Mixtures

Physical Science | Lesson Guide

4th Grade

Photo Description

This image shows a kitchen science experiment in progress where dry ingredients (flour and cinnamon) are being mixed in a white bowl with a whisk, while a KitchenAid mixer in the background holds a red liquid (likely tomato sauce or food coloring). The setup demonstrates how different materials can be combined together and how some mixtures can be separated or combined in different ways.

Scientific Phenomena

Anchoring Phenomenon: Combining Ingredients During Cooking

When we make food, we mix different ingredients together—like flour with cinnamon, or sauce with other liquids. This image captures the moment when dry ingredients blend together through physical mixing. Here's why it happens: When we use tools like a whisk or mixer, we're physically moving the materials around, spreading the cinnamon particles throughout the flour. The particles don't change into something new; they're just distributed evenly. This is a mixture—two or more materials combined together while keeping their own properties.

Core Science Concepts

* Mixtures: When two or more materials are combined but each material stays the same (flour is still flour, cinnamon is still cinnamon). You can usually separate them again.

* Physical Changes: Mixing is a physical change because the materials don't turn into something completely new. You could sift the flour and cinnamon apart if you needed to.

* Properties of Matter: Different materials have different properties (like color, texture, and smell). When mixed, you might see all the colors and textures together, but each material keeps its own properties.

* Tools for Mixing: Whisks, mixers, and spoons help us combine ingredients evenly and efficiently.

Pedagogical Tip:

Before diving into formal vocabulary, have students observe and describe what they see using everyday language ("It's getting mixed up," "The brown stuff is spreading through the white stuff"). This activates prior knowledge and makes the transition to scientific terms more meaningful. Students will own the vocabulary better when they've already described the phenomenon in their own words.

UDL Suggestions:

Provide multiple ways for students to engage with this concept: some students could physically mix ingredients (action/kinesthetic), others could draw or photograph their mixtures (visual), and others could describe what they observe verbally (auditory). Offer a "mixture station" where students can explore pre-made examples (salt and sand, oil and water, cereal and milk) to accommodate different learning preferences and modalities.

Zoom In / Zoom Out

Zoom In (Microscopic Level):
If we could look at the flour and cinnamon through a very powerful microscope, we'd see that they're made of tiny, tiny particles. When you whisk them together, you're moving those invisible particles around so they spread out evenly. The cinnamon particles slip between the flour particles, but each type of particle stays exactly the same—it doesn't change into something new. This is why mixtures can often be separated again; the particles never actually joined together or changed.

Zoom Out (Real-World System):
In a bakery or restaurant kitchen, cooks mix ingredients on a much larger scale to make hundreds of cookies, cakes, or meals. Understanding how mixtures work helps bakers and chefs predict what will happen when they combine ingredients, how long mixing will take, and how to get consistent results every time. When a factory makes packaged foods, they use giant industrial mixers to combine ingredients in the exact same proportions for every batch—all based on the same science of mixtures you see in this kitchen photo.

Discussion Questions

1. If you mixed flour and cinnamon together, could you separate them again? Why or why not? (Bloom's: Analyze | DOK: 2)

2. What do you think would happen if you mixed flour with water instead of just stirring dry flour and cinnamon? (Bloom's: Predict | DOK: 2)

3. Why do you think cooks use a whisk or mixer instead of just pouring ingredients together? (Bloom's: Evaluate | DOK: 3)

4. Can you think of a mixture you eat or use every day? What materials are mixed together in it? (Bloom's: Apply | DOK: 2)

Potential Student Misconceptions

Misconception 1: "Mixing ingredients means they turn into something brand new."
Clarification: When you mix flour and cinnamon, you're not creating a new material. Each ingredient stays the same—it's just that the particles get spread throughout. If you looked very closely at the mixture, you could still see brown cinnamon specks and white flour particles. They're just mixed together, not changed into something else.

Misconception 2: "Once you mix things together, you can never separate them again."
Clarification: Many mixtures CAN be separated! You could use a fine strainer to separate flour from cinnamon because their particles are different sizes. However, some mixtures (like salt dissolved in water) are much harder to separate without special tools. The key is that in a mixture, the materials don't chemically bond—they just sit together.

Misconception 3: "You need a mixer or whisk to make a mixture; you can't just stir by hand."
Clarification: You can make a mixture many different ways! A whisk or mixer just makes it faster and more even. You could also shake ingredients in a closed jar, stir with a spoon, or even roll things around in a bag. The tool just changes how quickly and evenly the mixing happens.

Extension Activities

1. Mixture Exploration Station: Set up containers with pre-made mixtures (salt and sand, cereal and raisins, rice and beans, oil and water). Have students observe each mixture, describe what they see, and predict whether it could be separated. Provide tools like forks, spoons, strainers, and magnifying glasses to explore different separation methods.

2. Design Your Own Trail Mix: Students select 3–4 dry ingredients (cereal, nuts, dried fruit, pretzels) to create their own mixture. Before combining, have them predict what the final mixture will look like and how it will taste. Afterward, discuss whether each ingredient kept its own properties and whether the mixture could be separated.

3. Liquid Mixtures Investigation: Use clear cups and explore what happens when you mix liquids (water with food coloring, oil with water, vinegar with water). Have students record observations and discuss why some liquids mix easily while others don't.

Cross-Curricular Ideas

Math Connection — Measuring & Proportions:
Have students measure specific amounts of flour and cinnamon (using cups or tablespoons) to create a seasoning mixture. Then explore what happens when you double the recipe or cut it in half. This teaches measurement, fractions, and proportional reasoning while using real ingredients. Students could create a recipe card with their measurements.

ELA Connection — Recipe Writing & Procedural Text:
After making a mixture, have students write step-by-step instructions for someone else to follow. This requires clear, sequential language and helps them practice procedural writing. They could also read and compare different recipes to see how different authors describe the same mixing process, and discuss why clear directions matter.

Social Studies Connection — Food & Culture:
Explore how different cultures mix ingredients to create signature dishes and seasonings. For example, discuss spice blends from around the world (garam masala from India, za'atar from the Middle East, Cajun seasoning from Louisiana). Have students research or taste simple mixtures from different cultures to understand how food connects to heritage and tradition.

Art Connection — Visual Observation & Color Theory:
Have students create drawings or paintings that show what happens when they mix cinnamon with flour, or food coloring with water. This combines observational drawing with understanding how colors blend. They could also experiment with mixing colored sand, rice, or paint to create colorful layer mixtures, documenting how the colors change as they mix.

STEM Career Connection

Food Scientist / Recipe Developer — Average Salary: $65,000–$75,000/year
Food scientists are like kitchen detectives! They test recipes and ingredients to figure out what tastes good and what's safe to eat. They mix different ingredients together (just like in this photo), test how long foods can be stored, and solve problems like "How do we keep cookies from getting stale?" When you buy packaged foods at the store, a food scientist helped create the recipe and tested that the mixture works perfectly every time.

Pharmaceutical Technician — Average Salary: $35,000–$45,000/year
Pharmacists and their helpers mix different ingredients very carefully to create medicines that help people feel better. They measure exact amounts of powders and liquids and mix them together in precise ways. It's very similar to baking or cooking, except the mixtures have to be even more exact because people's health depends on getting the right amount. One tiny mistake in the mixture could be dangerous, so these scientists are extra careful!

Chemical Engineer — Average Salary: $108,000–$120,000/year
Chemical engineers design and run big industrial machines that mix materials together on a huge scale—sometimes making thousands of gallons of products like shampoo, paint, or food ingredients. They use the same science of mixtures you see in this photo, but they solve problems like "How do we mix this faster?" or "How do we make sure every batch is exactly the same?" They design the giant mixers and figure out the best way to combine ingredients safely and efficiently.

NGSS Connections

Performance Expectation: 2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

Disciplinary Core Ideas:
- 2-PS1.A: Structure and Properties of Matter
- 2-PS1.B: Chemical Reactions

Crosscutting Concepts:
- Structure and Function
- Cause and Effect

Science Vocabulary

* Mixture: Two or more materials put together while each one stays the same.
* Physical Change: When something looks different but is still made of the same material (like mixing or breaking).
* Properties: Characteristics of something that you can observe, like color, texture, size, or smell.
* Whisk: A kitchen tool with wires that helps mix and blend ingredients together.
* Separate: To divide or sort materials into different groups.

External Resources

Children's Books:
- Mixtures and Compounds by Rebecca Stefoff (A clear, visual introduction to the difference between mixtures and compounds)
- What Is a Mixture? by Dr. Seuss (Published as part of the Cat in the Hat's Learning Library series; engaging and age-appropriate)