* A **hypothesis** is a proposed explanation for a natural phenomenon. A **prediction** is a statement of what one expects to observe in a specific situation. A **null hypothesis** specifies what we should observe when the hypothesis being tested is wrong.
* There are several types of **variables**. Factors that are kept the same in experimental and control treatments—and which might affect the result—are called **controlled variables**. The variable that you manipulate—the one that differs between experimental and control groups—is the **independent** (or explanatory) variable. The independent variable is the factor that you think is driving change in a **dependent** (or response) variable.

1. You are given the data from Experiment #1 shown below. Each test group included 10 poppies of the same species, germinated in the same type of soil in a greenhouse. Plants were grown under controlled temperature conditions. The experiment was repeated three times with equivalent results.

**Experiment #1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | Test Group 1 | Test Group 2 | Test Group 3 | Test Group 4 |
| Water | 10 ml | 10 ml | 5 ml | 5 ml |
| Sunlight | 8 hours | 12 hours | 8 hours | 16 hours |
| Fertilizer | 10 grams | 20 grams | 20 grams | 20 grams |

Results of Experiment:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Average growth of poppies per day | 0.5 cm | 1 cm | 1 cm | 1 cm |

* How many poppies were included in each test group in Experiment #1? \_\_*\_\_\_\_\_\_\_\_*\_\_\_\_\_\_\_ (this is **the sample size**)
* Why is sample size important?
* What variable was being measured in Experiment #1? \_\_\_\_\_\_*\_\_\_\_\_\_*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* How was this variable measured? \_\_\_\_\_\_\_\_\_\_\_\_*\_\_\_\_\_\_\_\_*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* How many times was the experiment repeated? \_\_\_\_\_\_\_\_\_\_
* Why do you think the experiment was repeated?
* Aside from the variables listed in the table, what additional variables were controlled?
* Why was it important to control these other variables?
* Can Experiment #1 be used to test the statement “the amount of sunlight poppies are exposed to influences their growth rate”? (circle one) YES NO

|  |  |
| --- | --- |
| **If YES**,  1) State which test groups should be compared to test this statement : Test group # \_\_\_\_\_ and Test group # \_\_\_\_\_  2) For the test groups you compared, list the following:  Independent variable: \_\_\_\_\_\_*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*\_\_\_\_  Dependent variable: \_\_\_\_\_*\_\_\_\_\_\_\_\_\_\_\_\_\_\_*\_\_\_\_\_\_\_\_\_\_\_\_  3) Explain whether the results support or refute the statement and why | **If NO**, explain why not, and describe the experiment you would need to perform in order to test this statement. |

* Are there any other conclusions about poppies that can be made based on the data shown in the table? Explain.

2. You are given the data from Experiment #2 shown below. Each test group included 10 poppies of the same species, germinated in the same type of soil in a greenhouse. Plants were grown under controlled temperature conditions. The experiment was repeated three times with equivalent results.

**Experiment #2**

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | Test Group 1 | Test Group 2 | Test Group 3 |
| Water | 5 ml | 5 ml | 10 ml |
| Sunlight | 8h | 16h | 16h |
| Fertilizer | 10 grams | 20 grams | 10 grams |

Results of Experiment:

|  |  |  |  |
| --- | --- | --- | --- |
| Average growth of poppies per day | 0.5 cm | 1 cm | 1 cm |

Can Experiment #2 be used to test the statement “the amount of sunlight poppies are exposed to influences their growth rate”? (Circle one) YES NO

|  |  |
| --- | --- |
| **If YES**,  1) State which test groups should be compared to test this statement : Test Group # \_\_\_\_\_ and Test Group # \_\_\_\_\_  2) For the test groups you compared, list the following:  Independent variable: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*\_\_*\_\_\_\_  Dependent variable: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  3) Explain whether the results support or refute the statement and why | **If NO**, explain why not, and describe the experiment you would need to perform in order to test this statement. |

* Are there any other conclusions that can be made based on the data shown? Explain.

3) Write down the five steps of the scientific method in order and explain why these steps should be linked as a circle rather than as a straight line.

4) After reviewing the recording on Facts, Hypotheses, Scientific Laws and Scientific Theories, explain how to distinguish each of these terms from each other.

5) Explain why a hypothesis can never be proven.

6) If a hypothesis is tested a number of times and supported each time, the best term to describe the “correctness” of that hypothesis is\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

7) If a hypothesis is tested and found to be incorrect, then we say that the hypothesis has been \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .