Topic: Fish Tank Nitrogen Cycle Lab

Summary: Students will graph and analyze data to determine why fish died in a pretend fish tank.

Goals & Objectives: Students will be able to graph data. Students will be able to write a claim and support the claim with evidence and scientific reasoning.

NGSS Standards:
HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

Time Length: 2-3 days

Prerequisite Knowledge: Carbon and water cycles are already discussed so students know that atoms in nature can move in a cycle.

Materials:
- Graph paper
- Handouts of the assignment, and pencil or pens
- A projector to show a YouTube video

Procedures:
1. Start by showing your students the YouTube video on the nitrogen cycle (https://www.youtube.com/watch?v=1XC7xT0mIbY).   After the video, tell the students that a fish tank failed and the fish died. Their job is to determine what went wrong.

2. Have students create 4 graphs either by hand or use Google Sheets / Excel. Creating the graphs may last for 1 to 2 days. You may need to have some students finish the graphs as homework.

3. Once all the students have finished the graphs, have students use those graphs to evaluate four Claim Evidence Reasoning example paragraphs. None of the paragraphs are completely correct, but they give the students a good idea on how to write their own CER

4. Students can use their graphs to write their own CER paragraph. Students may not use the CER evaluation paper while they write their own CER.

Accommodations: Students with an IEP can have extra time with creating the graphs or only make two graphs (Organisms and Nitrogen graphs). You can provide sentence stems for students if they struggle to start writing their own CER.

Fish Tank Lab

Word	Definition	Image
Nitrate	Plants absorb nitrogen from the soil	(O=N with O and O)
Nitrite	Nitrites are intermediate molecules in the nitrogen cycle	(N with O and O)
Ammonia	Decomposers convert waste / dead organic material into ammonia	(N with H, H, H)
Atmospheric Nitrogen (N₂)	78% of the gases in the atmosphere is _____.	N ≡ N

1. **Fill in the 4 white blank boxes with the nitrogen based molecules bolded above.**
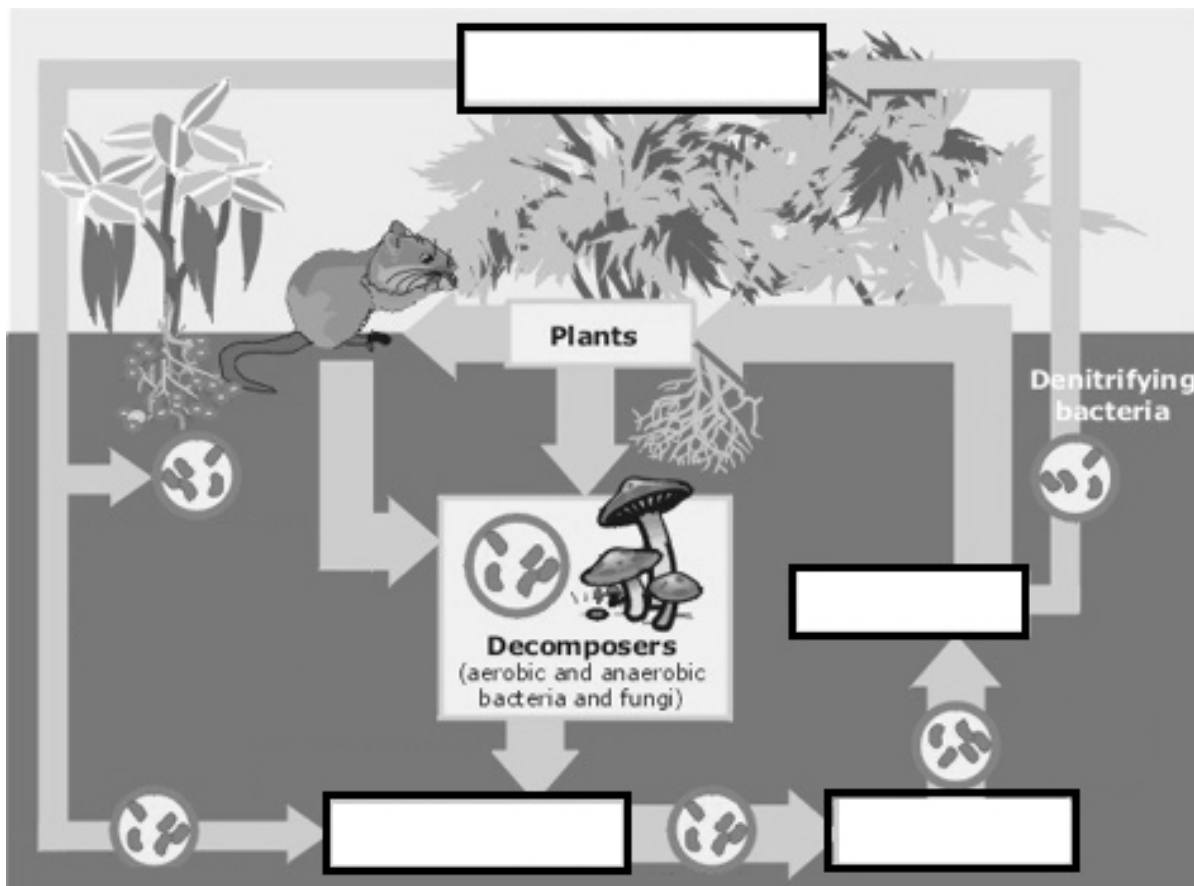
2. Data Table

Date	# of Animals	# of Plants	Temp (°C)	pH	Ammonia (ppm)	Nitrite (ppm)	Nitrate (ppm)
8/1/18	8	2	25	7.8	2	0	0
8/2/18	8	2	25	7.6	2	0	0
8/4/18	8	2	25	7.8	4	0	0
8/7/18	8	2	25	7.4	2	0	0
8/8/18	8	2	26	7.6	2	0	0
8/9/18	8	2	26	7.4	1	0	0
8/12/18	8	2	25	7.0	.25	0	0
8/16/18	8	2	25	7.6	0	0	0
8/18/18	8	2	25	7.4	0	0	0
8/19/18	8	2	24	7.6	0	0	0
8/21/18	8	2	25	7.6	0	0	0
8/22/18	8	2	25	7.6	.25	0	0
8/25/18	8	2	25	7.8	.25	0	0
8/26/18	8	2	26	7.8	0	0	0
8/27/18	8	2	26	7.6	0	0	0
8/28/18	8	2	26	7.8	0	0	0
9/2/18	8	2	25	7.4	.25	.25	0
9/3/18	8	2	25	7.4	.25	0	0
9/4/18	8	0	25	7.6	.25	.25	5
9/6/18	8	0	26	7.6	.25	.5	5
9/7/18	8	0	26	7.6	.5	1	10
9/10/18	8	0	25	7.8	.5	2	20
9/11/18	7	0	25	7.4	1	1	20
9/14/18	6	0	25	7.4	1	2	40
9/15/18	1	0	25	7.6	1	2	80
9/16/18	0	0	24	7.6	1	5	80

3. Create 4 separate line graphs for the above data. The X axis is a date range *(do not put only the dates in the table as you would in a bar graph, create a range from the first date to last date to display a proper scale)*. Make sure to include axes labels, a title, circle each data point, and a legend. The 4 line graphs are as follows:

  i.   Animal & Plant Population
  iii. Temperature

  ii.   Ammonia, Nitrite, Nitrate
  iv.   pH

Name: _____ Row: _____

Date:_____ Period:_____

Fish Tank CER Evaluations

Driving Question: What caused the fish tank ecosystem to become unstable for the fish to die?

The fish started dying because the fish ate all the plants. Plants normally absorb all of the nitrites in the water and once the plants were gone on 9/4, there was nothing to absorb the nitrites. On 9/16, the nitrite levels increased to 5 and that is when the nitrites turned into nitrates.

1. Circle the claim (answer to the driving question) and underline the evidence in the paragraph.
2. Rate the paragraph's claim by circling strong, weak or doesn't answer question.

Strong Claim   Weak Claim   Claim Doesn't Answer Question

Strong Evidence   Weak Evidence   Totally Incorrect Evidence

3. Using your graphs, determine if the evidence is supported by the data. Circle strong, weak, or incorrect evidence as your rating. State the data below (evidence from the graphs).

4. Were there any misconceptions in the paragraph and if there were, identify those misconception(s) and explain what was wrong using science concepts, theories or laws.

The fish started dying because the fish tank temperature was too hot. Since the temperature was too hot, the fish were not able to maintain homeostasis and the fish died. Fish cool themselves off by swimming and when the fish were inspected, they were swimming around.

5. Circle the claim (answer to the driving question) and underline the evidence in the paragraph.
6. Rate the paragraph's claim by circling strong, weak or doesn't answer question.

Strong Claim   Weak Claim   Claim Doesn't Answer Question

Strong Evidence   Weak Evidence   Totally Incorrect Evidence

7. Using your graphs, determine if the evidence is supported by the data. Circle strong, weak, or incorrect evidence as your rating. State the data below (evidence from the graphs).

8. Were there any misconceptions in the paragraph and if there were, identify those misconception(s) and explain what was wrong using science concepts, theories or laws.

The fish started dying because of the ammonia got too high. Fish waste is turned in to ammonia. That ammonia is then turned into nitrites and lastly nitrates. On 9/2 the ammonia

started increasing because of the plants and those same plant absorbed all of the nitrates in the water. Once the plants were gone on 9/4, the nitrates increased in concentration. When nitrate concentration levels became too high, the fish started dying.

9. Circle the claim (answer to the driving question) and underline the evidence in the paragraph.
10. Rate the paragraph's claim by circling strong, weak or doesn't answer question.

    Strong Claim   Weak Claim   Claim Doesn't Answer Question

    Strong Evidence   Weak Evidence   Totally Incorrect Evidence

11. Using your graphs, determine if the evidence is supported by the data. Circle strong, weak, or incorrect evidence as your rating. State the data below (evidence from the graphs).

12. Were there any misconceptions in the paragraph and if there were, identify those misconception(s) and explain what was wrong using science concepts, theories or laws.

The fish started dying because the fish tank could not maintain a stable pH. Fresh water fish like to live in in an aquatic environment that has a neutral pH of 7.8. The fish tank pH fluctuated constantly and that caused the fish to stop maintaining homeostasis. Once the fish could not maintain homeostasis, they started dying.

13. Circle the claim (answer to the driving question) and underline the evidence in the paragraph.
14. Rate the paragraph's claim by circling strong, weak or doesn't answer question.

    Strong Claim   Weak Claim   Claim Doesn't Answer Question

    Strong Evidence   Weak Evidence   Totally Incorrect Evidence

15. Using your graphs, determine if the evidence is supported by the data. Circle strong, weak, or incorrect evidence as your rating. State the data below (evidence from the graphs).

16. Were there any misconceptions in the paragraph and if there were, identify those misconception(s) and explain what was wrong using science concepts, theories or laws.

Nitrogen Cycle CER

Write a claim evidence reasoning paragraph(s) to answer the following question. Why did the fish die?

Date:_____ Period:_____

You have to complete your Claim Evidence Reasoning paragraph within the space provided below. *Do not write in margins.*

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Grading Rubric	Missing	Too basic, needs lots of help	Approaching, needs some help	Meets or exceeds
Claim: claim answers the question correctly based on correlations in the graphs	**0**	**-**	√	**+**
Evidence: 1) evidence supports the claim, 2) numbers, labels and dates are used, 3) date comparisons are used to establish trend	**0**	**-**	√	**+**
Reasoning: 1) the nitrogen cycle is used to explain why the evidence supports the claim 2) explain what caused the algae bloom.	**0**	**-**	√	**+**
Correct English: wrote using complete sentences, a best effort on spelling and grammar, and use of scientific vocabulary	**0**	**-**	√	**+**