

Science 8th Grade

Indicators	Standards	Additional Specificity	Month
<p>▲ Actively engages in investigations, including developing questions, gathering and analyzing data, and designing and conducting research</p>	<p>S1 B1:2 a,b,c,d</p>	<p>2. The scientific investigations includes, when appropriate,</p> <ul style="list-style-type: none"> a. formulating a testable hypothesis. b. identify and test variables (independent, dependent, and variables to be kept constant). c. using methods for gathering data that is observable, measurable, and replicable. d. analyzing and evaluating the results in order to clarify the questions and hypotheses, and to refine methods for further research. 	<p>Introduce in August Review all year</p>
<p>Actively engages in using technological tools and mathematics in their own scientific investigations.</p>	<p>S1 B1:3 a,b,c,d,e</p>	<p>3. a. using a variety of technologies, such as hand tools, measuring instruments, calculators, and computers as an integral component of scientific investigations.</p> <ul style="list-style-type: none"> b. using common mathematical functions to analyze and describe data. c. uses statistical and graphing data analysis techniques. d. recognizes that the accuracy and precision of the data, and therefore the quality of the investigation, depends on the instruments used. e. using equipment properly and safely. 	<p>Introduce in August Review all year</p>
<p>Understands scientific knowledge consists of hypotheses, inferences, laws, and theories.</p>	<p>S7 B2: 3 a,b</p>	<p>3. a. A hypothesis is a testable statement that is subject to further investigation and potential confirmation</p> <ul style="list-style-type: none"> b. An inference is a testable conclusion, based on previous established knowledge, observed evidence, and logic. 	<p>August - September</p>
<p>▲ Understands atoms, the fundamental organizational unit of matter, are composed of subatomic particles. Chemists are primarily interested in the protons, electrons, and neutrons found in the</p>	<p>S2A B1: 1 a,b,c,d</p>	<p>1 a. All atoms are identified by the number of protons in the nucleus, i.e. the atomic number. The protons have a positive charge and a mass of 1 amu. Protons and neutrons are</p>	<p>September- October</p>

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<p>atom.</p> <p>Understands isotopes are atoms with the same atomic number (same number of protons) but different numbers of neutrons. The nuclei of some atoms are radioactive isotopes that spontaneously decay, releasing radioactive energy.</p>	<p>S2A B1: 2 a</p>	<p>found in the small, dense, nucleus.</p> <p>b. Neutrons have a neutral charge and a mass of 1 amu.</p> <p>c. The electrons have a negative charge and are found outside the nucleus in an electron cloud. The mass of an electron is approximately 2,000 times smaller than a proton. The electrons determine the size and chemical properties of the atom.</p> <p>d. The number of electrons is equal to the number of protons in a neutral atom. Ions have a different number of electrons than protons.</p> <p>2 a. The periodic table reflects the average mass of the isotopes.</p>	<p>September-October</p>

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<p>▲ Understands the periodic table lists elements according to increasing atomic number. This table organizes physical and chemical trends by groups, periods, and sub-categories.</p>	<p>S2A B2: 2 a,b,c</p>	<p>2a. Elements in the same group have the same number of valence electrons and can be used to predict similar physical and chemical properties. Elements are grouped by similar ground state valence electron configurations.</p> <p>b. As periods increase, the principle energy levels of the outermost (<i>valence</i>) electrons increase. Electrons changing from one energy level to another may result in the emission or absorption of various forms of electromagnetic radiation, including the range of colors that form visible light. When there is color, there are electrons changing energy levels.</p> <p>c. Sub-categories are regions such as metals, non-metals, and transition elements. Nonmetals have different physical and chemical properties than metals. For example, nonmetals have lower melting points, lower density, and are poorer conductors of electricity and heat. Chemical properties depend on the subshell of the valence electrons which are different for metals and non-metals. (<i>valence</i>) electrons increase. Electrons changing from one energy level to another may result in the emission or absorption of various forms of electromagnetic radiation, including the range of colors that form visible light. When there is color, there are electrons changing energy levels.</p> <p>c. Sub-categories are regions such as metals, non-metals, and transition elements. Nonmetals have different physical and chemical properties than metals. For example, nonmetals have lower melting points, lower density, and are poorer conductors of electricity and heat. Chemical</p>	<p>September-October</p>

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<p>▲ Understands chemists use kinetic and potential energy to explain the physical and chemical properties of matter on earth that may exist in any of these three states: solids, liquids, and gases.</p> <p>▲ Understands chemical bonds result when valence electrons are transferred or shared between atoms. Breaking a chemical bond requires energy. Formation of a chemical bond releases energy. Ionic compounds result from atoms transferring electrons. Molecular compounds result from atoms sharing electrons.</p> <p>▲ understands a chemical reaction occurs when one or more substances (reactants) react to form a different chemical substance(s) (products). There are different types of chemical reactions all</p>	<p>S2A B2: 1 a</p> <p>S2A B3: 1 a,b,c,d,e</p> <p>S2A B3: 1 a,b,c,d</p>	<p>properties depend on the sub-shell of the valence electrons which are different for metals and non-metals.</p> <p>1a. Elements and molecules may exist as gases, liquids or solids. Ionic compounds most commonly exist as solids.</p> <p>3 a. Valence electron configurations determine whether an atom gains, loses, or shares electrons to achieve a more stable electron configuration similar to the noble gases.</p> <p>b. Positively charged ions are called cations, and negatively charged ions are called anions. Cations are attracted to anions (opposite charges attract). Most cations are metals; most anions are nonmetals. In stable ionic compounds, the sum of the charges is zero.</p> <p>c. Covalent bonds form when two or more atoms share one or more pairs of electrons to achieve a more stable electron configuration. The two classifications of covalent bonds are nonpolar and polar. The greater the electronegativity difference between atoms involved in the bond, the more polar the bond.</p> <p>d. The energy required to break ionic bonds is greater than the energy required to break covalent bonds. Heat exchange during a chemical reaction is often easily noticed: a reaction that absorbs heat will feel colder; a reaction that releases heat will feel warmer.</p> <p>1a. Chemical reactions are written as balanced chemical equations.</p>	<p>October- November</p> <p>October- November</p> <p>October- November</p>

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<p>of which demonstrate the Law of Conservation of Matter and Energy.</p> <p>Understands the differences and reactions between acids, bases, and salts. Perform calculations to determine the concentration of ions in solutions.</p>	<p>S2A B3: 3 a,b</p>	<p>In ordinary chemical reactions, the number and kind of atoms must be conserved.</p> <p>b. Examples of chemical reactions are synthesis, decomposition, combustion, single and double replacement, acid/base, and oxidation/reduction.</p> <p>c. Two or more of the following may often identify chemical reactions: physical property change, effervescence, mass change, precipitation, light emission, and heat exchange.</p> <p>d. The rate (speed) of a chemical reaction depends on such parameters as temperature, concentration, catalysts, inhibitors, surface area, and reaction type.</p> <p>3a. Acids react with bases to produce water and salt.</p> <p>b. pH is a logarithmic function of hydronium ion concentration. pH decreases as the hydronium ion concentration increases. pOH and hydroxide concentrations are found in a similar way.</p>	<p>November-December</p>

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<p>▲ understands Newton' Laws and the variables of time, position, velocity, and acceleration can be used to describe the position and motion of particles understands Newton' Laws and the variables of time, position, velocity, and acceleration can be used to describe the position and motion of particles</p> <p>Understands physicists use conservation laws to analyze the motion of objects.</p> <p>Understands matter has energy. Mass and energy can be interchanged. The total energy in the universe is constant, but the type of energy may vary.</p>	<p>S2B B1: 1 a,b,c,d,e,f,g</p> <p>S2B B1: 2 a,b</p> <p>S2B B2: 1 a</p> <p>S2B B3: 1a,e</p>	<p>1. a. The kinematic (motion) variables: position, velocity, and acceleration can most concisely be described as vectors. b. Velocity describes how position changes and acceleration describes how velocity changes. c. From the definitions of velocity and acceleration, one can derive equations that relate the kinematic variables. d. Acceleration occurs when there is either a change in speed or a change in direction. In the case of uniform circular motion, the acceleration points towards the center of the circle. The magnitude of this acceleration is constant, and is related to the speed of the object and the radius of the circle. e. In the absence of a net force, an object's velocity will not change. f. In the presence of a net force, an object will experience an acceleration which is modeled mathematically by Newton's second law. g. The force that one object exerts on a second object has the same magnitude but opposite.</p> <p>2. a. Mechanical energy is conserved when no non-conservative forces (such as friction) do work. b. The momentum of an object is a product of its mass and velocity. Momentum is conserved when there are no external forces on the system.</p> <p>1a. The amount of energy in a given amount of mass at rest is given by $E = mc^2$</p>	<p>January-February</p> <p>January-February</p> <p>January-February</p>

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<p>There are four fundamental forces in nature: strong nuclear force, weak nuclear force, electromagnetic force, and gravitational force.</p>		<p>1. a. The strong nuclear force keeps particles together in atomic nuclei.</p> <p>e. The gravitational force is the attractive force that objects exert on one another due to their mass. The gravitational force between any two masses is given by Newton's law of universal gravitation, which states that the force is inversely proportional to the square of the distance between the masses. This explains the motion of planets.</p> <p>Near the surface of the Earth, the acceleration of an object due to gravity is independent of the mass of the object and therefore constant.</p>	<p>January-February</p>

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<p>▲ understands living organisms contain DNA or RNA as their genetic material, which provides the instructions that specify the characteristics of organisms.</p>	<p>S3 B2: 1a,b,c,d</p>	<p>1. a. Nucleotides (adenine, thymine, guanine, cytosine and uracil) make up DNA and RNA molecules. b. Sequences of nucleotides that either determine or contribute to a genetic trait are called genes. c. DNA is replicated by using a template process that usually results in identical copies. d. DNA and associated proteins supercoil during cellular replication to become structured as chromosomes.</p>	<p>February-March</p>
<p>Understands organisms usually have a characteristic number of chromosomes; one pair of these may determine the sex of individuals.</p>	<p>S3 B2: 2a</p>	<p>a. Most cells in humans contain 23 pairs of chromosomes; the 23rd pair usually contains the XX for female or XY for male.</p>	<p>February-March</p>
<p>▲ understands hereditary information is contained in genes, located in the chromosomes of each cell.</p>	<p>S3B2: 3a,b,c</p>	<p>3. a. An inherited trait of an individual can be determined by one gene or by many genes (a polygenic trait), and a single gene can influence more than one trait. b. The expression of traits is determined by a complex interaction of genes and the environment.</p>	<p>February-March</p>
<p>Understands gametes carry the genetic information to the next generation.</p>	<p>S3B2: 4 a,b</p>	<p>c. Alleles, which are different forms of a gene, may be dominant, recessive, or co-dominant.</p>	<p>February-March</p>
<p>Understands expressed mutations occur in DNA at very low rates.</p>	<p>3B3: 5 a,b,c</p>	<p>4. a. Gametes usually contain only one member from each chromosome pair. b. Gametes unite to form a new individual in most organisms.</p> <p>5. a. Mutations are genetic changes and can be beneficial, neutral, or deleterious. Many mutations have deleterious effect on the organism's survival and/or reproduction. b. Only mutations in gametes can be passed on to offspring and thus affect future generations. c. Mutations in somatic cells can</p>	<p>February-March</p>

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		affect the individual organism, but not its offspring.	
<p>▲ understands stellar evolution.</p> <p>Understands the current scientific explanation of the origin and structure of the universe.</p> <p>Understand how the tools of astronomy have revolutionized the study of the universe.</p>	<p>S4B4: 1 a,b,c</p> <p>S4B4: 2 a,b</p> <p>S4B4: 3 c,d</p>	<p>1. a. Condensation of gases, due to gravity, is a foundation for the formation of stars</p> <p>b. The life cycle of the star begins with the nebula, which contains mostly hydrogen and helium. Heavier elements were, and continue to be, made by the nuclear fusion reactions in stars.</p> <p>c. The Hertzsprung-Russell (H-R) diagram is used to classify stars. The sun is a main sequence star.</p> <p>d. Stars are classified by their color, temperature, age, apparent brightness and distance from earth.</p> <p>a. The formation of the universe began with an expansion of gases from a hot, dense state. By studying the light emitted from distant galaxies, it has been found that galaxies are moving apart from one another.</p> <p>b. The red shift of light, within the Doppler effect, emitted by distant galaxies supports the conclusion that the universe is expanding.</p> <p>c. Galaxies are a level of organization of the universe. There are at least 100 billion galaxies in the observable universe. Galaxies are organized into superclusters with large voids between them.</p> <p>d. The sun is a second-generation star, which, along with our galaxy (The Milky Way which includes about 100 billion stars) formed billions of years after the Big Bang.</p>	<p>March-April</p> <p>March-April</p> <p>March-April</p>
<p>▲ understands biological evolution, descent with modification, is a scientific explanation for the history</p>	<p>S3 B3: 1 d</p>	<p>d. The frequency of heritable traits may change over a period of</p>	<p>April-May</p>

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<p>of the diversification of organisms from common ancestors</p> <p>organisms adapt to environmental challenges and changes as a result of natural selection, genetic drift, and various mechanisms of genetic change.</p> <p>Understands energy is received, transformed and expended in ecosystems.</p> <p>▲ understands the distribution and abundance of organisms and populations in ecosystems are limited by the carrying capacity. understands the distribution and abundance of organisms and populations in ecosystems are limited by the carrying capacity.</p> <p>Understands organisms cooperate and compete in complex, interdependent relationships</p> <p>Understands human beings live within and impact ecosystems.</p>	<p>S3 B3: 2 a,b,c</p> <p>S3 B4: 2 a,b</p> <p>S3 B4: 3 a,b</p> <p>S3 B4: 4 a,b</p> <p>S3 B4: 5 a,b</p>	<p>generations within a population of organisms, usually when resource availability and environmental conditions change as a consequence of extinctions, geologic events, and/or changes in climate.</p> <p>2. a. Genetic changes occur only in individual organisms. b. Natural selection and genetic drift occur within populations or organisms. c. Variation among individuals in a population allows individuals to respond differently to environmental challenges.</p> <p>2. a. Radiant energy that enters the biosphere is balanced by the energy that leaves the earth into space as radiant energy, primarily heat. b. Transfer of energy through a series of organisms in an ecosystem is known as a food web.</p> <p>a. The carrying capacity is determined by the availability of matter and energy, and the ability of the ecosystem to recycle materials. b. Living organisms produce more offspring than environmental resources can support, resulting in a competition for resources</p> <p>a. predator-prey relationships b. symbiotic relationships (parasitism, mutualism, commensalisms).</p> <p>5. a. Humans modify ecosystems</p>	<p>April-May</p> <p>April-May</p> <p>April-May</p> <p>April-May</p> <p>April-May</p>

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<p>▲ understands the sun is the primary source of energy for life through the process of photosynthesis. understands the sun is the primary source of energy for life through the process of photosynthesis.</p>	<p>S3 B5: 2 a,b,c</p>	<p>as a result of population growth, technology, and consumption.</p> <p>b. Human modifications of habitats through direct harvesting, pollution, atmospheric changes, and other factors affect ecosystem stability.</p> <p>a. Plants and other photosynthetic organisms use energy to make organic compounds (primarily glucose) from carbon dioxide and water (CO₂ and H₂O) through a series of biochemical reactions.</p> <p>b. The energy in these compounds is used to assemble larger molecules with biological activity, including proteins, DNA, carbohydrates, and fats.</p> <p>c. These molecules serve as sources of energy for the plants themselves and for many other organisms through food webs.</p> <p>2 and H₂O) through a series of biochemical reactions.</p> <p>b. The energy in these compounds is used to assemble larger molecules with biological activity, including proteins, DNA, carbohydrates, and fats.</p> <p>c. These molecules serve as sources of energy for the plants themselves and for many other organisms through food webs.</p>	<p>April-May</p>