Los Angeles Unified School District
Division Of Instruction
Secondary Science

Integrated Science 7
One Semester course
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 seven according to the *Preferred Integrated Learning Progression model*. 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. Since LAUSD offers one semester of science, segment 2 and 3 are prioritized as a recommendation for schools.

In this course, grade seven students use the lenses of *Energy and Matter: flows, cycles, and conservation; cause and effect* as the cross disciplinary lenses to develop deep understanding of:

- The chemistry of organisms and nonliving things
- Matter cycles and energy flows
- Natural processes and human activities shape Earth's resources and ecosystem
- Sustaining 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: Organisms and Nonliving Things are Made of Atoms

Preferred Integrated – Grade 7 – Instructional Segment 1: Organisms and Nonliving Things Are Made of Atoms
Guiding Questions: How does the matter in living and nonliving things differ? How does adding or removing thermal energy affect the physical states of matter? How do interactions at the atomic level help us understand the observable properties of organisms and nonliving matter?
Students who demonstrate understanding can: MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable,

and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system] ***[Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.] (Introduced, but not assessed until IS3)***

MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures. [Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] ***[Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete description of all individual atoms in a complex molecule or extended structure is not required.]***

MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material Examples of new materials could include new medicine, foods, and alternative fuels] ***[Assessment Boundary: Assessment is limited to qualitative information.] (Introduced, but not assessed until IS4)***

MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.]

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 Developing and Using Models Constructing Explanations and Designing Solutions Obtaining, Evaluating, and Communicating Information	Highlighted Disciplinary Core Ideas PS1.A: Structure and Properties of Matter PS1.B Chemical Reactions PS3.A: Definitions of Energy ESS3.A: Earth's Natural Resources	Highlighted Crosscutting Concepts Cause and Effect Scale, Proportion, and Quantity Structure and Function
Highlighted California Environmental Principles & 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*.		

Instructional Segment 2: Matter Cycles and Energy Flows through Organisms and Rocks

Preferred Integrated – Grade 7 – Instructional Segment 2: Matter Cycles and Energy Flows through Organisms and Rocks
Guiding Questions: How do rocks and minerals record the flow of energy and cycling of matter in the Earth? How do we get energy from our food? How are hot objects different than cold objects? What changes when they heat up or cool down?
Students who demonstrate understanding can: MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.]

[Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.]
MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. [Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] ***[Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.]***
MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. [Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] ***[Assessment Boundary: Assessment does not include the identification and naming of minerals.]***
MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] ***[Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]***

MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms that represent atoms.] ***[Assessment Boundary: Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces.]***

MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.* [Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride.] ***[Assessment Boundary: Assessment is limited to the criteria of amount, time, and temperature of substance in testing the device.]***

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 Science and Engineering Practices	Highlighted Disciplinary Core Ideas	Highlighted Crosscutting Concepts
Asking Questions and Defining Problems Developing and Using Models Analyzing and Interpreting Data Constructing Explanations (and Designing Solutions Engaging in Argument from Evidence	LS1.C: Organization for Matter and Energy Flow in Organisms PS1.A: Structure and Properties of Matter PS1.B: Chemical Reactions PS3 D: Energy in Chemical Processes and Everyday Life ESS2.A Earth's Materials and Systems ETS1.A: Defining and Delimiting Engineering Problems ETS1.B: Developing Possible Solutions ETS1.C: Optimizing the Design Solution	Patterns Energy and Matter: Flows, Cycles, and Conservation Stability and Change

Highlighted California Environmental Principles & Concepts:
Principle III Natural systems proceed through cycles that humans depend upon, benefit from and can alter.
Principle IV The exchange of matter between natural systems and human societies affects the long term functioning of both.

Principle V Decisions affecting resources and natural systems are based on a wide range of considerations and decision-making processes

Instructional Segment 3: Natural Processes and Human Activities Shape Earth's Resources and Ecosystems

Preferred Integrated – Grade 7 – Instructional Segment 3: Natural Processes and Human Activities Shape Earth's Resources and Ecosystems
Guiding Questions: • How can we use interactions between individual rocks or individual organisms to understand systems as big as the whole geosphere or whole ecosystem? • How can we use patterns in geosphere interactions to predict the location of resources? • How can we use patterns in ecosystem interactions to predict how organisms compete and share resources?
Students who demonstrate understanding can: MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.] MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.] MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.] ***[Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.]*** MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. [Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).] ***[Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed.]***

MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).] MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] ***[Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]*** MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material Examples of new materials could include new medicine, foods, and alternative fuels] ***[Assessment Boundary: Assessment is limited to qualitative information.] (Revisited from IS1, but not assessed until IS4)*** MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms that represent atoms.] ***[Assessment Boundary: Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces.]***
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
Developing and Using Models	LS2 A: Interdependent Relationships in Ecosystems	Patterns Cause and Effect

Analyzing and Interpreting Data Constructing Explanations and Designing Solutions Obtaining, Evaluating, and Communicating Information	LS2 B: Cycles of Matter and Energy Transfer in Ecosystems ESS1 C: The History of Planet Earth ESS2 B: Plate Tectonics and Large-Scale System Interactions ESS3 A: Natural Resources PS1 A: Structure and Properties of Matter PS1 B: Chemical Reactions	Energy and Matter: Flows, Cycles, and Conservation Cycles, and Conservation Structure and Function

Highlighted California Environmental Principles & 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

Principle III Natural systems proceed through cycles that humans depend upon, benefit from and can alter

Principle IV The exchange of matter between natural systems and human societies affects the long-term functioning of both

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

Instructional Segment 4: Sustaining Biodiversity and Ecosystem Services in a Changing World

Preferred Integrated – Grade 7 – Instructional Segment 4: Sustaining Biodiversity and Ecosystems Service in a Changing World
Guiding Questions: • What natural processes and human activities threaten biodiversity and ecosystem services? • How can people help sustain biodiversity and ecosystem services in a changing world?

Students who demonstrate understanding can:

MS- LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.* [Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]

MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. [Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.]

MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. [Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]

MS-PS1-3 Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.] ***[Assessment***

Boundary: Assessment is limited to qualitative information.] (Assess after being introduced in IS1 and IS3)

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 Analyzing and Interpreting Data Constructing Explanations and Designing Solutions Engaging in Argument from Evidence Obtaining, Evaluating, and Communicating Information	LS2.C Ecosystem Dynamics, Functioning and Resilience LS4.D Biodiversity and Humans ESS2.A Earth Materials and Systems ESS2.C Roles of Water in Earth's Surface Processes PS1 B: Chemical Reactions ESS3.B Natural Hazards PS1.B: Structure and Properties of Matter ETS1.A: Defining and Delimiting Engineering Problems	Patterns Cause and Effect Scale, Proportion and Quantity Structure and Function Structure and Function Stability and Change

	ETS1.B: Developing Possible Solutions ETS1.C: Optimizing the Design Solution	

Highlighted California Environmental Principles & 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.
Principle III Natural systems proceed through cycles that humans depend upon, benefit from and can alter.
Principle IV The exchange of matter between natural systems and human societies affects the long term functioning of both.
Principle V Decisions affecting resources and natural systems are complex and involve many factors.

***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