

Photo Description



Scientific Phenomena

This image demonstrates the anchoring phenomenon of diffusion - the natural movement of particles from areas where there are many particles to areas where there are fewer particles. When the blue dye is added to the water, the tiny dye particles spread out evenly through the water molecules because they are constantly moving and bumping into each other. This happens without any stirring or mixing because all matter is made of tiny particles that are always in motion, even when we can't see them moving.

Core Science Concepts

1. Matter is made of tiny particles - All substances, including water and dye, are composed of extremely small particles that are too small to see with our eyes.
2. Particles are always moving - Even in liquids that appear still, the tiny particles are constantly moving and colliding with each other.
3. Mixing happens naturally - When different substances come together, their particles naturally spread out and mix without any outside force.
4. Observable changes in matter - We can observe how matter behaves and changes when different substances are combined.

Pedagogical Tip:

Use the "think-pair-share" strategy when showing this phenomenon. Have students first observe silently, then discuss their observations with a partner, and finally share with the whole class. This builds observation skills and scientific vocabulary.

UDL Suggestions:

Provide multiple ways for students to express their observations: drawing pictures, using gestures, verbal descriptions, or simple written words. Some students may better understand the concept through kinesthetic activities like moving around the room to model particle movement.

Zoom In / Zoom Out

1. Zoom In: At the molecular level, individual water molecules and dye molecules are bouncing off each other millions of times per second. Each collision pushes the molecules in different directions, gradually spreading the dye molecules throughout the water.
2. Zoom Out: This same diffusion process happens throughout nature - when perfume spreads through a room, when pollutants mix in rivers and oceans, when oxygen moves from our lungs into our blood, and when nutrients spread through soil to reach plant roots.

Discussion Questions

1. What do you think will happen to the blue color over time? (Bloom's: Predict | DOK: 2)
2. How is this similar to when you add sugar to water? (Bloom's: Compare | DOK: 2)
3. Why do you think the blue spreads out instead of staying in one spot? (Bloom's: Analyze | DOK: 3)
4. What would happen if we used hot water instead of cold water? (Bloom's: Hypothesize | DOK: 3)

Potential Student Misconceptions

1. Misconception: The liquid mixes because gravity pulls the dye down.
Clarification: While gravity affects how the dye initially enters the water, the spreading and mixing happens because particles are always moving in all directions.
2. Misconception: The water and dye stay completely separate.
Clarification: The particles of water and dye mix together at the particle level, creating a uniform blue solution over time.
3. Misconception: Someone has to stir or shake the jar to make mixing happen.
Clarification: Mixing occurs naturally because particles are always in motion, even without any external force.

Cross-Curricular Ideas

1. Math - Patterns and Observation: Have students create a sequence of drawings showing the blue dye spreading at different time intervals (0 minutes, 1 minute, 5 minutes, 10 minutes). Count how many swirls or cloud-like shapes they observe in each drawing. This connects to recognizing and extending patterns, a key K-5 math standard.
2. ELA - Descriptive Writing and Vocabulary: Ask students to write or dictate sentences describing what they see using sensory words (swirly, cloud-like, spreading, flowing). Create a class word wall with descriptive vocabulary. Read aloud picture books about water and mixing, then have students act out the words with movement and gestures.
3. Art - Color Mixing and Movement: Extend this into an art exploration by having students predict what colors will form when two different food coloring drops mix together. Create artwork by dropping food coloring on wet paper towels or coffee filters to observe how colors spread and blend. Display the results and discuss how the patterns look similar to the dye in water.
4. Social Studies - Water in Our World: Connect to water systems by discussing where water comes from in our community and how it stays clean. Talk about how pollutants can spread through water (similar to the dye spreading), and why it's important to keep our water sources clean. This builds environmental awareness and community responsibility.

STEM Career Connection

1. Water Treatment Specialist: These scientists and engineers work to keep our drinking water clean and safe. They understand how different substances mix and separate in water, similar to the blue dye spreading. Water treatment specialists test water, remove bad things from it, and make sure the water coming to our homes is healthy to drink. They use their knowledge of how particles move and mix to protect people's health. Average Annual Salary: \$48,000 - \$65,000
2. Research Chemist: Chemists are scientists who study how different materials and liquids behave when they mix together. They conduct experiments like the one shown in the photo to understand how substances combine and change. Their discoveries help create new medicines, paints, cleaning products, and many other things we use every day. Average Annual Salary: \$65,000 - \$85,000
3. Environmental Scientist: These professionals study how water, air, and soil work together in nature. They observe how pollutants spread through water systems (like the dye spreading in the jar) and work to protect our environment. Environmental scientists help keep rivers, lakes, and oceans healthy for plants, animals, and people. Average Annual Salary: \$62,000 - \$78,000

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 Idea: 2-PS1.A - Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature.
- Crosscutting Concept: Patterns - Patterns in the natural world can be observed and used as evidence.

Science Vocabulary

- * Particles: Tiny pieces of matter that are too small to see but make up everything around us.
- * Mixing: When two or more different things combine together.
- * Liquid: A form of matter that flows and takes the shape of its container.
- * Dissolve: When one substance spreads out completely and evenly in another substance.
- * Properties: Special things about matter that we can observe, like color or how it moves.

External Resources

Children's Books:

- What Is the World Made Of? All About Solids, Liquids, and Gases by Kathleen Weidner Zoehfeld
- Mixing and Separating by David Dreier
- Solids, Liquids, and Gases by Ginger Garrett