Name: Date: pd:

Unit 9: Greenhouse Gases

Acid Rain Lab

When precipitation falls to earth, it has a pH between 5.6-5.8. Rain is normally slightly acidic because CO_2 dissolves into water droplets to create weak carbonic acid.

$$H_2O + CO_2 \rightarrow H_2CO_3$$

However, pollution from cars and factories can also dissolve into water droplets. When this occurs, the pH drops lower than 5.6 and creates *acid rain*. Acid rainfall has been measured as low as pH 3, and fog droplets in Los Angeles have been recorded at a pH of 2!

Acid rain falls regularly in the North Eastern United States and Western Europe. Scientists are interested in the long-term effects of acid rain on ecosystems. In this activity you will be investigation how pH affects seed *germination* (sprouting). Every plant seed is a tiny embryo packaged with food. Even though plants don't have a nervous system, the dormant (inactive) seeds can sense changes in temperature and moisture and decide when to grow.

Purpose: Read the procedure and then in your own words, explain what the purpose of this lab is.

Hypothesis: What do you predict will happen to the seeds in different pH solutions?

Materials:

- 3 plastic zip close baggies
- 6 paper towels
- 30 seeds (same type)
- Distilled Water (pH 7)
- Solution of pH 5
- Solution of pH 3
- Ruler

Procedure:

1. Label your three baggies as "Distilled Water," "pH 3," and "pH 5." Include your class period, date, and each group member's name on each bag.
2. Take two paper towels and stack them on top of each other.
3. Place 10 seeds on one side of the paper towel and fold the towel in half over the seeds.
4. Carefully place the folded paper towel with the seeds into the plastic bag labeled "Distilled Water." Repeat steps 2-4 for the other two bags.
5. Add 50 mL of distilled water, 50 mL of pH 5 solution and 50 mL of pH 3 solution to the bag with the matching label. Gently add a puff of air to each bag before sealing it.
6. You will observe the seeds and add 25 mL of solution every other day for the next three weeks. In your data table you will record the number of seeds germinated, the root length of germinated seeds, and calculate the average root length for each observation day.
7. After collecting your data, you will create a line graph of average root length for each solution.

Data Collection:

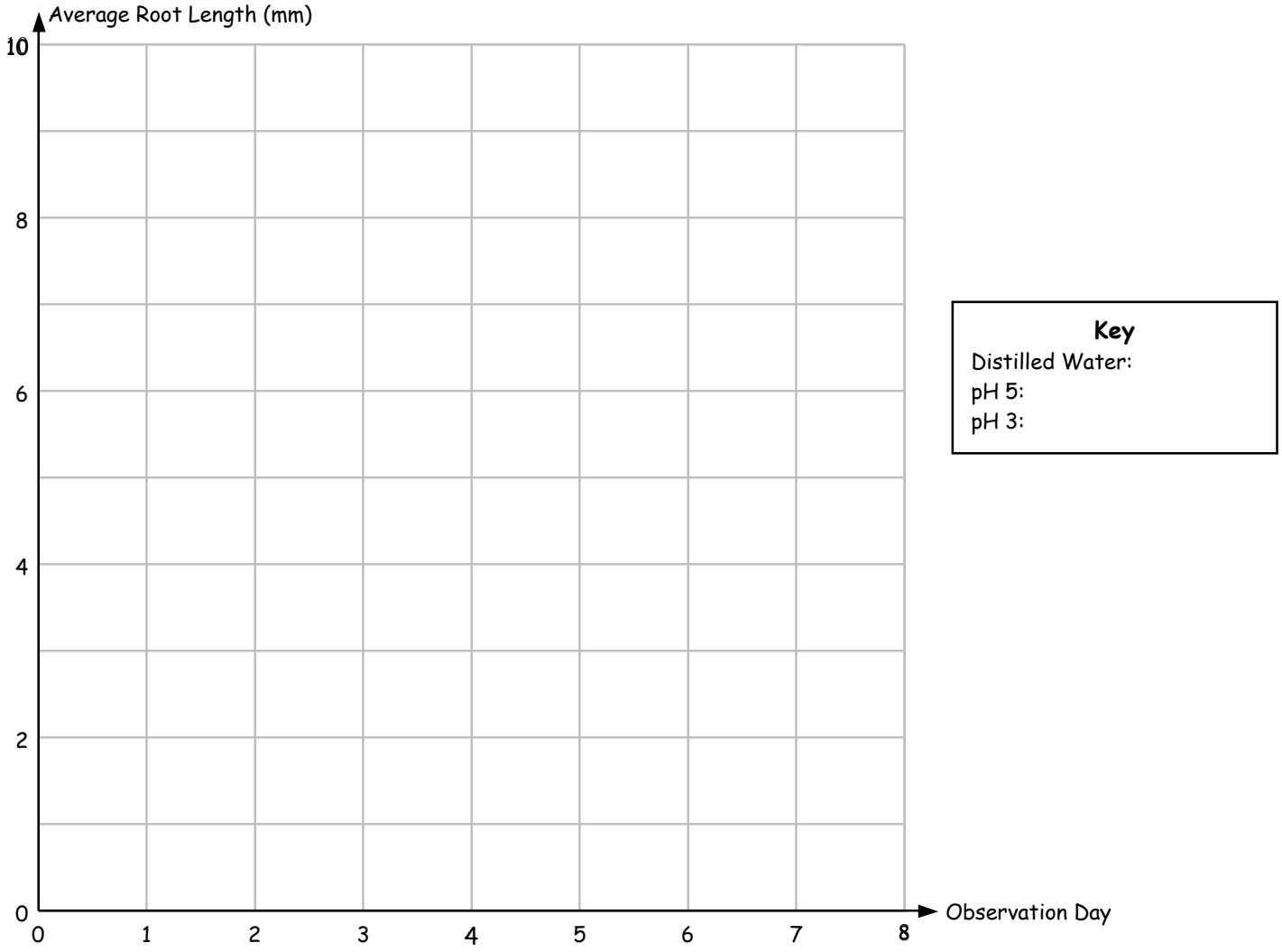
		Total Number of Seeds Germinated		
		Distilled Water (pH 7)	pH 5	pH 3
Observation Number and Date	1:			
	2:			
	3:			
	4:			
	5:			
	6:			
	7:			
	8:			

		Root Length for Distilled Water in mm	
		Individual root length measurements (do not count non-germinated seeds)	Average (mm)
Observation Number	Ex:	1 mm, 3 mm, 0.5 mm, 2.5 mm (1 mm + 3 mm + 0.5 mm + 2.5 mm)/4 =	1.75
	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8		

		Root Length for pH 5 Solution in mm	
		Individual root length measurements (do not count non-germinated seeds)	Average (mm)
Observation Number	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8		

		Root Length for pH 3 Solution in mm	
		Individual root length measurements (do not count non-germinated seeds)	Average (mm)
Observation Number	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8		

Graph:
Create a line graph that shows average root length over time for each of the three solutions. You will have one line for each solution.



Analysis:

1. In which bag did the seeds germinate the fastest? In which bag did the most seeds germinate?

2. What solution had the fastest root growth? What solution had the longest root growth?

3. Using your lab results, explain how acid rain could affect seed germination and plant growth in an ecosystem.

4. What affects would changes in plant growth have on the rest of the community?

5. Why would some farmers be less affected by acid rain than others?

6. Explain how acid rain could affect the evolution of a plant species.