Acid Precipitation
Task Information

Grade: 8th grade

Content:
- Block H (The Chemistry of Matter). Section VI, 1 and 2. page 29 - 30; Appendix H - 60

Format: Manipulative

Purpose: The student will use an indicator to determine and evaluate the level of acidity in simulated water sources from New York State.

Skills:

Primary: Interpreting data, Observing
Secondary: Predicting

Time: 8 - 15 minutes

Materials:

Teacher
- citric acid (Fruit Fresh™)
- stock bottles
- permanent fine line black marker
- water

per Student
- dropper bottles labeled A - D
- pH paper (range 2 - 8) in vial with color key
- transparency test card
- paper towels
- water (550 ml)
- waste container
- safety goggles
- water for cleaning

Preparation:

1. **Stock Solution Preparation;**
   a. The solutions can be purchased as buffer solutions from a science supply company.
   - If you are making your own solutions use citric acid crystals (Fruit Fresh™) which are less toxic than other acids

   b. You might use the following chart to make enough stock solutions to fill 30 student dropper bottles with 50 ml each.

Bottle	Desired pH	Grams of Citric acid	ml of Distilled Water
A	4.0		1500 ml
B	6.0		1500 ml
C	7.0	0	1500 ml
D	6.0		1500 ml

For best results:
- Test each solution with pH paper strips prior to use.
- It is difficult to maintain a pH of 7 in a stock solution. Atmospheric CO_2 will lower the pH upon exposure. Keep bottle tightly covered and adjust pH as needed by adding drops of a weak base such as lime water or baking soda solution. (Add cautiously and test often with pH paper.)
- Transfer attached template for testing card with a permanent marker or a copy machine. Use shiny side of transparency to avoid contamination between tests.

Safety:
- Students **must** wear safety goggles.
- Check MSDS (Materials Safety Data Sheet) for further laboratory precautions.
- Laboratory safety procedures required.

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Acid Precipitation
Test Card

A B C D

Acid Precipitation
Test Card

A B C D

Acid Precipitation
Test Card

A B C D

Acid Precipitation
Test Card

A B C D

Acid Precipitation

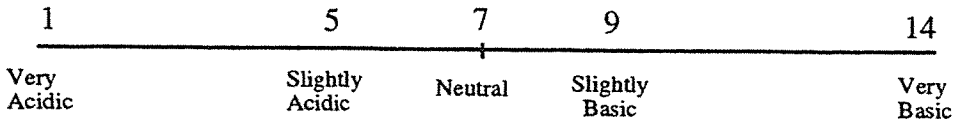
Task: At this station, you will experiment with 4 solutions representing water collected in March 1995 from sources around New York State to determine their level of acidity.

Materials:

- pH color chart
- pH paper
- water for cleaning
- transparency test card
- solution filled dropper bottles labeled A - D
- waste cup
- paper towels
- safety goggles

Background:

pH paper is an indicator used to determine how acidic or basic a solution is.
Distilled water with a pH of 7 is not an acid or base; it is called neutral.



The dropper bottles A through d contain samples that represent water collected in March 1995 from the following sources:

- Bottle A - Adirondack Lake water
- Bottle B - Finger Lake water
- Bottle C - Drinking (tap) water
- Bottle D - Great Lake water

Directions:

1. Put your safety goggles on. DO NOT taste or touch any solution. Clean up any spills immediately.
2. Place one drop of each solution on the transparency circle on the test card with the same letter as the solution.
3. Dip the end of a pH paper into solution A.
4 Compare the color of the pH paper with the chart on the pH color chart.
5 Record the pH of the solution on the data table on the answer sheet.
6. Repeat steps 3 through 5 for solutions B, C, and D using separate unused strips of pH paper for each solution..
7. Place used strips of pH paper in the waste cup.
8. Clean the transparency test cards with water. Throw any garbage into the waste cup.
9. Answer questions 1 through 4 on the answer sheet.

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Answer Sheet
Acid Precipitation

1. Record the pH of each sample on the data table below.

Sample	Source of Water	pH Levels	
		March 1993	March 1995
A	Adirondack Lake	5.0	
B	Finger Lake	6.0	
C	Drinking (tap)	7.0	
D	Great Lake	5.5	

2. Using the data you have collected and the background information, determine the following:
   a. Which 1995 sample is most acidic? (If there is a tie, list them)

   _____

   b. Which 1995 sample is least acidic? (If there is a tie, list them)

   _____

The pH of rain water in all of these areas was measured at 4.5 in 1993 and 3.0 in 1995.

3. Compare your results on the data table from 1995 with the results from 1993. Which sample(s) was/were most affected by acid rain?

   _____

   In the space below, explain the reason for your answer.

   _____

   _____

   _____

   _____

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4. To survive, many organisms need the water pH to be between a pH of 5 and 9. The list below shows the lowest pH of water at which certain organisms can live.

Bass	**pH 5.0**	**Perch**	**pH 4.5**	**Snail**	**pH 6.0**
Minnow	**pH 6.5**			**Salamander**	**pH 5.5**

Predict the order in which the organisms in a lake will die as a lake becomes more acidic.

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Acid Precipitation - Scoring Rubric

Maximum Score - 9 points

Question 1. pH data table. — 3 points total

Sample	Source of Water	pH Levels	
		March 1993	March 1995
A	Adirondack Lake	5.0	4.0 (3-5)
B	Finger Lake	6.0	6.0 (5-7)
C	Drinking (tap)	7.0	7.0 (6-8)
D	Great Lake	5.5	6.0 (5-7)

Point Criteria:

- Students receive points for the number of recorded pH's within the acceptable range of answers given in the data table.
  - Allow 3 points for 3 - 5 correct data entries
  - Allow 2 points for 2 correct data entries
  - Allow 1 point for 1 correct data entries

Question 2. Most and least acidic solutions — 2 points total

Point Criteria:

- Allow 1 point for identifying the most acidic solution as sample A
  - Accept any student's response correctly **based on his/her data.**
- Allow 1 point for identifying the least acidic solution as sample C
  - Accept any student's response correctly **based on his/her data.**

Question 3. Sample most affected by acid rain and explanation — 2 points to

Point Criteria:

- Allow 1 point for identifying sample A as the most affected
  - Accept any student's response correctly **based on his/her data**
- Allow 1 point for stating that the pH of A dropped or became more acidic than the others.

Question 4. Order organisms will die — 2 points total

Point Criteria:

- Correct order is minnow, snail, salamander, bass, and perch
  - Allow partial credit (1 point) for 1 misplaced organism
  - Allow no credit for more than 1 misplaced organism

Highest possible score - 9 points

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Student ID _____ **Acid Precipitation - Scoring Form**

Male or Female (circle one)

Circle the student's score for each question. Add the points for each question and write the total score at the bottom of the scoring form.

Question	Circle Point Breakdown	Points Earned
1. pH Data Table		
3 - 4 correct	3	
2 correct	2	_____
1 correct	1	
0 correct	0	
2. Most/Least Acidic Samples		
Most - Sample A	0 1	_____
Least - Sample C	0 1	
3. Comparing Results		
Named Sample	0 1	_____
Reason for Choice	0 1	
4. Order Organisms Will Die (minnow, snail, salamander, bass, perch)	0 1 2	_____

Total Score _____

Total possible score - 9 points

#3

Student ID HM-8-1-4 **Acid Precipitation - Scoring Form**

Male or (Female) (circle one)

Circle the student's score for each question. Add the points for each question and write the total score at the bottom of the scoring form.

Question	Circle Point Breakdown	Points Earned
1. pH Data Table		
3 - 4 correct	(3)	3
2 correct	2	
1 correct	1	
0 correct	0	
2. Most/Least Acidic Samples		
Most - Sample A	0 (1)	2
Least - Sample C	0 (1)	
3. Comparing Results		
Named Sample	0 (1)	2
Reason for Choice	0 (1)	
4. Order Organisms Will Die (minnow, snail, salamander, bass, perch)	0 1 (2)	2

Total Score 9

Total possible score - 9 points

Answer Sheet

1. Record the pH of each sample on the table below.

Sample	Source of Water	pH levels	
		March 1990	March 1993
A	Acid rain	4.5	2.0
B	Adirondack Lake	5.0	3.5
C	Finger Lake	6.0	7.0
D	Household Tap	7.0	(7.5)
E	Great Lake	5.5	C.5

2. Using the data you have collected and the background information, determine the following:
   a. Which 1993 sample(s) is/are most acidic? Sample A
   b. Which 1993 sample(s) is/are least acidic? Sample D

3. Compare your results from 1993 with the results from 1990. Which sample(s) was/were most affected by acid rain? Sample A

   In the space below, explain the reason for your answer.

   The Ph level of Sample A changed by 2.5, a greater change than in any of the other samples.

4. To survive, many organisms need the water pH to be between a pH of 5 and 9. The list below shows the lowest pH of water at which certain organisms can live.

Bass	**pH 5.0**	**Perch**	**pH 4.5**	**Snail**	**pH 6.0**
Minnow	**pH 6.5**	**Salamander**	**pH 5.5**		

   Predict the order in which the organisms in a lake will die as a lake becomes more acidic.

   Minnow, Snail, Salamander, Bass, Perch.

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