

Q405: Saturday Science FS21

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Grade level: 5-8

Anchoring Question/Phenomena for the unit: How can you make something new that was not there before?

Lesson Plan 1

Desired Results

Driving Question for this week's Saturday Session

- What happens when a bath bomb is placed in water (and why does the reaction happen)?
- Where is the gas coming from?

DCI Addressed in lesson:

PS1.B Chemical Reactions

When substances endure a chemical change, the atoms rearrange; however, the mass stays the same. Regardless of the form, the matter is conserved.

SEPS Addressed in Lesson:

Students will be asking questions and defining problems, as laid out by the science and engineering practices. This initial lesson is starting their questioning process so that students can conduct experiments to build solutions.

Students are creating observations to create explanations for occurrences within the lesson.

CCCs Addressed in Lesson:

The crosscutting concepts addressed in this lesson plan are cause and effect. What causes the bubbles of gas to form when placing the bath bombs in the water.

Besides science, what other disciplines of STEM will be included in this lesson?

The STEM topic infusion for this week will be a technology infusion because students are using scientific knowledge for practical application. This will be done by dropping the bath bomb and viewing the reaction to gain scientific knowledge. Students will draw a representation of the experiment, and then students will do a baking soda and vinegar experiment to compare the two reactions. This will be a technology infusion because students are using scientific knowledge for practical application.

Learning objectives (outcomes):

Students will be able to explain/state:

- that the bath bombs dissolve in the water.
- why a reaction that creates a gas occurs when the bath bomb touches the water.

Timeline of Activities for the Day

- 9:30-9:45: Students will have time to think about the entry ticket question and write/draw whatever they feel best answers the warm-up question. The question is, "If you could invent anything in the world, what would it be?"
- 9:45-9:50: Share with the class.
- 9:50-10:10: Students will decide as a whole group what the classroom rules will be, and one of the teachers will write the rules on paper and post them in the classroom for everyone to see. This will be a class-wide discussion, and everyone will have input on the rules implemented.
- 10:10-10:20: We will split the class into 5 groups, one 5th, two 6th, one 7th, and one 8th grade group. Each group will have a designated table and come up with a team name. The name must

have something to do with science. This will be how the teachers refer to each group for the rest of the program.

- 10:20-11:30: Students will begin the lesson of the day.
 - Engage 1: 10:20-10:25
 - Explore 1: 10:25-10:40
 - Explain 1: 10:45-10:55
 - Engage 2: 10:55-11:00
 - Explore 2: 11:00-11:20
 - Explain 2: 11:20-11:30
 - Elaborate/Extend 2:
- 11:30-12:00: Students will be asked to think about what a gas is while cleaning up and watching a Bill Nye video. Students will not be asked to write anything down, just to think about what they did in class.
 -  Bill Nye The Science Guy Phases of Matter

Learning Plan

ENGAGE 1

- Students will be exploring what will happen during the reaction and what causes it during the first engagement. Students will be asked to draw and annotate their predictions.
- One person will lead the students to think about what will happen to the bath bomb when put into the water by drawing on their chart. One side will say “prediction,” and one side will say “observation.” Under “prediction,” students will draw and annotate what they think will happen based on prior knowledge.

EXPLORE 1

- Students will then be asked to present their predictions and observations to the class. After this, the bath bomb experiment will be demonstrated. Into a tub of water, the teacher will drop a bath bomb and students will observe the reaction. They will then fill in the rest of the chart with their observations.
- One person will lead this part and see how students' predictions compare to the reaction. They will then work within their groups to create an explanation of what happened to the bath bomb. During this time, the teachers will be listening in and prompting questions.

EXPLAIN 1

- After students have understood the predictions and observations, they will work as a class to create one explanation for what happened to the bath bomb and what caused it to happen. They will be guided towards defining key vocabulary to extend their learning.
- One person will lead this part in facilitating the group discussion. She will have gathered the information and will work to create driving questions that lead them to find the important details needed to extend their learning and prepare for the next lesson.
 - Questions:
 - What were some characteristics of the bath bomb before we did anything with it?
 - What did you observe about the bath bomb after it changed when put into the water?
 - Can anyone come up with an explanation for what we observed?
 - They probably won't guess it exactly correct so introduce key vocab.
 - Key vocab: Solid, Liquid, Gas, Reaction, Dissolve
 - Using the keywords discussed, can someone create an explanation for what we observed?

ENGAGE 2

- Teacher will ask the kids to predict where they think the bubbles come from when using a bath bomb. Students will turn and talk with their group and then raise their hands to write down ideas. Then, she will explain that students will be investigating the source of the bubbles. Before giving the students any resources and tools, she will explain classroom expectations and the procedure they will be following.

- She will provide the groups with a graphic organizer to record their data once they measure the weight of the bath bomb in a water bottle, when it is crushed up and when it is whole. They will also record the weight of the bottle before and after the lid is opened.

EXPLORE 2

- During this time, students will measure out the weight of a bath bomb that is normal and crushed and the weight of the water bottle. Students will crush up a bath bomb and measure the weight between the powered bath bomb and the normal bath bomb. Then students will place a piece of the bath bomb in the water bottle to see its reaction and weigh the bottle after the chunk of bath bomb has been placed in it. Then, students will repeat this process with the crushed bath bomb. The weight of the two bottles will be the same.

Explain 2

- Teacher will ask the students to share what they found when measuring their water bottles. Students will discuss why the water bottles' mass was the same after adding the bath bomb, regardless of the changes. Students will have recorded the weight before and after the water bottle was opened. The teacher will lead a discussion in which the goal is for students to notice that the mass decreased when they opened the water bottles.
 - Discussion questions
 - Where does the gas come from?
 - Why did the weight of the water bottle change once the cap was removed?
 - What type of products could be used for bath bombs that create the gas?
- After collecting students' ideas about these questions, the teacher will explain how this experiment shows that the gas isn't trapped in the bath bomb. The gas comes from the combination of water with the powder (baking soda and citric acid), resulting in a chemical reaction creating gas. We also know that the gas isn't trapped inside the bath bomb because we crushed the bath bomb. There was still gas that was released after putting the powder in water.

ELABORATING/EXTENDING Understanding 2

- By following the bath bomb experiment with the water bottle experiment, students will build immediate connections between the two and develop explanations for the gas released during the chemical reaction. To extend the lesson to next week's content, students will be asked to reflect on the findings they discovered during the class and what they mean. While students are watching the video at the end of class, teachers can talk to individual students at random to get a sense of their understanding. This allows the teachers to see where students are with their current understanding while also getting students to think about the larger concept of the next lesson and the takeaways from the week 1 experiments.

Formative Assessment Evidence

What evidence will you gather to understand if ALL your students met the learning outcome?

- There will be class discussions throughout the activities where students use cues to show their level of understanding.
- Exit tickets will be provided at the end to see how students can apply their learning to upcoming topics.

Individual Student Accommodations

Accommodations/Modifications for Individual Students

- IEP
 - One student has an IEP and will need extra observation.
- Allergies:
 - Nuts, Bees, Latex, Wheat, Banana, Pollen
- Groups will be split into 2-3 students per group based on the grade level.
- Additional questions and information will be provided for students at higher levels.

- Students will be offered multiple means of creating a response to allow for engagement with different literacy levels.

Materials + Quantity:

- 1 tub
- 10 bath bombs
- 1 pack empty water bottles
- 6 scales
- 16 goggles
- 16 ziplock bags
- 6 white boards
- 20 pencils
- 16 composition notebooks (1 per student)
- 6 sets of colored pencils
- 6 dry erase markers
- 1 sharpie
- Poster Paper
- Powerpoint
- Graphic Organizer

Lesson Plan 2

Desired Results

Driving Question for this week's Saturday Session

- How can chemicals that are capable of creating a gas be combined into a solid object?

DCI Addressed in lesson:
PS1.B: Chemical Reactions

- "When two or more different substances are mixed, a new substance with different properties may be formed."
 - -NGSS
- When we combine chemicals, new compounds are formed, thus giving the solution different properties. These properties vary based on the different substances used and the reactions will vary.

SEPS Addressed in Lesson:

- Students will be asking questions and defining problems, as laid out by the science and engineering practices. This initial lesson is starting their questioning process so that students can conduct experiments to build solutions.
- Students are creating observations to create explanations for occurrences within the lesson.

CCCs Addressed in Lesson:

The cross cutting concept addressed in this lesson plan scale, proportion, and quantity. Using the scale to measure out correct portions for bath bombs to ensure that a reaction takes place.

Besides science, what other disciplines of STEM will be included in this lesson?

The STEM infusion for this lesson will be math and engineering. Students will be asked to measure specific quantities of multiple substances to create their own bath bomb. Engineering will come into play when students are substances to use in their bath bombs and how to create them. Designing a combination of substances in order to form a chemical compound that acts as a bath bomb. This will be tested to determine the efficacy of their design.

Learning objectives (outcomes):

Students will be able to explain/state:

- what substances make the bath bomb dissolve when it reacts with water.

Timeline of Activities for the Day

- 9:30-9:40 Students will review what happened last week, safety procedures, and classroom rules
- 9:40-9:50 Students will engage in learning about the properties of matter. This way students have a basic knowledge before beginning their experiment design.
- 9:50-10:10 Students will come up with at least three different possible combinations for creating a bath bomb using the materials that are provided. This will be their experiment design as they determine the materials, what they will do to combine them, and how they will test the design.
- 10:10-10:45 (Recorders stay until 10:20) Students will test their experiments so that they can make observations and collect data. This will be the exploration part of the first lesson.

- 10:45-10:55 Students will work as a class to discuss their results and make larger understandings about the experiment. They will be led to the conclusion that certain chemicals create a gas when combined with water
- 10:55-11:15 Students will test different chemical combinations to see which ones create a gas when they react with water.
- 11:15-11:25 Students will discuss their results and present the chemical combinations they found with the class
- 11:25-11:30 Students will complete an exit to display their understanding of the driving question for the day.

Learning Plan

ENGAGE 1

- Students will be asked what their favorite part of Saturday Science was last week. One student per table will share with the class.
- The topic of today's class will be introduced briefly, leaving out the information about making bath bombs.
 - “Today we are going to explore what goes into a bath bomb. We will be working with chemicals and different substances up close and personal, so practicing lab safety is very important.”
- Explaining lab safety and classroom rules
 - Goggles stay on during experiments.
 - No food or eating around substances.
 - Wash hands after manipulating substances.
 - No rough-housing around experiments.
- Teacher will lead the class in reviewing the properties of matter; liquids, solids, and gases. The tables will be assigned to make 2-minute “posters” on their whiteboards about a phase of matter.
 - Solid- Particles are close together and the substance does not change form without a chemical or physical change.
 - Liquid- Particles are not as stuck together like a solid. The substance flows in shape to fit into the container it is put in but not expanding to fill it up.
 - Gas- Particles are free-floating within the container holding them. They are not close together and the gas particles will expand to fit into the container they are trapped in.

EXPLORE 1

- Students will start with a set of substances that could be used in their experiment. They will be trying to create a bath bomb by combining these substances. They will create at least three possible combinations that they think will create a bath bomb. Once they have generated these ideas, they will move onto testing
- Teachers will review students' ideas and have a list of recipes that they will provide if none of the students' ideas will work. This list will be used for differentiation to help different groups try more options. For example, the higher level group will be asked to try their three ideas and then be asked to make all 4 recipes. This experiment will be a large portion of the class time.

EXPLAIN 1

- After the experiment, students will be asked to present their findings. In this part, a discussion will be led with questions that lead students to the understanding that certain chemical combinations create a gas. These questions include:
 - What is created when the bath bombs react?
 - How do we know if a gas is released?
 - What were the differences between the bath bombs that reacted and the ones that didn't?
 - When we combine substances, why do some combinations create a reaction but others don't?

ELABORATING/EXTENDING Understanding 1

- Connecting the experiment to the fact that gases are created by certain chemical combinations, students are creating a learning extension that moves into the next experiment.

EXPLORE 2

- Students will now use the same substances used to create the bath bombs to see if they can find any combinations that create a gas. They can combine up to three substances, but the goal should be to create a gas using only two substances.

EXPLAIN 2

- Students will present their findings and list any combinations they found successful. This will prompt conversation about how different combinations provide different reactions.

ELABORATING/EXTENDING Understanding 2

- This lesson will start to get students thinking about what kind of gas is being released. They are already curious about gases and it will prompt their thinking towards the next lesson.

Formative Assessment Evidence

What evidence will you gather to understand if ALL your students met the learning outcome?

- Students will be given an exit ticket:
 - How can a bath bomb be a solid but also create a gas?

Individual Student Accomodations

Accommodations/Modifications for Individual Students

- IEP
 - One student has an IEP and requires more support when doing hands-on tasks. They will be closely monitored so they can ask for help or be kept on task throughout the class.
- Extra steps for the 7th-8th grade groups
 - The students at the top of the grade range will be asked to conduct experiments to explain what substances hinder creating a bath bomb and making it fizz.
 - If they finish their extension before the time for the experiment is up, they will go to groups who may be struggling and assist.

Materials + Quantity:

Baking soda
 Citric acid
 Sugar free lemonade mix
 Lemonade mix
 Dixie cups
 Red solo cups
 Epsom salt
 Corn starch
 Olive oil
 Vegetable oil
 Coconut oil
 Salt
 Sugar
 Expo markers
 Pencils
 Stirring sticks/toothpicks
 Paper

Instructor Names: Abigail Heckaman, Bryce Wilson, Abbigail Mendenhall

Grade level: 5-8

Anchoring Question/Phenomena for the unit: How can you make something new that was not there before?

Lesson Plan 3

Desired Results

Driving Question for this week's Saturday Session

- What gases could be coming from the bath bomb?

DCI Addressed in lesson:

- MS-PS1-2: "Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred."
 - NGSS

When a chemical reaction occurs, the properties of the product are different from that of the solvent and solution. These properties indicate whether or not a chemical change occurred and can be analyzed through data.

SEPS Addressed in Lesson:

Students will be collecting and analyzing data in order to detect similarities and differences between different combinations of compounds.

CCCs Addressed in Lesson:

The cross cutting concepts addressed in this lesson plan are stability and change. Students are watching the way that when combined, some substances remain the same (stability,) some substances endure physical changes, and some substances react with one another (change).

Visible patterns represent the same patterns that occur on a microscopic level.

Besides science, what other disciplines of STEM will be included in this lesson?

- This lesson includes technology through the application of knowledge in order to understand what causes reactions.

Learning objectives (outcomes):

Students will be able to explain/state:

- Some substances make reactions when they're combined, but others don't.

Timeline of Activities for the Day

- **9:30-9:35:** Settle in/entry ticket- "What is one difference between the bath bombs you made last week and the bath bombs you buy in the store?"
- **9:35-9:45: Engage 1-** Students will instruct the teachers on how to create a bath bomb and what ingredients to use. The bath bomb will be left out for a week to see if it dries and resembles a store-bought bath bomb, which is dry and spherical.
- **9:45-10:15: Explore 1-** Students will watch a short demo of all of the individual ingredients used to make a bath bomb react individually in water to discover what ingredients are causing a reaction and what that reaction is. Students will be given a worksheet with a table of the ingredients and how they combine to guide their learning.
- **10:15-10:30: Explain 1-** I will be explaining to students about solutes, solvents, acids, and bases and their part in the chemical reactions that we observed as a class.
- **10:30-11:15: Explore 2-** Students will watch a demonstration of making Elephant's Toothpaste, another bath bomb, vinegar and baking soda, and various other combinations that will not create a

reaction (we will go outside for this part). Students will be recording their observations on the worksheet handed out to them.

- **11:15-11:30:** Students will be going over their worksheets as a class, and the teacher will follow along with the students under the doc-cam. Students will be asked what they think was causing the reaction, and how it compared to the bath bomb if at all.
- **11:30-11:45 Elaborating/Extending:** Students will be asked to create an exit ticket in order to show their understanding for the day in a way that allows them to make inferences about next week's topic: molecular compounds.

Learning Plan

ENGAGE 1

- Students will be creating a bath bomb using the ingredients they built recipes from the prior week. In the prior week, they were curious about why their bath bombs did not look like store bought ones, despite having the same reaction. They will use their ideas to come up with ways to re-create a store bought bath bomb. They will make adjustments based on their observations and will be allowed to leave the bath bomb out for a week to dry and see the changes in the bath bomb over time. I will take a picture of the bath bomb that we created as a class so that we can compare it when we look at it again next week.

EXPLORE 1

- Students will watch a demo done in the classroom of the individual chemicals to see their reactions in water and each other. Using all of the ingredients that students were able to make bath bombs with, there will be a chart that allows students to fill in their observations about each combination. Students will observe the combinations and determine which ones react with one another. Some of the dry substances, for example baking soda and cornstarch, will be combined with water as this will be the activator in the combination.

EXPLAIN 1

- I will ask one student from each group to come up on the board and mark their answers on the graph displayed on the powerpoint. Once all the groups marked their answers I will ask
 - what they noticed about the table?
 - What were the main ingredients that caused a reaction when mixed in water?Then I will explain that when baking soda and citric acid were mixed in water it caused a chemical reaction to take place. I will explain that there are solutes and solvents in this chemical reaction. A solute is what dissolves in the solvent. Therefore, the baking soda and citric acid (the solute) dissolves in water (the solvent). I would ask students in this case what is being used (water, baking soda, or citric acid) to break down or dissolve the powder and therefore, being our solvent? I would then explain that the two solutes are citric acid and baking soda and the combination of these three ingredients creates a solution. I will then ask them why the baking soda and citric acid combined with water creates gas? I will then explain that citric acid is an acid (pH around 3-6) in the reaction and that baking soda is the base (pH around 8.3) and when combined they create a neutral substance when mixed with water. We can see that when mixing the two solutes in the solvent it creates a gas (or carbon dioxide) but do you think it makes any new chemicals that have come from this reaction beyond gas? Once a few students give their answers I will explain that by looking at different chemical reactions we can better understand what is created when mixing substances.

EXPLORE 2

- Students will be taken outside for this phase of the lesson. There will be 6 different chemical combinations tested, all performed by the teacher. Three of these combinations will produce a

reaction and the other three will not react. Students will be provided with a chart that they will be expected to fill out. This chart will have a row for each chemical reaction with a column for both the observations about the reaction and the chemical equation created. During this phase of the experiment, students will only be filling out the 'observation' section as they will be completing the equation column later.

- Chemical combinations:
 - Baking Soda and Vinegar
 - Potassium Chloride and Hydrogen Peroxide
 - Citric Acid and Baking Soda in Water
 - Baking Soda and Cornstarch in Water
 - Lemonade Mix and Citric Acid in Water
 - Vinegar and Epsom Salt

EXPLAIN 2

- Students will lead in a discussion on what was observed and recorded while students were outside for the experiments. As a class, students will be working to create a chart with all of their observations for each reaction. After all observations are recorded on the classroom chart, they will be comparing each reaction to one another.
 - Questions:
 - Which combination had the most extreme reaction?
 - Why were we able to combine some of the same substances and only find reactions on some?
 - Even if we don't see a reaction, could a reaction still be occurring?
- Molecular formulas and compounds will be introduced and explained, along with the periodic table of elements for students to reference when writing chemical names. There will be a chart of each ingredient used so that students can reference this for next week.
 - Questions:
 - Who knows what a compound is?
 - Who can explain what a chemical equation represents?

ELABORATING/EXTENDING Understanding

- In order to expand into the next lesson, students will be led to think about the molecules in the compounds they watched during the reactions. After discussing what molecular forms and compounds are, students will be prepared for the next lesson in which they will explore the way molecules work in chemical reactions. In addition, students will be prompted to think beyond this day's lesson in the exit ticket, where we will ask, "what happens to the molecules when a gas is released?"

Formative Assessment Evidence

What evidence will you gather to understand if ALL your students met the learning outcome?

- Students will be filling out a lab worksheet as they go through the lesson and will be turning in this worksheet at the end of the day.
- Students will also be given an exit ticket in response to the following question:
 - "What happens to the molecules when a gas is released?"
 - They can represent their understanding of this question through words, drawings, or any other option that they are most comfortable with (within reason).

Individual Student Accommodations

Accommodations/Modifications for Individual Students

- Our student with ADHD will be put with a student he works well with, depending on who is present for class.
- Alterations with groups may occur depending on what students are present in order to ensure all students are able to engage with peers.
 - Example: combining two groups in order to make a group of 5.

- The higher-level students will be provided more substances to determine reactions between and will have additional questions such as:
 - Are there different reactions occurring or is each reaction the same?
 - Epsom salt dissolves in water. Why wouldn't that be a chemical reaction?
 - What is happening on a molecular level when chemical reactions occur?

Materials + Quantity:

Powerpoint

vinegar

baking soda

potassium chloride

hydrogen peroxide

citric acid

cornstarch

lemonade mix

epsom salt

3 small composition notebooks

pencils

colored pencils (6 packs)

worksheets printed out (16)

dixie paper cups (20)

red plastic cups (6)

whiteboard

expo markers (1 pack)

plastic bin

coconut oil

vegetable oil

olive oil

sugar free lemonade mix

sugar

salt

Lesson Plan 4

Desired Results

Driving Question for this week's Saturday Session

- How do molecules relate to chemical reactions?

DCI Addressed in lesson:

- MS-PS1-5: Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.

When chemical reactions occur, the molecules within the compounds remain the same before and after the reaction. These molecules are rearranged to create new compounds and released in different forms, thus providing the solution.

SEPS Addressed in Lesson:

- Students will be collecting and analyzing data in order to detect similarities and differences between different combinations of compounds.

CCCs Addressed in Lesson:

- The cross cutting concepts addressed in this lesson are systems and system models. Students are creating models of elements, molecules, compounds, and chemical reactions.

Besides science, what other disciplines of STEM will be included in this lesson?

- This lesson includes engineering, as students are creating models and physical representations of molecules.

Learning objectives (outcomes):

Students will be able to explain/state:

- Compounds combine with one another in order to create reactions.

Timeline of Activities for the Day

- **9:30- 9:35-** Settle in/ entry ticket: "What is the difference between a solute and solvent?"
- **9:35- 9:45-** Engage 1 - students will be observing the bath bomb from last week. We will have a class discussion about what was observed and what they predict will happen as well as adding cornstarch to the outside of the bath bomb. They will also be watching a youtube video about water and its molecular properties.
- **9:45-10:05** Explore 1- Students will be given a list of compounds on a worksheet that they need to create using playdough and toothpicks.
- **10:05- 10:25** Explain 1-will be explaining how the molecules we created using playdoh are a part of the chemical reactions seen in the bath bomb experiment. New vocabulary will be introduced and explained as well.
- **10:25- 11:05** Explore 2- Students will follow the guide provided by the teacher to make molecules and connect them.
- **11:05- 11:30** Explain 2- Students will be reviewing their compounds and making connections between the compounds before and after the reaction, using the models.
- **11:30 -11:40-** Elaborating/ Extending- Students will be looking at how the chemical equations are closed systems using the information they gathered from the explore part of the lesson.
- **11:40-11:45-** Exit ticket: "What is a closed system? Are all chemical reactions closed systems?"

Learning Plan

ENGAGE

- We will pass out entrance ticket slips that ask the students:
 - What is the difference between a solute and a solvent?
- We will begin by having students look at the bath bombs we created as a class last week. We will pass the bath bomb around and ask students
 - Are there any changes from the last time you saw the bath bomb?
 - What is the difference between the bath bombs we created and the store bought bath bombs now that it has sat out for a week?
 - What do you think will happen to the bath bomb if we let it sit out another week?
 - We will explain that some students had the idea of adding corn starch on the outside of our bath bombs so we will be adding baking soda to the outside. How do you think this will change the outcome of our bath bomb?
- Youtube video about water molecules, because students began exploring water molecules last week.
 - <https://www.youtube.com/watch?v=3jwAGWky98c&t=49s>
 - We will then explain that students will be creating their own molecules using playdough and toothpicks. We are going to give each student two things of playdough (they do not get to pick the color) and a set of toothpicks and we will hand out the worksheet.

EXPLORE 1

- Students will be given a list of compounds that are used in the bath bomb with additional compounds. With this list, they will be given Play-doh and toothpicks and asked to create models of the compounds using the Play-doh and toothpicks. There will be a worksheet provided for students to draw and label their compounds. Some worksheets will have more examples than others as a guiding tool, to account for differentiation.
- While students are completing the activity, some prompting questions could be presented:
 - What do each of these different colors represent?
 - What do the toothpicks represent?
 - Is there a specific order that these molecules need to be arranged?

EXPLAIN 1

- Students will have finished creating their compounds and be ready to discuss what they have created. First, students will be reviewing the models they created and how they line up with the compounds given.
 - Questions:
 - How do we know this matches the model?
 - Find an incorrect and correct example.
 - Why would a model be helpful in understanding molecules?
- Students will follow with a vocabulary guided worksheet. The information will be presented and available for use in the following activity.
 - Element: a single type of atom
 - Molecule: Two or more ATOMS that have been chemically combined.
 - Compound: Two or more ELEMENTS that have been chemically combined.
 - Equation: A written description of the combination of two chemical compounds.
 - Solute, Solvent, Solution

EXPLORE 2

- Students will be using Play-doh models to represent chemical reactions. They will still have their compound worksheets available to reference for the molecules, but will be given a new worksheet for this part. Students will be drawing their two compounds before the reaction occurs and then using an answer bank, they will find the solution. The idea is that students will be able to recognize that the reactants and the solution have the same types and quantities of molecules in them. We will

be providing the band so that students can create an accurate representation of the results, as they will not know how to divide the compounds once they have rearranged.

- Probing questions:
 - We know the number of molecules will stay the same. Does the number of toothpicks (bonds) stay the same?
 - How do you know the equation has the same number of molecules on each side?
 - What are some common molecules or compounds that you are seeing?
 - What do you think is occurring when the compounds are rearranged?

EXPLAIN 2

- After students have worked to create their compounds, it will be time to talk about what their findings are and see where their level of understanding is. With the probing questions, students will have been directed to understand how compounds rearrange themselves to form new compounds.
- Students will be asked synthesis questions in order to connect science ideas presented between the models and the equations.
 - How are molecules moved around in equations so that the solution is different than the solute and solvent?
- Students will be introduced to closed systems as they analyze how the molecules that go into an equation also come out of the equation.

ELABORATING/EXTENDING Understanding

- Students will be asked to start thinking about how we know what compounds will connect with one another. This will invite students to begin thinking critically about what happens during a reaction.
- Students will be asked in their exit ticket to describe a closed system and explain if all reactions will be closed systems.

Formative Assessment Evidence

What evidence will you gather to understand if ALL your students met the learning outcome?

- Students will be given a template to draw their molecule models during the Explain 1 portion.
- Students will be working on a worksheet during the Explore 2 section where they are provided the two reacting compounds and asked to find the solution. Using this, they will be given an answer bank to confirm their answers and create molecules that represent the solution accurately.

Individual Student Accommodations

Accommodations/Modifications for Individual Students

- There will be an extra worksheet for students who finish the equation activity early. This will include more difficult equations.
- A vocabulary worksheet will be provided so that the younger students can reference it for definitions.
- Our student with ADHD will be given a worksheet with a list of the names and appearances of the molecules and compounds he will be building.

Materials + Quantity:

Toothpicks

Play-doh

Paper

Colored pencils

Pencils

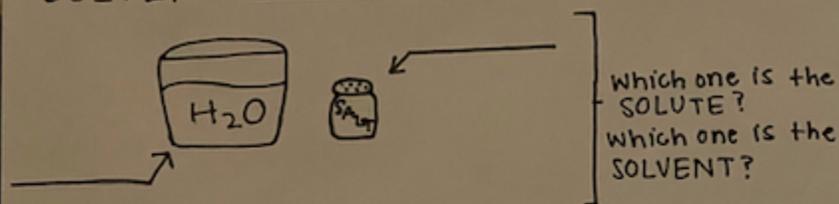
Worksheets

Corn-starch

Bath Bomb (Homemade, in the clear container)

11/6 NOTES

- SOLUTE: _____ in the solvent.
- SOLVENT: _____ a solute. Usually a liquid.



VOCAB

Element: A single type of _____.

Molecule: Two or more _____ that have been chemically combined.

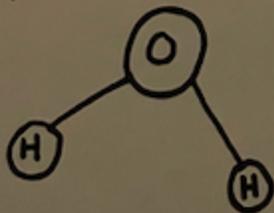
Compound: Two or more _____ that have been chemically combined.

Equation: A written description of the _____ of two chemical compounds.

Solution: A liquid mixture of the _____ evenly distributed in the _____.

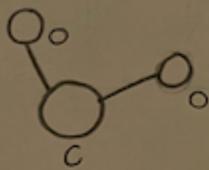
Water!

Model

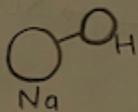
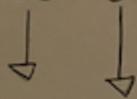
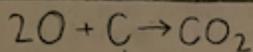


Equation \uparrow oxygen
 $2\text{H} + 1\hat{\text{O}}$
 \downarrow
2 hydrogens

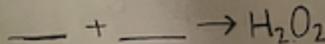
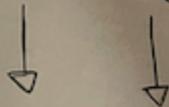
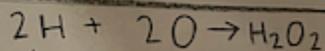
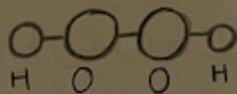
Compounds



Equations



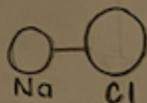
CHALLENGE!



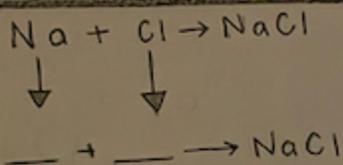
Hydrogen Peroxide.

Compounds

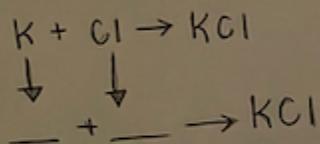
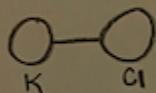
What color is your Na?
What color is your Cl?



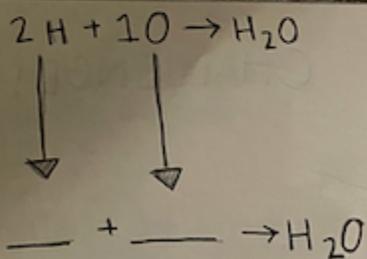
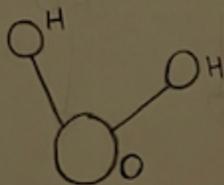
Equations



What color is your K?
What color is your Cl?



What color is your H?
What color is your O?



WHY does the equation have
2 hydrogens?

Lesson Plan 5

Desired Results

Driving Question for this week's Saturday Session

- How can you make something new that was not there before?

DCI Addressed in lesson:

PS1.B: Chemical Reactions

- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.
 - NGSS

When substances are combined, there are distinguishing characteristics that display the rearrangement of molecules. This can be done through a chemical reaction, phase change, or dissolving.

SEPS Addressed in Lesson:

- Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
 - NGSS

CCCs Addressed in Lesson:

- The cross cutting concepts addressed in this lesson is patterns, as students are seeing the ways in which reactions, phase changes, and dissolving has consistencies

Besides science, what other disciplines of STEM will be included in this lesson?

- This lesson includes technology, as students will be applying science ideas to create conclusions.

Learning objectives (outcomes):

Students will be able to explain/state

- the same molecules that go into the equation come out, but as different compounds.

Timeline of Activities for the Day

- 9:30-9:35 - Settle in
- 9:35-9:45 - Engage/entrance ticket
- 9:45-10:05 - Explore 1
- 10:05-10:20 - Explain 1
- 10:20-10:30 - Engage 2
- 10:30-11:00 - Explore 2
- 11:00-11:25 - Explain 2
- 11:25-11:35 - Elaborating/Extending
- 11:35-12:00 - Video and pick up

Learning Plan

ENGAGE 1

- We will begin with an entrance ticket asking students:
 - Write out or draw the definition of element, molecule, and compound using colored pencils and a sheet of printer paper.

EXPLORE 1

- I will have students look in their folder for the worksheet where we found the mass of the bath bomb. I will ask them the question “How can a new substance (a gas) be produced and the total mass of the closed system not change?”
 - I will create a T chart where the left side writes our predictions and the right side is what we learned after the lesson. I will write students' ideas down on the left side of the chart to compare later.
- Then, I will instruct students that they will be observing a bath bomb reaction again, and focusing on the total mass of both the water and the bath bomb. Students will take the mass of the bath bomb that we found on our worksheet and then the mass of the water and add them together. Here students will find the mass of the water before they put the bath bomb in and then the mass after the bath bomb has finished its reaction. Students will take the individual mass of the bath bomb + the mass of the water and then find the sum. Then, they will put the bath bomb in the water, and once the bath bomb is dissolved they can find the total mass of the solution.

EXPLAIN 1

- Once students have found the masses as a group, we will talk about their findings as a class. The groups should find that the mass doesn't change even though it produces a gas. I will ask the students why they think the mass stayed the same even though we know that we created a gas when putting the bath bomb in water. I will explain that we know when we put the bath bomb into water we know that the compounds in the reaction change to create a new compound (the reaction written above). I will write on the board the chemical reaction and explain that this is a system and then explain that a system is a chemical reaction that we are observing. In a system we look at how matter and energy are transferred. So we have our system and then we have our surroundings like the air around us. There are open systems, closed systems, and isolated systems. I will draw out an explanation for both an open system and a closed system and explain the properties of each. Then I will ask the students if they think the bath bomb is a closed or open system depending on what we learned. Then, I will explain that this system is a closed system because mass is conserved in the system but that energy is free to move in the system by entering or exiting. Therefore, the gas is separated but the same amount of matter that went into the system came out. I will explain that if we take this solution we created and then boil it we will be left with the compound on the right side of the equation. Then, I will have students add to their notes the definition of a closed system, a system, and matter.
 - Vocabulary:
 - system- the chemical reaction that we are observing
 - closed system- matter stays in the system but energy is free to flow in and out.
 - matter- anything that has weight or takes up space
- Once students have finished their notes, we will finish up the T chart. We will talk about how their ideas stayed the same, changed, and/or what we should add to our chart after learning about closed systems.

ENGAGE 2

- Students will be introduced to the different observations and types of combinations they may see during the mixing of two different substances. They will be asked to define the following:
 - Reaction
 - The mixing of two substances to create new or different substances than before.
 - 4 ways to detect a reaction:
 - Change in color
 - Change in odor

- Creation of gas
- Creation of precipitate
- Physical change
 - The mixing of two substances that produce the same substances with different physical traits.
- Phase change
 - The transition of a substance from solid, liquid or gas to another state.

EXPLORE 2

- Students will be provided basic household ingredients and asked to create a chart with reactions, physical changes, or phase changes. This chart will have three columns, each one representing one of the three results mentioned previously. They will put each reaction combination in its respective column, based on their observations. With their table groups, they will be mixing items to see which of these options occurred when substances were combined. This may be a difficult activity and students could have troubles differentiating these ideas, so teachers will be walking around to help students. They will also have a list of which items will create a reaction, physical change, or phase change in order to check students' work.
- Probing questions:
 - How can you tell this is a reaction instead of a physical change?
 - Is there a way we can create a phase change without heating or cooling?
 - What are some ways we can separate the substances after we have mixed them?
 - Can you recall the 4 ways we can detect a chemical reaction?

EXPLAIN 2

- Students will come back as a whole class and analyze their answers. This activity is likely to have varied responses, so having the correct answers and talking through how we can be certain of the answer will create better understanding.
- Is dissolving salt a chemical reaction or a physical change?
 - This is a difficult question, as there are arguments for both sides. Generally, there is a test that determines if chemical change has occurred through using only physical changes to get beginning substances. Salt can be dried out of water through heating, but it has still changed compounds prior to the heating.

ELABORATING/EXTENDING Understanding

- Students will be recognizing that new substances, including the gas they saw in the original bath bombs, are not created from new molecules, but rather a rearrangement of molecules. They will be synthesizing their learning about observing chemical reactions, writing out and modeling chemical reactions, and the common detectors for a chemical reaction to come up with this conclusion and finish the lesson.
- Exit ticket: "How can we create something that wasn't there before?"

Formative Assessment Evidence

What evidence will you gather to understand if ALL your students met the learning outcome?

- The formative assessment used to determine student understanding is through the exit ticket. The question in the ticket will be "How can we create something that wasn't there before?" This is the driving question for the unit matrix and students should be able to recognize that while the compound may not have been there, whether it be a solid, gas, or liquid, the molecules were already present.

Individual Student Accommodations

Accommodations/Modifications for Individual Students

- The younger table group will be given extra teacher-led instruction during the explore phase. This is to monitor the focus of our student with ADHD.

- The higher level groups will be provided additional chemical compounds that may be in the bath bombs and provided extra questions. These include epsom salt, baking soda, etc.
 - o Are these other compounds being rearranged in the reaction?
 - o Is there a way we could separate all the substances after combining them?

Materials + Quantity:

Bath Bombs

4 clear/translucent cups or beakers

Colored pencils

Printer paper

Pencils

Baking soda

Cornstarch

Salt

Epsom salt

Sugar

Vinegar

Lemonade mix

Red solo cups

measuring scales