Los Angeles Unified School District

Division Of Instruction

Secondary Science

Integrated Science 8AB
Prerequisite: None

Course Description:
This course is meant to be a guide for educators on how to approach the teaching of *CA NGSS* in grade eight according to the *Preferred Integrated Learning Progression mode*l. The *Preferred Integrated Model* provides an opportunity for students to engage in real world phenomena, ask questions, and seek answers to those questions without regard to disciplinary boundaries. The crosscutting concepts of the Next Generation Science Standards serve as lenses for students to engage in science and engineering practices to figure out disciplinary core ideas.

In this course, grade eight students use the lenses of Stability and change; scale, proportion and quantity as the cross disciplinary lenses to develop deep understanding of:

- Moving and colliding objects
- Noncontact forces influencing phenomena
- Evolution
- Sustaining local and global biodiversity

The Three Dimensions of the Next Generation Science Standards:

1. Scientific and Engineering Practices
1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

2. Disciplinary Core Ideas
LS: Life Science
LS1: From Molecules to Organisms: Structures and Processes
LS2: Ecosystems: Interactions, Energy, and Dynamics
LS3: Heredity: Inheritance and Variation of Traits
LS4: Biological Evolution: Unity and Diversity
ESS: Earth and Space Science

ESS1: Earth's Place in the Universe
ESS2: Earth's Systems
ESS3: Earth and Human Activity
PS: Physical Science
PS1: Matter and Its Interactions
PS2: Motion and Stability: Forces and Interactions
PS3: Energy
PS4: Waves and Their Applications in Technologies for Information Transfer
ETS: Engineering, Technology and the Application of Science
ETS1: Engineering Design

3. Cross Cutting Concepts
1. Patterns.
2. Cause and effect:
3. Scale, proportion, and quantity.
4. Systems and system models.
5. Energy and matter: Flows, cycles, and conservation.
6. Structure and function.
7. Stability and change.

Instructional Segment* 1: Objects Move and Collide

Preferred Integrated – Grade 8 – Instructional Segment 1: Objects Move and Collide
Guiding Questions: What are forces and how do they affect the motions of objects? Do objects always need a force in order to keep moving? What happens when a moving object collides with something? How do fossils provide evidence of an ancient collision that wiped out the dinosaurs?
Students who demonstrate understanding can: MS-LS4-1. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. [Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] ***[Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.]*** MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.* [Clarification Statement: Examples of practical problems could

include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.] ***[Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.]***

MS-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] ***[Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.]***

MS-PS3-1. Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. [Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.]

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

*The performance expectations marked with an asterisk integrate traditional science content with engineering through a practice or disciplinary core idea.

The bundle of performance expectations above focuses on the following elements from the NRC document *A Framework for K–12 Science Education*:

Highlighted	**Highlighted Disciplinary Core Ideas**	Highlighted Crosscutting Concepts

Science and Engineering Practices	**LS4**.A Evidence of Common Ancestry and Diversity	Systems and System Models
Developing and Using Models	PS2.A Forces and Motion	Cause and Effect: Mechanism and Explanation
Using Mathematic and Computational Thinking	PS2.B Types of Interactions	Matter and Energy: Flows, Cycles, and Conservation
Constructing Explanations and Designing Solutions	PS3.A Definitions of Energy	
	ETS1.A Defining and Delimiting Engineering Problems	
	ETS1.B Developing Possible Solutions	
	ETS1.C Optimizing the Design Solution	

Highlighted California Environmental Principles and Concepts:

Principle II The long-term functioning and health of terrestrial, freshwater, coastal, and marine ecosystems are influenced by their relationships with human societies

Principle V Decisions affecting resources and natural systems are complex and involve many factors

Instructional Segment 2: Noncontact Forces Influence Phenomena

Preferred Integrated – Grade 8 – Instructional Segment 2: Noncontact Forces Influence Phenomena
Guiding Questions: What causes the cyclical changes in the appearance of the Moon? How can an object influence the motion of another object without touching it? Does Earth's force of gravity attract other objects equally?
Students who demonstrate understanding can: MS-ESS1-1. Develop and use a model of the Earth-Sun-Moon system to describe the cyclic patterns of lunar phases, eclipses of the Sun and Moon, and seasons [Clarification Statement: Examples of models can be physical, graphical, or conceptual] (Introduced, but seasons are not assessed until IS4)

MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system [Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as their school or state)] ***[Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.]***

MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system [Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius Examples of data include statistical information, drawings and photographs, and models] ***[Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies]***

MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electrical and magnetic forces [Clarification Statement: Examples of devices that use electrical and magnetic forces could include electromagnets, electric motors, or generators Examples of data could include the effect of the number of turns of wire on the electromagnet or the effect of increasing the number or strength of magnets on the speed of an electric motor] ***[Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.]***

MS-PS2-4. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. [Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.] [Assessment Boundary: Assessment does not include Newton's Law of Gravitation or Kepler's Laws.]

MS-PS2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact [Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically charged strips of tape, and electrically charged pith balls Examples of investigations could include first-hand experiences or simulations]

MS-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system [Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair Examples of models could include representations, diagrams, pictures, and written descriptions of systems] ***[Assessment Boundary: Assessment is limited to two objects and electric, magnetic, and gravitational interactions]***

*The performance expectations marked with an asterisk integrate traditional science content with engineering through a practice or disciplinary core idea.

The bundle of performance expectations above focuses on the following elements from the NRC document *A Framework for K–12 Science Education*:

Highlighted Science and Engineering Practices	Highlighted Disciplinary Core Ideas	Highlighted Crosscutting Concepts
Asking Questions and Defining Problems	ESS1 A: The Universe and Its Stars	Patterns
Developing and Using Models	ESS1 B: Earth and the Solar System	Systems and System Models
Planning and Carrying Out Investigations	PS2 B: Types of Interactions	Scale, Proportion, and Quantity
Analyzing and Interpreting Data	PS3 A: Definitions of Energy	Cause and Effect
Engaging in Argument from Evidence	PS3 C: Relationship Between Energy and Forces	

Instructional Segment 3: Evolution Explains Life's Unity and Diversity

Preferred Integrated – Grade 8 – Instructional Segment 3: Evolution Explains Life's Unity and Diversity
Guiding Questions: What can we infer about the history of Earth and life on earth from the clues we can uncover in rock layers and the fossil record? What evidence supports Darwin's theory of biological evolution? How do evolution and natural selection explain life's unity and diversity?
Students who demonstrate understanding can: MS-ESS1-4 Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. [Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] ***[Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]*** MS-LS3-1 Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.] MS-LS4-1. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. [Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] [Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.] MS-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. [Clarification Statement: Emphasis is on explanations of the

evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.]

MS-LS4-3. Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy**.** [Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Assessment Boundary: Assessment of comparisons is limited to gross appearance of anatomical structures in embryological development.]

MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.]

MS-LS4-5. Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. [Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.]

MS-LS4-6. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time**.** [Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations.]

*The performance expectations marked with an asterisk integrate traditional science content with engineering through a practice or disciplinary core idea.

The bundle of performance expectations above focuses on the following elements from the NRC document *A Framework for K–12 Science Education*:

Highlighted Science and Engineering Practices	Highlighted Disciplinary Core Ideas	Highlighted Crosscutting Concepts
	ESS1.C The History of Planet Earth	Patterns

Developing and Using Models Analyzing and Interpreting Data Using Mathematics and Computational Thinking Constructing Explanations and Designing Solutions Engaging in Argument from Evidence Obtaining, Evaluating, and Communicating Information	LS3.A Inheritance of Traits LS3.A Variation of Traits LS4.A Evidence of Common Ancestry and Diversity LS4.B Natural Selection LS4.C Adaptation	Stability and Change Cause and Effect Structure and Function
Highlighted California Environmental Principles and Concepts: *Principle II The long-term functioning and health of terrestrial, freshwater, coastal and marine ecosystems are influenced by their relationships with human societies*		

Instructional Segment 4: Sustaining Local and Global Biodiversity

Preferred Integrated – Grade 8 – Instructional Segment 4: Sustaining local and global biodiversity
Guiding Questions: What are the characteristic properties and behaviors of waves? What human activities harm Earth's biodiversity and what human activities help sustain local and global biodiversity? How does communication technology encode information and how can digital technologies be used to help sustain biodiversity?
Students who demonstrate understanding can:

MS-PS4-1 Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. [Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.] ***[Assessment Boundary: Assessment does not include electromagnetic waves and is limited to standard repeating waves.]***

MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
[Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions***.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]***

MS-PS4-3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals. [Clarification Statement: Emphasis is on a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in Wi-Fi devices, and conversion of stored binary patterns to make sound or text on a computer screen.] ***[Assessment Boundary: Assessment does not include binary counting. Assessment does not include the specific mechanism of any given device.]***

MS-ESS1-1. Develop and use a model of the Earth-Sun-Moon system to describe the cyclic patterns of lunar phases, eclipses of the Sun and Moon, and seasons. [Clarification Statement: Examples of models can be physical, graphical, or conceptual.]

MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.]

MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.]

MS-LS4-6. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

[Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations.]

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

*The performance expectations marked with an asterisk integrate traditional science content with engineering through a practice or disciplinary core idea.

The bundle of performance expectations above focuses on the following elements from the NRC document *A Framework for K–12 Science Education*:

Highlighted Science and Engineering Practices	Highlighted Disciplinary Core Ideas	Highlighted Crosscutting Concepts
Asking Questions and Defining Problems	LS4 B: Natural Selection	Patterns
Developing and Using Models	LS4 C: Adaptation	Cause and Effect
Analyzing and Interpreting Data	ESS1 A: The Universe and Its Stars	Structure and Function
Using Mathematics and Computational Thinking	ESS1 B: Earth and the Solar System	Stability and Change
Constructing Explanations and Designing Solutions	ESS3 C: Human Impacts on Earth Systems	
	PS4 A: Waves Properties	
	PS4 B: Electromagnetic Radiation	
	PS4 C: Information Technologies and Instrumentation	

Engaging in Argument from Evidence Obtaining, Evaluating, and Communicating Information	ETS1 A: Defining and Delimiting Engineering Problems ETS1 B: Developing Possible Solutions	

Highlighted California Environmental Principles and Concepts:

Principle I The continuation and health of individual human lives and of human communities and societies depend on the health of the natural systems that provide essential goods and ecosystem services

Principle II The long-term functioning and health of terrestrial, freshwater, coastal and marine ecosystems are influenced by their relationships with human societies

***Segments were adopted from CA Science Framework - June 2016**

Texts/Materials

- Amplify – HMH Science Dimensions – SCALE Stanford
- LAUSD Secondary Science Curriculum Map
- Supplemental materials and resources

Assessment

- District Interim Assessment
- Teacher designed formative and summative assessment