

NOTES – NOS

Nature of Science – Scientific Explanations

Lesson 1 – Understanding Science

What is Science?

The last time that you watched dogs play in a park or in your backyard, did you realize that you were practicing science?

Q: What is science?

A: the investigation and exploration of natural events and of the new information that results from those investigations



Branches of Science

No one person can study the entire natural world. Therefore, people tend to focus on one of 3 fields or branches –

Q: What is **Life Science**? (7th grade)

A: the study of all living things

Q: What is **Physical Science**? (8th grade)

A: the study of chemistry, physics and of the interactions of matter and energy

Q: What is **Earth Science**? (9th grade)

A: the study of Earth, including Earth's landforms, rocks, soil, and forces that shape Earth's surface

Scientific Inquiry

Q: What is scientific inquiry?

A: the diverse ways in which scientists study the natural world by using the scientific method

Q: What is the scientific method?

A: a series of steps that scientists use to answer questions and solve problems

- **Identify** the problem and **Ask** a question
- **Collect** information/**Research**
- **Form** a hypothesis.
- **Test** the hypothesis.
- **Analyze** the results.
- **Draw** conclusions and **Communicate** the results.

➤ **Identify** the problem and **Ask** a question – focus the investigation and identify what you want to find out

→ You can't solve a problem if you haven't identified it!

→ During this step we observe → infer → predict

Q: What is an **observation**?

A: the use of your 5 senses to gather info

Q: What is an **inference**?

A: an interpretation of an observation that is based on evidence or prior knowledge

Q: What is a **prediction**?

A: a statement about what will happen next in a sequence of events

Ex. I observe you yawn → I infer you are tired → I predict you are going to fall asleep

➤ **Form** a hypothesis – an educated guess; a possible explanation or answer to a question made by info you already know or info gathered from observations

→ We try to prove our hypothesis through testing in an experiment

➤ **Test** the hypothesis – find out whether it is a reasonable answer to your original question

→ A scientist will often test a hypothesis by testing the prediction.

→ To set up an experiment you must chose variables.

Q: What is a variable?

A: any factor in an experiment that can have more than one value

→ There are 2 types of variables –

- **Independent Variable (IV)** – the factor that is changed or that you want to test
Ex. # of times a plant is watered in a week
- **Dependent Variable (DV)** – the factor that is being measured or observed; the results of the experiment
Ex. plant growth

When forming a hypothesis, use the "If **IV** then **DV**" formula.

Ex. If I water a plant everyday then its leaves will turn brown.

→ **Constants** are the variables that stay the same throughout an experiment

Ex. same sized plants are used and are potted with the same soil (type/amount)

→ A **control** is the standard used for comparison

Ex. a plant that doesn't receive H₂O to compare to the other plants that do receive water

→ In an experiment, **data** is collected.

Q: What is data?

A: measurements or other specific information collected as the results of an experiment

Ex. height of each plant, color of its leaves, or # of leaves dropped

Q: But how do I make sure the results of an experiment are correct and valid?

A: conduct at least 3 trials

→ The more times tried the more chances to get it right! REPEAT, REPEAT, REPEAT! At LEAST 3 times or more! ☺

- **Analyze** the results – determine if your results support your hypothesis, do calculations & organize data into charts and graphs
- **Draw conclusions** –
 - Do your results supported your hypothesis? → show how your results support it!
 - Do your results NOT support your hypothesis? → what went wrong?
 - ❖ Do you need more information to get the results you want?
 - Gather more information.
 - Redesign the procedure.
 - Test your hypothesis again.
- **Communicate** results – tell others about your experiment. BE ACCURATE! Make a presentation(.ppt) create a web site, write a scientific essay

Results of Scientific Inquiry – Scientific Theory and Scientific Laws

In the end, our results should try to prove something... Theory vs. Law? What's the difference?

- A **theory** is an explanation based on many observations and investigations that have been supported by testing
 - answers "why"
 - an **opinion** supported by research & can be changed or replaced as new theories are tested
 - Ex. plants die because people over H₂O them
- A **law** is a summary of many experimental results and observations
 - answers "what"
 - a **fact** supported by research and repeated experiments with the same results & tells you how things work and that the same results will happen every time
 - Ex. what goes up, must come down (ie. the law of gravity)

The Scientific Method



Step 1: Identify a Problem and Ask a Question

Make Observations → State the problem to be solved or the question to be answered



Step 2: Collect Information/Research and Infer

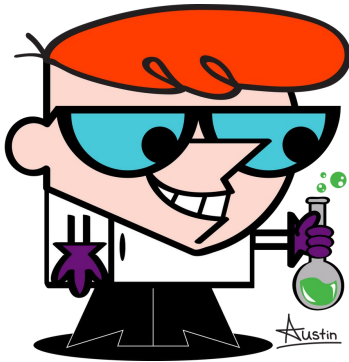
Obtain facts and ideas from books, journals, internet, etc. that provide insight regarding your problem/question. Infer what the information means



Step 3: Form a Hypothesis

Based on the information/research you collect, propose a solution or "best guess" that will help guide your experiment and attempt to answer the proposed problem/question. Predict what you think will happen as a result.

X → then modify/ revise hypothesis to correct



Step 4: Test the Hypothesis – "Experiment"

Describe, design, and conduct an experiment that would give you information or data that supports (or not) your hypothesis. Collect data/record observations.

✓ → then repeat to confirm



Step 5: Analyze the Results – "Accept/Reject the Hypothesis"

Determine whether your data/results from the experiment supports (or not) your hypothesis; if not, it may be necessary to review your information/research and revise your hypothesis. Graph results. Classify information. Make calculations.



Step 6: Draw Conclusions and Communicate Results

Formulate a conclusion that answers the original question from step one and share the results with the scientific community (or the community at large ie. school, parents, friends, etc.).



*Be aware that these are the basic steps of the Scientific Method, however, you may see variations of this. ☺