INTRODUCTION TO CER LAB ANALYSIS IMAGE PROMPTS

GUIDED NOTES AND STUDENT PRACTICE ACTIVITIES

Science by Sinai

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Teacher Notes

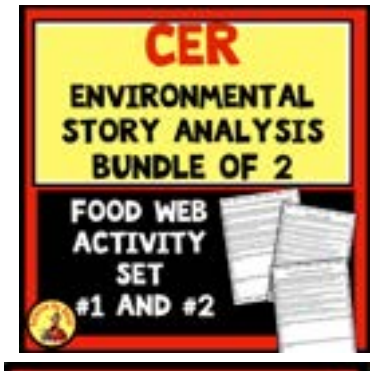
Introducing and teaching the method of CER – claim, evidence and reasoning is not so easy. You are training the students to raise their level of critical thinking and to dig deep for evidence they can use to support a claim.

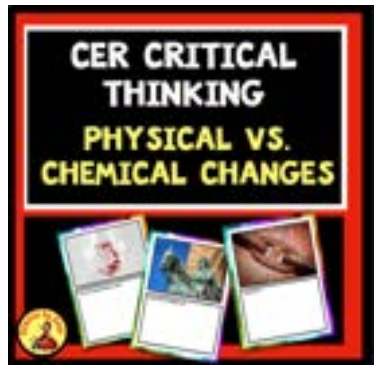
This activity explains the basics behind CER and then has instructions on how to use CER to analyze a lab and then an image writing prompt. On the basic overview of CER there are guided notes.

There are two activities for the students to practice their CER skills. The first one involves analyzing a lab and the second one has students viewing an image.

You will notice that I use CER templates throughout my activities and these are available in my Teachers Pay Teachers store called Science by Sinai. I also have many CER image prompt bell ringers available.

I have blog posts on teaching CER that may be useful such as Boost Your Student's Critical Thinking with CER in Science Class.and Using CER Science Image Prompts as Bellringers.





Introduction to the CER Method

Definition: The CER method is a structured approach used to write scientific explanations or arguments.

Components:
1. **Claim**: A statement or conclusion that answers the scientific question.
2. **Evidence**: Data, observations, or facts that support the claim.
3. **Reasoning**: Explanation or interpretation that connects the evidence to the claim and provides scientific justification.

Step 1: Formulating a Claim	Step 2: Providing Evidence	Step 3: Developing Reasoning
- Identify the scientific question or problem. - Craft a clear and concise statement that directly answers the question.	- Gather relevant data, observations, or research findings. - Include specific details and support the claim with evidence.	- Explain the significance of the evidence and how it supports the claim. - Provide scientific reasoning based on principles, theories, or scientific concepts.

Question:

Question: How does the amount of sunlight affect plant growth?

Claim:

Increased sunlight exposure leads to enhanced plant growth due to photosynthesis.

Evidence:

Plants exposed to more sunlight showed higher rates of photosynthesis, as evidenced by increased biomass and leaf greenness.

Reasoning:

Photosynthesis is the process by which plants convert sunlight into energy, and increased sunlight exposure provides more energy for photosynthesis to occur so there is increased plant growth.

Introduction to the CER Method Guided Notes

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Step 1: Formulating a Claim	Step 2: Providing Evidence	Step 3: Developing Reasoning
- Identify the scientific question or problem. - Craft a clear and concise statement that _____ _____ _____	- Gather relevant _____ _____ _____ - Include specific details and support the claim with evidence.	- Explain the significance of the evidence and how it _____- Provide _____ based on principles, theories, or scientific concepts.

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Claim:	Evidence:	Reasoning:
Increased sunlight exposure leads to enhanced plant growth due to photosynthesis.	Plants exposed to more sunlight showed higher rates of photosynthesis, as evidenced by increased biomass and leaf greenness.	Photosynthesis is the process by which plants convert sunlight into energy, and increased sunlight exposure provides more energy for photosynthesis to occur so there is increased plant growth.

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How to Use the CER Method to Analyze a Lab

Example Lab: The Effect of Surface Type on the Speed of Pullback Cars

Hypothesis: Pullback cars will travel faster on smooth surfaces than on rough surfaces.

Procedure:

1. Measure a distance of 2 meters on three different surfaces: tile, carpet, and sandpaper.
2. Pull back the car to the same point on each surface and release it.
3. Use a stopwatch to measure the time it takes for the car to travel 2 meters.
4. Repeat three times for each surface and record the times.
5. Calculate the average speed for each surface using the formula: speed = distance/time.

Results:

Tile Surface: Times in seconds: 2.5, 2.4, 2.6. Average time: 2.5 seconds.
Carpet Surface: Times in seconds: 5.0, 4.8, 5.2. Average time: 5.0 seconds.
Sandpaper Surface: Times in seconds: 3.5, 3.6, 3.7. Average time: 3.6 seconds.

Average Speeds:

Tile Surface: 0.8 meters/second
Carpet Surface: 0.4 meters/second
Sandpaper Surface: 0.56 meters/second

1. Formulate Your Claim
Your claim is a statement that answers your original question or hypothesis. It should be based on the data you collected.
2. Collect Your Evidence
Evidence consists of the data and observations you gathered during your experiment. This evidence should directly support your claim.
3. Explain Your Reasoning
Reasoning links your evidence to your claim. It explains why the evidence supports the claim and includes scientific principles or theories that justify your conclusion.

Question:

How does the type of surface affect the speed of pullback cars?

Claim:

Pullback cars travel faster on smooth surfaces than on rough surfaces.

Evidence:

1. The average speed of the pullback car on the tile surface was 0.8 meters/second.
2. The average speed of the pullback car on the carpet surface was 0.4 meters/second.
3. The average speed of the pullback car on the sandpaper surface was 0.56 meters/second.

Reasoning:

The data supports the claim that pullback cars travel faster on smooth surfaces compared to rough surfaces. The tile surface, being the smoothest, allowed the car to have the highest average speed of 0.8 meters/second. This is because smooth surfaces have less friction. In contrast, the carpet surface, which is rougher, created more friction, slowing down the car to an average speed of 0.4 meters/second. The sandpaper surface, generated more friction than the tile, resulting in an average speed of 0.56 meters/second. This demonstrates that the texture of the surface significantly impacts the speed of the pullback car, with smoother surfaces enabling faster travel due to reduced friction.

CER ACTIVITY

Name _____

Directions: Use the three steps of claim, evidence and reasoning to analyze the results of this lab.

The Effect of Water Temperature on the Dissolving Rate of Alka-Seltzer Tablets

Hypothesis:
Alka-Seltzer tablets will dissolve faster in hot water than in cold water.

Procedure:
Setup: We will test the dissolving rate of Alka-Seltzer tablets in three different temperatures of water: cold (10°C), room temperature (25°C), and hot (60°C).

1. Pour 200 ml of cold water into the first beaker, 200 ml of room temperature water into the second beaker, and 200 ml of hot water into the third beaker.
2. Record the temperature of each water sample using the thermometer.
3. Drop an Alka-Seltzer tablet into the cold water and start the stopwatch.
4. Record the time it takes for the tablet to completely dissolve.
5. Repeat steps 3 and 4 for the room temperature water and hot water.
6. Conduct three trials for each water temperature and record the times.
7. Calculate the average dissolving time for each water temperature.

Results:
-Cold Water (10°C):
- Dissolving times: 85 seconds, 90 seconds, 88 seconds
- Average time: 88 seconds

- Room Temperature Water (25°C):
  - Dissolving times: 50 seconds, 55 seconds, 52 seconds
  - Average time: 52 seconds

- Hot Water (60°C):
  - Dissolving times: 20 seconds, 22 seconds, 21 seconds
  - Average time: 21 seconds

CER ACTIVITY

Directions: Use the three steps of claim, evidence and reasoning to analyze the results of this lab.

Question:

Claim:

Evidence:

Reasoning:

Sample Student Answers Using CER Method

Directions: Use the three steps of claim, evidence and reasoning to analyze the results of this lab.

Question:

Does water temperature affect the rate that Alka-Seltzer dissolves?

Claim:

Alka-Seltzer tablets dissolve faster in hot water than in cold water.

Evidence:

1. The average dissolving time of the Alka-Seltzer tablet in cold water (10°C) was 88 seconds.
2. The average dissolving time of the Alka-Seltzer tablet in room temperature water (25°C) was 52 seconds.
3. The average dissolving time of the Alka-Seltzer tablet in hot water (60°C) was 21 seconds.

Reasoning:

The data supports the claim that Alka-Seltzer tablets dissolve faster in hot water compared to cold water. In hot water (60°C), the molecules move faster, which increases the rate of interaction between the water molecules and the tablet. This leads to the tablet dissolving more quickly. In cold water (10°C), the molecules move more slowly, so there is a slower rate of interaction and a longer dissolving time of 88 seconds. This demonstrates that temperature impacts the rate at which the Alka-Seltzer tablet dissolves, with higher temperatures dissolving it faster.

How to Do An Image Analysis with a Leading Question.

Question:

How do tree roots impact urban infrastructure?

Claim:

Tree roots can disrupt urban infrastructure, such as sidewalks, by exerting pressure as they grow.

Evidence:

1. Tree roots visible from under the sidewalk surface, causing cracks and lifting sections of concrete.
2. Sidewalk is pushed up
3. The tree's trunk is thick, indicating that it is mature with an extensive root system.

Reasoning:

Tree roots grow in search of water and nutrients. As roots grow bigger, they exert pressure on surrounding objects, such as sidewalks and pavement, leading to cracking and pushing up heavy cement. If this is repeated in many areas, it can definitely affect the city infrastructure.

Step 1: Formulating a Claim
Examine the image and formulate a claim that addresses the leading question. The claim should be a clear and concise statement that summarizes your main observation or inference.

Step 2: Identifying Evidence
Look at the image and identify at least three pieces of evidence that support your claim. Evidence can include observable features, patterns, or interactions depicted in the image.

Step 3: Developing Reasoning
Explain how the identified evidence supports your claim by providing scientific reasoning and drawing connections between tree root growth and urban infrastructure damage.

CER ACTIVITY

Directions: Use the three steps of claim, evidence and reasoning to analyze this image. You may need to do a bit of research to help you with the evidence.

Name_____

Question:
Does a chemical reaction cause these glow sticks to give off light?

Claim:

Evidence:

Reasoning:

Sample Student Answers Using CER Method

Name_____

Question:
Does a chemical reaction cause these glow sticks to give off light?

Claim:
Glue sticks have a chemical reaction called chemiluminescence Which produces visible light.

Evidence:
Glue sticks are giving off visible light. Light is a direct result of a chemical reactions in the glow stick. To start a glow stick you need to bend or snap it to activate it. This allows the mixing of two separate chemicals which leads to the chemiluminescent reaction. Different chemicals will produce different colors during the reactions.

Reasoning:
The giving off of visible light, the presence of different colors and the fact that they need to be snapped in order to begin glowing, show evidence of a chemical reaction. Glow sticks use chemiluminescence which is a reaction that gives off light without heat. The two chemicals mix and release energy in the form of light.

Credits

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