Fractional Lava Lamps

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Name/Grade level of course: Grade 6

Length: 3 class periods *(This suggested length can be modified at teacher's discretion)*

Appropriateness for Students:

As an interdisciplinary lesson, students will be subjected to scientific and mathematical concepts while collaborating with their classmates and thinking critically. Since this lesson contains a hands-on activity, students will be more invested than normal.

Concepts and Key Vocabulary Defined:

Fraction, Numerator, Denominator, Hypothesis, Density, Volume

Performance Objectives: Students Will Be Able To (SWBAT):

- Make predictions based on prior knowledge of fractions, volume, and density
- Observe minor chemical reactions
- Conduct their own experiments to develop conclusions
- Apply and extend previous understandings of multiplication and division to divide fractions by fractions

Common Core Math Standards:

CCSS.MATH.CONTENT.6.NS.A.1
Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?*.

Science Standards:

3.2.6.A1.
Distinguish the differences in properties of solids, liquids, and gases. Differentiate between volume and mass. Investigate that equal volumes of different substances usually have different masses.

Materials and Advance Preparations:

Plastic Vials, Food Coloring, Vegetable/Canola Oil, Alka-Seltzer Tablets, Paper Towels, Cups
Optional: Science goggles and gloves - These are a preventative safety measure, potentially necessary depending on student ages. Use at teacher's discretion.

Supplementary Materials:

Lava Lamps Activity Worksheet

Safety:
Remind students not to put lids on the plastic vials while the chemical reaction is occurring - this could result in too much pressure causing the lid to pop off.
To prevent the food coloring from dying surfaces, remind students to lay down paper towels under the vials before beginning the experiment.
Remind students not to consume the ingredients.

SIOP:

Preparation	**Integration of Processes**	**Scaffolding**
_X_Adaptation of Content	___Reading	_X_Modeling
_X_Links to Background	_X_Writing	___Guided Practice
_X_Links to Past Learning	_X_Speaking	___Independent Practice
_X_Strategies Incorporated	_X_Listening	_X_Comprehensible Input

Application	**Grouping Options**	**Assessment**
_X_Hands-on	_X_Whole Class	_X_Individual
_X_Meaningful	___Small Group	_X_Group
_X_Linked to Objectives	_X_Partners	_X_Written
_X_Promotes Engagement	___Independent	_X_Oral

Engagement		
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Possible Misconceptions
KWL chart - Know and Want	What do we ALREADY KNOW about fractions? lava lamps? chemical experiments?	They are not whole numbers; they are portions of whole numbers. They are everywhere! Lava lamps work by the heat of a light bulb. You must be careful and pay attention with chemical experiments.
	How do lava lamps work?	Heat? Magic? Density? Chemical reaction?
	What do we WANT to know?	How do lava lamps use fractions? Why are we doing this? What is the point of this? How do lava lamps relate to math?
Introduce Key Terms and Vocabulary. Here, you should have the students tell you how they would define each term before revealing the definition. It might also be helpful for students to write these down so that they can reference them at any point or you may want to provide a handout with each	What is a fraction?	A way to write part of a whole. A number with a numerator and denominator.
	What is the numerator?	The top number of a fraction.
	What is the denominator?	The bottom number of a fraction.

word and corresponding definitions for student reference after the key terms are introduced. This is of course at teachers' discretion.	What is a hypothesis? What is density? What is volume?	The denominator must be greater than zero to be a proper fraction. An idea or educated guess. A science term for the unproved truth. The weight of a liquid. The amount of liquid. Relationship to objects mass (m) and volume (V) (i.e. d=m/v) The amount of liquid. The amount of space in an object to hold liquid or gas. Volume is calculated by a formula specific to the object's shape.
Introduce lava lamps with pictures to show how cool they are. Also how, very generally, that this will be related to fractions and you may want to point out important features to pay attention to (such as volume, ingredients, amount of ingredients, etc.). Note: We do not want students caught up in the more complex factors, such as fluid-dynamics or intricate chemistry.	What do you think is important to keep in mind when creating lava lamps?	Color Water Heat Density Volume Directions Mass Measurements
Have students start preparing their first hypothesis and read over the provided outlined set of directions. Remind students to pay attention to the order in which the ingredients should be used. Encourage students to utilize		

their past knowledge of fractions. Also have each pair of students decide who is going to conduct the experiment first while the other student records observations. Note to students that they will switch and repeat. *END CLASS PERIOD 1*		

Exploration		
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Possible Misconceptions
START CLASS PERIOD 2 It's time to have students experiment with the lava lamps. Make sure each pair of students gets one or two vials, a cup of canola oil, a cup of water, one or two containers of food coloring, paper towels, and a packet of alka seltzer tablets. Students should have been given an outlined set of instructions the day prior that indicates the order in which the ingredients should be used. In this case, students will be challenge with understanding how much of each ingredient to use and how to apply simple fractions. The class will later be reflecting on what happened when the experiment did or	Student directions for lava lamp activity instructions: 1. Develop a hypothesis. 2. Lay down paper towels and place your "ingredients" on top. 3. Fill the vial with water. 4. Add oil to the vial. You may have to wait for the oil and water to separate. 5. Add food coloring. You can be creative here and make your own colors or you can keep them as they came. 6. Add alka seltzer to the vial. 7. Record your observations. Activity Worksheet Questions:	

did not work well, so let them make lots of mistakes! BUT be sure to explain to the students that you have given them all the materials they need to complete the experiment and that they must figure out how to do it. Remind students to fill in their worksheets. *Note*: After the second time through if the students have not created a lava lamp start giving them hints. FOR TEACHER USE ONLY (at this point): Actual lava lamp activity instructions: 1. Develop a hypothesis. 2. Lay down paper towels and place your "ingredients" on top. 3. Fill the vial ¼ the way with water. 4. Add 2/4 (½) parts oil - so that the vial is almost full but not completely. You may have to wait for the oil and water to separate. 5. Add 3-4 drops of food coloring. You can be creative here and make your own colors or you can keep them as they came. 6. Break one your alka seltzer into four pieces.	1. Develop a hypothesis before starting the experiment. Hint: You may want to consider how much of each "ingredient" to add. 2. Try the experiment based on your hypothesis. Write down your steps, how much of each ingredient you used, and observations here. 3. Did the experiment work? What went wrong, if anything? What could you do better/What could you change? Why? 4. Before trying the experiment again, please compare your process and results with another group. (*For example, What did you do differently? What did you do the same? What worked? What didn't work?*) 5. Then develop another hypothesis as you did in question 1. 6. Switch roles with your partner and try the experiment again. Be sure to write your steps, amount of each	

7. Add one piece (¼ of a tablet) into the vial. 8. Record your observations. For the science behind this reaction, please visit: *http://www.sciencefun.org/kidszone/experiments/lava-lamp/* *END CLASS PERIOD 2.*	ingredient used, and observations here. 7. It's time to reflect on the experiment again. What was different this time? Is there anything else you would change? Why or why not? .	

Explanation		
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Possible Misconceptions
START CLASS PERIOD 3 Now, discuss with the class what was found when experimenting with the lava lamps (*for example, interesting results, what happened?, theories*). As the class reviews be sure they note different relationships between amounts of each ingredient. In other words, it should become clear that each of the ingredients play different roles in the "lava lamp" reaction. Note: For more advanced classes, this is an opportunity for teachers to introduce the chemistry of the lava lamps and the reactions that are taking place during the experiment.	Do any teams want to share what happened in their experiment? Suggested Guiding Questions: What happened when you added too much alka setzer? Did anyone notice a gas being released from the vial? Where did it come from? What other matters did we notice? Did anyone add too much of another ingredient? What happened?	Students should report observations (*for example, adding too much of an ingredient, what worked/didn't work*) The lava lamp bubbled over a lot. The lava lamp released a lot of gas. The gas came from the alka seltzer tablet. A chemical reaction caused the alka seltzer to turn into a gas. The chemical reaction caused evaporation. Liquid. Solid.

	Did anyone add too little of an ingredient? What happened?	Too much oil, not enough water OR not enough oil, too much water...very little "lava lamp" effect was visible. Too much food coloring, not intended color (*for example, too much blue and not enough red is very deep purple*). We didn't add enough of anything and realized it was too small...didn't work. Not enough alka seltzer, so it just looked like flat soda.
Next, link the math! Show them that they were actually playing with fractions! Start simple, if the vial is full it is a whole (or 1). If the vial is less than 1, it is a part or fraction.	Now you're all probably wondering, how does this relate to math? To fractions? Well, what do we think the vial represents? What do we mean by whole fractions and part fractions? What is the difference? So now, thinking back to our experiment, how do fractions relate to the lava lamps?	A whole. One. A part. A whole is 1. A part is less than 1. Each ingredient is a part. The vial is a whole. More than the vial makes an improper fraction. If the ingredients stay in the vial, it's less than a whole.
After discussing how fractions relate, let's see if we can apply them. Start being saying, "If we look at the vial as being a whole, or 1, how can we divide the space to create a	If we look at the vial as being a whole, or 1, how can we divide the space to create a lava lamp? How many ingredients do we have?	Use part fractions. Each ingredient is less than 1. 4. (oil, alka seltzer, water, food coloring)

lava lamp?" In other words you're guiding the students to determine the fractional amounts of each ingredient. Demonstrate division on the board by drawing the vial.	If we put an equal amount of each ingredient how much of each ingredient would be put in?	The vial would be split into four equal parts. We would put in ¼ of each. A quarter.
	Does ¼ of each ingredient result in a good lava lamp?	No, you don't need that much food coloring. Too much alka seltzer. Too much oil. Not enough water.
Provide students with actual measurements. Encourage students to brainstorm what the vial should actually look like and ask them to sketch a drawing. Then do it together as a class demo on the board.	How many parts do we think each ingredient should be? (*Have students discuss this for a few minutes in their pairs, then regroup as class discussion.*) Good work everyone, here are the actual measurements.	Various answers and reasoning. We were close! We were way off, oops.

Elaboration		
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Possible Misconceptions
While the students may be enjoying themselves, they might not understand how this can be helpful in the real world, or how often they see fractions and don't know it. By introducing ideas such as cooking or mixing paint, students can discuss how fractions can make a big difference in the real world, just as they made a big difference in the outcome of the experiment.	Where do we think this applies in the real world? OR How could what we did today be used differently? Where do we see fractions in the real world?	Making a cake. Any food recipe. Mixing paints. Chemistry Lab. Recipes. Clocks. Sport Fields.

Evaluation		
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Possible Misconceptions
Since this takes a few days, to save time, we suggest you evaluate your students by their recorded observations and completed worksheets.		

Attachments: Lava Lamps Activity Worksheet

Lava Lamps Activity Worksheet

Name: _____

Date: _____

1. Develop a hypothesis before starting the experiment. Hint: You may want to consider how much of each "ingredient" to add.
   Hypothesis:_____
   _____
   _____
   _____

2. Try the experiment based on your hypothesis. Write down your steps, how much of each ingredient you used, and observations here. Note: You do not have to use all the spaces provided.
   Steps:
   1. _____
   2. _____
   3. _____
   4. _____
   5. _____
   6. _____
   7. _____
   8. _____
   9. _____
   10. _____

   How much did you put in of each ingredient?
   water? _____
   oil? _____
   alka selzter? _____
   food coloring? _____

3. Did the experiment work? What went wrong, if anything? What could you do better/What could you change? Why?

_____
_____
_____
_____
_____
_____
_____
_____

4. Before trying the experiment again, please compare your process and results with another group. (*For example, what did you do differently? What did you do the same? What worked? What didn't work?*). Then develop another hypothesis as you did in question 1.
Hypothesis:_____
_____
_____
_____
_____
_____
_____
_____
_____

5. Try the experiment again, but this time switching roles with you partner. Be sure to write your steps, amount of each ingredient used, and observations here.
Steps:
    11. _____
    12. _____
    13. _____
    14. _____
    15. _____
    16. _____
    17. _____
    18. _____
    19. _____
    20. _____

How much did _____did you put in?
water? _____
oil? _____
alka selzter? _____
food coloring? _____

6. What was different this time? Is there anything else you would change? Why or why not?

7. Once you have completed the experiment twice, please compare your steps and results between your first and second attempts. Describe the differences and develop a conclusion.
   What was the same?

   What was different and how was that important?

   Conclusion:

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Name/Grade level of course: Grade 7

Length: 3 class periods *(This suggested length can be modified at teacher's discretion)*

Appropriateness for Students:

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Concepts and Key Vocabulary Defined:

Fraction, Numerator, Denominator, Hypothesis, Density, Volume

Performance Objectives: Students Will Be Able To (SWBAT):

- Make predictions based on prior knowledge of fractions, volume, and density
- Observe minor chemical reactions
- Conduct their own experiments to develop conclusions
- Apply and extend previous understandings of operations with fractions

Common Core Math Standards:

CCSS.MATH.CONTENT.7.NS.A.2
Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
CCSS.MATH.CONTENT.7.NS.A.3
Solve real-world and mathematical problems involving the four operations with rational numbers.(Computations with rational numbers extend the rules for manipulating fractions to complex fractions.)

Science Standards:

3.2.7.A1.
Differentiate between elements, compounds, and mixtures. Identify groups of elements that have similar properties. Explain how materials are characterized by having a specific amount of mass in each unit of volume (density).

Materials and Advance Preparations:

Plastic Vials, Food Coloring, Vegetable/Canola Oil, Alka-Seltzer Tablets, Paper Towels, Cups
Optional: Science goggles and gloves - These are a preventative safety measure, potentially necessary depending on student ages. Use at teacher's discretion.

Supplementary Materials:

Lava Lamps Activity Worksheet

Safety:
Remind students not to put lids on the plastic vials while the chemical reaction is occurring - this could result in too much pressure causing the lid to pop off.
To prevent the food coloring from dying surfaces, remind students to lay down paper towels under the vials before beginning the experiment.
Remind students not to consume the ingredients.

SIOP:

Preparation	**Integration of Processes**	**Scaffolding**
_X_Adaptation of Content	___Reading	_X_Modeling
_X_Links to Background	_X_Writing	___Guided Practice
_X_Links to Past Learning	_X_Speaking	___Independent Practice
_X_Strategies Incorporated	_X_Listening	_X_Comprehensible Input

Application	**Grouping Options**	**Assessment**
_X_Hands-on	_X_Whole Class	_X_Individual
_X_Meaningful	___Small Group	_X_Group
_X_Linked to Objectives	_X_Partners	_X_Written
_X_Promotes Engagement	___Independent	_X_Oral

Engagement		
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Possible Misconceptions
KWL chart - Know and Want	What do we ALREADY KNOW about fractions? lava lamps? chemical experiments?	They are not whole numbers; they are portions of whole numbers. They are everywhere! Lava lamps work by the heat of a light bulb. You must be careful and pay attention with chemical experiments.
	How do lava lamps work?	Heat? Magic? Density? Chemical reaction?
	What do we WANT to know?	How do lava lamps use fractions? Why are we doing this? What is the point of this? How do lava lamps relate to math?
Introduce Key Terms and Vocabulary. Here, you should have the students tell you how they would define each term before revealing the definition. It might also be helpful for students to write these down so that they can reference them at any point or you may want to provide a handout with each word and corresponding	What is a fraction?	A way to write part of a whole. A number with a numerator and denominator.
	What is the numerator?	The top number of a fraction.
	What is the denominator?	The bottom number of a fraction.

definitions for student reference after the key terms are introduced. This is of course at teachers' discretion.		The denominator must be greater than zero to be a proper fraction.
	What is a hypothesis?	An idea or educated guess. A science term for the unproved truth.
	What is density?	The weight of a liquid. The amount of liquid. Relationship to objects mass (m) and volume (V) (i.e. d=m/v)
	What is volume?	The amount of liquid. The amount of space in an object to hold liquid or gas. Volume is calculated by a formula specific to the object's shape.
Introduce lava lamps with pictures to show how cool they are. Also how, very generally, that this will be related to fractions and you may want to point out important features to pay attention to (such as volume, ingredients, amount of ingredients, etc.). Note: We do not want students caught up in the more complex factors, such as fluid-dynamics or intricate chemistry.	What do you think is important to keep in mind when creating lava lamps?	Color Water Heat Density Volume Directions Mass Measurements
Have students start preparing their first hypothesis and read over the provided information. Remind students to think about the order in which the ingredients should be used and how much of each. Encourage students to		

utilize their past knowledge of fractions. Also have each pair of students decide who is going to conduct the experiment first while the other student records observations. Note to students that they will switch and repeat. *END CLASS PERIOD 1*		

Exploration		
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Possible Misconceptions
START CLASS PERIOD 2 It's time to have students experiment with the lava lamps. Make sure each pair of students gets one or two vials, a cup of canola oil, a cup of water, one or two containers of food coloring, paper towels, and a packet of alka seltzer tablets. Students should have been given very basic set of instructions the day prior that indicates the objective and provided materials. In this case, students will be challenged with understanding how much of each ingredient to use, what order to add them, and how to apply fractions. The class will later be reflecting on what happened when the experiment did or	Student directions for lava: *Objective*: Create a "lava lamp" using the materials listed below. *Materials*: Canola oil, water, alka seltzer tablet, food coloring Activity Worksheet Questions: 1. Develop a hypothesis before starting the experiment. Hint: You may want to consider how much of each "ingredient" to add and when. 2. Try the experiment based on your hypothesis. Write down your steps, how much of each ingredient you used, and observations here.	

did not work well, so let them make lots of mistakes! BUT be sure to explain to the students that you have given them all the materials they need to complete the experiment and that they must figure out how to do it. Remind students to fill in their worksheets. FOR TEACHER USE ONLY (at this point): Actual lava lamp activity instructions: 1. Develop a hypothesis. 2. Lay down paper towels and place your "ingredients" on top. 3. Fill the vial ¼ the way with water. 4. Add 2/4 (½) parts oil - so that the vial is almost full but not completely. You may have to wait for the oil and water to separate. 5. Add 3-4 drops of food coloring. You can be creative here and make your own colors or you can keep them as they came. 6. Break one your alka seltzer into four pieces. 7. Add one piece (¼ of a tablet) into the vial. 8. Record your observations.	3. Did the experiment work? What went wrong, if anything? What could you do better/What could you change? Why? 4. Before trying the experiment again, please compare your process and results with another group. (*For example, What did you do differently? What did you do the same? What worked? What didn't work?*) 5. Then develop another hypothesis as you did in question 1. 6. Switch roles with your partner and try the experiment again. Be sure to write your steps, amount of each ingredient used, and observations here. 7. It's time to reflect on the experiment again. What was different this time? Is there anything else you would change? Why or why not? .	

For the science behind this reaction, please visit: *http://www.sciencefun.org/kidszone/experiments/lava-lamp/* *END CLASS PERIOD 2.*		

Explanation		
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Possible Misconceptions
START CLASS PERIOD 3 Now, discuss with the class what was found when experimenting with the lava lamps (*for example, interesting results, what happened?, theories*). As the class reviews be sure they note different relationships between amounts of each ingredient. In other words, it should become clear that each of the ingredients play different roles in the "lava lamp" reaction. Note: For more advanced classes, this is an opportunity for teachers to introduce the chemistry of the lava lamps and the reactions that are taking place during the experiment.	Do any teams want to share what happened in their experiment? Suggested Guiding Questions: What happened when you added too much alka setzer? Did anyone notice a gas being released from the vial? Where did it come from? Why did the oil and water not mix? What other matters did we notice?	Students should report observations (*for example, adding too much of an ingredient, what worked/didn't work*) The lava lamp bubbled over a lot. The lava lamp released a lot of gas. The gas came from the alka seltzer tablet. A chemical reaction caused the alka seltzer to turn into a gas. The chemical reaction caused evaporation. They're different kinds of matter. They have different densities. Liquid. Solid.

	Did anyone add too much of another ingredient? What happened?	Too much oil, not enough water OR not enough oil, too much water...very little "lava lamp" effect was visible. Too much food coloring, not intended color (*for example, too much blue and not enough red is very deep purple*).
	Did anyone add too little of an ingredient? What happened?	We didn't add enough of anything and realized it was too small...didn't work. Not enough alka seltzer, so it just looked like flat soda.
Next, link the math! Show them that they were actually playing with fractions! Start simple, if the vial is full it is a whole (or 1). If the vial is less than 1, it is a part or fraction.	Now you're all probably wondering, how does this relate to math? To fractions? Well, what do we think the vial represents?	A whole. One. A part.
	What do we mean by whole fractions and part fractions? What is the difference?	A whole is 1. A part is less than 1.
	So now, thinking back to our experiment, how do fractions relate to the lava lamps?	Each ingredient is a part. The vial is a whole. More than the vial makes an improper fraction. If the ingredients stay in the vial, it's less than a whole.
After discussing how fractions relate, let's see if we can apply them. Start being saying, "If we look at the vial as being a whole, or 1, how can we	If we look at the vial as being a whole, or 1, how can we divide the space to create a lava lamp? Pretty much everyone did their experiments with	Use part fractions. Each ingredient is less than 1.

divide the space to create a lava lamp?" In other words you're guiding the students to determine the fractional amounts of each ingredient. Demonstrate division on the board by actually doing the fractional division alongside a detailed picture. After, provide students with actual measurements. Encourage students to brainstorm what the vial should actually look like according to the actual measurements and ask them to sketch a drawing and prove the math (i.e. show the division works and the ingredients all add up to a whole).	integers or whole numbers, but what if we introduced rational numbers? What is a rational number? So, how many parts do we think each ingredient should be? (*Have students discuss this for a few minutes in their pairs, then regroup as class discussion.*) Good work everyone, here are the actual measurements.	A rational number is any number that can be written as a fraction. An example is ⅓. We've been using these already. Various answers.

Elaboration		
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Possible Misconceptions
While the students may be enjoying themselves, they might not understand how this can be helpful in the real world, or how often they see fractions and don't know it. By introducing ideas such as cooking or mixing paint, students can discuss how fractions can make a big difference in the real world, just as they made a big difference in the outcome of the experiment.	Where do we think this applies in the real world? OR How could what we did today be used differently? Where do we see fractions in the real world?	Making a cake. Any food recipe. Mixing paints. Chemistry Lab. Recipes. Clocks. Sport Fields.

Evaluation		
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Possible Misconceptions
Since this takes a few days, to save time, we suggest you evaluate your students by their recorded observations and completed worksheets.		

Attachments: Lava Lamps Activity Worksheet

Lava Lamps Activity Worksheet

Name: _____

Date: _____

8. Develop a hypothesis before starting the experiment. Hint: You may want to consider how much of each "ingredient" to add.
   Hypothesis:_____
   _____
   _____
   _____

9. Try the experiment based on your hypothesis. Write down your steps, how much of each ingredient you used, and observations here. Note: You do not have to use all the spaces provided.
   Steps:
   21. _____
   22. _____
   23. _____
   24. _____
   25. _____
   26. _____
   27. _____
   28. _____
   29. _____
   30. _____

   How much did you put in of each ingredient?
   water? _____
   oil? _____
   alka selzter? _____
   food coloring? _____

10. Did the experiment work? What went wrong, if anything? What could you do better/What could you change? Why?

_____
_____
_____
_____
_____
_____
_____
_____

11. Before trying the experiment again, please compare your process and results with another group. (*For example, what did you do differently? What did you do the same? What worked? What didn't work?*). Then develop another hypothesis as you did in question 1.
Hypothesis:_____
_____
_____
_____
_____
_____
_____
_____
_____

12. Try the experiment again, but this time switching roles with you partner. Be sure to write your steps, amount of each ingredient used, and observations here.
Steps:
    31. _____
    32. _____
    33. _____
    34. _____
    35. _____
    36. _____
    37. _____
    38. _____
    39. _____
    40. _____

How much did _____did you put in?
    water? _____
    oil? _____
    alka selzter? _____
    food coloring? _____

13. What was different this time? Is there anything else you would change? Why or why not?

14. Once you have completed the experiment twice, please compare your steps and results between your first and second attempts. Describe the differences and develop a conclusion.
    What was the same?

    What was different and how was that important?

    Conclusion:

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Name/Grade level of course: Grade 8

Length: 3 class periods *(This suggested length can be modified at teacher's discretion)*

Appropriateness for Students:

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Concepts and Key Vocabulary Defined:

Fraction, Numerator, Denominator, Hypothesis, Density, Volume

Performance Objectives: Students Will Be Able To (SWBAT):

- Make predictions based on prior knowledge of fractions, volume, and density
- Observe minor chemical reactions
- Conduct their own experiments to develop conclusions
- Know that there are numbers that are not rational, and approximate them by rational numbers

Common Core Math Standards:

CC.2.2.8.C.1
Define, evaluate, and compare functions.
CC.2.2.8.C.2
Use concepts of functions to model relationships between quantities.

Science Standards:

3.2.8.A4.
Compare and contrast physical and chemical changes in terms of products.

Materials and Advance Preparations:

Plastic Vials, Food Coloring, Vegetable/Canola Oil, Alka-Seltzer Tablets, Paper Towels, Cups
Optional: Science goggles and gloves - These are a preventative safety measure, potentially necessary depending on student ages. Use at teacher's discretion.

Supplementary Materials:

Lava Lamps Activity Worksheet

Safety:
Remind students not to put lids on the plastic vials while the chemical reaction is occurring - this could result in too much pressure causing the lid to pop off.
To prevent the food coloring from dying surfaces, remind students to lay down paper towels under the vials before beginning the experiment.
Remind students not to consume the ingredients.

SIOP:

Preparation	**Integration of Processes**	**Scaffolding**
_X_Adaptation of Content	___Reading	_X_Modeling
_X_Links to Background	_X_Writing	___Guided Practice
_X_Links to Past Learning	_X_Speaking	___Independent Practice
_X_Strategies Incorporated	_X_Listening	_X_Comprehensible Input

Application	**Grouping Options**	**Assessment**
_X_Hands-on	_X_Whole Class	_X_Individual
_X_Meaningful	___Small Group	_X_Group
_X_Linked to Objectives	_X_Partners	_X_Written
_X_Promotes Engagement	___Independent	_X_Oral

Engagement		
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Possible Misconceptions
KWL chart - Know and Want	What do we ALREADY KNOW about fractions? lava lamps? chemical experiments?	They are not whole numbers; they are portions of whole numbers. They are everywhere! Lava lamps work by the heat of a light bulb. You must be careful and pay attention with chemical experiments.
	How do lava lamps work?	Heat? Magic? Density? Chemical reaction?
	What do we WANT to know?	How do lava lamps use fractions? Why are we doing this? What is the point of this? How do lava lamps relate to math?
Introduce Key Terms and Vocabulary. Here, you should have the students tell you how they would define each term before revealing the definition. It might also be helpful for students to write these down so that they can reference them at any point or you may want to provide a handout with each word and corresponding definitions for student reference after the key terms are introduced. This is of course at teachers' discretion.	What is a fraction?	A way to write part of a whole. A number with a numerator and denominator.
	What is the numerator?	The top number of a fraction.
	What is the denominator?	The bottom number of a fraction. The denominator must be greater than zero to be a proper fraction.
	What is a hypothesis?	An idea or educated guess. A science term for the unproved truth.

	What is density? What is volume?	The weight of a liquid. The amount of liquid. Relationship to objects mass (m) and volume (V) (i.e. d=m/v) The amount of liquid. The amount of space in an object to hold liquid or gas. Volume is calculated by a formula specific to the object's shape.
Introduce lava lamps with pictures to show how cool they are. Also how, very generally, that this will be related to fractions and you may want to point out important features to pay attention to (such as volume, ingredients, amount of ingredients, etc.). Note: We do not want students caught up in the more complex factors, such as fluid-dynamics or intricate chemistry.	What do you think is important to keep in mind when creating lava lamps?	Color Water Heat Density Volume Directions Mass Measurements
Have students start preparing their first hypothesis and read over the provided information. Remind students to think about the order in which the ingredients should be used and how much of each. Encourage students to utilize their past knowledge of fractions. Also have each pair of students decide who is going to conduct the experiment first while the other student records observations. Note to		

students that they will switch and repeat. *END CLASS PERIOD 1*		

Exploration		
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Possible Misconceptions
START CLASS PERIOD 2 It's time to have students experiment with the lava lamps. Make sure each pair of students gets one or two vials, a cup of canola oil, a cup of water, one or two containers of food coloring, paper towels, and a packet of alka seltzer tablets. Students should have been given very basic set of instructions the day prior that indicates the objective and provided materials. In this case, students will be challenged with understanding how much of each ingredient to use, what order to add them, and how to apply fractions. The class will later be reflecting on what happened when the experiment did or did not work well, so let them make lots of mistakes! BUT be sure to explain to the students that you have given them all the materials they need to complete the experiment and that they	Student directions for lava: *Objective*: Create a "lava lamp" using the materials listed below. *Materials*: Canola oil, water, alka seltzer tablet, food coloring Activity Worksheet Questions: 1. Develop a hypothesis before starting the experiment. Hint: You may want to consider how much of each "ingredient" to add and when. 2. Try the experiment based on your hypothesis. Write down your steps, how much of each ingredient you used, and observations here. 3. Did the experiment work? What went wrong, if anything? What could you do better/What could you change? Why?	

must figure out how to do it. Remind students to fill in their worksheets. FOR TEACHER USE ONLY (at this point): Actual lava lamp activity instructions: 1. Develop a hypothesis. 2. Lay down paper towels and place your "ingredients" on top. 3. Fill the vial ¼ the way with water. 4. Add 2/4 (½) parts oil - so that the vial is almost full but not completely. You may have to wait for the oil and water to separate. 5. Add 3-4 drops of food coloring. You can be creative here and make your own colors or you can keep them as they came. 6. Break one your alka seltzer into four pieces. 7. Add one piece (¼ of a tablet) into the vial. 8. Record your observations. For the science behind this reaction, please visit: *http://www.sciencefun.org/kidszone/experiments/lava-lamp/* *END CLASS PERIOD 2.*	4. Before trying the experiment again, please compare your process and results with another group. (*For example, What did you do differently? What did you do the same? What worked? What didn't work?*) 5. Then develop another hypothesis as you did in question 1. 6. Switch roles with your partner and try the experiment again. Be sure to write your steps, amount of each ingredient used, and observations here. 7. It's time to reflect on the experiment again. What was different this time? Is there anything else you would change? Why or why not? .	

Explanation		
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Possible Misconceptions
START CLASS PERIOD 3 Now, discuss with the class what was found when experimenting with the lava lamps (*for example, interesting results, what happened?, theories*). As the class reviews be sure they note different relationships between amounts of each ingredient. In other words, it should become clear that each of the ingredients play different roles in the "lava lamp" reaction. Note: For more advanced classes, this is an opportunity for teachers to introduce the chemistry of the lava lamps and the reactions that are taking place during the experiment.	Do any teams want to share what happened in their experiment? Suggested Guiding Questions: What happened when you added too much alka setzer? Did anyone notice a gas being released from the vial? Where did it come from? Why did the oil and water not mix? What happened to the alka seltzer? (i.e. describe the chemical reaction)	Students should report observations (*for example, adding too much of an ingredient, what worked/didn't work*) The lava lamp bubbled over a lot. The lava lamp released a lot of gas. The gas came from the alka seltzer tablet. A chemical reaction caused the alka seltzer to turn into a gas. The chemical reaction caused evaporation. They're different kinds of matter. They have different densities. The alka seltzer reacted with the water and became part of it. The water made the alka seltzer evaporate. The alka seltzer turned into a gas and disappeared.

	What other matters did we notice? Did anyone add too much of another ingredient? What happened? Did anyone add too little of an ingredient? What happened?	Liquid. Solid. Too much oil, not enough water OR not enough oil, too much water...very little "lava lamp" effect was visible. Too much food coloring, not intended color (*for example, too much blue and not enough red is very deep purple*). We didn't add enough of anything and realized it was too small...didn't work. Not enough alka seltzer, so it just looked like flat soda.
Next, link the math! Show them that they were actually playing with fractions! Start simple, if the vial is full it is a whole (or 1). If the vial is less than 1, it is a part or fraction.	Now you're all probably wondering, how does this relate to math? To fractions? Well, what do we think the vial represents? What do we mean by whole fractions and part fractions? What is the difference? So now, thinking back to our experiment, how do fractions relate to the lava lamps?	A whole. One. A part. A whole is 1. A part is less than 1. Each ingredient is a part. The vial is a whole. More than the vial makes an improper fraction. If the ingredients stay in the vial, it's less than a whole.
After discussing how fractions relate, let's see if we can apply them to a function.	What is a function?	Put something in, get something out.

Now you should encourage students to create their own function and have them model this with a picture and corresponding mathematical work.	Can anyone describe a function for the lava lamp? What about the reaction of the alka seltzer in water, how is this a function? (i.e. what's the input and what's the output?) How can we create a function for the lava lamp using fractions?	Put the ingredients in and we get a lava lamp. Input is water and alka seltzer. Output is water and evaporated alka seltzer (aka gas). Just add quantities and describe what's happening.

Elaboration		
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Possible Misconceptions
While the students may be enjoying themselves, they might not understand how this can be helpful in the real world, or how often they see fractions and don't know it. By introducing ideas such as cooking or mixing paint, students can discuss how fractions can make a big difference in the real world, just as they made a big difference in the outcome of the experiment.	Where do we think this applies in the real world? OR How could what we did today be used differently? Where do we see fractions in the real world?	Making a cake. Any food recipe. Mixing paints. Chemistry Lab. Recipes. Clocks. Sport Fields.

Evaluation		
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Possible Misconceptions
Since this takes a few days, to save time, we suggest you evaluate your students by their recorded observations and completed worksheets.		

Lava Lamps Activity Worksheet

Name: _____

Date: _____

15. Develop a hypothesis before starting the experiment. Hint: You may want to consider how much of each "ingredient" to add.
    Hypothesis:_____
    _____
    _____
    _____

16. Try the experiment based on your hypothesis. Write down your steps, how much of each ingredient you used, and observations here. Note: You do not have to use all the spaces provided.
    Steps:
    41. _____
    42. _____
    43. _____
    44. _____
    45. _____
    46. _____
    47. _____
    48. _____
    49. _____
    50. _____

    How much did you put in of each ingredient?
    water? _____
    oil? _____
    alka selzter? _____
    food coloring? _____

17. Did the experiment work? What went wrong, if anything? What could you do better/What could you change? Why?

_____
_____
_____
_____
_____
_____
_____
_____

18. Before trying the experiment again, please compare your process and results with another group. (*For example, what did you do differently? What did you do the same? What worked? What didn't work?*). Then develop another hypothesis as you did in question 1.
Hypothesis:_____
_____
_____
_____
_____
_____
_____
_____
_____

19. Try the experiment again, but this time switching roles with you partner. Be sure to write your steps, amount of each ingredient used, and observations here.
Steps:
    51. _____
    52. _____
    53. _____
    54. _____
    55. _____
    56. _____
    57. _____
    58. _____
    59. _____
    60. _____

How much did _____did you put in?
    water? _____
    oil? _____
    alka selzter? _____
    food coloring? _____

20. What was different this time? Is there anything else you would change? Why or why not?

21. Once you have completed the experiment twice, please compare your steps and results between your first and second attempts. Describe the differences and develop a conclusion.
What was the same?

What was different and how was that important?

Conclusion: