# (Exercise 1) Before you arrive for the *Scientific Method: The Process of Science* lab exercise, please

# 1. Read the lab thoroughly. Note all safety guidelines.

**2. Answer these preparatory questions:**

**What safety procedures must you follow during this lab period?**

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**What is science?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Are scientists the only people who use the scientific method? Explain your answer.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Briefly describe a current event or new finding that used the scientific method.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Give an example of a question that cannot be answered using the scientific method.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Consider the following broad statement: *Groups of tadpoles of the same species reared in the lab may have significantly different average weights.***

**Narrow the above statement to a more precise, insightful observation that could be tested. Include factors that you think might affect the sizes of tadpoles in the lab.**

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**What should be considered when formulating a useful hypothesis?**

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**What is a null hypothesis?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Why is it important to formulate a null hypothesis?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Why is it important to vary only one variable when comparing the control and experimental groups in an experiment?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Imagine that you want to compare a new diet for tadpoles that are reared in the laboratory to the traditional laboratory diet of boiled lettuce. You want to determine if the new diet will increase the average weight of the tadpoles. The new diet is a meat-based food. In your experiment you keep all other factors, such as tadpole density, temperature, pH, and the amount of food, constant. The only difference between your control and experimental groups is the type of food the tadpoles receive.**

**Write a null hypothesis for this experiment:**

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**Write an alternate hypothesis for this experiment:**

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**What is the independent variable?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**What is the dependent variable?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Would you want to test only one pan of tadpoles fed lettuce, and only one pan of tadpoles fed meat? Why or why not?**

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**After you completed your experiment, you weighed each tadpole and collected the following data. For ease of calculation, this example will utilize only a few tadpoles from each type of diet.**

**The tadpoles described in this table were fed boiled lettuce.**

|  |  |  |
| --- | --- | --- |
| **Tadpole Weight (mg)** | **Deviation** | **Deviation2** |
| **35.24** |  |  |
| **42.98** |  |  |
| **43.44** |  |  |
| **40.56** |  |  |
| **40.87** |  |  |
| **39.12** |  |  |
| **39.15** |  |  |
| **39.19** |  |  |

**Mean Weight of Tadpoles\_\_\_\_\_\_\_\_\_\_\_ Sum\_\_\_\_\_\_\_\_\_\_\_\_**

**Calculate the mean of this sample. Record it above.**

**Calculate the deviation for each tadpole.**

**Remember that deviation = tadpole weight - mean**

**Square each deviation, then sum all of the squared deviations. Record it above.**

**Calculate the variance for this group and record it here:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Remember that variance = sum of squared deviations/n-1**

**Calculate the standard deviation of this group and record it here:\_\_\_\_\_\_\_\_\_\_**

**Remember that standard deviation = √ variance**

**The tadpoles in this table were fed a meat-based diet.**

|  |  |  |
| --- | --- | --- |
| **Tadpole Weight (mg)** | **Deviation** | **Deviation2** |
| **55.99** |  |  |
| **56.45** |  |  |
| **58.67** |  |  |
| **56.15** |  |  |
| **58.56** |  |  |
| **60.43** |  |  |
| **59.11** |  |  |
| **61.33** |  |  |

**Mean Weight of Tadpoles\_\_\_\_\_\_\_\_\_\_\_ Sum\_\_\_\_\_\_\_\_\_\_\_\_**

**Calculate the mean of this sample. Record it above.**

**Calculate the deviation for each tadpole.**

**Square each deviation, then sum all of the squared deviations. Record it above.**

**Calculate the variance for this group and record it here:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Calculate the standard deviation of this group and record it here:\_\_\_\_\_\_\_\_\_\_**

**How would you determine if the type of diet significantly affected tadpole size?**

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**In general, what does it mean if we say that a control group is significantly different from a treatment group?**

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