Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_

**Blackline Master #1**

Law of Conservation of Mass Explained

Engage*: After viewing the videos, tell me what you think:*

Time Lapse Construction:

When we build new cities,

1. the total mass of the earth decreases.
2. the total mass of the earth increases.
3. the total mass of the earth remains the same.

Why did you select this answer? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Time Lapse Plant Growth:

When new plants grow,

1. the total mass of the earth decreases.
2. the total mass of the earth increases.
3. the total mass of the earth remains the same.

Why did you select this answer? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Explore:*

*Part A: Answer the following questions before, during, and after viewing the Teacher Demo.*

Pre-Demo: If I add together water and an effervescent tablet, will the total mass before mixing be less than, equal to, or greater than the mass after mixing? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Explain: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Demo: Fill in the chart below while watching the demo:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Item | Mass Before Mixing | Mass After Mixing |  | \*Calculating the mass of the water | |
| Effervescent tablet |  |  |  | Mass of container and water |  |
| 100 mL Water\* |  |  |  | Mass of container |  |
| Erlenmeyer flask |  |  |  | Mass of water |  |
| Total Materials |  |  |  |  |  |

Post Demo: What did you notice about the mass before and after mixing? How can you explain what you saw? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Did the effervescent tablet and water reaction support or fail to support the law of conservation of mass? Why or why not? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How do you think you could change the experiment to demonstrate the law of conservation of mass? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Did your data support or fail to support your hypothesis? Explain. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Explore:*

*Part B: Using the materials provided and instructions listed below, conduct an experiment that will demonstrate that the Law of Conservation of Mass is valid. Record your group measurements in the data table provided.*

|  |  |  |  |
| --- | --- | --- | --- |
| Instructions:  1. Place 20 g of Baking Soda in a medicine cup and find its mass.  2. Place 20 mL of vinegar in a medicine cup and find its mass.  3. Find the mass of the vinegar and record the mass of the vinegar and baking soda in your table.  4. Record the masses of both in your data table.  5. Place both containers into the zipper baggie without spilling the contents, remove as much air as possible from the bag, and tightly seal the bag.  6. Tip the cups over to mix the vinegar and baking soda together without opening the bag.  7. After all evidence of a reaction has stopped, find the final mass of all the contents within the bag (do not open the bag). | Item | Mass Before | Mass After |
| Vinegar & Cup |  |  |
| Baking Soda & Cup |  |  |
| Baggie |  |  |
| Total |  |  |

*Explain: Answer the following questions about your experiment:*

1. Describe what happened when the vinegar was mixed with the baking soda.

2. What would be some reasons that we sealed the zipper baggie before we conducted the experiment?

3. Did the vinegar and baking soda undergo a chemical change or a physical change? How do you know?

4. How did your experiment support or fail to support the Law of Conservation of Mass?

5. How was your experiment different from the teacher demo in part A?

Expand: *Using the differences we noticed in question 5 above, change and recreate the teacher demo so that it proves the Law of Conservation of Mass.*

Planning:

Why did the teacher’s demo fail to support the law of conservation of mass?

What part of the setup should be changed?

What are 3 possible ways to change the setup and fix the problem?

1.

2.

3.

Try It Out:

|  |  |
| --- | --- |
| Describe Your Procedure Here: | Draw/Describe Your Setup Here: |
| Record Your Data Here: | Write a Conclusion Statement Here: |

Student Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Blackline Master #2**

**Checking for Understanding: Maintaining Matter**

\_\_\_ 1. During an experiment, Ashland noticed that the mass of the water in his beaker changed after the water was heated. Which of the following best describes what happened to the water in Ashland’s experiment?

1. The total mass of the water in his beaker changed because the chemical composition of the water changed when he heated it.
2. The total mass of the water in his beaker changed because part of the water vaporized and is now in the air around the beaker.
3. The total mass of the water in his beaker changed because the water was destroyed when it was heated.
4. The total mass of the water in his beaker changed due to improper measurement techniques.

\_\_\_ 2. The equation below shows the reaction that occurs when baking soda reacts with vinegar.

Baking Soda + Vinegar 🡪 Water + Carbon Dioxide + Sodium Acetate

Which of the following best compares the masses of the substances involved in this reaction

1. The mass of the vinegar equals the combined masses of the sodium acetate, water and carbon dioxide.
2. The mass of baking soda equals the combined masses of sodium acetate, water and carbon dioxide.
3. The combined masses of the vinegar and baking soda equal the combined masses of sodium acetate and water.
4. The combined masses of baking soda and vinegar equal the combined masses of sodium acetate, water and carbon dioxide.

\_\_\_ 3. In a landfill, old biodegradable materials are breaking down while, at the same time, new trash is   
 being added daily. Which statement best describes the relationship between a landfill and the

mass of the earth?

1. The mass of the earth increases due to trash being added to the landfill
2. The mass of the earth decreases due to materials breaking down in the landfill
3. The mass of the earth remains the same regardless of the amount of trash in the landfill
4. The mass of the earth might increase or decrease, it all depends on the amount of trash.

\_\_\_ 4. When new cities are built,

1. the mass of the earth increases.
2. the mass of the earth decreases.
3. the mass of the earth remains the same.

\_\_\_\_ 5. As the earth’s population expands,

1. the mass of the earth increases.
2. the mass of the earth decreases.
3. the mass of the earth remains the same.

**Blackline Master #3: ANSWER KEYS**

Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_

Law of Conservation of Mass Explained: *Sample Student Responses*

Engage*: After viewing the videos, tell me what you think:*

Time Lapse Construction:

When we build new cities,

1. the total mass of the earth decreases.
2. the total mass of the earth increases.
3. the total mass of the earth remains the same.

Why did you select this answer? \_\_\_*Student responses will vary*\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Time Lapse Plant Growth:

When new plants grow,

1. the total mass of the earth decreases.
2. the total mass of the earth increases.
3. the total mass of the earth remains the same.

Why did you select this answer? \_\_\_*Student responses will vary \_\_*\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Explore:*

*Part A: Answer the following questions before, during, and after viewing the Teacher Demo.*

Pre-Demo: If I add together water and an Effervescent tablet tablet, will the total mass before mixing be less than, equal to or greater than the mass after mixing? \_*responses will vary*\_

Explain: \_\_*responses will vary but should indicate a rational reason why student has chosen this hypothesis*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Demo: Fill in the chart below while watching the demo:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Item | Mass Before Mixing | Mass After Mixing |  | \*Calculating the mass of the water | |
| Effervescent tablet Tablet |  |  |  | Mass of container and water |  |
| 100 mL Water\* |  |  |  | Mass of container |  |
| Erlenmeyer Flask |  |  |  | Mass of water |  |
| Total Materials |  |  |  |  |  |

Post Demo: What do you notice about the numbers for the mass before and after mixing? How can you explain what you saw? *Student responses will vary but should indicate that the mass numbers at the beginning and ending of the experiment did not match and should provide a reasonable explanation of what was observed.*

Did the Effervescent tablet and water reaction demonstrate the law of conservation of mass? Why or why not? *Student responses will vary but students should be able to explain that the demo did NOT demonstrate the law of conservation of mass because the mass was not the same at the beginning and end so “matter was lost.”*

How do you think you could change the experiment to demonstrate the law of conservation of mass? *Student responses will vary. Students may not be able to hypothesize yet how they could demonstrate the law of conservation of mass. Some students may be able to identify that gas was escaping the demonstration and that gases have mass. They may be able to identify that something needs to be changed so that the gas cannot escape.*

*Explore:*

*Part B: Using the materials provided and instructions listed below, conduct an experiment that will explain that the Law of Conservation of Mass is valid. Record your group measurements in the data table provided.*

|  |  |  |  |
| --- | --- | --- | --- |
| Instructions:  1. Place 20 g of Baking Soda in a medicine cup and find its mass.  2. Place 20 mL of vinegar in a medicine cup and find its mass.  3. Find the mass of the vinegar and record the mass of the vinegar and baking soda in your table.  4. Record the masses of both in your data table.  5. Place both containers into the Zipper baggie bag without spilling the contents, remove as much air as possible from the bag, and tightly seal the bag.  6. Tip the cups over to mix the vinegar and baking soda together without opening the bag.  7. After all evidence of a reaction has stopped, find the final mass of all the contents within the bag (do not open the bag). | Item | Mass Before | Mass After |
| Vinegar & Cup |  |  |
| Baking Soda & Cup |  |  |
| Baggie |  |  |
| Total |  |  |

*Explain: Answer the following questions about your experiment:*

1. Describe what happened when the vinegar was mixed with the baking soda.

*Student answers will vary but should include:*

1. *bubbles were produced*
2. *gas was released*

2. What would be some reasons that we sealed the Zipper baggie bag before we conducted the experiment? *Student answers will vary but should include that closing the bag will trap the gas that was released from the reaction. Advanced or high school level students could also include information and terms related to closed systems.*

3. Did the vinegar and baking soda undergo a chemical change or a physical change? How do you know? *This experiment shows a chemical change. Bubbles appearing and the creation of a gas are both evidence of a new substance being formed. Chemical changes are defined as a change in matter that creates a new substance.*

4. How did your experiment demonstrate the conservation of mass? *The total mass of the bag, vinegar, baking soda, and measuring cups (all of the materials) was the same before and after the reaction*

5. How was your experiment different from the teacher demo in part A? *Student answers will vary but should include the fact that the teacher experiment allowed gas to be released into the room while the student experiment trapped the gas.*

Expand: *Using the differences we noticed in question 5 above, change and recreate the teacher demo so that it proves the Law of Conservation of Mass.*

Planning:

Why didn’t the teacher demo show conservation of mass? *The teacher setup didn’t have a way to trap the gas being produced, therefore there was no way to measure the mass of the gas.*

What part of the setup should be changed? *A baggie, balloon or some other container should be used to trap and measure the gas released from the experiment*

What are 3 possible ways to change the setup and fix the problem?

1.  *Student answers will vary but should be aimed at a solution to capture and measure the gas produced.*

2.

3.

Try It Out:

|  |  |
| --- | --- |
| Describe Your Procedure Here:  *Student answers will vary in each of these sections. Student procedures and setups should be approved by the teacher before students are allowed to proceed with their independent experimentation.* | Draw/Describe Your Setup Here: |
| Record Your Data Here: | Write a Conclusion Statement Here: |

**Checking for Understanding: Maintaining Matter**

**Answer Key**

\_\_\_ 1. During an experiment, Ashland noticed that the mass of the water in his beaker changed after the water was heated. Which of the following best describes what happened to the water in Ashland’s experiment?

1. The total mass of the water in his beaker changed because the chemical composition of the water changed when he heated it.
2. *The total mass of the water in his beaker changed because part of the water vaporized and is now in the air around the beaker.*
3. The total mass of the water in his beaker changed because the water was destroyed when it was heated.
4. The total mass of the water in his beaker changed due to improper measurement techniques.

\_\_\_ 2. The equation below shows the reaction that occurs when baking soda reacts with vinegar.

Baking Soda + Vinegar 🡪 Water + Carbon Dioxide + Sodium Acetate

Which of the following best compares the masses of the substances involved in this reaction?

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2. The mass of baking soda equals the combined masses of sodium acetate, water and carbon dioxide.
3. The combined masses of the vinegar and baking soda equal the combined masses of sodium acetate and water.
4. *The combined masses of baking soda and vinegar equal the combined masses of sodium acetate, water and carbon dioxide.*

\_\_\_ 3. In a landfill, old biodegradable materials are breaking down while, at the same time, new trash is   
 being added daily. Which statement best describes the relationship between a landfill and the

mass of the earth?

1. The mass of the earth increases due to trash being added to the landfill
2. The mass of the earth decreases due to materials breaking down in the landfill
3. *The mass of the earth remains the same regardless of the amount of trash in the landfill*
4. The mass of the earth might increase or decrease, it all depends on the amount of trash.

\_\_\_ 4. When new cities are built,

1. the mass of the earth increases.
2. the mass of the earth decreases.
3. *the mass of the earth remains the same.*

\_\_\_\_ 5. As the earth’s population expands,

1. the mass of the earth increases.
2. the mass of the earth decreases.
3. *the mass of the earth remains the same.*