1.3 - Matter & Energy Unit, Packet 3

Score
□ Above & Beyond
□ Meets Expectations
□ Near Expectations
□ Incomplete – *fix the following pages*:

First & Last Name: _____ Period/Hour:_____

NOTE: Packets are due after completing Part 5. Check each page to be sure all blanks are completed.

Driving Question: What happens to the matter and energy contained in molecules when a substance is combusted? ?

Anchoring Phenomenon: We have investigated combustion in both wood and ethanol in the previous packets. Here we will develop a sophisticated explanation for how all combustible substances change when they burn.

Deeper Questions

1. What happens to the atoms and energy in molecules during combustion?
2. How does what we can observe during combustion (e.g., heat & light) relate to the changes happening at the molecular level?
3. Why do some substances burn but others do not?

Schedule

Part 1: Introduction
- Tiki Torch Combustion

Part 2: Core Ideas
- Evaluating Sample Responses
- Writing a "Level 3" Response

Part 3: Investigation
- Combustion Connections

Part 4: Review Game
- Jeopardy Review Game

Part 5: Final Review
- Final Q&A

NGSS Standards (*PEs* & *CCCs are summarized below. SEPs are noted throughout the packet*).
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

1. Matter & Energy
1.1: What happens when something burns?
1.2: How does burning change matter & energy?
1.3: Unit Assessment

2. Animals
2.1: How do animal cells use food?
2.2: What happens to food when it is consumed?
2.3: How do enzymes change molecules?
2.4: Unit Assessment

3. Plants
3.1: How do plant cells differ from animal cells?
3.2: How do plant cells obtain matter and energy?
3.3: How can we investigate plant growth and function?
3.4: Unit Assessment

4. Ecosystems
4.1: Why do different places have different amounts of species?
4.2: How does human activity affect species?
4.3: Unit Assessment

Resource Links: Class Website; Jeopardy Review Game; Treasures of Earth movie;

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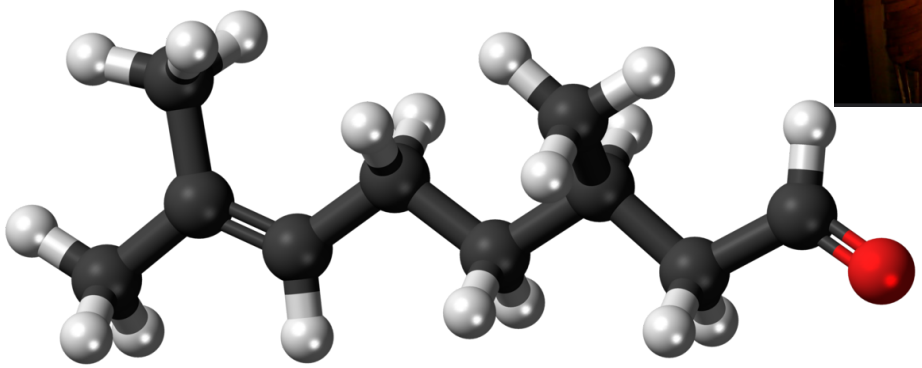
Part 1: Introduction – Tiki Torch Combustion (1.3.1)

Overview: In this activity, you will show your readiness for an assessment and demonstrate your understanding by explaining a scenario you haven't encountered yet in this class.

Background: Tiki torches (like the one in the image to the right) contain citronella. A molecule of citronella is shown below. Carbon atoms are shown in black. Hydrogen atoms are shown in light gray. One oxygen atom on the furthest right is shown in red. Use this information to answer the questions below (*image source*).



Questions:

1. **Why are citronella molecules combustible?** What about their molecular structure enables citronella to burn?

2. As citronella combusts, its mass decreases. **Why? What is happening to the atoms in the citronella molecules?**

3. As citronella combusts, the flame releases light and heat energy. **Where did this energy come from?**

4. **How would you rate the sophistication of your response to the questions above?** Circle one.
   a. Level 1 - More Time & Preparation is Needed Outside of Class Prior to the Assessment
   b. Level 2 - Some comprehension is evident but more preparation is needed.
   c. Level 3 - Highly Sophisticated (*fully addresses the question, completely accurate, and uses precise language and terms*).

5. **What topics (if any) are still confusing or unclear to you? What questions do you still have?**

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Part 2: Critiquing Responses (1.3.2)

Directions: *One of our key questions is shown below, along with four sample responses. For each of the following responses, provide a brief written justification for why you think they earned a 1 (still learning), 2 (acceptable), or 3 (sophisticated). Repeat this same process with your responses on the previous page.*

Question: What is happening to matter and energy when a log burns on a fire?

Bristol*: The atoms in the log are turned into energy, which is why we see a flame.*

3 2 1 Complete: Do they fully address the entire question and explain all changes to matter & energy?
3 2 1 Accurate: Is every aspect of the written response factually correct?
3 2 1 Precise: Are they effectively using terms from the course in a clear and specific manner?

Overall Score: _____/3 Comments: _____

_____

Nina*: The atoms from the log are turned into CO_2. The energy in the log is what makes the fire.*

3 2 1 Complete: Do they fully address the entire question and explain all changes to matter & energy?
3 2 1 Accurate: Is every aspect of the written response factually correct?
3 2 1 Precise: Are they effectively using terms from the course in a clear and specific manner?

Overall Score: _____/3 Comments: _____

_____

Avery*: The atoms in the log's molecules are rearranged with oxygen to form CO_2 and H_2O. The high energy bonds (C-C, C-H) in the log's molecules are transformed into heat, light, and motion energy of the flame.*

3 2 1 Complete: Do they fully address the entire question and explain all changes to matter & energy?
3 2 1 Accurate: Is every aspect of the written response factually correct?
3 2 1 Precise: Are they effectively using terms from the course in a clear and specific manner?

Overall Score: _____/3 Comments: _____

_____

Chandra*: The energy of the fire comes from the spark that lit the fire, which destroys any atoms that aren't turned into ashes.*

3 2 1 Complete: Do they fully address the entire question and explain all changes to matter & energy?
3 2 1 Accurate: Is every aspect of the written response factually correct?
3 2 1 Precise: Are they effectively using terms from the course in a clear and specific manner?

Overall Score: _____/3 Comments: _____

_____

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Part 3: Investigation (1.3.3)

Directions: In this activity, you will watch a documentary about combustion and energy production. This will provide an opportunity to connect what you have learned in this unit to real-world considerations. Record your ideas separately (e.g., on a white board or scratch paper). Be prepared to discuss your ideas as a class.

Movie URL: Treasures of the Earth – Power History Documentary

Questions:

1. How are some substances (like fossil fuels) capable of storing so much energy? How are the molecules within these substances different from non-combustible substances?
2. How does the energy found within fossil fuel become transformed into the electricity used to power our homes and businesses?
3. Where did fossil fuels come from? How did they form?
4. What concerns are associated with the use of fossil fuels? How do we know if these concerns are legitimate?
5. How does the use of fossil fuels correlate to recent changes in atmospheric concentrations of carbon dioxide?
6. Do you think we should continue to use fossil fuels? Why or why not?

Part 4: Jeopardy Review (1.3.4)

Overview: In this activity, you will be playing a Jeopardy-style game to review key concepts from the course. The rules for this review game are posted within the presentation. You can also use this outside of class to help prepare you for the unit test. Your instructor may decide to use an alternative option (like Gimkit or Kahoot).

Part 5: Final Q&A (1.3.5)

Directions: For each objective, rank it as a 1 (*completely unsure*), 2 (*somewhat unsure*), or 3 (*completely sure*). Then review any content that is still unfamiliar based on your instructor's directions.

1. What is the difference between matter and energy?
2. How are the following different from each other? Atoms, mass, elements, molecules.
3. If a substance gains mass, what is happening to the amount of atoms in that substance?
4. What happens to the matter and energy in wood when it burns?
5. What is a chemical bond? How are bonds represented in pictures of molecules?
6. What is a high energy bond? How would we know if something contains high energy bonds?
7. Where does the energy of a fire come from?
8. Both ethanol and water are clear liquids. Why does ethanol burn but water does not?
9. "*Combustion reactions are rearrangement reactions*." Explain this in your own words.
10. Both ethanol and water are clear liquids. Why does ethanol burn but water does not?
11. True or false: the amount of atoms and the amount of energy after combustion ends is the same as before combustion began. Explain.
12. What happens to the matter and energy in molecules when a substance is combusted?

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