Unit 1B: Experimental Design

E.Q.: How is science different from other fields of study?

What is Science?

Neil Degrasse Tyson says it best…..

Science in America - Neil deGrasse Tyson

https://www.youtube.com/watch?v=8MqTOEospfo

What is Science?

https://www.youtube.com/watch?v=Tmb1c3BGQuM

Part 1. What is science?

- Science is a process based on inquiry that helps develop explanations about events in nature.
- It is systematic, which means it follows an order and steps.

Why is Science Important?

*The study of science leads to new discoveries that help make our lives:

- More productive
- More efficient
- More convenient
- More entertaining
- Healthier / Live longer

WHO REMEMBERS?

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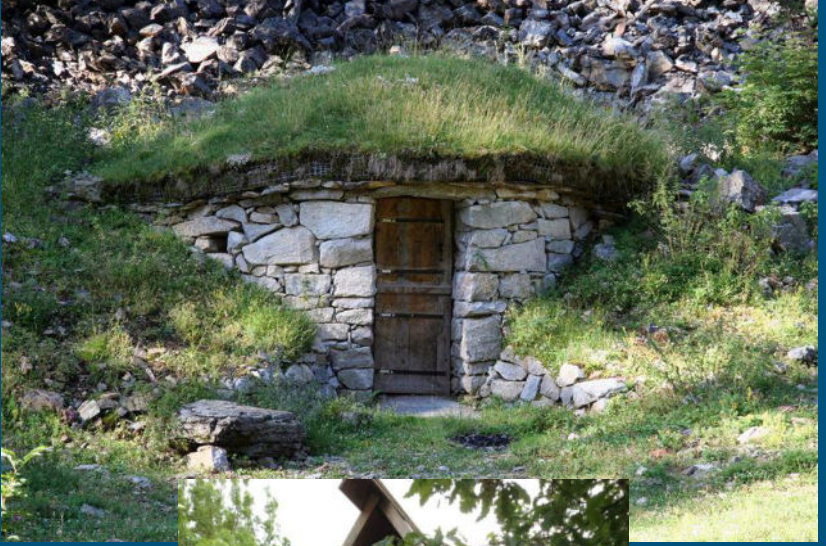
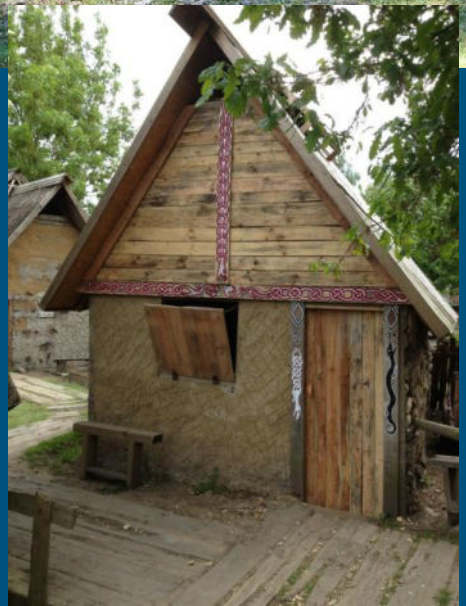




What are the Major Categories of Science

- Life Science: Deals with living things
- Earth Science: Investigates Earth and space
- Physical Science: Studies matter and energy

The Scientific Method

Name 3 things you KNOW about the scientific method.

What steps do scientists follow when they are conducting an investigation?

The scientific methods: A general set of steps that scientists follow to test ideas.

What are the Steps to the Scientific Methods?

- State the problem in the form of a question
- Research the answer to the question
- State the Hypothesis in the form of if, then, because
- List material with amounts and types: be specific
- List procedures: in the correct order. Try to start each step with a verb
- Analyze the data
- Draw Conclusions:
  - If the hypothesis is supported repeat the steps several times
  - If the hypothesis is not supported, modify the hypothesis and test again.

What are the variables in an experiment?

There are usually two types of variables in an experiment:

- Independent Variable: The variable that is purposely changed or manipulated in the experiment. Also known as the test variable or the cause. Ex. The amount of fertilizer used on the plant.

- Having only one independent variable increases validity

- Dependent Variable: The outcome of the experiment. EX. How tall the plant grew. Also known as the responding variable and the thing that was affected.

What are Constants or Controlled Variables?

These are variables that must stay the same in every experiment when it is repeated and replicated. Ex.: Size of the pot the plant is in. The same type of plant used. The same soil. The same amount of water and sun.

What is the Control Group?

The control group is the group used for comparison. It is typically what normally happens without using a test variable. Ex.: The plant that is grown in the same conditions but without fertilizer. Fertilizer is the I.V., therefore, we need to compare it to the control group, the group that does not receive fertilizer.

What's the difference between an investigation and an experiment?

An investigation is something a scientist does in order to learn new information such as classify, research, observing, and sometimes may use an experiment.

An experiment is the proof or testing of an idea to support an answer to a question. Ex. Testing the effect of fertilizer on plant growth.

How to Write a Hypothesis?

- The hypothesis is written as an if, then, because statement. Where the because statement has been researched. The hypothesis should answer your question or problem.

  Example:

- If the plant receives fertilizer,
- Then it will grow taller,
- Because fertilizer uses nitrogen which helps the plant in photosynthesis, while the phosphorus helps the plant to store and use energy, and the potassium in fertilizer will enhance the enzyme activation.

What is a Bias?

Bias occurs when the scientist's expectations changes how the results are analyzed or the conclusions are made. Scientists strive to be non biased so their opinions and ideas don't affect the outcome of an investigation.

Repetition vs. Replication

Repetition: Making multiple trials in an experiment. The scientist repeats the experiment. This assures accuracy of the data.

Replication: A different scientist replicates the experiment exactly as it was done before. They should get the same results.

What is Psuedoscience?

A collection of beliefs or practices mistakenly regarded as being based on scientific methods. Many of these have been passed down for so long we believe them to be scientific, but they do not use the scientific methods and are not based on scientific evidence.

EX.: Palm Reading

What are examples of pseudoscience?

palm reading, astrology and zodiac signs, magnet bracelet therapy, crystal therapy, mood oils

https://www.youtube.com/watch?v=xDl1En6N14A
https://youtu.be/rPmLPU08ZbU

https://www.youtube.com/watch?v=gC_qoRjzQaA

Science	Pseudoscience
Willingness to change with new evidence	Fixed ideas
Ruthless peer review	No peer review
Takes account of all new discoveries	Selects only favourable discoveries
Invites criticism	Sees criticism as conspiracy
Verifiable results	Non-repeatable results
Limits claims of usefulness	Claims of widespread usefulness
Accurate measurement	“Ball-park” measurement

In your own words, why is science important?

Students, write your response!

Which type of science would expect to learn about rocks?

Students choose an option

Which type of science would you expect to learn about chemistry?

Students choose an option

Kamal wanted to know which frisbee design would fly the furthest. He had a round disc, a round disc with holes in it, and a disc made from lead. What is the I.V?

Students, write your response!

Kamal wanted to know which frisbee design would fly the furthest. He had a round disc, a round disc with holes in it, and a disc made from lead. What is the D.V?

Mr. McLeod wasn't quite sure of Mrs. Whitten's results so he did her experiment for himself. This was an example of

Make an if, then, because hypothesis for the following problem/question?

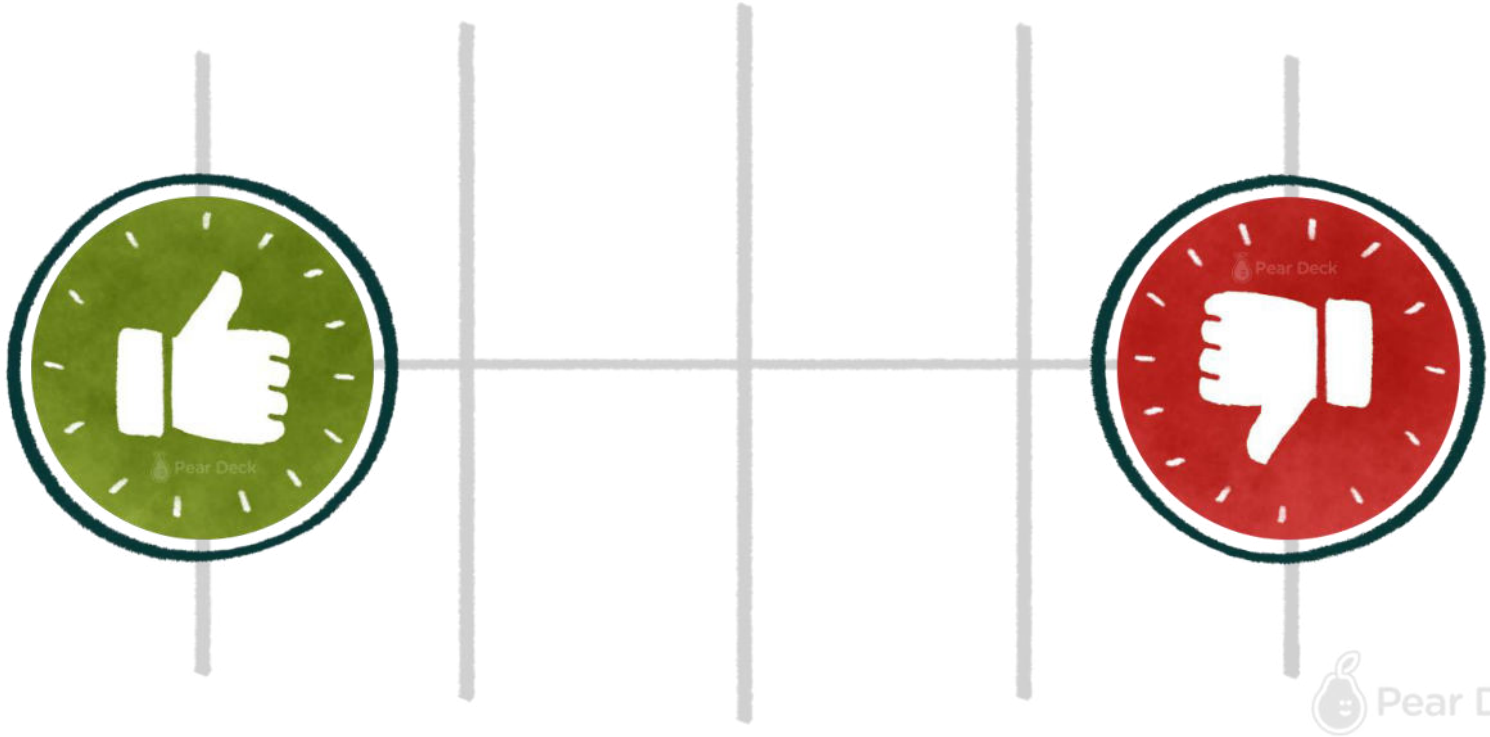
Does hot water or cold water freeze faster?

Students, write your response!

Summarize how you believe that science is different from other fields of study.

If you still have questions, highlight the top 3 that you have, in the summary section of your notes.

How well do you feel about these concepts?



Students, drag the icon!