

Acid Precipitation - Micro 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:

- disposable pipettes labeled A - D
- fine line permanent black marker
- pH paper (range 2 - 8) with pH color chart
- water for clean up
- small plastic cups - 4
- paper towels
- dropper bottles for stock solutions
- waste container
- safety goggles

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 pipettes with 1 ml each.

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

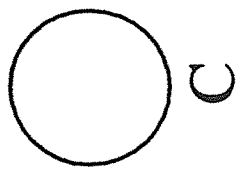
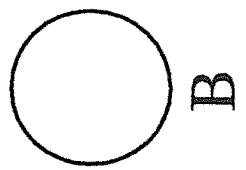
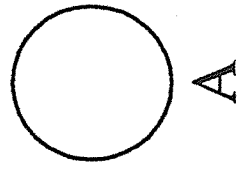
2. Materials Preparation

- a. Label disposable pipettes "A", "B", "C", and "D".
- b. Pour individual stock solutions in small plastic cups. To fill pipettes, place a handful of pipettes into the solutions (tips down), and squeeze bulbs simultaneously. Capillarity will keep solutions in the pipettes without sealing.
- c. For best results, test each solution with pH paper strips prior to use.
- d. Pipettes will fit inside of the cassette case with tips up for easy storage and handling. Styrofoam can be used as spacers.
- e. Pipettes - 2" Specialty Transfer Pipettes (1 ml, 43 drops/ml)
- f. Use the permanent marker or a copy machine to transfer the template onto the transparency. Use the smooth side of the transparency to avoid contamination. Discard after each use.
- g. Alternative: purchase Reaction Plates (24 wells). Use Flat sides of both lids and bottoms of reaction plates. Wash Between uses.

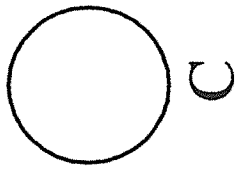
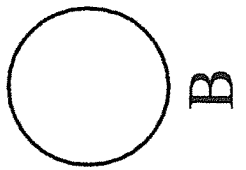
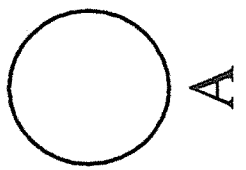
Safety:

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

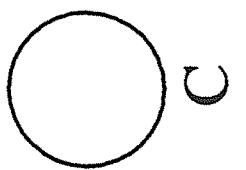
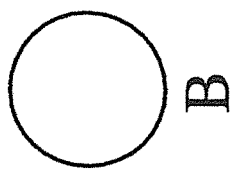
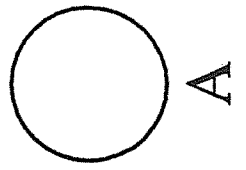
Acid Precipitation
Test Card



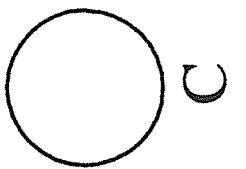
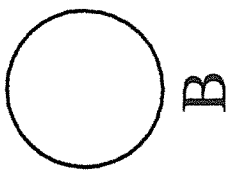
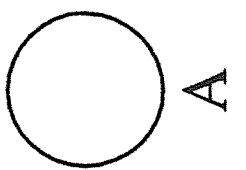
Acid Precipitation
Test Card



Acid Precipitation
Test Card



Acid Precipitation
Test Card



Acid Precipitation - Micro

Task: At this station, you will experiment with 5 solutions representing water collected in March 1995 from sources around New York State to determine their level of acidity.

Materials:

- solution filled disposable pipettes A through D
- pH paper (range 2 - 8)
- pH color chart
- transparency test card
- waste cup
- paper towels
- safety goggles
- cassette case
- water for cleaning

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.

1	5	7	9	14
Very Acidic	Slightly Acidic	Neutral	Slightly Basic	Very Basic

The disposable pipettes A - D contain samples that represent water collected in March 1995 from the following sources:

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

You will test the water samples collected in March 1995. Results from these samples will be compared with water collected in March 1993 from these same locations.

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 with the same letters as the solution.
3. Dip the end of a pH paper into solution A.
4. Compare the color of the pH paper with the pH color chart.
5. Record the pH of the solution on the data table on the answer sheet.
6. Repeat steps 3 -5 for solutions **B** through **D** using separate strips of pH paper for each solution.
7. Place used strips of pH paper in the waste cup.
8. Clean the transparency test card with water. Throw any garbage into the waste cup.
9. Answer questions 1 - 4 on the answer sheet.

Please Continue on the Next Page

Answer Sheet Acid Precipitation - Micro

1. Record the pH of each sample on the 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:
- Which 1995 sample is **most** acidic?
(If there is a tie, list them.) _____
 - Which 1995 sample is **least** acidic?
(If there is a tie, list them.) _____

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

3. Compare your results 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.

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.

Student ID _____
 Male or Female (circle one)

**Acid Precipitation - Micro
 Scoring Form**

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 2 correct 1 correct 0 correct	3 2 1 0	_____
2. Most/Least Acidic Samples Most - Sample A Least - Sample C	0 1 0 1	_____
3. Comparing Results Named Sample Reason for Choice	0 1 0 1	_____
4. Order Organisms Will Die (minnow, snail, salamander, bass, perch)	0 1 2	_____

Total Score _____

Highest Possible score - 9 points

Acid Precipitation - Micro - Scoring Rubric

Maximum Score - 9 points

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)

****** *The theoretical pH value of each solution is given first.
The acceptable range of student answers is given in parenthesis.*

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 - 4 correct data entries
 - Allow 2 points for 2 correct data entries
 - Allow 1 point for 1 correct data entries

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.

3. Sample most affected by acid rain and explanation

2 points total

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.

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

Student ID 2H-1
Male or Female (circle one)

Acid Precipitation - Micro
Scoring Form

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 2 correct 1 correct 0 correct	<p style="text-align: center;">(3)</p> <p style="text-align: center;">2</p> <p style="text-align: center;">1</p> <p style="text-align: center;">0</p>	<u>3</u>
2. Most/Least Acidic Samples Most - Sample A Least - Sample C	<p style="text-align: center;">0 (1)</p> <p style="text-align: center;">(0) 1</p>	<u>1</u>
3. Comparing Results Named Sample Reason for Choice	<p style="text-align: center;">0 (1)</p> <p style="text-align: center;">(0) 1</p>	<u>1</u>
4. Order Organisms Will Die (minnow, snail, salamander, bass, perch)	<p style="text-align: center;">(0) 1 2</p>	<u>0</u>

Total Score 5
Highest Possible score - 9 points

Answer Sheet Acid Precipitation - Micro

2H-1

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

Sample	Source of Water	pH levels	
		March 1993	March 1995
A	Acid rain	4.5	4.5
B	Adirondack Lake	5.0	4.5
C	Finger Lake	6.0	5.5
D	Household Tap	7.0	7.0
E	Great Lake	5.5	5.5

2. Using the data you have collected and the background information, determine the following:
- Which 1995 sample(s) is/are **most** acidic? Acid rain + Adirondack Lake
 - Which 1995 sample(s) is/are **least** acidic? Finger lake + GREAT LAKE
3. Compare your results from 1995 with the results from 1993. Which sample(s) was/were most affected by acid rain?
Adirondack lake

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

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.

Perch, Bass, Salamander, Snail +
Minnow

Student ID 2H-3

Acid Precipitation - Micro
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 2 correct 1 correct 0 correct	<p style="text-align: center;">(3)</p> <p style="text-align: center;">2</p> <p style="text-align: center;">1</p> <p style="text-align: center;">0</p>	<u>3</u>
2. Most/Least Acidic Samples Most - Sample A Least - Sample C	<p style="text-align: center;">0 (1)</p> <p style="text-align: center;">0 (1)</p>	<u>2</u>
3. Comparing Results Named Sample Reason for Choice	<p style="text-align: center;">0 (1)</p> <p style="text-align: center;">0 (1)</p>	<u>2</u>
4. Order Organisms Will Die (minnow, snail, salamander, bass, perch)	<p style="text-align: center;">(0) 1 2</p>	<u>0</u>

Total Score 7

Highest Possible score - 9 points

Answer Sheet Acid Precipitation - Micro

2H-3

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

Sample	Source of Water	pH levels	
		March 1993	March 1995
A	Acid rain	4.5	4.5
B	Adirondack Lake	5.0	4.5
C	Finger Lake	6.0	5.5
D	Household Tap	7.0	7.0
E	Great Lake	5.5	6.5

2. Using the data you have collected and the background information, determine the following:

a. Which 1995 sample(s) is/are **most** acidic? Acid rain

b. Which 1995 sample(s) is/are **least** acidic? Household Tap

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

Adirondack Lake

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

There were more hydrogen ions in the lake which made it acidic.

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.

perch, Bass, salamander, snail, minnow

Student ID 24-5

Acid Precipitation - Micro
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 2 correct 1 correct 0 correct	<p style="text-align: center;">(3)</p> <p style="text-align: center;">2</p> <p style="text-align: center;">1</p> <p style="text-align: center;">0</p>	<u>3</u>
2. Most/Least Acidic Samples Most - Sample A Least - Sample C	<p style="text-align: center;">0 (1)</p> <p style="text-align: center;">0 (1)</p>	<u>2</u>
3. Comparing Results Named Sample Reason for Choice	<p style="text-align: center;">0 (1)</p> <p style="text-align: center;">0 (1)</p>	<u>2</u>
4. Order Organisms Will Die (minnow, snail, salamander, bass, perch)	<p style="text-align: center;">0 1 (2)</p>	<u>2</u>

Total Score 9
Highest Possible score - 9 points

Answer Sheet Acid Precipitation - Micro

2H-5

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

Sample	Source of Water	pH levels	
		March 1993	March 1995
A	Acid rain	4.5	4.5
B	Adirondack Lake	5.0	4.5
C	Finger Lake	6.0	5.5
D	Household Tap	7.0	7.0 (7.3)
E	Great Lake	5.5	5.5

2. Using the data you have collected and the background information, determine the following:

a. Which 1995 sample(s) is/are most acidic? A C B

b. Which 1995 sample(s) is/are least acidic? D

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

LETTER: C | B |
 X more acidic: 5 | 5 |

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

SAMPLES B & C GOT MORE
ACIDIC BECAUSE MORE FOSSIL
FUELS WERE BURNED AND MORE
NO_x AND SO₂ WERE REUSED INTO THE
AIR

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.

THE FIRST TO DIE WILL BE THE MINNOW,
THEN THE SNAIL, THEN SALAMANDER, THEN BASS
THEN THE PERCH.