

Rainbow Test Tubes

Problem: How many colors can be created by starting with red, yellow, and blue solutions?

Materials per group of 3-4 students:

- 9-10 test tubes with test tube rack
- Erlenmeyer flasks filled with red, yellow, and blue solutions of food coloring and water
 - 5 drops of food coloring per 200 mL (25 per 1L)
- 3 x 25 mL Graduated Cylinders
- 3 x 10 mL Graduated Cylinders
- pipette
- beaker filled with clean water
- large beaker for used water



Parameters Part 1 -

1. Follow proper lab procedures and avoid color contamination.
2. *Each test tube must have a final volume of 25 mL.*
3. Create solutions for the three secondary colors using the three primary colors.
4. Record the volume of each primary color used for each secondary color.
5. Select, in your group's opinion, the *best* shade for orange, green, and purple and highlight or circle the data in your table. Discard the other trials.
6. Add 25 mL of the three primary colors into three empty test tubes.
7. **Arrange the 6 test tubes into rainbow order and have it checked by me.**



Table 1: Secondary Color Trials

Trial	Orange		Green		Purple	
	Red mL	Yellow mL	Blue mL	Yellow mL	Red mL	Blue mL
1						
2						
3						
4						

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Parameters Part 2 - "Designer" Colors

- Using the 6 colors in your test tube rack, with your group, create 3-4 additional colors.
- If you run out of a color, use your data from Part 1 to create more solution.
- Record which colors you used how much of each in mL (needs to add up to 25mL).
- Record the trials for your **group** below.
- Rinse out test tube between trials.
- Circle or highlight the best trials for each color.
- Share your new colors with me to have them checked.



Table 2 - Additional Color Trials

Trial	Red mL	Orange mL	Yellow mL	Green mL	Blue mL	Purple mL	New Color
ex	-	3	10	7	-	5	swampy
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Rainbow Test Tubes**Analysis - answer in complete sentences**

All groups will share their data ([excel spreadsheet](#)) for orange, green, and purple solutions.

1. What was the average composition in mL for for each color?
 - a. Explain using the data from the class spreadsheet.
 - b. What patterns or trends did you notice?
 - c. How did your data for orange, green, and purple compare to the group average?
2. Each student will share their data ([excel spreadsheet](#)) for their favorite 'designer' color combination.
 - a. Select two colors from the class data and describe their composition.
 - b. Why did you select those two colors?
3. Was creating the new colors a physical or chemical change? Explain.

Conclusion - Write a $\frac{1}{2}$ to $\frac{3}{4}$ page reflection on this experiment.

Some questions to help guide you as you are gathering your thoughts:

- Did you have 25 mL in each test tube? Why or why not?
- How did you solve the initial challenge?
- How did your group work as a team to solve this problem?
- What worked?
- What didn't work?
- What were some problems you were able to figure out?
- How did you solve them?
- What did you learn by doing this activity?
- What frustrated you about this activity?
- What was your favorite color and why?
- What techniques did you use?