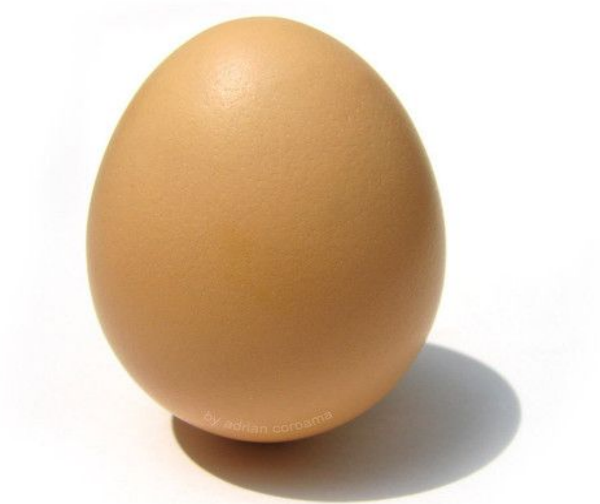
Unit 1-Characteristics of Life, Scientific Method and Microscopes

Section 1.1 Characteristics of Life



1.1 Learning Targets

1. Be able to list the 8 characteristics of living things and describe what each characteristic means.
2. Summarize the levels of organization

Studying Life

Biology: the science that seeks to understand the *living* world.

- *bio*= “life”
- *-logy*= “study of”

Other examples of areas of study in science:
Geology, Archaeology, Herpetology, Cosmology, Mycology, and more!

How do we know it’s alive?

- How do we know if something is living?
- It involves more than one characteristic to describe something as living
- *Keep in mind* that some non-living things have living characteristics
  - Ex: wind up toys move, so do living organisms

All living things……..

1. Are organized or made up of units called cells
2. Reproduce
3. Are made from a genetic code (DNA)
4. Grow and develop
5. Metabolism-obtain and use materials and energy
6. Respond to stimuli
7. Homeostasis-maintain a stable internal environment
8. Change over time

1. Living things are organized or made up of cells

- Cell: small, self-contained units, the smallest unit of an organism
  - Unicellular: single cell organisms
  - Multicellular: many-celled organisms

2. Reproduction

- The process of producing new organism

- 2 types
  1. Sexual reproduction: cells from 2 parents unite to produce the first cell of the new organism
  2. Asexual reproduction: the new organism has a single parent

3. Based on a Genetic Code

- Determines the inherited traits of every organism
  - Example: brown hair, blue eyes, tall, short, etc.

- DNA: deoxyribonucleic acid: molecule that provides the instructions for inheritance

4. Growth and Development

- Growth: change in size
  - Ex: A toddler "grows" in height, weight, and size in general

- Development: process involving the reproduction of cells or maturing of cells
  - Periods of rapid and dramatic change
  - Ex: A toddler "develops" new brain cells, muscle cells, liver cells, etc.

5. Need for Materials and Energy

- Organisms use energy and materials to grow, develop and reproduce
- Organisms *need* materials and energy to stay alive

- Metabolism: the combination of chemical reactions through which an organism builds up or breaks down materials as it carries out its life processes

- The way an organism obtains energy varies
  - Ex: Plants use photosynthesis
    Grasshoppers eat grass
    Birds eat grasshoppers

6. Response to the Environment

- **Stimulus:** a *signal* to which an organism responds
  1. External (adaptations): stimuli that come from the environment; physical or behavioral
     - Ex: light, temperature
     - Ex: when the ground is warm and there is enough water, a plant seed will respond by germinating
     - Ex: roots respond to gravity by growing downward
  2. Internal (homeostasis): stimuli that come from within the organism
     - Ex: hunger; when the level of sugar in your blood gets too low, your body responds by making you feel hungry

7. Maintaining Internal Balance

- **Homeostasis**: process by which organisms keep their internal conditions constant in order to survive
  - Ex: body temperature and water must remain constant for survival
  - Ex: Shivering sometime occurs when you are cold. This muscle action produces heat and helps to warm your body.
  - Ex: Sweating helps the body release heat through the skin, thus keeping you cool.

8. Change over time

- Changes over a few generations may not seem significant
- Changes over thousands of years can be dramatic
- The ability for an organism to change with the ever changing world is key for survival.

- Also known as **evolution:** change over time!

Levels of Organization

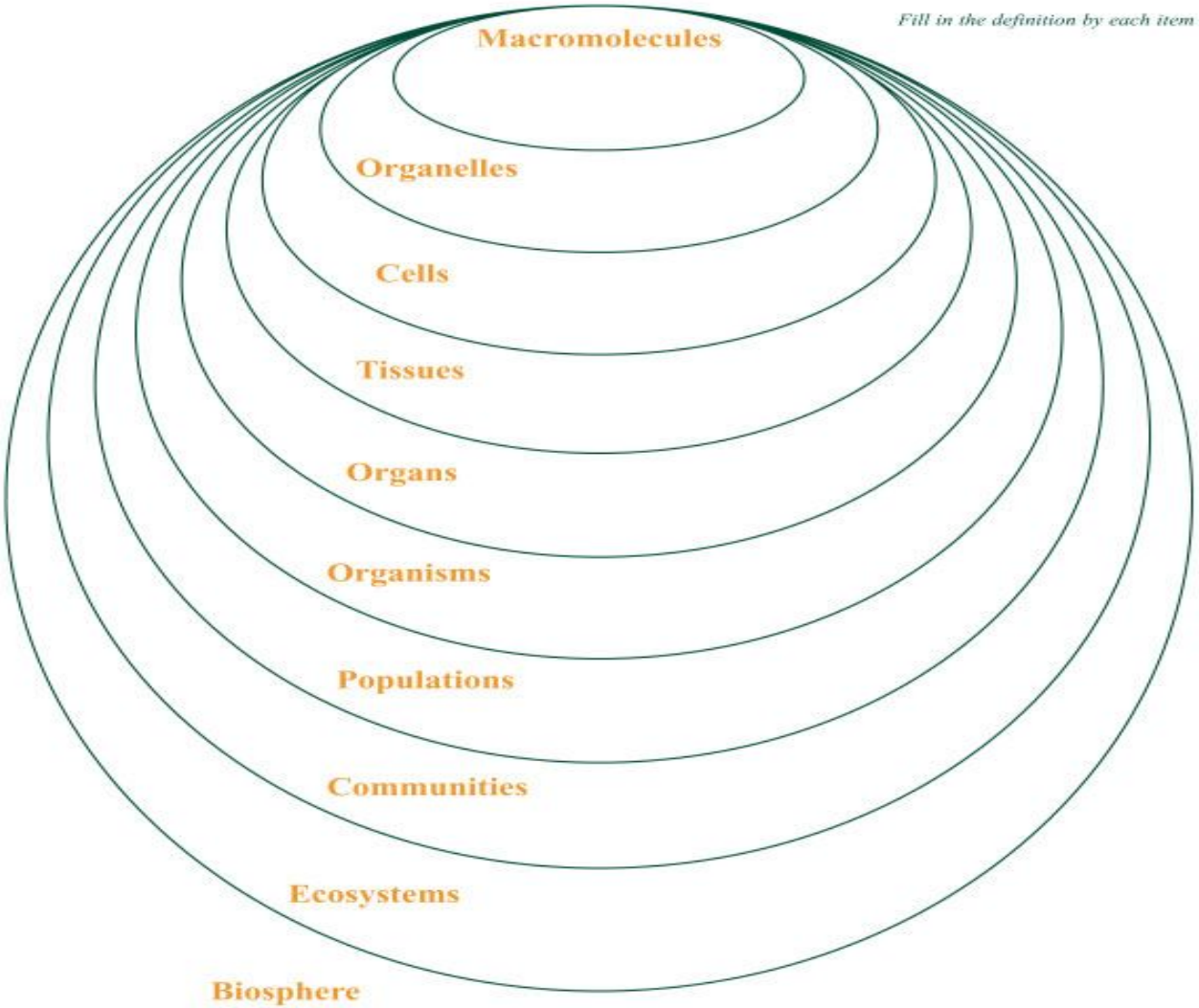
Starting with the largest category, all living things on Earth live in the biosphere, to the smallest unit of life, the cell.

Biosphere>biome>ecosystem>community>population>organism>organ system>organ>tissue>cell

BECPOOOTC is the order of these levels-want to remember them?

Beyonce Eats Canned Peas Out Of Orange Tupperware Containers;)

Fill in the definition by each item



Great white sharks are notorious loners. How do they still depend on others to survive?

Video clip?

1.2 Learning Targets

Explain how so much diversity of life is also unified

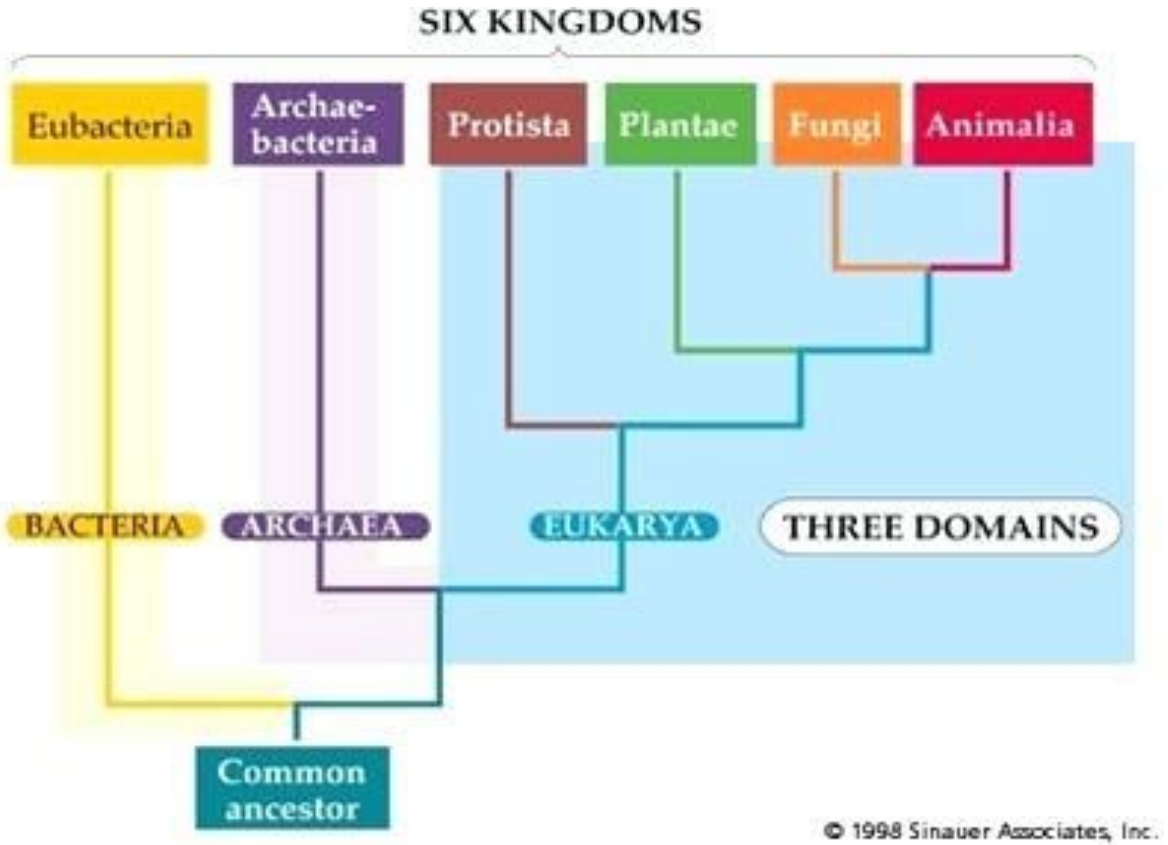
Be able to list the three domains and six kingdoms in which all living things are organized

Unity in Diversity-Three major themes of Biology

1. Life is diverse yet unified
2. Interdependence-Living things depend on one another
3. Evolution-All living things change over time.

Tree of Life-Unity in Diversity

Living things are divided up into three domains and 6 kingdoms depending on their DNA. DNA tells us how closely related organisms are to each other.



Chapter 1, section 3

Below are 3 pictures of natural environments. Choose one picture and write two questions a biologist might ask about the organisms in the picture.

1.3 Learning Targets

- **Learning Targets**
  - Explain the goal of science.
  - Explain and demonstrate the scientific method.
  - Differentiate between an observation and inference.
  - Explain and write a hypothesis for a set of observations.

What is science?

Goal:

- to investigate and understand the natural world
- to explain events in the natural world
- to use those explanations to make useful predictions.

- **<u>3 basic features:</u>**

1. Deals only with the natural world
2. Scientists collect information and look for patterns and connections between events
3. Scientists propose explanations that can be tested

So……

science is an organized way of using evidence to learn about the natural world!

Thinking like a scientist:

- Use the **scientific method:**
  - An organized plan for gathering, organizing, and communicating information.

Steps:

1. Make Observation
2. Ask Questions
3. Develop Hypothesis (proposed answer)
4. Test Hypothesis with an Experiment
5. Analyze Data and Draw Conclusions

Making Observations

- **Observations:** information gathered in an orderly way, and by using the senses
  - Example: you observe that the bread in your cabinet has 5 green, fuzzy spots on it.
- **Data:** the information that is gathered from observations
  - 2 types of data:

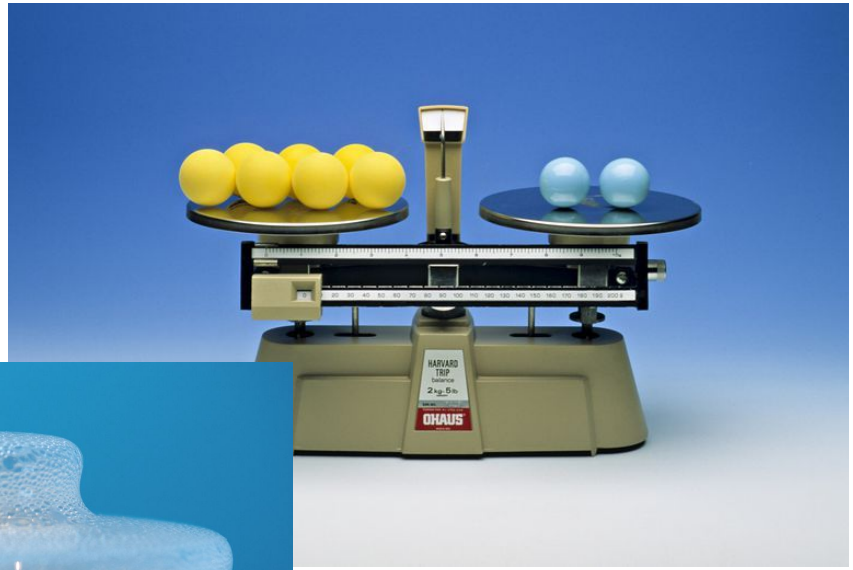
    Quantitative: data expressed in numbers
    - Example: you count that there are 5 fuzzy, green spots

    Qualitative: data expressed as descriptors and usually cannot be counted
    - Example: you observe that the green, fuzzy spots are green and fuzzy

Practice: Qualitative or Quantitative?

1. There are 1420 students at Mattawan High School.
2. The classroom was cold.
3. The classroom was 70 degrees
4. My mother is beautiful.
5. His father is 6’4”.
6. My sister is crazy.
7. The dog is a Saint Bernard.
8. It takes me 20 minutes to get to school.
9. There are 34 green tennis balls in my drawer.
10. The Earth is about 25,000 miles around the equator.

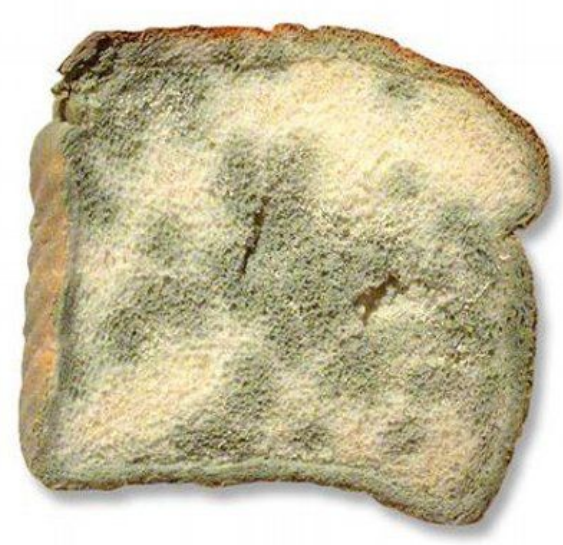
Practice: Making Qualitative and Quantitative Obs.



- We can use our observations to ask questions and make inferences.

- <u>Inference:</u> a *logical interpretation* of data based on prior knowledge or experience.

  - Example: you infer the bread has been in the cabinet for too long and has now gone bad; or you may infer the green, fuzzies are mold.



Practice Observing and Inferring

- With the person sitting next to you, quietly observe each picture.
- Write two observations for each picture and one inference.

Explaining and Interpreting Evidence

- After observing, asking questions, and inferring, the scientist will develop a proposed answer or **hypothesis**

- Hypothesis: a *proposed* scientific explanation for a set of observations.
  - Based on prior knowledge, logical inference and informed, creative imagination.
  - It is a statement
  - It is testable
  - If led to a conclusion, the data must be reliable and logical.

Parts of an Experiment

Independent variable: Part of the experiment that is being manipulated (changed or altered)

Dependent variable: Part of the experiment that we look for a change or response in.

Control: Part of the experiment not getting manipulated (not getting the independent variable)

Hypothesis: A testable statement of what you believe the outcome of the experiment will be

Spongebob WS in Packet:)

1.4 Learning Targets

- Describe and apply the measurement system that most scientists use.
- Construct a graph using appropriate techniques.
- Explain and analyze data.
- Explain the safety procedures of working safely in science.

Metric System

We are use to the English System of measurements that use units like miles, inches, pounds, and gallons.

The metric system uses **Liters, grams, and meters** with prefixes added and is based on the number 10.

How many feet in 1 miles?

How many meters in a kilometer?

Metric Prefixes and Symbols

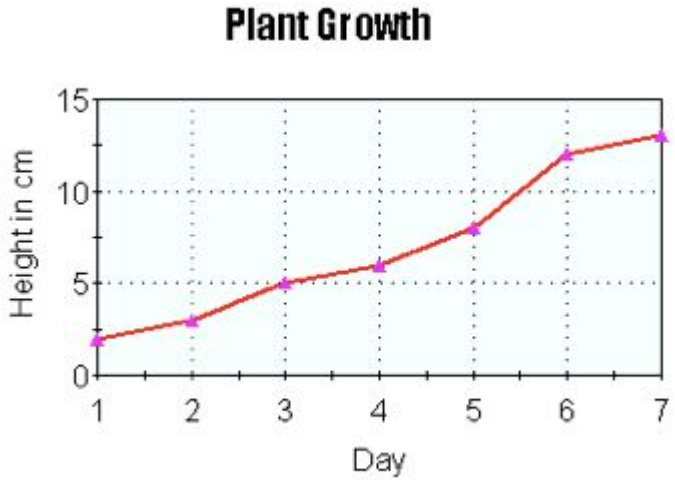
MULTIPLICATION FACTOR	PREFIX	SYMBOL
$1\,000\,000\,000\,000\,000\,000 = 10^{18}$	exa	E
$1\,000\,000\,000\,000\,000 = 10^{15}$	peta	P
$1\,000\,000\,000\,000 = 10^{12}$	tera	T
$1\,000\,000\,000 = 10^{9}$	giga	G
$1\,000\,000 = 10^{6}$	mega	M
$1\,000 = 10^{3}$	kilo	k
$100 = 10^{2}$	hecto	h
$10 = 10^{1}$	deka	da
$0.1 = 10^{-1}$	deci	d
$0.01 = 10^{-2}$	centi	c
$0.001 = 10^{-3}$	milli	m
$0.000\,001 = 10^{-6}$	micro	m
$0.000\,000\,001 = 10^{-9}$	nano	n
$0.000\,000\,000\,001 = 10^{-12}$	pico	p
$0.000\,000\,000\,000\,001 = 10^{-15}$	femto	f
$0.000\,000\,000\,000\,000\,001 = 10^{-18}$	atto	a

Graphing

Graphing is a way to organize your data quickly, to show trends, compare, contrast, or just organize large amounts of information.

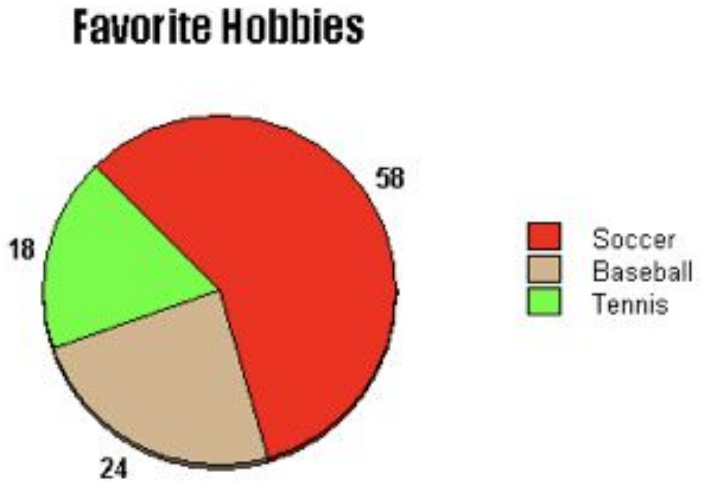
Bar graphs can be used to show how something changes over time or to compare items.

Line graphs can be used to show how something changes over time or show trends and/or correlations.



Pie charts can be used to show percentages of a whole.

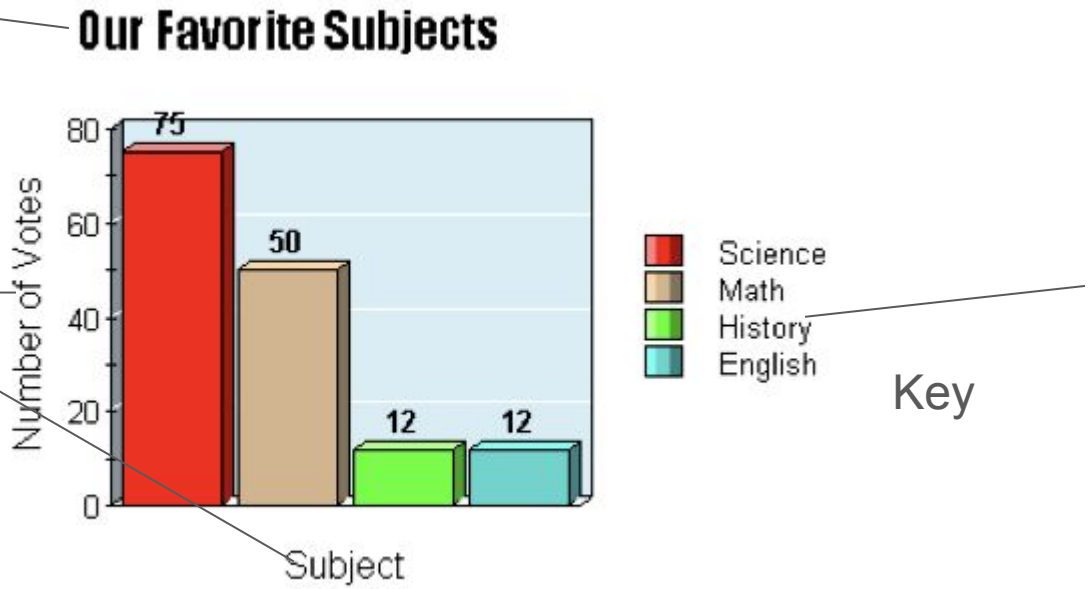
They do not show changes over time.



What Does A Graph Need?

Title

Axis Labeled

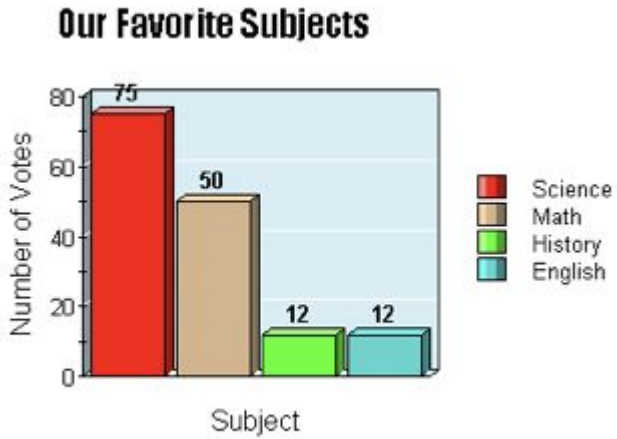


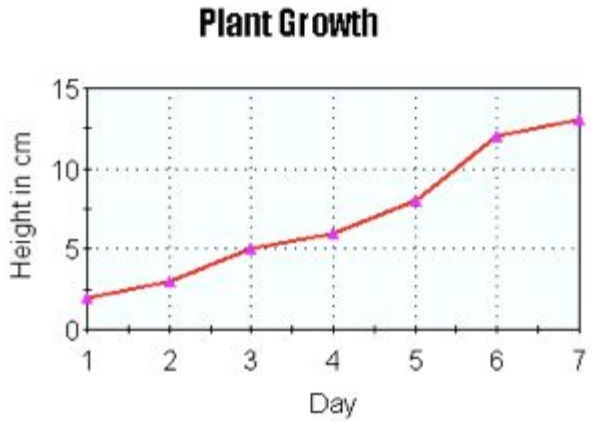
Key

Fitting the Graph

Size: does it take up most of the space, not little in the corner?

Increments: what does each line/division represent?





Example 1

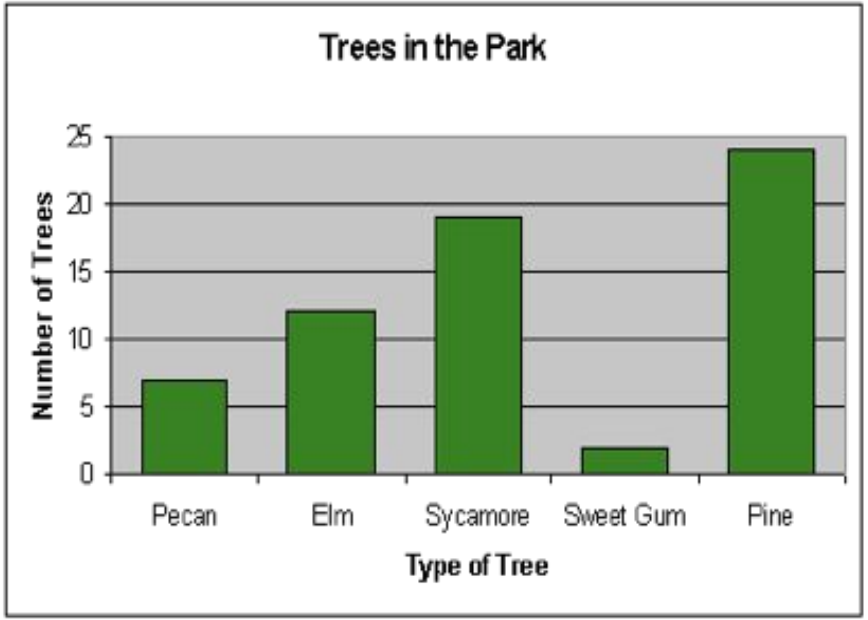
What kind of graph is it?

What is the title?

What is shown on the x axis?

What is shown on the y axis?

What are the increments of the y axis?



Example 2

What kind of graph is it?

What is the title?

What is shown on the x axis?

What is shown on the y axis?

What are the increments of the y axis?

What are the increments of the X axis?

Example 3

What is the title?

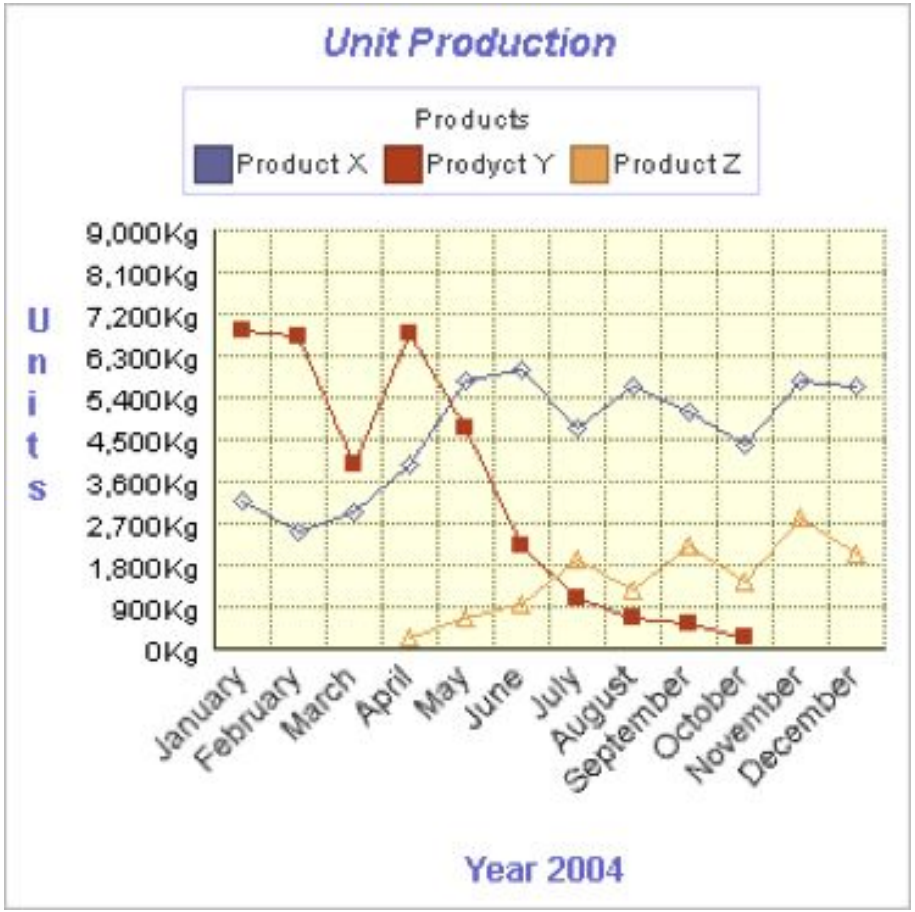
What is shown on the X axis?

What is shown on the Y axis?

What are the units on the Y axis?

What are the increments of the Y axis?

How do I know which line represents product X?



Care of Microscopes

1. Always carry with 2 hands
2. Only use lens paper for cleaning
3. Do not force knobs
4. Always store covered
5. Keep objects clear of desk and cords

Let’s get familiar with the parts of our kind of microscopes, which are **Compound Light Microscopes**.