Mixing Matters: The Chemistry of Color

Materials Needed

- Red, Blue, and Yellow primary tempera paints (or food coloring/liquid watercolors)
- Small mixing containers (3-6 plastic cups or dishes)
- Spoon or pipette for measuring and mixing
- Paper or designated surface for painting/recording results
- Water and paper towels for cleanup
- Computer or tablet with internet access
- Access to a simple digital drawing program (e.g., MS Paint, Google Drawings, or a free online color mixer tool)
- "Color Combination Chart" template (simple 3x2 table)

Learning Objectives (The Goal)

By the end of this lesson, you will be able to:

1. Identify the three primary colors (the core ingredients).
2. Predict and successfully create the three secondary colors by mixing primary colors (the basic chemical mixture).
3. Compare the results of mixing colors physically (like paint) and mixing colors digitally (like light on a screen).

Success Criteria

You know you have succeeded when:

- You have correctly labeled all primary and secondary colors on your chart.
- Your physical mixtures look distinctly Orange, Green, and Purple.
- You can explain how digital colors are "mixed" on the computer screen.

I. Introduction (10 minutes)

The Hook: The Secret Ingredient

Educator Prompt: Imagine you are a chemist trying to invent a brand new substance. Many complex materials we use every day, like plastic or medicine, are built from simple starting ingredients. In the world of art and light, we also have "starting ingredients."

Question: What happens when you mix yellow paint and blue paint? Do they disappear, or do they create a brand new color? How is mixing colors similar to mixing chemicals?

Setting the Stage

We are going to be Color Chemists today! We will work with the most basic chemical mixtures: Primary Colors. These are the ingredients that cannot be made by mixing any other colors.

Activity: Quick Check

- Name the three primary colors. (Answer: Red, Yellow, Blue)

II. Body: Content & Practice (40 minutes)

Phase 1: I Do (Modeling the Mixing Process)

Concept: Subtractive Mixing (Physical Pigments)

The instructor demonstrates the first mixture clearly, explaining the importance of using equal amounts (proportion).

1. Gather two containers. Place one spoonful of Red paint in the first container and one spoonful of Yellow paint in the second.
2. Carefully combine the Red and Yellow into a third container.
3. Mix thoroughly until a consistent, new color appears.

Modeling Observation: "I mixed Red and Yellow, and the result is Orange. Orange is now a Secondary Color, because it was created by combining two Primary Colors."

Transition: Now it’s your turn to be the chemist and predict the next two mixtures.

Phase 2: We Do (Guided Hands-On Practice)

Activity: Creating Secondary Colors

The learner performs the next two mixtures with guidance. Use the "Color Combination Chart" to record predictions and actual results.

Primary Color 1	Primary Color 2	Prediction (What new color?)	Actual Result (Secondary Color)
Blue	Yellow	(Learner predicts)	Green
Red	Blue	(Learner predicts)	Purple/Violet

Discussion & Formative Assessment:

- What did you notice about the color when you first started stirring?
- If you added too much Blue to the Yellow, how could you fix your mixture? (Answer: Add more Yellow. This introduces the concept of stoichiometry/balancing ingredients.)

Phase 3: You Do (Application and Digital Chemistry)

Concept: Additive Mixing (RGB Light)

We just saw how paint (pigments) mix. Now we will see how light mixes using the computer, which operates on the **RGB model** (Red, Green, Blue). This is how screens create all the colors you see.

Activity: Digital Color Mixing Simulation

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1. **Setup:** Open the simple digital drawing program or online color mixer.
2. **Challenge 1 (Digital Green):** In the program, select the purest Red and the purest Blue available. Try to digitally "layer" or mix them (e.g., drawing overlapping shapes or using the color picker combination). Does Red + Blue make Purple on the screen?
3. **Challenge 2 (Digital Yellow):** On the computer, try mixing Red light and Green light. In the RGB model, Red + Green light creates Yellow.
4. **Reflection:** Record your observations. Is physical mixing the same as digital mixing?

*(Educator Note: If a student uses a paint program set to RGB, mixing digital Red and Blue pigments will still create Purple. The key contrast is that Red and Green *light* makes Yellow, while Red and Green *paint* makes brown/muddy.)*

Success Criterion Check: Does the learner grasp that screens use a different system (light) than paint (pigments)?

III. Conclusion (10 minutes)

Recap and Review (Tell Them What You Taught)

Summary Dialogue:

- What are the three core ingredients, or Primary Colors?
- What do we call the colors created when we mix two primaries? (Secondary Colors)
- We learned that mixing chemicals (like paint) is called **Subtractive Mixing** because the mixture absorbs light and gets darker.
- Mixing light on a computer screen is called **Additive Mixing**, where adding more light colors makes the result brighter!

Summative Assessment: The Color Chemist Report

The student presents their "Color Combination Chart" and their observations from the computer activity. They must verbalize the following equation:

R + B = P (Red + Blue = Purple)

The student explains one key difference between the physical mixing (paint) and the digital mixing (computer screen).

Differentiation and Adaptability

Scaffolding (For deeper understanding of KS1 concepts)

- **Visual Aids:** Use color flashcards or labeled bottles to reinforce Primary vs. Secondary definitions throughout the activity.
- **Focus Reduction:** If the RGB concept is confusing, skip the digital mixing and focus only on mixing paint, ensuring the student can confidently identify the three secondary colors first.
- **Simple Language:** Substitute complex terms like "pigment" and "additive/subtractive" with "paint material" and "light mixing."

Extension (For the 13-year-old’s advanced cognitive interest)

- **Tertiary Colors:** Challenge the student to mix a Primary Color with an adjacent Secondary Color (e.g., Red + Orange) to create Tertiary Colors (e.g., Red-Orange). This introduces more complex ratio thinking.
- **Ratio Chemistry:** Challenge the student to find the perfect ratio (e.g., 2 parts Blue, 1 part Red) to achieve a deep indigo or teal, emphasizing that varying proportions changes the outcome—a crucial concept in chemical formulation.
- **Digital Research:** Research why the standard printing colors (CMYK: Cyan, Magenta, Yellow, Black) are different from the Primary Colors (Red, Yellow, Blue) and discuss their application in technology.