Seed Germination Lab C. Kohn, Waterford, WI

Name: Hour Date:

Date Assignment is due: *Friday, March 12* Why late?
 Day of Week Date If your project was late, describe whySeed germination is one of the most fascinating aspects of gardening. It never ceases to amaze even the most seasoned gardener when a tiny seed can give birth to a plant the can provide us with food multiple times. So how does a small seed become the vegetables and flowers in our gardens? How does a complex plant rich in diverse structures and cells grow out of such a simple and tiny compartment? How does a seed know when “it’s time”? How can we improve the rate at which seeds turn into food we can eat? How can we use our understanding of seeds to make our garden more productive?

In this lab, you will be designing an experiment to provide the answers to some of these questions. In this case, you will not be following specific instructions or finding results that have already been determined by the instructor. Rather, you will be using your training in the scientific method to test a hypothesis and report the results.

As you probably know, a good experiment has several key components – 1) a question; 2) a testable hypothesis; 3) a rationale for why you chose the hypothesis; 4) experimental methods; 5) expected and reported data; and 6) a conclusion explaining whether or not the data supported the hypothesis and what it means.

1. Your experiment will focus on a changeable independent variable and a measurable dependent variable. Your dependent variable will probably be one of two things, either a) germination rate (e.g. 14 of 30 seeds germinated) or b) root length (e.g. the average root length at 7 days was 1.3 cm). Your independent variable is the thing you change. In this case, you might change the moisture levels, light, temperature, pH, etc.
	1. What will be your independent variable?
	2. What will be your dependent variable?
2. A good experiment begins with a good question. Usually an experimental question is specific and related to the independent and dependent variables. For example, in a different experiment you might ask, “What would be the impact of different temperatures on the rate of change in plant height?” In that case, you saw that the dependent variable and independent variable were specifically included with no ambiguity.
	1. What is your experimental question?

1. A hypothesis usually follows a good question; a hypothesis is very similar to the question, except that you are making a specific prediction based on evidence, logic, or rational thought. For example, the previous research question might become, “I hypothesize that increase the temperature will increase the rate of change in plant height.” Turn your question into a hypothesis below:

	1. I hypothesize that
2. A good scientist understands how they will test a hypothesis before attempting to do so. The first consideration is replicates; replicates are repeated parts of the experiment for the sake of accuracy. If you will be testing an idea on radish seeds, you probably wouldn’t want to test only one seed. The more times you repeat an experiment, the more accurate the results. However, time, difficulty, and expense can limit how many replicates we can have as well. You should shoot for a balance between accuracy and ease when selecting the number of replicates you will perform.

Sometimes an experiment needs a control; for example, if you are testing whether or not acidic soil improves seed germination, you would need neutral soil to compare to (otherwise, how would you know if there was a difference?). A control is simply explained as “normal” in an experiment. For example, if you’re testing the impact of temperature on germination, “normal” might be room temperature (or it might be the temperature of the soil at the time of planting – it’s somewhat up to you to define “normal”.

Variables must also be taken into consideration. While the tested independent variable should be different between your replicates, everything else should be the same. For example, if you were testing the impact of moisture on seed germination, you would have different levels of moisture but keep temperature, lighting, pressure, air flow, and all other components of the experiment the same as much as possible.

	1. How groups will you have? List these groups below (e.g. *4 groups, one at 50o, one at 60o, another at 70o, and a final at 80o*, or *3 groups, one at no moisture, one at partial moisture, and a third at complete moisture in water*). **Check with Mr. Kohn before writing to make sure this is ok!**
	2. What will be your control (for comparison)? Describe your control below:
	3. List 8 variables below that you will have to keep constant. Then explain how you will keep those variables uniform among all of your replicates:
3. Using information from your previous experiments, explain your methods in a step-by-step fashion (like the directions for a recipe). Be sure to explain your methods so that another group could perform your work in *exactly* the same way with the same results as you. List all details, specifics, and measurements.
4. What are your expected results? In other words, what do you expect to find at the end of the week and why?
5. Graph your expected results below. Be sure to include a key so that a reader can understand your graph.
6. Use the space below to record your observations, data, and measurements for each day:
	1. Monday
	2. Tuesday
	3. Wednesday
	4. Thursday
	5. Friday
7. (For Friday): Summarize your findings and data below. What happened?
8. Graph your final results below. Be sure to include a key so that a reader can understand your graph.
9. Did your data support your hypothesis? Explain the take-away message from your experiment below. Explain what happened, why it happened, and what this means for gardening.

**Materials Needed to Grow Seeds**

* plain paper towels or coffee filters
* flower or vegetable seeds
* sandwich size plastic bags
* water to moisten the towels
* permanent marker or masking tape
* ruler

**Setting Up the Root Growth Science Experiment**

You will each need a plastic bag, paper towel or coffee filter, and two or three plant seeds. Multiple seeds are used in case one does not germinate, or grow.

First, fold the paper towel into quarters or the coffee filter in half. Next, dampen the paper so it is moist but not dripping wet. Then, gently open the paper along its last fold and place the seeds inside, putting them about one inch apart so the sprouts do not become tangled.

Place the moist paper with the seeds into the plastic bag and seal about halfway. Mark the bag with the your name, date, and sealing time using a permanent marker or masking tape. Each seed should also be given a number which is marked clearly on the bag. Then, put the bag in a warm place in the classroom.

**Measuring and Recording Root Growth Data**

You should prepare a chart or table on which to record their data. This should include your name, type of seed, time of observation, seed number and length of roots. If seeds grow more than one root, you can either continue to measure the first one or further divide the data section for their observation so it contains space for the additional roots.

If you begin the activity on a Monday you can usually end your data collection on Friday. Since the environment create can cause sprouting to occur faster than if placed in soil, it is possible to make more than one observation each day. Once the data recording is complete you can use it to make comparisons between each other, different growing environments, and even look at variations between the seeds in the same bag.