

Title:

Purpose: The purpose of this research project is to determine the effects of elevated levels of sodium chloride (table salt) applied to the soil on the growth rate of soybean plants

Hypothesis:

SCIENCE FAIR  
 CORRELATION OF TITLE, PURPOSE, & HYPOTHESIS  
 WORKSHEET A-1

NAME \_\_\_\_\_  
 DATE \_\_\_\_\_  
 I.D.# \_\_\_\_\_  
 # CORRECT \_\_\_\_\_  
 # POSSIBLE \_\_\_\_\_  
 % CORRECT \_\_\_\_\_

#	Compare Each Group for Continuity	Explain Any Inconsistencies
1.	<b>Title:</b> The Effects of a High Sodium Diet on Exercise Activity in Mice	
	<b>Purpose:</b> The purpose of this experiment is to determine the effect of sodium on the concentration of potassium in the blood of mice.	
	<b>Hypothesis:</b> It is hypothesized that an increase in sodium in the diet of mice will cause an increase in heart rate.	
2.	<b>Title:</b> The Determination of the Effects of Sodium Chloride on Polyvinylchloride	
	<b>Purpose:</b> The purpose of this experiment is to determine the effects of salt on plastic materials.	
	<b>Hypothesis:</b> It is hypothesized that sodium chloride will cause galvanized pipe to rust.	
3.	<b>Title:</b> The Determination of the Strength of Wood Beam Thickness vs. Width	
	<b>Purpose:</b> The purpose of this experiment is to determine how the width and thickness of a wood beam affects its strength.	
	<b>Hypothesis:</b> It is hypothesized that beam thickness affects the strength of a beam more than its width.	
4.	<b>Title:</b> Which Glue Is Best?	
	<b>Purpose:</b> The purpose of this experiment is to determine which type of wood glue is best.	
	<b>Hypothesis:</b> It is hypothesized that highest priced glue will leave the least noticeable trace when it has dried.	
5.	<b>Title:</b> Which Brand of Monofilament Fishing Line Has the Greatest Tensile Strength?	
	<b>Purpose:</b> The purpose of this experiment is to determine which brand of monofilament fishing line has the greatest tensile strength.	
	<b>Hypothesis:</b> It is hypothesized that the brand of monofilament fishing line that has the longest chained polymer will have the greatest tensile strength.	
6.	<b>Title:</b> Which Brand of Laundry Detergent Removes the Most Soil from Blue Jeans?	
	<b>Purpose:</b> The purpose of this experiment is to determine which brand of laundry detergent will remove the most amount of soil from blue jeans.	
	<b>Hypothesis:</b> It is hypothesized that the laundry detergent with the greatest percentage of bleach will remove the greatest amount of soil from blue jeans.	

## Description

An industrial engineering research scientist is asked by her supervisor to determine which type of glue would be the best glue to use in their furniture manufacturing plant.

Answer the following questions concerning the research plan that scientist would develop to give to her supervisor.

When determining the best glue, what characteristics of the glue should be considered?

- a. drying time
- b. strength of glue bond formed
- c. cost of glue
- d. chemical composition
- e. density
- f. a, b, and c
- g. d and e

1. Which would be an example of a good title for this research?

- a. A Glue for You
- b. Determining the Fastest Drying Furniture Glue
- c. What Sticks and What Doesn't
- d. Where the Glue Meets the Wood
- e. Determining the Best Glue for Furniture Manufacturing

2. Which would be the best stated purpose of the research?

- a. The purpose of this research is to determine which glue is strongest?
- b. The purpose of this research is to determine which glue dries the fastest?
- c. The purpose of this research is to determine which glue bonds wood to wood surfaces most consistently.
- d. The purpose of this research is to determine which glue is most cost effective when used in furniture manufacturing.
- e. The purpose of this research is to determine which glue would have the best characteristics for use in furniture manufacturing.

3. Which would be the hypothesis that best relates to the purpose of the research?

- a. It is hypothesized that the glue A which contains a rubber cement base will be the best glue.
- b. It is hypothesized that glue B be the best glue.
- c. Glue C will be best.
- d.

DETERMINATION OF THE BEST BATTERY  
SCIENCE FAIR  
SIMULATION

NAME \_\_\_\_\_  
DATE \_\_\_\_\_  
I.D. \_\_\_\_\_

The following is a description of a researcher who has been asked to write a research plan to investigate a problem. After reading the description of the problem, you are to write a research plan that would investigate problem described. The research plan will include a title, purpose, hypothesis, procedure,

Description

A research scientist, Jim Anderson, works for a large company that uses several types of equipment that are powered by batteries. Although there are a few situations where the company can use rechargeable batteries, the majority of the situations require the use of disposable, non-rechargeable batteries. This situation thus makes purchasing the best battery an important financial decision. Jim has been asked to develop a written research plan for determining the best battery to be used in the company's equipment. The term best battery in this case would mean the brand of battery that provides a constant voltage of nine volts for the greatest amount of time at the lowest cost. The time in minutes that each brand of battery provides a constant 9 volts is to be included in the research. A minimum of 5 brands of 9 volt batteries are to be tested. Each brand of battery is to be tested 10 times.

Title

Purpose

Hypothesis

Procedure

Materials:

Steps:

## Description

The Stretch Wire Company has the opportunity to purchase a patent on a new type of metal alloy that could be used in the making of certain types of wire. An alloy is a mixture of two or more metals. Pam Williams, a research scientist at the company, has been asked to determine one of the physical characteristics of this new type of metal alloy. The physical characteristic to be tested is the tensile strength. Pam has submitted the following research plan to her supervisor for approval.

## Research Plan

Researcher: Pam Williams

Title: Determination of the Tensile Strength of 5 % Titanium-Steel Alloy

### A. Purpose

The purpose of this research is to determine the tensile strength of a 5 % titanium-steel alloy.

### B. Hypothesis

It is hypothesized that the 5 % titanium-steel alloy will have a greater tensile strength than an all-steel alloy, but less tensile strength than an all-titanium alloy.

### C. Procedure

#### Materials:

36 metal alloy rods; 12 of each type of alloy  
metric ruler  
force table

#### Steps:

1. Visually inspect 36 metal alloy rods, 12 rods of each type of alloy for imperfections: 12 - 5 % titanium-steel, 12 all-steel rods, 12 all-titanium rods.
2. The length of all 36 rods will be measured and recorded.
3. Each rod will be placed into a force table and stretched until the rod breaks. The force on the rod and the length of the rod when the force is applied in the force table will be the recorded as each rod is tested.
4. The data from each rod tested in the force table will be graphed.
5. The tensile strengths of each type of metal alloys will be averaged and compared.

## Questions

1. Did the research plan include replicate testing for each type of sample? If yes, how many replicates will be tested?
2. Did the research plan include control groups? If yes, which group or groups would be considered the control group or groups.

DETERMINATION OF THE BEST WICK MATERIAL  
FOR CANDLES  
SCIENCE FAIR  
SIMULATION

NAME \_\_\_\_\_  
DATE \_\_\_\_\_  
I.D. \_\_\_\_\_

The following is a description of a simulated situation in which a researcher has been asked to write a research plan to investigate a problem. After reading the description of the problem, you are to write a research plan that would investigate problem described.

Investigative Assignment

A research scientist, Jane Winston, is employed by a company that manufactures candles. The company is currently exploring using a different type of substance for wicks in its candles. There are 6 different types of substances that could be used as candle wicks. The best wick material would give the brightest flame, burn the longest, and has the lowest cost. Jane's supervisor request that she write a research plan to investigate the 6 types of candle wicking.

**Research Plan**

Title

Purpose

Description of Problem or Question (Minimum 200 words, Maximum 250 words)

Hypothesis

Procedure

Materials:

Steps:

DETERMINATION OF THE STRUCTURAL INTEGRITY OF  
2-LITER PLASTIC SOFT DRINK BOTTLES  
SCIENCE FAIR RESEARCH PLAN SIMULATION

NAME \_\_\_\_\_  
DATE \_\_\_\_\_  
I.D.# \_\_\_\_\_

The following is a description of a simulation in which a scientist has been asked to write a research plan to investigate a problem. After reading the investigative assignment of the problem, you are to write a research plan that would investigate problem described.

### Investigative Assignment

Many liquids we use in our everyday lives are packaged in plastic containers. As with any packaging material it is important that structural integrity of the container be such that it can withstand the dropping and crushing that these containers may experience under normal circumstances.

Materials scientist and engineer, Jim Austin, is employed by a quality control institute. Jim's supervisor has asked him to present a research plan for testing the structural integrity of three different types of 2-liter plastic used in the making of soft drink bottles. Structural integrity refers to how well a container resists breaking or fracturing when dropped from various heights with a fluid inside. It also refers to how well a material resists breaking or fracturing when placed under a force that creates increased internal pressure in the container.

### Research Plan

Title

Purpose

Description of Problem or Question (Minimum 200 words, Maximum 250 words)

Hypothesis

Procedure

Materials:

Steps:

SCIENCE FAIR  
CODING SYSTEM FOR TEST SPECIMENS

NAME \_\_\_\_\_  
DATE \_\_\_\_\_  
I.D.# \_\_\_\_\_  
# CORRECT \_\_\_\_\_  
# POSSIBLE \_\_\_\_\_  
% CORRECT \_\_\_\_\_

Consider the following:

A scientist, Sam Hutton, is asked by his supervisor to research the effects of a company's waste product on corn and soybean plants. The waste product is produced by the company for which the scientist works. The company is considering selling the waste product as nutrient to farmers in the surrounding area. The company needs to know if the waste product has any nutrient value to the type of crops grown by farmers in area. The waste product does contain two elements, nitrogen and potassium, that are considered important for plant growth in general.

The research plan that Sam submitted to his supervisor for this research has been approved. He is now ready to start setting up plants in test groups and control groups. He will be using 30 plants in each control group of corn and soybeans, and 30 plants in each test group of corn and soybeans. He will be using 3 test groups of corn and three test groups of soybeans.

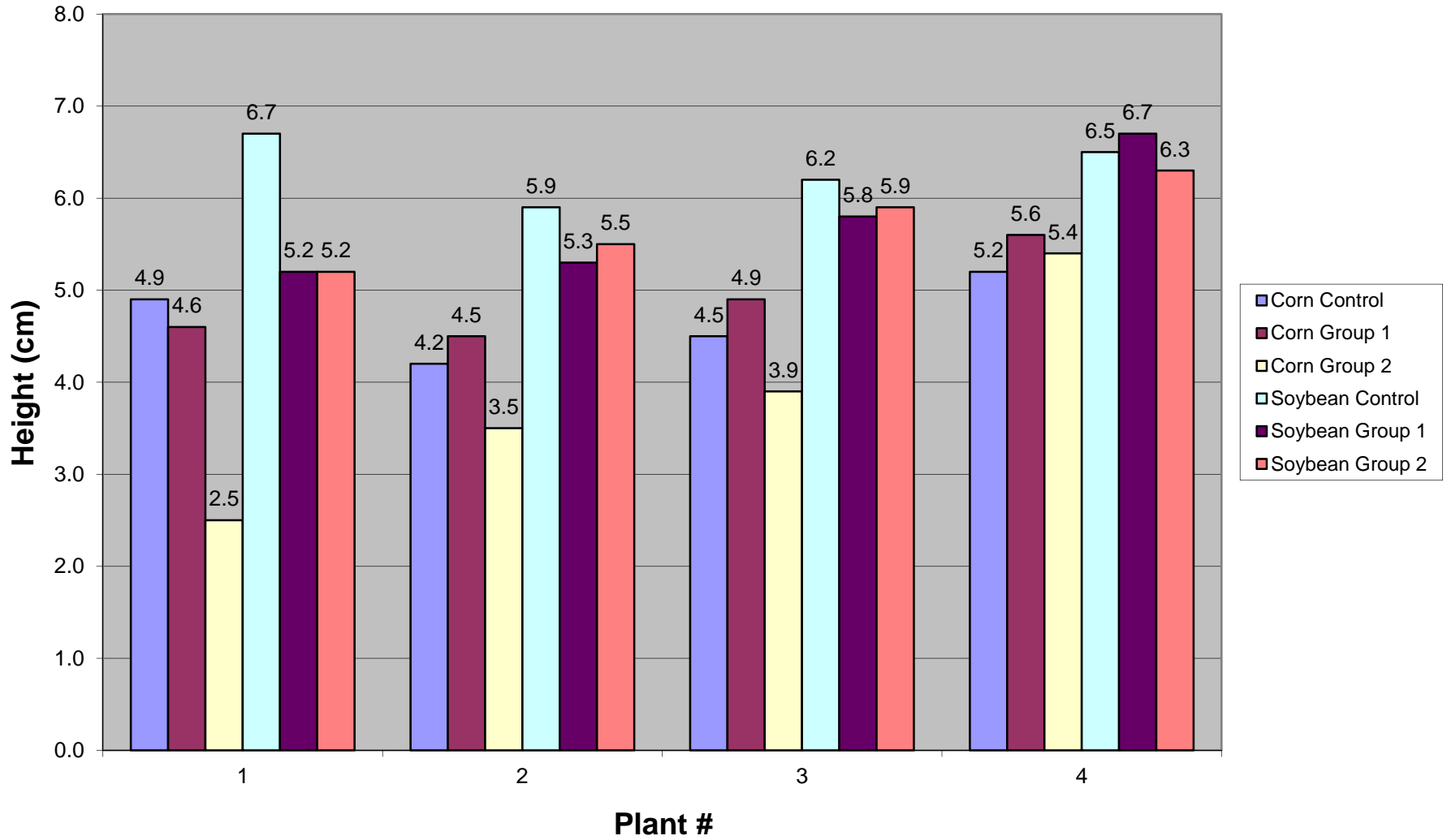
Including the plants in control group and all the test groups, how many plants total will be used in Sam's experiment?

\_\_\_\_\_

Sam now has to develop a labeling system for all of the plants used in his experiment. Often this process is referred to as "coding the specimens". Remember he has two control groups, one of corn and one of soybeans. He also has three test groups of corn and three test groups of soybeans. All of the control groups and the test groups have 30 specimens (plants) in them.



# Corn & Soybean Height Data - 5/7/2005



Affects of N on Corn  
Part A  
Simulation

Name \_\_\_\_\_  
Date \_\_\_\_\_  
I.D.# \_\_\_\_\_

A scientist decides to investigate how different amounts of nitrogen affect the heights of corn plants. All of the corn plants were taken from the same container of seed. Three test groups and a control group of corn plants were used. They were all grown in the same environment with the exception of the addition of nitrogen added to the water given to the test group plants A, B, and C. Test group A had a nitrogen solution of 1%, test group B had a nitrogen solution of 5%, and test group C had a nitrogen solution of 10%. The control group corn plants receive only water without nitrogen. There were 10 plants in each test group and 10 plants in the control group.

The following final plant height data in centimeters was recorded: test group A - plant 1, 12.3 cm, plant 2, 11.5 cm, plant 3, 13.7 cm, plant 4, 12.7 cm, plant 5, 12.1 cm, plant 6, 11.6 cm, plant 7, 10.4 cm, plant 8, 12.5 cm, plant 9, 13.1 cm, plant 10, 12.2 cm; test group B - plant 1, 11.3 cm, plant 2, 13.4 cm, plant 3, 11.6 cm, plant 4, 11.7 cm, plant 5, 12.9 cm, plant 6, 11.0 cm, plant 7, 11.9 cm, plant 8, 12.8 cm, plant 9, 11.1 cm, plant 10, 12.4 cm; test group C - plant 1, 12.4 cm, plant 2, 12.7, plant 3, 12.9 cm, plant 4, 13.6 cm, plant 5, 11.8 cm, plant 6, 13.2 cm, plant 7, 12.5, plant 8, 12.5, plant 9, 11.9 cm, plant 10, 13.5 cm; control group - plant 1, 11.4 cm, plant 2, 11.1 cm, plant 3, 11.7 cm, plant 4, 12.1 cm, plant 5, 11.3 cm, plant 6, 11.6 cm, plant 7, 12.2 cm, plant 8, 11.0 cm, plant 9, 12.3 cm, plant 10, 12.1 cm.

You are to construct a table for the height data of the corn plants grown in this experiment. Use MS Excel to make the table. Cells containing plant heights cannot include any letters or labels, only height numbers. In the table report the average, minimum, and maximum heights the corn plants in cm of test groups A, B, C, and the control group. Turn on the grid option so that the grid lines will appear on the hard copy. Also include a header with the usual information for classroom assignments in the upper right hand corner. Use "Affects of N on Corn - Part A Sim" for the assignment line. Column and row headers are to be included. Design a plant identification code for each plant that will be reported in the table. Consider that you have test groups A, B, C and a control group. In each group you have plants numbered 1 through 10. Design your plant identification code using these facts.

**PHYSICAL SCIENCE**  
**AFFECTS OF N ON CORN**  
**GRAPHING SCORE SHEET**

Student \_\_\_\_\_  
 Date \_\_\_\_\_  
 I.D. # \_\_\_\_\_  
 Student Checker \_\_\_\_\_

		Points Possible	Points Scored
Paper Heading			
	First & last name	1	
	Class	1	
	Assignment	1	
	Date Due	1	
	Period	1	
	I.D. #	1	
Group A Graph			
	Title	5	
	x-axis label	5	
	y-axis label ( w units)	5	
	Legend removed	5	
	Value at top of bars	5	
	Bar color black	5	
Group B Graph			
	Title	5	
	x-axis label	5	
	y-axis label ( w units)	5	
	Legend removed	5	
	Value at top of bars	5	
	Bar color black	5	
Group C Graph			
	Title	5	
	x-axis label	5	
	y-axis label ( w units)	5	
	Legend removed	5	
	Value at top of bars	5	
	Bar color black	5	
Group Control			
	Title	5	
	x-axis label	5	
	y-axis label ( w units)	5	
	Legend removed	5	
	Value at top of bars	5	
	Bar color black	5	
	Total Poss./ Points Scored =	126	

Science Fair Simulation  
Expired Soda  
D#040601.SFSIM1

Name \_\_\_\_\_  
Date \_\_\_\_\_  
I.D.# \_\_\_\_\_  
# Correct \_\_\_\_\_  
# Possible \_\_\_\_\_  
% Correct \_\_\_\_\_

### Description

A research scientist is assigned the task of determining the effect of various carbonated soft drinks on plants and soil. The company that the scientist works for has received a request by two soft drink companies concerning the dispose of several thousand gallons of carbonated soft drinks. The expiration date for these carbonated soft drinks has passed and the drinks can no longer be marketed to consumers. Each company has tested the carbonated soft drink solutions and has certified that there has been no chemical change in the solutions of soft drinks. The companies involved are considering giving the outdated carbonated soft drink solutions to farmers to apply to the fields in which they will be raising corn and soybeans. This material would be applied to crops after they had emerged from the ground and reached a height of 50.8 centimeters.

### Assignment

You are to write a research plan that the scientist would submit to his or her research supervisor. A research plan includes:

Title  
Purpose  
Hypothesis  
Procedure  
Bibliography

The following directions will guide you through the steps needed to develop the research plan.

### **Title**

Write three different titles that might be used for this research plan. Keep in mind that a title should inform the reader of the research plan what is going to be researched and how it will be researched.

**Although the title of a research plan is the first item, it is suggested that you complete other parts of the research plan first before developing the three possible titles.**

(1) \_\_\_\_\_

(2) \_\_\_\_\_

(3) \_\_\_\_\_

**Purpose**

The purpose of a research plan is given in a sentence stating what will be determined by the research. Write three different sentences stating a three different possible purposes for this research plan.

(1) \_\_\_\_\_

\_\_\_\_\_

(2) \_\_\_\_\_

\_\_\_\_\_

(3) \_\_\_\_\_

\_\_\_\_\_

**Hypothesis**

The hypothesis of a research plan states what the researcher thinks or guesses will happen. You are to state three different possible hypotheses for this research. Each hypothesis should be a single, complete sentence.

(1) \_\_\_\_\_

\_\_\_\_\_

(2) \_\_\_\_\_

\_\_\_\_\_

(3) \_\_\_\_\_

\_\_\_\_\_

**Procedure**

To development a procedure for this research plan, answer the following questions.

1. What types of plants should be used in this experiment?

\_\_\_\_\_

\_\_\_\_\_

2. Should a control group be used in this experiment? If yes, describe the conditions to which the control group will be exposed.

Should a control group be used? \_\_\_\_\_

Describe conditions for control group.

\_\_\_\_\_

3. At what height in inches should the plants be when starting the experiment? (1 in = 2.54 cm)

\_\_\_\_\_

4. How many of each type of plant should be used in:

(1) Experimental groups (receive experimental variable, in this case the soda)

(a) corn (total number in experimental group) = \_\_\_\_\_

# Pop A = \_\_\_\_\_

# Pop B = \_\_\_\_\_

# Pop C = \_\_\_\_\_

# Pop D = \_\_\_\_\_

(b) soybeans (total number in experimental group) = \_\_\_\_\_

# Pop A = \_\_\_\_\_

# Pop B = \_\_\_\_\_

# Pop C = \_\_\_\_\_

# Pop D = \_\_\_\_\_

(2) Control groups (do not receive experimental variable, in this case the soda)

(a) corn (total number in control group) = \_\_\_\_\_

(b) soybean (total number in control group) = \_\_\_\_\_

## 5. What quantities will the researcher measure?

When the researcher conducts the experiment, what quantities should be measured? Remember that quantities must be measured in terms of numbers. During experiments scientists need to have objective measurements, not subjective measurements. Subjective measurements are approximations whereas objective measurements are compared to a standard. For example if someone stated that a 2" x 4" board was as long as a car that would be a subjective measurement. On the other hand if someone used a tape measure and stated that the board was 11 feet 5 inches in length that would be an objective measurement. Choose quantities that can be measured objectively, not subjectively.

What quantities should be measured?

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## 6. What units would be appropriate for the quantities being measured?

After you have chosen the quantities that will be measured, you need to consider in what units these quantities will be measured. If you have chosen length as a quantity to be measured during the experiment, what units would be appropriate? Remember that quantities are items such as length, weight (or mass), and time. Units for length could be feet or meters. Units for weight or mass could be pounds or kilograms. Units for time could be seconds, minutes, hours, or days. It is important to choose appropriate units for the size of the item being measured. If you are measuring the height of a small plant, inches or centimeters are appropriate. Feet, yards, meters, miles, or kilometers would not. Also scientists prefer to use the metric system of units when making measurements. If this is not possible to take a metric measurement during the experiment, English units may be converted to metric units later.

What would be the appropriate units for the quantities measured in the experiment?

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## 7. How often should the plants be measured for these quantities?

The data that is generated during the experiment is collected over a period of time. The length of time depends on the type of subject that is being tested. Many bacteria typically show results in hours to a few days. Some plants show significant changes in a day, others take months. Chemical reactions can happen in seconds, fractions of a second, or hours. Remember that more the data points that are collected the clearer the picture becomes as to what happened during the experiment.

How often should the plants be measured for these quantities?

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## 8. What types of graphs should be used to show the data from the experiment?

Graphing of data from an experiment gives the fastest and clearest way of seeing patterns or trends. The choice of graph style or format is important. Not all graphs are appropriate for all types of data. For example if you were going to graph the heights of plants over a period of time, you might use a bar graph or a line graph. If you think about how a plant grows it does not jump from one height to another. It actually grows continuously over time, sometimes faster, sometimes slower. While a bar graph shows the height of a plant at a specific time, a line graph implies a continuous change in height. Therefore a line graph would best represent the situation. Other graph types such as pie graphs are used mainly when data is analyzed from a percent of the whole set of data. For example, if you were analyzing how many soybean seeds germinated compared to how many seeds did not. A pie graph would be very useful in this situation.

What types of graphs should be used to show the data from the experiment?

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## 9. Write the detailed procedure to be used.

Now write a detailed procedure that would be used by the researcher to do the experiment. Use as many sheets of your loose leaf notebook paper as needed. Write this in a step by step manner. It is strongly suggested that you use a word processing software program to “brain-storm” a procedure. Simply start by typing a step you feel should be included in the procedure. Do not worry about sentence structure at this point. Also do not number the steps until you are very sure you are done, otherwise you will have to renumber all of your steps when you add another step between two already existing steps. However, when you are done number all the steps of your procedure.

Write entire procedure on your own notebook paper.

**Bibliography**

The bibliography is a list of sources that have been examined and aided in developing the research plan. You will not need to include a bibliography for this simulation. However, when you write a research plan of your own you must include at least three sources in your bibliography. If your research is going to include vertebrae animals, you must have at least a fourth source that gives instructions on how feed and care for the type of animal you are working with.

7.	<p><b><u>Title:</u></b> The Determination of the Fastest Dissolving Pain Killer</p> <p><b><u>Purpose:</u></b> The purpose of this experiment is to determine which pain killer is least acidic.</p> <p><b><u>Hypothesis:</u></b> It is hypothesized that the pain killer with the least amount of inert ingredients by mass will relieve pain in the least amount of time.</p>	
8.	<p><b><u>Title:</u></b> How Is the Diameter of a Tree Related to Its Height?</p> <p><b><u>Purpose:</u></b> The purpose of this experiment is to determine what, if any, relationship exists between the diameter of a tree and its height.</p> <p><b><u>Hypothesis:</u></b> It is hypothesized that a tree's diameter will increase proportionately with an increase in height.</p>	
9.	<p><b><u>Title:</u></b> Will a Magnetic Field Affect the Growth Rate of Corn Plants?</p> <p><b><u>Purpose:</u></b> The purpose of this experiment is to determine if a magnetic field will cause plants to grow taller than plants which are not in a magnetic field.</p> <p><b><u>Hypothesis:</u></b> It is hypothesized that plants growing in a magnetic field will grow faster than plants that are not in a magnetic field.</p>	
10.	<p><b><u>Title:</u></b> The determination of acids and bases on the freezing point of water</p> <p><b><u>Purpose:</u></b> The purpose of this experiment is to determine the effects of different concentrations of different acids and bases on the freezing point of water.</p> <p><b><u>Hypothesis:</u></b> It is hypothesized that acids will dissolve in water more quickly than bases.</p>	