Vacation to Transylvania

Subject Area(s) Number and Operations, Measurement

Associated Unit

Lesson Title Cell Work

Grade Level **6** (6-8)

Time Required **50-90 mins**

Summary Laboratories often have devices and tools that measure in SI units. Students need plenty of exposure in working with these measurements as well as actual experience doing the measurements. This will help them gain interest in the STEM fields as well as decrease their anxiety in considering one of them as a career. This lesson will be a review of measuring in ml by creating solutions of different colors. They will also be working to convert ºF to ºC and/or ºC to ºF in trying to keep certain cell types in a livable environment. Finally, students will practice their ratio skills by splitting cells in a petri dish.

Engineering Connection

Engineers and scientists use measurements, ratios, and temperatures every day. In engineering applications, the goal is often to optimize a process or product; requiring precise measurements. Scientists sometimes do work with living organisms that require specific readings to maintain their environment. These fields are rich in many different mathematical areas and concepts that allow professionals to be successful in their experiments and objectives.

Engineering Category =

Choose the category that best describes this lesson's amount/depth of engineering content:

1. Relating science and/or math concept(s) to engineering

Keywords

Measurement, cell printing, temperature, split cells, ratio, fibroblasts, solutions, graph, Celsius, Fahrenheit, pipette, milliliters

Educational Standards (List 2-4)

State STEM Standard Integrate Science, Technology, Engineering, and Mathematics Content. Engage in Inquiry. Engage in Logical Reasoning. Collaborate as a STEM team.

ITEEA Standard Technological progress promotes the advancement of science and mathematics.

CCSS Standard MAFS.6.RP.1.3

Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

Pre-Requisite Knowledge

- How to add integers
- How to use a thermometer

- How to develop/read a graph
- How to manipulate equations

Learning Objectives

After this lesson, students should be able to:

- **Accurately measure solutions using a pipette**
- **Explain what a ratio is**
- **Demonstrate a 1:4 ratio using solutions**
- **Using the formulas for Celsius and Fahrenheit, convert between the two and create a graphical representation**

Introduction / Motivation (5E – Engage)

Scientists have discovered new types of cells and need someone to work on keeping them alive for further experiments. That is where you come in! You are a lab assistant and are responsible for making the food for the cells, which will be different according to which cell type you are working with. The Scientist you are working with, Dr. Acula, has only discovered the temperature the cells need to be in measured in Celsius, he has tasked you to determine what it is in Fahrenheit and provide a justification visually as well. Finally, you are to make sure the cells do not become too confluent and are tasked with splitting them into new dishes so they may continue to grow. There's a lot going on in the lab but he knows you are up to the challenge!

Can you help Dr. Acula keep order of the new cells types and help keep them alive?

Lesson Background & Concepts for Teachers (5E – Explain)

Students will be in groups of 2-3 and work around the lesson in stations. Teachers will provide students with 3 containers of blue, red, and yellow solutions. The students will use a 25ml pipette to measure how much of each solution is needed to create new solutions of green, purple, and orange colors. These solutions will be the "food" for the cells. The students will then be given a thermometer and told to take the temperature of solutions at different temperatures. The temperatures of the solutions should be at 50 ºF, 120 ºF, and -20 ºF. Students will need to convert these temperatures to ºC using the graphs and formulas provided. Lastly, students will take 24ml of each new solution they created and split them into new petri dishes using a 1:4 ratio. Each student should have a hands-on opportunity at this point. They are to add an amount of water that will make the total amount of solution in the dish 10ml and discuss what they see happen to the color.

Vocabulary / Definitions

Word	Definition
Ratio	The relationship between two amounts showing the number of times one value contains or is contained within the other
Celsius	The scale of temperature in which water freezes at 0 and boils at 100 under standard conditions
Solution	A liquid mixture in which the minor component is uniformly distributed within the major component
Fahrenheit	The scale of temperature in which water freezes at 32 and boils at 212 under

	standard conditions
Confluent	Flowing together or merging; the number of adherent cells in a culture dish or a flask, referring to the proportion of the surface which is covered by cells

Associated Activities (5E – Explore)

Before the Activity:

- Set 3 containers of solutions (red, blue, and yellow) at the desk groups. Place the 25ml pipette and filler as well. Set 3 empty containers for the new solutions.
- Have new solutions (purple, green, and orange) set at 120 ºF, -20 ºF, 50 ºF for measuring. Place thermometers by containers.
- Set up petri dishes in desk groups with 10ml pipette in separate container for later use. Have water readily available.

With the students:

- Demonstrate pipette and filler usage. Have students practice with water.
- Discuss with students solutions and ratios. What makes something a solution? What is the purpose of a ratio?
- Place students in groups of 2-3 and hand out worksheets; walk through worksheet with students, answering questions.
- Refresh students how to manipulate equations in needed to solve for variable.
- Discuss how to interpret given ratios and determine meaning of 1:4.

Lesson Closure

1) How many ml went into each dish from your original solution? How did you know? What math did you use?
2) How much water did you have to add after you split your solution? How did you know? Discuss any changes in color.

3) What is your definition of a ratio? Describe an example other than the one explored today.

Assessment (5E – Evaluate)

Pre-Lesson Assessment

Before beginning the activity, have students write or discuss with their partner what a ratio is, what a solution is and how to solve 2 step equations.

Activity-Embedded Assessment

During the activity, have students complete their provided worksheets and monitor their answers for possible misconceptions. Engage the class in thought provoking questions during their work time.

Post-Activity Assessment

After the activity, have students discuss with other groups what they saw and learned for today. Include any questions they might have on a notecard and turn in for review.

Attachment: Lesson Plan Worksheet

Contributors

Jordan Lewis

Attachments

Name: _____ Date: _____

Dr. Acula's Scientists Stations

Station 1:

Dr. Acula needs you to make the food for each type of cell you will be working with. You will be given solutions of blue, red, and yellow coloring. Use a 25ml pipette to mix them together in a way to make new solutions that are purple, green, and orange for the cells. Record how many ml of <u>each original color</u> it took to make the new solutions below. <u>You will need a total of at least 24ml of the new solutions.</u>

	Amount Blue	Amount Red	Amount Yellow	Total of new solution
Orange				
Purple				
Green				

Station 2:

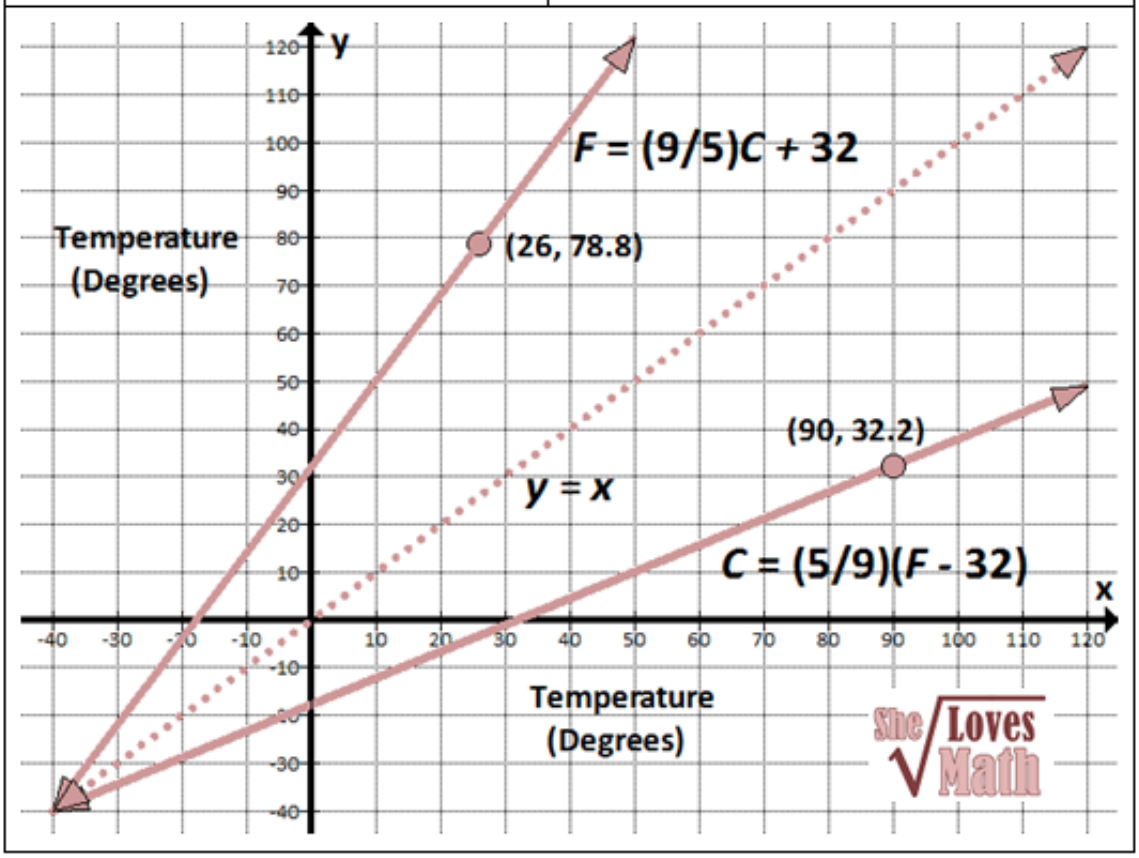
The cells need to be kept at specific temperatures to keep them alive. Dr. Acula has recorded the temperatures in Fahrenheit and needs you to convert your new solution temperatures to Celsius. Use the graph below and the equations given to <u>record the new temperatures measured in Celsius on the graph.</u> Discuss with your group and record any patterns you notice. Think: What would the temperature be in ºF if measured 0 ºC? What about in ºC if measured 32 ºF?

Orange measures _____ ºF, what is the temperature in Celsius? _____

Purple measures _____ ºF, what is the temperature in Celsius? _____

Green measures _____ ºF, what is the temperature in Celsius? _____

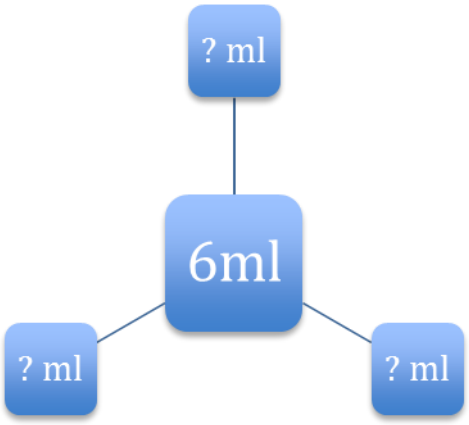
Fahrenheit based on Celsius	Celsius based on Fahrenheit
$F = \frac{9}{5}C + 32$	$C = \frac{5}{9}(F - 32)$



Station 3:

Now that you have the food for the cells at the right temperatures, Dr. Acula wants to make more of the cells by splitting the food into new dishes. Using your solutions, a 10ml pipette, and 4 10ml petri dishes to split the cells using a 1:4 ratio. <u>After you split the solutions, add water to each dish until it equals the full 10ml of the dish.</u>

For example, if a solution has a total amount of 6ml and I want to split it using a 1:3 ratio, how many ml would each of the 3 dishes need to have?



Questions to answer:

1) How many ml went into each dish from your original solution? How did you know? What math did you use?

2) How much water did you have to add after you split your solution? How did you know? Discuss any changes in color.

3) What is your definition of a ratio? Describe an example other than the one explored today.