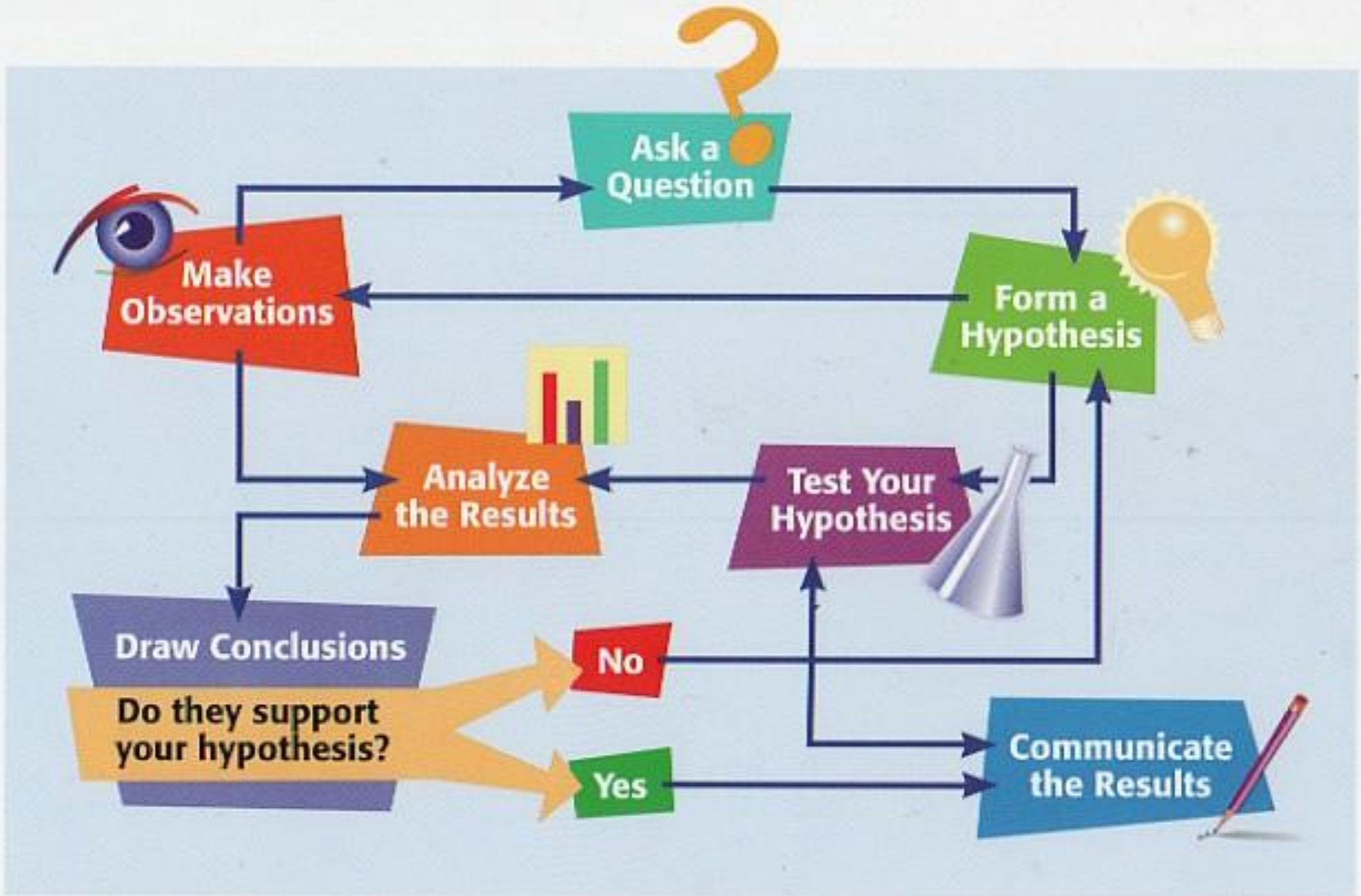


THE SCIENTIFIC METHOD

A Way to Solve a Problem

Part 1

The Scientific Method



WHAT IS THE SCIENTIFIC METHOD?

Step-by-step way in which scientists answer questions.

1. Ask a **question**.
2. **Research** the topic.
3. Form a **hypothesis**.
4. **Test/Experiment** the Hypothesis.
5. Gather **Data**.
6. Analyze **Results**.
7. Draw **Conclusions**.
8. Communicate **Results**.

I. STATE THE PROBLEM/ASK QUESTIONS

- The problem identifies what you want **to find out**.
- Develop a **clear** statement defining the problem
- Make sure your problem is narrowed/**specific** enough
- State the **problem** in the form of a question:
 - How does _____ affect _____?
 - What is the effect of _____ on _____?

2. RESEARCH

- Write down all information you already **know**
- Do research in books on the **topic** you are investigating
- Ask **experts** on the subject you are researching
- If you find an **answer** to your problem/question you do not need to move on

3. WHAT IS A HYPOTHESIS?



- An **explanation** that is based on prior scientific research or observations and that can be tested.
- “**Educated Guess**” (your high school teacher may not like this definition)
- Written as an “**If... then...**” Statement



HOW DO YOU TEST A HYPOTHESIS?

- Develop a test to support or not support your hypothesis. (This is your experiment).
 - Must be run multiple times – called repeated trials
 - Must have only ONE independent variable (the factor being tested)
- Must include 2 setups
 - Experimental setup
 - Control setup

HOW DO YOU TEST A HYPOTHESIS?

- Use a **Controlled** Experiment
 - An experiment that tests only **one** factor at a time by using a comparison of a control group and an experimental group.
- **Control** Group
 - The group where the scientist changes **nothing**. The Control group is used for **comparison**.
- **Experimental** Group
 - The group that the scientist has **changed** something. It is the **variable** in the experiment where you want to see how this condition affects something.

WHAT IS A VARIABLE?

- A **variable** is something that can change, either naturally or on purpose.
- In an experiment it is a factor that is **different** from one group to another.

WHAT IS A VARIABLE?

- **Independent** Variable
 - The factor that the scientist **has changed** in order to test the hypothesis.

- **Dependent** Variable
 - The **result** of what the scientist changed. It is the effect of what happened in the experiment.

WHAT ARE CONSTANTS?

They are what the scientist kept the same in both the control group and the experimental group.

THE SCIENTIFIC METHOD

A Way to Solve a Problem

Part 2

HOW CAN YOU GATHER DATA?

- Make **Observations**.
 - Any use of the **senses** to gather information.
- **Qualitative** Observations
 - Anything that you **see**, smell, touch, **taste**, or hear.
 - Ex. Blue, bitter, fizzing sound.
- **Quantitative** Observations
 - Any observation that can be **measured**.
 - Must include a **number**.
 - Ex. 5 centimeters long

HOW CAN YOU ANALYZE RESULTS TO DETERMINE PATTERNS?



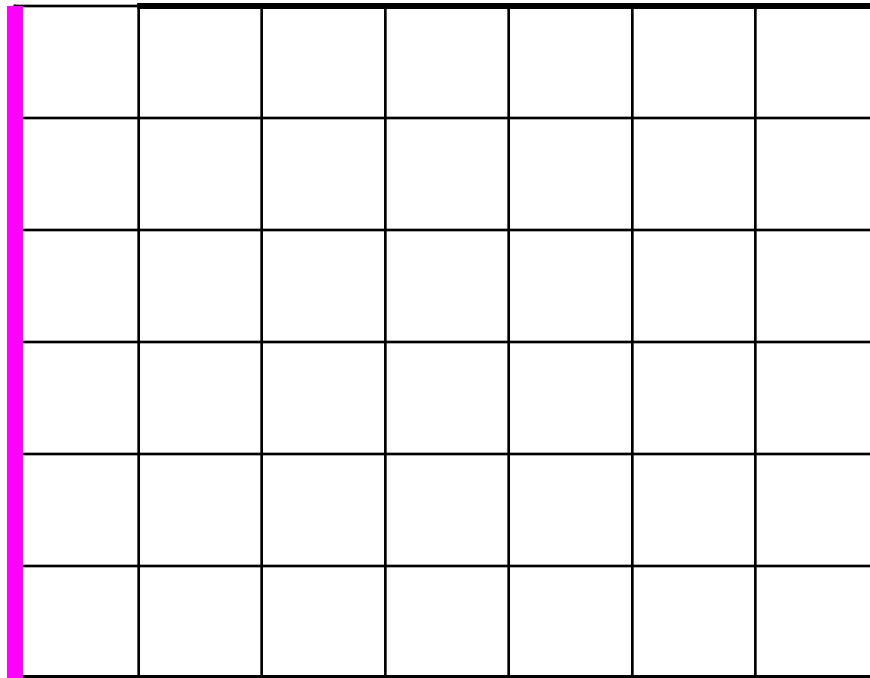
- **Record Data**

- Write **observations** and **measurements**
- Be **consistent** when you are checking your experiments and recording the results
- Create **tables** or **charts**

- **Create** graphs from collected Data (Pie, **Line**, and **Bar** Graphs)

- Complete all necessary mathematical **calculations**

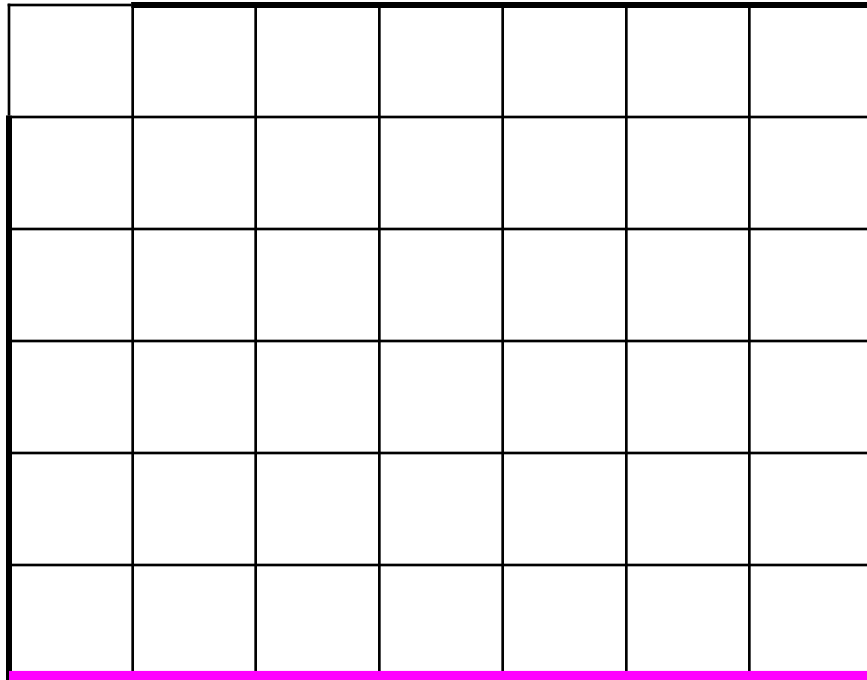
HOW TO SET UP YOUR GRAPH!



Y Axis

(This is for your dependent variable)

HOW TO SET UP YOUR GRAPH!



X Axis

(This is for your
independent
variable)



TAILS

T – Title

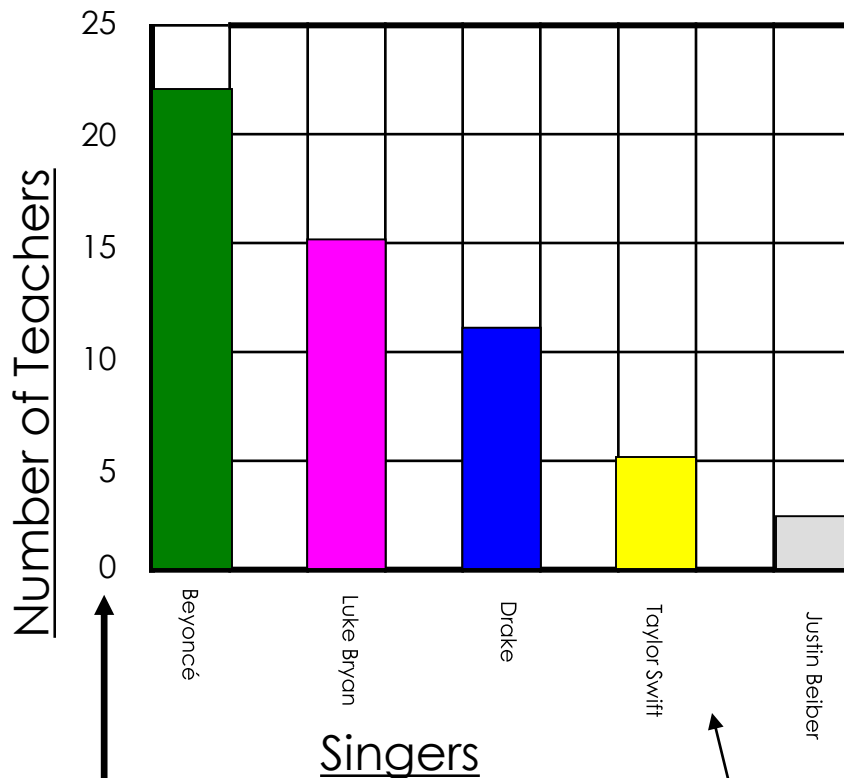
A – Axis

I – Interval

L – Labels

S – Scale

Teachers Favorite Singer



LABEL your bars or data points

Give the bars a general label.
What do those words mean?

DRY MIX

- Dependent
- Responding
- Y-axis
- Manipulating
- Independent
- X-axis

CONCLUSION

- You state whether your prediction was accepted or rejected and try to explain your results.

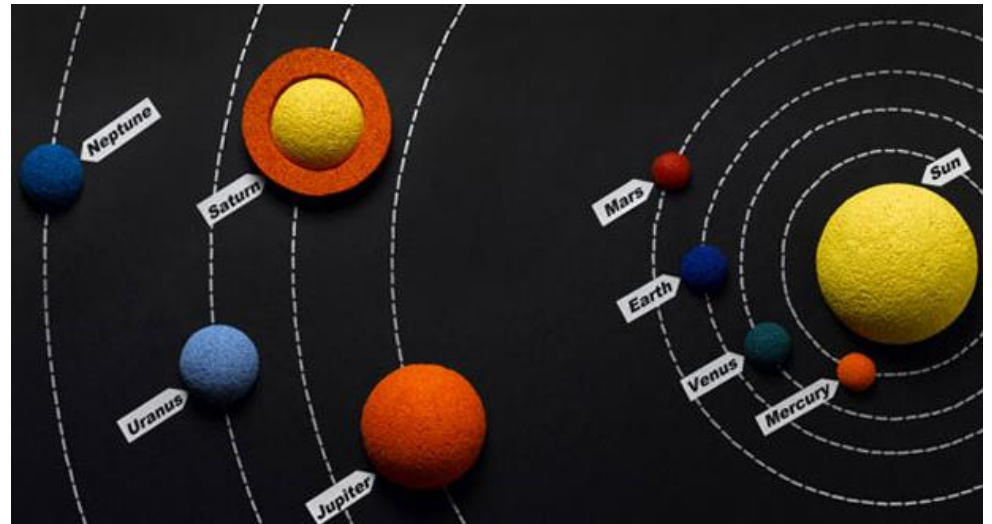


- Use the RECCALL format to write your conclusion.

WHAT ARE SCIENTIFIC MODELS?

Model

- A representation of an object or system.



THEORY VS LAW

Theory

- An explanation that **ties** together many hypotheses and observations.
- Supported by **repeated** trials. May help with further **predictions**.
- Tells **why** it happens.

Law

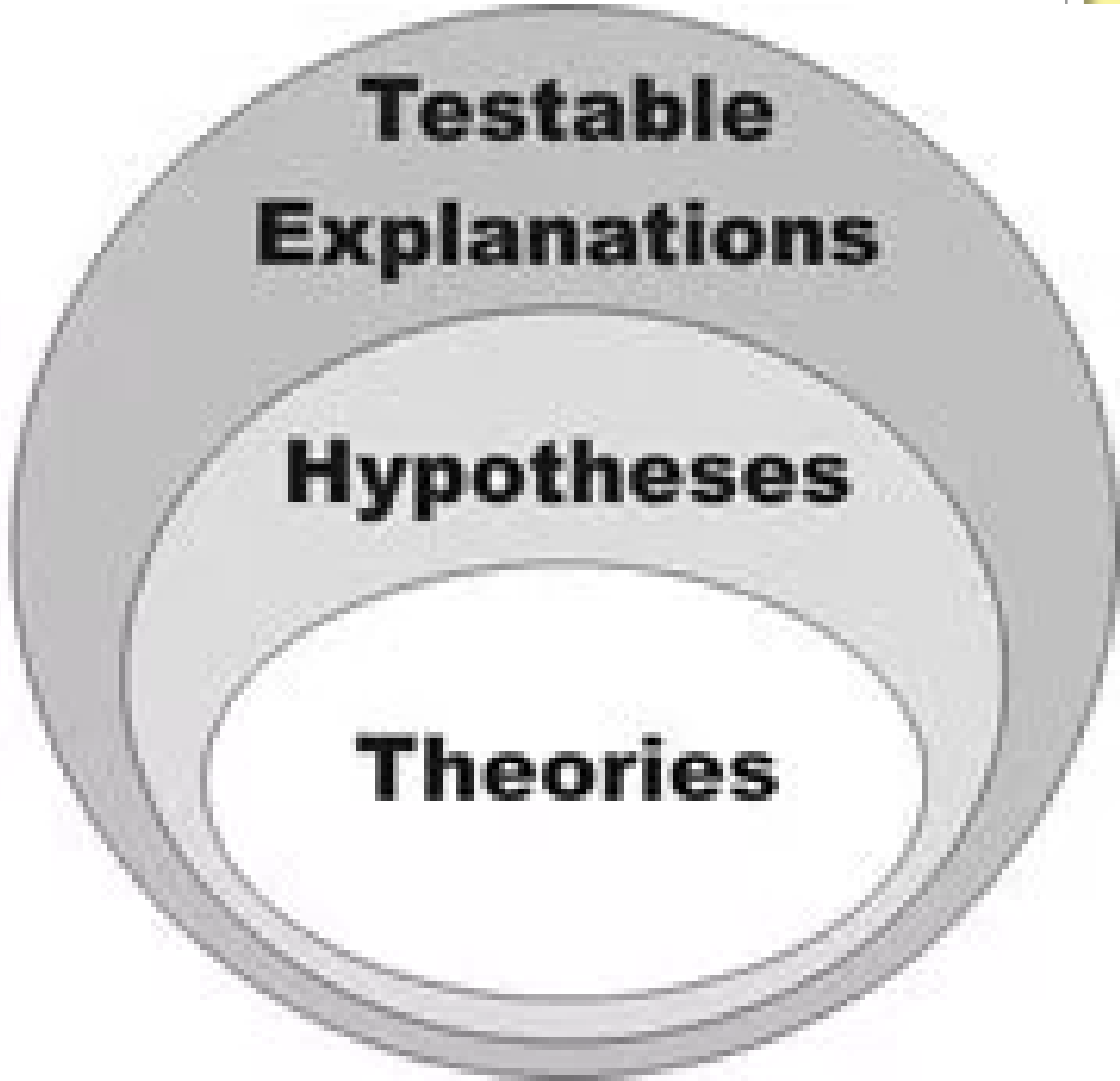
- A **summary** of many experimental results and observations.
- Tells **how** things work.
- Tells **what** happens.

WHAT IS THE DIFFERENCE BETWEEN A SCIENTIFIC THEORY AND A SCIENTIFIC LAW?



Facts

Laws



**Testable
Explanations**

Hypotheses

Theories