2026-2027 Elementary School - 5th Grade Science - Unit 2 - Modeling Matter Unit Framework

Unit 1 **Unit 2** Unit 3 Unit 4

Kentucky Academic Standards for Science

<table>
<tr><th>Unit Title</th><th>Estimated Time Frame</th></tr>
<tr><td>Modeling Matter: The Chemistry of Food</td><td>41 Days</td></tr>
<tr><td colspan="2">Unit Anchor Phenomenon (Big Idea):</td></tr>
<tr><td colspan="2">The food coloring from Good Food Production, Inc. is not the same as Red Dye #75.</td></tr>
<tr><td colspan="2">Problem Students are Trying to Solve (Essential Question):</td></tr>
<tr><td colspan="2">How can we help Good Food Production, Inc. figure out if their food coloring includes a harmful dye?</td></tr>
<tr><td colspan="2">Unit Three Dimensional Statement</td></tr>
<tr><td colspan="2">Students are introduced to the particulate model of matter (energy and matter) and apply it in their role as food scientists as they explain how to separate a food-coloring mixture and how to create a stable salad dressing (stability and change). They do this by making firsthand observations of a variety of macroscale phenomena involved in separating and creating mixtures, and then by creating diagram models and using physical and digital models to visualize what might be happening at the nanoscale (scale, proportion, and quantity).</td></tr>
<tr><td colspan="2">Essential Standards (Focal Performance Expectations) (KAS for Science):</td></tr>
<tr><td colspan="2">5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen.
Clarification Statement: Examples of evidence could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.
Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.
KILP: 1 - Recognize that text is anything that communicates a message.
6 - Collaborate with others to create new meaning.
7 - Utilize digital resources to learn and share with others.

5-PS1-2. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling or mixing substances, the total weight of matter is conserved.
Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.
Assessment Boundary: Assessment does not include distinguishing mass and weight.
KILP: 1 - Recognize that text is anything that communicates a message.
2 - Employ, develop, and refine schema to understand and create text.
7 - Utilize digital resources to learn and share with others.</td></tr>
</table>

5-PS1-3. Make observations and measurements to identify materials based on their properties.
Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.
Assessment Boundary: Assessment does not include density or distinguishing mass and weight.
KILP: 2 - Employ, develop, and refine schema to understand and create text.
6 - Collaborate with others to create new meaning.
8 - Engage in specialized, discipline specific literacy practices.

Supporting Standards (Connections to Other Performance Expectations)**:**

5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.
Clarification Statement: None provided.
Assessment Boundary: None provided.

Connections to Kentucky Interdisciplinary Literacy Practices (KILP):

1. Recognize that text is anything that communicates a message.
2. Employ, develop and refine schema to understand and create text.
6. Collaborate with others to create new meaning.
7. Utilize digital resources to learn and share with others.
8. Engage in specialized, discipline specific literacy practices.

Connections to Standards for Mathematical Practice:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.

Science & Engineering Practices Identified in Standards (While only a subset of science and engineering practices are explicitly identified as the mechanism for how students demonstrate mastery at the end of instruction, students should still utilize all of the science and engineering practices as they develop their understanding.) NGSS Appendix F	Priority Content Disciplinary Core Ideas NGSS Appendix E	Crosscutting Concepts Identified in Standards (While only a subset of crosscutting concepts are explicitly identified as the mechanism for how students demonstrate mastery at the end of instruction, students should still utilize all of the crosscutting concepts as they develop their understanding.) NGSS Appendix G
Developing and Using Models Develop a model to describe phenomena. **Using Mathematics and Computational Thinking** Measure and graph quantities such as weight to address scientific and engineering questions and problems. **Planning and Carrying Out Investigations** Make observations and measurements in order to produce data to serve as the basis for evidence for an explanation of a phenomenon.	**PS1.A: Structures and Properties of Matter** ● Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gasses are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. ● The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. ● Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) **PS1.B: Chemical Reactions** ● No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.)	**Scale, Proportion, and Quantity** ● Natural objects exist from the very small to the immensely large. ● Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.

Prerequisite Skills for Focal Performance Expectations Science & Engineering Practices (from NGSS Appendix F and/or FCPS Enduring Science Skills Document)	**Prerequisite Disciplinary Core Ideas** (from NGSS Appendix E) (Prerequisite Content Knowledge)	**Prerequisite Crosscutting Concepts** (from NGSS Appendix G)
1. Identifies basic limitations of a particular model. 2. Uses models to describe phenomena. 3. Evaluate appropriate tools and begin to identify appropriate methods for collecting data. Make predictions about what would happen if a variable changes. 4. Decide when to use qualitative vs. quantitative data. 5. Use counting and numbers to identify and describe patterns in the natural and designed world(s). 6. Describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs. 7. Use quantitative data to compare two alternative solutions to a problem.	1. Matter exists as different substances that have observable different properties. 2. Different properties are suited to different purposes. 3. Objects can be built up from smaller parts. 4. Heating and cooling substances cause changes that are sometimes reversible and sometimes not.	1. Use relative scales (e.g., bigger and smaller; hotter and colder; faster and slower) to describe objects. 2. Use standard units to measure length.

Preconceptions/Misconceptions:
(found in the Science Background section of the Amplify Teacher Resources) 1. A particulate view of matter—the idea that matter is made of particles called atoms and molecules, rather than being continuous—is a difficult, but very important, concept for students to develop. To explain any change in matter, one must understand this concept. Students initially may view atoms or molecules as embedded in a substance, like blueberries in a muffin, rather than making up the entire substance. It is useful to ask students questions such as What would be left if you took all the atoms out of this chair? [Nothing.] Since the particulate nature of matter is so difficult for students to accept, some researchers emphasize the importance of studying the macroscopic world first and then explaining that world by using ideas consistent with a particulate view of matter. In Chapter 1 of the Modeling Matter unit, students start with general observations of the chromatography process and of mixing different substances. They are then able to discover how a molecular view of these phenomena can help explain what is happening. In Chapter 2, students apply their new understanding of the particulate nature of matter to another situation—explaining solubility (the degree to which solids dissolve in liquids). In Chapter 3, they apply it to explain miscibility (whether liquids mix together or form separate layers)

2. Students may confuse the property of a substance with the properties of the molecules that make up that substance. For example, they may think that an atom of copper is shiny and malleable, a molecule of water is a tiny drop of water, or a molecule of a solid object is hard. Remind students that individual atoms or molecules do not have properties such as hardness or shininess, only large groups of molecules do.

3. The part of dissolving when the solid seems to disappear as it is mixed into the liquid is easily observed. However, the fact that the solid is still present in the liquid is much harder for students to believe and understand. One of the best ways to prove this is for students to experience the taste difference when a safe substance, such as sugar, is dissolved in water. Experiences providing evidence that the "disappeared" substance is still present in the liquid are essential for helping students understand that the substance has not leached into the container, gone into the air, or just plain vanished.

4. Students must notice that dissolving something completely and evenly disperses it throughout the solution. Students often jump to the mistaken conclusion that solutions are more concentrated at the bottom. One possible source for their thinking this is prior experience with pulpy orange juice or other settling that occurs in suspended mixtures. Older students may also think sugar is more concentrated at the bottom of a glass because it's heavier than water. This can be disproved by tasting the sugar solution using a straw and observing that it tastes just as sweet at the top of the glass as it does at the bottom.

Pedagogical Considerations:

1. Since the term substance is often used casually to include both substances and mixtures, many chemistry texts use the term pure substance to make it clear that something is not a mixture. However, when used in the technical sense, substance always means a pure substance. In the Modeling Matter unit, we use the term substance rather than the term pure substance.

2. It is important to avoid giving students the idea that individual molecules or atoms of substances are simply miniature versions of those substances. For example, a single water molecule is very different from a drop of water. A molecule does not have a boiling point or even a phase, but an assembly of many water molecules does have the properties we are familiar with, such as a boiling point and phase at room temperature. Students may be tempted to describe individual molecules as having a particular color. It is not worth the class time to dissuade them of this notion, and we encourage you to avoid using language that would give them this impression. Color is a special case of this molecular/macroscopic property distinction, as individual molecules of colored substances would be invisible, but sophisticated equipment could be used to measure features of the molecule that would predict the exact color of the substances made of many of those molecules.

3. Students do not need to know the difference between stabilizers and emulsifiers, although they are exposed to both in the Modeling Matter unit (stabilizers: cornstarch and flour, emulsifier: lecithin). Students' understanding of emulsifiers also need not extend beyond the idea that molecules in an emulsifier allow normally unmixable liquids to mix by attracting the molecules of both.

Essential Vocabulary:

property	substance	atom	evidence	dissolve
observe	matter	model	inference	soluble
mixture	molecule	attract	explain	

Assessment Profile:
SAMPLE DRAFT End of Unit Assessments **Pre-Unit Assessment (formative) → Lesson 1.1** **Critical Junctures (formative) → Level 1 Progress Build - end of Lesson 1.10** **Level 2 Progress Build - end of Lesson 2.5** **Level 3 Progress Build - end of Lesson 3.6** **End of Unit Assessment (Summative) → Lesson 3.7** **Formative Assessments:** On-the-Fly Assessment 1: Observing and Describing Properties of Mixtures (Lesson 1.2, Activity 2) On-the-Fly Assessment 2: Thinking About Objects at the Nanoscale (Lesson 1.3, Activity 3) On-the-Fly Assessment 3: Students' Ideas About Molecules (Lesson 1.4, Activity 5) On-the-Fly Assessment 4: Discussing Properties of Molecules (Lesson 1.5, Activity 4) On-the-Fly Assessment 5: Modeling Nanoscale Objects (Lesson 1.6, Activity 2) On-the-Fly Assessment 6: Digital Nanovision Models of Chromatography (Lesson 1.6, Activity 4) On-the-Fly Assessment 7: Making Inferences About Molecules (Lesson 1.7, Activity 2) On-the-Fly Assessment 8: Evaluating Models (Lesson 1.8, Activity 3) On-the-Fly Assessment 9: Distinguishing Observations from Inferences (Lesson 2.3, Activity 3) On-the-Fly Assessment 10: Digital Nanovision Models of Dissolving (Lesson 2.4, Activity 2) On-the-Fly Assessment 11: Scientific Explanations About Dissolving (Lesson 2.4, Activity 3) On-the-Fly Assessment 12: Debriefing Data (Lesson 3.1, Activity 3) On-the-Fly Assessment 13: Making Inferences (Lesson 3.2, Activity 3) On-the-Fly Assessment 14: Ideas About Mixing and Separating (Lesson 3.3, Activity 1) On-the-Fly Assessment 15: Drawing Initial Models of Emulsifiers (Lesson 3.5, Activity 2) On-the-Fly Assessment 16: Evaluating Models of Emulsifiers (Lesson 3.6, Activity 2)
Other High Quality Resources
Next Generation Science Standards - Quality Examples of Science Lessons and Units
FCPS Resources
FCPS Achievement & Trauma-Informed Strategies in the Classroom

Individual lesson information to be completed at the school level based on pre-unit assessment data and formative assessment data.

<table>
<tr><td colspan="5">Chapter 1 Problem Students are Trying to Solve: (Supporting Question)</td></tr>
<tr><td colspan="5">Why did the food coloring separate into different dyes?</td></tr>
<tr><td colspan="5">Chapter 1 Three Dimensional Statement:</td></tr>
<tr><td colspan="5">Students use physical models and create their own diagram models to investigate and communicate what is happening at the nanoscale during the process of chromatography (scale, proportion, and quantity). Through their investigations and models, students discover similarities and differences in the properties of substances and the properties of molecules (patterns).</td></tr>
<tr><td colspan="2"></td><td colspan="3">Anchor Resource Connections</td></tr>
<tr><td>Lesson Learning Intention
(describes clearly what the students will know and/or be able to do as a result of learning and teaching.)</td><td>Lesson Success Criteria
(based on lesson sequence and connections to Learning Intention)</td><td>Learning Progression
(from “Evidence sources and reflection opportunities” AND “Application of key concepts to problem” on the Coherence Flowchart)</td><td>Key Concepts
(from Key Concepts section on the Coherence Flowchart)</td><td>Amplify Progress Build Level
(these are found in Planning for the Unit on the Unit Landing Page in Progress Build)</td></tr>
<tr><td colspan="5">The Pre-Unit Assessment is diagnostic and designed to reveal students’ understanding of the unit’s core content, both unit-specific science concepts and crosscutting concepts, prior to instruction by indicating, for formative purposes, where students initially fall along the levels of the Progress Build (PB). The Pre-Unit Assessment also measures students’ understanding of important supporting content not explicitly included in the PB. As such, it offers a baseline from which to measure growth of understanding over the course of the unit.</td></tr>
<tr><td>I am learning to observe and compare two mixtures so that I can develop an initial explanation of why something different happened with each of the two substances.</td><td>I know I am successful when I can:
• describe what a food scientist does.
• observe different mixtures.
• share my initial thinking about mixtures.</td><td>• Pre-Unit Assessment</td><td></td><td>Progress Build Level 1: Observable properties result from molecular properties.
All matter is made up of particles too small to see—atoms connected together to form molecules. If two pure substances have different observable properties (in the same conditions), they are made of different molecules.</td></tr>
</table>

I am learning to investigate various mixtures so that I can identify specific properties of each substance.	I know I am successful when I can: ● describe how to observe something. ● explain what a property is. ● define the words mixture and substance. ● Make and record observations of different properties.	● Observe and record properties of food mixtures		**Progress Build Level 1: Observable properties result from molecular properties.**
I am learning to investigate various mixtures so that I can identify similarities and differences in the mixtures and classify mixtures based on their properties.	I know I am successful when I can: ● debrief my observations of the food mixtures. ● use a Shared Listening routine to further discuss observations. ● classify the mixtures based on their properties.			**Progress Build Level 1: Observable properties result from molecular properties.**
I am learning to use a scale tool so that I can learn to evaluate information about the particulate nature of matter.	I know I am successful when I can: ● explain what matter is. ● explain that a Scale Tool helps to see how tiny the tiniest bits of matter are. ● describe nanoscale. ● Preview the book *Made of Matter* and share initial ideas.	● Observe digital Scale Tool to view nanoscale objects (1.3)		**Progress Build Level 1: Observable properties result from molecular properties.**

I am learning to obtain information from a text so that I can learn to evaluate information about the particulate nature of matter.	I know I am successful when I can: ● obtain information from *Made of Matter* paying close attention to text features. ● describe what an inference is. ● define what a model is. ● explain what an atom is ● define molecule. ● explain the relationship between atoms and molecules.	● Read *Made of Matter* (1.3)		**Progress Build Level 1: Observable properties result from molecular properties.**
I am learning to do an investigation using chromatography so that I can separate a mixture.	I know I am successful when I can: ● describe chromatography, ● perform a chromatography investigation.	● Use chromatography to separate food coloring mixture (1.4)		**Progress Build Level 1: Observable properties result from molecular properties.**
I am learning to use a model so that I can reflect on how similarities and differences in molecules could help them explain what might be happening at the nanoscale in my chromatography experiment.	I know I am successful when I can: ● explain the relationship between a molecule and a substance. ● explain why a mixture is not a substance. ● describe how chromatography worked. ● explain ways in which molecules can be different and similar.	● Observe the Pasta Model and discuss in relation to chromatography (1.4) ● Write about how molecules can be similar and different (1.4)	● All molecules of one substance are exactly the same, and they are different from molecules of any other substance. (1.4)	**Progress Build Level 1: Observable properties result from molecular properties.**

I am learning to use additional models so that I can identify more similarities and differences in molecules.	I know I am successful when I can: ● define evidence. ● explain the three essential parts of a chromatography test. ● make predictions of what might happen when the fan is turned on in the fan model. ● record observations of the fan model results.	● Use and discuss the Fan Model of chromatography (1.5)	● Different molecules have different properties. (1.5)	**Progress Build Level 1: Observable properties result from molecular properties.**
I am learning to use an additional model so that I identify more similarities and differences in molecules that can help clarify the difference between observation and inference.	I know I am successful when I can: ● discuss the fan model results. ● discuss properties of substances in the model. ● define attract. ● explain what an inference is. ● describe the difference between observations and inferences.	● Use and discuss the Fan Model of chromatography (1.5)		**Progress Build Level 1: Observable properties result from molecular properties.**

Other High Quality Resources
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Individual lesson information to be completed at the school level based on pre-unit assessment data and formative assessment data.

Chapter 2 Problem Students are Trying to Solve: (Supporting Question)

Why do some salad dressings have sediments, and others do not?

Chapter 2 Three Dimensional Statement:

Students investigate the macroscale phenomenon (scale, proportion, and quantity) of dissolving and then use digital models and create their own diagram models to show what happens to matter at the nanoscale when substances seem to disappear (dissolve).

		Anchor Resource Connections		
Lesson Learning Intention (describes clearly what the students will know and/or be able to do as a result of learning and teaching.)	**Lesson Success Criteria** (based on lesson sequence and connections to Learning Intention)	**Learning Progression** (from "Evidence sources and reflection opportunities" AND "Application of key concepts to problem" on the Coherence Flowchart)	**Key Concepts** (from Key Concepts section on the Coherence Flowchart)	**Amplify Progress Build Level** (these are found in Planning for the Unit on the Unit Landing Page in Progress Build)
I am learning to….. so that I can….	I know I am successful when I can: •			
I am learning to….. so that I can….	I know I am successful when I can: •			
I am learning to….. so that I can….	I know I am successful when I can: •			

Other High Quality Resources

[Next Generation Science Standards - Quality Examples of Science Lessons and Units]

FCPS Resources

[FCPS Achievement & Trauma-Informed Strategies in the Classroom]

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Chapter 3 Problem Students are Trying to Solve: (Supporting Question)				
Why can salad-dressing ingredients separate again after being mixed?				
Chapter 3 Three Dimensional Statement:				
Students use digital models and create their own diagram models in order to explain the macroscale phenomena (scale, proportion, and quantity) of liquids mixing, separating, and being emulsified.				
		Anchor Resource Connections		
Lesson Learning Intention (describes clearly what the students will know and/or be able to do as a result of learning and teaching.)	**Lesson Success Criteria** (based on lesson sequence and connections to Learning Intention)	**Learning Progression** (from "Evidence sources and reflection opportunities" AND "Application of key concepts to problem" on the Coherence Flowchart)	**Key Concepts** (from Key Concepts section on the Coherence Flowchart)	**Amplify Progress Build Level** (these are found in Planning for the Unit on the Unit Landing Page in Progress Build)
I am learning to….. so that I can….	I know I am successful when I can: •			
I am learning to….. so that I can….	I know I am successful when I can: •			
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