Problem Solving in Science

I. Everyday Problem Solving

Assume one evening you go into your living room and you turn the lamp switch to the on position. The lamp does not light. Note that with your sense of sight you observed that the light bulb did not go on. This created a problem that you now must solve.

A. What do you think is the cause of the lack of light?

B. What would you do to solve this problem?

C. What would you do next if the above practice did not solve the problem?

D. Describe the method or process that you are using to solve this problem.

II. Solving Problems in Science

A. Read the following paragraph and then answer the questions.

Farmer Jones has two large pastures, pastures A and B. One summer he decides to let his cows graze on pasture B. While the cows graze, they produce fecal droppings (solid wastes) on the pasture. During the course of the summer he observes that the grass in this pasture is thicker, greener, and longer. He read in the recent newspapers that horticulturists were very interested in improving the growth of lawns on Long Island. So farmer Jones decides to notify the scientists from the Horticultural Society. The scientists arrive at the farm, observe the two pastures, and collect data. Assume that you are one of the scientists who has to find out what was the cause of the better growth of grass in pasture B.

1. *Observations*

a. Describe what you observed.

b. Define the term, "OBSERVATIONS".

2. ***Problem Statement***

a. Describe the problem you had to solve.

b. State the problem as a question.

c. Define the term, "PROBLEM".

3. Hypothesis

a. State a possible explanation that would explain the difference in the growth of the grass in pasture B.

b. Define the term, "HYPOTHESIS".

A Check for Understanding

Directions: For each of the following observations, state the problem as a question, and state a relevant hypothesis.

Observation 1: One day while walking home John notes that the grass under the shady tree does not grow as well as the grass in the sun.

a. State the problem.

b. State the hypothesis.

Observation 2: One evening several patrons of a Taco Bell got terrible stomach cramps and bloody diarrhea after eating some beef tacos.

a. State the problem.

b. State the hypothesis.

4. Variable

a. As the scientist, what did you identify as the cause of the better growth of the grass in pasture B?

b. What did you select to study as the causative agent?

c. Define the term, "VARIABLE".

5. Control Group (Pasture A)

a. Describe the natural setting of pasture A.

b. Define the term, "CONTROL GROUP".

6. Experimental Group (Pasture B)

a. Explain why pasture B is the "study group or experimental group".

b. Define the term, "Experimental Group"

c. State the one major difference between pasture A and B.

A Check for Understanding

<u>Directions</u>: In each statement identify the variable, the control, and the variable groups.

1. To test the effect of smoking on lung on lung disease two groups are formed – group of smokers, and a group of nonsmokers.

Variable = _____ Control Group = _____ Variable Group = _____

2. ***To test the effect of fluoride on the prevention of tooth decay, the scientists created Group 1 that used Colgate toothpaste with flouristan, and group II with plain Colgate toothpaste.***

Variable = _____ Control Group = _____ Variable Group = _____

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7. Control Factors

a. In order to ensure that you can arrive at a cause and effect relationship, list the conditions that must be kept the same in both pastures.

b. Define the term, "CONTROL FACTORS".

c. To ensure a cause and effect relationship in the toothpaste groups above, list the control factors that must be kept the same in both groups.

8. Controlled Experiment or Test

a. Describe in detail how would you conduct your test or experiment to ensure that you can arrive at a cause and effect relationship in pasture B.

b. Define the term, "CONTROLLED EXPERIMENT".

9. Conclusion

a. As a result of your controlled experiment, state your findings.

b. Define the term, "CONCLUSION".

II. The Scientific Method

A. Compare the method you used to solve your lamp problem and to solve the problem of the greener grass in pasture B

B. Explain the advantage of using a logical, sequential, method of problem solving.

C. Arrange each of the following steps in a logical sequence.

_____ Identify the variable

_____ State the hypothesis

_____ State the problem

_____ Make observations

_____ State the conclusion

_____ Establish the control and variable groups

_____ Perform the controlled experiment

D. Define the term, "Scientific Method".

E. List in sequence the major steps or parts of the "Scientific Method".

Scientific Method Homework

IV. Create a problem that must be solved scientifically.

1. State your observations:

2. State your problem:

3. State your hypothesis:

4. Identify your variable:

5. List your control factors:

6. Outline your controlled experiment and identify the experimental and control groups.

7. State your conclusion.

Name: _____ Per: _____ Date: _____

Experimental Design Worksheet

DIRECTIONS: Design a controlled experiment based on your question.

Problem:

Hypothesis:

Variable:

Independent Variable: **Dependent Variable:**

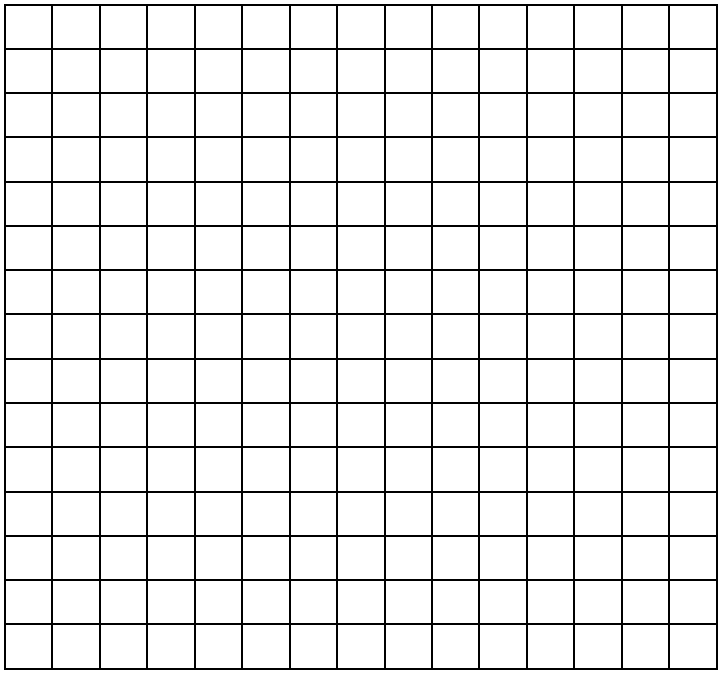
Experimental Set-up

Group A: _____	**Group B: _____**
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•

<u>Control Factors</u>:

<u>Data</u>: Create a data for the above experiment.

Label the X and the Y axis on the graph below according to your data table.



1) **What is the effect of water temperature on the respiratory rate of goldfish?**

2) **What is the effect of caffeine on urine production?**

3) **What is the effect of pH on the growth of bacteria colonies?**

4) **What is the effect of fertilizer on the average height of corn plants?**

5) **What is the effect of exercise on heart rate?**

6) **What is the effect of ultraviolet light on the growth of bacteria colonies?**

7) **What is the effect of high fiber vitamins on the production of milk in cows?**

8) **What is the effect of iron on the average mass of lettuce heads?**

9) **What is the effect of sunlight on the average height of tomato plants?**

10) **What is the effect of salt on the cell size of Elodea plants(aquatic plant)?**