Scientific Method

Who uses it?
What is it?
Why should I care?
It is a way to solve problems. Do you have any problems to solve?

Any big or any small ones?
Any of these sound familiar?

- Where are my shoes?
- What should I have for lunch?
- Which deodorant works the longest?
- What is the cure for cancer?
Steps of the Scientific Method

- Mnemonic to help you remember the steps of the Scientific Method.

Ann Has Twenty Adorable Dogs & Cats.
How is Science Done?

Science begins with an observation.

This is the process of gathering information about events or processes in a careful, orderly way.
Step One:

- **Ask a question (ANN):** Pick a topic that interests you. Change your topic idea into a question.
Information

Gather data about your question. Sources include--

books
magazines
reports
experts
your past experiences
Step Two:

- Hypothesize (HAS): After you’ve done your research, make a prediction to answer your question.
What is a hypothesis?

- It is an educated guess based on data and research.

- It is what you think the answer is based upon your gathered information.
Step Three:

Test (Twenty): This is the actual experiment that you will conduct.
The Experiment can be broken down into two parts:

- **Materials**: What do you need for the experiment?
- **Procedure**: Detailed steps of the experiment
Types of Experiment Variables:

1) **Independent (Manipulated):** This is the **one** thing you change in your experiment.

2) **Dependent (Responding):** This is what you measure and observe. May have more than one.
3) Controlled: These are all the things that **must** stay the same in an experiment.
Step Four:

- **Analyze (Adorable):** Make your observations and gather your data.

- Data may be displayed in a table, graph, pictures, or photographs.
Types of Data:

1) Qualitative: Gathered through the senses (smell, sight, etc.).

2) Quantitative: Number information
Step Five:

- **Draw Conclusion (Dogs):** What is the answer to your question? Was your hypothesis correct?
Step Six:

Communicate results *(Cats)*: Share your findings with others.
It is OK if it turns out that your hypothesis was not correct.

Scientists are always asking new questions or looking at old questions from a different angle. As they find new answers, scientific knowledge continues to grow and change.
Why is this important?
You will help others learn.
Practice Problem:
You want to determine the effects of a certain fertilizer on the growth of orchids grown in a greenhouse. Materials that are available to you include: greenhouse, 100 orchid plants, water, fertilizer, and soil. You want to know if the orchids will grow best with a weak concentration of fertilizer, a medium concentration of fertilizer, or a high concentration of fertilizer. How will you design an experiment to test different concentrations of this fertilizer?

State your hypothesis:
How will you set up a controlled experiment?

Here is one possibility:
The 100 plants will be divided into 4 groups as follows:

- **Group 1:** 25 plants will receive plain water.  **CONTROL GROUP**
- **Group 2:** 25 plants will receive a weak concentration of fertilizer.  **EXPERIMENTAL GROUP**
- **Group 3:** 25 plants will receive a medium concentration of fertilizer.  **EXPERIMENTAL GROUP**
- **Group 4:** 25 plants will receive a high concentration of fertilizer.  **EXPERIMENTAL GROUP**
After one month of measuring the orchids, the following data is obtained:

Group 1 (Control Group):  Grew to an average height of 15 cm.

Group 2 (Weak conc.):  Grew to an average height of 35 cm.

Group 3 (Medium conc.):  Grew to an average height of 28 cm.

Group 4 (High conc.):  Grew to an average height of 10 cm.
Was your hypothesis supported?

What is your conclusion based on these results?