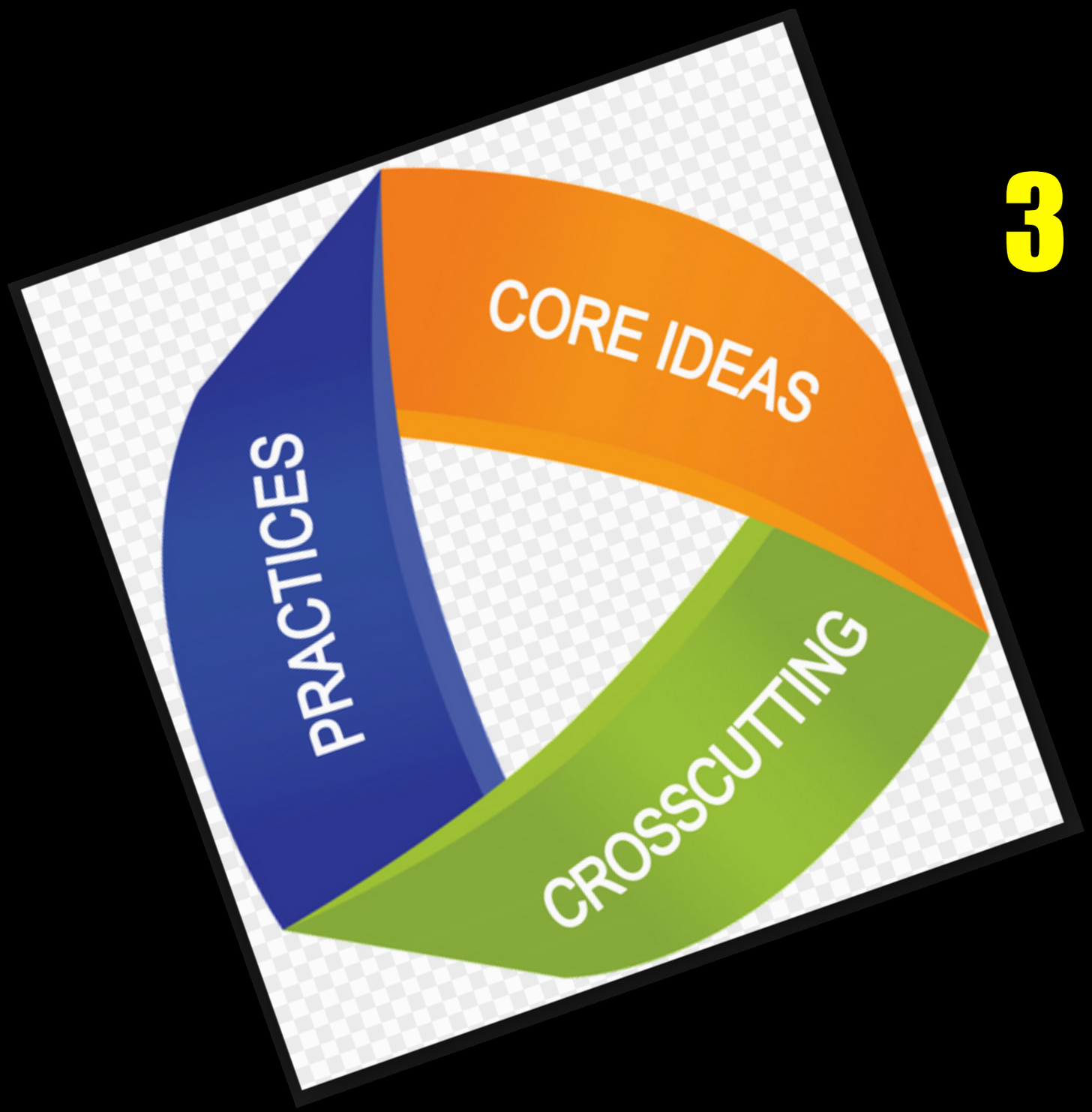


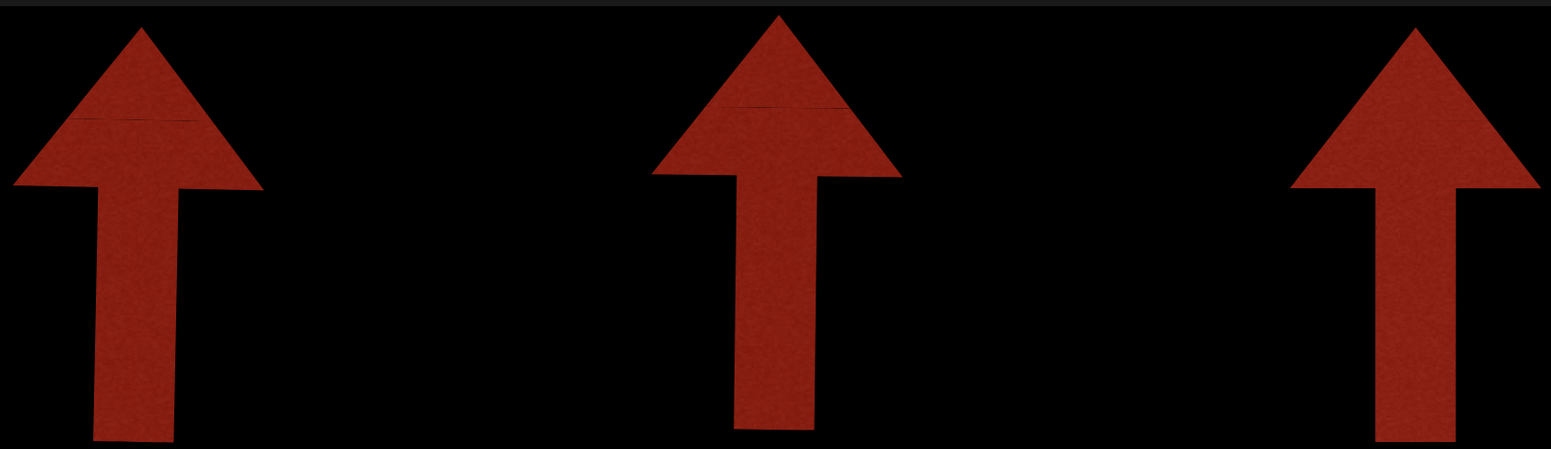
3 D Assessment

Performance Expectations:

HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Science and Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
Models: Develop and Use a model based on evidence to illustrate the relationships between systems or between components of a system. Planning and Carrying Out Investigations: Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design, decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (number of trials, cost, risk, time) and refine the design accordingly.	LS1-2 Multicellular organisms have a hierarchical structural organization in which any 1 system is made up of numerous parts and is itself a component of the next level. LS1-3: Feedback mechanisms maintain a living system's internal conditions with certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) what is going on inside the living system.	Systems and System Models: Models (Physical, mathematical, computer) can be used to simulate systems and interactions-including energy, matter, and information flows-within and between systems at different scales Stability and Change: Feedback (negative and positive) can stabilize or destabilize a system. .



NGSS Science and Engineering Practices

- Asking questions (science) and defining problems (engineering)
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematical and computational thinking
- Constructing explanations (science) and designing solutions (engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

NEXT GENERATION SCIENCE STANDARDS For States, By States

MICHIGAN Department of Education

Crosscutting Concepts

1. Cause and Effect
2. Structure and Function
3. Systems and System Models
4. Scale, Proportion, and Quantity
5. Stability and Change
6. Energy and Matter
7. Patterns

Tch

Scaffolding

Single Dimension

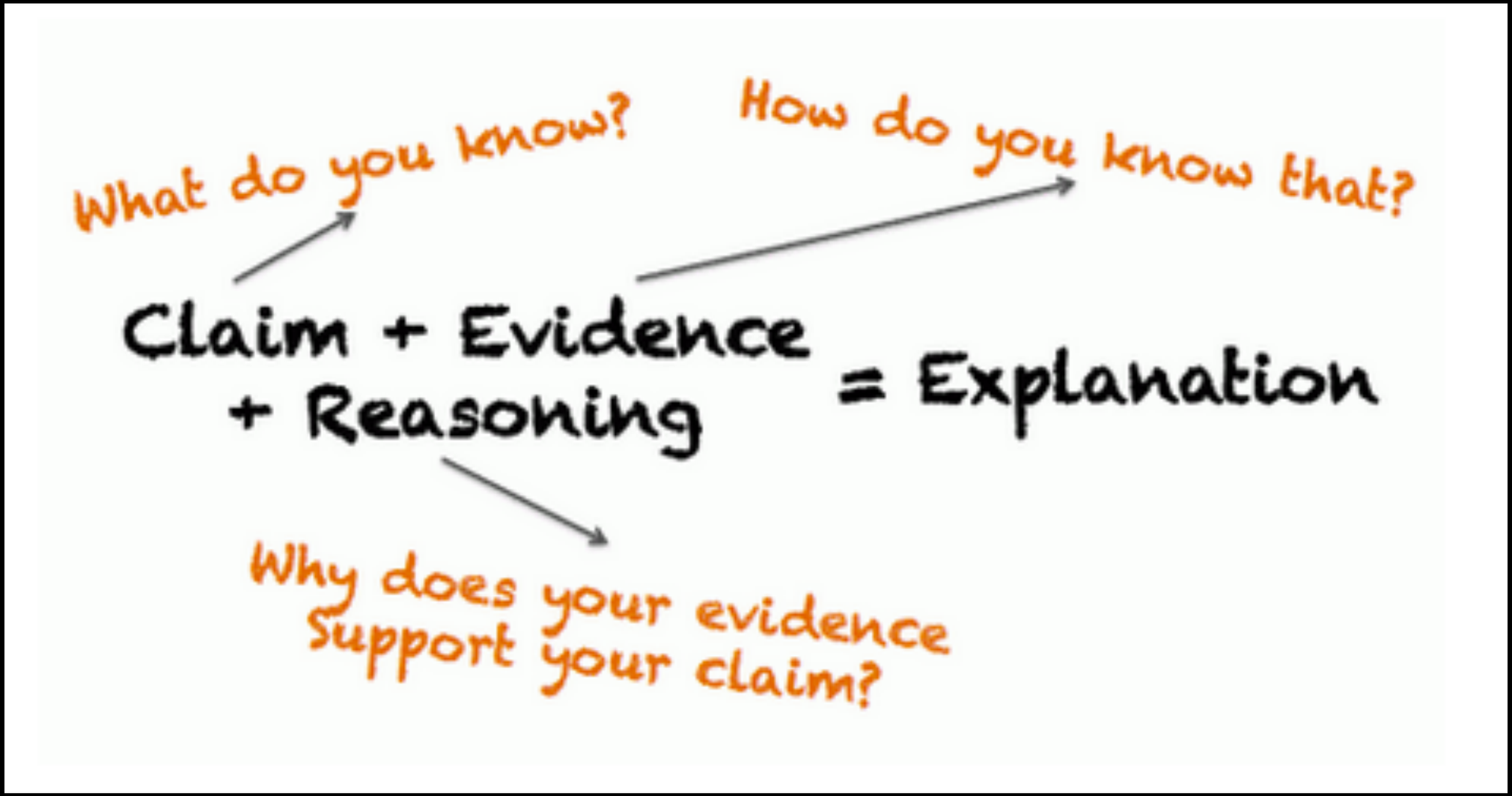
Multiple Dimensions

All 3 Dimensions

Escher

https://www.pinterest.com/pin/936608672213391 96/?lp=true

Evidence Claim Reasoning



From Eric Brunsell

SCIENTIFIC EXPLANATIONS

CLAIM

Statement about the results of an investigation

- A one-sentence answer to the question you investigated.
- It answers, **what can you conclude?**
- It should not start with **yes** or **no.**
- It should describe the relationship between **dependent** and **independent** variables.

EVIDENCE

Scientific data used to support the claim

Evidence must be:

- **Sufficient** — Use enough evidence to support the claim.
- **Appropriate** — Use data that support your claim. Leave out information that doesn't support the claim.
- **Qualitative** — (Using the senses), or **Quantitative** (numerical), or a combination of both.

REASONING

Ties together the claim and the evidence

- Shows **how** or **why** the data count as evidence to support the claim.
- Provides the justification for why **this** evidence is important to **this** claim.
- Includes one or more **scientific principles** that are important to the claim and evidence.

***Remember:** Read what you've written to be sure it makes sense as a whole explanation.

Activate Learning

www.activatelearning.com

From Activate Learning

Paul Andersen https://thewonderofscience.com/

Argumentation Template

The Guiding Question:

Our **Claim**:

Our **Evidence**:

Our **Reasoning**:

Phenomenon (fi-nom-uh-non)

-noun

1. a rare or significant fact or event
2. something that is impressive or extraordinary

Paul Andersen

Short Performance Assessments

Here Comes the Sun

K-ESS2-1

Phenomenon: weather conditions

We have been keeping track of weather conditions this month. Look at our calend… decide which weather occurred most and least.

August

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Show me your work

Most

Least

What type of clothing would you need the most of for the month?

NGSS Science and Engineering Practices

- Asking questions (science) and defining problems (engineering)
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematical and computational thinking
- Constructing explanations (science) and designing solutions (engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

NEXT GENERATION SCIENCE STANDARDS For States, By States

MICHIGAN Department of Education

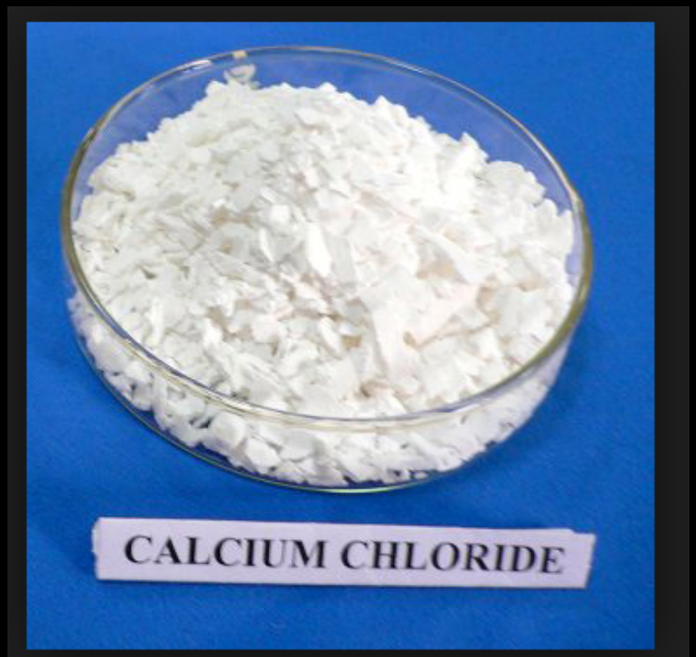
Combine D's

1. Cause and Effect
2. Structure and Function
3. Systems and System Models
4. Scale, Proportion, and Quantity
5. Stability and Change
6. Energy and Matter
7. Patterns

Crosscutting Concepts

Tch

3 D Assessment



3 D Assessment
Planning and Carrying Out an Investigation

Ken, Mike, Susanna and Kathy observed their science teacher place calcium chloride, baking soda and a small vial of liquid universal indicator in a ziplock bag. The teacher sealed the bag and spilled the liquid. The students observed the changes that took place. Based on their observations, the students wanted to determine what materials caused the various reactions they observed and decided on a plan to follow. They also determined the chemical reaction and wrote the following equation:

$$CaCl_2 + 2\ NaHCO3 \rightarrow CaCO_3 + 2\ NaCL + H_20 + CO_2$$

Answer the following questions based on the scenario above. Provide evidence and explanation for your responses.

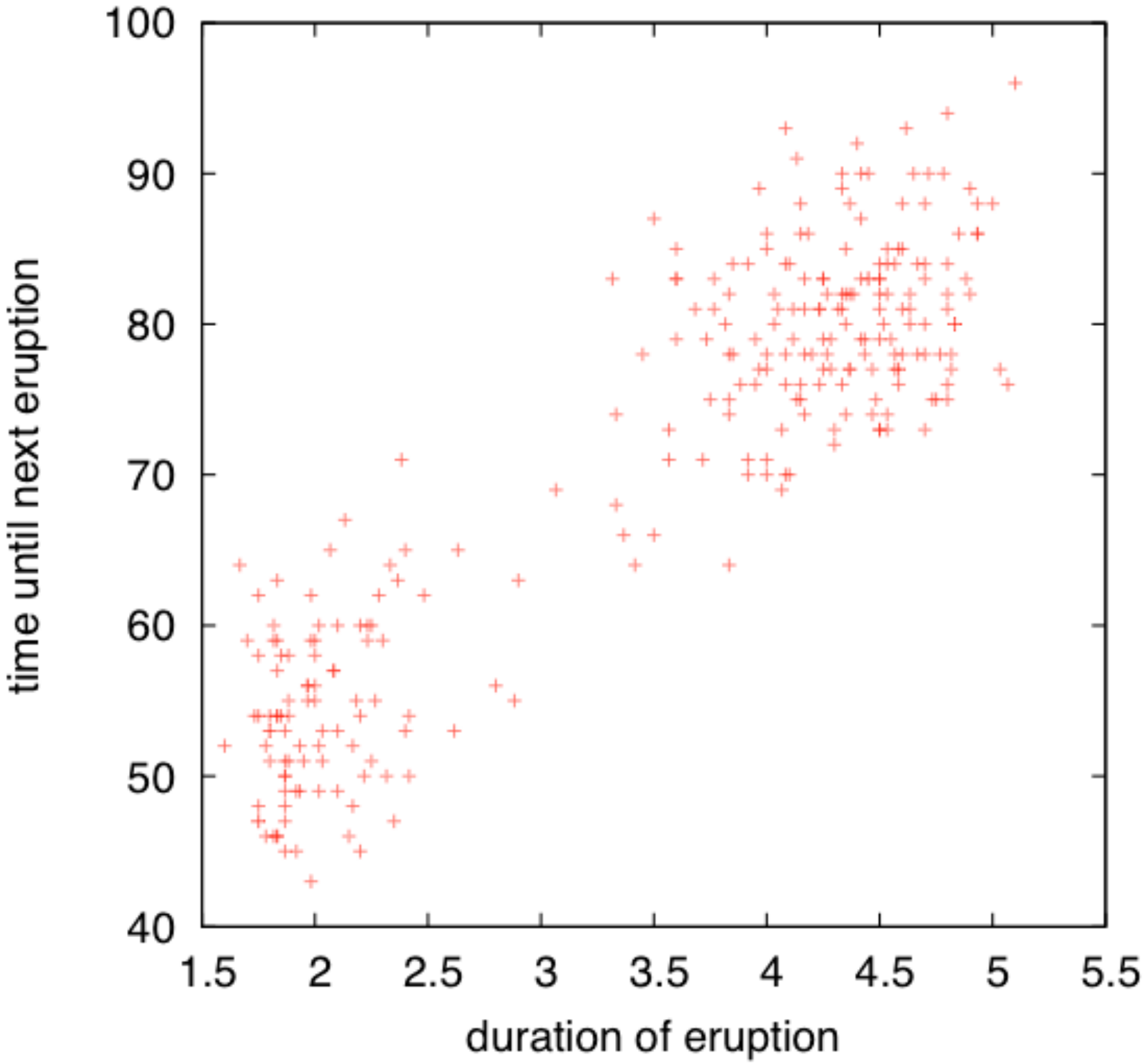
1. What Science & Engineering Practice was the main focus of the scenario? Explain.

2. What is the phenomenon the students encountered? Explain.

3. When the students wrote out the chemical equation, what Crosscutting Concept was being emphasized? Explain.

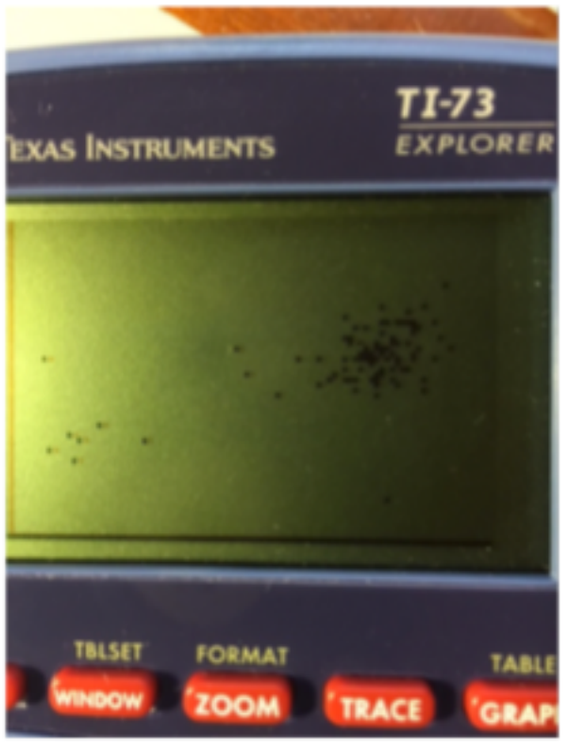
4. Provide examples of questions students might develop if they chose to focus on the Science & Engineering Practice of Asking Questions.

5. How might this activity be changed into an engineering problem?


100
90
80
70
60
50
40
1.5
2
2.5
3
3.5
4
4.5
5
5.5
time until next eruption
duration of eruption

OLD FAITHFUL

Students in Dr. Graves' class were discussing the Old Faithful eruption data. They remembered that the data included the time of eruption, called the duration, and the time between eruptions called the interval. When the data was graphed, a scatterplot like the one below was created. They are remembered the model eruption of Old Flaskful in the classroom. The eruption occurred several times, even though each time had less and less water in the funnel and flask.



Answer the following in complete sentences, providing evidence for your responses.

1. When creating the scatterplot, what primary SEP(s) was/were being used?

2. What are the variables in the data set?

3. Explain HOW the data could be used to predict an eruption time for Old Faithful.

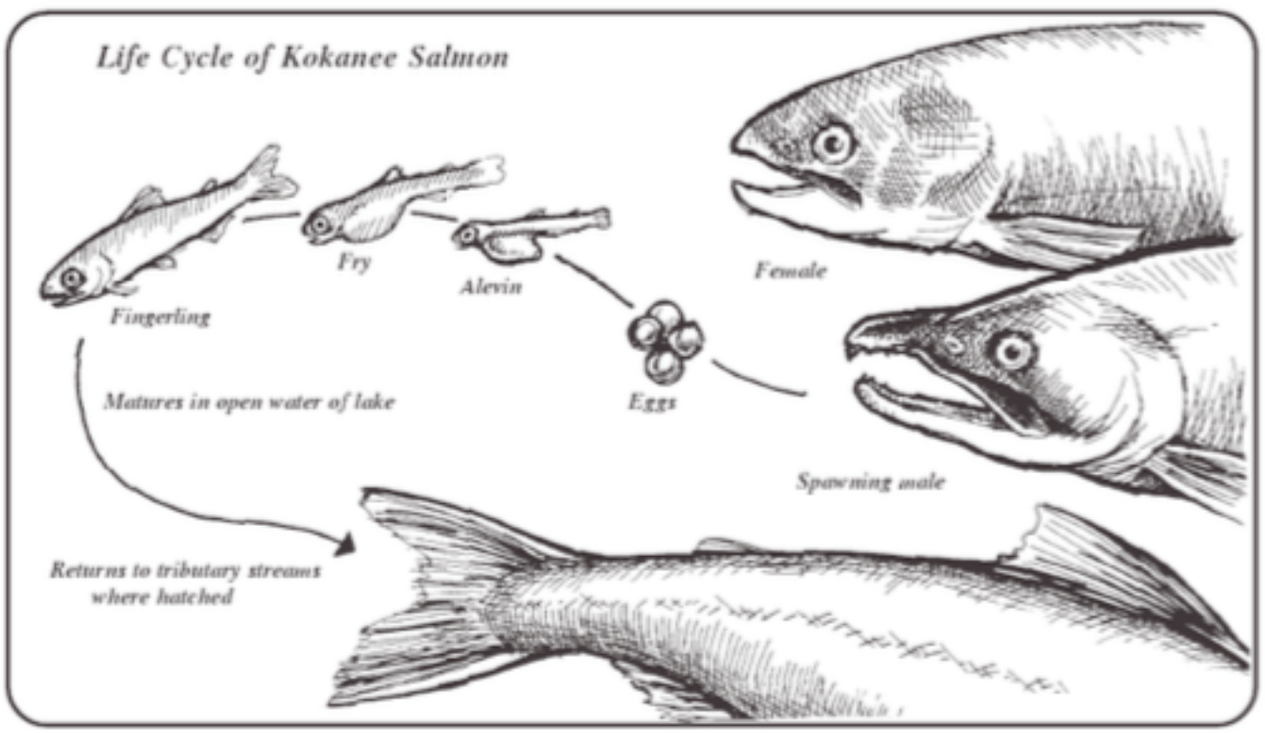
4. When Old Flaskful erupted in class, what crosscutting concept(s) was/were evident?

Kokanee Salmon Sheet 1

The kokanee salmon (*Oncorhynchus nerka*) is a landlocked variety of sockeye salmon. First introduced to Flathead Lake in 1914, they quickly became widespread in the lake. They are also found in other water sources on both sides of the continental divide in Montana. Kokanee can reach 3-5 pounds, but 1 pound is most common. The size of the fish is dependent upon several factors including population density and the availability of food. They spawn in the fall by either running upstream from their lake or spawning along the shorelines. Kokanee reach sexual maturity in their fourth year and transform greatly prior to spawning. The normally silver colored fish turns smooth-skinned and red colored with a large hooked jaw and teeth on the males. All adults die after spawning and are eaten by eagles, bears and other animals.

Kokanee Adult, non spawning

Kokanee Adult, spawning



Kokanee Salmon Rubric

Based on the Kokanee Salmon Case Study, please respond to the following:

1. Provide evidence that you engaged in the Science & Engineering Practice of Asking Questions in science.

2. How was the case study an example of systems & system models?

3. Provide evidence that through the case study you were constructing explanations and designing solutions.

4. Provide evidence that through the case study you were analyzing and interpreting data.

5. Based on the case study, write a claim-evidence-reasoning example that summarizes the reason there are no longer Kokanee Salmon in Flathead Lake.

Scoring Rubric:

3: Student meets expectations and shows advanced thinking about the concept
2: Student provides evidence that is reasonable, clearly stated, addresses each point
1: The statement is somewhat unclear, not clearly described, simplistic or shows little thought
0: The statement is very unclear or incorrect, not related to the question, problem or concept

STEM
teaching tools

Teaching Tools for Science, Technology, Engineering and Math (STEM) Education

HOME | TOOLS | USES | NEWS | ABOUT

STEM Teaching Tools

The STEM Teaching Tools site has tools that can help you teach science, technology, engineering and math (STEM). We are currently focused on supporting the teaching of the **Next Generation Science Standards (NGSS)**. **Each tool** is focused on a specific issue and leverages the best knowledge from research and practice. Under the **News section**, you can learn a bit more about how you might use them. **This article** provides background on this effort. Review more resources in our Tools area and check out the online "short courses" shown below.

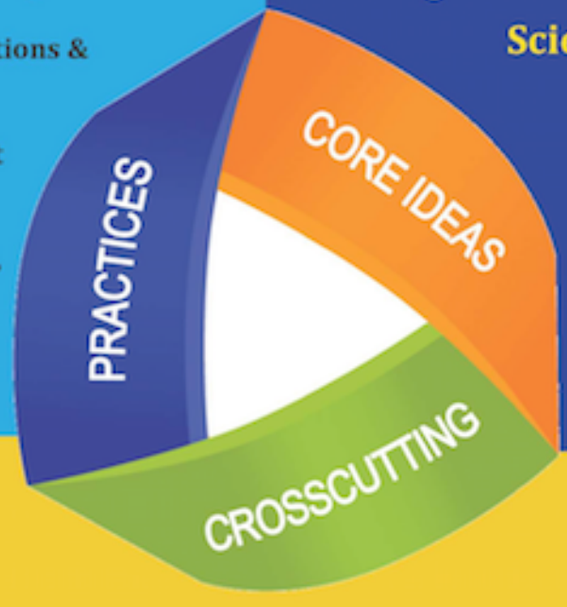
Help us improve our approach by sending in your feedback via this short survey.

http://stemteachingtools.org/

Next Generation Science Standards

- Asking Question & Defining Problems
- Developing & Using Models
- Planning & Carrying Out Investigations
- Analyzing & Interpreting Data
- Using Mathematics & Computational Thinking
- Constructing Explanations & Designing Solutions
- Engaging in Argument from Evidence
- Obtaining, Evaluating, & Communicating

- **Earth & Space Science**
- **Life Science**
- **Physical Science**
- **Engineering & Technology Science**



- Patterns
- Cause and Effect
- Scale, Proportion, and Quantity
- Systems and System Models
- Energy and Matter
- Structure and Function
- Stability and Change

Online Instruction and Learning

Navigating the world of online learning

Search

MONTANA STATE UNIVERSITY

Mountains & Minds

Home | FAQ Articles | Videos and Resources | **Presentations** | NGSS Conceptual Change | EMERGE

jgravesedu.com