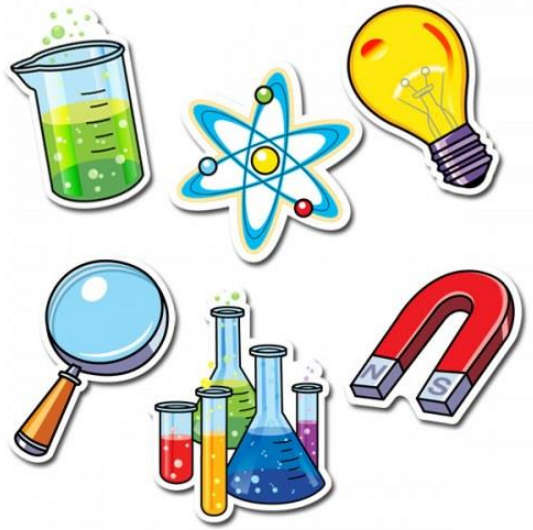
Thinking Like A Scientist

Lesson 1



THE BRANCHES of SCIENCE and HOW THEY FIT TOGETHER

- **Life Science** or **Biology**
  - The study of all living things, like plants, animals, and even single-cell organisms (e.g. bacteria)

- **Earth Science**
  - Deals with Earth and space – things like planets, stars, and rocks
  - Earth science studies nonliving things and their history
- **Physical Science**
  - Is all about matter and energy, the most basic building blocks of the universe
  - Physical science includes **physics** (energy interacting with matter) and **chemistry** (matter and how it transforms

Science is like thinking about the universe as a LEGO WORLD

1. **Physics** studies a single Lego and all of its properties, like how it moves around and its energy
2. **Chemistry** studies how Legos fit together to create larger things
3. **Life Science** studies all of the possible living things made out of Legos
4. **Earth Science** studies all the nonliving things in the Lego world

Scientific Inquiry

What does **INQUIRY** mean?

Asking

Investigation

Question/questioning

Examination

EXPLORATION

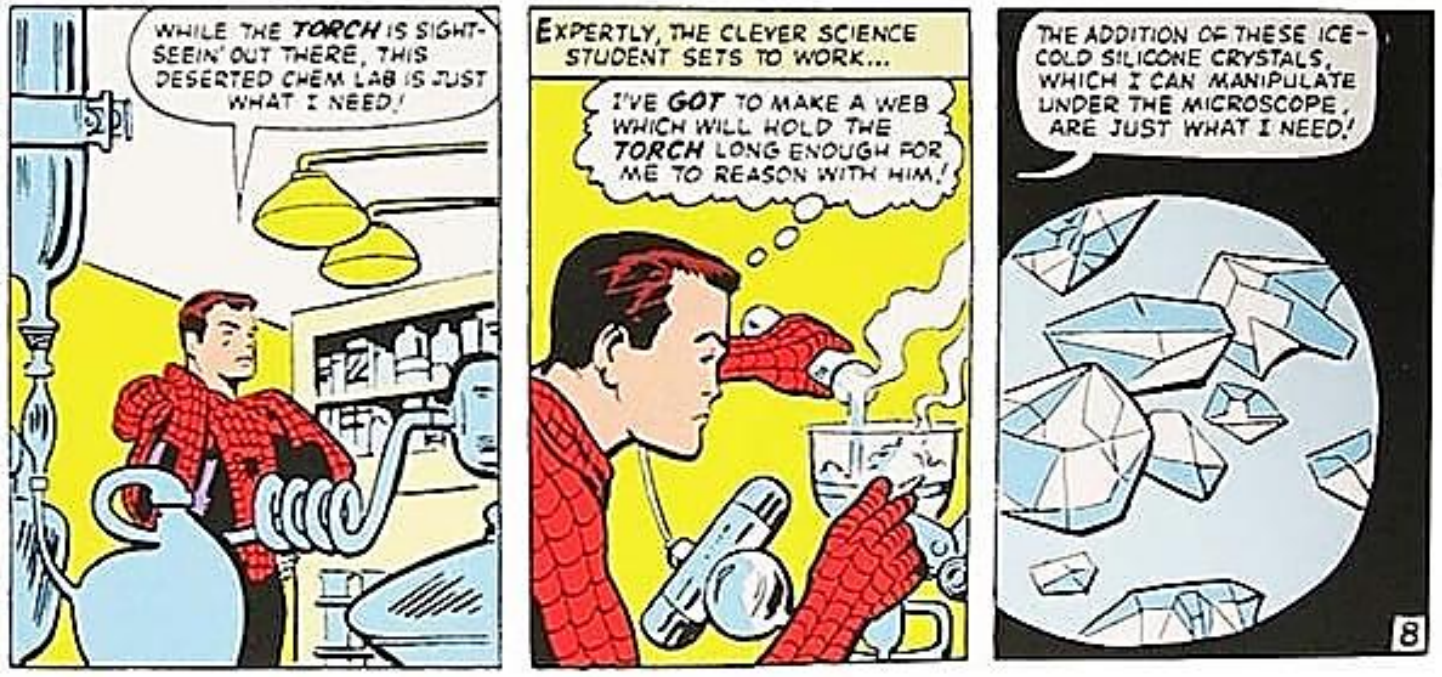
Probe for information

Scientific Inquiry

- Science is a way to find answers to questions about the world around us
- Scientists are very much like detectives
  - Use evidence to solve complex puzzles
- Scientists find evidence by conducting experiments and making observations
  - The process used by scientists to research a question is called **SCIENTIFIC INQUIRY** or the **SCIENTIFIC METHOD**

Scientific Inquiry/Method

- This begins with a question about the world around us and how it works
- After a question has been identified, the next step is to collect all of the possible information that relates to the investigation
  - Do background research
  - Make observations
  - Conduct experiments



Scientific Inquiry/Method

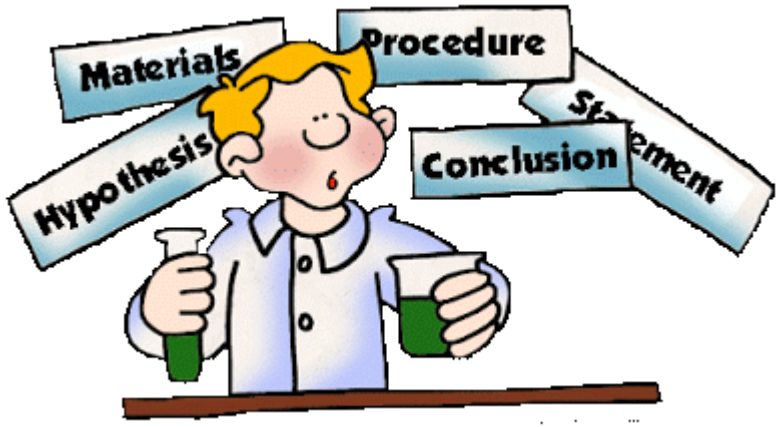
Parts of the Scientific Inquiry/Method:

1. **Scientific Inquiry/Method**
   The strategy used for scientific investigations.
2. **Hypothesis**
   A prediction or proposed explanation that can be tested.
   An educated guess.
3. **Observations**
   Using all of your senses and scientific instruments to describe a thing or event.
4. **Quantitative & Qualitative** data/information
   QUANTITATIVE = information or data based on countable measurements of something
   - Measurement = has both a NUMBER and a UNIT (e.g. 3 feet, 45 minutes, 1 litre, 25 degrees Celsius)

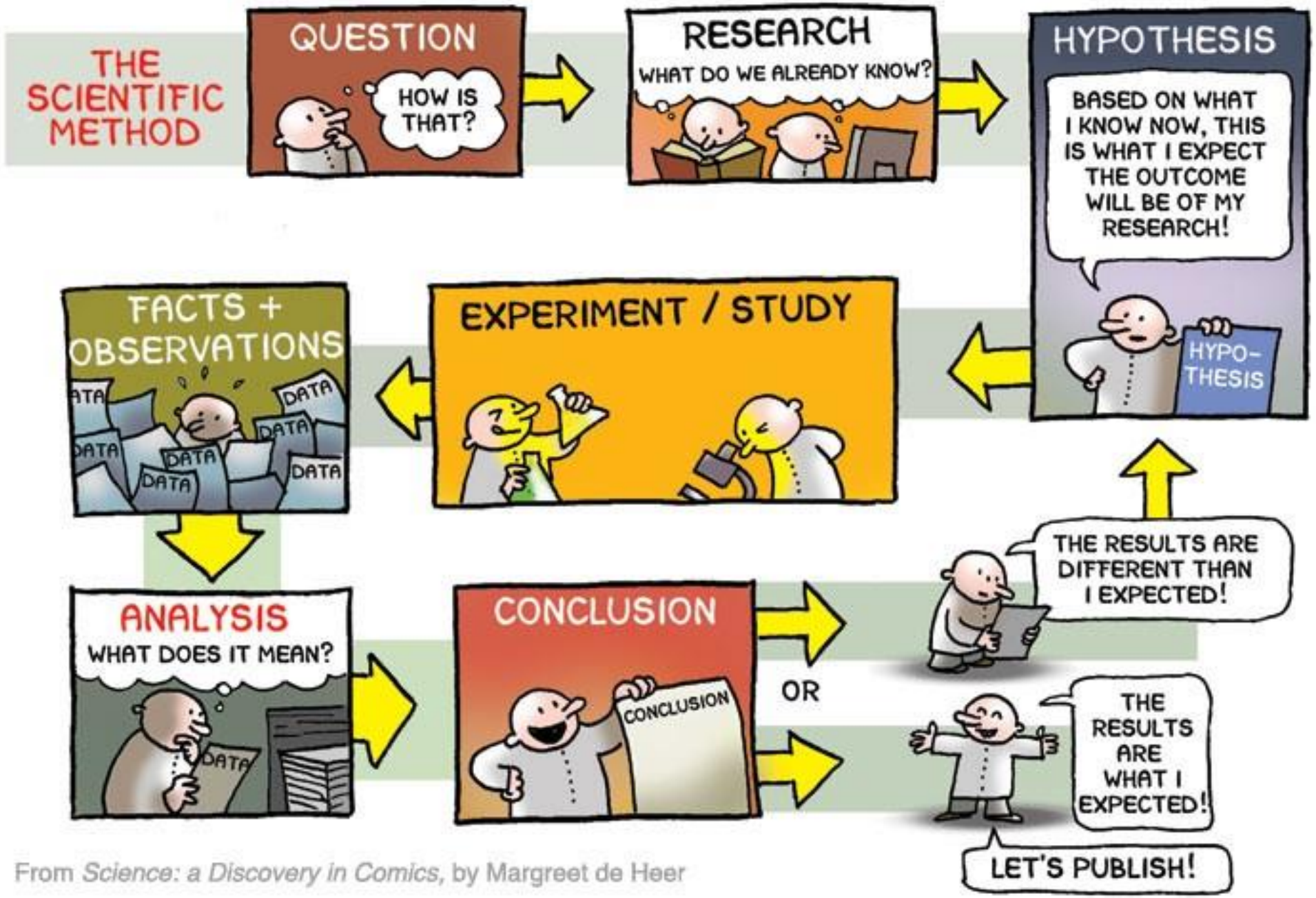
   QUALITATIVE = information based on the qualities of something
   - Describing the QUALITY of something (e.g. size, appearance etc.)
5. **Conclusion**
   The findings of your scientific investigation.

Scientific Inquiry/Method

Basic Steps:

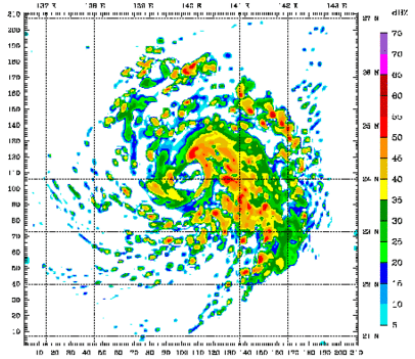


1. Ask a question
2. Do background research
3. Make a **hypothesis**
4. Test your **hypothesis** with **experiments** and **observations**
5. **Analyze** results
6. Make a **conclusion** about your **hypothesis**
   a. **IF FALSE,** make a new hypothesis and begin the process again
7. Share results!

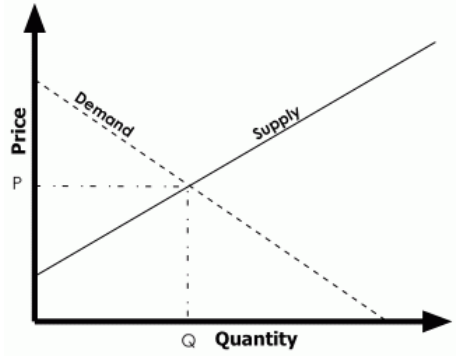


From *Science: a Discovery in Comics*, by Margreet de Heer

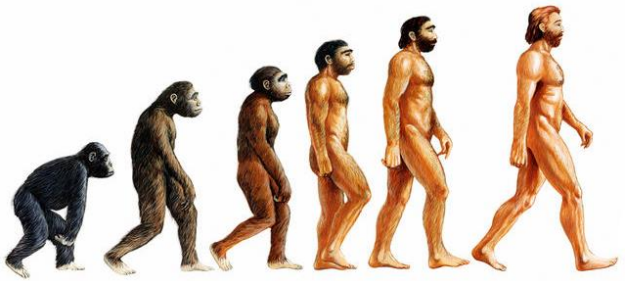
Science Models



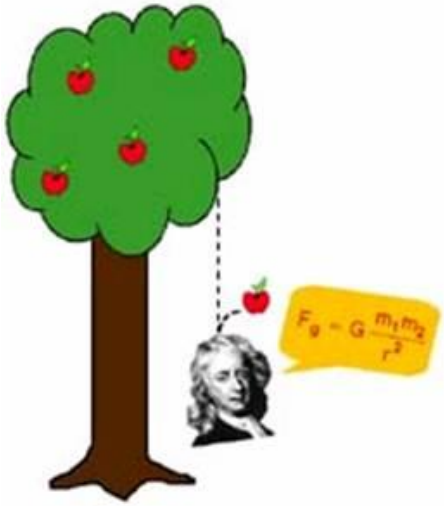
- Sometimes, things are too big, too small, or too expensive to observe in real life so scientists create **models**
- **Models** help simplify things to make observing and thinking about them easier:
  - **Physical Models**: a globe or a diorama
  - **Computer Models:** a simulation of changing weather patterns (thinking weather network); 3D simulations of people or places
  - **Mathematical Models:** the equation of a line (y=mx+b); a business using the past costs of a project to predict future costs



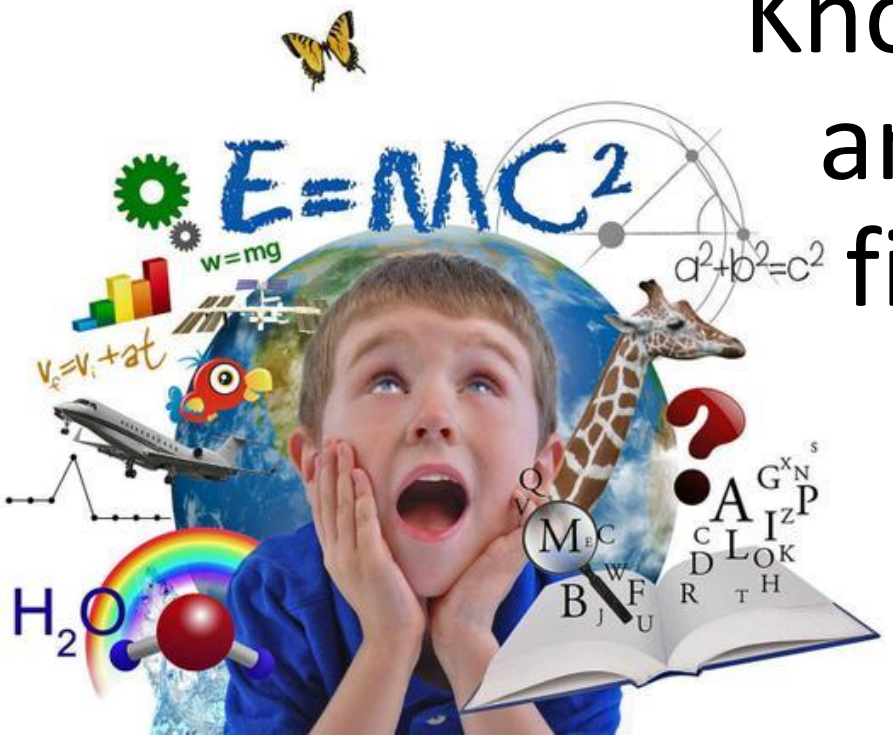
Scientific Ideas, Theories, and Laws



- After scientists make many observations, they develop ideas to:
  - Explain how things happen
  - Explain why things happen
- Scientific ideas all start as **predictions**
  - Evidence may or may not support them
- **Theory** – an explanation of WHY something happens based on extensive testing and observation
  - Scientists can develop a theory after a hypothesis has been confirmed through many tests and experiments
- **Law** – describes WHAT happens under certain conditions
  - Also based on many observations and tests
  - A rule that describes how something in nature behaves, but not necessarily why it behaves that way.
    - E.g. Sir Isaac Newton observed that objects naturally fall to the ground. He came up with the Law of Universal Gravitation to describe the pattern of objects naturally falling to the ground. This law predicts the motion of objects under the force of gravity, but does not explain why objects move that way.



An experiment isn’t a failure if it does not workout as predicted. Knowing what is false is an important part of figuring out what is true!



Review Qs

1. What are the three main branches of science, and what does each study?
2. What are the basic steps of scientific inquiry? HINT: If all goes well, there are 7 steps
3. Why is a hypothesis?
4. If your observations do not support your hypothesis, what should you do?
5. What are models and why are they used in science? Give an example of a model.