

**TAMALPAIS UNION HIGH SCHOOL DISTRICT
Larkspur, California**

Course of Study

Integrated Science

Integrated Science is a two-year science sequence for 9th and 10th grade students. This program is in line with the TUHSD mission statement and strategic priorities, and provides meaningful and engaging learning experiences for all students. The Integrated Science sequence is designed to ensure high levels of learning in scientific topics, provide the necessary background information and critical thinking skills needed to make informed decisions on scientific issues, and prepare students for more advanced study in science. The program is laboratory based, using a thematic approach to organize the content. It involves research, data gathering and interpretation of experimental results, as well as provides opportunities for students to learn to collaborate, positively contribute to a changing and dynamic world and to communicate effectively using oral and written means. The knowledge and skills learned in the Integrated Science program will be developed and applied within the major concepts in biology, earth science, as well as important introductory concepts from chemistry and physics, and key components of experimental design. Successful completion of the program will satisfy the district's graduation requirement in Life and Physical Science.

TUHSD Mission Statement

THE TAMALPAIS UNION HIGH SCHOOL DISTRICT is dedicated to the development of creative, passionate, and self-motivated learners. Upon graduation, students will be prepared for engaged citizenship and able to contribute individually and collaboratively in order to address the challenges of a dynamic and diverse world. To these ends, all students will demonstrate mastery of core competencies and will be offered meaningful learning experiences to enable them to access and critically analyze information, pose substantive questions, and communicate effectively. (Adopted by the Board 25-August-2009)

Entrance Requirements:

Integrated Science is a 20-credit program open to all students. Suggested pre-requisite knowledge and skills are outlined in the program's learning progressions and proficiency scales (see below).

Learning Outcomes and Assessment Criteria (Program Goals and Proficiency Scales)

Integrated Science 1-4

Investigation and Experimentation

IE-1: Investigation and Experimentation. Science is a way of knowing about who we are and where we live. Scientists work by observation and experimentation. Students will ask questions, design experiments, conduct experiments, analyze data, and report conclusions as part of a scientific investigation.

Earth Science

ES-1: Matter Cycles. Earth is a series of interconnected systems that change over time. One group of systems involves the cycling of matter. Students will follow a specific type of matter (i.e. water, carbon, nitrogen) through an entire biogeochemical cycle, including an analysis of human interactions with that cycle.

ES-2: Energy Flow. Earth is a series of interconnected systems that change over time. One group of systems involves the flow of energy. Students will describe the flow of energy through a variety of transformations that involve internal heat energy from the Earth, incoming solar energy and human energy use.

ES-3: Interconnected Spheres. Earth is a series of interconnected systems that change over time. One group of systems involves the different ‘spheres’ – geosphere, hydrosphere, atmosphere and biosphere. Students will understand the structure/composition of each sphere and they will analyze the interaction between these spheres at a specific location on the Earth’s surface.

ES-4: Astronomy. Earth is part of a larger series of systems that change over time – the solar system, galaxy, and universe. Students will understand and explain the Earth’s place within these systems and within the evolution of those systems.

Life Science

LS-1: Levels of Organization. Living organisms are complex structures with interconnected levels of organization. Students will analyze the interactions between the biochemical, cellular and organismal levels of organization in a specific organism.

LS-2: Homeostasis. Living organisms are complex structures that respond to their environment. Organisms maintain homeostasis by using one or more organ systems to adjust to changes in both their internal and external environments. Students will explain a specific example of homeostasis.

LS-3: Sexual Reproduction, Genetics and Evolution. Living organisms reproduce and the result is offspring that are similar, but not identical to, their parents. Students will understand how both the similarities and differences are produced and how the differences are important to evolution.

LS-4: Populations. A population is a group of individuals of the same species that live in a similar geographical area. These populations grow or shrink in response to factors both within and outside of the population. Students will make predictions about the change in population size when given a specific set of these factors.

LS-5: Ecology. Living organisms interact with other living organisms and with non-living aspects of their environment. Students will analyze these biotic and abiotic relationships within a given ecosystem, including energy flow and the role of humans in that ecosystem.

LS-6: Genetics, Traits and Evolution. Groups of living organisms change over time. These evolutionary changes occur at both the molecular/genetic and organismal levels of organization. Students will interpret evidence from each level of organization to explain a specific example of evolutionary change.

LS-7: Mechanisms of Evolution. Groups of living organisms change over time. This evolutionary change occurs as a result of several different processes. Students will understand the difference between evolutionary outcomes and evolutionary processes – including natural selection, genetic drift, gene flow and mutation.

Chemistry

CH-1: Atoms and Molecules. The fundamental structures of matter influence the properties and reactions of all living and physical systems. Students will describe the structure of matter at the atomic and molecular levels. They will explain how different types of matter serve as resources for humans.

CH-2: Chemistry of Life. Living systems are made of carbon-based molecules and have fundamental structures. Students will be able to identify and describe the important structures, properties and uses of molecules such as proteins, carbohydrates, lipids and nucleic acids.

Physics

PH-1: Newton's Laws of Motion. Objects in the universe move and interact in predictable ways. These movements and interactions can be understood using Newton's laws. Students will calculate, analyze, and predict the motion of individual objects, as well as how multiple objects interact in a system.

PH-2: Waves. Waves are one way to transfer energy from one location to another. There are two types of waves, mechanical and electromagnetic. Students will distinguish between the two types of waves. They will describe the characteristics of waves and explain how variations in these characteristics affect the energy of waves.

IE 1A: Focus – Experimentation

Goal: Investigation and Experimentation: <i>Science is a way of knowing about who we are and where we live. Scientists work by observation and experimentation. Students will ask questions, design experiments, conduct experiments, analyze data, and report conclusions as part of a scientific investigation.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> • Designs and conducts a scientifically valid experiment that addresses a self-identified scientific question.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> • Creates a testable hypothesis statement (based on prior knowledge, instruction, and/or research) that addresses a specific scientific question. • Designs a controlled experiment in response to a specific scientific question.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> • Distinguishes between testable and non-testable hypothesis statements. • Accurately collects data using appropriate scientific equipment. • Identifies the independent and dependent variables of an experiment.
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

IE 1B: Focus – Analysis

Goal: Investigation and Experimentation: <i>Science is a way of knowing about who we are and where we live. Scientists work by observation and experimentation. Students will ask questions, design experiments, conduct experiments, analyze data, and report conclusions as part of a scientific investigation.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> Provides in-depth analysis of experimental results – evaluating the hypothesis and experimental design using evidence.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> Uses raw data to determine descriptive statistics - central tendency and variation (e.g. mean, standard deviation) relevant to the hypothesis Uses descriptive statistics to select and construct appropriate graphs Uses descriptive statistics and graphs to draw valid conclusions.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> Creates data tables appropriate to the experiment Uses data to create graphs. Knows that the conclusion uses data to evaluate the hypothesis
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

ES 1: Focus – Matter Cycles

Goal: Matter Cycles: <i>Earth is a series of interconnected systems that change over time. One group of systems involves the cycling of matter. Students will follow a specific type of matter (i.e. water, carbon, nitrogen) through an entire biogeochemical cycle, including an analysis of human interactions with that cycle.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> • Describes the chemical and physical changes that occur in two or more biogeochemical cycles. • Proposes strategies (e.g. organic farming, install scrubbers in smoke stacks) to mitigate human caused disruptions to the biogeochemical cycles addressed in the first bullet of the score 4.0 criteria.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> • Uses the law of conservation of matter to explain two or more biogeochemical cycles, with a focus on the movement between atmosphere, hydrosphere, geosphere and biosphere. • Describes how human activities impact the biogeochemical cycles addressed in the first bullet of the score 3.0 criteria.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> • Restates the law of conservation of matter. • Describes the processes of the water cycle. • Defines and provides examples of biogeochemical cycles. • Identifies human activities that impact biogeochemical cycles.
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

ES 2A: Focus –Energy Flow and Internal Earth Heat Energy

Goal: Energy Flow: <i>Earth is a series of interconnected systems that change over time. One group of systems involves the flow of energy. Students will describe the flow of energy through a variety of transformations that involve internal heat energy from the Earth, incoming solar energy and human energy use.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> • Traces the specific energy transformations, both qualitatively and quantitatively, that occur in Earth’s interior. • Explains how the interactions between geological processes – based on Earth’s internal energy – and atmospheric processes – based on Earth’s incoming energy shape Earth’s surface at a specific location.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> • Explains how energy flow through Earth’s interior determines the structure (density, temperature and pressure) of the interior. • Explains how energy flow through Earth’s interior drives processes of the geosphere (plate tectonics).
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> • Defines and provides an example of the first law of thermodynamics (energy conversions). • Defines and provides an example of the second law of thermodynamics (energy loss/inefficiency). • Identifies the layers of Earth’s interior – core, asthenosphere, and lithosphere.
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

ES 2B: Focus – Energy Flow and Incoming Solar Radiation

<p>Goal: Energy Flow: <i>Earth is a series of interconnected systems that change over time. One group of systems involves the flow of energy. Students will describe the flow of energy through a variety of transformations that involve internal heat energy from the Earth, incoming solar energy and human energy use.</i></p>	
<p>Proficiency Scale</p>	
4.0	<p>In addition to the 3.0 level criteria, the student:</p> <ul style="list-style-type: none"> Traces the specific energy transformations, both qualitatively and quantitatively, that occurs as solar radiation enters the atmosphere. Explains how the interactions between atmospheric processes – based on Earth’s incoming energy– and geological processes – based on Earth’s internal energy – shape Earth’s surface at a specific location.
3.5	<p>No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content.</p>
3.0	<p>In addition to the 2.0 level criteria, the student:</p> <ul style="list-style-type: none"> Explains how energy flow resulting from incoming solar energy determines the structure (density, temperature and pressure) of Earth’s atmosphere. Explains how energy flow resulting from incoming solar energy drives the processes of Earth’s atmosphere (weather and climate).
2.5	<p>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</p>
2.0	<p>The student:</p> <ul style="list-style-type: none"> Defines and provides an example of the first law of thermodynamics (energy conversions). Defines and provides an example of the second law of thermodynamics (energy loss/inefficiency). Distinguishes between the absorption, reflection, and transmission of solar radiation.
1.5	<p>Partial knowledge of the 2.0 content but some knowledge of the 3.0 content</p>
1.0	<p>Partial knowledge of the 2.0 content, but not of the 3.0 content.</p>
0.5	<p>Limited knowledge of the 2.0 content but not of the 3.0 content</p>
0.0	<p>No understanding or skill demonstrated.</p>

ES 2C: Focus – Energy Flow and Human Energy Use

<p>Goal: Energy Flow: <i>Earth is a series of interconnected systems that change over time. One group of systems involves the flow of energy. Students will describe the flow of energy through a variety of transformations that involve internal heat energy from the Earth, incoming solar energy and human energy use.</i></p>	
<p>Proficiency Scale</p>	
4.0	<p>In addition to the 3.0 level criteria, the student:</p> <ul style="list-style-type: none"> • Traces the specific energy transformations, both qualitatively and quantitatively, that occur between human energy use and the ultimate source – either solar or internal heat – of that energy. • Evaluates the relative costs and benefits of a specific human energy resource and make predictions about future use of that resource.
3.5	<p>No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content</p>
3.0	<p>In addition to the 2.0 level criteria, the student:</p> <ul style="list-style-type: none"> • Performs simple calculations for energy transformations and energy efficiency. • Explains energy transformations and the loss of useful energy that occur as humans use specific energy resources.
2.5	<p>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</p>
2.0	<p>The student:</p> <ul style="list-style-type: none"> • Defines and provides an example of the first law of thermodynamics (energy conversions). • Defines and provides an example of the second law of thermodynamics (energy efficiency). • Identifies different forms of energy, including mechanical, light, chemical, nuclear, and heat. • Identifies renewable and nonrenewable energy resources used by humans.
1.5	<p>Partial knowledge of the 2.0 content but some knowledge of the 3.0 content</p>
1.0	<p>Partial knowledge of the 2.0 content, but not of the 3.0 content.</p>
0.5	<p>Limited knowledge of the 2.0 content but not of the 3.0 content</p>
0.0	<p>No understanding or skill demonstrated.</p>

ES 3A: Focus – Geosphere

Goal: Interconnected Spheres: <i>Earth is a series of interconnected systems that change over time. One group of systems involves the different ‘spheres’ – geosphere, hydrosphere, and atmosphere. Students will understand the structure/composition of each sphere and they will analyze the interaction between these spheres at a specific location on the Earth’s surface.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> • Uses patterns of plate tectonic activity to predict future geological activity and its results. • Identifies and describes the interactions between the geosphere and either hydrosphere or atmosphere (e.g. outgassing of volcanoes) at a specific location on Earth’s surface.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> • Describes the properties of the geosphere and how these properties affect its structure. • Explains the relationship between the structure of the geosphere and plate tectonics. • Describes the role of radiation, conduction, and convection in the transfer of Earth’s internal heat.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> • Defines geosphere, lithosphere, core, asthenosphere, radiation, conduction, convection, and plate tectonics. • Identifies the structure and composition of Earth’s geosphere.
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

ES 3B: Focus – Hydrosphere

<p>Goal: Interconnected Spheres: <i>Earth is a series of interconnected systems that change over time. One group of systems involves the different ‘spheres’ – geosphere, hydrosphere, and atmosphere. Students will understand the structure/composition of each sphere and they will analyze the interaction between these spheres at a specific location on the Earth’s surface.</i></p>	
<p>Proficiency Scale</p>	
4.0	<p>In addition to the 3.0 level criteria, the student:</p> <ul style="list-style-type: none"> • Predicts how changes in temperature, salinity and density affect the structure and composition of the hydrosphere. • Identifies and describes the interactions between the hydrosphere and either geosphere or atmosphere (e.g. erosion, weather events) at a specific location on Earth’s surface.
3.5	<p>No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content</p>
3.0	<p>In addition to the 2.0 level criteria, the student:</p> <ul style="list-style-type: none"> • Explains that temperature, salinity and density affect the structure and composition of the hydrosphere. • Explains the relationship between structure of the hydrosphere and ocean currents. • Describes the role of radiation, conduction, and convection in the transfer of heat in Earth’s hydrosphere.
2.5	<p>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</p>
2.0	<p>The student:</p> <ul style="list-style-type: none"> • Defines hydrosphere, radiation, conduction, convection, thermocline, halocline, salinity. • Identifies the structure (thermocline, halocline) and chemical composition of the hydrosphere.
1.5	<p>Partial knowledge of the 2.0 content but some knowledge of the 3.0 content</p>
1.0	<p>Partial knowledge of the 2.0 content, but not of the 3.0 content.</p>
0.5	<p>Limited knowledge of the 2.0 content but not of the 3.0 content</p>
0.0	<p>No understanding or skill demonstrated.</p>

ES 3C: Focus – Atmosphere

Goal: Interconnected Spheres: <i>Earth is a series of interconnected systems that change over time. One group of systems involves the different ‘spheres’ – geosphere, hydrosphere, and atmosphere. Students will understand the structure/composition of each sphere and they will analyze the interaction between these spheres at a specific location on the Earth’s surface.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> • Predicts how change in the structure and composition of the atmosphere affects weather and climate. • Identifies and describes the interactions between the atmosphere and either geosphere or hydrosphere (e.g. ocean acidification, glaciation) at a specific location on Earth’s surface.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> • Interprets the structure and composition of the atmosphere as it impacts weather and climate. • Describes the role of radiation, conduction, and convection in the transfer of heat in Earth’s atmosphere. • Explains how humans have impacted the composition of Earth’s atmosphere.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> • Defines atmosphere, troposphere, stratosphere, mesosphere, thermosphere, radiation, conduction, convection. • Identifies the structure and composition of the atmosphere.
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

ES 4A: Focus – Origins of the Universe

Goal: Astronomy: <i>Earth is part of a larger series of systems that change over time – the solar system, galaxy, and universe. Students will understand and explain the Earth’s place within these systems and within the evolution of those systems.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> • Compares and contrasts competing scientific theories about the origin, behavior and age of the universe.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> • Describes and provides evidence for the big bang theory. • Describes evidence for an expanding universe. • Describes evidence for current estimates of the age of the universe.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> • Defines: big bang, nuclear fusion, Hubble’s law, red shift, electromagnetic spectrum.
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

ES 4B: Focus – Stars and Galaxies

Goal: Astronomy: <i>Earth is part of a larger series of systems that change over time – the solar system, galaxy, and universe. Students will understand and explain the Earth’s place within these systems and within the evolution of those systems.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> • Uses emission spectra and other data to determine the composition of a star and infer its life stage.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> • Explains how stars, including the Sun, are formed and powered by nuclear reactions. • Distinguishes between the fates of small, medium and large mass stars.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> • Defines and identifies the stages of a star’s life cycle.
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated

ES 4C: Focus – Our Solar System

Goal: Astronomy: <i>Earth is part of a larger series of systems that change over time – the solar system, galaxy, and universe. Students will understand and explain the Earth’s place within these systems and within the evolution of those systems.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> Evaluates other planets and moons in the solar system for their ability to harbor life and/or support human colonization.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> Describes what the evidence from Earth and Moon rocks indicates about the age and origin of the solar system, its planets and their moons. Compares and contrasts the Earth and Moon with other planets/ moons in our solar system. Explains why small rocky planets are formed in the inner solar system and gas giants are found further from the sun.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> Identifies the planets in our solar system. Identifies earth’s location within the Milky Way galaxy.
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

LS 1A: Focus – Levels of Organization

Goal: Levels of Organization: <i>Living organisms are complex structures with inter-connected levels of organization. Students will explain the interactions between biochemical and organismal levels of organization in a specific organism.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> • Can evaluate the role of specific macromolecules, cells, organs, and organ systems in maintaining homeostasis in an organism.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> • Can explain the function of macromolecules (lipids, protein, nucleic acid, carbohydrate) in cells. • Understands how cellular organelles and macromolecules work to accomplish specific functions within a cell • Demonstrates how organs in organ systems accomplish specific functions within an organism.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> • Can explain that cells are made of organelles. • Can identify the functions of cellular organelles • Knows the types of macromolecules in cells.
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated

LS 1B: Focus – Protein Synthesis

Goal: Levels of Organization: <i>Living organisms are complex structures with interconnected levels of organization. Students will explain the interactions between biochemical, cellular and organismal levels of organization in a specific organism.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> • Relates protein synthesis to cellular activity. • Predicts the effect of enzymes on cellular activity in varied environmental conditions.
	3.5 No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> • Explains the primary sequence of molecular biology (DNA → mRNA → protein) • Connects the roles of mRNA, tRNA and rRNA in protein synthesis to the primary sequence • Illustrates at least two examples of protein function in the cell
	2.5 No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> • Defines amino acids and proteins • Knows examples of protein function in the cell (including enzymes) • Understands that amino acids bond together to form proteins
	1.5 Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
	0.5 Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

LS 1C: Focus – Photosynthesis and Cell Respiration

Goal: Levels of Organization: <i>Living organisms are complex structures with interconnected levels of organization. Students will explain the interactions between biochemical, cellular and organismal levels of organization in a specific organism</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> • Compares and contrasts photosynthesis and cellular respiration. • Demonstrates how photosynthesis and cellular respiration provide the matter and energy needed to organize cells, organisms and ecosystems.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> • Describes photosynthesis and its role in energy transfer from the sun to food/organic molecules. • Describes cellular respiration and its role in energy transfer from food/organic molecules to the energy used in cellular processes.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> • Knows the products and reactants of both photosynthesis and respiration. • Knows photosynthesis makes food/organic molecules and cellular respiration breaks down food/organic molecules. • Knows which types of organisms do cellular respiration and which types of organisms do photosynthesis.
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

LS 2: Focus – Homeostasis and Organ Systems

Goal: Homeostasis: <i>Living organisms are complex structures that respond to their environment. Organisms maintain homeostasis by using one or more organ systems to adjust to changes in both their internal and external environments. Students will explain a specific example of homeostasis.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> • Compares and contrasts negative and positive feedback mechanisms. • Analyzes how a malfunction in an organ/organ system affects the maintenance of homeostasis.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> • Demonstrates how an internal stimulus causes a response in two or more organ systems to maintain homeostasis in an organism. • Demonstrates how an external stimulus causes a response in two or more organ systems to maintain homeostasis in an organism.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> • Defines organ, organ system and organism. • Defines and give an example of homeostasis. • Defines and give examples of positive and negative stimuli.
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

LS 3A: Focus – Meiosis and Mitosis

Goal: Sexual Reproduction, Genetics and Evolution: <i>Living organisms reproduce and the result is organisms that are similar, but not identical, to their ‘parents.’ Students will understand how both the similarities and differences are produced and how the differences are important to evolution</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> • Compares and contrasts mitosis and meiosis • Relates the processes of independent assortment and crossing over to genetic variation.
	3.5 No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> • Explains the process of meiosis, including crossing over and independent assortment. • Explains the process of mitosis. • Students understand how sexual reproduction results in offspring that are genetically similar and different from their parents.
	2.5 No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> • Defines: meiosis; mitosis; haploid; diploid; gamete; allele; gene; chromosomes • Explains that genes are located on chromosomes.
	1.5 Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
	0.5 Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

LS 3B: Focus – Inheritance

Goal: Sexual Reproduction, Genetics and Evolution: <i>Living organisms reproduce and the result is organisms that are similar, but not identical, to their ‘parents.’ Students will understand how both the similarities and differences are produced and how the differences are important to evolution</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> • Infers the inheritance of a trait based on observed phenotypes in a population. • Explains the relationship between meiosis, sexual reproduction and Punnett squares
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> • Predicts patterns of inheritance in a monohybrid cross using Punnett squares. • Predicts patterns of inheritance in a dihybrid cross using Punnett squares. • Illustrates that some traits are autosomal and some are sex-linked.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> • Constructs Punnett squares for a monohybrid cross • Defines: homozygous; heterozygous; genotype; phenotype; dominant; recessive
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

LS 3C: Focus – Evolution

Goal: Sexual Reproduction, Genetics and Evolution: <i>Living organisms reproduce and the result is organisms that are similar, but not identical, to their ‘parents.’ Students will understand how both the similarities and differences are produced and how the differences are important to evolution.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> • Interprets an evolutionary scenario, explains which adaptations are advantageous, possible molecular processes may have caused these adaptations, and how natural selection acts to produce the evolutionary change.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> • Describes the relationship between genetic variation and natural selection • Describes the relationship between natural selection and evolution • Compares and contrasts artificial selection and natural selection
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> • Defines: variation; mutation; adaptation; evolution; artificial selection ; natural selection
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

LS 4A: Focus – Population Limiting Factors

Goal: Populations: <i>A population is a group of individuals of the same species that live in a similar geographical area. These populations grow or shrink in response to factors both within and outside of the population. Students will make predictions about the change in population size when given a specific set of these factors.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> Analyzes how developments in science and technology – such as agriculture, medicine or resource availability – impact the human population.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> Compares and contrasts density-dependent and density-independent limiting factors, using examples of each. Illustrates the impact of different limiting factors on population size and growth rate. Explains how limiting factors affect carrying capacity, using specific examples.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> Defines: immigration; emigration; limiting factors; carrying capacity Provides examples of how populations are affected by their environment. Provides examples of limiting factors.
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

LS 4B: Population Growth Rates

Goal: Populations: <i>A population is a group of individuals of the same species that live in a similar geographical area. These populations grow or shrink in response to factors both within and outside of the population. Students will make predictions about the change in population size when given a specific set of these factors.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> Predicts future populations, given a scenario that includes historical population data.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> Calculates and interprets population growth rates. Creates and Interprets graphical models of population change. Infers possible causes of population growth rates from population data.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> Defines: exponential growth; logistic growth; growth rate Graphs population data
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

LS 5A: Focus – Ecosystem Structure and Energy Flow

Goal: Ecology: <i>Living organisms interact with other living organisms and with non-living aspects of their environment. Students will analyze these biotic and abiotic relationships within a given ecosystem, including energy flow and the role of humans in that ecosystem.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> Predicts changes to an ecosystem’s trophic levels if a given human activity continues and if it changes.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> Describes the relative abundance of organisms in different trophic levels of an ecosystem. Explains the transfer of energy between organisms in different trophic levels of an ecosystem. Explains the role and impact of human activity on energy flow in a given ecosystem.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> Defines: Ecosystems, Biotic, Trophic levels, Producer, Consumer, Decomposer, Food Web, Energy Pyramid, Biomass Draws a food chain from a given set of organisms Describes an example of human impact on an ecosystem
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

LS 5B: Focus – Ecosystem Structure, Biotic and Abiotic Factors

Goal: Ecology: <i>Living organisms interact with other living organisms and with non-living aspects of their environment. Students will analyze these biotic and abiotic relationships within a given ecosystem including energy flow and the role of humans in that ecosystem.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> Predicts changes to an ecosystem’s abiotic and biotic factors if a given human activity continues and if it changes.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> Explains the relationships between abiotic and biotic factors in a given ecosystem. Explains the role and impact of human activity on the biotic and abiotic factors in a given ecosystem.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> Defines: Ecosystems, Biotic, Abiotic Distinguishes between and provides examples of abiotic and biotic factors Describes an example of human impact on an ecosystem
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

LS 6: DNA, Traits and Evolution

Goal: Genetics, Traits and Evolution: <i>Groups of living organisms change over time. These evolutionary changes occur at both the molecular/genetic and organismal levels of organization. Students will interpret evidence from each level of organization to explain a specific example of evolutionary change</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> • Evaluates competing evolutionary hypotheses using multiple types of evidence • Constructs a cladogram representing the evolutionary relationships between given set of organisms
	3.5 No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> • Explains the relationship between changes in DNA structure, an organism's traits, and evolution. • Analyzes structural differences from both living and extinct organisms to infer evolutionary relationships. • Analyzes differences in DNA and protein sequences to infer evolutionary relationships. • Describe the evolutionary relationships depicted in a cladogram.
	2.5 No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> • Explains that changes in DNA (mutation, recombination) plays a role in evolution. • Explains that DNA and traits are related. • Defines: variation, mutation, homologous structure, analogous structure, vestigial structure, cladogram
	1.5 Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
	0.5 Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

LS 7: Mechanisms of Evolution

Goal: Mechanisms of Evolution: <i>Groups of living organisms change over time. This evolutionary change occurs as a result of several different processes. Students will understand the difference between evolutionary outcomes and evolutionary processes – including natural selection, genetic drift, gene flow and mutation.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> Predicts and explains the plausible evolutionary outcomes of a given scenario
3.5	In addition to score 3.0 performance, in depth inferences and applications with partial success
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> Distinguish between and provide examples of natural selection, genetic drift, gene flow and mutation Models one of the processes – natural selection, genetic drift, gene flow, mutation – to demonstrate its relationship to evolutionary change Analyzes the evolutionary processes involved in a given scenario
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> Defines: Evolution, Variation, Genes, Natural selection, Genetic drift, Fitness, Mutation, Speciation Explains that populations of organisms possess a variety of genes and traits.
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

CH 1: Atoms and Molecules

Goal: Atoms and Molecules: <i>The fundamental structures of matter influence the properties and reactions of all living and physical systems. Students will describe the structure of matter at the atomic and molecular levels. They will explain how different types of matter serve as resources for humans.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none">• Compares the usefulness of two related resources based on their chemical and physical properties
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none">• Describes the relationship between the atomic and molecular structure and the chemical and physical properties of a given type of matter.• Describes how electrons are involved in covalent and ionic bonding and provide an example of each.• Distinguishes between exothermic and endothermic chemical reactions and provide an example of each.• Explains the relationship between the chemical and physical properties of a type of matter and its usefulness as a resource.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none">• Distinguishes between physical and chemical properties, as well as physical and chemical changes.• Distinguishes between protons, neutrons and electrons in terms of charge and location in the atom.• Distinguishes between a neutral atom and an ion.• Explains that molecules are formed by chemical bonds between atoms.
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

CH 2: Chemistry of Life

Goal: Chemistry of Life: <i>Living systems are made of carbon-based molecules and have fundamental structures. Students will be able to identify and describe the important structures, properties and uses of molecules such as proteins, carbohydrates, lipids and nucleic acids.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none">• Distinguishes among different types of proteins, carbohydrates, or nucleic acids and their descriptive functions (e.g. hormone, heredity).• Matches the structural formulas of monomers to proteins, carbohydrates, lipids, or nucleic acids.
3.5	No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none">• Describes the unique bonding properties of carbon that permits the formation of proteins, carbohydrates, lipids, and nucleic acids.• Describes the structure, properties, and functions of proteins, carbohydrates, lipids, and nucleic acids.
2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none">• Identifies that carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur are the most abundant elements in proteins, carbohydrates, lipids, and nucleic acids.• Identifies the monomers of proteins, carbohydrates, and nucleic acids.• Provides examples of proteins, carbohydrates, lipids and nucleic acids.
1.5	Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
0.5	Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated.

PH 1: Newton's Laws of Motion

Goal: Newton's Laws of Motion: <i>Objects in the universe move and interact in predictable ways. These movements and interactions can be understood using Newton's laws. Students will calculate, analyze, and predict the motion of individual objects, as well as how multiple objects interact in a system.</i>	
Proficiency Scale	
4.0	In addition to the 3.0 level criteria, the student: <ul style="list-style-type: none"> Analyzes the forces involved in a particular situation and predict the result of changes in those forces.
	3.5 No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content
3.0	In addition to the 2.0 level criteria, the student: <ul style="list-style-type: none"> Describes the relationships between force, acceleration, and mass. Describes the relationship between mass, gravity, and weight. Describes how Newton's Laws apply to a given situation.
	2.5 No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content
2.0	The student: <ul style="list-style-type: none"> Defines Newton's Laws of Motion. Identifies that gravity is a universal and fundamental force. Distinguishes between mass and weight.
	1.5 Partial knowledge of the 2.0 content but some knowledge of the 3.0 content
1.0	Partial knowledge of the 2.0 content, but not of the 3.0 content.
	0.5 Limited knowledge of the 2.0 content but not of the 3.0 content
0.0	No understanding or skill demonstrated

PH 2A: Focus – Electromagnetic Waves

<p>Goal: Waves: <i>Waves are one way to transfer energy from one location to another. There are two types of waves, mechanical and electromagnetic. Students will distinguish between the two types of waves. They will describe the characteristics of waves and explain how variations in these characteristics affect the energy of waves.</i></p>	
<p>Proficiency Scale</p>	
4.0	<p>In addition to the 3.0 level criteria, the student:</p> <ul style="list-style-type: none"> Analyzes and make predictions about wave behavior in response to varying conditions. Identifies and provides examples of electromagnetic waves that occur in the geosphere, atmosphere and hydrosphere.
3.5	<p>No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content</p>
3.0	<p>In addition to the 2.0 level criteria, the student:</p> <ul style="list-style-type: none"> Describes the relationship between the properties of an electromagnetic waves and their position within the electromagnetic spectrum. Describes the relationship between wavelength, frequency, and amplitude. Performs calculations involving wavelength, frequency, and amplitude. Identifies the source of an electromagnetic wave and explain the effects of the resulting wave.
2.5	<p>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</p>
2.0	<p>The student:</p> <ul style="list-style-type: none"> Defines: wavelength, frequency, and amplitude Identifies that waves transfer energy. Identifies the sequence of electromagnetic waves, by wavelength, in the electromagnetic spectrum. Identifies the units used to measure wavelength, frequency, and amplitude.
1.5	<p>Partial knowledge of the 2.0 content but some knowledge of the 3.0 content</p>
1.0	<p>Partial knowledge of the 2.0 content, but not of the 3.0 content.</p>
0.5	<p>Limited knowledge of the 2.0 content but not of the 3.0 content</p>
0.0	<p>No understanding or skill demonstrated</p>

PH 2B: Focus – Mechanical Wave

<p>Goal: Waves: <i>Waves are one way to transfer energy from one location to another. There are two types of waves, mechanical and electromagnetic. Students will distinguish between the two types of waves. They will describe the characteristics of waves and explain how variations in these characteristics affect the energy of waves.</i></p>	
<p>Proficiency Scale</p>	
4.0	<p>In addition to the 3.0 level criteria, the student:</p> <ul style="list-style-type: none"> Analyzes and make predictions about wave behavior in response to varying conditions. Identify and provide examples of mechanical waves that occur in the geosphere, atmosphere, and hydrosphere.
3.5	<p>No major errors or omissions regarding 3.0 content and partial knowledge of the 4.0 content</p>
3.0	<p>In addition to the 2.0 level criteria, the student:</p> <ul style="list-style-type: none"> Identifies the source of a mechanical wave and explain the effects of the resulting wave Describes the relationship between wavelength, frequency, and amplitude. Performs calculations involving wavelength, frequency, and amplitude.
2.5	<p>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</p>
2.0	<p>The student:</p> <ul style="list-style-type: none"> Defines: wavelength, frequency, and amplitude Identifies that waves transfer energy. Identifies the units used to measure wavelength, frequency, and amplitude.
1.5	<p>Partial knowledge of the 2.0 content but some knowledge of the 3.0 content</p>
1.0	<p>Partial knowledge of the 2.0 content, but not of the 3.0 content.</p>
0.5	<p>Limited knowledge of the 2.0 content but not of the 3.0 content</p>
0.0	<p>No understanding or skill demonstrated.</p>

Instructional Materials

Integrated Science uses staff-generated curriculum supplemented by the TUHSD board approved textbooks. The textbooks for this program are “Integrated Science 1-2” and “Integrated Science 3-4”, Custom Edition (2009).

Requirements Satisfied:

Completion of Integrated Science 1-2 is accepted towards the “g” requirement for UC and CSU admissions. Completion of Integrated Science 3-4 is accepted towards the “d” requirement for UC and CSU admissions. Completion of both courses satisfies the TUHSD science graduation requirement.

Appendices:

Sample Scope and Sequence:

The Integrated Science program is designed to be flexible for teachers to use their discretion to determine the best scope and sequence for the program goals, associated curriculum and subsequent units. All students will demonstrate progress towards mastery of identified content and skills (program goals) after two years. Listed below is a sample of scope and sequence for Integrated Science 1-2 and Integrated Science 3-4 courses. This order is not required, merely one example of how to structure the content into thematic units.

Course	Units of Study	Related Program Goals
Integrated Science 1-2	Experimental Design	IE 1A, IE 1B
	San Francisco Bay	IE 1A, IE 1B, ES 1, ES 3B, LS 5A, LS 5B
	Climate	IE 1A, IE 1B, ES 2B, ES 3C, PH 2A
	Origins	IE 1A, IE 1B, ES 4A, ES 4B, ES 4C, LS 7, PH 1, PH 2A
	Disease	IE 1A, IE 1B, LS 1A, LS 2, LS 3A
Integrated Science 3-4	Experimental Design	IE 1A, IE 1B
	Islands	IE 1A, IE 1B, ES 2A, ES 3A, PH 2B
	Vertebrate Evolution	IE 1A, IE 1B, LS 1B, LS 3A, LS 3B, LS 3C, LS 6, LS 7
	Populations	IE 1A, IE 1B, LS 1C, LS 4A, LS 4B, CH 1, CH 2, PH 2A
	Resources	IE 1A, IE 1B, ES 2C, CH 1

Sample Unit of Study and Assessments 1:

Starlight, Starbright - Integrated Science 1, 2 (Galileo) - by John Hayden

Established Goals

IE 1: Investigation and Experimentation. Science is a way of knowing about who we are and where we live. Scientists work by observation and experimentation. Students will ask questions, design experiments, conduct experiments, analyze data, and report conclusions as part of a scientific investigation.

ES 4A, 4B, 4C Astronomy. Earth is part of a larger series of systems that change over time – the solar system, galaxy, and universe. Students will understand and explain the Earth’s place within these systems and within the evolution of those systems.

PH 2B: Electromagnetic Waves. Waves are one way to transfer energy from one location to another. There are different types of waves, including mechanical and electromagnetic waves. Students will distinguish between different types of waves. They will describe the characteristics of waves and explain how variations in these characteristics affect the energy of waves.

[NTN Agency Learning Outcomes](#). Focus on Use Effort and Practice to Grow, Meet Benchmarks, Tackle and Monitor Learning, Actively Participate, and Build Relationships

[NTN Oral Communication Outcomes](#). Focus on Clarity, Evidence, Organization, Use of Digital Media and Visual Displays,

Driving Question

Are there other stars in the universe that could support an Earth-like planet?

Problem Statement

How can we, as astronomers, determine whether other stars are similar to our sun?

Enduring Understandings: Students will understand that...

- All stars share many similarities with our sun.
- It is likely that other stars in the universe support an Earth-like planet.
- The lifespan of all stars, including our sun, is limited.

Essential Questions: Students will keep considering...

- What type of stars are most likely to support an Earth-like planet?
- What limits a star’s life span?

Students will know...

- The various stages of star life cycles.
- How stars, including the sun, are formed and powered by nuclear reactions.

- How to use emission spectra data or other data to determine the composition of a star and infer its life stage.

Products

Students will create an iMovie comparing the characteristics (age, life stage, emission spectra, temperature, color, placement on HR diagram, fate) of their chosen star to the characteristics of the sun. Students will assess whether their star is likely to support an Earth-like planet as our sun does.

Workshops/Activities

Knows/Need to Knows

Group Norms/Agreements

Reading 13-1, 13-2, 14-1, 14-3 from IS 1,2 Textbook

Stars - Formation and Life Cycles

Our Sun - Specifics about the Sun

[iMovie Requirements](#)

[Emission Spectra Lab Activity](#)

Reading HR Diagrams

iMovie Scaffold

[Reflection](#)

Possible Necessary Workshop Topics

Emission/Absorption Spectra

Reading an HR Diagram

Nuclear Fusion/Gravity

Star Life Cycles

Electromagnetic Radiation

Need to Create/Provide

[Pre-assessment](#)

Notebook Set-Up

iMovie Training

Reflection Template

[Study Guide](#)

[Astronomy Test](#)

Proficiency Scales

[Star Life Cycles Entry Event Video](#)

[Generalized 4-point Scoring Scale \(from Marzano\)](#)

[iMovie Requirements](#)

[Spectroscopy Lab Form](#)

Passport Activities

[View Entry Event](#)

Knows/Need to Knows

Group Contract

Create Evernote Notebook

Choose a Star

Read 13-1 (Star Characteristics) and Vocabulary/Analysis Questions

[Research your star's characteristics](#)

Read 14-1 (The Study of Light/EMR) and Vocabulary/Analysis Questions

[Complete Spectroscopy Lab](#)

Read 13-2 (Star Life Cycles) and Vocabulary/Analysis Questions

[Astronomy Test](#)

Develop Starlight, Starbright iMovie Draft

Critical Friends Feedback

[Starlight, Starbright Presentation](#)

[Starlight, Starbright Reflection](#)

Grade/Assess

[Analysis Questions Answers](#)

[Astronomy Test](#)

[iMovie - Group](#)

Agency Performance

Into E-Portfolio

[Analysis Questions Answers](#)

iMovie - Group

[Entry Event - Video Text](#)

Our sun. 4.6 billion years old. 109 times the size of Earth. Emits the light and heat necessary to support life here on Earth. Are there other stars like our sun in the universe? Stars that could support an Earth-like planet? In this project, you will gather data on a star you have *discovered*, compare its characteristics to those of our sun, and assess its ability to support an Earth-like planet.

Sample Unit of Study and Assessments 2:

**Human Population and Food Resources
Integrated Science 3-4 by Todd Samet**

Stage 1 Desired Results		
<p>Established Goals</p> <p>LS-4: Populations. A population is a group of individuals of the same species that live in a similar geographical area. These populations grow or shrink in response to factors both within and outside of the population. Students will make predictions about the change in population size when given a specific set of these factors.</p> <p>LS-1: Levels of Organization. Living organisms are complex structures with interconnected levels of organization. Students will analyze the interactions between the biochemical, cellular and organismal levels of organization in a specific organism.</p> <p>ES-1: Matter Cycles. Earth is a series of interconnected systems that change over time. One group of systems involves the cycling of matter. Students will follow a specific type of matter (i.e. water, carbon, nitrogen) through an entire biogeochemical cycle, including an analysis of human interactions with that cycle.</p>	Transfer	
	<p><i>Students will be able to independently use their learning to...</i></p> <p>1. Use current and historical population data to analyze the factors influencing that population and to predict future patterns of population change</p>	
	Meaning	
	<p>UNDERSTANDINGS <i>Students will understand that...</i></p> <p>1. Human population growth is a dynamic and multi-faceted phenomenon.</p> <p>2. Analyzing human population, and predicting population changes, requires an understanding of carrying capacity and factors that limit growth.</p> <p>3. Predicting future population change requires data from past population patterns and assumptions about future population patterns.</p> <p>4. Food resources produced through agricultural ecosystems are a limiting factor to human population growth.</p> <p>5. Agricultural ecosystems have both important differences and similarities when compared to natural ecosystems.</p>	<p>ESSENTIAL QUESTIONS <i>Students will keep considering...</i></p> <p>1. What is the maximum population of the human species?</p> <p>2. What factors will ultimately limit the growth of the human population? Will those factors have a greater impact on birth rates or death rates?</p> <p>3. Can the human population produce enough food to feed itself now? Can the human population produce enough food to feed itself in 50 years?</p> <p>4. Is modern agricultural practice or traditional agricultural practice a better model for feeding the human population?</p>
Acquisition		
<p><i>Students will know...</i></p> <p>1. Mechanisms of population growth in open and closed ecosystems.</p> <p>2. Carrying capacity and</p>	<p><i>Students will be skilled at...</i></p> <p>1. Using population data to calculate growth rates and predict trends</p>	

	<p>parameters that affect the carrying capacity of an ecosystem.</p> <ol style="list-style-type: none"> 3. Historical trends in human population growth 4. The process of photosynthesis, including the light-dependent and light-independent reactions 5. The process of cell respiration, including the differences in aerobic and anaerobic respiration 6. The biochemical similarities and differences between photosynthesis and cell respiration 7. The nutritional and energy demands of humans and how those demands are met through photosynthesis and agricultural practices 8. The role of the nitrogen cycle in modern agricultural ecosystems 	<p>in population growth and/or decline</p> <ol style="list-style-type: none"> 2. Using population data to graph trends in population growth and/or decline 3. Using models to analyze and interpret past and future trends in population growth and/or decline
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Stage 2 - Evidence		
Code	Evaluative Criteria	Assessment Evidence
	Laboratory report rubric	<p>PERFORMANCE TASK(S): <i>Students will show that they really understand by evidence of...</i> Design and conduct an experiment testing the effect of light intensity on rate of photosynthesis. Collect and analyze the relevant data and communicate results as a formal laboratory report.</p>
	Project specific rubric	<p>Research current population and agricultural data from a specific country, assess whether the country currently is at, below or above carrying capacity and predict the carrying capacity status for 50 years in the future.</p>
		<p>OTHER EVIDENCE: <i>Students will show they have achieved Stage 1 goals by...</i> Modeling Populations Lab</p> <p>Analyzing Human Populations – Global and Regional Analysis</p> <p>Photosynthesis Quiz</p> <p>Human Energy Needs Analysis</p> <p>Unit Test</p>

Stage 3 – Learning Plan		
Code	<i>Pre-assessment</i> Student knowledge of current human population and trends, including their predictions of future trends.	
	LEARNING EVENTS	<i>Progress Monitoring</i>
	<i>Student success at transfer, meaning, and acquisition depends on...</i>	
A	1. Comparing Malthusian and Cornucopian views of human population (Simon v. Ehrlich)	
A, M	2. Population Sampling Lab	
M	3. Mathematics of Population Growth and Decline	
M	4. Modeling Population Growth Lab	
M, T	5. Analyzing Human Population – Global and Regional Analysis	
A	6. Human Population and the Demographic Transition	
A	7. Reading Analysis – “Population and Photosynthesis”	
A, M	8. Text Reading/Class Discussion – Photosynthesis (Light Dependent and Light Independent Reactions)	
M	9. Plant Pigments Lab	
M, T	10. Effect of Light Intensity on Photosynthetic Rate Lab	
A	11. Text Reading/Class Discussion – Cellular Respiration (Anaerobic and Aerobic)	
M	12. Human Energy Needs Analysis	
T	13. Calculating Solar Input and Human Carrying Capacity	
A	14. Reading/Discussion – Agricultural Ecosystems	
A	15. Reading/Discussion – Nitrogen Cycle and Agriculture	
T	16. Project – Evaluating Agriculture, Food Resources and Population	

Sample Unit of Study and Assessments 3:

Integrated Science 2 Climate Unit Tamalpais High School

Essential Questions:

- What is the structure and function of Earth's atmosphere?
- What are natural and man-made causes of climate change and what are impacts on the environment?
- How does matter rotate through a biogeochemical cycle and how does it interact with humans?
- What is the relationship between the biotic and abiotic factors in different biomes?

Program Goals

IE-1. Science is a story about who we are and where we live. Scientists write that story by observation and experimentation. Students will ask questions, design experiments. Conduct experiments, analyze data, and report conclusions as part of a scientific investigation.

ES-1. Earth is a series of interconnected systems that change over time. One group of systems involves the cycling of matter. Students will follow a specific type of matter (i.e. nitrogen, carbon) through an entire biogeochemical cycle, including an analysis of human interactions with that cycle.

ES-2. Earth is a series of interconnected systems that change over time. One group of systems involves the cycling of energy. Students will follow a specific form of energy through a variety of transformations that involve internal heat energy from the earth, incoming solar energy, and human energy use.

ES-3. Earth is a series of interconnected systems that change over time. One group of systems involves the different 'spheres' of earth materials -lithosphere, hydrosphere and atmosphere. Students will understand the structure/composition of each sphere and they will analyze the interaction between these three systems - over time - at a specific location on the earth's surface.

LS-5. Living organisms interact with other living organisms and with non-living aspects of their environment. Students will analyze these biotic and abiotic relationships within a given ecosystem, including the specific role of humans in that ecosystem.

PS-2. Waves are one of many ways to transfer energy from one location to another. There are different types of waves that carry out this function, including mechanical and electromagnetic waves. Students will identify the correct type of wave for a given situation and describe the important differences between wave types. They will also be able to

identify the variations of waves (wavelength, frequency, etc.) and how these variations affect the energy of the waves.

Climate PreAssessment

Level 2

1. (ES-1) Why is the sun an important part of the water cycle?
 - a. It causes evaporation of water
 - b. It provides energy to drive the water cycle
 - c. It will change the air temperature
 - d. It provides energy for plants
 - e. Several of these

2. (ES-2) Plants making food from sunlight is known as:
 - a. Chemosynthesis
 - b. Photosynthesis
 - c. Decomposition
 - d. consumption

3. (ES-3) All of the following are functions of the Earth's atmosphere EXCEPT
 - a. temperature regulation
 - b. protection from UV radiation
 - c. allows for life on earth
 - d. production of climate and weather
 - e. all of these are functions of the atmosphere

4. (ES-3) The state of the atmosphere at a given time and place is defined as Insulation
 - a. Weather
 - b. condensation
 - c. precipitation

5. (ES-3) The Sun's rays strike the Earth at different angles because _____. This causes seasonal changes.
 - a. the Earth tilts on its axis
 - b. the Sun tilts on its axis
 - c. the moon revolves around Earth
 - d. of the way the moon deflects sunlight
 - e. the Sun's gravitational pull

6. (ES-3) All of the following can cause **long term** climate changes except _____.
 - a. changes in the tilt of earth's axis
 - b. El Niño
 - c. changes in earth's orbit
 - d. changes in the direction of earth's axis points
 - e. ice ages

7. (LS-5) A biome can be defined as:
 - a. a patchwork of habitats that differ in abiotic factors
 - b. a region that is characterized by common topography
 - c. a region with four distinct seasons
 - d. a region with a community of plants and animals adapted to a specific climate

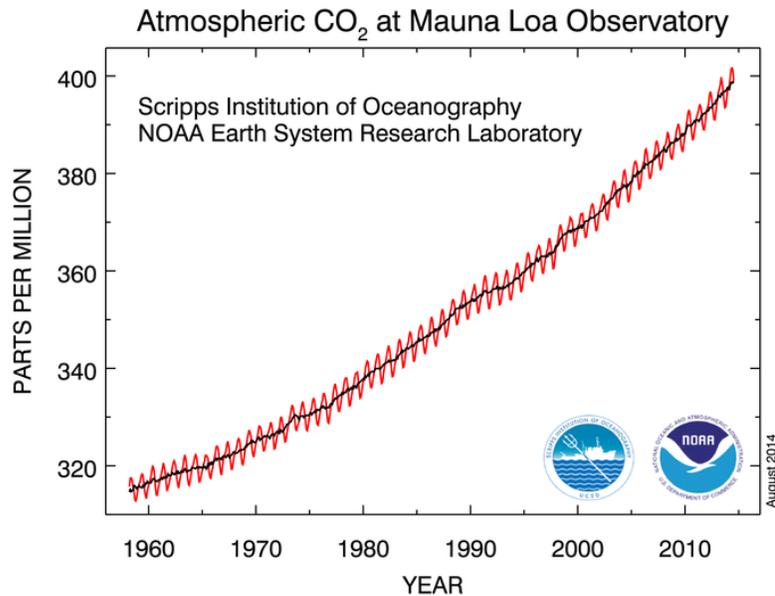
8. (PS-2) Solar Radiation initially travels through the atmosphere to Earth's surface via
 - a. Conduction
 - b. Convection
 - c. Radiation
 - d. Electromagnetic waves
 - e. Several of these

Level 3

9. (ES-3) Why do the seasons occur at different times of the year in the northern hemisphere and southern hemisphere?

Level 4

10. (ES-3)



Using the data above predict future climate trends. Justify your prediction.

Learning Activities

- Climate Notes
- Are We Changing Planet Earth video
- Biome notes

- Climatograms
- Radiation / Conduction / Convection
- Structure of the Atmosphere notes
- Natural climate change
- Energy trail flow chart and/or US Energy Consumption WS
- Guest Speaker

Climate Menu

	MANDATORY: By completing these you will earn a C		EXTENSION Choices to earn a B or an A
ACTIVITIES	Assignment	Stamp showing Mastery	Complete 1 choice to earn a B Complete 2 choices to earn an A <ul style="list-style-type: none"> ❖ Biome Walkaround ❖ Water Cycle Paper Craft
	Climatograms		
	Carbon Cycle		
	Bingo		
VIDEOS	Assignment	Stamp showing Mastery	Go to http://streaming.factsonfile.com Then search under titles for “Are We Changing the Earth” Watch the entire show (1hr) and create original questions for the video: 10 questions for a “B”, 15 for an “A.”
	National Geographic –Six Degrees Could Change the World		
NOTES	Assignment	Stamp showing Mastery	
	Climate Intro		
	Structure of the Atmosphere		
	Climatograms and Biomes		
	Heat Energy		
	Natural Climate Changes		
	Global Warming		
LAB	Greenhouse Effect Lab		
PROJECT	Effects of Climate Change Project Choose a country, and describe how climate change may affect that country. Your project may be a poster, 3D model, PowerPoint, video, or any other idea you get approval for (speak to Ms. Wuerth first)		For a B or an A, you must choose an additional country, and complete the project for that country also. (The two projects do NOT need to be the same format. For example, you could do a PowerPoint for one country or a poster for the other, etc. You can also choose the same format for both countries, two posters, for example)

Post Assessments (may include, but are not limited to:)

- Effects of Climate Change Project
- Cycle Posters
- Presentations

Adopted: 10/3/94

Revised: 7/26/99

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Revised: 6/30/04

Revised: 5/07

Updated: 12/10

Revised: 5/26/15