



Physical Science Curriculum Guide for High School SDP Science Teachers



Please note: Pennsylvania & Next Generation Science Standards as well as Instructional Resources are found on the SDP Curriculum Engine

Physical Science: Term 1 Unit 1

Topic: Scientific Knowledge, Practices, and the Scientific Method

Duration: Traditional (50 minute periods): 7 - 10 classes (adjust using professional discretion)

Block (90 minute periods): 3 - 5 classes (adjust using professional discretion)

Eligible Content

CHEM.A.1.1.2 Classify observations as quantitative and/or qualitative.

CHEM.A.1.1.3 Utilize significant figures to communicate the uncertainty in a quantitative observation.

BIO.B.3.3.1 Distinguish among the scientific terms: hypothesis, inference, law, theory, principle, fact, and observation.

Performance Objectives

SWBAT: *These are examples, created by SDP teachers, of how you may translate the eligible content into learning goals for your classroom.*

- **SWBAT** follow a multistep procedure when carrying out experiments **IOT** apply the scientific method.
- **SWBAT** to define scientific law and scientific theory **IOT** distinguish between them.
- **SWBAT** distinguish between accuracy and precision **IOT** to correctly utilize the SI system of measurements.
- **SWBAT** analyze graphs, create graphs, use formulas and convert between units **IOT** depict quantitative data and explain it.

Key Terms and Definitions

1. **Distinguish:** perceive and point out a difference
2. **Constants:** all of the factors that are the same in both the experimental group and the control group.
3. **Control:** the factor or subject of an experiment that is not manipulated but can be used to make comparisons between sets of data.
4. **Dependent Variable:** the factor in an experiment that is changed or determined by manipulation of one or more other factors (independent variables).
5. **Hypothesis:** a proposed explanation based on limited observation used as the starting point of further investigation.
6. **Independent Variable:** the factor in an experiment that is deliberately manipulated in an experiment.

7. **Inference:** a logical interpretation based on prior knowledge or experience. For example: You see a window broken and a baseball on the floor next to the shattered glass. You can infer that a baseball broke your window (Biology Corner, 2016, <https://www.biologycorner.com/lesson-plans/scientific-method/scientific-method/>)
8. **Qualitative Observation:** observations that involve the use of one's senses and are not measureable.
9. **Quantitative Observation:** observations that involve measurable values
10. **Scientific Law:** the summary of of many repeated and consistent experimental results and observations, and explanation of observable phenomenon
11. **Scientific Theory:** an explanation for some phenomenon that is based on observation, experimentation, and reasoning.
12. **Scientific Method:** a series of steps followed to solve problems including collecting data, formulating a hypothesis, testing the hypothesis, and stating conclusions. A method of thinking through a problem to a conclusion that is substantiated.
13. **Scientific Notation:** a method of expressing a quantity as a number multiplied by 10 to the appropriate power. Proper form includes one digit to the left of the decimal times 10 to a specific power (2.0×10^3)
14. **Significant Figure:** a prescribed decimal place that determines the amount of rounding off to be done based on the precision of the measurement.
15. **SI System of Measurement:** Le Système International d'Unités, the International System of Units or metric system, which is the measurement system that is accepted worldwide.

Physical Science: Term 1 Unit 2

Topic: Matter and its States

Duration: Traditional (50 minute periods): 12 - 15 classes (adjust using professional discretion)

Block (90 minute periods): 5 - 7 classes (adjust using professional discretion)

Eligible Content

CHEM.A.1.1.1: Classify physical or chemical changes within a system in terms of matter and/or energy.

CHEM.A.1.2.2: Differentiate between homogenous and heterogeneous mixtures.

CHEM.A.1.2.3: Describe how factors (e.g. temperature, concentration, surface area) can affect solubility.

CHEM.A.1.1.4: Relate the physical properties of matter to its atomic or molecular structure.

CHEM.B.2.2.1: Utilize mathematical relationships to predict changes in the number of particles, the temperature, the pressure, and the volume in a gaseous system (i.e., Boyle's law, Charles's law, Dalton's law of partial pressures, the combined gas law, and the ideal gas law).

Performance Objectives

SWBAT: *These are examples, created by SDP teachers, of how you may translate the eligible content into learning goals for your classroom.*

- **SWBAT** identify a substance's physical and chemical properties IOT distinguish one substance from another.
- **SWBAT** analyze mixtures IOT to determine if they are homogenous or heterogeneous.
- **SWBAT** examine solutions IOT identify the solute and the solvent.
- **SWBAT** distinguish between physical and chemical changes IOT identify these changes in an experiment.
- **SWBAT** conduct an experiment IOT to show how physical properties can separate a mixture.
- **SWBAT** distinguish between endothermic and exothermic changes IOT summarize the role of energy during changes of state.
- **SWBAT** state the law of conservation of mass and the law of conservation of energy IOT explain how they apply to changes of state.
- **SWBAT** illustrate the molecular-level models of solids, liquids, and gases IOT to show the effects of adding or removing thermal energy.
- **SWBAT** conduct experiments using the steps of the scientific method IOT demonstrate the effects of adding or removing energy from a substance.

Key Terms and Definitions

1. **Distinguish:** perceive and point out a difference
2. **Molecules:** the smallest unit of a substance that keeps all of the physical and chemical properties of that substance
3. **Mixture:** a combination of two or more substances that are not chemically combined
4. **Pure Substance:** a sample of matter, either a single element or a single compound, that has definite chemical and physical properties
5. **Homogeneous Mixture:** the substances are not mixed uniformly and are not evenly distributed
6. **Heterogeneous Mixture:** the components are evenly distributed, and the mixture is the same throughout
7. **Melting Point:** the temperature and pressure at which a solid becomes a liquid
8. **Density:** a measurement of how much matter is contained in a certain volume of a substance - $\text{Density} = \text{Mass}/\text{Volume}$
9. **Boiling Point:** the temperature and pressure at which a liquid becomes a gas
10. **Reactivity:** the ability of a substance to combine chemically with another substance

11. **Suspension:** a mixture in which particles of a material are more or less evenly dispersed throughout a liquid or gas
12. **Colloid:** a mixture consisting of tiny particles that are too small to settle out or be filtered out
13. **Solution:** a homogeneous mixture of two or more substances uniformly dispersed throughout a single phase
14. **Solute:** in a solution, the substance that dissolves in the solvent
15. **Solvent:** in a solution, the substance in which the solute dissolves
16. **Physical Change:** a change of matter from one form to another, without a change in chemical properties
17. **Chemical Change:** a change that occurs when one or more substances are changed into entirely new substances that have different properties.
18. **Kinetic Theory:** states that all matter is made up of tiny, moving particles, the particles are always in motion, and at the same temperature, heavier particles move slower than lighter particles
19. **Energy:** the ability to change or move matter; the capacity to do work.
20. **Thermal Energy:** energy that comes from the temperature of matter. The hotter the substance, the more its molecules vibrate, and therefore the higher its thermal energy.
21. **Endothermic changes:** energy is added, or required as a change of state takes place. Examples: melting and evaporation
22. **Exothermic changes:** energy is released, or removed, as a change of state takes place. Examples: condensation and freezing
23. **Law of Conservation of Mass:** mass cannot be created or destroyed. The total mass of the reactants is the same as the total mass of the products.
24. **Law of Conservation of Energy:** energy cannot be created or destroyed. Energy may be converted to another form during a physical or chemical change, but the total amount of energy present before and after the change is the same.
25. **Boyle's Law:** the volume of a gas increases as the pressure decreases, if the pressure does not change.
26. **Charles's Law:** the volume of a gas increases as the temperature increases, if the pressure does not change.
27. **Gay-Lussac's Law:** the pressure of a gas increases as the temperature increases, if the volume does not change.

Physical Science: Term 1 Unit 3

Topic: Atoms and the Periodic Table

Duration: Traditional (50 minute periods): 15 - 19 classes (adjust using professional discretion)

Block (90 minute periods): 7-9 classes (adjust using professional discretion)

Eligible Content

CHEM.A.1.1.4 Relate the physical properties of matter to its atomic or molecular structure.

CHEM.A.2.1.1 Describe the evolution of atomic theory leading to the current model of the atom based on the works of Dalton, Thomson, Rutherford, and Bohr.

CHEM.A.2.1.2 Differentiate between the mass number of an isotope and the average atomic mass of an element.

CHEM.A.2.2.1 Predict the ground state electronic configuration and/or orbital diagram for a given atom or ion.

CHEM.A.2.2.2 Predict characteristics of an atom or an ion based on its location on the periodic table (e.g., number of valence electrons, potential types of bonds, reactivity).

CHEM.A.2.2.3 Explain the relationship between the electron configuration and the atomic structure of a given atom or ion.

CHEM.A.2.3.1 Explain how the periodicity of chemical properties led to the arrangement of elements on the periodic table.

Performance Objectives

SWBAT: *These are examples, created by SDP teachers, of how you may translate the eligible content into learning goals for your classroom.*

- **SWBAT** create a timeline or graphic organizer **IOT** describe the evolution of atomic theory leading to the current model of the atom based on the works of Dalton, Thomson, Rutherford, and Bohr.
- **SWBAT** explain that matter is made of particles called atoms, which are composed of even smaller particles (protons, neutrons, and electrons) **IOT** discuss the nature and behavior of these particles in elements, compounds and mixtures.
- **SWBAT** explain the repeating pattern of chemical properties by using the repeating patterns of atomic structure within the periodic table **IOT** deduce the behavior of elements as they interact with each other in solutions and in chemical reactions.
- **SWBAT** list and describe the nuclear changes (fission, fusion and radioactive decay) **IOT** develop models to illustrate these nuclear changes and the energy they release.

Key Terms and Definitions

1. **Atomic Mass:** expressed in atomic mass units (amu), typically used as a property of an atom of a particular element or isotope.
2. **Atomic Number:** the number of protons in the nucleus of an atom.
3. **Electron:** a negatively charged subatomic particle found either free (unattached to an atom) or bound in an electron orbital around the nucleus of an atom.
4. **Electron Cloud:** a three dimensional area around the nucleus of an atom that contains any electrons associated with that atom
5. **Energy Level:** a comparative amount of energy that a particular set of electrons has as they travel outside of the nucleus
6. **Group/family:** a column of the Periodic Table containing elements with the same number of valence electrons and similar chemical properties.
7. **Ion:** an atom that has gained or lost one or more electrons and has a negative or positive charge (ex: K^+ or K^-).
8. **Nuclear Fusion:** a nuclear reaction in which the nuclei of smaller atoms fuse to form a larger nucleus causing the release of energy.
9. **Nuclear Fission:** a nuclear reaction in which the nucleus of an atom is split as a result of a nuclear collision causing a release of energy.
10. **Neutron:** a subatomic particle found in the nucleus of an atom having no electrical charge and a mass slightly more than a proton.
11. **Organic compounds:** compound that contains carbon atoms; usually covalently bonded
12. **Period:** a row of the Periodic Table which contains elements which all have the same number of electron energy levels
13. **Products:** substance that forms in a chemical reaction; found on the right side of the arrow
14. **Proton:** a subatomic particle found in the nucleus of an atom with a positive charge and a mass slightly less than that of a neutron.
15. **Radioactive Decay:** a nuclear reaction in which an unstable (radioactive) heavy nucleus releases alpha and beta particles as well as gamma radiation in order to stabilize as a lighter nucleus.
16. **Reactants:** substance or molecules that participate in chemical reactions; found on the left side of the arrow
17. **Valence Electrons:** an electron in an outer energy level that can be involved in bonding reactions.
18. **Isotope:** two or more forms of the same element that contain equal numbers of protons but different numbers of neutrons.

Physical Science: Term 2 Unit 4

Topic: Chemical Bonding

Duration: Traditional (50 minute periods) : 13 - 16 days (adjust using professional discretion)

Block (90 minute periods) : 6 - 8 days (adjust using professional discretion)

Eligible Content

CHEM.A.1.2.5: Describe how chemical bonding can affect whether a substance dissolves in a given liquid.

CHEM.B.1.4.1: Recognize and describe different types of models that can be used to illustrate the bonds that hold atoms together in a compound (e.g., computer models, ball-and-stick models, graphical models, solid-sphere models, structural formulas, skeletal formulas, Lewis dot structures).

CHEM.B.1.4.2: Utilize Lewis dot structures to predict the structure and bonding in simple compounds.

A.2.1.1: Describe the unique properties of water [and how these properties support life on Earth (e.g., freezing point, high specific heat, cohesion)].

A.2.2.1: Explain how carbon is uniquely suited to form biological macromolecules.

A.2.2.2: Explain how biological macromolecules form from monomers.

A.2.2.3: Compare and contrast the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms.

Performance Objectives

SWBAT: *These are examples, created by SDP teachers, of how you may translate the eligible content into learning goals for your classroom.*

- **SWBAT** draw Lewis dot structures (up to the first 20 elements) **IOT** explain how bonds represent valence electrons and store energy.
- **SWBAT** contrast ionic and covalent compounds and their resulting properties **IOT** explain the relationship between the physical properties of a substance and its molecular or atomic structure.
- **SWBAT** identify the chemical formulas of simple inorganic compounds **IOT** interpret the meaning of a simple chemical reaction.
- **SWBAT** diagram the nature of polar molecules and hydrogen bonding **IOT** explain the unique properties of water and its importance to living things.
- **SWBAT** classify the formation of compounds and their resulting properties using bonding theories (ionic and covalent) **IOT** explain the relationship between the physical properties of a substance and its molecular or atomic structure.
- **SWBAT** distinguish between formulas of molecular compounds and ionic compounds **IOT** explain the patterns in bonding resulting from the position of elements on the periodic table.

- **SWBAT** describe how carbon atoms bond covalently and hydrogen bonds occur between and within molecules forming organic compounds **IOT** explain the complexity of the 4 major types of organic compounds: carbohydrates, proteins, lipids and nucleic acids.

Key Terms and Definitions

1. **Amino Acid:** any one of 20 different organic molecules that contain a carboxyl and an amino group and that combine to form proteins.
2. **ATP (Adenosine Triphosphate):** a large molecule that is used inside all cells to store energy (makes bonds by adding a phosphate group) OR release energy (breaks bonds releasing a phosphate group)
3. **Bond Length:** the distance between two bonded atoms at their minimum potential energy; the average distance between the nuclei of two bonded atoms.
4. **Bond Angle:** the angle formed by two bonds to the same atom.
5. **Carbohydrate:** the fuel of life; organic compound that is made of carbon, hydrogen, and oxygen in the ratio 1:2:1; used by cells to make ATP
6. **Chemical formula:** shows how many atoms of each element are in a unit of a substance. ex: Aluminium sulfate has the chemical formula $\text{Al}_2(\text{SO}_4)_3$, indigo $\text{C}_{16}\text{H}_{10}\text{N}_2\text{O}_2$, glucose $\text{C}_6\text{H}_{12}\text{O}_6$ (Holt, 2004, p.41).
7. **Covalent Bond:** a bond formed when atoms share one or more pairs of electrons.
8. **Empirical Formula:** the composition of a compound in terms of the relative numbers and kinds of atoms in the simplest ratio. Ex: CH_2O is the empirical formula of glucose $\text{C}_6\text{H}_{12}\text{O}_6$
9. **Glucose:** $\text{C}_6\text{H}_{12}\text{O}_6$
10. **Hydrogen Bond:** the intermolecular force occurring when a hydrogen atom that is bonded to a highly electronegative atom of one molecule is attracted to two unshared electrons of another molecule.
11. **Ionic Bond:** a bond formed by the attraction between oppositely charged ions
12. **Ionic Compound:** a compound formed from ionic bonding, the attraction between two oppositely charged ions.
13. **Metallic Bond:** a bond formed by the attraction between positively charged metal ions and the electrons around them.
14. **Molecular Compound:** a compound formed from covalent bonding, the attraction between two chemically unstable atoms that share valence electrons.
15. **Molecular Formula:** a chemical formula that shows the number and kinds of atoms in a molecule, but not the arrangement of the atoms (this term can be used synonymously as chemical formula). Ex: molecular formula of aspirin is $\text{C}_9\text{H}_8\text{O}_4$.
16. **Monomer:** a simple molecule that can combine with other like or unlike molecules to make a polymer.
17. **Polyatomic Ion:** an ion made of two or more atoms (OH^- , NH_4^+)
18. **Polymer:** a large molecule that is formed by more than five monomers, or small units.
19. **Protein:** an organic compound that is made of one or more chains of amino acids and that is a principal component of all cells.
20. **Structural Formula:** a formula that indicates the location of the atoms, groups, or ions relative to one another in a molecule and that indicates the number and location of chemical bonds.

Physical Science: Term 2 Unit 5

Topic: Chemical Reactions

Duration: Traditional (50 minute periods) : 13 - 16 days (adjust to student needs using professional discretion)

Block (90 minute periods) : 6 - 8 days (adjust to student needs using professional discretion)

Eligible Content

CHEM.B.2.1.2: Use stoichiometric relationships to calculate the amounts of reactants and products involved in a chemical reaction.

CHEM.B.2.1.3: Classify reactions as synthesis, decomposition, single replacement, double replacement, or combustion.

CHEM.B.2.1.5: Balance chemical equations by applying the Law of Conservation of Matter.

BIO.A.3.2.1: Compare the basic transformations of energy during photosynthesis and cellular respiration.

BIO.A.2.3: Explain how enzymes regulate biochemical reactions within a cell.

Performance Objectives

SWBAT: *These are examples, created by SDP teachers, of how you may translate the eligible content into learning goals for your classroom.*

- **SWBAT** recognize signs that a chemical reaction may be taking place **IOT** identify situations involving chemical change and kinetic energy transfer between particles.
- **SWBAT** observe chemical changes involving measureable changes in energy **IOT** describe the differences between endothermic and exothermic reactions.
- **SWBAT** identify the chemical formulas of simple inorganic compounds **IOT** interpret the meaning of a simple chemical reaction.
- **SWBAT** analyze a simple chemical equation **IOT** verify and explain the Law of Conservation of Mass.
- **SWBAT** follow a multistep procedure **IOT** balance an equation.
- **SWBAT** identify mole ratios in a balanced chemical equation **IOT** calculate the relative masses of reactants and products from chemical reaction.

- **SWBAT** determine whether a chemical equation represents a synthesis, decomposition, single-displacement, double-displacement or combustion reaction **IOT** predict the products of some reactions based on the reaction type.
- **SWBAT** collect data regarding the rate of a reaction **IOT** determine factors that affect reactions rates.

Key Terms and Definitions

1. **Reactant:** a substance or molecule that participates in a chemical reaction
2. **Product:** a substance that forms in a chemical reaction.
3. **Chemical Energy:** The energy released when a chemical compound reacts to produce new compounds.
4. **Exothermic Reactions:** a chemical reaction in which heat is released to the surroundings.
5. **Endothermic Reactions:** a chemical reaction that requires heat.
6. **Synthesis Reactions:** a reaction in which substances combine to form a new compound.
7. **Decomposition Reactions:** a reaction in which a single compound breaks down to form two or more simpler substances.
8. **Single-Displacement Reactions:** a reaction in which one element or radical takes the place of another element or radical in a compound.
9. **Double-Displacement Reactions:** a reaction in which a gas, a solid precipitate, or a molecular compound forms from the apparent exchange of atoms or ions between two compounds.
10. **Combustion Reactions:** the oxidation reaction of an organic compound, in which heat is released.
11. **Radical:** an atom, molecule or ion that has unpaired electrons available for bonding and is highly reactive.
12. **Oxidation-Reduction Reactions:** any chemical change in which one species is oxidized (loses electrons) and another species is reduced (gains electrons); also called redox reactions.
13. **Mole Ratio:** the relative number of moles of the substances required to produce a given amount of product in a chemical reaction.
14. **Balanced Equation:** a chemical equation that has an equal amount of each element on each side of the equation.
15. **Catalyst:** a substance that changes the rate of a chemical reaction without being consumed or changed significantly.
16. **Enzyme:** a type of protein that speeds up metabolic reactions in plants and animals without being permanently changed or destroyed.
17. **Substrate:** the reactant in reactions catalyzed by enzymes.
18. **Chemical Equilibrium:** a state of balance in which the rate of a forward reaction equals the rate of the reverse reaction and the concentrations of products and reactants remain unchanged.

Physical Science: Term 2 Unit 6

Topic: Solutions, Acids and Bases

Duration: Traditional (50 minute periods) : 13 - 16 days (adjust to student needs using professional discretion)

Block (90 minute periods) : 6 - 8 days (adjust to student needs using professional discretion)

Eligible Content

CHEM.A.1.2.1: Compare properties of solutions containing ionic or molecular solutes (e.g., dissolving, dissociating).

CHEM.A.1.2.2: Differentiate between homogenous and heterogenous mixtures (e.g. how much mixtures can be separated).

CHEM.A.1.2.3: Describe how factors (e.g. temperature, concentration, surface area) can affect solubility.

CHEM.A.1.2.4: Describe various ways that concentration can be expressed and calculated.

CHEM.A.1.2.5: Describe how chemical bonding can affect whether a substance dissolves in a given liquid.

Performance Objectives

SWBAT: *These are examples, created by SDP teachers, of how you may translate the eligible content into learning goals for your classroom.*

- **SWBAT** distinguish between heterogeneous mixtures and homogeneous mixtures **IOT** compare the properties of suspensions, colloids, and solutions.
- **SWBAT** utilize their understanding of suspensions, colloids and solutions **IOT** devise methods for separating the elements of a suspension, colloid or solution.
- **SWBAT** explain how the characteristics of various substances make them soluble or insoluble **IOT** predict the solubility of a specific substance.
- **SWBAT** explain the concept of “like dissolves like” **IOT** apply the concept to the phenomenon of ionic dissociation.
- **SWBAT** describe the process of dissociation **IOT** discuss the nature of strong acids and bases vs. weak acids and bases.
- **SWBAT** utilize various indicators **IOT** distinguish between strong or weak acids and bases.

- **SWBAT** predict the product of a neutralization reaction and cite specific textual evidence
IOT write an explanatory response describing the role of buffer systems in industry and homeostasis in living things (ie. pH of plasma in blood).

Key Terms and Definitions

1. **Dissociation:** the separating of a molecule or compound into simpler molecules, atoms, radicals, or ions.
2. **Polar Compound:** a compound whose electron are not equally distributed among its atoms and has a partial negative charge on one side of the molecule and a partial positive charge on the other.
3. **Non-Polar Compound:** a compound whose electrons are equally distributed among its atoms.
4. **Hydrogen bond:** the intermolecular force occurring when a hydrogen atom that is bonded to a highly electronegative atom of one molecule is attracted to two unshared electrons of another molecule.
5. **Solubility:** the ability of one substance to dissolve in another at a given temperature and pressure; expressed in terms of the maximum amount of solute that will dissolve in a given amount of solvent.
6. **Concentration:** the amount of a particular substance in a given quantity of a mixture, solution, or ore.
7. **Saturated solution:** a solution that cannot dissolve any more solute under the given conditions.
8. **Unsaturated solution:** a solution that is able to dissolve additional solute.
9. **Supersaturated solution:** a solution that has more solute dissolved in it than possible under normal circumstance.
10. **Molarity:** the concentration of a solution in moles of dissolved solute per liter of solution.
11. **Acid:** any compound that increases the number of hydronium ions when dissolved in water; acids turn blue litmus paper red and react with bases and some metals to produce salts.
12. **Indicator:** a compound that can reversibly change color depending on the pH of the solution or other chemical change.
13. **Base:** any compound that increases the number of hydroxide ions when dissolved in water; bases turn red litmus paper blue and react with acids to form salts.
14. **pH:** a value used to express the acidity or alkalinity of a solution; the logarithm of the reciprocal of the concentration of hydronium ions.
15. **Neutralization reaction:** the reaction of the ions that characterize acids (hydronium ions) and the ions that characterize bases (hydroxide ions) to form water molecules and a salt.
16. **Salt:** an ionic compound that forms when a metal atom or a positive radical replaces the hydrogen of an acid.

Physical Science: Term 3 Unit 7

Topic: Earth Science

Duration: Traditional (50 minute periods) : 11 - 15 days (adjust to student needs using professional discretion)

Block (90 minute periods) : 5 - 7 days (adjust to student needs using professional discretion)

Eligible Content

3.3.10.A2: Analyze the effects on the environment and the carbon cycle of using both renewable and nonrenewable sources of energy.

3.3.10.A4: Relate geochemical cycles to conservation of matter. Explain how the Earth's systems and its various cycles are driven by energy.

3.3.10.A5: Explain how there is only one ocean. Explain the processes of the hydrologic cycle. Explain the dynamics of oceanic currents and their relationship to global circulation within the marine environment.

3.3.10.A7: SCALE/MODELS - Interpret and create models of the Earth's physical features in various mapping representations. CONSTANCY AND CHANGE - Relate constancy and change to the hydrologic and geochemical cycles. SCALE - Apply an appropriate scale to illustrate major events throughout geologic time.

CONSTANCY/CHANGE - Describe factors that contribute to global climate change.

Performance Objectives

SWBAT: *These are examples, created by SDP teachers, of how you may translate the eligible content into learning goals for your classroom.*

- **SWBAT** create a chart IOT describe the stages of the hydrologic cycle.
- **SWBAT** analyze data regarding air temperature and humidity IOT explain the relationship between them.
- **SWBAT** interpret the names of the cloud types IOT determine their appearance and altitude.
- **SWBAT** compare and contrast weather and climate IOT to explain the phenomenon of climate change (global warming)
- **SWBAT** explain how the oxygen-carbon cycle works IOT to argue its importance to living organisms.

- **SWBAT** create a model of the Earth IOT illustrate the layers of the planet, movement of the plate tectonics and the “ring of fire.”
- **SWBAT** compare examples of change to the earth’s surface over time as they are related to continental movement and ocean basin formation IOT support the theory of plate tectonics
- **SWBAT** to analyze various features of the earth’s surface IOT explain the interaction of processes that take place at plate boundaries and occur due to wind and precipitation.
- **SWBAT** to describe and classify major types of rocks and minerals IOT identify them when observed separately from one another.

Key Terms and Definitions

1. **Crust:** the thin and solid layer of Earth, above the mantle
2. **Mantle:** the layer of rock between Earth’s crust and core
3. **Core:** the center part of Earth, below the mantle
4. **Plate tectonics:** the theory that explains how the outer parts of Earth change through time, and that explains the relationship between continental drift, sea-floor spreading, seismic activity, and volcanic activity
5. **Lithosphere:** the solid, outer layer of Earth, the consists of the crust and the rigid upper mantle
6. **Seismology:** the study of earthquakes, including their origin, propagation, energy, and prediction
7. **Richter scale:** a scale that expresses the magnitude of an earthquake
8. **Acid precipitation:** precipitation, such as rain, snow, or sleet, that contains a high concentration of acids, often because of pollution in the atmosphere
9. **Erosion:** a process in which the materials of the Earth’s surface are loosened, dissolved, or worn away and transported from one place to another by a natural agent, such as wind, water, ice or gravity
10. **Deposition:** the process in which material is laid down
11. **Troposphere:** the lowest layer of the atmosphere; we live in this layer; it’s the densest layer
12. **Stratosphere:** the upper layer of the atmosphere, which lies immediately above the troposphere and extends from 10 km to about 50 km above Earth’s surface
13. **Ozone:** a gas molecule that is made up of three oxygen atoms
14. **Mesosphere:** the coldest layer of the atmosphere, between the stratosphere and the mesosphere
15. **Thermosphere:** the uppermost layer of the atmosphere, in which temperature increases as altitude increases
16. **Ionosphere:** reflects radio waves; also where auroras take place
17. **Greenhouse effect:** the warming of the surface of the lower atmosphere of Earth that occurs when carbon dioxide, water vapor, and other gases in the air absorb and reradiate infrared radiation

18. **Carbon cycle:** the process by which carbon moves from the atmosphere into the Earth and its organisms and then back again
19. **Aerobic respiration:** respiration that uses oxygen
20. **Anaerobic respiration:** respiration without oxygen
21. **Water cycle:** the continuous movement of water from the ocean to the atmosphere to the land and back to the ocean
22. **Coriolis effect:** the curving of the path of a moving object from an otherwise straight path due to Earth's rotation
23. **Air Mass:** a large body of air where temperature and moisture content are similar throughout
24. **Front:** the boundary between air masses of different densities and usually different temperatures
25. **Climate:** the average weather conditions in an area over a long period of time
26. **Global warming: (climate change)** a gradual increase in the average global temperatures that is due to a higher concentration of gases, such as carbon dioxide, in the atmosphere
27. **Topography:** the rise and fall of a land surface

Physical Science: Term 3 Unit 8

Topic: Environmental Science

Duration: Traditional (50 minute periods) : 15 - 20 days (adjust to student needs using professional discretion)

Block (90 minute periods) : 9 - 11 days (adjust to student needs using professional discretion)

Eligible Content

BIO.A.3.1.1 Describe the fundamental roles of plastids (e.g. chloroplasts) and mitochondria in energy transformations.

BIO.A.3.2.1 Compare and contrast the basic transformation of energy during photosynthesis and cellular respiration.

BIO.B.4.1.1 Describe the levels of ecological organization (i.e. organism, population, community, ecosystem, biome, biosphere).

BIO.B.4.1.2 Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems.

BIO.B.4.2.1 Describe how energy flows through an ecosystem (e.g. food chains, food webs, energy pyramids).

Performance Objectives

SWBAT: *These are examples, created by SDP teachers, of how you may translate the eligible content into learning goals for your classroom.*

- **SWBAT** define biotic, abiotic, ecosystem, community IOT explain the structure of ecosystems.
- **SWBAT** trace the paths of the sun's energy, carbon, oxygen, and water through a diagram IOT summarize how abiotic factors cycle through ecosystems.
- **SWBAT** identify the products and reactants of photosynthesis IOT explain how plants are primary producers and form the basis of food chains.
- **SWBAT** diagram how energy flows through an ecosystem IOT explain food chains, food webs, and energy pyramids.
- **SWBAT** compare a chloroplast in a plant cell to a solar panel IOT analyze the role of chloroplasts in photosynthesis.
- **SWBAT** analyze diagrams and cite textual evidence IOT describe the levels of ecological organization (i.e. organism, population, community, ecosystem, biome, biosphere).

Key Terms and Definitions

1. **Ecosystem:** a community of organisms and their abiotic environment.
2. **Biotic factors:** Organisms and products of organisms that are part of the environment and potentially affect the life of other organisms.
3. **Abiotic factors:** describes the nonliving part of the environment, including water, rocks, light and temperature.
4. **Carrying capacity:** the largest population that an environment can support at any given time.
5. **Producer:** an organism that can make organic molecules from inorganic molecules; a photosynthetic or chemosynthetic autotroph that serves as the basic food source in an ecosystem.
6. **Consumer:** an organism that eats other organisms or organic matter instead of producing its own nutrients or obtaining nutrients from inorganic sources.
7. **Decomposer:** an organism that feeds by breaking down organic matter from dead organisms; examples include bacteria and fungi.
8. **Biosphere:** the part of Earth where life exists
9. **Biodiversity:** the variety of organisms in a given area, the genetic variation within a community, or the variety of species in a community, or the variety of communities in an ecosystem.
10. **Food web:** a diagram that shows the feeding relationships between organisms in an ecosystem.
11. **Nitrogen cycle:** the process in which nitrogen circulates among the air, soil, water, plants and animals in an ecosystem.
12. **Community:** a group of species that live in the same habitat and interact with each other.
13. **Population:** a group of organisms of the same species that live in a specific geographical area and interbreed.

14. **Succession:** the replacement of one type of community by another at a single location over a period of time.
15. **Fossil fuel:** a nonrenewable energy resource formed from the remains of organisms that lived long ago; examples include oil, coal, and natural gas
16. **Renewable resource:** a natural resource that can be replaced at the same rate as it is consumed, such as food production by photosynthesis
17. **Nonrenewable resource:** a substance that is consumed faster than it forms and therefore can be replaced within a human life span
18. **Geothermal energy:** the energy produced by heat within the Earth
19. **Pollution:** an undesirable change in the natural environment that is caused by the introduction of substances that are harmful to living organisms, or by excessive wastes, heat, noise, or radiation
20. **Global warming: (climate change)** a gradual increase in average global temperature.
21. **Eutrophication:** an increase in the amount of nutrients, such as nitrates, in a marine or aquatic ecosystem.
22. **Recycling:** the process of recovering valuables or useful materials from waste or scrap; the process of reusing some items.

Physical Science: Term 4 Unit 9

Topic: Force and Motion

Duration: Traditional (50 minute periods) : 10 - 12 days (adjust to student needs using professional discretion)

Block (90 minute periods) : 5 - 6 days (adjust to student needs using professional discretion)

Eligible Content: Intentionally blank

Performance Objectives

SWBAT: *These are examples, created by SDP teachers, of how you may translate the eligible content into learning goals for your classroom.*

- **SWBAT** explain the relationship between motion and a frame of reference **IOT** mathematically define the aspects of motion (distance, velocity, speed, and acceleration) and then represent them on graphs.
- **SWBAT** create distance and velocity vs. time graphs **IOT** analyze an object's motion in terms of average speed and acceleration, changes in speed or acceleration, and the lack of motion.
- **SWBAT** distinguish between balanced and unbalanced forces **IOT** understand how each effect the motion of objects.

- **SWBAT** describe how static and kinetic friction impact the motion of an object **IOT** identify ways in which friction can be reduced or increased.
- **SWBAT** conduct an experiment investigating static, sliding, and rolling friction **IOT** determine which is the largest force and which is the smallest force.
- **SWBAT** describe Newton's Three Laws of Motion both conceptually and mathematically **IOT** to apply them to real-world situations involving forces and mass.
- **SWBAT** use knowledge of the Law of Universal Gravitation, Conservation of Energy and the Conservation of Momentum **IOT** explain common phenomenon (such as projectile motion, rocket propulsion, etc.).

Key Terms and Definitions

1. **Motion:** an object's change in position relative to a reference point
2. **Speed:** the distance traveled divided by the time interval during which the motion occurred
3. **Displacement:** the change in position of an object
4. **Velocity:** the speed of an object in a particular direction
5. **Acceleration:** the rate at which velocity changes over time; an object accelerates if its speed, direction, or both change
6. **Slope:** in a distance-time graph, the slope represents the object's speed
7. **Force:** an action exerted on a body in order to change the body's state of rest or motion; force has magnitude and direction
8. **Net Force:** combination of all of the forces acting on an object
9. **Friction:** a force that opposes motion between two surfaces that are in contact
10. **Static Friction:** the friction between surfaces that are stationary
11. **Kinetic Friction:** the friction between moving surfaces
12. **Inertia:** the property of matter that resists change in motion.
13. **Newton's First Law:** an object at rest remains at rest and an object in motion maintains a constant velocity unless it experiences an unbalanced force.
14. **Newton's Second Law:** the unbalanced force acting on an object equals the object's mass times its acceleration - $F = ma$
15. **Free Fall:** the motion of a body when only the force of gravity is acting on the body
16. **Terminal Velocity:** the constant velocity of a falling object when the force of air resistance is equal in magnitude and opposite in direction to the force of gravity.
17. **Projectile motion:** the curved path that an object follows when thrown, launched, or otherwise projected near the surface of Earth; the motion of objects that are moving in two dimensions under the influence of gravity
18. **Momentum:** a quantity defined as the product of the mass and velocity of an object
19. **Newton's Third Law:** For every action force, there is an equal and opposite reaction force

Physical Science: Term 4 Unit 10

Topic: Work, Power, and Energy

Duration: Traditional (50 minute periods) : 15 - 18 days (adjust to student needs using professional discretion)

Block (90 minute periods) : 7 - 9 days (adjust to student needs using professional discretion)

Eligible Content

BIO.A.3.2 Identify and describe how organisms obtain and transform energy for their life processes.

Performance Objectives

SWBAT: *These are examples, created by SDP teachers, of how you may translate the eligible content into learning goals for your classroom.*

- **SWBAT** define work and power conceptually and mathematically **IOT** analyze the movement of an object and calculate the amount of work done and power generated.
- **SWBAT** use knowledge of conservation of energy and momentum **IOT** explain common phenomena.
- **SWBAT** identify and describe six types of simple machines **IOT** compare and contrast them in terms of mechanical advantage and practical use.
- **SWBAT** identify elements of simple machines in compound machines **IOT** analyze their mechanical advantage and efficiency.
- **SWBAT** determine the efficiency of mechanical systems by applying mathematical formulas **IOT** analyze simple machines.
- **SWBAT** calculate the mechanical advantage of moving an object using a simple machine **IOT** compare and contrast characteristics of a simple machine.
- **SWBAT** discuss the methods of energy transfer **IOT** analyze the factors that influence **convection, conduction, and radiation** between objects or regions that are at different temperatures.

Key Terms and Definitions

1. **Work:** the quantity of energy transferred by a force when it is applied to a body and causes that body to move in the direction of the force.
2. **Power:** a quantity that measures the rate at which work is done.
3. **Mechanical Advantage:** a quantity that measures how much a machine multiplies force or distance.

4. **Simple Machine:** one of the six basic types of machines of which all other machines are composed.
5. **Compound Machine:** a machine made of more than one simple machine
6. **Potential Energy:** the stored energy resulting from the relative positions of objects in a system.
7. **Kinetic Energy:** the energy of a moving object due to its motion.
8. **Efficiency:** a quantity, usually expressed as a percentage, that measures the ratio of useful work output to work input.
9. **Energy:** the capacity to do work
10. **Conduction:** the transfer of energy through a material
11. **Convection:** the movement of matter due to differences in density that are caused by temperature variations.
12. **Radiation:** the energy that is transferred as electromagnetic waves, such as visible light and infrared waves.

Physical Science: Term 4 Unit 11

Topic: Electricity and Magnetism

Duration: Traditional (50 minute periods) : 11 - 13 days (adjust to student needs using professional discretion)

Block (90 minute periods) : 6 - 7 days (adjust to student needs using professional discretion)

Eligible Content: Intentionally Blank

Performance Objectives

SWBAT: *These are examples, created by SDP teachers, of how you may translate the eligible content into learning goals for your classroom.*

- **SWBAT** identify repulsive and attractive forces between charged objects **IOT** apply the behavior of electrostatic attractions to multiple scientific disciplines (ie. polarity of water, polarity of amino acids, hydrophobic and hydrophilic parts of lipids).
- **SWBAT** explain how a potential difference (voltage) produces a current in a conductor **IOT** describe how batteries are a source of electrical current.
- **SWBAT** describe electricity and magnetism as two aspects of a single electromagnetic force **IOT** effectively explain how electricity produces magnetism and magnetism produces electricity.
- **SWBAT** apply Ohm's Law **IOT** calculate resistance, current, and voltage.
- **SWBAT** illustrate schematic diagrams of circuits **IOT** distinguish between series and parallel circuits.

- **SWBAT** explain that moving charges create magnetic fields IOT analyze the magnetic fields of a bar magnet, a wire with a current running through it and a solenoid.

Key Terms and Definitions

1. **Electrical charge:** an electrical property of matter that creates electric and magnetic forces and interactions
2. **Conductor:** materials that allow electric charges to move freely and carry electric current - i.e. metal
3. **Insulator:** materials that do not transfer charge easily - i.e. cardboard, plastic, and glass
4. **Electric force:** the force of attraction or repulsion between objects due to charge
5. **Electric field:** a region in space around a charged object that causes a stationary charged object to experience an electric force
6. **Electrical potential energy:** the ability to move an electric charge from one point to another
7. **Voltage:** causes charges to move, producing a current
8. **Cell:** a device that is a source of electric current because of a potential difference, or voltage, between the terminals
9. **Current:** the rate that electric charges move through a conductor
10. **Ampere:** the SI unit of current
11. **Resistance:** the opposition posed by a material or a device to the flow of current
12. **Series circuit:** the components of a circuit that form a single path for current
13. **Parallel circuit:** a circuit in which all of the components are connected to each other side by side
14. **Magnetic pole:** one of two points, such as the ends of a magnet, that have opposing magnetic qualities
15. **Magnetic field:** a region where a magnetic force can be detected
16. **Electromagnet:** a coil that has a soft iron core and that acts as a magnet when an electric current is in the coil
17. **Electromagnetic induction:** the process of creating a current in a circuit by changing a magnetic field
18. **Generator:** a machine that converts mechanical energy into electrical energy
19. **Alternating current:** an electric current that changes direction at regular intervals - AC
20. **Direct current:** the charges always move from one terminal to the other in the same direction
21. **Transformer:** a device that increases or decreases the voltage of alternating current