

## Photo Description



## Scientific Phenomena

This image demonstrates the anchoring phenomenon of diffusion and mixing of liquids. When a colored liquid (likely food coloring or dye) is added to clear water, the molecules of the colored substance begin to spread out and move throughout the water due to molecular motion. The blue dye particles are naturally moving from areas where there are many dye molecules to areas where there are fewer, eventually creating an even distribution throughout the water. This process happens because all molecules are constantly in motion, even when we can't see them moving.

## Core Science Concepts

1. Matter and Its Properties: Liquids can be mixed together and take the shape of their container. Different liquids can have different colors and properties.
2. Observable Changes: When substances are mixed, we can observe changes in color, appearance, and other properties using our senses.
3. Particle Movement: Even though we can't see them, tiny particles in liquids are always moving and spreading out.
4. Mixing and Solutions: Some substances can dissolve or spread evenly throughout other substances, creating mixtures.

### Pedagogical Tip:

Have students make predictions about what will happen before conducting mixing experiments. This activates prior knowledge and gives you insight into their thinking before instruction begins.

### UDL Suggestions:

Provide multiple ways for students to document observations by offering options like drawing, writing, or verbal descriptions with a partner. This supports different learning preferences and abilities.

## Zoom In / Zoom Out

**Zoom In:** At the molecular level, individual dye molecules are bouncing around and colliding with water molecules. Each tiny particle is moving randomly in different directions, gradually spreading the blue color throughout the entire container through molecular motion.

Zoom Out: This same mixing process happens throughout nature - in oceans when rivers carry sediments, in our bloodstream when nutrients spread through our bodies, and in the atmosphere when gases mix in the air we breathe.

### Discussion Questions

1. What do you think will happen if we add yellow food coloring to this blue mixture? (Bloom's: Apply | DOK: 2)
2. How could we make the blue color spread faster or slower through the water? (Bloom's: Analyze | DOK: 3)
3. Where else have you seen liquids mixing together in your daily life? (Bloom's: Apply | DOK: 2)
4. Why do you think the blue color eventually spreads throughout all the water instead of staying in one spot? (Bloom's: Analyze | DOK: 3)

### Potential Student Misconceptions

1. Misconception: "The liquid stops moving once it looks still."  
Reality: Molecules continue moving even when the liquid appears motionless to our eyes.
2. Misconception: "Someone or something is pushing the blue color through the water."  
Reality: The spreading happens naturally due to the constant motion of molecules, not from an outside force.
3. Misconception: "The blue liquid disappears when it mixes."  
Reality: The blue molecules are still there, just spread out evenly so the color looks lighter.

### Cross-Curricular Ideas

1. Mathematics - Patterns and Sequences: Have students observe the mixing process at different time intervals (0 minutes, 1 minute, 5 minutes, 10 minutes) and create a bar graph or picture graph showing how the color intensity changes over time. This connects to measurement and data representation standards.
2. ELA - Descriptive Writing: Ask students to write or dictate sentences describing what they observe using sensory words (swirling, spreading, mixing, cloud-like, bright). Create a class word bank of descriptive adjectives and use them in collaborative storytelling about the "journey of the blue dye."
3. Art - Color Mixing and Observation: Connect to color theory by experimenting with different food coloring colors in water and predicting what new colors will form when mixed (blue + yellow = green). Students can create watercolor paintings inspired by the swirling patterns they observe in the jar.
4. Social Studies - Water Around Us: Discuss how water mixing is important in our communities - from water treatment plants that clean our drinking water to rivers carrying nutrients to farms. Invite students to think about where water comes from in their homes and how it's kept clean.

### STEM Career Connection

1. Water Treatment Specialist - These scientists and engineers make sure the water we drink from our taps is clean and safe. They test water, mix in special substances to clean it, and watch how things dissolve and mix together, just like in our jar experiment. They help keep our communities healthy! Average Salary: \$48,000 - \$62,000 USD
2. Chemist - Chemists are scientists who study how different materials mix, dissolve, and change. They do experiments similar to our food coloring activity to learn about substances and create new materials like medicines, paints, and cleaning products. Average Salary: \$65,000 - \$82,000 USD

3. Environmental Scientist - These scientists study how liquids and gases mix in nature, like how pollution spreads in water and air. They work to understand and protect our environment by studying mixing and diffusion in oceans, rivers, and the atmosphere. Average Salary: \$61,000 - \$76,000 USD

### 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 - Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature.
- Crosscutting Concepts: Patterns - Patterns in the natural and human designed world can be observed and used as evidence.

### Science Vocabulary

- \* Mixture: When two or more different materials are combined together but keep their own properties.
- \* Dissolve: When one substance spreads out completely and evenly in another substance.
- \* Properties: The characteristics of matter that we can observe, like color, shape, or texture.
- \* Molecules: Tiny particles that make up all matter, too small to see without special tools.
- \* Diffusion: The way particles naturally spread out from crowded areas to less crowded areas.

### External Resources

Children's Books:

- Mixing and Separating by David Dreier
- What Is Matter? by Robin Johnson
- Solids, Liquids, and Gases by David Dreier