# Mixture

Physical Science | Lesson Guide

3rd Grade

## Photo Description

This image shows concrete with many different colored rocks and pebbles mixed inside. The rocks are different sizes, shapes, and colors like brown, orange, red, black, and gray. You can see how all the pieces are stuck together to make a strong, hard surface.

## Scientific Phenomena

The anchoring phenomenon here is composite material formation - specifically how concrete demonstrates that combining different materials creates something stronger than any single material alone. This happens because the cement acts as a binding agent that hardens around the aggregate (rocks and sand), distributing forces across the entire structure. The varied sizes of aggregate help fill spaces and create interlocking connections, while the chemical curing process of cement creates strong bonds throughout the mixture.

## Core Science Concepts

1. Material Properties: Different materials have different characteristics (hardness, color, texture) that can be observed and measured.

2. Mixtures vs. Solutions: Concrete is a mixture where you can still see the individual components (rocks, sand, cement) even after they're combined.

3. Engineering Design: Humans combine materials with specific properties to solve problems and meet needs, like creating strong surfaces for roads and buildings.

4. Forces and Structures: The combination of materials helps distribute weight and forces, making the final product stronger than individual parts.

**Pedagogical Tip:**

Have students bring in small rock samples from home to create a class collection. This builds personal connection to the content and provides concrete examples for comparison and classification activities.

**UDL Suggestions:**

Provide multiple ways for students to explore material properties: visual observation charts, tactile exploration stations with different textures, and audio descriptions of what they're feeling and seeing to support diverse learning needs.

## Zoom In / Zoom Out

Zoom In: At the molecular level, cement particles undergo hydration reactions with water, forming calcium silicate hydrate crystals that grow and interlock around the aggregate particles, creating incredibly strong chemical bonds that give concrete its durability.

Zoom Out: This concrete is part of larger infrastructure systems like roads, sidewalks, and buildings that connect communities, support transportation networks, and provide the foundation for modern civilization's built environment.

## Discussion Questions

1. What patterns do you notice in how the rocks are arranged in the concrete? (Bloom's: Analyze | DOK: 2)

2. Why do you think engineers choose to mix different sized rocks instead of using all the same size? (Bloom's: Evaluate | DOK: 3)

3. How might the properties of this concrete change if we removed all the rocks and just used cement? (Bloom's: Apply | DOK: 2)

4. What other materials in our classroom or school are made by combining different things together? (Bloom's: Apply | DOK: 2)

## Potential Student Misconceptions

1. Misconception: "Concrete and cement are the same thing."
   Clarification: Cement is just one ingredient in concrete - like flour in bread. Concrete is the mixture of cement, water, sand, and rocks.

2. Misconception: "The rocks make concrete weaker because they take up space."
   Clarification: The rocks (aggregate) actually make concrete much stronger by providing structure and helping spread out forces.

3. Misconception: "All the pieces were glued together after mixing."
   Clarification: The cement and water create a chemical reaction that hardens naturally, binding everything together as it cures.

## Cross-Curricular Ideas

Math Connection: Have students sort and classify rocks from the photo by size, then create a bar graph showing how many rocks fall into each size category (small, medium, large). This builds data analysis skills while reinforcing the observation that concrete contains mixed-size aggregate.

ELA Connection: Ask students to write descriptive sentences about the concrete using sensory words (rough, bumpy, hard, speckled). Then have them create a simple "How Concrete is Made" sequence story using transition words like "first," "next," and "finally" to describe the mixing and curing process.

Social Studies Connection: Explore how concrete is used in your community by taking a neighborhood walk to identify concrete structures (sidewalks, building foundations, roads). Students can create a map or list of all the places they find concrete, discussing how it helps people in their community.

Art Connection: Create a mixed-media collage by gluing actual small rocks, sand, and pebbles onto paper to recreate a concrete texture. This hands-on activity helps students understand how different materials combine to create a finished product while exploring artistic composition.

## STEM Career Connection

Civil Engineer: A civil engineer designs and builds structures like roads, bridges, and buildings. They decide what materials to use (like concrete) to make sure everything is safe and strong. They work on projects that help communities grow and connect. Average Annual Salary: $88,000

Materials Scientist: A materials scientist studies different materials to understand how they work and how to make them better. They might experiment with concrete recipes to make it stronger, last longer, or be better for the environment. Average Annual Salary: $95,000

Construction Worker: A construction worker builds buildings, roads, and other structures using materials like concrete. They mix concrete, pour it into forms, and help create the buildings and structures we use every day. Average Annual Salary: $67,000

## NGSS Connections

Performance Expectation: 2-PS1-2: Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

Disciplinary Core Ideas:
- 2-PS1.A: Different kinds of matter exist and many of them can be either solid or liquid
- 2-PS1.B: Different properties are suited to different purposes

Crosscutting Concepts:
- Patterns: Patterns in the natural and human designed world can be observed
- Structure and Function: The shape and stability of structures are related to their function

## Science Vocabulary

* Mixture: When two or more different materials are combined but keep their own properties.
* Properties: The special characteristics that describe how a material looks, feels, or acts.
* Aggregate: The rocks, sand, and gravel pieces mixed into concrete.
* Composite: A material made by combining two or more different materials to make something stronger.
* Cement: The gray powder that hardens when mixed with water to hold other materials together.

## External Resources

Children's Books:
- "What Is the World Made Of?: All About Solids, Liquids, and Gases" by Kathleen Weidner Zoehfeld
- "Materials" by Carol Baldwin
- "Rocks and Minerals" by Steve Parker