effects of malaria

### **Cells**

- Students will evaluate how the process of machinery parts working together relates to the cell theory
- Students will state the cell theory, label and describe the functions of major organelles, and distinguish between plant and animal cells
- Students will summarize how traits are controlled by DNA, genes, and chromosomes
- Students will list, illustrate, and paraphrase the events that occur during the cell cycle
- Students will relate the levels of cell organization to the development of an organism, beginning with a fertilized egg
- Students will observe, draw, and discriminate between animal and plant cells
- Students will explain how cancer develops, describe at least three common types of cancer, list three methods of treatment, and identify four ways to help prevent certain cancers

### **Ecological Succession**

- Students will interpret and dramatize the consequences of interruptions
- Students will identify two types of ecological succession and will describe the stages of primary succession
- Students will examine the effects of the glacial retreat at Glacier Bay, Alaska. They will track the stages of primary succession that have occurred in this area
- Students will describe and illustrate the four series of secondary succession
- Students will give examples of how secondary succession has taken place since the fires of 1988 in Yellowstone National Park
- Students will prepare models to demonstrate primary and secondary succession. They will conduct an experiment and analyze variables involved in volcanic eruptions
- Students will examine and summarize two events in history that initiated ecological succession

## PHYSICAL SCIENCE

### Measuring Matter

- Students will recognize the need for standard units of measurement and select logical and accurate ways to measure
- Students will compare the metric and customary measurement systems. They will recall common metric prefixes
- Students will measure and calculate area and volume
- Students will distinguish between mass and weight and cite the differences between the Celsius and Fahrenheit
- Students will calculate the density of an object
- Students will take metric and customary measurements and calculate areas and volumes
- Students will construct an object that is buoyant and analyze its buoyancy

### Changing Matter

- Students will observe and then compare physical characteristics of events occurring in the classroom. They will evaluate the importance of making detailed observations and gathering evidence
- Students will describe how a physical change affects bonds and physical properties. They will differentiate van der Waals forces from chemical bonds
- Students will distinguish between substances and mixtures. They will demonstrate how to use physical changes to separate mixtures
- Students will identify differences between chemical and physical changes. They will name two chemical properties of matter
- Students will contrast chemical and nuclear changes. They will identify fission and fusion as two forms of nuclear change
- Students will make models of water molecules to simulate physical, chemical, and nuclear changes. They will demonstrate the solubility and insolubility of different liquids
- Students will analyze how combustion is used to power a variety of vehicles

### Force and Work

- Students will assess the advantages of using tools to accomplish work
- Students will describe the relationship between speed, velocity, and acceleration. They will calculate the speed of a given object
- Students will use appropriate metric units to calculate force and work
- Students will classify and describe levers and inclined planes as types of simple machines
- Students will locate and label the load, effort, and fulcrum for each of the three classes of levers  
Students will demonstrate the three classes of levers. They will describe the relationship of the distance between the effort and the fulcrum to the amount of effort needed in a first-class lever
- Students will calculate the grade of a slope. They will give examples of how simple machines were used in ancient civilizations

### **Electricity and Magnetism**

- Students will conclude how different life would be without electrical energy
- Students will explain what an electric charge is and how static electricity occurs
- Students will analyze electric current, compare and contrast it to static discharge, and describe and illustrate voltage
- Students will compare and contrast series and parallel circuits and evaluate how they affect an electric current
- Students will illustrate magnetic fields and describe the relationship between current electricity and magnetism
- Students will detect the buildup and discharge of static electricity and identify how the length of the circuits affects the strength of an electromagnet
- Students will identify transformations of energy and rate different methods of producing electricity

## **THE HUMAN BODY**

### **Transitions**

- Students will review the stages of a monarch butterfly's life cycle and relate the changes involved in metamorphosis to adolescence
- Students will relate the changes that occur during puberty to the work of the endocrine system. They will also label six parts of the endocrine system and compare it to the nervous system
- Students will illustrate the structure of the skin and will describe the cause and effect relationship between skin glands and pubescent changes
- Students will associate the growth spurts of puberty with the endocrine system, genetics, and healthy eating and exercise
- Students will label the basic structures of a tooth and evaluate their own oral hygiene habits. They will also distinguish between primary and permanent teeth
- Students will evaluate their daily lifestyle choices in terms of balance and self-control
- Students will summarize the processes that stimulate and regulate the human body's sleep cycle. They will also log and assess their own sleep and wake cycle

### **Disease**

- Students will associate the malfunctions and failures of commonly used items to the unexpected impairment of the human body. They will also investigate a disease known since ancient times - leprosy
- Students will determine the differences between infectious and noninfectious diseases. They will identify four major groups of pathogens
- Students will identify certain infectious diseases and the pathogens that cause them. They will describe viral reproduction
- Students will identify genetic disorders and allergies as noninfectious diseases. They will classify infectious and noninfectious diseases based on given criteria
- Students will identify integral parts of the immune and lymphatic systems and discuss the functions of each
- Students will graph and analyze data of four specific infectious diseases. They will interpret how pathogens are transmitted and list preventive methods
- Students will explain how the human body builds immunity to pathogens and will differentiate between active and passive immunity

## EARTH AND SPACE SCIENCE

### Earth's Processes

- Students will examine natural, predictable, and necessary life changes and distinguish between physical and chemical changes in matter
- Students will describe a natural rock cycle, using the names of three major rock types. They will also list several minerals that are useful to their daily lives
- Students will summarize the theories of plate tectonics and continental drift. They will predict possible features and events that may occur at different types of plate boundaries
- Students will identify key features of the ocean floor and explain how they were formed
- Students will evaluate how salinity, density, and temperature affect ocean currents. They will summarize the causes and effects of El Niño
- Students will compare solutions with different densities, associating water density with ocean currents. They will also simulate geologic core sampling
- Students will apply the concept of magnetism to changes on the ocean floor as they construct a model of opposite magnetic polarities

### Natural Resources

- Students will apply their knowledge of basic human needs to determine the necessary resources for survival on a deserted island. They will evaluate how to conserve resources in order to survive
- Students will list natural resources and distinguish between renewable and nonrenewable resources
- Students will identify the three main types of fossil fuels, explain how each is formed, and give examples of how each is used
- Students will cite physical characteristics of metals and distinguish them as a subgroup of minerals. They will simulate how ore is extracted
- Students will summarize the environmental and economic issues surrounding landfills and waste. They will plan, prepare, and propose ways to reduce, reuse, and recycle
- Students will perform three tests to identify specific properties of minerals. They will decide on an appropriate use for oil based on their observation and understanding of its properties
- Students will describe how solar energy, biomass, and geothermal energy are used as alternative energy sources

### Weather and Climate

- Students will observe and recall three pertinent properties of air through experimentation
- Students will evaluate the relationship between unequal heating, differences in air pressure, and convection currents. They will relate how those relationships influence the formation of wind(s)
- Students will explain the factors that influence the formation of global winds. They will identify where the different global wind belts are located
- Students will determine the relationship between an air mass and a front. They will classify four types of air masses and two types of fronts
- Students will demonstrate a proper understanding of common symbols used on weather maps
- Students will assemble and employ a model of an anemometer
- Students will compare and contrast mountain breezes, valley breezes, jet streams, and monsoons. They will describe how each one is formed

### **Sun, Earth, and Moon**

- Students will record descriptions of historical names of the moon. They will construct and use an astrolabe
- Students will compare and contrast the motions of Earth and its moon. They will also be able to state four factors that influence these motions
- Students will model how Earth's tilt during its revolution around the sun causes the seasons, solstices, and equinoxes
- Students will identify and model moon phases. They will illustrate lunar and solar eclipses
- Students will illustrate how tides occur and describe the differences between a spring and a neap tide
- Students will use scientific investigative methods to design and construct a simple telescope. They will also discuss the advance of technology leading to a greater understanding of the motions of the earth and the moon
- Students will cite at least two facts about the *Apollo 11* moon mission and label three types of features on a lunar map

## **F. Grade 6 Objectives By Strand**

### **LIFE SCIENCE**

#### **Classification I**

- Students will categorize objects according to similar characteristics and organize this information into a concept map
- Students will explain the importance and history of classification. They will describe how the Linnaean system of binomial nomenclature has influenced modern classification
- Students will differentiate between and describe the characteristics of the Bacteria and Archaea Domains
- Students will identify the four kingdoms of the Eukarya Domain. They will examine the distinguishing characteristics of Kingdoms Protist and Fungus
- Students will list the characteristics of several groups within the Plant Kingdom
- Students will observe, compare, and classify various organisms in the Bacteria and Eukarya Domains
- Students will list and describe various plant tropisms

#### **Classification II**

- Students will identify various animals as vertebrates or invertebrates. They will also categorize animals according to habitat
- Students will compare and contrast vertebrates and invertebrates. They will be able to name mine phyla of animals
- Students will distinguish between ectothermic and endothermic vertebrates. They will list characteristics of birds and animals
- Students will be able to classify invertebrates by placing them into their corresponding phylum
- Students will differentiate between the phyla of cnidarians, poriferans, annelids, platyhelminthes, and nematodes
- Students will examine and identify the external and internal anatomy of a bony fish. They will use a dichotomous key to classify mollusks
- Students will describe the climate, vegetation, and animal life of the six major land biomes



### **Cell Processes**

- Students will compare and contrast an egg to an animal cell. They will predict how vinegar affects an eggshell
- Students will identify the structure and function of cell organelles
- Students will distinguish between photosynthesis, cellular respiration, and fermentation. They will explain how cells produce energy with and without oxygen
- Students will discriminate between passive and active transport. They will demonstrate osmosis, using an egg as a shell
- Students will summarize the events of mitosis and meiosis. They will illustrate the phases of meiosis I and II
- Students will compare and contrast the processes of diffusion and osmosis. They will enact and recount the phases of mitosis
- Students will identify and differentiate between various types of asexual reproduction

### **Heredity and Genetics**

- Students will relate how random genetic distribution plays a role in the inheritance of traits
- Students will explain Mendel's contributions to the study of genetics. They will distinguish between genotype and phenotype
- Students will contrast dominant and recessive alleles. They will apply the terms purebred and hybrid to genotypes
- Students will use Punnett squares to predict outcomes of single gene crosses. They will analyze a pedigree
- Students will analyze and summarize the differences between dominance, codominance, and incomplete dominance
- Students will evaluate genetic information and formulate logical conclusions based upon supporting evidence
- Students will apply the concepts of heredity to animal breeding using a Punnett square and information from a family tree

## **PHYSICAL SCIENCE**

### **Periodic Table of Elements**

- Students will apply the pattern of periodicity found in rows and columns to the periodic table of elements
- Students will analyze atomic structure, using the periodic table of elements. They will explain how an atom is held together by electrostatic charge and the strong force
- Students will relate the structure of an atom to the properties of the element. They will use the atomic model to describe the location of electrons in energy levels, or shells
- Students will associate the number of valence electrons with chemical properties and position of elements on the periodic table
- Students will draw electron dot diagrams to predict the structure and chemical properties of atoms as they combine to form molecules
- Students will investigate the relationship between the structure and properties of elements. They will organize the graph data to represent periodic relationships
- Students will be able to identify which elements will react more readily than others. They will be able to explain the relationship between valence electrons, energy levels, and reactivity

### **States of Matter**

- Students will demonstrate the features and behaviours of three states of matter
- Students will classify states of matter based upon observed physical properties
- Students will compare and contrast three temperature scales and rank the heat capacities of different substances
- Students will list and summarize the unique properties of water
- Students will classify items as acids or bases according to pH
- Students will analyze what takes place during the heating and cooling of water and convert between Celsius and Fahrenheit temperatures
- Students will investigate uses a heat and explain how it performs work

### **Fluids**

- Students will identify and demonstrate the properties of the states of matter
- Students will apply the concepts of forces between particles, volume, and shape to contrast states of matter
- Students will relate the properties of fluids and Archimedes' and Pascal's Principles
- Students will describe Bernoulli's principle and demonstrate their understanding of it through several hands- on experiments
- Students will explain the relationship among lift, weight, thrust, and drag and how they affect flight
- Students will explain the behaviour of air using Bernoulli's Principle and air pressure
- Students will relate the forces of flight to race cars, helicopters, and the curving path of spinning balls

### **Why Things Move**

- Students will review the concept of relative motion and identify examples of motion
- Students will describe early scientific thought about motion and summarize Newton's Laws of Motion
- Students will distinguish between speed and velocity
- Students will demonstrate the Law of Conservation of Momentum and relate it to the acceleration
- Students will differentiate between static and kinetic friction, and will compare frictional force between different materials
- Students will differentiate elastic from inelastic collisions. They will analyze the properties of different surfaces, and pertaining to friction
- Student will relate the law of motion and thermodynamics to perpetual motion

## **THE HUMAN BODY**

### **Uniqueness of Humans**

- Students will identify, locate, and describe major organs and systems of the human body
- Students will summarize the major structures and functions of the cardiovascular, respiratory, digestive, and urinary systems. They will explain the interdependence of body systems
- Students will differentiate between the three types of muscle tissue. They will describe the location and capabilities of each type
- Students will name the parts and functions of the human skeletal system. They will experiment with bone decalcification
- Students will describe the basic components of the nervous system. They will distinguish between the central and the peripheral systems
- Students will reconstruct the skeletal remains found from dissecting owl pellets. They will analyze the relationship between surface area and rate of absorption
- Students will identify and analyze how the sense organs detect stimuli and then send impulses to the brain for interpretation

### **Body Stewardship**

- Students will predict the main nutrient found in a variety of pre-selected foods while explaining the criteria used for their predictions. They will also simulate the emulsification of fat
- Students will examine and evaluate a healthy lifestyle consisting of a balanced diet and regular exercise
- Students will identify specific nutrients needed for cardiovascular health. They will explain how an unbalanced diet can lead to certain associated diseases
- Students will analyze how good nutrition and regular exercise at an early age affect the health of the musculoskeletal system
- Students will demonstrate the transmission of electrochemical impulses. They will specify some of the nutrients needed for a healthy nervous system
- Students will determine which nutrients are found in a variety of food samples
- Students will appraise diet and lifestyle choices. They will apply healthy cooking methods to menu planning

## **EARTH AND SPACE SCIENCE**

### **Oceans in Motion**

- Students will relate the movement of water confined in a bottle to the movement of ocean water. They will analyze the movement of global surface currents
- Students will compare and contrast predictable patterns in which ocean water moves and will identify three major types of water movement
- Students will summarize the cause and effects of surface, deep, longshore, and rip currents. They will differentiate between El Niño and La Niña
- Students will categorize the ocean by temperature and regional zones
- Students will classify marine organisms into one of three major groups according to where the organisms live and how they move. Students will also describe specific marine habitats
- Students will construct hydrometers and use them to compare the densities of different salinity levels. They will estimate the solute concentration of an unknown solution based on previously collected data
- Students will investigate the characteristics of brine pools. They will assess how certain organisms are able to thrive in extreme ocean environments

### **Rock Records**

- Students will simulate how a sedimentary rock is formed. They will classify rocks according to specific criteria
- Students will summarize the processes that occur during the formation of igneous, metamorphic, and sedimentary rocks
- Students will describe how water, wind, and weight cause weathering and erosion
- Students will relate the processes and factors in deposition, and compare and contrast major geologic interpretations of deposition rates
- Students will classify mold, trace, resin, and petrified fossils and relate the conditions by which fossils are formed
- Students will summarize the origin of life from both a creationist and evolutionist viewpoint, stating three main differences
- Students will sequence the order of events in which a fossil is formed. They will also draw and demonstrate their understanding of contour lines
- Students will analyze the concept of the geologic column and interpret it in light of major views of geologic deposition

**Violent Motions**

- Students will analyze how forces interact - whether in their bodies, on the earth, or in the atmosphere - to conclude that, over time, equilibrium is re-established
- Students will correlate the concept of equilibrium with the cause and effect of earthquakes. They will describe the release and travel of energy through the earth during an earthquake
- Students will identify the basic components of a volcano. They will classify volcanoes based on structure and activity level
- Students will describe the factors that lead to thunderstorm and tornado formation. They will classify these storms based on observable and measurable characteristics
- Students will explain how tropical cyclones develop. They will identify the key features and will be able to describe how cyclones are named and classified
- Students will determine how to locate the epicenter of an earthquake. They will use the Mercalli and Richter scales to predict an earthquake's rating based on damage descriptions
- Students will identify the three basic requirements for fire formation and will analyze how a wildfire can both beneficial and harmful within a forest setting

**Astronomy**

- Students will analyze the importance of and the relationship between observation and perspective as related to celestial bodies
- Students will differentiate between apparent and absolute magnitudes
- Students will identify star populations. They will use the Hertzsprung-Russell (H-R) diagram to classify stars according to temperature and absolute magnitude
- Students will describe and illustrate changes within stars that correlate with a star's life cycle
- Students will discuss and describe celestial movements and they will summarize Kepler's Laws of Planetary Motion
- Students will research a historical account of telescope technology. They will use the H-R diagram to predict the next stage in a star's life cycle
- Students will distinguish between star clusters and constellations. They will observe the patterns of the physical distribution of stars

**V. STRANDS AND OBJECTIVES, GRADES 7-8**

The SCA Science program in grades seven and eight is aligned with the Ontario curriculum, which is divided into four strands: Life Systems, Structures and Mechanisms, Matter and Energy, Earth and Space Systems. In grade seven, those strands correspond to four units: Pure Substances and Mixtures, Interactions in the Environment, Form and Function, and Heat in the Environment. In grade eight, those strands correspond to four units: Cells, Systems in Action, Fluids, and Water Systems.

## A. Grade 7 Objectives By Strand

### LIFE SYSTEMS: INTERACTIONS IN THE ENVIRONMENT

**Students will assess the impacts of human activities and technologies on the environment, evaluate ways of controlling these impacts, and will ...**

- Assess the impact of selected technologies on the environment
- Analyze the costs and benefits of selected strategies for protecting the environment

**Students will investigate interactions within the environment, identify factors that affect the balance between different components of an ecosystem, and will ...**

- Follow established safety procedures for investigating ecosystems
- Design and construct a model ecosystem and use it to investigate interactions between the biotic and abiotic components in an ecosystem
- Use scientific inquiry/research skills to investigate occurrences that affect the balance within a local ecosystem
- Use appropriate science and technology vocabulary, including sustainability, biotic, ecosystem, community, population, and producer, in oral and written communication
- Use a variety of forms to communicate with different audiences and for a variety of purposes

**Students will demonstrate an understanding of interactions between and amongst biotic and abiotic elements in the environment, and will ...**

- Demonstrate an understanding of an ecosystem as a system of interactions between living organisms and their environment
- Identify biotic and abiotic elements in an ecosystem, and describe the interactions between them
- Describe the roles and interactions of producers, consumers, and decomposers within an ecosystem
- Describe the transfer of energy in a food chain and explain the effects of the elimination of any part of the chain
- Describe how matter is cycled within the environment and explain how it promotes sustainability
- Distinguish between primary succession and secondary succession within an ecosystem
- Explain why an ecosystem is limited in the number of living things that it can support
- Describe ways in which human activities and technologies alter balances and interactions in the environment
- Describe Aboriginal perspectives on sustainability and describe ways in which they can be used in habitat and wildlife management

### STRUCTURES AND MECHANISMS: FORM AND FUNCTION

**Students will analyze personal, social, environmental factors that need to be considered in designing and building structures and devices, and will ...**

- Evaluate the importance for individuals, society, the economy, and the environment of factors that should be considered in designing and building structures and devices to meet specific needs
- Evaluate the impact of ergonomic design on the safety and efficiency of workplaces, tools, and everyday objects, and describe changes that could be made in personal spaces and activities on the basis of this information

**Students will design and construct a variety of structures, investigate the relationship between the design and function of these structures and the forces that act on them, and will ...**

- Follow established safety procedures for using tools and handling materials
- Design, construct, and use physical models to investigate the effects of various forces on structures
- Investigate the factors that determine the ability of a structure to support a load
- Use technological problem-solving skills to determine the most efficient way for a structure to support a given load
- Investigate methods used by engineers to ensure structural safety
- Use appropriate science and technology vocabulary, including truss, beam, ergonomics, shear, and torsion, in oral and written communication
- Use a variety of forms to communicate with different audiences and for a variety of purposes

**Students will demonstrate an understanding of the relationship between structural forms and the forces that act on and within them, and will ...**

- Classify structures as solid structures, frame structures, or shell structures
- Describe ways in which the centre of a gravity of a structure affects the structure's stability
- Identify the magnitude, direction, point of application, and plane of application of the forces applied to a structure
- Distinguish between external forces and internal forces acting on a structure
- Describe the role of symmetry in structures
- Identify and describe factors that can cause a structure to fail
- Identify the factors that determine the suitability of materials for use in manufacturing a product

## **MATTER AND ENERGY: PURE SUBSTANCES AND MIXTURES**

**Students will evaluate the social and environmental impacts of the use and disposal of pure substances and mixtures, and will ...**

- Assess positive and negative environmental impacts related to the disposal of pure substances and mixtures
- Assess the impact on society and the environment of different industrial methods of separating mixtures and solutions

**Students will investigate the properties and applications of pure substances and mixtures, and will ...**

- Follow established safety procedures for handling chemicals and apparatus
- Use scientific enquiry/experimental skills to investigate factors that affect the solubility of a substance and the rate at which substance dissolve
- Investigate processes used for separating different mixtures
- Use scientific inquiry/experimentation skills to investigate the properties of mixtures and solutions
- Use appropriate science and technology vocabulary, including mechanical mixture, solution, solute, insoluble, saturated, unsaturated, and dilute, in oral and written communication
- Use a variety of forms to communicate with different audiences and for a variety of purposes

**Students will demonstrate an understanding of the properties of pure substances and mixtures, describe these characteristics using the particle theory, and will ...**

- Distinguish between pure substances and mixtures
- State the postulates of the particle theory of matter
- Use the particle theory to describe the difference between pure substances and mixtures
- Distinguish between solutions and mechanical mixtures
- Describe the processes used to separate mixtures or solutions into their components, and identify some industrial applications of these processes
- Identify the components of a solution
- Identify solutes and solvents in various kinds of solutions
- Describe the concentration of a solution in qualitative terms
- Describe the difference between saturated and unsaturated solutions
- Explain why water is referred to as the universal solvent

## **EARTH AND SPACE SYSTEMS: HEAT IN THE ENVIRONMENT**

**Students will assess the costs and benefits of technologies that reduce heat loss or heat-related impacts on the environment, and will ...**

- Assess the social and environmental benefits of technologies that reduce heat loss or transfer
- Assess the environmental and economic impacts of using conventional and alternative forms of energy

**Students will investigate ways in which heat changes substances, describe how heat is transferred, and will ...**

- Follow established safety procedures for using heating appliances and handling hot materials
- Investigate the effects of heating and cooling on the volume of a solid, liquid, and gas
- Use technological problem-solving skills to investigate heat transfer through conduction, convection, and radiation
- Use appropriate science and technology vocabulary, including heat, temperature, conduction, convection, and radiation, in oral and written communication
- Use a variety of forms to communicate with different audiences and for a variety of purposes

**Students will demonstrate an understanding of heat as a form of energy that is associated with the movement of particles and is essential to many processes within Earth's systems, and will ...**

- Use the particle theory to compare how heat affects the motion of particles in a solid, a liquid, and a gas
- Identify ways in which heat is produced
- Use the particle theory to explain the effects of heat on volume in solids, liquids, and gases
- Explain how heat is transmitted through conduction, and describe natural processes that are affected by conduction
- Explain how heat is transmitted through convection, and describe natural processes that depend on convection
- Explain how heat is transmitted through radiation, and describe the effects of radiation from the Sun on different kinds of surfaces
- Describe the role of radiation in heating and cooling Earth, and explain how greenhouse gases affect the transmission of radiated heat through the atmosphere
- Identify common sources of greenhouse gases, and describe ways of reducing emissions of these gases

## B. Grade 8 Objectives By Strand

### LIFE SYSTEMS: CELLS

**Students will assess the impact of cell biology on individuals, society, and the environment, and will ...**

- Assess the role of selected technologies in enhancing our understanding of cells and cellular processes
- Assess the potential that our understanding of cells and cell processes has for both beneficial and harmful effects on human health and the environment, taking different perspectives into account

**Students will investigate functions and processes of plant and animal cells, and will ...**

- Follow established safety procedures for handling apparatus and materials
- Use a microscope correctly and safely to find and observe components of plant and animal cells, and make accurate drawings of their observations
- Prepare dry- and wet-mount slides of a variety of objects for use with a microscope
- Use scientific inquiry/experimentation skills to investigate the processes of osmosis and diffusion
- Use appropriate science and technology vocabulary, including organelle, diffusion, osmosis, cell theory, selective permeability, membrane, stage, and eyepiece, in oral and written communication
- Use a var

**Students will demonstrate an understanding of the basic structure and function of plant and animal cells and cell processes, and will ...**

- Demonstrate an understanding of the postulates of the cell theory (e.g. the cell is the basic unit of life; all cells come from pre-existing cells; all living things are made up of one or more cells)
- Identify structures and organelles in cells, including the nucleus, cell membrane, cell wall, chloroplasts, vacuole, mitochondria, and cytoplasm, and explain the basic functions of each
- Compare the structure and function of plant and animal cells
- Explain the processes of diffusion and osmosis and their roles within a cell
- Identify unicellular organisms (e.g. amoebae) and multicellular organisms (both vertebrates and invertebrates) and compare ways in which they meet their basic needs (i.e. nutrition, movement, gas exchange)
- Describe the organization of cells into tissues, organs, and systems

### STRUCTURES AND MECHANISMS: SYSTEMS IN ACTION

**Students will assess the personal, social, and/or environmental impacts of a system, and evaluate improvements to a system and/or alternative ways of meeting the same needs, and will ...**

- Assess the social, economic, and environmental impacts of automating systems.
- Assess the impact on individuals, society, and the environment of alternative ways of meeting needs that are currently met by existing systems, taking different points of view into consideration



**Students will investigate a working system and the ways in which components of the system contribute to its desired function, and will ...**

- Follow established safety procedures for working with apparatus, tools materials, and electrical systems
- Investigate the work done in a variety of everyday activities and record the findings quantitatively
- Use scientific inquiry/experimentation skills to investigate mechanical advantage in a variety of mechanisms and simple machines
- Use technological problem-solving skills to investigate a system (e.g. an optical system, a mechanical system, an electrical system) that performs a function or meets a need
- Investigate the information and support provided to consumers/clients to ensure that a system functions safely and effectively
- Use appropriate science and technology vocabulary, including mechanical advantage, input, output, friction, gravity, forces, and efficiency, in oral and written communication
- Use a variety of forms to communicate with different audiences and for a variety of purposes (e.g. using appropriate mathematical conventions, create a graph to represent changes in mechanical advantage when certain factors in a mechanism are manipulated)

**Students will demonstrate an understanding of different types of systems and the factors that contribute to their safe and efficient operation, and will ...**

- Identify various types of systems (e.g. mechanical systems, body systems, optical systems, mass transit systems, healthcare systems)
- Identify the purpose, inputs, and outputs of various systems
- Identify the various processes and components of a system that allow it to function efficiently and safely
- Compare, using examples, the scientific definition with the everyday use of the terms work, force, energy, and efficiency
- Understand and use the formula work = force x distance ( $W = F \times d$ ) to establish the relationship between work, force, and distance moved parallel to the force in simple systems
- Calculate the mechanical advantage ( $MA = \text{force needed without a simple machine} / \text{force needed with a simple machine}$ ) of various mechanical systems
- Explain ways in which mechanical systems produce heat, and describe way to make these systems more efficient
- Describe systems that have improved the productivity of various industries
- Identify social factors that influence the evolution of a system over time

## **MATTER AND ENERGY: FLUIDS**

**Students will analyze how the properties of fluids are used in various technologies, and assess the impact of these technologies on society and the environment, and will ...**

- Assess the social, economic, and environmental impacts of selected technologies that are based on the properties of fluids
- Assess the impact of fluid spills on society and the environment, including the cost of the cleanup and the effort involved

**Students will investigate the properties of fluids, and will ...**

- Follow established safety practices for using apparatus, tools, and materials
- Determine the mass-to-volume ratio of different amounts of the same substance
- Investigate and compare the density of a variety of liquids
- Investigate applications of the principles of fluid mechanics
- Use scientific inquiry/experimentation skills to identify factors that affect the flow rates of various fluids
- Use technological problem-solving skills to design, build, and test devices that use pneumatic or hydraulic systems
- Use appropriate science and technology vocabulary, including viscosity, density particle theory of matter, hydraulic, and pneumatic, in oral and written communication
- Use a variety of forms (e.g. oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes

**Students will demonstrate an understanding of the properties and uses of fluids, and will ...**

- Demonstrate an understanding of viscosity and compare the viscosity of various liquids
- Describe the relationship between mass, volume, and density as a property of matter
- Explain the difference between solids, liquids, and gasses in terms of density, using the particle theory of matter (i.e. that in general, solids are more dense than liquids, which are more dense than gases)
- Explain the difference between liquids and gases in terms of the compressibility and how their compressibility affects their usage
- Determine the buoyancy of an object, given its density, in a variety of fluids' Explain in qualitative terms the relationship between pressure, volume, and temperature when a liquid or a gas is compressed or heated
- Explain how forces are transferred in all directions in fluids (Pascal's law)
- Compare the ways in which fluids are used and controlled in living things to the ways in which they are used and controlled in manufactured devices

**EARTH AND SPACE SYSTEMS: WATER SYSTEMS**

**Students will assess the impact of human activities and technologies on the sustainability of water resources, and will ...**

- Evaluate personal water consumption, compare it with personal water consumption in other countries, and propose a plan of action to reduce personal water consumption to help address water sustainability issues
- Assess how various sources (e.g. Canadian Geographic; the science section in newspapers; Internet websites; local, national, and international news on television and radio) address issues related to the impact of human activities on the long-term sustainability of local, national, or international water systems
- Assess the impact on local and global water systems of a scientific discovery or technological innovation

**Students will investigate factors that affect local water quality, and will ...**

- Follow established safety procedures for the use of apparatus and chemicals
- Investigate how municipalities process water
- Test water samples for a variety of chemical characteristics (e.g. pH, salinity, chlorine)
- Use scientific inquiry/research skills to investigate local water issues
- Use technological problem-solving skills to design, build, and test a water system device that performs a practical function or meets a need
- Use appropriate science and technology vocabulary, including water table, aquifer, polar icecap, and salinity, in oral and written communication
- Use a variety of forms (oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes

**Students will demonstrate an understanding of the characteristics of Earth's water systems and the influence of water systems on a specific region, and will ...**

- Identify the various states of water on Earth's surface, their distribution, relative amounts, and circulation, and the conditions under which they exist (i.e. ice, water, gas)
- Demonstrate an understanding of the watershed as a fundamental geographic unit and explain how it relates to water management and planning
- Explain how human and natural factors cause changes in the water table
- Identify factors that affect the size of glaciers and polar icecaps, and describe the effects of these changes on local and global water systems
- Explain changes in atmospheric conditions caused by the presence of bodies of water



## **Appendix A: Grade 1/2 Science Rubrics**





## Science Experiment Rubric (Grade 1/2)

|                    | LEVEL 1   | LEVEL 2   | LEVEL 3  | LEVEL 4  |
|--------------------|---|---|--|--|
| <b>HYPOTHESIS</b>  | Does not relate to question; does not state expectation; disconnected explanation | Partially relates to question; partially states expectation; unreasonable explanation | Relates to question; states expectation; reasonable explanation      | Relates to question; realistic expectation; insightful explanation   |
|                    | 8 9   | 10 11   | 12 13  | 14 15  |
| <b>MATERIALS</b>   | Lists some necessary materials in point form                                      | Lists most necessary materials in point form  | Lists all necessary materials in point form with some guidance       | Independently lists all necessary materials in point form  |
|                    | 9 10 11   | 12 13 14  | 15 16 17   | 18 19 20   |
| <b>PROCEDURE</b>   | Numbers some steps in partially chronological order                               | Numbers all steps in mostly chronological order                                       | Numbers all steps in chronological order with full sentences         | Numbers all steps in chronological order with full, detailed sentences   |
|                    | 8 9   | 10 11   | 12 13  | 14 15  |
| <b>OBSERVATION</b> | States observation with little accuracy   | States observation with some accuracy   | States observation clearly and accurately                            | States observation clearly and accurately and with exceptional detail  |
|                    | 8 9   | 10 11   | 12 13  | 14 15  |
| <b>CONCLUSION</b>  | Does not refer back to hypothesis or explain why it was or was not correct        | Refers back to hypothesis; does not explain why it was or was not correct             | Refers back to hypothesis and explains why it was or was not correct | Refers back to hypothesis and explains why it was or was not correct and relates findings to the natural world |
|                    | 8 9   | 10 11   | 12 13  | 14 15  |
| <b>DIAGRAM</b>     | Inaccurate visual representation of experiment                                    | Mostly accurate visual representation of experiment                                   | Accurate visual representation of experiment                         | Accurate and detailed visual representation of experiment  |
|                    | 9 10 11   | 12 13 14  | 15 16 17   | 18 19 20   |
| <b>TOTAL</b>       |   |   |  | /100   |



## Science Project Rubric (Grade 1/2)

|                            | LEVEL 1  | LEVEL 2   | LEVEL 3  | LEVEL 4   |
|----------------------------|--|---|--|---|
| <b>FINDING INFORMATION</b> | Student uses a reliable source of information with significant guidance.   | Student uses a reliable source of information with much guidance.   | Student uses a reliable source of information with some guidance.  | Student uses a reliable source of information with little to no guidance.   |
|                            | 9 10 11  | 12 13 14  | 15 16 17   | 18 19 20  |
| <b>ACCURACY</b>            | Information is inaccurate and/or not clearly explained.  | Information is mostly accurate and/or not fully explained.  | Information is accurate and clearly explained.   | Information is accurate, clearly explained, with significant detail.  |
|                            | 14 15 16   | 17 18 19  | 20 21 22   | 23 24 25  |
| <b>CREATIVITY</b>          | Information is presented with minimal thought or effort.   | Information is presented with some attention to detail.   | Information is presented in a creative way.  | Information is presented in a unique and creative way.  |
|                            | 3 4  | 5 6   | 7 8  | 9 10  |
| <b>NEATNESS</b>            | Information is not displayed neatly. Student needs many reminders to take care with the presentation.  | Information is not displayed neatly. Student needs some reminders to take care with the presentation.   | Information is mostly displayed neatly. Student took care to make presentation look nice, with some guidance.                                      | Information is displayed neatly. Student independently worked to make presentation look nice.   |
|                            | 3 4  | 5 6   | 7 8  | 9 10  |
| <b>PARTICIPATION</b>       | Student does not participate fully, needs many reminders to use time wisely and to stay on task. Student is easily distracted by others.                         | Student mostly participates fully, needs some reminders to use time wisely and to stay on task. Student is often distracted by others.                      | Student participates fully, uses time wisely, is not distracted by others, needs few reminders to stay on task.                                    | Student participates fully, uses time wisely, is not distracted by others, needs no reminders to stay on task.                                |
|                            | 3 4  | 5 6   | 7 8  | 9 10  |
| <b>PRESENTATION</b>        | Information is not presented in a clear, organized or interesting manner. Student needs many reminders to use a clear, loud voice and maintain good eye contact. | Information is mostly presented in a clear, organized and interesting manner. Student needs some reminders to use a clear, loud voice and good eye contact. | Information is presented in a clear, organized, and interesting manner. Student uses a clear, loud voice, good eye contact with minimal reminders. | Information is presented in a clear, organized, and interesting manner. Student uses a clear, loud voice, good eye contact with no reminders. |
|                            | 8 9  | 10 11   | 12 13  | 14 15   |
| <b>TOTAL</b>               |  |   |  | /100  |



## **Appendix B: Grade 3/4 Science Rubrics**





## Science Experiment Rubric (Grade 3/4)

|                    | LEVEL 1   | LEVEL 2   | LEVEL 3  | LEVEL 4  |
|--------------------|---|---|--|--|
| <b>HYPOTHESIS</b>  | Does not relate to question; does not state expectation; disconnected explanation       | Partially relates to question; partially states expectation; unreasonable explanation   | Relates to question; states expectation; reasonable explanation                            | Relates to question; realistic expectation; insightful explanation   |
|                    | 8 9   | 10 11   | 12 13  | 14 15  |
| <b>MATERIALS</b>   | Lists some necessary materials in point form; does not use materials appropriately      | Lists most necessary materials in point form and mostly uses them appropriately         | Lists all necessary materials in point form and uses them appropriately with some guidance | Independently lists all necessary materials in point form and uses them appropriately                          |
|                    | 9 10 11   | 12 13 14  | 15 16 17   | 18 19 20   |
| <b>PROCEDURE</b>   | Demonstrates low understanding of correct procedure by outlining few sequential steps   | Demonstrates some understanding of correct procedure by outlining most sequential steps | Demonstrates understanding of correct procedure by outlining all sequential steps          | Demonstrates understanding of correct procedure by outlining all sequential steps independently                |
|                    | 8 9   | 10 11   | 12 13  | 14 15  |
| <b>OBSERVATION</b> | Partially states observation with little of the expected completeness and/or repetition | States observation with some of the expected completeness and/or repetition             | States observation clearly and accurately with expected completeness and/or repetition     | States observation clearly and accurately with more than expected completeness and/or repetition               |
|                    | 8 9   | 10 11   | 12 13  | 14 15  |
| <b>CONCLUSION</b>  | Does not refer back to hypothesis or explain why it was or was not correct              | Refers back to hypothesis; does not explain why it was or was not correct               | Refers back to hypothesis and explains why it was or was not correct                       | Refers back to hypothesis and explains why it was or was not correct and relates findings to the natural world |
|                    | 8 9   | 10 11   | 12 13  | 14 15  |
| <b>CONVENTIONS</b> | Uses some correct vocabulary; doesn't follow scientific method in correct order         | Uses most correct vocabulary; follows scientific method in mostly correct order         | Uses correct vocabulary; follows scientific method in correct order                        | Uses advanced vocabulary; follows scientific method in correct order with little to no guidance                |
|                    | 9 10 11   | 12 13 14  | 15 16 17   | 18 19 20   |
| <b>TOTAL</b>       |   |   |  | /100   |



## Science Project Rubric (Grade 3/4)

|                            | LEVEL 1   | LEVEL 2  | LEVEL 3   | LEVEL 4  |
|----------------------------|---|--|---|--|
| <b>FINDING INFORMATION</b> | Information is unclear or incomplete, finds appropriate material with significant guidance  | Information is mostly clear and complete, finds appropriate material with guidance   | Information is clear and complete, finds appropriate material mostly independently  | Information is clear and complete, independently finds appropriate material  |
|                            | 9    10    11   | 12    13    14   | 15    16    17  | 18    19    20   |
| <b>ACCURACY</b>            | Information is inaccurate. Few sources used   | Information is mostly accurate. Few sources used   | Information is accurate. Appropriate sources used   | Information is accurate. Multiple sources used   |
|                            | 14    15    16  | 17    18    19   | 20    21    22  | 23    24    25   |
| <b>CREATIVITY</b>          | Information is presented with little thought or effort  | Information is presented with some thought and effort  | Information is presented in a creative way  | Information is presented in a unique and creative way  |
|                            | 3    4  | 5    6   | 7    8  | 9    10  |
| <b>NEATNESS</b>            | Information is not displayed neatly. Student needs many reminders to take care with the presentation  | Information is not displayed neatly. Student needs some reminders to take care with the presentation   | Information is mostly displayed neatly. Student took care to make presentation look nice, with some guidance                                      | Information is displayed neatly. Student independently worked to make presentation look nice   |
|                            | 3    4  | 5    6   | 7    8  | 9    10  |
| <b>PARTICIPATION</b>       | Student does not participate fully, needs many reminders to use time wisely and stay on task. Student is easily distracted by others                            | Student mostly participates fully, needs some reminders to use time wisely and stay on task. Student is often distracted by others                         | Student participates fully, uses time wisely, is not distracted by others, needs few reminders to stay on task                                    | Student participates fully, uses time wisely, is not distracted by others, needs no reminders to stay on task                                |
|                            | 3    4  | 5    6   | 7    8  | 9    10  |
| <b>PRESENTATION</b>        | Information is not presented in a clear, organized or interesting manner. Student needs many reminders to use a clear, loud voice and maintain good eye contact | Information is mostly presented in a clear, organized and interesting manner. Student needs some reminders to use a clear, loud voice and good eye contact | Information is presented in a clear, organized, and interesting manner. Student uses a clear, loud voice, good eye contact with minimal reminders | Information is presented in a clear, organized, and interesting manner. Student uses a clear, loud voice, good eye contact with no reminders |
|                            | 8    9  | 10    11   | 12    13  | 14    15   |
| <b>TOTAL</b>               |   |  |   | /100   |

## **Appendix C: Grade 5/6 Science Rubrics**





## Science Experiment Rubric (Grade 5/6)

|                    | LEVEL 1  | LEVEL 2   | LEVEL 3  | LEVEL 4  |
|--------------------|--|---|--|--|
| <b>HYPOTHESIS</b>  | Does not relate to question; does not state expectation; disconnected explanation        | Partially relates to question; partially states expectation; unreasonable explanation   | Relates to question; states expectation; reasonable explanation                            | Relates to question; realistic expectation; insightful explanation   |
|                    | 3 4  | 5 6   | 7 8  | 9 10   |
| <b>MATERIALS</b>   | Lists some necessary materials in point form; does not use materials appropriately       | Lists most necessary materials in point form and mostly uses them appropriately         | Lists all necessary materials in point form and uses them appropriately with some guidance | Independently lists all necessary materials in point form and uses them appropriately                          |
|                    | 9 10 11  | 12 13 14  | 15 16 17   | 18 19 20   |
| <b>PROCEDURE</b>   | Demonstrates low understanding of correct procedure by outlining few of sequential steps | Demonstrates some understanding of correct procedure by outlining most sequential steps | Demonstrates understanding of correct procedure by outlining all sequential steps          | Demonstrates understanding of correct procedure by outlining all sequential steps independently                |
|                    | 8 9  | 10 11   | 12 13  | 14 15  |
| <b>OBSERVATION</b> | Partially states observation with few of the expected completeness and/or repetition     | States observation with some of the expected completeness and/or repetition             | States observation clearly and accurately with expected completeness and/or repetition     | States observation clearly and accurately with more than expected completeness and/or repetition               |
|                    | 8 9  | 10 11   | 12 13  | 14 15  |
| <b>CONCLUSION</b>  | Does not refer back to hypothesis or explain why it was or was not correct               | Refers back to hypothesis; does not explain why it was or was not correct               | Refers back to hypothesis and explains why it was or was not correct                       | Refers back to hypothesis and explains why it was or was not correct and relates findings to the natural world |
|                    | 3 4  | 5 6   | 7 8  | 9 10   |
| <b>CONVENTIONS</b> | Uses some correct vocabulary; doesn't follow scientific method in correct order          | Uses most correct vocabulary; follows scientific method in mostly correct order         | Uses correct vocabulary; follows scientific method in correct order                        | Uses advanced vocabulary; follows scientific method in correct order with little to no guidance                |
|                    | 9 10 11  | 12 13 14  | 15 16 17   | 18 19 20   |
| <b>APPLICATION</b> | Does not identify potential applications to real world situations                        | Occasionally identifies potential applications to real world situations with guidance   | Identifies potential applications to real world situations with some guidance              | Independently identifies potential applications to real world situations                                       |
|                    | 3 4  | 5 6   | 7 8  | 9 10   |
| <b>TOTAL</b>       |  |   |  | /100   |



## Science Project Rubric (Grade 5/6)

|                      | LEVEL 1   | LEVEL 2  | LEVEL 3   | LEVEL 4  |
|----------------------|---|--|---|--|
| <b>RESEARCH</b>      | Information is unclear or incomplete, finds appropriate material with significant guidance  | Information is mostly clear and complete, finds appropriate material with guidance   | Information is clear and complete, finds appropriate material mostly independently  | Information is clear and complete, independently finds appropriate material  |
|                      | 9 10 11   | 12 13 14   | 15 16 17  | 18 19 20   |
| <b>ACCURACY</b>      | Information is inaccurate. Few sources used. Not cited correctly using APA format   | Information is mostly accurate. Few sources used and cited correctly using APA format with guidance  | Information is accurate. Multiple sources used and cited correctly using APA format with some guidance  | Information is accurate. Multiple sources used and independently cited correctly using APA format  |
|                      | 14 15 16  | 17 18 19   | 20 21 22  | 23 24 25   |
| <b>CREATIVITY</b>    | Information is presented with little thought or effort  | Information is presented with some thought and effort  | Information is presented in a creative way  | Information is presented in a unique and creative way  |
|                      | 3 4   | 5 6  | 7 8   | 9 10   |
| <b>NEATNESS</b>      | Information is not displayed neatly. Student needs many reminders to take care with the presentation  | Information is not displayed neatly. Student needed several reminders to take care with the presentation   | Information is mostly displayed neatly. Student took care to make presentation look nice, with some guidance                                      | Information is displayed neatly. Student independently worked to make presentation look nice   |
|                      | 3 4   | 5 6  | 7 8   | 9 10   |
| <b>PARTICIPATION</b> | Student does not participate fully, needs many reminders to use time wisely and stay on task. Student is easily distracted by others                            | Student mostly participates fully, needs some reminders to use time wisely and stay on task. Student is often distracted by others                         | Student participates fully, uses time wisely, is not distracted by others, needs few reminders to stay on task                                    | Student participates fully, uses time wisely, is not distracted by others, needs no reminders to stay on task                                |
|                      | 3 4   | 5 6  | 7 8   | 9 10   |
| <b>PRESENTATION</b>  | Information is not presented in a clear, organized or interesting manner. Student needs many reminders to use a clear, loud voice and maintain good eye contact | Information is mostly presented in a clear, organized and interesting manner. Student needs some reminders to use a clear, loud voice and good eye contact | Information is presented in a clear, organized, and interesting manner. Student uses a clear, loud voice, good eye contact with minimal reminders | Information is presented in a clear, organized, and interesting manner. Student uses a clear, loud voice, good eye contact with no reminders |
|                      | 8 9   | 10 11  | 12 13   | 14 15  |
| <b>TOTAL</b>         |   |  |   | /100   |



## **Appendix D: Grade 7/8 Science Rubrics**





## Conducting An Investigation (Grade 7/8)

|  | LEVEL 1  | LEVEL 2  | LEVEL 3  | LEVEL 4  |
|--|--|--|--|--|
| <b>Demonstrates Understanding of testable question</b> | Demonstrates limited understanding of the cause and effect relationship expressed in the testable question.  | Demonstrates some understanding of the cause and effect relationship expressed in the testable question.   | Demonstrates considerable understanding of the cause and effect relationship expressed in the testable question.   | Demonstrates thorough understanding of the cause and effect relationship expressed in the testable question.   |
|  | 3 4  | 5 6  | 7 8  | 9 10   |
| <b>Use of Tools and Equipment</b>                      | Chooses and uses tools and equipment with limited appropriateness or concern for safety.   | Chooses and uses tools and equipment with some appropriateness or concern for safety.  | Chooses and uses tools and equipment with considerable appropriateness or concern for safety.  | Chooses and uses tools and equipment with a high degree of appropriateness or concern for safety.  |
|  | 3 4  | 5 6  | 7 8  | 9 10   |
| <b>Controlling the variables of an experiment</b>      | Understands and controls the variables with limited effectiveness.   | Understands and controls the variables with some effectiveness.  | Understands and controls the variables with considerable effectiveness.  | Understands and controls the variables with a high degree of effectiveness.  |
|  | 3 4  | 5 6  | 7 8  | 9 10   |
| <b>Generation and Support of Hypothesis</b>            | Generates hypothesis with limited effectiveness.<br><br>Rarely supports hypothesis with reasons.   | Generates hypothesis with some effectiveness.<br><br>Occasionally supports hypothesis with reasons.  | Generates hypothesis with considerable effectiveness.<br><br>Regularly supports hypothesis with reasons.   | Generates hypothesis with a high degree of effectiveness.<br><br>Consistently supports hypothesis with reasons.  |
|  | 3 4  | 5 6  | 7 8  | 9 10   |
| <b>Recording Data</b>                                  | Presents data and identifies patterns with limited accuracy.   | Presents data and identifies patterns with some accuracy.  | Presents data and identifies patterns with considerable accuracy.  | Presents data and identifies patterns with a high degree of accuracy.  |
|  | 3 4  | 5 6  | 7 8  | 9 10   |
| <b>Making Observations</b>                             | Rarely makes complete and precise observations.  | Occasionally makes complete and precise observations.  | Regularly makes complete and precise observations.   | Consistently makes complete and precise observations.  |
|  | 3 4  | 5 6  | 7 8  | 9 10   |
| <b>Use of conventions, vocabulary, and terminology</b> | Uses conventions, vocabulary and terminology with limited accuracy.<br><br>Expresses the steps of the scientific procedure and ideas that support the conclusion with limited effectiveness. | Uses conventions, vocabulary and terminology with some accuracy.<br><br>Expresses the steps of the scientific procedure and ideas that support the conclusion with some effectiveness. | Uses conventions, vocabulary and terminology with considerable accuracy.<br><br>Expresses the steps of the scientific procedure and ideas that support the conclusion with considerable effectiveness. | Uses conventions, vocabulary and terminology with a high degree of accuracy.<br><br>Expresses the steps of the scientific procedure and ideas that support the conclusion with a high degree of effectiveness. |
|  | 9 10 11  | 12 13 14   | 15 16 17   | 18 19 20   |

|   |   |  |  |  |
|---|---|--|--|--|
| <b>Identification of potential applications of the results to real world situations</b> | Rarely identifies potential applications to real world situations.        | Occasionally identifies potential applications to real world situations. | Regularly identifies potential applications to real world situations.          | Consistently identifies potential applications to real world situations.           |
|   | 3 4   | 5 6  | 7 8  | 9 10   |
| <b>Overall Presentation</b>   | Expresses and organizes ideas and information with limited effectiveness. | Expresses and organizes ideas and information with some effectiveness.   | Expresses and organizes ideas and information with considerable effectiveness. | Expresses and organizes ideas and information with a high degree of effectiveness. |
|   | 3 4   | 5 6  | 7 8  | 9 10   |
| <b>TOTAL</b>  |   |  |  | /100   |



## Explore an Issue Critically (Grade 7/8)

|   | LEVEL 1  | LEVEL 2  | LEVEL 3  | LEVEL 4  |
|---|--|--|--|--|
| <b>Identification of the issue</b>  | Identifies the issue and identifies perspectives with limited clarity.   | Identifies the issue and identifies perspectives with some clarity.  | Identifies the issue and identifies perspectives with considerable clarity.  | Identifies the issue and identifies perspectives with a high degree of clarity.  |
|   | 9 10 11  | 12 13 14   | 15 16 17   | 18 19 20   |
| <b>Selection of relevant sources</b>  | Selects relevant sources and identifies bias with limited accuracy.<br><br>Analyzes information and uses strategies to organize research with limited effectiveness. | Selects relevant sources and identifies bias with some accuracy.<br><br>Analyzes information and uses strategies to organize research with some effectiveness. | Selects relevant sources and identifies bias with considerable accuracy.<br><br>Analyzes information and uses strategies to organize research with considerable effectiveness. | Selects relevant sources and identifies bias with a high degree of accuracy.<br><br>Analyzes information and uses strategies to organize research with a high degree of effectiveness. |
|   | 9 10 11  | 12 13 14   | 15 16 17   | 18 19 20   |
| <b>Analysis of Information</b>  | Analyzes information with limited effectiveness.   | Analyzes information with some effectiveness.  | Analyzes information with considerable effectiveness.  | Analyzes information with a high degree of effectiveness.  |
|   | 9 10 11  | 12 13 14   | 15 16 17   | 18 19 20   |
| <b>Use of conventions, vocabulary, and terminology</b>                                  | Uses conventions, vocabulary and terminology with limited accuracy.  | Uses conventions, vocabulary and terminology with some accuracy.   | Uses conventions, vocabulary and terminology with considerable accuracy.   | Uses conventions, vocabulary and terminology with a high degree of accuracy.   |
|   | 3 4  | 5 6  | 7 8  | 9 10   |
| <b>Identification of potential applications of the results to real world situations</b> | Rarely identifies potential applications to real world situations.   | Occasionally identifies potential applications to real world situations.   | Regularly identifies potential applications to real world situations.  | Consistently identifies potential applications to real world situations.   |
|   | 9 10 11  | 12 13 14   | 15 16 17   | 18 19 20   |
| <b>Overall Presentation</b>   | Expresses and organizes ideas and information with limited effectiveness.  | Expresses and organizes ideas and information with some effectiveness.   | Expresses and organizes ideas and information with considerable effectiveness.   | Expresses and organizes ideas and information with a high degree of effectiveness.   |
|   | 3 4  | 5 6  | 7 8  | 9 10   |
| <b>TOTAL</b>  |  |  |  | /100   |



## Performing An Activity (Grade 7/8)

|   | LEVEL 1   | LEVEL 2  | LEVEL 3  | LEVEL 4  |
|---|---|--|--|--|
| <b>Demonstrates Understanding of Content</b>  | Demonstrates limited understanding of content.  | Demonstrates some understanding of content   | Demonstrates considerable understanding of content.  | Demonstrates thorough understanding of content.  |
|   | 9 10 11   | 12 13 14   | 15 16 17   | 18 19 20   |
| <b>Use of Tools and Equipment</b>   | Chooses and uses tools and equipment with limited appropriateness or concern for safety.                          | Chooses and uses tools and equipment with some appropriateness or concern for safety.                          | Chooses and uses tools and equipment with considerable appropriateness or concern for safety.                          | Chooses and uses tools and equipment with a high degree of appropriateness or concern for safety.                          |
|   | 3 4   | 5 6  | 7 8  | 9 10   |
| <b>Making Observations</b>  | Rarely makes complete and precise observations.   | Occasionally makes complete and precise observations.  | Regularly makes complete and precise observations.   | Consistently makes complete and precise observations.  |
|   | 9 10 11   | 12 13 14   | 15 16 17   | 18 19 20   |
| <b>Recording Data</b>   | Presents data and identifies patterns with limited accuracy.  | Presents data and identifies patterns with some accuracy.  | Presents data and identifies patterns with considerable accuracy.  | Presents data and identifies patterns with a high degree of accuracy.  |
|   | 3 4   | 5 6  | 7 8  | 9 10   |
| <b>Use of conventions, vocabulary, and terminology</b>                                  | Uses conventions, vocabulary and terminology with limited accuracy.   | Uses conventions, vocabulary and terminology with some accuracy.   | Uses conventions, vocabulary and terminology with considerable accuracy.   | Uses conventions, vocabulary and terminology with a high degree of accuracy.   |
|   | Expresses the steps of the scientific procedure and ideas that support the conclusion with limited effectiveness. | Expresses the steps of the scientific procedure and ideas that support the conclusion with some effectiveness. | Expresses the steps of the scientific procedure and ideas that support the conclusion with considerable effectiveness. | Expresses the steps of the scientific procedure and ideas that support the conclusion with a high degree of effectiveness. |
|   | 9 10 11   | 12 13 14   | 15 16 17   | 18 19 20   |
| <b>Identification of potential applications of the results to real world situations</b> | Rarely identifies potential applications to real world situations.  | Occasionally identifies potential applications to real world situations.                                       | Regularly identifies potential applications to real world situations.  | Consistently identifies potential applications to real world situations.   |
|   | 3 4   | 5 6  | 7 8  | 9 10   |
| <b>Overall Presentation</b>   | Expresses and organizes ideas and information with limited effectiveness.   | Expresses and organizes ideas and information with some effectiveness.   | Expresses and organizes ideas and information with considerable effectiveness.   | Expresses and organizes ideas and information with a high degree of effectiveness.   |
|   | 3 4   | 5 6  | 7 8  | 9 10   |
| <b>TOTAL</b>  |   |  |  | /100   |



## Solve a Technological Problem Grade 7/8

|   | LEVEL 1  | LEVEL 2  | LEVEL 3  | LEVEL 4  |
|---|--|--|--|--|
| <b>Knowledge of Relevant Concepts</b>   | Demonstrates limited knowledge of relevant concepts and describes the problem with limited effectiveness.  | Demonstrates some knowledge of relevant concepts and describes the problem with some effectiveness.  | Demonstrates considerable knowledge of relevant concepts and describes the problem with considerable effectiveness.  | Demonstrates a high degree of knowledge of relevant concepts and describes the problem with a high degree of effectiveness.  |
|   | 3 4  | 5 6  | 7 8  | 9 10   |
| <b>Identification of required materials and equipment</b>                         | Identifies and lists the required materials and equipment with limited effectiveness.<br><br>Selects and uses tools and equipment with limited concern for safety. | Identifies and lists the required materials and equipment with some effectiveness.<br><br>Selects and uses tools and equipment with some concern for safety. | Identifies and lists the required materials and equipment with considerable effectiveness.<br><br>Selects and uses tools and equipment with considerable concern for safety. | Identifies and lists the required materials and equipment with a high degree of effectiveness.<br><br>Selects and uses tools and equipment with a high degree of concern for safety. |
|   | 9 10 11  | 12 13 14   | 15 16 17   | 18 19 20   |
| <b>Creating a plan to solve the problem using procedural writing</b>              | Outlines the steps of a plan to solve the problem with procedural writing with limited clarity.  | Outlines the steps of a plan to solve the problem with procedural writing with some clarity.   | Outlines the steps of a plan to solve the problem with procedural writing with considerable clarity.   | Outlines the steps of a plan to solve the problem with procedural writing with a high degree of clarity.   |
|   | 3 4  | 5 6  | 7 8  | 9 10   |
| <b>Recording of results</b>   | Records results of trials with limited clarity.  | Records results of trials with some clarity.   | Records results of trials with considerable clarity.   | Records results of trials with a high degree of clarity.   |
|   | 3 4  | 5 6  | 7 8  | 9 10   |
| <b>Evaluating the success of objects or devices designed to solve the problem</b> | Evaluates the success of objects or devices with limited effectiveness.<br><br>Modifies the device or object with limited effectiveness.                           | Evaluates the success of objects or devices with some effectiveness.<br><br>Modifies the device or object with some effectiveness.                           | Evaluates the success of objects or devices with considerable effectiveness.<br><br>Modifies the device or object with considerable effectiveness.                           | Evaluates the success of objects or devices with a high degree of effectiveness.<br><br>Modifies the device or object with a high degree of effectiveness.                           |
|   | 9 10 11  | 12 13 14   | 15 16 17   | 18 19 20   |
| <b>Identifying modification to improve the solution</b>                           |  |  |  |  |
|   |  |  |  |  |
| <b>Use of conventions, vocabulary, and terminology</b>                            | Uses conventions, vocabulary and terminology with limited accuracy.  | Uses conventions, vocabulary and terminology with some accuracy.   | Uses conventions, vocabulary and terminology with considerable accuracy.   | Uses conventions, vocabulary and terminology with a high degree of accuracy.   |
|   | 3 4  | 5 6  | 7 8  | 9 10   |

|   |   |  |  |  |
|---|---|--|--|--|
| <b>Identification of potential applications of the results to real world situations</b> | Rarely identifies potential applications to real world situations.        | Occasionally identifies potential applications to real world situations. | Regularly identifies potential applications to real world situations.          | Consistently identifies potential applications to real world situations.           |
|   | 3 4   | 5 6  | 7 8  | 9 10   |
| <b>Overall Presentation</b>   | Expresses and organizes ideas and information with limited effectiveness. | Expresses and organizes ideas and information with some effectiveness.   | Expresses and organizes ideas and information with considerable effectiveness. | Expresses and organizes ideas and information with a high degree of effectiveness. |
|   | 3 4   | 5 6  | 7 8  | 9 10   |
| <b>TOTAL</b>  |   |  |  | /100   |



## **Appendix E: Science Fair Description & Rubric**





## Science Fair Guidelines

Sudbury Christian Academy's annual science fair is an opportunity for students to explore and to test scientific principles in life sciences, physical sciences, engineering, and computer sciences. Whenever appropriate, students shall adhere to the scientific method, otherwise staying true to the strictures of their chosen field. They shall conduct their experiments safely and ethically, keeping thorough and accurate notes. They shall strive to exceed the expectations of the curriculum, and to produce an excellent and engaging presentation.

Science Fair is mandatory for students in grades 7 and 8. The main fair is optional for JK-6 students. Some classes will have in-class fairs/presentations. Those not participating in the main fair are invited to visit the fair and to learn from the presentations and demonstrations.

Students may select a topic that aligns with one of four categories established by the regional science fair. The following descriptions are drawn from the regional guidelines, which in turn were adapted from the model used in the administration of the national science fair:

### LIFE & HEALTH SCIENCES

#### a) LIFE SCIENCES

A life science project examines some aspect of the life cycle of a non-human organism. Life science projects include botany, zoology, psychology, and kinesiology of non-human organisms. Some examples include examining plant growth or animal behaviour. Some projects, such as those involving digestion, involve both life science and physical science.

#### b) HEALTH SCIENCES

A health science project examines some biomedical and/or clinical aspect of human life or lifestyle and its translation into improved health for humans, or more effective health services and products. Health science projects include those related to the health of specific populations, societal and cultural dimensions of health, environmental influences on health, and animal research that directly impacts human health. Projects may relate to human aging, genetics, cancer research, musculoskeletal health, arthritis, circulatory and respiratory health, nutrition, neurosciences, mental health, psychology, metabolism, human development, infection, and immunology.

### PHYSICAL SCIENCES

A physical or mathematical science project studies an abiotic phenomenon to understand the relation between identified factors, perhaps including a cause and effect relationship, or the use of mathematics to solve a theoretical problem. Physical science projects include such fields as physics, chemistry, and astronomy, as well as comparative product testing. One example includes the use of mathematics to predict the growth and shape of cacti. Projects may relate to algorithms, operational research, application of mathematical models to solve problems, and statistics.

## ENGINEERING

An engineering project applies physical knowledge to solve a problem or achieve a purpose. A complete engineering project will include an outline of the need, the development of the innovation, and demonstration of the innovation to relevant members of the community. Engineering projects normally focus on a new process or product. One example includes the construction of a model of improved airplane wing design based on aerodynamic principles.

## COMPUTER SCIENCES

Computing and information technology projects concentrate primarily on the development of computing hardware and software applications including programming languages and algorithms, software design and databases, as well as the storage, transmission and manipulation of digital information. Projects using computers to store and analyze data may be categorized as one of the aforementioned sciences (as applicable), but projects that focus on the application of computers to solve a problem irrespective of the source of the data may be categorized as computer science.



- No more than two people have worked on the project
- The exhibit is no more than 3.5m high x 1.2m wide x 0.8m deep
- The exhibit is self-supporting and stable
- Any electrical power cord is CSA approved and grounded
- An insulating grommet is used whenever electrical service enters an enclosure
- Any non-current carrying parts are connected to ground lead (as applicable)
- Any exposed live parts are at a potential of less than 36 V to ground
- No voltages above 10kV are being generated
- Any flammable or poisonous chemicals are simulated for display
- Any radio-isotopes are sealed and at normal background activity
- Any hazardous moving parts are shielded
- Live animals may not be displayed
- Animal parts may not be displayed
- Pressurized containers may not be displayed
- Open flames may not be used for display
- Lasers may not be operated for public display
- High energy sources (e.g. X-rays) must be registered and approved by the province
- Microbiological cultures may not be displayed
- Biological toxins may not be displayed
- Plants, soils, and organic material may not be displayed

# SCIENCE FAIR JUDGING RUBRIC

| I. Scientific Thought   |   |    |    |   |    |    |  |    |    |  |    |    |
|---|---|----|----|---|----|----|--|----|----|--|----|----|
| Definition  | Level 1   |    |    | Level 2   |    |    | Level 3  |    |    | Level 4  |    |    |
| Experiment: An investigation to test a specific hypothesis using experiments. Variables, if properly identified, are somehow controlled.  | Duplication of a known experiment to confirm the hypothesis. Hypothesis is totally predictable. |    |    | Extension of a known experiment through modification of procedures, data gathering, and application.  |    |    | An original experiment with controls. Variables are identified, and some are controlled. Graphic presentation and simple statistics.   |    |    | An original experiment with controls. Variables are identified, and most are controlled. Graphic presentation and advanced statistical analysis.   |    |    |
| OR  |   |    |    |   |    |    |  |    |    |  |    |    |
| Study: A collection and analysis of data to reveal evidence of a fact or a situation of scientific interest. Variables, even if properly identified, are by their nature not feasible to control. | Study of existing printed material related to the basic issue.                                  |    |    | Study of material collected through compilation of existing data and through personal observations. Display attempts to address a specific issue. |    |    | Study based on observations and secondary research illustrating various options for addressing a relevant issue. Appropriate numerical, graphical, and statistical analysis. |    |    | Study correlating information from multiple significant sources which illustrate original solutions for addressing a current problem. Advanced numerical, graphical, and statistical analysis. |    |    |
| OR  |   |    |    |   |    |    |  |    |    |  |    |    |
| Innovation: Involving the development and evaluation of innovative devices, models, techniques, or approaches.  | Device or model that duplicates existing technology. Minimal reporting included.                |    |    | An improvement to an existing technological systems or equipment. Some justification included.  |    |    | An innovative adaptation or application of existing technology that might have commercial and/or human benefit.  |    |    | Integration of new and/or several existing technologies to produce an innovative system that clearly has commercial and/or human benefit.  |    |    |
| Score:  | 10  | 11 | 12 | 19  | 20 | 21 | 28   | 29 | 30 | 37   | 38 | 39 |
|   | 13  | 14 | 15 | 22  | 23 | 24 | 31   | 32 | 33 | 40   | 41 | 42 |
|   | 16  | 17 | 18 | 25  | 26 | 27 | 34   | 35 | 36 | 43   | 44 | 45 |

| II. Communication and Technical Explanation   |    |    |  |    |    |  |    |    |   |    |    |  |
|---|----|----|--|----|----|--|----|----|---|----|----|--|
| Level 1   |    |    | Level 2  |    |    | Level 3  |    |    | Level 4   |    |    |  |
| The student(s) have attempted to communicate an understanding of the scientific process and how it relates to their project, but with several misconceptions. |    |    | The student(s) have communicated a basic but incomplete understanding of the topic, but with a few misconceptions. |    |    | The student(s) have communicated a reasonable understanding of the scientific process and how it relates to their project, but with missing details. |    |    | The student(s) have communicated a complete and detailed understanding of the scientific process and how it relates to their project. |    |    |  |
| 9   | 10 | 11 | 12   | 13 | 14 | 15   | 16 | 17 | 18  | 19 | 20 |  |

| III. Interpretation of Results                                     |   |  |   |   |   |   |   |   |  |   |    |  |
|--|---|--|---|---|---|---|---|---|--|---|----|--|
| Level 1  |   |  | Level 2   |   |   | Level 3   |   |   | Level 4  |   |    |  |
| The student(s) demonstrate a limited ability to interpret results. |   |  | The student(s) demonstrate some ability to interpret results. |   |   | The student(s) demonstrate ability to interpret results with some complexity. |   |   | The student(s) demonstrate ability to interpret results with insight and complexity. |   |    |  |
| 0  | 1 |  | 2   | 3 | 4 | 5   | 6 | 7 | 8  | 9 | 10 |  |

#### IV. Relation and/or Application

| Level 1   | Level 2   | Level 3  | Level 4  |
|---|---|--|--|
| Shows little understanding of connecting science and technology with the outside world. | Shows some understanding of connecting science and technology with the outside world. | Shows general understanding of connecting science and technology with the outside world, with some implications for the project. | Shows thorough understanding of connecting science and technology with the outside world, with complete grasp of implications for the project. |
| 1 2   | 3 4   | 5 6  | 7 8  |

#### V. Research and Inquiry Skills

| Level 1   | Level 2  | Level 3   | Level 4   |
|---|--|---|---|
| A few relevant sources cited and little variety of sources accessed and analyzed. | Some relevant sources cited and some variety of sources accessed and analyzed. | Many relevant sources cited and a variety of sources accessed and analyzed. | Many relevant sources cited and a wide variety of sources accessed and analyzed thoroughly. |
| 0 1   | 2 3  | 4 5   | 6 7   |

#### VI. Display and Visual Presentation

| Skill (for five points)  | Dramatic Value (for five points)   |
|--|--|
| <ul style="list-style-type: none"> <li>- Is the workmanship neat and careful?</li> <li>- Is the lettering clear and legible?</li> <li>- Is the layout logical and self-explanatory?</li> <li>- Is the content clear and complete?</li> </ul> | <ul style="list-style-type: none"> <li>- Is the display simple and visually balanced?</li> <li>- Does the display capture attention?</li> <li>- Does the display have impact?</li> <li>- Is there good balance and use of contrast?</li> </ul> |
| 1 2 3 4 5  | 1 2 3 4 5  |

Total score

/100

Constructive Comments

## **Appendix F: APA Citation Quick Guide**







# American Psychological Association (APA) Citation Quick Guide

It is important to always credit the source of your information using a standard style of citation. One of the most common forms of citation in the sciences is outlined in the style guide produced and governed by the American Psychological Association (APA).

Students in **grades 5-8** will be expected to provide properly formatted references for any piece of information derived from a third party source – whether electronic or print, directly quoted or referenced in passing – using both parenthetical citation and a reference list, to identify the source material. Failure to do so will invoke the school’s discipline policy in regards to academic integrity. See Parent/Guardian Handbook for details.

## PARENTHETICAL CITATION

At the end of a sentence or section where third-party information is used in any capacity – including but not limited to direct quotes, passing mention, borrowed images, relevant examples – the writer must provide a short citation in parenthetical format. As a general rule, the three pieces of information which must be provided in parentheses are: a) the author’s last name (or the name of the producing organization if the author is unknown); b) the year of publication; and c) the page or paragraph number:

When the author is known, the parenthetical citation might appear as (Smith, 2009, p. 22). When the author is unknown, and when there are no page numbers (as in the case of most websites), the parenthetical citation might appear as (Environment Canada, 2019, para. 4). Note that closing punctuation for the sentence appears after, not before, citation.

## REFERENCE LIST

At the end of a paper or project, it is important to list all sources in alphabetical order by authors’ last names. In APA format, this is called a reference list, and should simply be titled “References” in plain font, centred. Each entry in the reference list should be left justified, with second and subsequent lines indented. Depending on the type of source (e.g. book, article, website), the order of information within each entry varies:

| Book   |
|--|
| Author, A.A. (Year of publication). <i>Title of book: Capital letter also for subtitle</i> . Location: Publisher.                  |
| Smith, J.D. (2010). <i>Dinosaurs of the Jurassic Period: From Aardonyx to Zuniceratops</i> . Toronto: University of Toronto Press. |

| Interview   |
|---|
| Interviewee’s name and description of conversation (personal communication, Month DD, YYYY).      |
| H.R. Jones interview about her career in marine biology (personal communication, April 12, 2019). |

Note: Parenthetical citation format for interviews is different from most other sources, and should appear as (H.R. Jones, personal communication, April 12, 2019).

### Journal Article

Author, A.A. (Year of publication). Title of article. *Title of Periodical*, volume number (issue number), pages.

Fredricks, P.D. (2012). Radon emissions in sedimentary rock formations. *British Journal of Geology*, 55 (17), 233-248.

### Motion Picture

Producer, P.P. (Producer), & Director, D.D. (Director). (Year of publication). *Title of motion picture* [Motion picture]. Country of origin: Studio or distributor.

Grazer, B.T. (Producer), & Howard, R.W. (Director). (1995). *Apollo 13* [Motion picture]. United States: Universal Pictures.

### Newspaper Article

Author, A.A. (YYYY, Month DD). Title of article. *Title of Newspaper*, pp. ##, ##.

Foster, R.O. (2018, May 10). CERN Sets Sights on Next Collision. *The Guardian*, pp. 3A, 3G.

Note: Unlike other types of articles (e.g. journals), p. or pp. precedes pages numbers for newspaper references, with p. for single pages and pp. for multiple pages.

### Webpage (author known)

Author, A.A. (Year of publication). Title of page [Description of format when necessary]. Retrieved from <https://domain.com/webpage>

Wired. (2019). How scientists are preparing Earth for an incoming asteroid [Video]. Retrieved from <https://www.youtube.com/watch?v=IURHSh4ISeo>

### Webpage (author unknown, year of publication unknown)

Title of webpage [Description of format when necessary]. (n.d.). Retrieved from <https://domain.com/webpage/>

How to Dissect a Frog [PDF file]. (n.d.). Retrieved from <https://www.laboratoryguidelines.com/dissection/frogs/>

For further instructions and samples, see the Online Writing Lab (OWL) published by Purdue University: [https://owl.purdue.edu/owl/research\\_and\\_citation/apa\\_style/](https://owl.purdue.edu/owl/research_and_citation/apa_style/)



