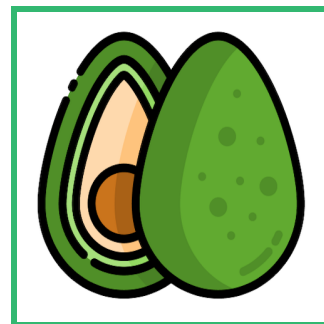


Can You Make the Rainbow?

A GuacaMOLE Lesson Plan

Set Up Time: 30 minutes

Lesson Time: 80 minutes



Materials for a Class of 30 Students (15 Pairs):

30 x	20 - 200 μ L Micropipette	15 x	50 mL Glass Beaker (or larger)
15 x	Micropipette Tip Boxes with Tips	30 x	Student Packet
30 x	96-Well Plates	15 x	Chalk Marker or Oil Pencil
30 x	8.5 x 11 Laminated Printer Paper	30 x	Calculator
15 x	Food Coloring (Red, Yellow, & Blue)	30 x	Dry Erase Board & Marker (optional)

Engage

Students are trained in the use of a micropipette. Students label a diagram of a micropipette and answer the questions while watching the introductory video.

Explore

Students use a micropipette to create a gradient of solutions in a well plate. Students follow the directions in their lab worksheet.

Explain (GuacaMOLE “Learn”)

Students learn how to calculate a serial dilution. Students take notes on the student worksheet. Then, students work on several example problems along with the teacher.

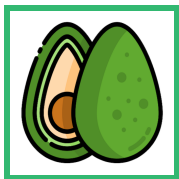
Elaborate (GuacaMOLE “Connect”)

Students calculate the serial dilutions they performed during the explore stage. Students work with their lab partner to complete this step.

Evaluate (GuacaMOLE “Practice”)

Students complete practice problems about serial dilutions. Students work on their own to complete these practice problems.

Name: _____



Can You Make the Rainbow?

GuacaMOLE Engage

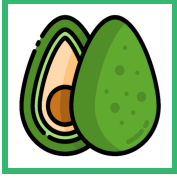
Chemists use a tool called a **micropipette** to measure small amounts of liquid. A micropipette is precise, and measures in units called **microliters**. The prefix for “micro-” is the Greek letter “μ” (mu), and microliters is abbreviated **μL**.

$$1 \text{ milliliter (mL)} = 1,000 \text{ (}\mu\text{L)}$$

Label the diagram and answer the questions while your teacher demonstrates how to use the micropipette:



1. How do you adjust the amount of liquid measured by the micropipette?
2. Why is it bad to have bubbles in the micropipette tip when you measure a sample of liquid?
3. What is the first stop? When should you use the first stop?
4. What is the second stop? When should you use the second stop?

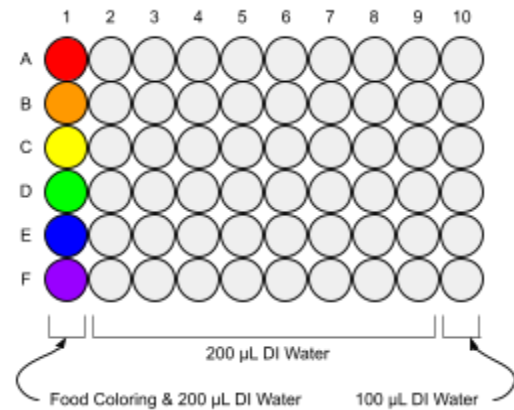


Can You Make the Rainbow?

GuacaMOLE Explore

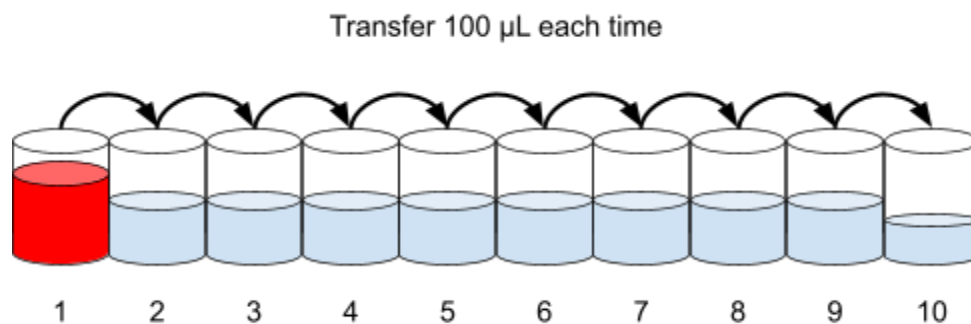
Set Up Your Well Plate

- ☐ Fill all wells in **A1** through **F9** with **200 μ L** of deionized water.
- ☐ Fill all wells in **A10** through **F10** with **100 μ L** of deionized water.
- ☐ **Well 1A:** 3 drops of red food coloring
- ☐ **Well 1B:** 1 drop red & 2 drops yellow food coloring
- ☐ **Well 1C:** 3 drops yellow food coloring
- ☐ **Well 1D:** 2 drops yellow & 1 drop blue food coloring
- ☐ **Well 1E:** 3 drops blue food coloring
- ☐ **Well 1F:** 2 drops blue & 1 drop red food coloring

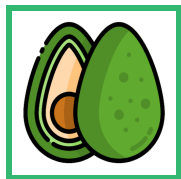


Perform a Serial Dilution

- ☐ Focus on one row (one color) at a time.
- ☐ Use the micropipette to take **100 μ L** of the solution in column **1**, and place it in the well in column **2**.
- ☐ Then, use the micropipette to take **100 μ L** of the solution in column **2**, and place it in the well in column **3**.
- ☐ Continue this process until you reach column **10**. Stop when you reach column **10**, and leave all of the remaining solution in well **10**.
- ☐ Complete this process for each color.



Name: _____



Can You Make the Rainbow?

GuacaMOLE Explain

Visit guacamole.one/learn.php and click on the "Solutions" topic.

Concentration

What is Concentration?

Concentration is _____

How is Concentration Calculated?



Dilutions

What is a Dilution?

Dilution is _____

How is Dilution Calculated?

$$C_1 V_1 = C_2 V_2$$

C_1 = Initial Concentration

V_1 = Initial Volume

C_2 = Final Concentration

V_2 = Final Volume

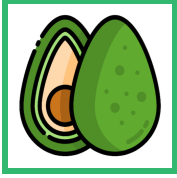
Serial Dilutions

What is a Serial Dilution?

A serial dilution is _____

How are Serial Dilutions Calculated?

Name: _____



Can You Make the Rainbow?

GuacaMOLE Elaborate

Visit guacamole.one/connect.php to read the article.

Serial Dilution Calculation

Use the space below to calculate the **concentration** of food coloring in each well according to the **serial dilution** you performed.

Hints:

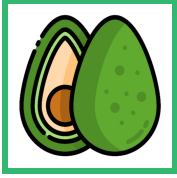
1. Draw a diagram of your serial dilution.
2. Use $C_1V_1 = C_2V_2$ to find C_2 for each dilution.

Serial Dilutions in The Real World

Read the article about **dilutions** called "**Thinning Oil Paint**" and answer the reflection question below.

1. According to the article, how do artists use serial dilutions in their everyday work?

Name: _____



Can You Make the Rainbow?

GuacaMOLE Evaluate

Visit guacamole.one/practice.php and click the "Solution" topic.

Question #1:

Your Work:

Question #2:

Your Work:

Question #3:

Your Work: