

Name _____

Period _____

Due date _____



ACID RAIN PROJECT Journal & Data



Normal rain water is a pH = 5.6, but pollutants in the atmosphere can cause precipitation to shift as low as pH = 2.3. This condition of strong acidity rain is known as ACID RAIN, and can be very harmful to the roots and leaves of plants.

In this project, you will grow sunflower seeds exposing them to varying levels of acidity. Each student will plant 3 seeds, measure the heights of their seedlings as they grow, calculate their average height, then find the average for their entire team. This team average will be recorded on the wall chart and averaged with the other teams in the class. On the final observation day, each student will also measure the length of the longest leaf, averaging this with their team, and recording the team average on the wall chart.

You will graph the final average heights and leaf lengths on the attached graph paper. You will also make daily observations of the growth of your 3 seedlings.

Predict what will happen to sunflowers grown at these pH values:

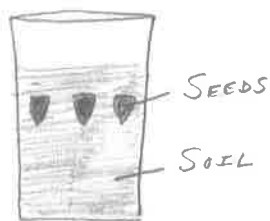
pH = 2 _____

pH = 4 _____

pH = 6 _____

What pH are you watering your sunflowers with? _____

PROCEDURE:



Label a plastic cup with your name and period. Fill the cup approximately $\frac{3}{4}$ full with potting soil. Plant 3 sunflower seeds by pushing them pointy end down about 1 inch below the surface of the soil. Water your sunflowers with **40 ml.** of water, using the water designated for your class.

After 1 week, you will make observations of your seedlings along with measurements of their lengths and the longest leaf.

ACID RAIN OBSERVATIONS



DATE	OBSERVATIONS (color, size, shape, changes)	Your average height (in)	Your longest leaf (in)

DATA TABLES

(Copy data off wall chart)

Average Height (in.) of Sunflowers

DATE:						
pH = 2						
pH = 4						
pH = 6						

Make a LINE GRAPH on the graph paper below. You will make **3 lines**:

pH = 2 (color GREEN & label “pH = 2”)

pH = 4 (color BLUE & label “pH = 4”)

pH = 6 (color PINK & label “pH = 6”)

Sunflower Growth and pH

[illegible]

AVERAGE
HEIGHT
(in.)

DATE _____

Average Longest Leaf (in.)

pH	2	4	6
LEAF LENGTH (in.)			

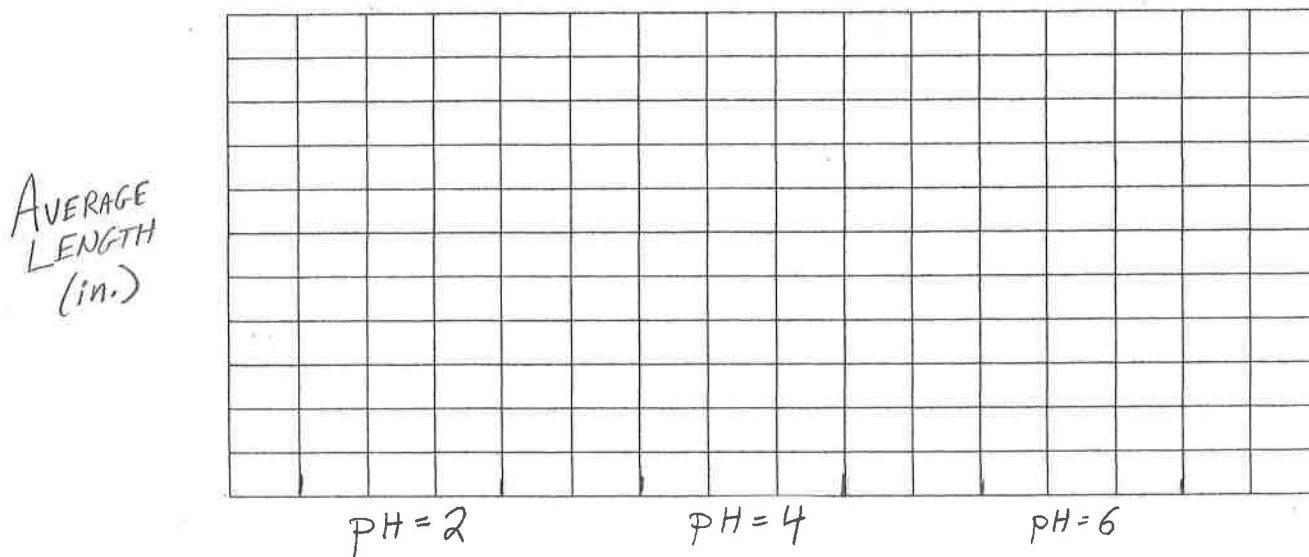
Make a BAR GRAPH on the graph paper below. You will make **3 bars**:

pH = 2 color GREEN

pH = 4 color BLUE

pH = 6 color PINK

pH and Leaf Length in Sunflowers



CONCLUSIONS:

1. Based on the data collected, what difference, if any, did pH have the growth of sunflower seedlings? (i.e. compare the 3 pH results & describe what happened)

2. Is this result what you predicted? (Look back on page 1 of the project) Why or why not?

_____ 3. In our experiment, what was the independent variable?

- A. Type of seed B. pH of the water C. Height of the plants

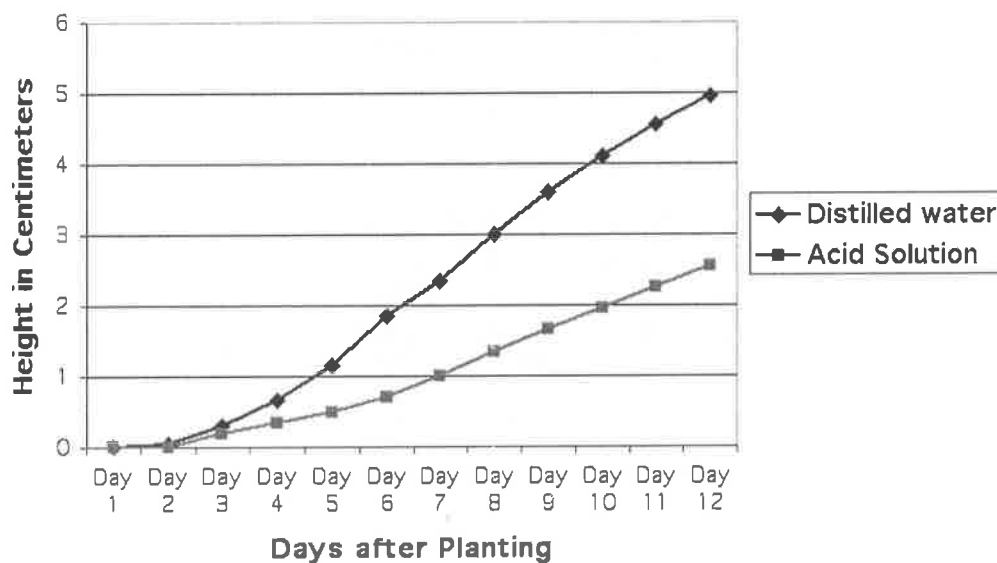
_____ 4. In our experiment, what was the dependent variable?

- A. Type of seed B. pH of the water C. Height of the plants

_____ 5. In what 2 ways could the validity of this experiment be improved?

- A. Water the plants more often & use a second type of seed
B. Increase the sample size & repeat the experiment
C. Water the plants with a pH = 8 & put half of the plants in the dark

Average Plant Growth in Centimeters



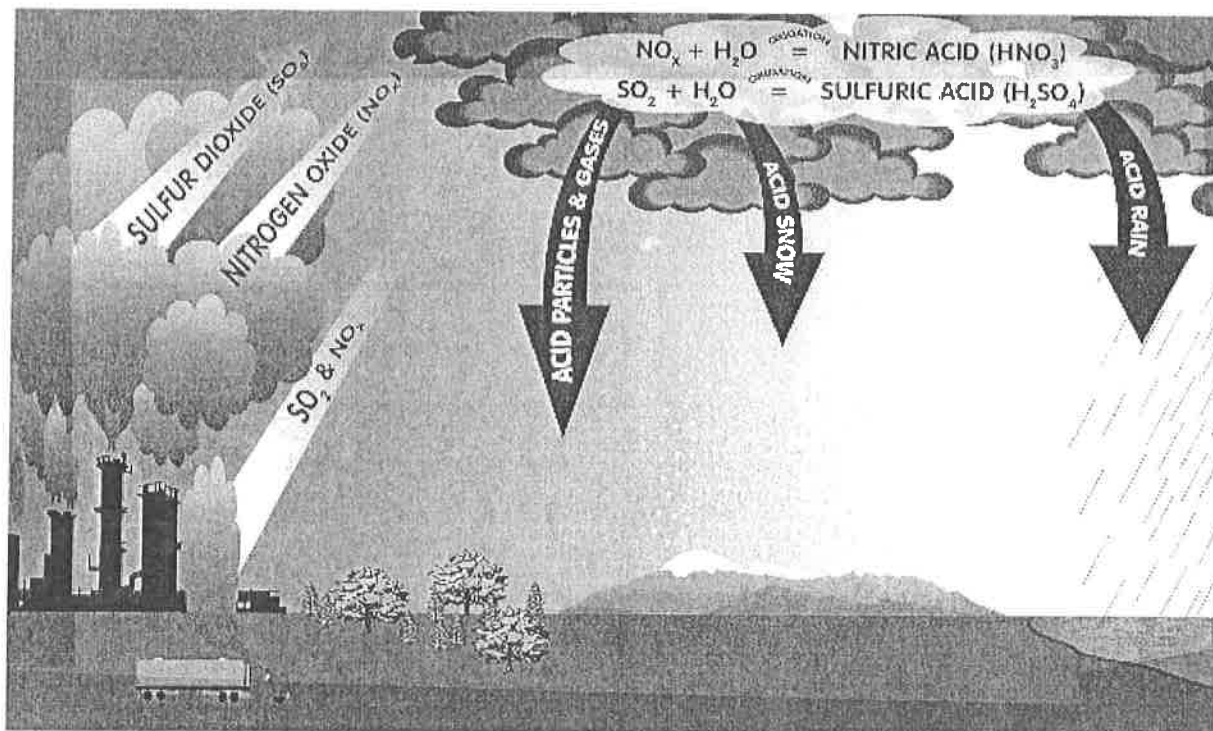
6. Based on the graph above, what is the relationship between Acid rain and plant growth?

_____ 7. On day 10, how much taller were the plants grown with distilled water over the plants grown in acid solution?

- A. 1 cm B. 2 cm C. 3 cm

What is Acid Rain?

Acid rain, or precipitation, comes in many forms: rain, snow, sleet, hail and fog, and as deposits of acid particles, aerosols and gases. It is formed when sulfur dioxide and nitrogen oxides combine with moisture in the atmosphere to produce sulfuric acid and nitric acid.



8. Name 2 chemicals that mix with water to produce acid rain: _____

9. Using the picture, give 4 ways acids leave the clouds: (HINT: See the arrows)

Effects of Acid Rain - Forests



Over the years, scientists, foresters, and others have noted a slowed growth of some forests. Leaves and needles turn brown and fall off when they should be green and healthy. In extreme cases, individual trees or entire areas of the forest simply die off without an obvious reason.

10. Leaves and needles impacted by acid rain:

- A. Still look green and healthy
- B. Grow slower but larger
- C. Turn brown and fall off

How Acid Rain Harms Trees

Acid rain does not usually kill trees directly. Instead, it is more likely to weaken trees by damaging their leaves, limiting the nutrients available to them, or exposing them to toxic substances slowly released from the soil. Quite often, injury or death of trees is a result of these effects of acid rain in combination with one or more additional threats.

Scientists know that acidic water dissolves the nutrients and helpful minerals in the soil and then washes them away before trees and other plants can use them to grow. At the same time, acid rain causes the release of substances that are toxic to trees and plants, such as aluminum, into the soil. Scientists believe that this combination of loss of soil nutrients and increase of toxic aluminum may be one way that acid rain harms trees. Such substances also wash away in the runoff and are carried into streams, rivers, and lakes. More of these substances are released from the soil when the rainfall is more acidic.

However, trees can be damaged by acid rain even if the soil is well buffered. Forests in high mountain regions often are exposed to greater amounts of acid than other forests because they tend to be surrounded by acidic clouds and fog that are more acidic than rainfall. Scientists believe that when leaves are frequently bathed in this acid fog, essential nutrients in their leaves and needles are stripped away. This loss of nutrients in their foliage makes trees more susceptible to damage by other environmental factors, particularly cold winter weather.

11. FILL-IN-THE-BLANKS: How does acid rain weaken trees?

...by damaging their _____, limiting the _____ available to them, or exposing them to _____ substances slowly released from the _____.

12. Which chemical, released out of the soil by acid rain, is especially toxic to plants?

- A. Aluminum
- B. Sulfur

- C. Nitrogen
- D. Oxygen

13. What are higher elevation forests "bathed" in? _____

How Acid Rain Affects Other Plants

Acid rain can harm other plants in the same way it harms trees. Although damaged by other air pollutants such as ground level ozone, food crops are not usually seriously affected because farmers frequently add fertilizers to the soil to replace nutrients that have washed away. They may also add crushed limestone to the soil. Limestone is an alkaline material and increases the ability of the soil to act as a buffer against acidity.

14. Which soil additive helps buffer against acid rain?

- A. Ozone
- B. Limestone

- C. Aluminum
- D. Carbon





"Put these on. We're on an acid rain cloud."