



## PLANNED COURSE OF STUDY

<b>Course Title</b>	Science
<b>Grade Level</b>	5th
<b>Content Area</b>	Science
<b>Length of Course</b>	September-June
<b>Author(s)</b>	Shaun Okawa

### Course Description:

In 5th grade, students use inquiry-based investigations to develop understandings of physical and life science. In Mixtures and Solutions (physical science), students are introduced to the fundamental ideas about matter and its interactions. In Living Systems (life science), students think about systems on different scales. Investigations include nutrient and transport systems within an organism that moves matter and provides energy to the individual organism, and feeding relationships in ecosystems that move matter among plants, animals, decomposers, and the environment.

### Course Rationale:

FOSS (Full Option Science System) is a researched-based science curriculum for grades K-8. The FOSS Program bridges research and practice by providing tools and strategies to engage students and teachers in enduring experiences that lead to deeper understand of the natural and designed worlds.

The Mixtures and Solutions Unit studies the structure of matter and the changes or transformations that take place. Learning about the makeup of substances gives the student knowledge about how things go together and how they can be taken apart. Learning about change in substances is important for several reasons: changes can be controlled to produce new materials, changes can be used to give off energy to run machines.

The Living System Unit consists of three sequential investigations, each designed to introduce students to transport systems in multicellular organisms. Learning about living systems gives the student knowledge about the needs of living things, the systems in place to sustain life, and the processes that living things go through.



### Curriculum Map

Month	Typical # of Weeks	Topics Covered this Month
September	4 weeks	Geography Skills
October	4 weeks	Mixtures and Solutions
November	3 weeks	Mixtures and Solutions
December	3 weeks	Social Studies
January	4 weeks	Social Studies
February	4 weeks	Social Studies
March	4 weeks	Social Studies
April	3 weeks	Living Systems
May	4 weeks	Living Systems
June	2 weeks	Living Systems



<b>Unit Title</b>	<b>Mixtures and Solutions</b>
Unit Description	The Mixtures and Solutions Module has five investigations that introduce students to fundamental ideas about matter and its interactions.
Essential Questions & Enduring Understandings	<p>Essential Questions:</p> <ul style="list-style-type: none"><li>● How can a mixture be separated?</li><li>● Where does the solid material go when a solution is made?</li><li>● How can you separate a mixture of dry materials?</li><li>● What is the difference between dissolving and melting?</li><li>● How can you determine which salt solution is more concentrated?</li><li>● What is the relationship between salt-solution concentration and density?</li><li>● What is a design to remove salt from ocean water?</li><li>● What is the effect of mixing two substances with water?</li></ul> <p>Enduring Understanding:</p> <ul style="list-style-type: none"><li>● A mixture is two or more materials intermingled</li><li>● Mixtures can be separated into their constituents by using screens, filters, and evaporation.</li><li>● The mass of a mixture is equal to the mass of its constituents</li><li>● Dissolving is an interaction between two (or more) substances: a solute which dissolve, and a solvent, which does the dissolving and into which the solute disappears.</li><li>● Melting is a change in a single substance from solid to liquid caused by heat (energy transfer)</li><li>● The amount of matter is conserved when it changes form</li><li>● Concentration is the amount of dissolved solid material per unit volume of water</li><li>● Density is mass per unit volume</li><li>● More concentrated salt solutions are denser</li><li>● A substance is a single, pure material</li><li>● Solubility is the property that indicates how readily a solute dissolves in a solvent</li><li>● Some mixtures result in chemical reaction</li></ul>



PA Core Standards	Assessment Anchors
3.2.5.A1 3.2.5.B2 & 3 3.4.5.A1 & 2 3.4.5.C1 & 2 3.4.5.E5	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.C.1.1 S8.C.2.1

<i>Key Unit Vocabulary</i>	<i>constraint, criteria, crystal, diatomaceous earth, dissolve, engineer, evaporation, extract, filter, magnet, mass, mixture, powder, property, salt, solute, solution, solvent, transparent, condensation, freezing, melting, model, phase change, siphon, water vapor, concentrated, concentration, density, dilute, equal volumes, layer, citric acid, Epsom salts, insoluble, saturated solution, soluble, solubility, substance, supersaturated, baking soda, calcium carbonate, calcium chloride, chalk, chemical reaction, gas, precipitate, product, reactant.</i>
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Learning Objectives – <i>The student will...</i>	Assessment Opportunities
INV 1 Recognize that a mixture is two or more materials intermingled	Science Notebook entry Response Sheet Performance assessment investigation 1 I-Check(quiz)
INV1 Design an experiment to separate mixtures into their constituents	Science Notebook entry Performance assessment
INV1 Discover that the mass of a mixture is equal to the mass of its constituents	Science Notebook entry Response Sheet Performance assessment investigation 1 I-Check(quiz)
INV 2 Develop a model which may involve observing, constructing, analyzing, evaluating, and revising.	Science Notebook entries Response Sheet
INV 2 Understand and explain that dissolving is an	Science Notebook entries Response Sheet



interaction between two (or more) substances: a solute which dissolve, and a solvent, which does the dissolving and into which the solute disappears.	Investigation 2 I-Check
INV 2 Discover that the amount of matter is conserved when it changes form.	Science Notebook entries Response Sheet Investigation 2 I-Check
INV 3 Define <i>concentration</i> as the amount of dissolved solid material per unit volume of water	Science notebook entries Response sheet Performance assessment Investigation 3 I-Check
INV 3 Identify that when equal volumes of salt solutions are weighed, the heavier one is more concentrated.	Science notebook entries Response sheet Performance assessment Investigation 3 I-Check
INV 3 Identify that <i>density</i> is mass per unit volume.	Science notebook entries Response sheet Performance assessment Investigation 3 I-Check
INV 4 Define a <i>substance</i> as a single, pure material	Science notebook entries Response sheet Performance assessment Investigation 4 I-Check
INV 4 Observe that solubility varies from substance to substance	Science notebook entries Response sheet Performance assessment Investigation 4 I-Check
INV 4 Identify that <i>solutions</i> are composed of a solvent (liquid) and a solute (solid), which is dissolved in the solvent.	Science notebook entries Response sheet Performance assessment Investigation 4 I-Check
INV 5 Discover that some mixtures result in a chemical reaction	Science notebook entries Response sheet Performance assessment Investigation 5 I-Check
INV 5 Observe that some products of reactions are soluble and can be identified by crystal structure after evaporation.	Science notebook entries Response sheet Performance assessment Investigation 5 I-Check



Sequence of Teaching and Learning		
Number of Lessons / Blocks	Lesson Topic	Lesson Activities
Investigation 1 8 Lessons	Separating Mixtures	<p>1.1 Students make three mixtures of solid materials (salt, gravel, and diatomaceous earth) and water. After they observe the mixtures, they attempt to separate them with screens and filters. They discover that water and salt make a special kind of mixture-a solution-that cannot be separated with a filter.</p> <p>1.2 Students add a measured amount of salt to a measured amount of water to make a solution. They compare the total mass of a mixture to the mass of its parts to infer that the invisible salt is still present. Students evaporate the salt solution to reclaim the salt as crystals.</p> <p>1.3 Students are given a dry mixture (gravel, powder, and salt) to separate. The mixture includes a new mystery material, magnetite. Students separate the mixture by using magnets, screens, filters, and evaporation. Students review the elements of engineering design as they design an efficient system to separate a dry mixture. They discuss their efforts in terms of science and engineering practices.</p> <p>1.4 Students are challenged to discover if natural materials in the schoolyard will make solutions when mixed with water. When students observe that organic material changes the color of the water, they are introduced to the concept of an extract.</p>
Investigation 2: 8 Lessons	Developing Models	<p>2.1 Students make multisensory observations of sealed black boxes in an effort to determine what is inside. They develop models and try to reach a consensus with other students who investigated the same boxes. Students construct physical models of black boxes in an</p>



		<p>effort to replicate the behaviors of the original black boxes.</p> <p>2.2 Students observe a device that delivers 600-700 mL of water. They develop conceptual models to explain how they think the device (drought-stopper) works.</p> <p>2.3 Students use hot water to heat four common solid materials and observe that one melts, two soften, and one is unchanged. With this review of phase change and melting, students are asked to develop models of dissolving and melting and tell how they are different.</p>
Investigation 3: 8 Lessons	Concentration	<p>3.1 Students observe and compare soft-drink solutions that differ in the amount of powder (water held constant) and in the amount of water (powder held constant) to develop the concept of concentration</p> <p>3.2 Students make salt solutions and compare their concentrations. Taste is no longer a viable indicator, so students use a balance to determine the relative concentration of the salt solutions.</p> <p>3.3 Students determine the relative concentrations of three mystery salt solutions (the most concentrated and the most dilute) by comparing equal volumes on a balance. More concentrated solutions have a greater mass.</p> <p>3.4 Students observe that a mass piece sinks in one liquid and floats in another, because the liquids are different densities. Armed with the knowledge that less dense objects float on more dense liquids, students investigate four salt solutions to discover which is more concentrated based on how they layer.</p>
Investigation 4: 8 Lessons	Reaching Saturation	<p>4.1 Students make a saturated solution by adding salt to water until no more salt will dissolve. After separating the undissolved solid salt, students use a balance to determine the mass of salt needed to saturate 50</p>



		<p>milliliters (mL) of water. The two components of a solution are identified as the solvent and solute</p> <p>4.2 Students add Epsom salts to 50 mL of water to make a saturated solution. They use a balance to determine the mass of Epsom salts in the saturated solution in order to compare the solubility of salt and Epsom salts.</p> <p>4.3 Students are given an unknown substance (citric acid) to identify based on its properties. They determine the unknown's solubility and compare their results to a table of known solubility for five substances. Students evaporate the unknown solution and compare the crystals to photographic images to confirm their identification.</p> <p>4.4 Students collect water samples from the school and use observation and evaporation to determine what's in each sample. Students find out about the source of their local water, where it is stored, and how it is treated. They apply their knowledge of solution chemistry to design a process to make ocean water suitable for drinking.</p>
Investigation 5: 8 Lessons	Fizz Quiz	<p>5.1 Students use three substances (calcium chloride, baking soda, and citric acid) to make three different combinations of two substances. They add water and observe the changes that occur. The new products that form (a gas and a white precipitate) are identified as evidence of a chemical reaction.</p> <p>5.2 Students use techniques from earlier investigation (filtering and evaporation) to separate the products of the reactions. They identify the products by testing the precipitate with vinegar to see if it is chalk, and by evaporating the liquid to discover the typical square crystal of salt.</p>





		<p>5.3 Using combinations of the substances used in Parts 1 and 2, students produce chemical reactions in zip bags. The closed systems allow students to effectively observe the volume of gas and discover a new precipitate when all three substances are mixed in a bag.</p>
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<b>Unit Title</b>	<b>Living Systems</b>
Unit Description	In this module, students think about systems on different scales—nutrient and transport systems within an organism that moves matter and provides energy to the individual organism and feeding relationships in ecosystems that move matter among plants, animals, decomposers, and the environment. Students come to understand through a variety of experiences that plants get the materials they need for growth primarily from water and air, and that energy in animals' food was once energy from the sun.
Essential Questions & Enduring Understandings	<p>Essential Questions:</p> <ul style="list-style-type: none"><li>● How can you identify a system?</li><li>● Is planet Earth a system?</li><li>● What organisms are both predators and prey in the kelp forest ecosystem?</li><li>● What happens when compost worms interact with organic litter?</li><li>● What does yeast need to break its dormancy?</li><li>● How do plants get the food they need?</li><li>● How do animals get the nutrients they need?</li><li>● How are nutrients transported to cells in a plant?</li><li>● How do humans transport nutrients to all their cells?</li><li>● Why do people breathe?</li><li>● What features of organisms attract attention?</li><li>● What behaviors are instinctive, and what behaviors are learned?</li><li>● What are the parts of a marine ecosystem?</li></ul> <p>Enduring Understandings:</p> <ul style="list-style-type: none"><li>● A system is a collection of interacting objects, ideas, and/or procedures that together define a physical entity or process.</li><li>● Earth can be described as the interaction of four earth systems: the rocky part (the geosphere), the atmosphere, the water (the hydrosphere), and the complexity of living organisms (the biosphere).</li><li>● Food webs are made up of producers (organisms that make their own food), consumers (organisms that eat other organisms to obtain food), and decomposers (organisms</li></ul>



that consume and recycle dead organisms and organic waste).

- A kelp forest has similarities to a rain forest (vertical layering). Phytoplankton are the major producers in most aquatic systems (both marine and freshwaters)
- Food webs and competition for resources exist in marine systems.
- Yeast is a single-celled fungus. Dormant yeast cells can become active when provided with water, warmth, and sugar as a food source. Carbon dioxide is a waste by-product of yeast metabolism.
- Chlorophyll is the green pigment that absorbs sunlight in the cells of producer organisms.
- A nutrient is a substance, such as sugar or starch that is used by a cell to produce the energy needed to perform the functions of life.
- Plants make their own food by photosynthesis. Green plant cells make sugar (food) from carbon dioxide and water in the presence of sunlight, and release oxygen.
- Animals obtain nutrients by eating other organisms.
- Digestion is the process used by animals to break down complex food items into simple nutrients.
- In vascular plants, Xylem tubes carry water and minerals from the plant's roots to all the cells in a one-way flow; phloem tubes carry sugar from the leaves to all the cells that need it.
- Vascular bundles are arranged in predictable patterns of veins in the leaves of vascular plants.
- In the human circulatory system, blood transports resources to the cells and waste from the cells.
- In humans, the respiratory system transports oxygen to the blood and carbon dioxide from the blood.
- All cells have basic needs: water, food, gas exchange, and waste disposal. Multicellular organisms have systems for transporting nutrients and wastes.
- A stimulus is something that triggers (starts) a response. A stimulus is often information received through the senses.
- A response is a reaction of a living thing to a stimulus.
- Animal adaptations include pattern and color that attract attention to warn predators off or to attract a mate.



	<ul style="list-style-type: none"> <li>● Animals communicate to warn others of danger, scare predators away, or locate others of their kind, including family members.</li> <li>● Instinctive behaviors, such as knowing what to eat, how to find shelter, and how to migrate, help organisms survive.</li> <li>● Marine ecosystems have biotic (living) and abiotic (nonliving parts). The ocean plays an important role in the carbon cycle.</li> </ul>
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PA Core Standards	Assessment Anchors
3.1.5.A2, 3, 5 & 9	S8.A.1.1
3.1.5.B1& 6	S8.A.1.3
3.1.5.C1 & 4	S8.A.2.1
3.2.5.A6	S8.A.3.1
3.2.5.B7	S8.A.3.2
3.3.5.A7	S8.A.3.3
3.3.5.B3	S8.B.1.1
3.4.5.A1 & 2	S8.B.3.1
3.4.5.D3	S8.D.1.3
3.4.5.E2	

Key Unit Vocabulary	<i>aquatic, aquatic ecosystem, algae, atmosphere, bacteria, biosphere, brain, carbon dioxide, carnivore, compost, consumer, decomposer, detritivore, detritus, energy, ecosystem, energy, food chain, food web, freshwater ecosystem, geosphere (lithosphere), herbivore, hydrosphere, interact, living, marine ecosystem, microorganism, nonliving, omnivore, phytoplankton, predator, prey, producer, recycle, red worm, terrestrial ecosystem, subsystem, system, zooplankton, bloodstream by-product, carbon dioxide, cell, chlorophyll, digestion, digestive system, dormancy, esophagus, fungus, large intestine, metabolism, mineral, mouth, nonliving, nutrient, photosynthesis, small intestine, stomach, sugar, waste, yeast, alveoli, artery, capillary, circulatory system, classify, diaphragm, heart, heart valve, leaf vein, left ventricle, lung palmate, parallel, phloem, pinnate, respiratory system right ventricle, sap transpiration, vascular bundle, vascular system, vein, vital capacity, Xylem, adaptation, behavior, brain, central nervous system, inherited</i>
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	<p><i>trait, instinct instinctive, learned behavior, neuron, receptor, reflex, response, response time, stimulus, terrestrial, bolus, carbohydrate, colon, digestion, digestive system, esophagus, glucose, membrane, multicellular organism, saliva, teeth, clade, circulate, circulatory system, classification, classify, heart, left atrium, left ventricle, lung, margin, palmate, right atrium, right ventricle, sap, specialized structure, vascular bundle, vascular plant, central nervous system, motor neuron, respond, sensory neuron, variable.</i></p>
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Learning Objectives – <i>The student will...</i>	Assessment Opportunities
<p>INV 1 Define that a system is a collection of interacting objects, ideas, and/or procedures that together define a physical entity or process.</p>	<p>Science notebook entries Response sheet Performance Assessment Investigation 1 I-Check</p>
<p>INV 1 Describe earth system and their interactions: the rocky part (geosphere), the atmosphere, the water (hydrosphere), and the complexity of living organisms (the biosphere)</p>	<p>Science notebook entries Response sheet Performance Assessment Investigation 1 I-Check</p>
<p>INV 1 Identify that food webs are made up of producers (organisms that make their own food), consumers (organisms that eat other organisms to obtain food), and decomposers (organisms that consume and recycle dead organisms and organic waste)</p>	<p>Science notebook entries Response sheet Performance Assessment Investigation 1 I-Check</p>
<p>INV 1 Describe the similarities and differences between a kelp forest and a rain forest. Phytoplankton are the major producers in most aquatic systems (both marine and freshwater)</p>	<p>Science notebook entries Response sheet Performance Assessment Investigation 1 I-Check</p>
<p>INV 2 Understand that yeast is a single-celled fungus. Dormant yeast cells can become active when provided with water, warmth, and sugar as a food source. Carbon dioxide is a waste by-product of yeast metabolism.</p>	<p>Science notebook entries Response sheet Performance Assessment Investigation 2 I-Check</p>
<p>INV 2</p>	<p>Science notebook entries</p>



Identify chlorophyll as the green pigment that absorbs sunlight in the cells of producer organisms.	Response sheet Performance Assessment Investigation 2 I-Check
INV 2 Understand that a nutrient is a substance, such as sugar or starch that is used by a cell to produce the energy needed to perform the functions of life.	Science notebook entries Response sheet Performance Assessment Investigation 2 I-Check
INV 2 Discover that plants make their own food through photosynthesis	Science notebook entries Response sheet Performance Assessment Investigation 2 I-Check
INV 2 Discover that animals obtain nutrients by eating other organisms.	Science notebook entries Response sheet Performance Assessment Investigation 2 I-Check
INV 2 Recognize digestion as the process used by animals to break down complex food items into simple nutrients.	Science notebook entries Response sheet Performance Assessment Investigation 2 I-Check
INV 3 Discover the components of vascular plants. Xylem tubes carry water and minerals from the plant's roots to all the cells in a one-way flow; Phloem tubes carry sugar from the leaves to all the cells that need it.	Science notebook entries Response sheet Performance Assessment Investigation 3 I-Check
INV 3 Recognize that vascular bundles are arranged in predictable patterns of veins in the leaves of vascular plants.	Science notebook entries Response sheet Performance Assessment Investigation 3 I-Check
INV 3 Understand that, in the human circulatory system, blood transports resources to the cells and waste from the cells	Science notebook entries Response sheet Performance Assessment Investigation 3 I-Check
INV 3 Understand that the human respiratory system transports oxygen to the blood and carbon dioxide from the blood	Science notebook entries Response sheet Performance Assessment Investigation 3 I-Check
INV 3	Science notebook entries



Recognize that all cells have basic needs: water, food, gas exchange, and waste disposal. Multicellular organisms have systems for transporting nutrients and wastes.	Response sheet Performance Assessment Investigation 3 I-Check
INV 4 Describe a stimulus as something that triggers a response. A stimulus is often information received through the senses.	Science notebook entries Response sheet Posttest
INV 4 Describe a response as a reaction of a living thing to a stimulus	Science notebook entries Response sheet Posttest
INV 4 Explain that animal adaptations are meant to attract attention to warn predators off or to attract a mate.	Science notebook entries Response sheet Posttest
INV 4 Identify that instinctive behaviors, such as knowing what to eat, how to find shelter, and how to migrate, help organisms survive.	Science notebook entries Response sheet Posttest
INV 4 Understand that marine ecosystems have biotic (living) and abiotic (nonliving parts).	Science notebook entries Response sheet Posttest

Sequence of Teaching and Learning		
Number of Lessons / Blocks	Lesson Topic	Lesson Activities
Investigation 1: 8 Lessons	1.1 Everyday Systems	Students are introduced to a system as a collection of interacting parts that work together to make a whole or produce an action. They are presented with a common device and identify all the elements that go together to make that system. Students describe other systems and subsystems.
	1.2 Earth Systems	Students explore Earth as a system. Through video, they are introduced to four subsystems of planet Earth—the geosphere, atmosphere, hydrosphere, and biosphere. Students focus on the biosphere and describe ecosystems by looking at feeding relationships and energy transfers, described as food webs.
	1.3	Students work with organism cards to create food webs in a



	Kelp Forest Food Web	kelp forest. They are introduced to a marine ecosystem and investigate food webs in the system.
	1.4 Recycling	Each group of students sets up a red worm habitat system to study detritivores. They record what organic materials go into the habitat with about 15 red worms and observe changes in the worm jar over 1–2 months.
Investigation 2 8 Lessons	2.1 Yeast Nutrition	Students design an investigation to determine the necessary conditions for activating dry yeast. After determining that water and a cookie produce yeast activity, they conduct experiments to discover that it is the sugar in the cookie that activates the yeast. Yeast is introduced as a single-celled fungus.
	2.2 Plant Nutrition	Students think about how to break the dormancy of another organism, the wheat plant. They plant wheat seeds in containers of soil and place half of the planters in a lighted environment and the other half in a dark environment. Students read about the action of chlorophyll and its role in the manufacture of sugar. They observe their wheat plants to determine which plants have chlorophyll. Students infer that the plants growing in light are the ones prepared to produce food to provide nutrients to their cells.
	2.3 Animal Nutrition	Students investigate how animals acquire nutrients for their cells by eating and digesting food. The painted lady butterfly goes through its life cycle while students observe the larvae and adults eating different food sources. The human digestive system is explored through a video that shows an experiment on chemical digestion in the stomach.
Investigation 3 8 Lessons	3.1 Plant Vascular Systems	Students continue their exploration of plants by observing the veins in leaves. They plant wheat seeds in clear straws to allow detailed observation of the development of leaves and to investigate their functions. Students go outdoors to discover what happens when some foliage of a growing plant is constrained in a clear plastic bag. When moisture condenses inside the bag, students speculate about the source of the water they find.
	3.2 Circulatory Systems	Students see a video showing how blood is delivered to every human cell by a system of vessels connected to a pump, the heart. They read about the structures inside the human heart. Students use simple equipment to assemble a functional model of a circulatory system that can pump blood





		to the lungs, collect blood from the lungs, and pump it to the body, where it is recycled.
	3.3 Respiratory Systems	Students study the structures and functions of the interacting parts of the respiratory system, learning about the acquisition and distribution of oxygen, and the process of waste removal. They measure their lung volume (vital capacity) and read about the circulatory and respiratory systems of other animals.
Investigation 4 8 Lessons	4.1 Stimulus/Res ponse	Through video and text, students learn about the role of sensory and motor neurons in brain messages. They use a falling cup to investigate the time that elapses between a visual stimulus and a response. They compare foot-response time to hand-response time.
	4.2 Attention	Each student chooses attention-getting colors, patterns, and a habitat for an action card. The cards are distributed to other students, who create organisms outdoors to attract the attention of the student who completed the card.
	4.3 instinct and Learning	Students learn about instinctive and learned behaviors. They study the monarch butterflies and their instinctive migration over several generations.
	4.4 Ecosystems	Students bring their study of decomposers to an end by dismantling the worm-habitat system they started 2 months earlier. They study marine ecosystems and are introduced to the importance of the ocean in the carbon cycle.