Using CERs as Formative Assessment to Show Student Learning in Interactive Notebooks

NSTA Area Conference Los Angeles 2021

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Steel Wool (Iron) and Air (Oxygen) LEGO Models

Starting Substances

Ending Substances

*Write a word equation for this chemical reaction

*Toward High School Biology - NSTA Press
Steel Wool (Iron) and Air (Oxygen)

**Directions:** Use the provided resources and draw what your LEGOS look like at the beginning.

*Write a word equation for this chemical reaction on the bottom of the page*

Starting substances

Ending substances
Steel Wool (Iron) and Air (Oxygen)

Starting Substances

Ending Substances

Directions: Use the provided resources and draw what your LEGOS look like at the end.

*Write a word equation for this chemical reaction on the bottom of the page*

Starting substances

Ending substances
Steel Wool (Iron) and Air (Oxygen)

Starting Substances

Ending Substances

*Write a word equation for this chemical reaction on the bottom of the page*

Starting substances

Ending substances
# Baking Soda and Vinegar LEGO Model

<table>
<thead>
<tr>
<th>Starting Substances</th>
<th>Ending Substances</th>
</tr>
</thead>
</table>

*Write a word equation for this chemical reaction*

*Toward High School Biology - NSTA Press*
Baking Soda and Vinegar LEGO Model

**Starting Substances**

**Directions:** Use the provided resources and draw what your LEGOS look like at the beginning.

*Write a word equation for this chemical reaction on the bottom of the page*

Starting substances  →  Ending substances
Baking Soda and Vinegar LEGO Model

Starting Substances

Ending Substances

*Write a word equation for this chemical reaction on the bottom of the page*

Starting substances

Ending substances

Directions: Use the provided resources and draw what your LEGO look like at the end.
Baking Soda and Vinegar LEGO Model

Starting Substances

Ending Substances

*Write a word equation for this chemical reaction on the bottom of the page*

Starting substances  Ending substances
Apply your thinking to predict which ending substances could form when methane gas reacts with oxygen gas from the air. Indicate whether it is or is not a possible ending substance and explain why.

### Starting Substances

<table>
<thead>
<tr>
<th>Methane gas</th>
<th>Oxygen gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₄</td>
<td>O₂</td>
</tr>
</tbody>
</table>

### Possible Ending Substances

<table>
<thead>
<tr>
<th>Substance</th>
<th>Fill in the blank in each sentence with “is” or “is not,” and write why you think this.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water H₂O</td>
<td>I think water _____ a possible ending substance because ...</td>
</tr>
<tr>
<td>Carbon dioxide CO₂</td>
<td>I think carbon dioxide _____ a possible ending substance because ...</td>
</tr>
<tr>
<td>Carbon monoxide CO</td>
<td>I think carbon monoxide _____ a possible ending substance because ...</td>
</tr>
<tr>
<td>Ammonia NH₃</td>
<td>I think ammonia _____ a possible ending substance because ...</td>
</tr>
</tbody>
</table>

*Toward High School Biology - NSTA Press*
Other Science Ideas the Students Have Learned

- Every substance has **unique** set of **characteristic properties**.
- Changes during which new substances form are called **chemical reactions**. There is a correlation between the amount of starting substance **decreasing** and ending substance **increasing**.
- A molecule is made of two or more **atoms** connected together in a **specific** arrangement.
- In chemical reactions, atoms that make up models of **starting substances** (reactants) **disconnect** from one another and connect in **different** ways to form the molecules of the **ending substance** (products).
- The **products** of the chemical reaction have **different properties** than the **reactants**.

*Poster in the classroom displays the Science Ideas.*
Science Idea #5: During chemical reactions, atoms that make up molecules of the starting substances (called reactants) disconnect from one another and connect in different ways to form the molecules of the ending substances (called products). Because the arrangement of atoms in the products is different from the arrangement of atoms in the reactants, the products of a chemical reaction have different properties from the reactants.
## CER Helpful Hints Poster

<table>
<thead>
<tr>
<th>Claim</th>
<th>A statement or conclusion that answers the question. One sentence. Does not start with yes/no.</th>
</tr>
</thead>
</table>
| Evidence | - Data that are relevant to and supports the claim.  
- Data are based on observations about the world that are either made with or senses or measured with instruments. |
| Reasoning (Science Ideas) | Widely accepted science ideas, concepts, or principles that can be used to show why the evidence supports the claim. |
**Question:** Did a new substance form when steel wool was exposed to oxygen, and if so, where did the atoms that make up the new substance come from?

<table>
<thead>
<tr>
<th>Claim:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence:</td>
<td></td>
</tr>
<tr>
<td>Reasoning:</td>
<td></td>
</tr>
</tbody>
</table>

**Rough Draft CER:**
**Question:** Did a new substance form when steel wool was exposed to oxygen, and if so, where did the atoms that make up the new substance come from?

**Claim:**
- One sentence that answers the question
- Should not start with yes or no

<table>
<thead>
<tr>
<th>Evidence:</th>
<th>Reasoning:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Question:** Did a new substance form when steel wool was exposed to oxygen, and if so, where did the atoms that make up the new substance come from?

**Claim:**

**Evidence:** Supports the claim with data collected

**Reasoning:**

**Evidence Sentence Starters:**
- When we did the investigation ____________, we found that the data showed that _______________.
- We saw ________________ in our investigation.
Question: Did a new substance form when steel wool was exposed to oxygen, and if so, where did the atoms that make up the new substance come from?

Claim:

Evidence: 

Reasoning: Explains what the data mean

Reasoning Sentence Starter: ● This means ___________ because we know (Science Idea).
**Question:** Did a new substance form when steel wool was exposed to oxygen, and if so, where did the atoms that make up the new substance come from?

<table>
<thead>
<tr>
<th>Claim:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Evidence:</th>
<th>Reasoning:</th>
</tr>
</thead>
</table>

**Rough Draft CER:**
Where is the gas coming from?

The gas is coming from the chemicals in the bath bomb. When we did our investigation of where the gas is coming from, our data showed that the gas is not new matter but come from what is already there.

The gas is not matter but comes from what was already there. The mass of the closed system stayed the same. The mass of the open system decreased. This proves that the gas is not matter because in the closed system, no matter could get in or out so the mass stayed the same even when changes happen to the matter also in an open system, matter can get in or out so the mass could change.
Question: When energy from a battery was added to water, were the gases produced by this made up of the same particles as those produced from heating the water?

Claim: The particles produced from when energy from a battery is added to water are NOT the same as those particles you get from heating water.

Evidence: Heating water made fire go out
• Gas A made popping sound and fire stayed the same
• Gas B made fire bigger and did not blow the fire out

Properties do NOT change for substance. So, the flammability should not change if it was the same.

CER: The particles produced from when energy from a battery is added to water are NOT the same as those particles you get from heating water. I know this because when we heated water and put fire over the vapor/gas, the flame went out but when we saw the video of gases A and gas B being put by fire we did not get the same reaction. Gas A made a popping sound but the flame stayed the same, it did not get bigger nor smaller. Gas B made the flame bigger and did not blow the fire out. If the reactions changed they would not be the same. Because properties do not change for substance. So the flammability would not change if it was made up of the same gas particles.
1. Turn to page __________ in your notebook.
   (Note: If you did not do your original argument, write "I did not do my original argument" in the boxes below instead.)

2. Reflect on your original Argument and identify TWO things you did well and TWO things you could improve upon when it comes to writing your Argument.

<table>
<thead>
<tr>
<th>What I did well</th>
<th>What I could improve upon:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
</tbody>
</table>

3. To help you re-write your Argument, complete the outline below.
   (This can be bullet points and/or note-style).
   **Complete the RIGHT side of the table with your information.**

<table>
<thead>
<tr>
<th>Step 1: Claim</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Single sentence</td>
<td></td>
</tr>
<tr>
<td>• Doesn't start with yes/no</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 2: Evidence</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• What data do you have to support your claim?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 3: Reasoning; Science Idea</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• What do you know about the topic?</td>
<td></td>
</tr>
<tr>
<td>• Explain applicable scientific concepts</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 4: Connection to Reasoning</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• How/Why does the data you chose important and relate to the scientific concepts of Steps 3 and your Claim?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 5: Re-state your Claim</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Re-write your original Claim and add in a concluding word at the beginning like Therefore, Thus, etc.</td>
<td></td>
</tr>
</tbody>
</table>

4. Now **RE-WRITE** your Argument on page __________. Remember to:
   - Follow the 5 Steps of Writing Your Argument
   - Follow your outline from question #3 above.
   - Check for spelling!
   - Re-read your Argument frequently to make sure it makes sense!
CER Argument Self-Reflection

1. Turn to page 57 in your notebook.
   (Note: If you did not do your original reasoning, write "I did not do my original reasoning" in the boxes below instead.)

2. Reflect on your original Argument and identify TWO things you did well and TWO things you could improve upon when it comes to writing your Argument.

<table>
<thead>
<tr>
<th>What I did well:</th>
<th>What I could improve upon:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I think I had a good reasoning and a good claim.</td>
<td>I think I could improve on adding more evidence</td>
</tr>
</tbody>
</table>

3. To help you re-write your Argument, complete the outline below.
   (This can be bullet points and/or note-style)

   Complete the RIGHT side of the table with your information.

<table>
<thead>
<tr>
<th>Step 1: Claim</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Single sentence</td>
</tr>
<tr>
<td>• Doesn’t start with yes/no</td>
</tr>
</tbody>
</table>

The particulate produced from when energy from a battery is added to water are not the same as those particulates you get from heating water.

<table>
<thead>
<tr>
<th>Step 2: Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>• What data do you have to support your claim?</td>
</tr>
</tbody>
</table>

- The width of the cup and spoon
- Heating water and seeing if a new green hue the same color

<table>
<thead>
<tr>
<th>Step 3: Background</th>
</tr>
</thead>
<tbody>
<tr>
<td>• What do you know about the topic?</td>
</tr>
<tr>
<td>• Explain applicable scientific concepts</td>
</tr>
</tbody>
</table>

Key metal idea

<table>
<thead>
<tr>
<th>Step 4: Reasoning</th>
</tr>
</thead>
<tbody>
<tr>
<td>• How/Why does the data you chose important and relates to the scientific concepts of Step 2 and your Claim?</td>
</tr>
</tbody>
</table>

Flammability is a property and we get different reactions from heating water and getting energy from a battery and because flammability is a property the substances can not be the same.

<table>
<thead>
<tr>
<th>Step 5: Re-state your Claim</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Re-write your original Claim and add in a concluding word at the beginning like Therefore, Thus, etc.</td>
</tr>
</tbody>
</table>

To sum it up the particulates produced from when energy from a battery is added to water are not the same as those particulates you get from heating water.

1. Now RE-WRITE your Argument on page 58. Remember to:
   - Follow the 5 steps of writing your argument.
   - Follow your outline from question #3 above.
   - Check for spelling!
   - Re-read your Argument frequently to make sure it makes sense!
   - Change/underline the font color for each of the four steps.
### Final Argument (CER)

<table>
<thead>
<tr>
<th>Step 1</th>
<th>State your claim</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 2</strong></td>
<td>Use data you collected from observations and/or experiments</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Provide an explanation of any relevant scientific concepts</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Show how and why the evidence you chose support the Claim</td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>Conclude your argument by restating the claim concluding words such as “Thus”, “Therefore”, “In conclusion”</td>
</tr>
</tbody>
</table>
The particulars produced from when energy from a battery is added to water are NOT the same as those particulars you get from heating water. They are not the same because when water was heated and fire was put over it, the vapor/gas the flame went out but in the video where people were testing flammability of gases A and B, Gas A made a popping sound but the flame stayed the same. Gas B made a flame bigger and did not blow the flame out. This proves that they are not the same substances because all the gases had a different reaction to fire and that means that they are not the same because properties do not change for substances and flammability is a property so if it changes, the substances are not the same.
thank you
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Science Coordinator, FCSS

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Jennifer Weibert
Science Coordinator, FCSS

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403B, 9:30am!