

# Do Now

Friday, August 12, 2016

What are three things you recall about the scientific method? Write your answer using complete sentences.

3.5 minutes

Do Now Check

By the end of the day today, IWBAT...

- Explain the steps involved in the scientific method.

**Why it matters in LIFE:**

Learning to think clearly and logically is one of the MOST IMPORTANT skills you will possess.

**Why it matters in THIS**

**CLASS:** You will conduct labs all year long that will require mastery of these concepts!

# Friday, 08/12/16

P.S.1; P.S. 2-11:

Distinguish between scientific hypotheses and scientific theories.

By the end of today,  
IWBAT...

Explain Steps in the Scientific Method

Essential Question:

How do we differentiate between independent and dependent variables?

Topic:

Scientific Methods

# Agenda

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- ~~□ Do Now (5)~~
- Scientific Method 2.0 (15)
- Simpsons Group Worksheet (15)
- Independent Practice (12)
- Exit Ticket (5)

# Expectations (Intro to New Material)

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- No talking while I, or anyone else, is speaking
- Raise your hand if you have something to say
- You may not leave the room at this time
- Take notes as directed

# Why is the Scientific Method Important?

- It creates a universal system that holds all scientists accountable
- Ensures that all experiments are REPLICABLE
- Without it, people could go around making all kinds of claims but if the claim is not testable, how can it be true?

For example:

- Question: What is the greatest country in the world?
- Hypothesis: America is the greatest country in the world.

# What is the Scientific Method?

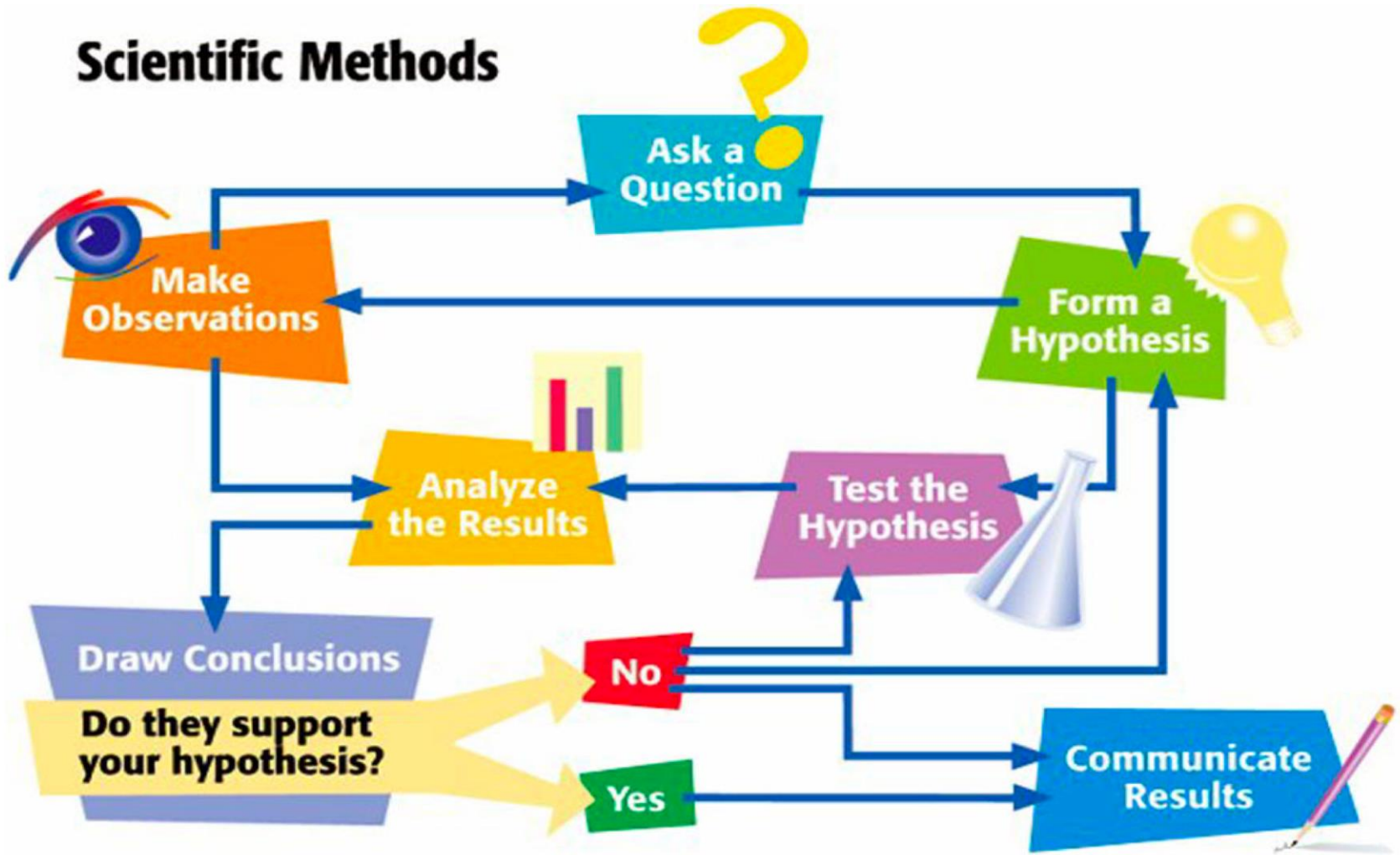
- Systematic format that scientists use to find the answer to a question

## Basic Format:

1. Ask a Question
2. Do background research
3. Form a hypothesis
4. Test your hypothesis
5. Collect and analyze data
6. Draw a conclusion

# But it's not always that easy...

## Scientific Methods



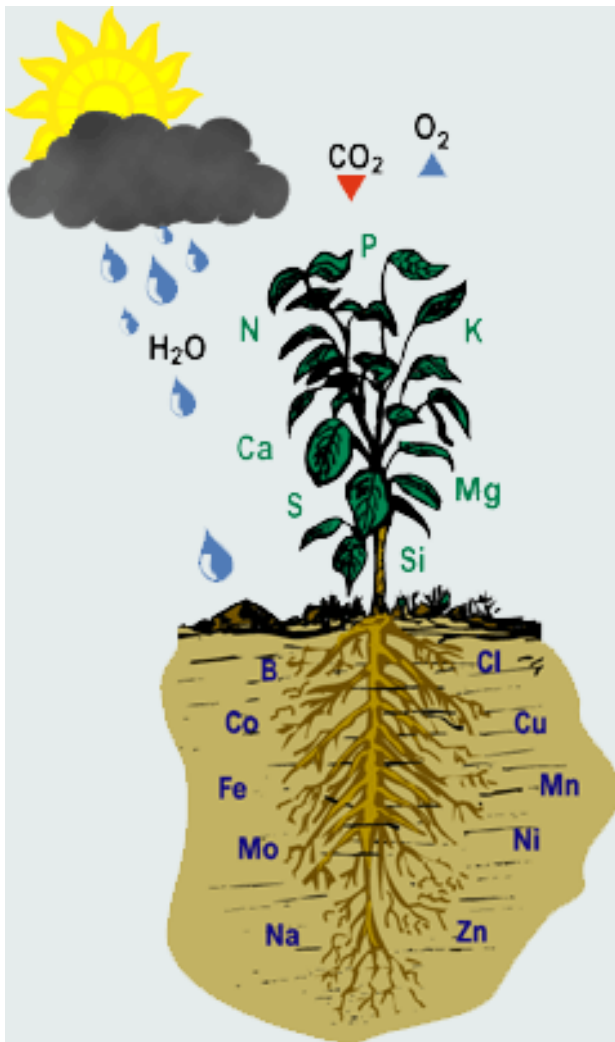


# 1. Ask a Question



**Question: Why are all of my plants dead??**

## 2. Do Background Research



**Plants need  
sunlight, water, and  
minerals in order to  
survive.**

# 3. Form a Hypothesis

- Hypothesis: an educated guess about the question you asked
- A hypothesis must always be:
  - *Testable*-This means that you can do an experiment to test your hypothesis
  - *Fact-based*-A statement such as “the universe is a hologram” is not fact-based, it’s based on opinion, due to mathematical expression, and therefore cannot be a testable hypothesis.

# 3. Form a Hypothesis

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- Ask a question: Why are all of my plants dead?
- Background research: Plants need sunlight, water, and minerals in order to survive.
- Hypothesis: If plants don't receive enough water, then they will die.

# 4. Test Your Hypothesis

- AKA do an experiment!
- All experiments will require:
  - Materials: what did you use?
  - Procedure: what are the steps you took?
  - Independent Variable: what did you change?
  - Dependent Variable: what are you measuring?
  - Control: what is your basis for comparison?

# More about Independent & Dependent Variable

- After a question is posed and a hypothesis is made, the experimenter needs to create an experiment to find out if his or her hypothesis is right or wrong
- In order to create a valid experiment, the experimenter can only change **ONE** variable at a time
- The variable that the experimenter changes is called the **INDEPENDENT** variable
- The variable that changes as a result of the independent variable is called the **DEPENDENT** variable

# 4. Test Your Hypothesis

Hypothesis: If plants don't receive enough water, then they will die.

- ❑ Materials: 3 plants, water, ruler
- ❑ Procedure: I will place 2 plants in the same spot on the window sill. I will water plant 1 normally. I will increase the amount of water I provide plant 2 every day and record its growth at the end of the day. I will do this for 6 days.
- ❑ Independent Variable: water
- ❑ Dependent Variable: plant growth
- ❑ Control: plant 1

# 5. Collect and Analyze Data

- Collect data by recording in a chart or table

Amount of water given	Growth
0 cups	0 cm
0.5 cups	1 cm
1 cup	2 cm
1.5 cups	2 cm
2.0 cups	0.5 cm
2.5 cups	0 cm

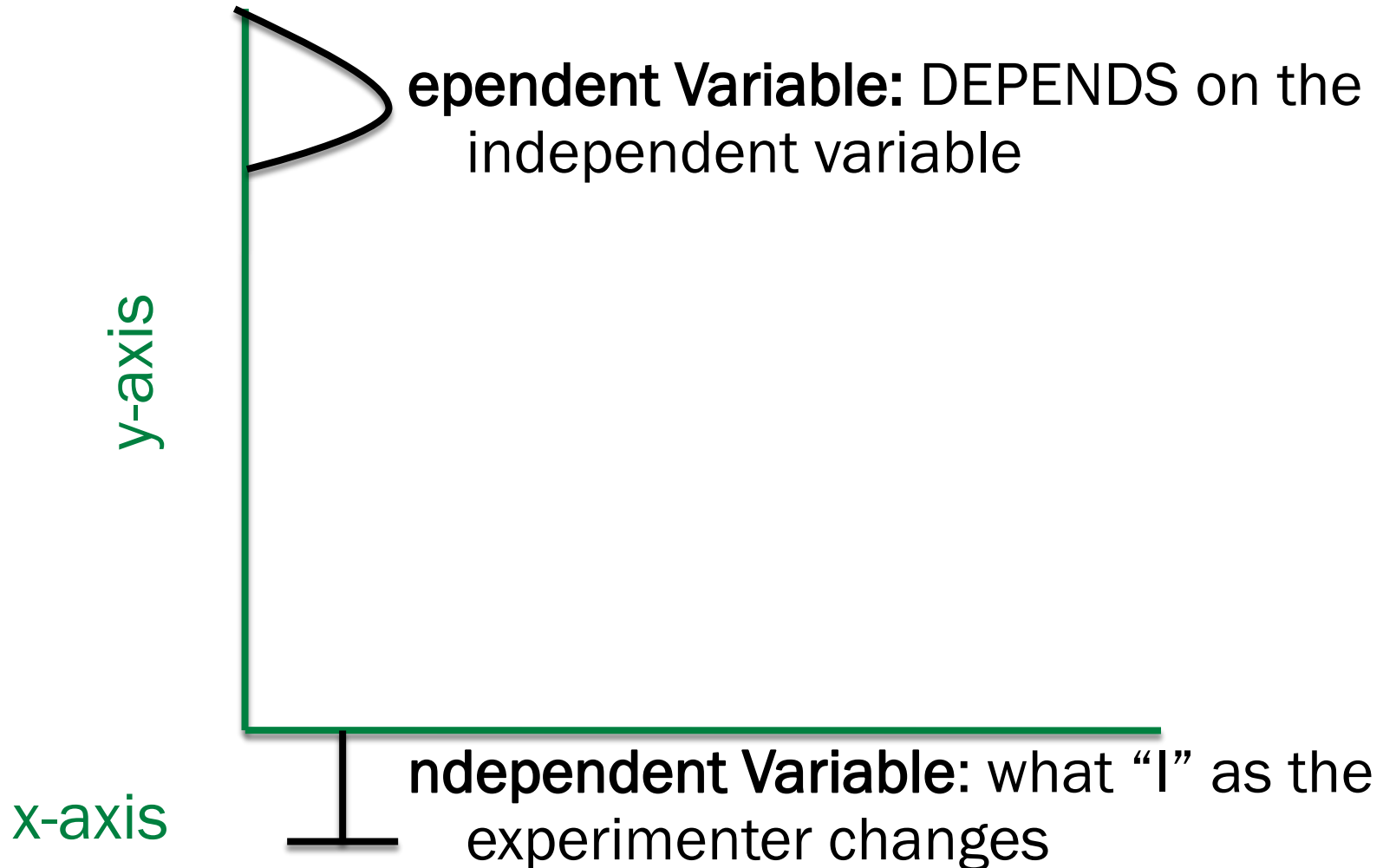


# 5. Collect and Analyze Data

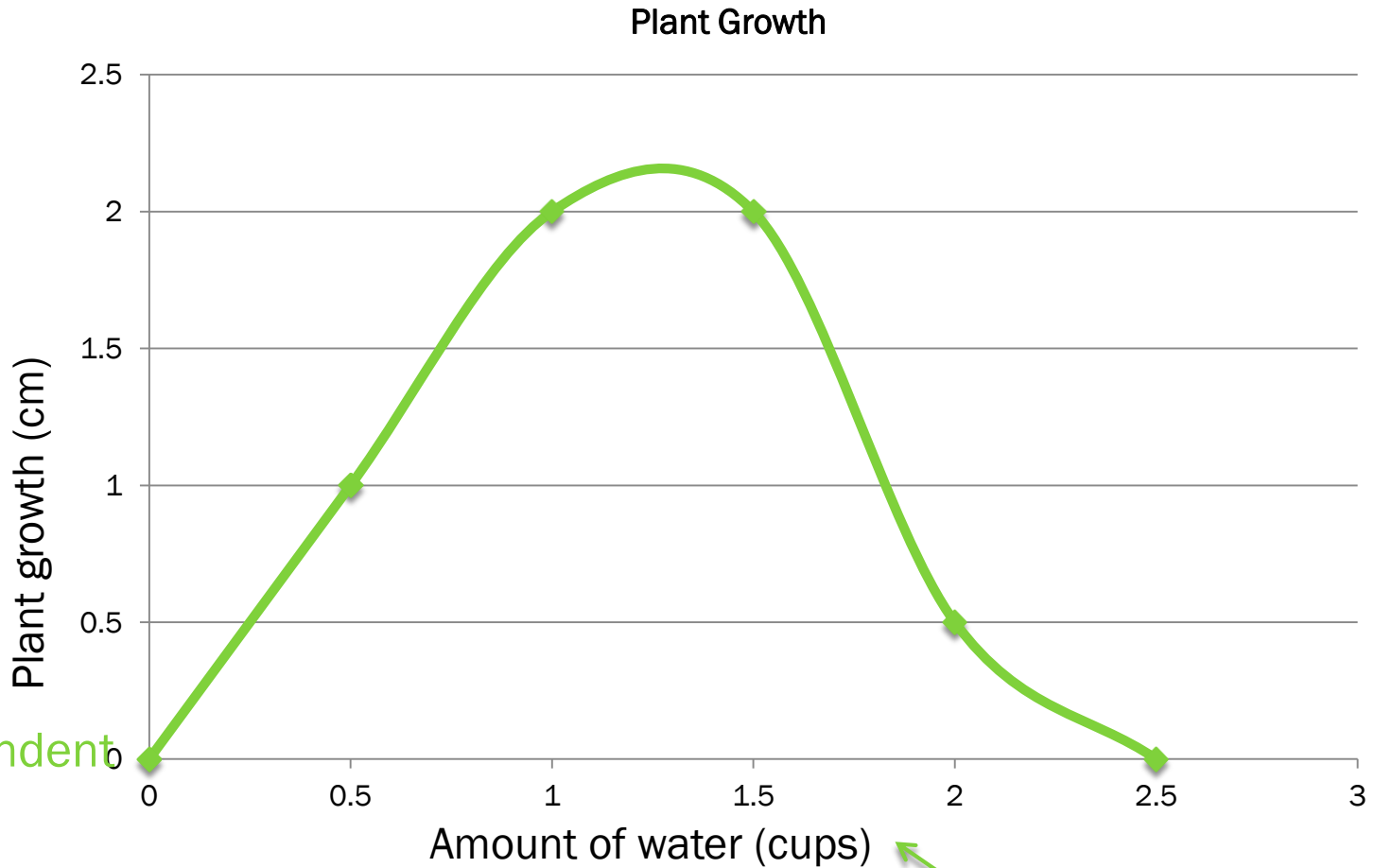
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- Analyze data by putting information from the chart into a graph
- This allows us to see relationships between variables

# 5. Collect and Analyze Data



# 5. Collect and Analyze Data



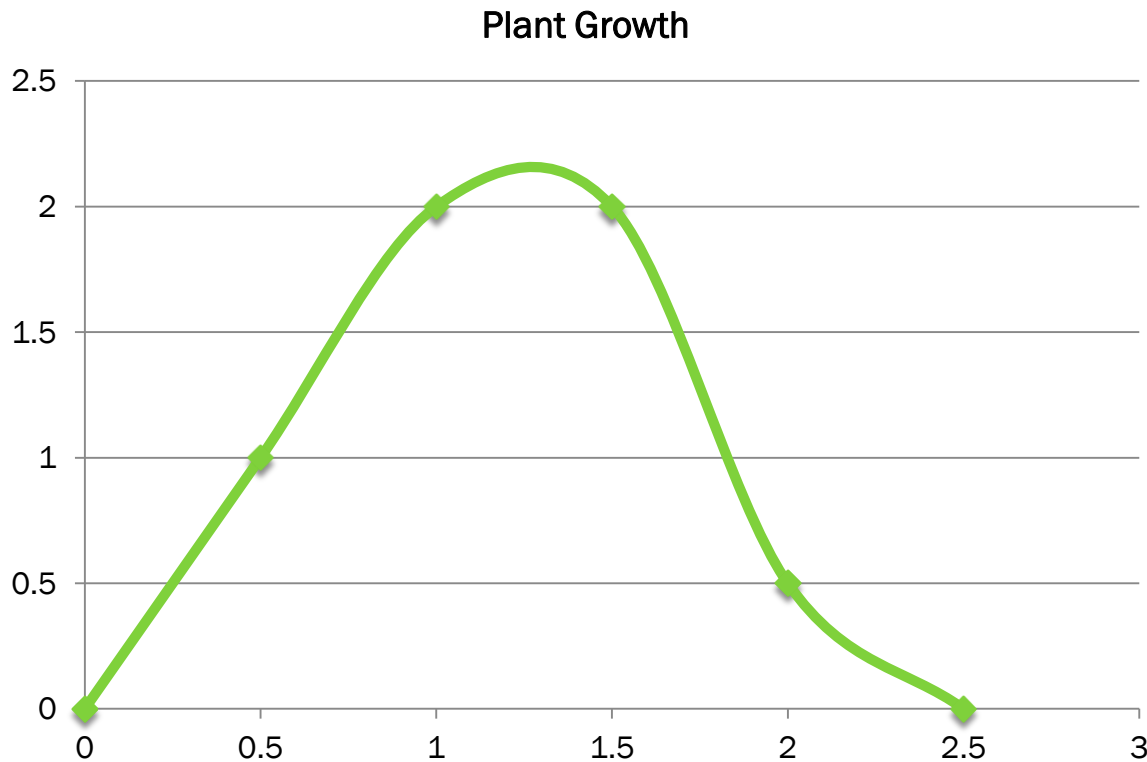
Y-axis: Dependent variable

X-axis: Independent variable

# 6. Draw Conclusions

- In this step of the scientific method, you look at your data from your experiment, and decide whether your hypothesis was correct or incorrect. A good conclusion has three parts:
  - Rejecting/accepting hypothesis
  - Sources of error
    - Human Error – your equipment doesn't work or you mess up in a way that affects your results
    - Bias – you expect something to happen and only report certain data
  - Follow up experiments

# 6. Draw Conclusions



Based on this data, I conclude that my conclusion was right: plants need water to survive. However, the results also show that too much water can have a detrimental effect on the plant's growth as well. Next time, I would include more plants in the experiment.

# Quick Checks!

- ❑ What is the process used by scientists to find the answers to questions?
- ❑ What is a hypothesis?
- ❑ What two things must be true in order for a hypothesis to be valid?
- ❑ What is an independent variable? What axis does it go on?
- ❑ What is a dependent variable? What axis does it go on?
- ❑ What is a control?
- ❑ What are the 3 parts of a good conclusion?

# Scientific Theories

- If your finding proves to be true for long periods of time and can be tested by multiple researchers, it has the potential to become a *theory*
- Theories are based on natural and physical phenomena and are capable of being tested by *multiple independent researchers*
- Hypotheses are *tentative* and *testable* statements that must be capable of being supported or not supported by observational evidence
- Hypotheses come and go by the thousands, but theories often remain to be tested and modified for decades or centuries.

# Hypothesis or Theory?

- The universe began almost 14 billion years ago with a massive expansion event.
- Raising the temperature of water will increase the amount of sugar dissolved.
- **Populations evolved over thousands of years from genetic mutations that allowed them to better adapt to their environments.**
- **It is impossible to determine whether or not you are moving unless you can look at another object. In other words, motion is relative.**
- **A plant that receives fertilizer will grow faster than a plant that does not receive fertilizer.**



# Agenda

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- ~~□ Do Now (5)~~
- ~~□ Scientific Method 2.0 (15)~~
- Simpsons Group Worksheet (15)
- Independent Practice (12)
- Exit Ticket (5)

# Expectations (Group Practice)

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- 100% Participation
- Raise your hand if you have a question
- If I am helping someone else ask another group or move on and I will get to you
- You may hold up a pass if you need to leave the room

# #1-5

- Control Group: Group B
- Independent Variable: juice
- Dependent Variable: stacks of paper
- Conclusion: The special juice does not increase productivity
- How could this experiment be improved?:  
Increase number of participants, repeat

# #6-15

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- Work with the person sitting next to you to complete the next two scenarios
- You have 10 minutes
- Raise your hand when you are done

# Agenda

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- ~~□ Scientific Method 2.0 (15)~~
- ~~□ Simpsons Group Worksheet (15)~~
- Independent Practice (12)
- Exit Ticket (5)

# Expectations (Independent Practice)

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- ❑ NO Talking
- ❑ You are working ALONE to make sure that YOU understand it
- ❑ Raise your hand if you have a question
- ❑ If I am helping someone else, move on and I will get to you
- ❑ You may hold up a pass if you need to leave the room

# #16-20

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- Complete the last two scenarios on your own
- Raise your hand when you are done
- You have 12 minutes

# Exit Ticket

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- You have the rest of the period to complete your exit ticket
- Turn it in to me on your way out
- Answer **ON YOUR OWN** and **HONESTLY** – I want to know what you learned today!



# Closing

## Reminders:

Bring in your Binder  
with 5 dividers ASAP  
(by Tues. the LATEST)

## Next Week:

Dimensional  
Analysis!  
Measuring!

Anything you did not  
finish today is due on  
**MONDAY**