Matter & Energy Unit Assessment

Name: _____ Hour_____Date: _____

Date Packet is due:_____ Why late? _____Score: _____
Day of Week Date If your project was late, describe why

Driving Question: What happens to substances & molecules during combustion?

Anchoring Phenomenon: When something burns (or is *combusted*), it seems like that substance disappears. What happens to the molecules of a substance when it is combusted?

Deeper Questions

1. What happens to the atoms in molecules during combustion?
2. What happens to energy in molecules during combustion?
3. How does what we can observe or measure during combustion relate to the changes happening at the molecular level?

Weekly Schedule

Part 1: Introduction
- Recap of the Matter & Energy Unit
- Group Concept Summaries

Part 2: Application & Practice
- Scenario Questions
- Critiquing Ideas

Part 3: Structured Review
- Self-Assessing Knowledge
- Guided Review

Part 4: Self Review

Part 5: Final Assessment

NGSS Standards:
HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Semester Schedule

Matter & Energy
Week 1: What happens when something burns?
Week 2: What happens to molecules during burning?
Week 3: Unit Assessment

Animals
Week 1: What are animal cells and food made from?
Week 2: What happens to food when it is consumed?
Week 3: What happens inside animal cells?
Week 4: Unit Assessment

Plants
Week 1: What are plant cells made from?
Week 2: How do plants get their food?
Week 3: What happens inside plant cells?
Week 4: Unit Assessment

Ecosystems
Week 1: How do living organisms affect each other?
Week 2: Tracing Matter
Week 3: Global Biodiversity
Week 4: Humans & Biodiversity

Part 1: Introduction

Overview: In this activity, your group will review the ideas and concepts from the Matter & Energy Unit. Your instructor will assign specific questions to your group. You will then critique the responses of other groups.

Driving Questions

1. What is the difference between matter and energy?
2. How are the following terms different? *Atoms, mass, elements, molecules.*
3. If a substance gains *mass*, what is happening to the amount of *atoms* in that substance?
4. What are the four kinds of energy? How are these all related to each other?

For each of the following, justify your answer with an explanation.

5. True or false: when something burns, the atoms in that substance are destroyed.
6. True or false: when something burns, the atoms in that substance become energy.
7. True or false: when something burns, the energy in that substance is destroyed.
8. True or false: when something burns, the carbon atoms in that substance are turned into oxygen and hydrogen atoms.
9. True or false: some atoms that were found in dinosaurs exist in organisms that are alive today.
10. True or false: the amount of energy in the universe at the time of the dinosaurs is the same today.
11. How can molecules contain energy if matter and energy are separate things?
12. What makes something a "fuel"? What primarily determines the chemical energy content of a molecule?
13. What do "high energy" molecules like gasoline, ethanol, and sugar molecules have in common?
14. Can we directly use the energy contained within high energy molecules? What has to happen in order for this energy to become available for use?
15. When we see flames during combustion, what is it that we're actually seeing?
16. Both ethanol and water are clear liquids. Why does ethanol burn but water does not?
17. Explain combustion in a way that specifically addresses our "three rules" of matter and energy: 1) All matter is made of atoms. 2) Atoms lasts forever. 3) Energy lasts for forever.

Vocabulary
Matter
Energy
Atoms
Molecules
Elements
Mass
Light Energy
Chemical Energy
Kinetic Energy
Heat Energy
Chemical Bond

Remember the following "rules" for energy and matter:

- **All solids, liquids, and gases are made of tiny particles called atoms**. Multiple atoms can bond together to form molecules (*e.g., water molecules consist of 1 oxygen atom & 2 hydrogen atoms*).
- In biology, **atoms last forever**. Atoms cannot be created or destroyed (*e.g., a carbon atom is always a carbon atom*). If something gains mass, it gains atoms. If it loses mass, it loses atoms. Atoms found on molecules can be rearranged to form new molecules.
- In biology, **energy lasts forever**. Energy cannot be created or destroyed. Energy can exist as light, heat, motion, or as chemical energy stored in the bonds of molecules. Energy in one form can be transferred into a different form (*e.g., light energy can be transformed into heat energy*).

Part 2: Application & Practice

Overview: You will work in groups to respond to situations that have not yet encountered. You will use your expertise in combustion to develop answers. You will then critique other group's responses (*refute, dispute, agree, or add*). Note: your instructor may assign specific questions to your group if time is limited.

A tree is growing from an acorn to a large, full grown oak tree.

1. What is happening to the number of atoms within that tree as it gains mass?
2. Do the molecules of the tree contain energy? Why or why not?
3. How is energy changing within that tree as it gains mass?

A squirrel eats an acorn from this tree.

4. What would happen to the atoms inside of the acorn's molecules?
5. What would happen to the energy inside of the acorn's molecules?

Eventually the oak tree dies. The oak tree is chopped into firewood to heat a home.

6. How are the atoms and molecules in the wood changing as the wood burns?
7. The fire releases a large amount of heat and light (and possibly other forms of energy). Where is this energy coming from?
8. What happens to matter and energy from the wood after it completely combusts and the fire goes out?
9. When wood combusts, it will produce ashes. However, the mass of the ashes is only a small percentage of the mass of the original wood. What happened to most of the mass of the wood after it completely combusts? Which of the following most agrees with your ideas? Explain.
    a. Most of the atoms in the wood were turned into energy through combustion and became weightless.
    b. Most of the atoms were turned into ashes, which are light and blow away easily in the wind.
    c. Most of the atoms in the wood were turned into invisible gases that we can't see.
    d. Most living things are mostly water. Because of this, most of the atoms in the wood evaporated in the heat of the fire.

Atoms and Dinosaurs: Millions and millions of years ago, dinosaurs were found all over the planet.

10. What happened to the atoms found in the cells of dinosaurs? Which seems most accurate? Explain why.
    a. Those atoms still exist today. Some of those atoms are found in organisms that are alive today.
    b. The carbon, oxygen, and hydrogen atoms (among others) that were found in the dinosaurs were turned into minerals during the process of fossilization.
    c. Those atoms no longer exist.
    d. Those atoms were turned into energy as dinosaurs digested food or were eaten / decomposed by other organisms.

11. Think about the molecules found in the cells of dinosaurs. Did these molecules contain energy when the dinosaur was still alive? Could some of that energy still exist today? Explain.

Most of electricity in the United States is produced using fossil fuels (such as coal or petroleum). Fossil fuels formed from the tissue of living organisms that existed millions and millions of years ago (such as dinosaurs as well as prehistoric plants and other organisms). Fossil fuels are valuable as a fuel source because they release large amounts of energy when they are combusted.

12. Make a prediction about the chemical structure of fossil fuels like coal or petroleum. If these substances are combustible, and if they release large amounts of energy when combusted, what can we assume about the molecular structure of these substances?
13. Where did the energy found in the molecules of fossil fuels come from? How did the dinosaurs and prehistoric plants acquire this energy?
14. What happens to the energy found within fossil fuels when it is combusted? Where does it go?
15. What happens to the matter found within fossil fuels when it is combusted? Where does it go?

Checking in

16. What was most surprising to you?
17. What still seems unclear to you?
18. Does anything seem inaccurate? How so?
19. How do these topics relate to things that you have already experienced in your life and/or things that you have learned previously?
20. How do these topics relate to decisions you will make in your future career and/or personal life?

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Part 3: Structured Review

Overview: you will begin by individually reviewing the driving questions below. For each objective, rank it as a 1 (*completely unsure*), 2 (*somewhat unsure*), or 3 (*completely sure*) based on your comfort with that objective. You can then use these rankings to determine which questions or content to prioritize during your review session with your instructor.

Driving Questions

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Part 4: Self Review

Overview: You will be provided with independent time to prepare for the final assessment. Your instructor will determine how you could most effectively use this time. Your instructor may also use this time to inform you of any work that you may be missing or need to re-submit.