Your Living Curriculum©

General Guide-Lines and Instructions for submission (GGL&I)

Submission No:

Below are your general guidelines for the genre you have chosen. This outline will give a an idea of good instructional content. It's our hope that you will have the best chance of getting your work accepted. Keep writing!

Level	Concepts & Topics
Sixth Grade	*In sixth grade, students apply their understanding of the cycling of matter, energy flow, and scale, as it relates to molecules, geosphere, the solar system, and ecosystems. By the end of sixth grade, students apply their understanding of how matter and energy relate to atoms, the solar system, and ecosystems.-Students will develop an understanding of the nature of matter and the role of energy transformation. Students will also deepen their understanding of scales, patterns, and properties of matter, the solar system, and ecosystems. Student investigations focus on collecting and making sense of observational data and measurements using the science and engineering practices: ask questions and define problems, develop and use models, plan and carry out investigations, analyze and interpret data, use mathematics and computational thinking, construct explanations and design solutions, engage in argument from evidence, and obtain, evaluate, and communicate information. While individual lessons may include connections to any of the crosscutting concepts, the standards in sixth grade focus on helping students understand phenomena through patterns; scale, proportion, and quantity; systems and system models; and energy and matter.*

Physical Science

If a **substance** could be divided into smaller and smaller pieces it would be found to be made of very, very small **particles**, smaller than can be seen even with a **microscope**. These particles are not in a substance; they are the substance. All the particles of a particular substance are the same and different from those of other substances. The particles are not static but move in random directions. The **speed** at which they move is experienced as the temperature of the material. The differences between substances in the **solid**, **liquid** or **gas** state can be explained in terms of the speed and range of the movement of particles and the separation and strength of the attraction between neighboring particles. All materials, anywhere in the universe, living and non-living, are made of a very large number of basic 'building blocks' called **atoms**, of which there are about 100 different kinds. The properties of different materials can be explained in terms of the behavior of the atoms and groups of atoms of which they are made. Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. In a liquid, the molecules are constantly in contact with each other; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and vibrate in position but do not change relative locations. Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (Boundary: Predictions here are qualitative, not quantitative.) **Gravity** is the universal attraction between all objects, however large or small, although it is only apparent when one of the objects is very large. This gravitational attraction keeps the planets in **orbit** around the **Sun**, the **Moon** round the **Earth** and their moons round other planets. The effect of gravity on an object on the Moon is less than that on Earth because the Moon has less mass than the Earth, so a person on the Moon **weighs** less than on Earth even though their mass is the same. The pull of the Earth on the Moon keeps it orbiting the Earth while the pull of the Moon on the Earth gives rise to **tides.** Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—for example, Earth and the sun. Long-range gravitational interactions govern the evolution and maintenance of large-scale systems in space, such as galaxies or the solar system, and determine the patterns of motion within those structures. Forces that act at a distance (gravitational, electric, and magnetic) can be explained

by force fields that extend through space and can be mapped by their effect on a test object (a ball, a charged object, or a magnet, respectively).
The **chemicals** in the cells of a battery store energy which is released when the battery is connected so that an electric current flows, **transferring energy** to other components in the circuit and on to the environment. **Motion energy** is properly called **kinetic energy**; it is proportional to the mass of the moving object and grows with the square of its speed. A system of objects may also contain **stored (potential) energy**, depending on their relative positions.

Earth and Space Science
The layer of air at the **Earth's** surface is **transparent** to most of the **radiation** coming from the **Sun**, which passes through. The radiation that is absorbed at its surface is the Earth's external source of energy. The radiation from the Sun absorbed by the Earth warms the surface which then emits radiation of longer **wavelength** (**infrared**) that does not pass through the atmosphere but is absorbed by it, keeping the Earth warm. This is called the **greenhouse effect** because it is similar to the way the inside of a greenhouse is heated by the Sun. Greenhouse gases in the atmosphere absorb and retain the energy radiated from land and ocean surfaces, thereby regulating Earth's average surface temperature and keeping it habitable.
The **Earth** rotates about an **axis** lying north to south and this motion makes it appear that the **Sun**, **Moon** and **stars** are moving round the Earth. This **rotation** causes day and night as parts of the Earth's surface turn to face towards or away from the Sun. It takes a year for the Earth to pass round the Sun. The Earth's axis is tilted relative to the plane of its orbit around the Sun so that the length of day varies with position on the Earth's surface and time of the year, giving rise to the **seasons**. The Earth is one of eight (so far known) planets in our solar system which, along with many other smaller bodies, **orbit** the Sun, in roughly circular paths, at different distances from the Sun and taking different times to complete an orbit. The distances between these bodies are huge – Neptune is 4.5 billion **km** from the Sun, 30 times further than Earth. As seen from Earth, planets move in relation to the positions of the stars which appear fixed relative to each other. The **solar system** consists of the sun and a collection of objects, including planets, their moons, and **asteroids** that are held in orbit around the sun by its **gravitational pull** on them. This model of the solar system can explain **tides**, **eclipses** of the sun and the moon, and the motion of the planets in the sky relative to the **stars**. Earth's spin axis is fixed in direction over the short term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.

Life Science
Interdependent organisms living together in particular environmental conditions form an **ecosystem**. In a stable ecosystem there are **producers** of food (plants), **consumers** (animals) and **decomposers**, (bacteria and fungi which feed on waste products and dead organisms). The decomposers produce materials that help plants to grow, so the molecules in the organisms are constantly re-used. At the same time, **energy** resources pass through the ecosystem. When **food** is used by organisms for **life processes** some energy is **dissipated** as **heat** but is replaced in the ecosystem by **radiation** from the **Sun** being used to produce plant food. In any given ecosystem there is **competition** among species for the energy resources and the materials they need to live. The persistence of an ecosystem depends on the continued availability in the environment of these energy resources and materials. **Organisms** and populations of organisms are dependent on their environmental interactions both with other **living** things and with **nonliving** factors. Growth of organisms and population increases are limited by access to resources. In any ecosystem, organisms and **populations** with similar requirements for food, water, oxygen, or other **resources** may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. Similarly,

predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. **Mutually beneficial** interactions, in contrast, may become so interdependent that each organism requires the other for survival. A healthy ecosystem is one in which multiple **species** of different types are each able to meet their needs in a relatively stable web of life. Newly **introduced species** can damage the balance of an ecosystem. Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of many other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

Seventh Grade

In seventh grade, students will investigate the relationship between forces and the changes in motion, how energy transfer impacts geologic and atmospheric processes, and the structure and function of cells. By the end of seventh grade, students will explore how forces cause changes in motion and how energy is transferred in geologic, atmospheric, and environmental processes. Students investigate force and motion in a wide variety of systems, model how heat energy drives cycles in weather and climate and explain the structure and function of cells. Student investigations focus on collecting and making sense of observational data and measurements using the science and engineering practices: ask questions and define problems, develop and use models, plan and carry out investigations, analyze and interpret data, use mathematics and computational thinking, construct explanations and design solutions, engage in argument from evidence, and obtain, evaluate, and communicate information. While individual lessons may include connections to any of the crosscutting concepts, the standards in seventh grade focus on helping students understand phenomena though patterns, cause and effect, and structure and function.

Physical Science

Electric and **magnetic** (**electromagnetic**) **forces** can be **attractive** or **repulsive**, and their sizes depend on the magnitudes of the **charges**, **currents**, or magnetic strengths involved and on the distances between the interacting objects. Gravitational forces are always attractive. There is a **gravitational force** between any two masses, but it is very small except when one or both of the objects have large **mass**—for example, Earth and the sun. Long-range gravitational interactions govern the evolution and maintenance of large-scale systems in space, such as galaxies or the solar system, and determine the patterns of motion within those structures. Forces that act at a distance (gravitational, electric, and magnetic) can be explained by **force fields** that extend through space and can be mapped by their effect on a test object (a ball, a charged object, or a magnet, respectively). On Earth, it [**gravity**] results in everything being pulled down towards the center of the Earth. We call this downward **attraction** the **weight** of an object. The object pulls the Earth as much as the Earth pulls the object, but because the Earth's mass is much bigger, we observe the resulting motion of the object, not of the Earth. For any pair of interacting objects, the **force** exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first but in the opposite direction. The **motion** of an object is determined by the **sum of the forces** acting on it; if the total force on the object is not zero, its motion will change. The greater the **mass** of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. Forces on an object can also change its **shape or orientation**. All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared.

Earth and Space Science

Earth processes are the result of **energy** flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce **chemical and physical changes** in Earth's materials and living organisms. Radioactive decay of material inside the Earth since it was formed is its internal source of energy. Radiation from the Sun provides the energy that enables plants containing chlorophyll to make glucose through the process of photosynthesis. The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. **Greenhouse gases** in the atmosphere absorb and retain the energy radiated from land and ocean surfaces, thereby regulating Earth's average surface temperature and keeping it habitable.

Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geological history. Plate movements are responsible for most **continental** and **ocean** floor features and for the distribution of most **rocks** and **minerals** within **Earth's crust**. Maps of ancient land and water patterns, based on investigations of rocks and **fossils**, make clear how Earth's plates have moved great distances, collided, and spread apart.

Weather and **climate** are influenced by interactions involving **sunlight**, the **ocean**, the **atmosphere**, ice, landforms, and living things. These interactions vary with **latitude**, **altitude**, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. Because these patterns are so complex, weather can be predicted only through **probability statistics**. Some natural hazards, are preceded by phenomena that allow for reliable predictions. Mapping the history of natural hazards in a region, combined with an understanding of related geological forces can help forecast the locations and likelihoods of future events.

Life Science

All living organisms are made of one or more **cells**, which can be seen only through a microscope. All the basic processes of life are the results of what happens inside cells. Cells divide to replace aging cells and to make more cells in growth and in reproduction. Food is the energy source they need in order to carry out these and other functions. Life is the quality that distinguishes living things - composed of living cells, from nonliving objects or those that have died. While a simple definition of life can be difficult to capture, all living things - that is to say all organisms -can be characterized by common aspects of their structure and functioning. Some cells in **multi-cellular organisms**, as well as carrying out the **functions** that all cells do, are **specialized**; for example, muscle, blood and nerve cells carry out specific functions within the organism. Cells are often aggregated into tissues, tissues into organs, and organs into **organ systems**. In the human body, systems carry out such key functions as respiration, digestion, elimination of waste and temperature control. The circulatory system takes material needed by cells to all parts of the body and removes soluble waste to the urinary system. Stem cells, which are not specialized, are capable of repairing tissues by being programmed for different functions. Cells function best in certain conditions. Both single cell and multi-cellular organisms have mechanisms to maintain temperature and acidity within certain limits that enable the organism to survive. Organisms are complex, organized and built on a hierarchical foundation of elements and atoms, to cells and systems of individual organisms to species and populations living and interacting in complex ecosystems. Organisms range in composition from a **single cell** (unicellular microorganisms) to multicellular organisms, in which different groups of large number of cells work together to form **systems of tissues and organs** (e.g. circulatory, respiratory, nervous, musculoskeletal), that are specialized for particular functions. Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (Boundary: At this grade level, only a few major cell structures should be introduced.) Organisms respond to **stimuli**

from their environment and actively maintain their internal environment through **homeostasis.** Plant species have **adaptations** to obtain the water, light, minerals and space they need to grow and reproduce in particular locations characterized by climatic, geological and hydrological conditions.
In most cases, the energy needed for life is ultimately derived from the sun through **photosynthesis** (although in some ecologically important cases, energy is derived from reactions involving inorganic chemicals in the absence of sunlight e.g. chemosynthesis). Plants, algae (including phytoplankton), and other energy-fixing microorganisms use sunlight, water and carbon dioxide to facilitate photosynthesis, which stores energy, forms plant matter, releases oxygen, and maintains plants' activities.

Eight Grade

In eighth grade, students will describe how cause-and-effect interact with stability and change to influence the natural world. By the end of eighth grade, students will describe how stability and change and the process of cause and effect influence changes in the natural world. Students will apply energy principles to chemical reactions, explore changes within Earth and understand how genetic information is passed down to produce variation among the populations. Student investigations focus on collecting and making sense of observational data and measurements using the science and engineering practices: ask questions and define problems, develop and use models, plan and carry out investigations, analyze and interpret data, use mathematics and computational thinking, construct explanations and design solutions, engage in argument from evidence, and obtain, evaluate, and communicate information. While individual lessons may include connections to any of the crosscutting concepts, the standards in eighth-grade focus on helping students understand phenomena through cause and effect, energy and matter, and stability and change.

Physical Science
All materials, anywhere in the universe, living and non-living, are made of a very large numbers of basic 'building blocks' called **atoms**, of which there are about 100 different kinds. **Substances** made of only one kind of atom are called **elements**. Atoms of different elements can combine together to form a very large number of **compounds**. A **chemical reaction** involves a rearrangement of the atoms in the reacting substances to form new substances, while the total amount of matter remains the same. The properties of different materials can be explained in terms of the behavior of the atoms and groups of atoms of which they are made. Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. The total number of each type of atom is conserved, and thus the mass does not change. Some chemical reactions release energy, others store energy.
Objects can have stored energy (that is, the ability to make things change) either because of their chemical composition (as in fuels and batteries), their movement, their temperature, their position in a gravitational or other field, or because of compression or distortion of an elastic material. **Energy** can be stored by lifting an object higher above the ground. When it is released and falls, this energy is stored in its **motion**. When an object is heated it has more energy than when it is cold. An object at a higher temperature heats the surroundings or cooler objects in contact with it until they are all at the same temperature. How quickly this happens depends on the kind of material which is heated and on the materials between them (the extent to which they are **thermal insulators** or **conductors**). The chemicals in the cells of a **battery** store energy which is released when the battery is connected so that an **electric current** flows, **transferring energy** to other components in the **circuit** and on to the environment. Energy can be transferred by **radiation**, as sound in air or light in air or a **vacuum**. Many processes and phenomena are described in terms of **energy exchanges**, from the growth of plants to the weather. The transfer of energy in making things happen almost

always results in some energy being shared more widely, heating more **atoms** and **molecules** and spreading out by conduction or radiation. The process cannot be reversed and the energy of the random movement of particles cannot as easily be used. Thus, some energy is **dissipated.** A simple wave has a repeating pattern with a specific **wavelength, frequency, and amplitude.**

Earth and Space Science

Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geological history. Plate movements are responsible for most **continental** and **ocean floor features** and for the distribution of most **rocks** and **minerals** within Earth's **crust**. Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. Some **natural hazards** are preceded by geological activities that allow for **reliable predictions**; others occur suddenly, with no notice, and are not yet predictable. By tracking the upward movement of magma, for example, volcanic eruptions can often be predicted with enough advance warning to allow neighboring regions to be evacuated. Earthquakes, in contrast, occur suddenly; the specific time, day, or year cannot be predicted. However, the history of earthquakes in a region and the mapping of fault lines can help forecast the likelihood of future events. Finally, satellite monitoring of weather patterns, along with measurements from land, sea, and air, usually can identify developing severe weather and lead to its reliable forecast. **Evolution** is shaped by Earth's varying geological conditions. Sudden changes in conditions (e.g., **meteor impacts, major volcanic eruptions**) have caused **mass extinctions**, but these changes, as well as more gradual ones, have ultimately allowed other life forms to flourish. The evolution and proliferation of living things over geological time have in turn changed the rates of **weathering** and **erosion** of land surfaces, altered the composition of Earth's soils and **atmosphere**, and affected the distribution of water in the **hydrosphere.** Human activities have significantly altered the **biosphere**, sometimes damaging or destroying natural **habitats** and causing **extinction** of many other species. But changes to Earth's environment can have different impacts (negative and positive) for different living things. Typically, as human populations and **per-capita consumption** of **natural resources** increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

Life Science

Genes are located in the **chromosomes** of **cells**, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of a specific **protein**, which in turn affects the **traits** of the individual (e.g., human skin color results from the actions of proteins that control the production of the pigment melanin). Changes (**mutations**) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. **Sexual reproduction** provides for transmission of genetic information to offspring through **egg** and **sperm cells**. These cells, which contain only one chromosome of each parent's chromosome pair, unite to form a new individual (offspring). Thus offspring possess one instance of each parent's chromosome pair (forming a new chromosome pair). Variations of **inherited traits** between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited or (more rarely) from mutations. (Boundary: The stress here is on the impact of gene transmission in reproduction, not the mechanism.) In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two **alleles** of each gene, one acquired from each parent. These versions may be identical or may differ from each other. In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some

changes are **beneficial, others harmful, and some neutral to the organism.**
Genetic variations among individuals in a population give some individuals an advantage in surviving and reproducing in their environment. This is known as **natural selection**. It leads to the predominance of certain traits in a population and the suppression of others. In **artificial selection**, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. **Adaptation** by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. In separated populations with different conditions, the changes can be large enough that the populations, provided they remain separated (a process called reproductive isolation), evolve to become separate species. Biodiversity is the wide range of existing life forms that have adapted to the variety of conditions on Earth, from terrestrial to marine ecosystems. Biodiversity includes genetic variation within a species, in addition to species variation in different habitats and ecosystem types (e.g., forests, grasslands, wetlands). Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling.