



## Designing and Conducting a Controlled Experiment: Salt Concentration and Radish Seed Germination

(60 points)



Toxicology is the science that studies the harm that different chemicals have on living things. One of the most significant way scientists can determine the toxicity of chemicals is through controlled laboratory investigations. In addition to furthering knowledge and understanding of toxicology, there are three main learning objectives built into this investigation. Your first objective was to design an experiment with given parameters that will produce results that are valid within the limitations of working within a classroom setting. The second objective was to collect data from that experiment and determine a conclusion based on quantitative observations. This was accomplished in small groups, but also as a collaborative whole. We shared each group's findings in order to better see trends that may develop as a result of a greater availability of numerical data. The third objective is to write a complete, formal lab report by extending the format learned during the Infiltration Lab. The report will be written and assembled in the following order:

### **1. ABSTRACT: (6 points)**

Write an abstract according to the correct format. Use your notes and reference previous abstracts written or provided as models to refresh your memory as to proper abstract structure. This will be one of the last things you will write, but it will be the first part of your assembled report.

\*\* As a good starting sentence for your abstract, as well as something to weave into the introduction or conclusion paragraph of your formal report, you should research salt and its effect on plant growth, soil quality, farming practices, etc. You could also weave in a discussion of the human impact of using salt in the environment. This will provide relevance for your study as it will make a real-world connection and/or application. \*\*

### **2. OBJECTIVE: (2 points)**

**The scientific objective of this investigation is to observe the effect that the concentration of a salt solution has on the germination of radish seed.**

Here is the list of materials you will be working with. You must find a use for everything on the list.

saltwater solutions of  
the following concentrations (%):

70 radish seeds

scissors

petri dishes with covers

10mL graduated cylinder

distilled water

paper towels (as a seed substrate)

transfer pipettes

safety glasses

forceps

storage tray

Sharpie marker

### **3. HYPOTHESIS: (2 points)**

State a hypothesis as to how you thought the concentration of salt solution may have affected seed germination when we first started to assemble the experiment. The hypothesis could be a trend statement, or it could be more definitive by referencing how specific concentrations may have affected germination in either a positive or negative way. Just remember, as I will remind you again in writing later (and verbally, of course): Do not use pronouns! **DO NOT WRITE:** "I think", "We think", "My/our hypothesis is", "Me and my group members thought that" Even writing "The hypothesis of the experiment..." isn't really the way scientists write, but if that's the only way you can figure to word it, it will do.

#### **4. THE PROCEDURE: (20 points)**

Your experimental design and all the steps performed will be written about in the procedure section of your report. The procedure should read like a detailed story specifically explaining everything that was done so that anyone reading it can clearly understand the process. The procedure is written in paragraph form, in past-tense, and once again, without the use of pronouns. Make sure that you take personal notes during the time your group is setting up the design of the experiment. This way, when you are ready to write the formal report, all you will have to do is convert your notes into sentences and paragraphs without worries that you will forget to include everything that had been accomplished during the planning and execution stages.

Remember, designing a controlled experiment that will produce valid, reproducible results requires attention to detail. An experiment must always be devised that eliminates the effects of all variables except the one that is being tested. The list below provides a refresher of important terminology related to the development of a scientific experiment. Make sure that, in your lab report procedure, you identify each of the following items indicated in the following list:

##### **Independent Variable:**

This is the "treatment" variable that the experimenter hypothesizes "has an effect" on some other variable.

##### **Dependent Variable:**

This is the variable that the experimenter hypothesizes is "affected by," or "related to," the independent variable. It is the "outcome" or "effect" variable, resulting from changes in the independent variable.

##### **Experimental Group and Control Group:**

The group receiving the treatment-present condition is called the **experimental group**, and the group receiving the treatment-absent, or no-treatment, condition (the other level of the independent variable) is called the **control group**. In some experiments, there are only two **levels of the independent variable**: the treatment-present condition and the treatment-absent condition. In some experiments, including this one, the treatment is applied in different amounts; the differing amounts are referred to as the **levels of the independent variable**.

##### **Controlled Variables:**

In scientific experimentation, the controlled variables are the elements which are constant and unchanged throughout the course of the investigation so as to not influence the outcome of the experiment. In this lab report, you need to identify 5 different controlled variables.

#### **5. OBSERVATIONS: (20 points)**

You will construct a data chart and a graph to present ALL of the data collected, as well as totals.. The data chart you will design yourself on a computer by using the organization and techniques that we have already talked about during previous investigations. If you still are having problems with software, and don't know how to manipulate rows, columns, etc., just see me and I will give you the tutorial one-on-one or in small groups.

You will be provided the graph to illustrate the data. The x- axis scale will be included and you can determine an appropriate y-axis scale. You will need to correctly plot data, label axes appropriately, and include a clear, distinct title. (Remember: a two-word title won't do the job, nor will just restating the labeled axes.)

#### **6. CONCLUSIONS: (10 points)**

State the findings of the investigation. Make references to the trends observed and use quantitative data to support. Confirm whether or not your original hypothesis was supported by the results. Discuss if the experiment produced results similar to the threshold or non-threshold model (discuss LD<sub>50</sub>, TLV, NOEL if applicable). You may have to account for possible uncertainties or discuss circumstances that were encountered that may have had an effect on the outcome.