

Name:

Lab Group:

Date:

What do Plants Need to Grow? – The Four Question Strategy

Observe Natural Phenomena

Do you have prior experience growing plants? Describe what you know about plant growth.

What do you observe about the seed germination demonstration set-up?

Summarize class observations about plant growth from seed to small seedling. (Be sure to include important events such as watering or fertilization, as well as basic observations derived from your senses including touch, sight and smell.)

Based on your prior experience with plants and your observations about plant growth from the seed germination demonstration use the 4-Question Strategy described below to develop potential plant investigation questions. (Reproduced with permission from: Cothron, J. H., Giese, R. N., & Rezba, R. J. (2006). Students and Research: Practical Strategies for Science Classrooms and Competitions. Dubuque: Kendall/Hunt Publishing Company.)

1. What materials are readily available for conducting experiments on plants?
2. How do plants act? (What do they do?)
3. How can you change the set of plant materials to affect the action? (See 1.)
4. How can you measure or describe the response of plants to the change?

WhatDoPlantsNeedToGrow? - Student Worksheet 2 of 3

Plant-A-Plant



Develop Investigation Plan

The next step is to develop an investigation plan based on your research question.

Depending on your experience conducting experiments, your teacher may ask you to now develop your own investigation based on a teacher directed or a self-selected research question OR to review and then conduct an existing investigation. The following information will assist you in developing or reviewing your investigation plan.

First you will select one material to vary; this is the **independent variable** and will come from the list for question 3.

Then you choose which responses will be measured; these are the **dependent variables** and will come from the list for question 4. Dependent variables are called so because they are expected to vary with changes to the independent variable.

All other items from question 3 are **constants** and should be kept the same for each treatment type.

The **control** is the treatment that the other treatments will be compared to. The control is often the natural condition of the independent variable.

It is scientific practice to repeat each treatment and the control at least 3 times. These are known as **replicates** or repeated trials. Replicates are important because they reduce the effects of chance errors on the over all results. A greater number of replicates increases our confidence in the final results. (More replicates make it easier to see any results that deviate from the group and may be considered unreliable.)