THE LIVING BOOK OF

SCIENCE FOR YOUNG LEARNERS

SCIENCE MASTER TITLE BIBLE

Kindergarten through Grade 8

9	54	270
GRADE LEVELS	CURRICULUM UNITS	MASTER LESSONS

A coherent, spiral K-8 science curriculum architecture

Life Science | Physical Science | Earth and Space Science | Engineering Design

Master Framework Edition v1.0
Prepared August 31, 2026

Purpose and Status of This Master Bible

Purpose. This document establishes the complete K-8 curriculum spine before age-specific scripts, narrated presentations, cinematic learning stories, classroom PPTs, investigations, assessments, or licensing packages are produced.

Status. Version 1.0 is the master framework for review. Lesson counts, unit order, and titles become production-locked only after final approval.

Core decision: Use one coherent K-8 progression, not disconnected grade-level products. Concepts return at increasing depth, with new models, evidence, mathematics, and engineering applications.

Curriculum Architecture

Grade Band	Grades	Lessons / Grade	Total	Instructional Emphasis
K-2 Foundations	K, 1, 2	24	72	Observe, describe, compare, recognize patterns, build simple models, and solve concrete problems.
Grades 3-5 Development	3, 4, 5	30	90	Measure, represent data, explain cause and effect, connect systems, and support claims with evidence.
Grades 6-8 Integration	6, 7, 8	36	108	Use particle, cellular, systems, evolutionary, geologic, force, wave, and space models to explain and design.

Total: 270 master lessons across 54 units. A master lesson is a content-production module, not necessarily one classroom period; it may support one to three classroom sessions plus investigation and assessment.

Design Principles

- **Three-dimensional learning:** Every unit integrates disciplinary core ideas, science and engineering practices, and crosscutting concepts.
- **Phenomenon and question first:** Each lesson begins with a driving question that can be investigated, modeled, or explained with evidence.
- **Spiral progression:** Ideas return at greater depth: visible patterns become mechanisms, components become systems, and qualitative observations become quantitative models.
- **Coherent domain balance:** Life, physical, Earth and space science, engineering, and the nature of science are connected rather than taught as isolated lists.
- **Developmentally appropriate precision:** Concepts are scientifically accurate but bounded to the reasoning, mathematics, scale, and evidence appropriate for each grade band.
- **Production readiness:** Each record provides a stable lesson code, title, driving question, and core knowledge statement for later scripts, videos, slides, activities, and assessments.

K-8 Scope and Sequence at a Glance

Grade	Year Theme	Unit Titles	Count
Kindergarten	Wonder and the World Around Us	The Scientist in Me; What Living Things Need; Plants, Animals, and Their Places; Pushes, Pulls, and Motion; Weather Watchers; Earth Materials and First Designs	24
Grade 1	Patterns, Signals, and Living Structures	Finding Evidence in Patterns; Structures Help Living Things; Light and Seeing; Sound and Communication; Sun, Moon, and Seasonal Patterns; Designs Inspired by Nature	24
Grade 2	Matter, Habitats, and a Changing Earth	Matter All Around Us; Changing and Combining Materials; Plants, Pollinators, and Seeds; Biodiversity and Habitats; Earth's Changing Surface; Mapping Land and Water	24
Grade 3	Forces, Life Cycles, and Environmental Change	Forces and Motion; Forces at a Distance; Life Cycles; Traits, Inheritance, and Variation; Ecosystems, Survival, and Change; Weather, Climate, and Hazards	30
Grade 4	Energy, Information, and a Dynamic Earth	Energy and Change; Waves, Light, and Information; Structures, Senses, and Survival; Reading Earth's Changing Surface; Natural Resources and Human Choices; Engineering with Energy and Information	30
Grade 5	Matter, Ecosystems, Earth Systems, and Space	Matter and Particles; Mixtures and Chemical Change; Energy and Matter in Organisms; Ecosystems Cycle Matter and Transfer Energy; Earth as a System of Systems; Earth, Sun, Stars, and Gravity	30
Grade 6	Matter, Cells, Energy, and Earth Systems	Evidence, Measurement, and Systems; Matter from Atoms to Materials; Energy and Thermal Systems; Cells and Organism Systems; Water, Weather, and Climate Systems; Human Impacts and Sustainable Systems	36
Grade 7	Chemical Change, Ecosystems, Heredity, and Earth History	Chemical Reactions; Ecosystem Interactions and Dynamics; Reproduction, Genes, and Inheritance; Evolution and Natural Selection; Earth's Deep History and Plate Tectonics; Dynamic Earth, Resources, and Risk	36
Grade 8	Forces, Waves, Space, and Integrated Engineering	Motion and Newtonian Forces; Gravity, Electricity, Magnetism, and Energy; Waves and Information Technologies; The Earth-Moon-Sun System; The Solar System and Universe; Integrated Science and Engineering Capstone	36

K-2 FOUNDATIONS

Kindergarten

Wonder and the World Around Us

Year architecture: 6 units | 24 master lessons | Spiral progression across science domains and engineering design

Unit 1: The Scientist in Me

Big Idea: Science begins with wonder, careful observation, safe exploration, and evidence.
Primary Standards Anchors: *Science and Engineering Practices; Patterns; K-2-ETS1*

Code	Title	Driving Question	Core Knowledge
K-01	**Science Starts with Wonder**	How can a question help us discover something new?	Scientists notice the world, ask questions, and look for evidence before deciding what an observation means.
K-02	**Using Our Senses Safely**	How do our senses help us observe?	Sight, hearing, smell, touch, and taste provide different information; safe science uses only the senses appropriate to the investigation.
K-03	**Same, Different, and Patterns**	What patterns can we find when we compare objects?	Objects can be described, sorted, and compared by observable features such as color, shape, size, texture, and number.
K-04	**From Question to Investigation**	What can we do when we want to find out?	A simple investigation includes a question, a safe plan, observations, a record of what happened, and a conclusion based on evidence.

Unit 2: What Living Things Need

Big Idea: Living things have needs, grow, and respond to the places where they live.
Primary Standards Anchors: *K-LS1-1; K-ESS3-1; Systems and System Models*

Code	Title	Driving Question	Core Knowledge
K-05	**Living or Nonliving?**	How can we tell whether something is alive?	Living things need resources, grow, and change; nonliving things do not carry out life processes even when they move or change.
K-06	**What Plants Need**	What helps a plant stay alive and grow?	Plants need water, light, air, nutrients, and enough space; plant needs can be investigated through repeated observation.
K-07	**What Animals Need**	What do animals need from their surroundings?	Animals need food, water, air, shelter, and suitable space, although the details differ among kinds of animals.
K-08	**What People Need**	How are human needs like the needs of other animals?	Humans are animals and share basic survival needs, while people also design homes, clothing, and tools to meet those needs.

Unit 3: Plants, Animals, and Their Places

Big Idea: Living things depend on their environments and can change them.
Primary Standards Anchors: *K-ESS2-2; K-ESS3-1, K-ESS3-3; Cause and Effect*

Code	Title	Driving Question	Core Knowledge
K-09	**A Place to Live**	Why do different living things live in different places?	A habitat provides the resources and conditions an organism needs; forests, ponds, deserts, and neighborhoods support different communities.
K-10	**Plants Change Their Surroundings**	How can a plant change the place where it grows?	Roots can move soil, leaves create shade, and fallen plant material becomes part of the ground.
K-11	**Animals Change Their Surroundings**	How can an animal change its home?	Animals dig, build, eat, carry materials, and leave wastes, producing observable changes in their environments.
K-12	**Caring for Our Shared Home**	What can people do to help living things?	People can reduce waste, protect water and habitats, and make choices that meet human needs while caring for other organisms.

Unit 4: Pushes, Pulls, and Motion

Big Idea: A push or pull can start, stop, speed up, slow down, or redirect an object.
Primary Standards Anchors: *K-PS2-1, K-PS2-2; K-2-ETS1; Cause and Effect*

Code	Title	Driving Question	Core Knowledge
K-13	**A Push Can Make Things Move**	What happens when we push an object?	The effect of a push depends on its strength and direction and on the object and surface involved.
K-14	**A Pull Can Make Things Move**	What happens when we pull an object?	Pulls can start or change motion; familiar examples include opening a drawer, tugging a wagon, and attracting some objects with a magnet.
K-15	**Changing Speed and Direction**	How can we change the way an object moves?	Stronger pushes and pulls generally cause larger changes in motion, while the direction of the force influences the direction of motion.
K-16	**Design a Safe Collision**	How can we protect an object when it bumps into something?	A design can reduce the effect of a collision by using barriers, padding, distance, or a change in shape; testing reveals improvements.

Unit 5: Weather Watchers

Big Idea: Weather changes from day to day, but observations reveal useful patterns.
Primary Standards Anchors: *K-ESS2-1; K-ESS3-2; Patterns*

Code	Title	Driving Question	Core Knowledge
K-17	**Look at the Sky**	What can the sky tell us about today's weather?	Clouds, sunlight, precipitation, and wind are observable parts of weather that can be recorded with words, pictures, and symbols.
K-18	**Warm, Cool, and Sunlight**	How does sunlight change the warmth of a place?	Sunlight warms Earth's surface; shade, time of day, cloud cover, and surface material can affect how warm a place becomes.

Code	Title	Driving Question	Core Knowledge
K-19	**Rain, Snow, Wind, and Clouds**	How can we describe different kinds of weather?	Weather can be described by temperature, cloud cover, precipitation, and wind; repeated observations reveal changes and patterns.
K-20	**Ready for Severe Weather**	How can weather information help keep us safe?	Forecasts and warning systems help people prepare for hazards by seeking shelter, dressing appropriately, and following a safety plan.

Unit 6: Earth Materials and First Designs

Big Idea: Earth materials have observable properties, and people choose materials to solve problems.
Primary Standards Anchors: *K-ESS3-1; K-2-ETS1-1, K-2-ETS1-2, K-2-ETS1-3*

Code	Title	Driving Question	Core Knowledge
K-21	**Rocks, Soil, Sand, and Water**	How are Earth materials alike and different?	Earth materials can be compared by size, color, texture, shape, hardness, and how they behave with water.
K-22	**Land and Water Around Us**	What shapes of land and water can we observe?	Land may be flat, steep, high, or low, while water collects and flows in places such as puddles, streams, ponds, lakes, and oceans.
K-23	**Choosing the Right Material**	Why are different objects made from different materials?	Materials are selected because their properties - such as strength, flexibility, absorbency, and transparency - fit a purpose.
K-24	**Build a Weather Shelter**	How can we design a shelter from sun, wind, or rain?	Engineers define a problem, compare material properties, build a model, test it under consistent conditions, and improve the design.

K-2 FOUNDATIONS

Grade 1

Patterns, Signals, and Living Structures

Year architecture: 6 units | 24 master lessons | Spiral progression across science domains and engineering design

Unit 1: Finding Evidence in Patterns

Big Idea: Careful measurements and records help scientists recognize patterns and make predictions.
Primary Standards Anchors: *Science and Engineering Practices; Patterns; K-2-ETS1*

Code	Title	Driving Question	Core Knowledge
1-01	**Observe, Measure, Compare**	How can measurements improve an observation?	Simple tools and agreed units make observations more precise and allow people to compare length, time, temperature, and amount.
1-02	**Record What Happens**	Why do scientists record observations?	Pictures, labels, tally marks, tables, and simple graphs preserve evidence and make changes easier to see.
1-03	**Patterns Help Us Predict**	How can a repeating pattern help us know what may happen next?	A pattern is a regularity in observations or data; reliable patterns can support predictions while new evidence can change them.
1-04	**Make a Fair Comparison**	How can we compare two ideas fairly?	A fair comparison changes one important condition, keeps others similar, uses the same measurement, and repeats observations.

Unit 2: Structures Help Living Things

Big Idea: Body parts and plant parts perform functions that support survival, growth, and communication.
Primary Standards Anchors: *1-LS1-1, 1-LS1-2, 1-LS3-1; Structure and Function*

Code	Title	Driving Question	Core Knowledge
1-05	**Plant Parts at Work**	How do roots, stems, leaves, flowers, fruits, and seeds help a plant?	Plant structures gather resources, support the body, reproduce, protect young plants, and disperse offspring.
1-06	**Animal Parts at Work**	How do body parts help animals survive?	Different structures help animals move, obtain food, breathe, protect themselves, sense information, and care for young.
1-07	**Senses Bring Information**	How does an animal learn what is happening around it?	Sense organs receive light, sound, chemicals, touch, or movement; the nervous system uses that information to guide responses.
1-08	**Parents and Offspring**	How are young living things like and unlike their parents?	Offspring are the same kind of organism as their parents and share many traits, but individuals are not exact copies.

Unit 3: Light and Seeing

Big Idea: Objects are seen when light from a source reaches them and then reaches our eyes.
Primary Standards Anchors: *1-PS4-2, 1-PS4-3; Cause and Effect*

Code	Title	Driving Question	Core Knowledge
1-09	**Sources of Light**	What makes its own light?	The Sun, flames, lamps, and some organisms produce light; many bright-looking objects only reflect light.
1-10	**Light Makes Seeing Possible**	Why is an object hard to see in the dark?	An object is visible when light illuminates it and light from the object enters the eye.
1-11	**Transparent, Translucent, or Opaque?**	What happens when light reaches different materials?	Materials transmit, scatter, reflect, or block different amounts of light and can be classified by these observable effects.
1-12	**Shadows Tell a Story**	How is a shadow formed and changed?	An opaque object blocks light to form a shadow; moving the light, object, or screen changes the shadow's position and size.

Unit 4: Sound and Communication

Big Idea: Vibrations produce sound, and patterned light or sound can carry information.
Primary Standards Anchors: *1-PS4-1, 1-PS4-4; Patterns; K-2-ETS1*

Code	Title	Driving Question	Core Knowledge
1-13	**Sound Begins with a Vibration**	What is moving when we hear a sound?	A vibrating object makes the surrounding material vibrate, creating sound that can be detected by ears or instruments.
1-14	**High, Low, Loud, and Soft**	How can sounds be different?	Faster vibrations are associated with higher pitch, while larger vibrations generally produce louder sounds.
1-15	**Sound Travels to Us**	How can a sound reach us from far away?	Sound requires matter and can travel through gases, liquids, and solids; distance and barriers can change what is heard.
1-16	**Send a Message**	How can light or sound carry a coded message?	A sequence of flashes, taps, or tones can represent information when sender and receiver share the same code.

Unit 5: Sun, Moon, and Seasonal Patterns

Big Idea: Objects in the sky show patterns that can be observed, recorded, and predicted.
Primary Standards Anchors: *1-ESS1-1, 1-ESS1-2; Patterns*

Code	Title	Driving Question	Core Knowledge
1-17	**The Sun's Daily Path**	What pattern does the Sun appear to follow?	The Sun appears in different positions across the day, producing a predictable pattern from sunrise to sunset.
1-18	**The Moon Changes Appearance**	Why does the Moon look different on different nights?	The Moon's visible shape changes in a repeating sequence called phases; the Moon itself does not change shape.
1-19	**Stars in the Night Sky**	What patterns can we notice among stars?	Stars form recognizable patterns from Earth, and the night sky changes predictably with time and season.

Code	Title	Driving Question	Core Knowledge
1-20	**Daylight Through the Year**	Why are some days longer than others?	The amount of daylight changes in a yearly pattern, with longer and shorter days associated with seasons.

Unit 6: Designs Inspired by Nature

Big Idea: People can study living structures and communication systems to inspire useful designs.
Primary Standards Anchors: *1-LS1-1; K-2-ETS1-1, K-2-ETS1-2, K-2-ETS1-3*

Code	Title	Driving Question	Core Knowledge
1-21	**Nature Solves Problems**	What can we learn from the structures of living things?	A living structure is suited to functions such as protection, movement, attachment, water collection, or temperature control.
1-22	**Copy the Function, Not the Organism**	How can a natural structure inspire a human design?	Biomimicry identifies a useful function in nature and represents it in a material, shape, or mechanism designed for a human need.
1-23	**Build and Test a Model**	How can a model show whether an idea may work?	A model is a simplified representation used to test criteria; evidence from repeated tests reveals strengths and weaknesses.
1-24	**Improve the Nature-Inspired Design**	How can feedback make a design better?	Engineers compare test results with criteria and constraints, then revise one feature at a time to improve performance.

K-2 FOUNDATIONS

Grade 2

Matter, Habitats, and a Changing Earth

Year architecture: 6 units | 24 master lessons | Spiral progression across science domains and engineering design

Unit 1: Matter All Around Us

Big Idea: Matter can be described and classified by observable properties.

Primary Standards Anchors: *2-PS1-1, 2-PS1-3; Patterns*

Code	Title	Driving Question	Core Knowledge
2-01	**Everything Is Made of Matter**	What do solids, liquids, and gases have in common?	Matter takes up space and has mass; it occurs as solids, liquids, and gases with different observable behaviors.
2-02	**Properties Help Us Describe Matter**	Which properties are useful for identifying a material?	Color, texture, hardness, flexibility, absorbency, magnetism, transparency, and state are observable properties used to compare materials.
2-03	**Classifying Solids and Liquids**	How can we group materials by how they behave?	Solids maintain their own shape, while liquids flow and take the shape of their container; both have measurable amounts.
2-04	**Pieces of the Same Material**	Do small pieces keep the properties of the original material?	Breaking an object changes size and shape but generally does not change the material or its characteristic properties.

Unit 2: Changing and Combining Materials

Big Idea: Materials can change physically or form new materials, and properties guide their use.

Primary Standards Anchors: *2-PS1-2, 2-PS1-4; K-2-ETS1; Cause and Effect*

Code	Title	Driving Question	Core Knowledge
2-05	**Heating and Cooling Matter**	How can temperature change a material?	Heating and cooling can melt, freeze, soften, harden, expand, or contract materials; some changes can be reversed.
2-06	**Reversible or Irreversible?**	Can every material be changed back?	Some changes, such as melting and freezing, are reversible, while cooking, burning, or rusting produces changes that are difficult to reverse.
2-07	**Combining Materials**	What can happen when materials are mixed together?	A mixture contains two or more materials; components may retain properties or interact to produce a material with different properties.
2-08	**Build with the Best Materials**	How do engineers choose materials for a structure?	Material selection depends on properties, purpose, cost, availability, and safety; tests provide evidence for a design decision.

Unit 3: Plants, Pollinators, and Seeds

Big Idea: Plants depend on environmental resources and on processes that help them reproduce.
Primary Standards Anchors: *2-LS2-1, 2-LS2-2; Structure and Function*

Code	Title	Driving Question	Core Knowledge
2-09	**Light and Water for Plants**	How do light and water affect plant growth?	Plants require light and water; controlled observations can show how changing access to either resource affects growth.
2-10	**From Seed to Seed**	What stages make up a flowering plant's life cycle?	Germination, growth, flowering, pollination, fruit formation, and seed dispersal form a repeating life cycle.
2-11	**Pollinators at Work**	How do animals help flowering plants reproduce?	Many animals transfer pollen between flowers while seeking food, enabling plants to form seeds and fruits.
2-12	**Seeds on the Move**	How do seeds travel to new places?	Seed structures enable dispersal by wind, water, animals, or gravity, reducing competition near the parent plant.

Unit 4: Biodiversity and Habitats

Big Idea: Different habitats contain different communities, and biodiversity can be observed and compared.
Primary Standards Anchors: *2-LS4-1; Patterns; Systems and System Models*

Code	Title	Driving Question	Core Knowledge
2-13	**What Makes a Habitat?**	How does a habitat meet the needs of organisms?	A habitat includes living and nonliving components that provide resources and conditions for a community of organisms.
2-14	**Life on Land and in Water**	How do organisms differ across habitats?	Terrestrial and aquatic habitats differ in temperature, water, light, oxygen, soil, and the kinds of organisms they support.
2-15	**Microhabitats: Small Places, Many Lives**	What can live in a very small habitat?	A log, leaf litter, schoolyard patch, or puddle can form a microhabitat with its own resources and organisms.
2-16	**Counting the Variety of Life**	How can we compare biodiversity in two places?	Biodiversity is the variety of living things in an area and can be compared through consistent observations and counts.

Unit 5: Earth's Changing Surface

Big Idea: Earth's surface changes through events that occur at different speeds.
Primary Standards Anchors: *2-ESS1-1, 2-ESS2-1; Stability and Change*

Code	Title	Driving Question	Core Knowledge
2-17	**Fast and Slow Earth Changes**	Which Earth changes happen quickly, and which take a long time?	Earthquakes, eruptions, floods, weathering, erosion, and deposition change land at rates ranging from sudden to extremely slow.
2-18	**Weathering Breaks Rock**	How can large rocks become smaller pieces?	Water, ice, wind, plant roots, and temperature changes can break rock into smaller particles without changing it into a new substance.
2-19	**Erosion Moves Earth Materials**	What moves weathered rock and soil?	Flowing water, wind, ice, and gravity transport sediment from one place to another.

Code	Title	Driving Question	Core Knowledge
2-20	**Deposition Builds New Land**	Where does moved sediment go?	When water, wind, or ice slows, sediment is deposited, building features such as deltas, beaches, dunes, and sandbars.

Unit 6: Mapping Land and Water

Big Idea: Maps show patterns in Earth features, and engineering can reduce erosion and flood damage.
Primary Standards Anchors: *2-ESS2-2, 2-ESS2-3; K-2-ETS1*

Code	Title	Driving Question	Core Knowledge
2-21	**Mountains, Valleys, Plains, and Coasts**	How can we describe the shape of land?	Landforms are recognizable shapes of Earth's surface created and changed by geologic and surface processes.
2-22	**Rivers, Lakes, Wetlands, and Oceans**	Where is water found on Earth's surface?	Water occurs in connected bodies of different sizes and salinity, from streams and ponds to lakes, wetlands, seas, and oceans.
2-23	**Reading a Physical Map**	How can a map represent land and water?	Symbols, colors, scale, direction, and elevation cues allow a flat map or model to represent the location and shape of features.
2-24	**Design to Slow Erosion**	How can we keep soil from washing or blowing away?	Plants, barriers, terraces, and channels can slow moving water or wind; fair tests compare how well designs retain soil.

GRADES 3-5 DEVELOPMENT

Grade 3

Forces, Life Cycles, and Environmental Change

Year architecture: 6 units | 30 master lessons | Spiral progression across science domains and engineering design

Unit 1: Forces and Motion

Big Idea: Forces change motion, and patterns of motion can be measured and predicted.

Primary Standards Anchors: *3-PS2-1, 3-PS2-2; Patterns; Cause and Effect*

Code	Title	Driving Question	Core Knowledge
3-01	**Describing Position and Motion**	How can we describe where an object is and how it moves?	Position is described relative to a reference point; motion is a change in position over time and may include speed and direction.
3-02	**Forces Are Pushes and Pulls**	How does a force affect motion?	A force can start, stop, speed up, slow down, or redirect an object, depending on its direction and strength.
3-03	**Balanced and Unbalanced Forces**	Why do some forces change motion while others do not?	Balanced forces have no net effect on motion, while unbalanced forces produce a change in speed or direction.
3-04	**Patterns of Motion**	What can repeated motion tell us?	Some motions repeat in predictable patterns, including swinging, rolling, bouncing, and orbit-like paths.
3-05	**Predicting Motion with Evidence**	How can past observations help predict future motion?	Measurements from repeated trials can reveal a stable pattern that supports a testable prediction.

Unit 2: Forces at a Distance

Big Idea: Magnetic and electric interactions can exert forces without direct contact.

Primary Standards Anchors: *3-PS2-3, 3-PS2-4; Energy and Matter*

Code	Title	Driving Question	Core Knowledge
3-06	**Contact and Noncontact Forces**	Can one object push or pull another without touching it?	Contact forces require touching, while gravitational, magnetic, and electric forces can act across a distance.
3-07	**Magnetic Poles and Patterns**	Why do magnets sometimes attract and sometimes repel?	Unlike magnetic poles attract and like poles repel, creating consistent interaction patterns.
3-08	**Static Electric Attraction**	How can a charged object attract something nearby?	Rubbing some materials transfers electric charge, producing temporary attraction or repulsion between objects.
3-09	**Distance Changes Force**	How does distance affect magnetic or electric interaction?	Noncontact interactions generally become stronger at shorter distances and weaker at greater distances.
3-10	**Design with Magnets**	How can magnetic force solve a practical problem?	Magnetic properties can be used in closures, sorting devices, levitation models, sensors, and moving mechanisms.

Unit 3: Life Cycles

Big Idea: Organisms pass through ordered life stages, reproduce, and continue their kind.
Primary Standards Anchors: *3-LS1-1; Patterns*

Code	Title	Driving Question	Core Knowledge
3-11	**Every Organism Has a Life Cycle**	What do all life cycles have in common?	Every organism begins life, grows, develops, reproduces if conditions allow, and eventually dies.
3-12	**The Life Cycle of a Flowering Plant**	How does a flowering plant produce a new generation?	Seeds germinate, plants mature, flowers are pollinated, and fruits protect and disperse new seeds.
3-13	**Life Cycles with Metamorphosis**	How can a young animal look very different from the adult?	Some animals undergo major body changes, as in the egg-larva-pupa-adult cycle of many insects or tadpole-to-frog development.
3-14	**Life Cycles Without Metamorphosis**	How do young birds, reptiles, and mammals develop?	Many young animals resemble smaller forms of adults and gradually change in size, proportions, skills, and independence.
3-15	**Comparing Life-Cycle Models**	How can a model reveal similarities and differences among life cycles?	Cycle diagrams show sequence and repetition, allowing comparison of stages, timing, reproduction, and dependence on the environment.

Unit 4: Traits, Inheritance, and Variation

Big Idea: Organisms inherit traits, individuals vary, and environments influence development.
Primary Standards Anchors: *3-LS3-1, 3-LS3-2, 3-LS4-2; Patterns*

Code	Title	Driving Question	Core Knowledge
3-16	**What Is a Trait?**	Which features or behaviors can be called traits?	A trait is an observable characteristic of an organism, including structures, colors, sizes, patterns, and some behaviors.
3-17	**Inherited Traits**	Why do offspring resemble their parents?	Many traits are passed from parents to offspring through inherited information, creating family resemblance.
3-18	**Variation Within a Species**	Why are members of the same species not identical?	Individuals inherit different combinations of traits, so a population contains variation even though its members share key characteristics.
3-19	**Environment Affects Traits**	How can surroundings influence the way a trait develops?	Nutrition, light, water, temperature, activity, and experience can influence growth and observable traits without changing species identity.
3-20	**Traits and Survival**	How can a trait be helpful in one environment?	A trait can improve access to food, protection, movement, reproduction, or tolerance of conditions, but usefulness depends on the environment.

Unit 5: Ecosystems, Survival, and Change

Big Idea: Organisms interact in groups and ecosystems, and environmental changes affect survival.
Primary Standards Anchors: *3-LS2-1, 3-LS4-1, 3-LS4-3, 3-LS4-4*

Code	Title	Driving Question	Core Knowledge
3-21	**Living in Groups**	How can group living help animals survive?	Groups can improve defense, hunting, migration, warmth, learning, and care of young, while also increasing competition.
3-22	**Food Chains Connect Organisms**	How does energy move through a simple ecosystem?	Energy moves from the Sun to producers and then to consumers; decomposers use dead material and return matter to the environment.
3-23	**When Environments Change**	What happens when an ecosystem becomes hotter, drier, wetter, or disturbed?	Organisms may move, adjust behavior, reproduce differently, decline, or die when conditions and resources change.
3-24	**Fossils Reveal Past Life**	How can a fossil tell us about an ancient environment?	Fossils preserve evidence of past organisms and, together with rock context, reveal how environments and communities have changed.
3-25	**Protecting a Habitat**	How can people reduce harm caused by an environmental change?	A solution should address a specific cause, use evidence, consider organisms and people, and be tested against criteria and constraints.

Unit 6: Weather, Climate, and Hazards

Big Idea: Weather data reveal patterns, climate describes long-term conditions, and preparation reduces hazard impacts.
Primary Standards Anchors: *3-ESS2-1, 3-ESS2-2, 3-ESS3-1; 3-5-ETS1*

Code	Title	Driving Question	Core Knowledge
3-26	**Measuring Weather**	Which measurements describe the atmosphere today?	Temperature, precipitation, wind speed and direction, cloud cover, humidity, and air pressure are measured with specialized tools.
3-27	**Weather Data and Maps**	How can many observations be combined to show a weather pattern?	Tables, graphs, symbols, and maps organize weather data across time and location, supporting comparisons and forecasts.
3-28	**Weather Is Not Climate**	How is climate different from today's weather?	Weather is the short-term state of the atmosphere; climate is the long-term pattern and range of weather in a region.
3-29	**Hazardous Weather**	Why do thunderstorms, tornadoes, hurricanes, floods, droughts, and blizzards matter?	Weather hazards form under particular conditions and can threaten lives, ecosystems, buildings, transportation, water, and power systems.
3-30	**Design for Weather Safety**	How can a community reduce the impact of severe weather?	Warnings, shelters, drainage, building features, emergency supplies, and communication plans reduce risk when matched to local hazards.

GRADES 3-5 DEVELOPMENT

Grade 4

Energy, Information, and a Dynamic Earth

Year architecture: 6 units | 30 master lessons | Spiral progression across science domains and engineering design

Unit 1: Energy and Change

Big Idea: Energy can be stored, moved, and transformed, producing observable change.

Primary Standards Anchors: *4-PS3-1, 4-PS3-2, 4-PS3-3; Energy and Matter*

Code	Title	Driving Question	Core Knowledge
4-01	**Energy Makes Change Possible**	What evidence shows that energy is present?	Motion, sound, light, heating, and electrical effects are evidence that energy is being stored, transferred, or transformed.
4-02	**Energy of Motion**	How does speed affect the energy of a moving object?	A faster object has more kinetic energy than the same object moving slowly and can produce a larger change in a collision.
4-03	**Stored Energy**	Where can energy be stored before something moves?	Energy can be stored in raised objects, stretched materials, compressed springs, fuels, foods, and batteries.
4-04	**Energy Transfers Between Objects**	How can energy move from one object to another?	Collisions, electric currents, light, sound, and heating can transfer energy between objects or systems.
4-05	**Energy Changes Form**	How can one device produce several energy effects?	Devices transform energy, such as electrical energy into light, sound, motion, or thermal energy, while total energy is accounted for.

Unit 2: Waves, Light, and Information

Big Idea: Waves carry energy and can be used to represent and transmit information.

Primary Standards Anchors: *4-PS4-1, 4-PS4-2, 4-PS4-3; Patterns*

Code	Title	Driving Question	Core Knowledge
4-06	**Patterns in Waves**	Which features of a wave repeat?	A wave has a repeating pattern described by features such as wavelength, amplitude, crest, and trough.
4-07	**Amplitude and Energy**	How does wave amplitude affect what we observe?	Greater amplitude represents more energy and is associated with effects such as louder sound or larger water-wave motion.
4-08	**Light Reflects from Objects**	How does reflected light allow us to see?	Light from a source reflects from objects and enters the eye, where sensory cells send information to the brain.
4-09	**Light Changes Direction**	What can happen when light meets a surface or new material?	Light may be reflected, absorbed, transmitted, or refracted depending on the material and angle.
4-10	**Information in Codes**	How can patterns represent words, images, or numbers?	Information can be encoded as patterns of symbols, signals, or binary states, then transmitted, received, and decoded.

Unit 3: Structures, Senses, and Survival

Big Idea: Internal and external structures work together to support survival, growth, behavior, and reproduction.
Primary Standards Anchors: *4-LS1-1, 4-LS1-2; Structure and Function*

Code	Title	Driving Question	Core Knowledge
4-11	**Structures Have Functions**	How does the shape or arrangement of a structure support its job?	A biological structure's form, material, and location contribute to functions such as support, transport, protection, movement, and exchange.
4-12	**Plant Systems Working Together**	How do roots, stems, and leaves function as a system?	Roots absorb and anchor, stems support and transport, and leaves capture light and exchange gases; each depends on the others.
4-13	**Animal Body Systems**	How do body systems cooperate to keep an animal alive?	Digestive, respiratory, circulatory, skeletal, muscular, nervous, and excretory systems perform specialized but interdependent functions.
4-14	**From Sensation to Response**	How does information from the environment lead to behavior?	Sensory receptors detect stimuli, the brain processes signals, and muscles or glands produce a response.
4-15	**Comparing Structure and Function**	How can different structures perform a similar function?	Wings, fins, legs, roots, and protective coverings show that organisms can solve similar functional problems in different ways.

Unit 4: Reading Earth's Changing Surface

Big Idea: Rocks, fossils, maps, and landforms provide evidence of Earth processes over time.
Primary Standards Anchors: *4-ESS1-1, 4-ESS2-1, 4-ESS2-2; Patterns*

Code	Title	Driving Question	Core Knowledge
4-16	**Rock Layers Record Change**	What story can layers of rock tell?	Sedimentary layers accumulate over time; their order, composition, and structures preserve a relative record of past conditions.
4-17	**Fossils and Ancient Environments**	How can a fossil reveal where and how an organism lived?	Fossil type and surrounding rock provide evidence of past organisms, climates, water depth, and environmental change.
4-18	**Weathering, Erosion, and Deposition**	How do surface processes reshape land?	Weathering breaks material, erosion transports it, and deposition places it elsewhere, continually modifying landforms.
4-19	**Maps Reveal Earth Patterns**	What patterns appear when landforms, earthquakes, and volcanoes are mapped?	Mountain ranges, trenches, earthquake zones, and volcanoes occur in broad geographic patterns rather than randomly.
4-20	**Volcanoes and Earthquakes**	How can sudden geologic events change Earth's surface?	Movement within Earth can release energy, deform land, produce earthquakes, and move molten rock to the surface.

Unit 5: Natural Resources and Human Choices

Big Idea: People obtain energy and materials from Earth, and choices have benefits, costs, and environmental effects.

Primary Standards Anchors: *4-ESS3-1, 4-ESS3-2; Cause and Effect*

Code	Title	Driving Question	Core Knowledge
4-21	**Earth Provides Resources**	Which materials and energy sources come from Earth?	People use water, soil, forests, minerals, sunlight, wind, flowing water, and fuels to meet needs and build societies.
4-22	**Renewable and Nonrenewable Resources**	Why can some resources be replaced more quickly than others?	Renewable resources are replenished on human time scales when managed well; nonrenewable resources form far more slowly than they are used.
4-23	**Fuels and Their Effects**	What happens when people use fuels for energy?	Burning fuels releases usable energy and also produces emissions and waste; extraction and transport can alter environments.
4-24	**Comparing Energy Choices**	How can evidence guide an energy decision?	Energy sources differ in reliability, cost, location, land use, emissions, waste, and effects on organisms and communities.
4-25	**Reducing Earth-Hazard Impacts**	How can people prepare for earthquakes, floods, landslides, or volcanic hazards?	Monitoring, mapping, land-use planning, engineering, warnings, and emergency practice can reduce harm without eliminating the hazard.

Unit 6: Engineering with Energy and Information

Big Idea: Engineering uses scientific ideas, criteria, constraints, models, tests, and iteration.

Primary Standards Anchors: *4-PS3-4, 4-PS4-3; 3-5-ETS1-1, 3-5-ETS1-2, 3-5-ETS1-3*

Code	Title	Driving Question	Core Knowledge
4-26	**Define the Engineering Problem**	What must a successful design do?	A clear problem statement identifies the user, need, measurable criteria, constraints, and relevant scientific information.
4-27	**Design an Energy Device**	How can stored or transferred energy perform a task?	A device can transform energy to move an object, produce light or sound, or change temperature; diagrams show energy pathways.
4-28	**Design a Communication System**	How can a signal send information accurately?	A communication system requires an encoded message, transmitter, pathway, receiver, and method for checking accuracy.
4-29	**Test One Variable at a Time**	How can testing reveal which design feature matters?	Controlled testing changes one feature, measures an outcome consistently, and repeats trials to distinguish patterns from chance.
4-30	**Improve and Explain the Design**	What evidence justifies a design change?	Engineers use test data to revise a model and explain how each change improves performance relative to criteria and constraints.

GRADES 3-5 DEVELOPMENT

Grade 5

Matter, Ecosystems, Earth Systems, and Space

Year architecture: 6 units | 30 master lessons | Spiral progression across science domains and engineering design

Unit 1: Matter and Particles

Big Idea: Matter is made of particles too small to see, and measurable properties identify materials.
Primary Standards Anchors: *5-PS1-1, 5-PS1-3; Scale, Proportion, and Quantity*

Code	Title	Driving Question	Core Knowledge
5-01	**Matter Is Made of Particles**	How can a model explain matter we cannot see directly?	All matter is composed of particles too small to see individually; particle models explain observable properties and changes.
5-02	**Solids, Liquids, and Gases in the Particle Model**	How does particle motion differ among states of matter?	Particles are closely arranged in solids, flow past one another in liquids, and move freely with wide spacing in gases.
5-03	**Measuring Matter**	Which measurements describe an amount of matter?	Mass measures the amount of matter, while volume measures occupied space; appropriate tools and units improve precision.
5-04	**Characteristic Properties**	How can properties help identify an unknown material?	Density, solubility, conductivity, magnetism, hardness, and response to temperature can distinguish substances and materials.
5-05	**Matter Is Conserved**	Where does matter go during a physical change?	Matter remains present during changes of state, dissolving, and rearrangement, even when it is difficult to see or collect.

Unit 2: Mixtures and Chemical Change

Big Idea: Matter can be mixed, separated, or rearranged into new substances while total mass is conserved.
Primary Standards Anchors: *5-PS1-2, 5-PS1-4; Energy and Matter*

Code	Title	Driving Question	Core Knowledge
5-06	**Mixtures Keep Their Parts**	How is a mixture different from a pure substance?	In a mixture, substances are physically combined and retain characteristic properties, although they may be difficult to distinguish.
5-07	**Solutions and Dissolving**	What happens when a solute dissolves?	Solute particles disperse among solvent particles to form a uniform solution; the matter remains present and can sometimes be recovered.
5-08	**Separating Mixtures**	Which property can be used to separate each mixture?	Filtering, screening, settling, evaporation, magnetism, and chromatography separate components by differences in physical properties.
5-09	**Evidence of a Chemical Change**	How can we tell whether new substances formed?	Color change, gas production, precipitate formation, odor, light, or temperature change can be evidence of a chemical reaction when alternatives are excluded.

Code	Title	Driving Question	Core Knowledge
5-10	**Conservation During Change**	Does mass disappear when substances react or dissolve?	In a closed system, total mass remains constant during physical and chemical changes because atoms are rearranged, not destroyed.

Unit 3: Energy and Matter in Organisms

Big Idea: Plants capture energy and build matter; animals obtain both energy and matter by eating.
Primary Standards Anchors: *5-PS3-1, 5-LS1-1; Energy and Matter*

Code	Title	Driving Question	Core Knowledge
5-11	**The Sun Powers Most Life**	Where does the energy in food begin?	Most food energy can be traced to sunlight captured by photosynthetic organisms.
5-12	**Plants Build Their Own Food**	How can a plant make sugar without eating?	Plants use light energy to combine carbon dioxide and water into sugars, storing energy in chemical form and releasing oxygen.
5-13	**Where Plant Mass Comes From**	How can a tiny seed become a large tree?	Most new plant mass comes from carbon dioxide and water incorporated into sugars and other molecules, not mainly from soil.
5-14	**Animals Obtain Matter and Energy**	Why must animals eat?	Animals consume food molecules for energy, growth, repair, movement, and production of wastes and body materials.
5-15	**Body Systems Move Resources**	How do materials reach every cell in a large organism?	Digestive and respiratory systems obtain nutrients and gases, while circulatory and excretory systems transport materials and remove wastes.

Unit 4: Ecosystems Cycle Matter and Transfer Energy

Big Idea: Matter cycles through ecosystems while energy moves through and eventually leaves as heat.
Primary Standards Anchors: *5-LS2-1; Systems and System Models; Energy and Matter*

Code	Title	Driving Question	Core Knowledge
5-16	**Producers, Consumers, and Decomposers**	What roles do organisms play in an ecosystem?	Producers build food, consumers obtain food from other organisms, and decomposers break down dead matter and wastes.
5-17	**Food Webs, Not Just Food Chains**	Why is a food web a better model of an ecosystem?	Most organisms have multiple feeding relationships, so interconnected food chains form a food web with alternative energy pathways.
5-18	**Matter Cycles Through Ecosystems**	How can the same matter become part of many organisms?	Water, carbon-containing matter, minerals, and gases move among organisms, air, water, and soil through feeding, growth, waste, death, and decomposition.
5-19	**Energy Flows One Way**	Why must ecosystems receive a continuing energy input?	Energy enters mainly as sunlight, is transferred through feeding, and is gradually released as heat rather than recycled.
5-20	**Ecosystem Change and Stability**	What helps an ecosystem continue functioning after change?	Diversity, available resources, connected populations, and the scale of disturbance influence ecosystem resistance and recovery.

Unit 5: Earth as a System of Systems

Big Idea: Earth's geosphere, hydrosphere, atmosphere, and biosphere interact, and water connects them.
Primary Standards Anchors: *5-ESS2-1, 5-ESS2-2, 5-ESS3-1; Systems and System Models*

Code	Title	Driving Question	Core Knowledge
5-21	**Earth's Four Interacting Spheres**	How do air, water, rock, and life affect one another?	The atmosphere, hydrosphere, geosphere, and biosphere exchange matter and energy, so a change in one sphere can affect others.
5-22	**The Water Cycle**	What moves water through Earth systems?	Solar energy drives evaporation and gravity drives precipitation and flow, cycling water through the atmosphere, surface, ground, ice, and organisms.
5-23	**Where Earth's Water Is Stored**	Why is usable fresh water limited?	Most Earth water is salty ocean water; much fresh water is frozen or underground, leaving a small accessible fraction in lakes, rivers, soil, and air.
5-24	**Interactions Shape Local Environments**	How can one event affect several Earth spheres?	A storm, drought, eruption, wildfire, or land-use change can alter air, water, land, organisms, and their interactions.
5-25	**Protecting Water and Earth Systems**	How can communities reduce damage to shared resources?	Monitoring, conservation, pollution prevention, habitat protection, and evidence-based policy can reduce harmful effects while meeting human needs.

Unit 6: Earth, Sun, Stars, and Gravity

Big Idea: Gravity shapes motion, and predictable sky patterns arise from Earth's rotation and orbit.
Primary Standards Anchors: *5-PS2-1, 5-ESS1-1, 5-ESS1-2; Scale, Proportion, and Quantity*

Code	Title	Driving Question	Core Knowledge
5-26	**Gravity Pulls Toward Earth's Center**	What does down mean on a spherical Earth?	Near Earth's surface, gravity pulls objects toward Earth's center, so local down points inward from every location.
5-27	**The Sun Is Our Star**	How is the Sun like other stars?	The Sun is a medium-sized star that appears larger and brighter than others because it is vastly closer to Earth.
5-28	**Brightness and Distance**	Why can a distant star look dim even if it is powerful?	Apparent brightness depends on both an object's light output and its distance from the observer.
5-29	**Daily and Seasonal Sky Patterns**	What motions explain changing shadows and star patterns?	Earth's rotation produces daily sky motion, while Earth's orbit and tilted axis produce yearly changes in daylight and visible constellations.
5-30	**Modeling the Scale of the Solar System**	How can a model represent distances too large to experience directly?	Scale models preserve selected proportions while simplifying actual sizes and distances; every model has useful features and limitations.

GRADES 6-8 INTEGRATION

Grade 6

Matter, Cells, Energy, and Earth Systems

Year architecture: 6 units | 36 master lessons | Spiral progression across science domains and engineering design

Unit 1: Evidence, Measurement, and Systems

Big Idea: Scientific knowledge grows through testable questions, reliable measurements, models, and evidence-based explanation.

Primary Standards Anchors: *MS Science and Engineering Practices; Crosscutting Concepts; MS-ETS1*

Code	Title	Driving Question	Core Knowledge
6-01	**Questions Science Can Investigate**	What makes a question testable?	A testable question identifies variables or observations that can be measured with available methods and evidence.
6-02	**Measurement, Units, and Uncertainty**	Why is every measurement an estimate?	Measurements include a value, unit, and limited precision; repeated trials and appropriate tools reduce but do not eliminate uncertainty.
6-03	**Variables and Controlled Investigations**	How can an investigation isolate cause and effect?	A controlled investigation changes an independent variable, measures a dependent variable, and controls relevant conditions.
6-04	**Data Displays and Relationships**	Which graph best reveals the pattern in a data set?	Tables and graphs should match variable types and can reveal trends, clusters, correlations, outliers, and limits in evidence.
6-05	**Models Explain and Predict**	Why use a model instead of the real system?	Physical, conceptual, mathematical, and computational models emphasize selected features to explain, predict, and test ideas; all have limitations.
6-06	**Thinking in Systems**	How do boundaries, inputs, outputs, and interactions clarify a complex phenomenon?	A system model identifies components, interactions, flows of matter or energy, feedback, scale, and what lies outside the chosen boundary.

Unit 2: Matter from Atoms to Materials

Big Idea: Atomic and molecular structure explains the properties and states of matter.

Primary Standards Anchors: *MS-PS1-1, MS-PS1-3, MS-PS1-4; Structure and Function*

Code	Title	Driving Question	Core Knowledge
6-07	**Atoms: Building Blocks of Matter**	What evidence supports the idea that matter is particulate?	Matter is composed of atoms, whose behavior can be inferred from observations such as diffusion, compression, dissolving, and conservation.
6-08	**Elements and the Periodic Table**	How does the periodic table organize kinds of atoms?	An element contains one kind of atom, and the periodic table organizes elements by atomic number and repeating property patterns.

Code	Title	Driving Question	Core Knowledge
6-09	**Molecules and Compounds**	How do atoms combine to make new substances?	Atoms bond in specific ratios to form molecules or extended structures; a compound has properties different from its component elements.
6-10	**Particle Motion and States of Matter**	How does particle motion explain solids, liquids, and gases?	State depends on particle energy, spacing, and attraction; temperature and pressure can shift the balance and cause phase changes.
6-11	**Density and Material Identity**	Why do equal volumes of different materials have different masses?	Density is mass per unit volume and is a characteristic property that helps identify substances and predict floating or sinking.
6-12	**Mixtures, Solutions, and Separation**	How can particle properties separate a mixture?	Mixtures combine substances without fixed chemical ratios; differences in size, density, solubility, boiling point, or magnetism enable separation.

Unit 3: Energy and Thermal Systems

Big Idea: Energy is stored and transferred, and thermal phenomena emerge from particle motion and interactions.
Primary Standards Anchors: *MS-PS3-1, MS-PS3-2, MS-PS3-3, MS-PS3-4, MS-PS3-5*

Code	Title	Driving Question	Core Knowledge
6-13	**Kinetic and Potential Energy**	How can energy be stored or expressed as motion?	Kinetic energy depends on motion, while potential energy depends on position, configuration, or interactions within a system.
6-14	**Temperature and Particle Motion**	What does temperature measure at the particle level?	Temperature reflects average kinetic energy of particles, while thermal energy also depends on the amount and type of matter.
6-15	**Conduction, Convection, and Radiation**	How does thermal energy move?	Thermal energy transfers by particle collisions, bulk fluid motion, and electromagnetic radiation, often through more than one pathway.
6-16	**Phase Changes and Energy**	Why can matter change state without a temperature increase?	During a phase change, transferred energy changes particle arrangement and attractions rather than average kinetic energy.
6-17	**Energy Is Conserved**	Where does energy go when a system seems to lose it?	Energy transfers among objects and forms; apparent losses usually represent dispersal to the surroundings, often as less concentrated thermal energy.
6-18	**Engineer a Thermal Barrier**	How can a device control thermal energy transfer?	Insulation performance depends on material, thickness, surface, trapped air, and pathway; controlled tests guide iterative improvement.

Unit 4: Cells and Organism Systems

Big Idea: Cells are the basic units of life, and specialized structures form interacting organism systems.
Primary Standards Anchors: *MS-LS1-1, MS-LS1-2, MS-LS1-3, MS-LS1-6, MS-LS1-7*

Code	Title	Driving Question	Core Knowledge
6-19	**Cell Theory and the Microscope**	How did new tools change our understanding of life?	Cell theory states that organisms are made of cells, cells are basic units of life, and new cells arise from existing cells.

Code	Title	Driving Question	Core Knowledge
6-20	**Prokaryotic and Eukaryotic Cells**	How are cells alike and different?	All cells have membranes, genetic material, cytoplasm, and ribosomes; eukaryotic cells also contain a nucleus and membrane-bound organelles.
6-21	**Organelles as a Coordinated System**	How do cell structures work together?	Organelles and membranes divide labor for information storage, protein production, energy transformation, transport, recycling, and internal balance.
6-22	**From One Cell to Many**	What changes when an organism becomes multicellular?	Multicellular organisms use cell differentiation and communication to form tissues, organs, and systems with specialized functions.
6-23	**Body Systems and Homeostasis**	How do organ systems maintain stable internal conditions?	Nervous, endocrine, circulatory, respiratory, digestive, excretory, immune, and support systems coordinate feedback to maintain homeostasis.
6-24	**Photosynthesis and Cellular Respiration**	How are food molecules, oxygen, and energy connected?	Photosynthesis stores light energy in sugars, while cellular respiration releases usable energy by rearranging sugar and oxygen into carbon dioxide and water.

Unit 5: Water, Weather, and Climate Systems

Big Idea: Uneven solar heating, water movement, air circulation, and geography produce weather and climate patterns.

Primary Standards Anchors: *MS-ESS2-4, MS-ESS2-5, MS-ESS2-6; Systems and System Models*

Code	Title	Driving Question	Core Knowledge
6-25	**Earth's Spheres Exchange Matter and Energy**	How do Earth systems influence one another?	The geosphere, hydrosphere, atmosphere, biosphere, and cryosphere interact through flows of matter and energy across connected cycles.
6-26	**The Water Cycle as a Global System**	What drives water through Earth?	Solar energy powers evaporation and atmospheric transport, while gravity drives precipitation, runoff, infiltration, groundwater flow, and ice movement.
6-27	**Air Pressure and Wind**	Why does air move?	Uneven heating creates density and pressure differences; air moves from higher toward lower pressure and is redirected by Earth's rotation and surface friction.
6-28	**Air Masses, Fronts, and Storms**	How do interacting air masses change weather?	Air masses carry temperature and moisture properties; fronts lift air, forming clouds, precipitation, wind shifts, and sometimes severe storms.
6-29	**Climate Patterns Across Earth**	Why do regions have different climates?	Latitude, elevation, mountains, distance from water, ocean currents, vegetation, and atmospheric circulation shape long-term weather patterns.
6-30	**Oceans Regulate Climate**	How can moving ocean water affect distant places?	Oceans store and redistribute heat through currents, exchange water and gases with the atmosphere, and moderate coastal climate.

Unit 6: Human Impacts and Sustainable Systems

Big Idea: Human systems depend on Earth resources and can be redesigned to reduce risk and environmental harm.

Primary Standards Anchors: *MS-ESS3-1, MS-ESS3-3, MS-ESS3-4, MS-ESS3-5; MS-ETS1*

Code	Title	Driving Question	Core Knowledge
6-31	**Resources Are Unevenly Distributed**	Why are important resources concentrated in certain places?	Geologic, hydrologic, and biologic processes produce uneven distributions of minerals, fuels, soil, groundwater, and living resources.
6-32	**Population, Consumption, and Land Use**	What determines the size of a community's environmental impact?	Impact depends on population, per-person consumption, technology, infrastructure, land use, and how materials are produced, used, and discarded.
6-33	**Pollution Moves Through Systems**	How can pollution travel far from its source?	Pollutants move through air, water, soil, organisms, and food webs; persistence and concentration determine exposure and effects.
6-34	**Evidence of a Changing Climate**	How do scientists distinguish long-term climate change from weather variation?	Multiple records - temperature, ice, sea level, oceans, ecosystems, and atmospheric gases - reveal long-term trends and human influence.
6-35	**Evaluate Risk and Tradeoffs**	How should a community compare environmental solutions?	Risk evaluation combines likelihood, consequence, uncertainty, equity, cost, feasibility, and unintended effects rather than relying on a single measure.
6-36	**Design a More Sustainable System**	How can a system meet needs while using fewer resources and producing less waste?	Sustainable design uses life-cycle thinking, circular material flows, efficiency, resilience, monitoring, and iteration to improve environmental and social outcomes.

GRADES 6-8 INTEGRATION

Grade 7

Chemical Change, Ecosystems, Heredity, and Earth History

Year architecture: 6 units | 36 master lessons | Spiral progression across science domains and engineering design

Unit 1: Chemical Reactions

Big Idea: Chemical reactions rearrange atoms, conserve matter, and transfer energy.
Primary Standards Anchors: *MS-PS1-2, MS-PS1-5, MS-PS1-6; Energy and Matter*

Code	Title	Driving Question	Core Knowledge
7-01	**Atoms Rearrange in Reactions**	What changes and what stays the same in a chemical reaction?	Chemical bonds are broken and formed as atoms rearrange into new substances; the kinds and numbers of atoms are conserved.
7-02	**Evidence That a Reaction Occurred**	Which observations support the claim that new substances formed?	Property changes, gas or precipitate formation, light, odor, and thermal change can support a reaction claim when physical alternatives are considered.
7-03	**Conservation of Mass**	Why is mass conserved in a closed reaction system?	Atoms are neither created nor destroyed in ordinary chemical reactions, so total mass remains constant when all reactants and products are contained.
7-04	**Exothermic and Endothermic Reactions**	Why do some reactions warm their surroundings while others cool them?	Bond rearrangements change stored chemical energy; net energy transfer to surroundings is exothermic, while net absorption is endothermic.
7-05	**Reaction Rate**	What can make a chemical reaction faster or slower?	Temperature, concentration, surface area, mixing, and catalysts affect how often particles collide effectively.
7-06	**Design with Chemical Energy**	How can a reaction safely heat or cool a system?	An engineered chemical device balances energy output, rate, containment, material compatibility, safety, cost, and environmental impact.

Unit 2: Ecosystem Interactions and Dynamics

Big Idea: Ecosystems depend on resource limits, interacting populations, energy flow, matter cycles, and resilience.
Primary Standards Anchors: *MS-LS2-1, MS-LS2-2, MS-LS2-3, MS-LS2-4, MS-LS2-5*

Code	Title	Driving Question	Core Knowledge
7-07	**Biotic and Abiotic Components**	What must an ecosystem model include?	Ecosystems include organisms, physical conditions, resources, and interactions connected across spatial and temporal scales.
7-08	**Energy Flow Through Trophic Levels**	Why is less energy available at higher trophic levels?	Organisms use and release much of the energy they obtain, so only a fraction becomes biomass available to the next trophic level.
7-09	**Matter Cycles Through Ecosystems**	How do carbon, water, nitrogen, and minerals move through an ecosystem?	Matter cycles among organisms and reservoirs through photosynthesis, respiration, feeding, excretion, decomposition, weathering, and transport.

Code	Title	Driving Question	Core Knowledge
7-10	**Competition, Predation, and Symbiosis**	How do interactions change population success?	Competition, predator-prey relationships, mutualism, commensalism, and parasitism affect access to resources, survival, and reproduction.
7-11	**Carrying Capacity and Population Change**	Why can no population grow forever?	Resource limits, habitat, disease, predation, weather, and density-dependent effects constrain population size and produce fluctuations.
7-12	**Disturbance, Resilience, and Biodiversity**	What helps an ecosystem recover after disturbance?	Recovery depends on disturbance intensity, connectivity, diversity, surviving organisms, resource conditions, and the rate of environmental change.

Unit 3: Reproduction, Genes, and Inheritance

Big Idea: Genetic information is stored in DNA, passed through reproduction, and expressed in interaction with the environment.

Primary Standards Anchors: *MS-LS1-4, MS-LS1-5, MS-LS3-1, MS-LS3-2*

Code	Title	Driving Question	Core Knowledge
7-13	**Asexual and Sexual Reproduction**	How do reproductive strategies affect genetic similarity?	Asexual reproduction usually produces genetically similar offspring, while sexual reproduction combines parental genetic information and increases variation.
7-14	**DNA, Genes, and Chromosomes**	How is hereditary information organized?	DNA stores genetic information; genes are functional DNA regions located on chromosomes, which are copied and distributed during cell division.
7-15	**From Gene to Trait**	How can information in DNA influence an observable trait?	Gene expression directs production of RNA and proteins that contribute to structures and processes, while many traits involve multiple genes.
7-16	**Predicting Inheritance**	How can probability describe possible offspring traits?	Models such as Punnett squares represent allele combinations and probabilities, not guaranteed outcomes for individual offspring.
7-17	**Sources of Genetic Variation**	Where do new and reshuffled genetic differences come from?	Mutation creates new DNA variation, while meiosis and fertilization reshuffle existing alleles into new combinations.
7-18	**Genes, Environment, and Development**	Why can organisms with similar genes develop differently?	Traits emerge from interactions among genes, nutrition, temperature, light, stress, activity, disease, and other environmental factors.

Unit 4: Evolution and Natural Selection

Big Idea: Populations change over generations when inherited variation affects survival and reproduction.

Primary Standards Anchors: *MS-LS4-1, MS-LS4-2, MS-LS4-3, MS-LS4-4, MS-LS4-5, MS-LS4-6*

Code	Title	Driving Question	Core Knowledge
7-19	**Fossils Document Life Through Time**	How does the fossil record show change and continuity?	Ordered rock layers contain fossils that reveal appearance, diversification, persistence, and extinction of lineages over geologic time.

Code	Title	Driving Question	Core Knowledge
7-20	**Evidence of Common Ancestry**	What evidence suggests that different species share ancestors?	Homologous structures, embryology, vestigial features, fossils, biogeography, and molecular similarities support common ancestry.
7-21	**Natural Selection**	How can a population become better suited to its environment?	Individuals with advantageous inherited traits tend to leave more offspring, increasing those traits in the population across generations.
7-22	**Adaptation Is a Population Process**	Why does an individual not evolve because it needs to?	Natural selection acts on existing variation among individuals, but evolutionary change is measured in populations over generations.
7-23	**Speciation and Extinction**	How do lineages split or disappear?	Isolation and divergent selection can produce new species, while rapid change, competition, habitat loss, or catastrophe can drive extinction.
7-24	**Selection in a Human-Changed World**	How do antibiotics, pesticides, and selective breeding change populations?	Human actions create selection pressures or choose breeders, changing trait frequencies and sometimes producing resistance or domesticated forms.

Unit 5: Earth's Deep History and Plate Tectonics

Big Idea: Rock, fossil, and geophysical evidence reveals a changing Earth over immense time.
Primary Standards Anchors: *MS-ESS1-4, MS-ESS2-1, MS-ESS2-2, MS-ESS2-3*

Code	Title	Driving Question	Core Knowledge
7-25	**The Geologic Time Scale**	How can Earth's 4.6-billion-year history be organized?	Relative dating, radiometric ages, fossils, and major events divide Earth history into nested intervals that reveal scale and sequence.
7-26	**The Rock Cycle as a System**	How can one rock become another kind?	Melting, crystallization, weathering, erosion, deposition, burial, heat, and pressure transform rock while matter cycles through Earth.
7-27	**Reading Strata and Fossils**	Which events happened first in a rock sequence?	Superposition, cross-cutting relationships, inclusions, index fossils, and unconformities support relative dating and reconstruction of past environments.
7-28	**Evidence That Continents Move**	What observations led to plate tectonic theory?	Matching fossils and rocks, continental shapes, seafloor ages, magnetic stripes, and global hazard patterns show that plates move.
7-29	**Plate Boundaries**	How do different plate motions shape Earth?	Divergent, convergent, and transform boundaries produce characteristic combinations of ridges, trenches, mountains, volcanoes, and earthquakes.
7-30	**Earth's Interior Drives Surface Change**	What powers plate motion?	Heat from Earth's interior drives mantle convection and related processes that move lithospheric plates over long time scales.

Unit 6: Dynamic Earth, Resources, and Risk

Big Idea: Earth processes create hazards and resources; risk can be reduced through evidence-based design and planning.

Primary Standards Anchors: *MS-ESS2-2, MS-ESS3-1, MS-ESS3-2; MS-ETS1*

Code	Title	Driving Question	Core Knowledge
7-31	**Earthquakes and Seismic Waves**	How do earthquakes reveal both hazards and Earth's interior?	Fault movement releases energy as seismic waves; wave arrival, magnitude, intensity, and ground conditions affect observations and damage.
7-32	**Volcanoes and Magma**	Why do volcanoes erupt differently?	Magma composition, gas content, temperature, viscosity, water, and tectonic setting influence eruption style and hazards.
7-33	**Weathering, Erosion, and Landscapes**	How do rock, climate, water, ice, wind, and gravity create landscapes?	Surface processes interact with rock type, uplift, climate, vegetation, and time to shape valleys, coasts, soils, and sediment deposits.
7-34	**How Earth Processes Concentrate Resources**	Why are minerals, groundwater, fuels, and fertile soils found in particular places?	Resource deposits form through specific igneous, sedimentary, metamorphic, hydrologic, and biologic processes over time.
7-35	**Hazard, Exposure, and Vulnerability**	Why can the same natural event have very different consequences?	Risk depends on hazard probability and magnitude, the people and assets exposed, vulnerability, preparedness, and capacity to recover.
7-36	**Design a Resilient Community**	How can a community prepare for its most important Earth hazard?	Resilient design combines hazard data, maps, building practices, natural buffers, warnings, evacuation, equity, cost, and iterative scenario testing.

GRADES 6-8 INTEGRATION

Grade 8

Forces, Waves, Space, and Integrated Engineering

Year architecture: 6 units | 36 master lessons | Spiral progression across science domains and engineering design

Unit 1: Motion and Newtonian Forces

Big Idea: Motion is measured relative to a reference frame, and net force changes motion.
Primary Standards Anchors: *MS-PS2-1, MS-PS2-2; Cause and Effect*

Code	Title	Driving Question	Core Knowledge
8-01	**Reference Frames and Motion**	How can the same object be moving and not moving?	Motion is described relative to a reference frame, so observers using different frames can report different positions and velocities.
8-02	**Speed, Velocity, and Graphs**	How do graphs represent motion?	Speed describes rate of distance change, velocity includes direction, and position-time or speed-time graphs reveal motion patterns.
8-03	**Acceleration**	What does it mean for velocity to change?	Acceleration is a change in speed, direction, or both; it can be inferred from motion measurements and graph shape.
8-04	**Newton's First Law**	Why does motion continue unless a net force acts?	Inertia is the tendency of an object to resist changes in velocity; balanced forces do not change motion.
8-05	**Newton's Second Law**	How do force and mass determine acceleration?	Acceleration increases with net force and decreases with mass, summarized by the relationship F = ma.
8-06	**Newton's Third Law and Collisions**	Why do forces always come in pairs?	Interacting objects exert equal-magnitude, opposite-direction forces on each other, while their accelerations can differ because their masses differ.

Unit 2: Gravity, Electricity, Magnetism, and Energy

Big Idea: Fields explain forces at a distance, and engineered systems transform and transfer energy.
Primary Standards Anchors: *MS-PS2-3, MS-PS2-4, MS-PS2-5; MS-PS3-1, MS-PS3-2*

Code	Title	Driving Question	Core Knowledge
8-07	**Gravity Is Universal**	What determines gravitational attraction?	Every mass attracts every other mass; gravitational force increases with mass and decreases strongly with distance.
8-08	**Mass, Weight, and Orbits**	Why can weight change while mass stays constant?	Mass is an object's amount of matter, while weight is gravitational force; orbital motion is continuous falling around a larger body.
8-09	**Electric Charge and Fields**	How can charges interact across empty space?	Electric fields surround charges and exert forces on other charges; like charges repel and unlike charges attract.

Code	Title	Driving Question	Core Knowledge
8-10	**Current, Voltage, and Circuits**	What conditions allow electric charge to flow?	A closed conducting path and potential difference drive current; resistance influences current and energy transfer in circuit components.
8-11	**Magnetic Fields and Electromagnets**	How are electricity and magnetism connected?	Moving charges create magnetic fields, and electric current through a coil can make a controllable electromagnet.
8-12	**Engineer an Energy System**	How can a system deliver useful output efficiently and safely?	Energy-system design traces inputs, transformations, useful outputs, dissipated energy, control, efficiency, load, safety, and tradeoffs.

Unit 3: Waves and Information Technologies

Big Idea: Waves transfer energy and information through interactions with matter and fields.
Primary Standards Anchors: *MS-PS4-1, MS-PS4-2, MS-PS4-3; Patterns*

Code	Title	Driving Question	Core Knowledge
8-13	**A Model of Wave Motion**	How can a disturbance move without carrying matter with it?	A wave transfers energy through oscillations or fields; particles of a medium usually move locally rather than traveling with the wave.
8-14	**Amplitude, Frequency, Wavelength, and Speed**	How are the measurable features of a wave related?	Wave behavior is described by amplitude, frequency, wavelength, period, and speed; changing one feature can affect others within a given medium.
8-15	**Mechanical and Electromagnetic Waves**	Why do some waves need matter while others cross space?	Mechanical waves require a medium, while electromagnetic waves are oscillating electric and magnetic fields that can travel through a vacuum.
8-16	**Reflection, Refraction, Absorption, and Transmission**	What happens when a wave meets a boundary?	Wave behavior at a boundary depends on material properties, angle, wavelength, and frequency, producing reflection, refraction, absorption, or transmission.
8-17	**Light, Color, and the Electromagnetic Spectrum**	Why do objects and signals have different colors or wavelengths?	Visible color depends on emitted, transmitted, or reflected wavelengths; visible light is a small part of the electromagnetic spectrum.
8-18	**Analog and Digital Information**	Why can digital information be copied reliably?	Analog signals vary continuously, while digital systems encode information in discrete states that can be checked, corrected, compressed, and reproduced.

Unit 4: The Earth-Moon-Sun System

Big Idea: Earth's rotation and orbit, the Moon's orbit, and gravity explain cyclic sky patterns.
Primary Standards Anchors: *MS-ESS1-1; Systems and System Models*

Code	Title	Driving Question	Core Knowledge
8-19	**Rotation, Day, and Night**	Why does the sky appear to turn each day?	Earth rotates once in about 24 hours, producing day and night and the apparent daily motion of the Sun, Moon, and stars.

Code	Title	Driving Question	Core Knowledge
8-20	**Orbit, Tilt, and Seasons**	Why are seasons not caused by Earth's distance from the Sun?	Earth's axial tilt changes solar angle and day length in each hemisphere as Earth orbits the Sun.
8-21	**Moon Phases**	Why does the Moon's illuminated shape appear to change?	Half the Moon is sunlit; its orbital position changes how much of that half is visible from Earth in a predictable cycle.
8-22	**Solar and Lunar Eclipses**	Why does an eclipse not happen every month?	Eclipses require precise Sun-Earth-Moon alignment, while the Moon's orbit is tilted relative to Earth's orbital plane.
8-23	**Gravity and Tides**	Why do ocean levels rise and fall in patterns?	Differences in lunar and solar gravitational pull across Earth, combined with rotation and basin shape, produce tidal cycles.
8-24	**Testing an Earth-Moon-Sun Model**	How can one model explain several sky phenomena?	A useful model connects relative positions, motions, light, shadows, scale, and viewpoint, and is revised when predictions conflict with observations.

Unit 5: The Solar System and Universe

Big Idea: Gravity organizes cosmic systems, and evidence reveals the origin, scale, and evolution of the universe.
Primary Standards Anchors: *MS-ESS1-2, MS-ESS1-3; Scale, Proportion, and Quantity*

Code	Title	Driving Question	Core Knowledge
8-25	**How the Solar System Formed**	What evidence explains the shared patterns of planetary motion?	The solar system formed from a rotating disk of gas and dust, leading to common orbital direction, layered bodies, and compositional patterns.
8-26	**Worlds of the Solar System**	How do planets, dwarf planets, moons, asteroids, and comets compare?	Solar system bodies differ in size, composition, atmosphere, temperature, surface, orbit, and geologic activity.
8-27	**Gravity Organizes the Solar System**	Why do solar system objects follow predictable paths?	Gravitational attraction and inertia produce stable or changing orbits, resonances, tides, and occasional collisions.
8-28	**Stars: Distance, Brightness, and Life Cycles**	How can light reveal a star's properties?	A star's spectrum, brightness, color, and distance provide evidence of temperature, composition, size, motion, and developmental stage.
8-29	**Galaxies and the Expanding Universe**	What evidence shows that the universe has changed over time?	Galaxy redshifts, cosmic background radiation, and elemental abundances support an expanding universe that began in a hot, dense state.
8-30	**Exploration Extends Human Senses**	How do spacecraft and telescopes turn signals into knowledge?	Instruments collect electromagnetic, particle, gravitational, and physical data; scientists calibrate, transmit, analyze, compare, and revise interpretations.

Unit 6: Integrated Science and Engineering Capstone

Big Idea: Complex problems require systems thinking, evidence, modeling, tradeoff analysis, iterative design, and clear communication.

Primary Standards Anchors: *MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4; All three NGSS dimensions*

Code	Title	Driving Question	Core Knowledge
8-31	**Frame a Complex Systems Problem**	How can a broad concern become a solvable problem?	A strong problem frame identifies stakeholders, system boundary, causes, measurable criteria, constraints, assumptions, and the evidence still needed.
8-32	**Analyze Competing Evidence**	How can we judge whether evidence supports a claim?	Evidence quality depends on relevance, source, method, sample, uncertainty, reproducibility, bias, and agreement with other observations.
8-33	**Build a Model with Feedback**	How can a model represent change in a complex system?	A systems model links components, flows, delays, reinforcing and balancing feedback, scale, and predicted outcomes under different conditions.
8-34	**Compare Solutions and Tradeoffs**	Why is the best solution rarely best in every way?	Decision matrices compare performance, cost, risk, equity, feasibility, environmental impact, durability, and unintended consequences using weighted evidence.
8-35	**Prototype, Test, and Optimize**	How can testing move a design toward the best feasible solution?	Iterative optimization uses controlled tests, quantitative results, failure analysis, and revised models to improve performance within constraints.
8-36	**Defend a Solution with Science**	How can a scientific argument persuade a critical audience?	A defensible proposal connects a clear claim to credible evidence and reasoning, addresses alternatives and uncertainty, and communicates limitations honestly.

Appendix A: Progression of Science and Engineering Practices

- **Asking Questions and Defining Problems:** K-2 asks observable questions; 3-5 refines testable questions and criteria; 6-8 frames variables, systems, stakeholders, and constraints.
- **Developing and Using Models:** K-2 uses drawings and physical models; 3-5 compares and revises models; 6-8 uses conceptual, mathematical, and systems models to explain and predict.
- **Planning and Carrying Out Investigations:** Progresses from guided observation to controlled comparisons, repeated trials, measurement, uncertainty, and method critique.
- **Analyzing and Interpreting Data:** Progresses from pictures and tallies to tables and graphs, then to trends, outliers, relationships, uncertainty, and competing interpretations.
- **Using Mathematics and Computational Thinking:** Progresses from counting and measurement to ratios, rates, scale, equations, probability, graph models, and optimization.
- **Constructing Explanations and Designing Solutions:** Progresses from evidence-based descriptions to causal mechanisms and solutions evaluated against criteria, constraints, and tradeoffs.
- **Engaging in Argument from Evidence:** Progresses from sharing observations to comparing claims, evaluating source quality, addressing alternatives, and defending a reasoned conclusion.
- **Obtaining, Evaluating, and Communicating Information:** Progresses from labeled drawings and oral reports to multimedia explanations, source evaluation, technical writing, and public defense.

Appendix B: Crosscutting Concepts

Crosscutting Concept	K-8 Function in the Curriculum
Patterns	Use regularities in observations and data to classify, predict, and infer mechanisms.
Cause and Effect	Distinguish coincidence from causal relationships and use mechanisms to explain change.
Scale, Proportion, and Quantity	Reason across sizes, times, rates, ratios, units, and models that simplify extreme scales.
Systems and System Models	Define boundaries, components, interactions, inputs, outputs, flows, and feedback.
Energy and Matter	Track where energy and matter enter, move, transform, cycle, disperse, and leave a system.
Structure and Function	Connect shape, material, organization, and location with what a structure can do.
Stability and Change	Examine equilibrium, rates, cycles, thresholds, disturbance, resilience, and long-term change.

Appendix C: Production Bridge

After this Master Title Bible is approved, each lesson can be expanded through the same production chain:

1. Lesson Production Bible: learning objectives, misconceptions, vocabulary, phenomenon, narrative arc, and scientific boundaries.
2. Student Learning: narrated visual presentation plus optional cinematic learning story.
3. Teaching Materials: classroom PPT, teacher notes, investigation, questions and answers, and assessment items.

4. Age Adaptation: vocabulary, pacing, runtime, visual density, mathematics, and autonomy calibrated by grade band.
5. Quality Review: scientific accuracy, standards coherence, developmental appropriateness, accessibility, and visual continuity.

Appendix D: Standards Basis and Sources

Alignment note. This is an original, NGSS-informed curriculum architecture. It uses the three-dimensional vision and topic progressions as a design basis, but it is not an official NGSS product and does not replace a state- or district-specific standards crosswalk.

- Next Generation Science Standards - Home
- NGSS Topic Arrangements
- NGSS Standards Search
- A Framework for K-12 Science Education - National Academies
- Georgia Department of Education - Science

Master framework total: 9 grade levels | 54 curriculum units | 270 master lessons