Notes

Pseudoscience –

Science –

Rules of science:



Branches of science:

* Physics –
* Chemistry –
* Earth Science –
* Astronomy –
* Biology –

Integrated Science –

Scientific Method –

1. Observation –

* Qualitative data -
* Quantitative data –

1. Problem –
2. Hypothesis –
3. Look for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that will help you make predictions about the problem
4. Break the problem \_\_\_\_\_\_\_\_\_\_\_ into smaller, \_\_\_\_\_\_\_\_\_\_\_\_\_\_ problems
5. Must be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Prediction – predict consequences that can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ if the hypothesis is correct
7. Test predictions – do \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to see if consequences you predicted are present
8. Draw conclusion – make a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ based on the information obtained

Experimental design concepts

A science experiment is designed so that only \_\_\_\_\_\_\_\_\_ variable is being tested at a time. A

\_\_\_\_\_\_\_\_\_\_\_\_ is something that is \_\_\_\_\_\_\_\_\_\_\_\_\_ to study how this change affects the thing being studied. By changing only one variable, when you make your conclusion you can be assured that it is only that one variable that is causing the \_\_\_\_\_\_\_\_\_\_\_\_.

1. Independent variable (IV) - the variable that is purposely \_\_\_\_\_\_\_\_\_\_\_\_\_\_ by the experimenter.
2. Dependent variable (DV) - the variable that \_\_\_\_\_\_\_\_\_\_\_\_and is the variable \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
3. Constant (C) - all factors that are kept the \_\_\_\_\_\_\_\_\_\_\_\_\_ during the experiment.
4. \_\_\_\_\_\_\_\_\_\_\_\_ - the standard to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the experimental effect against.
5. Repeated trials - the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of objects/organisms undergoing treatment for each value of the independent variable, or the number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the experiment is repeated.

**Scenario One:** The amount of vitamin C in orange juice.

**Description:** Erica’s chemistry class was studying a unit on acids and bases. They investigated the amount of absorbic acid (vitamin C) in a solution. Erica’s laboratory group decided to experiment with the amount of vitamin C in types of orange juice. The types of orange juice they experimented with were fresh, frozen, and bottled. They collected 100 mL of fresh squeezed juice. They mixed up 100 mL of frozen juice as directed on the package. They purchased 100 mL of orange juice from the vending machine in the cafeteria. Using an established procedure, the students measured the milligrams of absorbic acid in each sample of juice.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Problem: | | | | |
| Possible Hypothesis: | | | | |
| IV: | | | | |
| Treatment: |  |  |  |  |
| # of Trials: |  |  |  |  |
| DV: | | | | |
| Constants: | | | | |

**Ways that the experiment could have been improved?**

**Scenario Two:** The effectiveness of water sealants

**Description:** Jake’s family had recently built a new deck for a hot tub. He wondered which brand of water sealant would best protect the wood decking from absorbing water splashed from the hot tub. Jake performed a test by cutting small blocks from the decking material. He dipped two blocks in each of one of three major brands of sealant and allowed it to dry for two days. He massed each block. Jake placed the blocks in hot tub water overnight. He massed each block again, finding the difference in the masses (grams). He concluded the difference was the amount of water absorbed.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Problem: | | | | |
| Possible Hypothesis: | | | | |
| IV: | | | | |
| Treatment: |  |  |  |  |
| # of Trials: |  |  |  |  |
| DV: | | | | |
| Constants: | | | | |

**Ways that the experiment could have been improved?**

**Scenario Three:** The rate of a metal reaction is affected by the concentration of acid.

**Description:** Susan found that magnesium reacts with hydrochloric acid. She observed that the metal

disappears as the acid reacts with it. She found that many bubbles were released as the reaction happened. She wondered if changing the concentration (strength) of the acid would affect how fast the reaction occurred. Susan prepared five concentrations of hydrochloric acid, .25M, .5M, 1M, 2M, 4M**.** She placed a piece of magnesium in each concentration and described the intensity of the reaction as fast, moderate, or slow. She also recorded color changes in the metal as the reaction occurred. She repeated the procedures four times for each concentration of acid.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Problem: | | | | |
| Possible Hypothesis: | | | | |
| IV: | | | | |
| Treatment: |  |  |  |  |
| # of Trials: |  |  |  |  |
| DV: | | | | |
| Constants: | | | | |

**Ways that the experiment could have been improved?**

**Scenario Four:** Which kind of metal gives the most voltage in a battery?

**Description:** Tyler was studying batteries. He discovered that a battery works as electrons flow between two dissimilar metals through a solution. He wanted to find out what common metal combinations would give him the highest voltage measurements. He decided to test copperiron,

copperaluminum, copperzinc, ironaluminum, and ironzinc. He cut out strips of various sizes of the metals. Tyler prepared three different weak salt solutions. He placed each pair of metals into 50 mL of the solutions and measured the voltage produced, using a voltmeter. Tyler conducted three trials in each of the three different solutions with each pair of metals.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Problem: | | | | |
| Possible Hypothesis: | | | | |
| IV: | | | | |
| Treatment: |  |  |  |  |
| # of Trials: |  |  |  |  |
| DV: | | | | |
| Constants: | | | | |

**Ways that the experiment could have been improved?**

Other terms and definitions

Theory – a well \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ hypothesis, explains \_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_

things happen, can change

–Example:

Facts -- Data or \_\_\_\_\_\_\_\_\_\_\_\_\_\_ that can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ repeatedly

–Example:

Inference -- A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ drawn on the basis of \_\_\_\_\_\_\_\_\_\_\_\_

Law -- A general statement that explains \_\_\_\_\_\_\_\_\_\_\_ will happen, usually does

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

–Example:

Superstition -- A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that is NOT based on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

–Example: