Name: _____ Unit 1 All Topics

Period: _____

Unit 1 Notes: Introduction to Biology

Topic 1: Characteristics of Life

Topic 1 Objectives:

- I can tell the difference between organisms and nonliving things
- I can list and explain the characteristics all living things share
- I can explain why some things are considered nonliving, even though they meet some characteristics of life

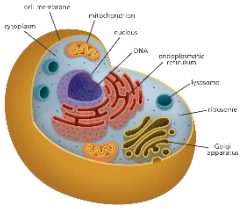
A. General Vocabulary

1. Biology: _____
   - **i.** Bio = _____ & Life = _____
2. Organism: anything that has or _____ all of the _____.

B. Characteristics of Living Things

1. **Made of one or more CELLS**
   - a. Cells are the _____capable of all life functions
     - i. *Uni*cellular organisms: composed of _____(i.e. bacteria)
     - ii. *Multi*cellular organisms: composed of _____ (i.e. humans)
     - iii. List the numbers of the photos under the correct heading below:

       Unicellular or Multicellular

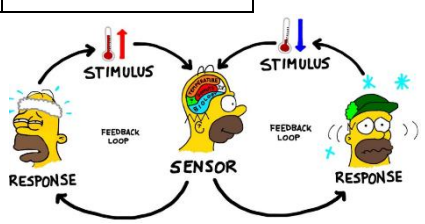


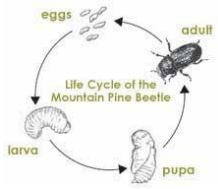
2. **Organization**
   - a. Living things are arranged in an _____.
   - b. Each organized structure in an organism has a _____.
     - i. Example: _____
   - c. Put a ***circle*** around the levels of organization below that are found in UNIcellular organisms and then put a ***box*** around all the levels of organization found in MULTIcellular organisms.

Atom → Molecule → Cell → Tissue → Organ → Organ System → Organism

Level	Definition	Example in Humans
Atom	The smallest unit of matter	
Molecule	Groups of atoms that are bonded together	
Cell	The smallest unit of life (composed of atoms and molecules).	
Tissue	Groups of cells that work together to perform a specific function.	
Organ	Groups of cells and tissues that work together to perform a specific function.	
Organ System	Groups of organs that work together to perform a specific function.	
Organism	An individual living thing.	

3. **Regulation**
   - a. Maintaining _____ _____ conditions despite changes in _____ conditions.
   - b. **Homeostasis:** when an organism's internal conditions are _____.
     - i. Example:

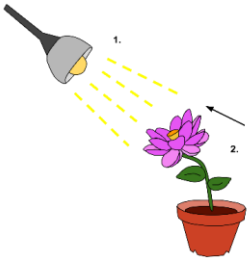




4. **Growth and Development**
   a. DNA directs pattern of growth and development
   b. Most organisms begin as _____ _____.
   c. _____**:** addition of _____ and/or new cells to an organism.
   d. _____**:** changes that take place to bring an organism to _____.

5. **Requires and Uses Energy**
   a. All chemical reactions that happen in an organism require _____. What is one source of energy? _____
      i. **Autotrophs**: organisms that _____ their own food (using energy from _____ during photosynthesis)
      ii. **Heterotrophs**: organism that get their energy from _____ other organisms.
   b. All energy originates from the _____.

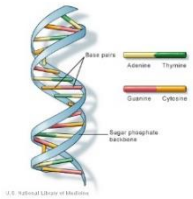
6. **Response to the Environment**
   a. *Internal Environment* = all things _____ of an organism
   b. *External Environment* = all things _____ an organism
   c. ***Stimulus*** = anything that is part of either an organism's external or internal environment that causes a _____ from the organism.
   d. ***Response*** = an organism's reaction to a _____.



7. **Reproduction**
   a. Reproduction = the production of _____ (can only happen within a species)
      i. No organism lives forever; so reproduction ensures their genes "live on" after they die.
   b. Two types: asexual vs. sexual
   c. *Species* = a group of organisms that can breed with one another and produce _____ offspring

8. **Groups of Living Things EVOLVE Over Time**
   a. *Evolution* = _____
      _____
      i. *Population* = group of organisms of the **same species** that live in a particular area.
   b. New species can develop over time if enough changes occur
   c. Natural selection — "survival of the fittest"
   d. _____: any inherited characteristics that results from changes in a species over time.
      i. Example: _____

9. **Has a Genetic Code (DNA)**
   a. All organisms store the complex information they need to live, _____, and reproduce in a genetic code written in a molecule called _____.

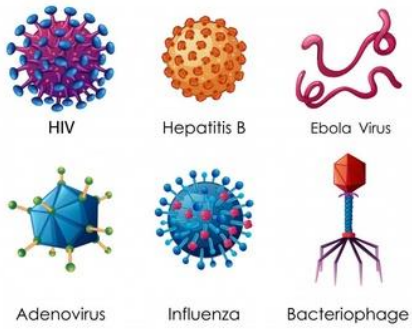


C. How do I tell if something is classified as living or not?

Living	Once-Living	Nonliving
• Must have _____ _____ characteristics currently! • No exceptions!	• Does not currently have all 9 characteristics, but _____ _____. • "_____" • Usually still have DNA and cells.	• Does not have all 9 characteristics of life. • May have some, but not all. • Never did in the _____. • Never will in the _____

[[*Language Target for Topic 1*: *I can be given information about an object and determine whether it is living, once-living, or nonliving.*]]

Use the prompt and information provided to determine if a virus is living, once-living, or nonliving. Support your decision with evidence from the reading.



Topic 2: Lab Safety

Topic 2 Objectives:

- I can distinguish between safe and unsafe practices in the lab
- I can identify the location of safety equipment in the classroom
- I can explain what the appropriate lab safety steps are in various scenarios (fire, cuts/burns, broken glass, etc)

A. General Safety Rules:

1. Listen to or read instructions carefully before attempting to do anything.
2. Wear proper protective gear and appropriate clothing.
3. Notify your teacher if any spills or accidents occur.
4. After handling chemicals, always wash your hands with soap and water.
5. During lab work, keep your hands away from your face and tie back your hair.
6. Know the location of lab safety equipment.
7. Keep your work area uncluttered. Take to the lab station only what is necessary.
8. Never put anything into your mouth during a lab experiment.
9. Clean up your lab area at the conclusion of the laboratory period.
10. Never "horse around" or play practical jokes in the laboratory.

B. Science Classroom Items

Behavior:	**Behavior cont'd:**	**Appropriate Clothing:**	**Equipment:**
Students should not touch equipment unless given proper instructions and permission by the teacher	Food, drink, & gum: NO!	• Complete-cover shoes • Tie _____ Back • Roll up loose sleeves	• wear glasses, not contacts • goggles (vents v. no vents) • sometimes, apron/gloves
Always read your lab procedure!	Minimize clutter	• Jersey Material: will melt!	• extinguisher & fire blanket • eye wash station

****You are responsible for replacing items broken or damaged due to negligence. What is "negligence?"**

_____

C. Various Safety Requirements

Glassware	**Chemical**	**Electrical**	**Heating**
• Do not use chipped or _____ glassware. Bring it to the teacher. • Broken glassware never goes in the regular trashcan. Place it in the broken glass _____. • Never pick up broken glass yourself. Tell the teacher.	• Wear goggles and an apron when pouring or heating *hazardous* chemicals • Never mix chemicals together unless it is part of the lab (and when it is, always do so in the manner specified). • Never touch/taste/smell any chemicals [_____, when necessary] • If mixing water and acid, the acid should be slowly poured into the water • Follow instructions for disposing of chemicals • Wash _____ after working with chemicals	• Be sure to place electrical cords out of the way so that no one trips over them • Before using electrical equipment, be sure that your work space and your hands are _____ • Never poke anything into electrical outlets (you will get a referral if you put anything other than plugs into the outlets)	• Before touching hot plates or burners, make sure they have cooled down (bring the back of your hand _____ to them to test) • Use tongs and/or protective gloves to handle hot objects • Never reach across an open flame (or burner) • Tie long hair back & refrain from wearing loose clothing • Always point the open end of test tubes _____ from yourself and others in the lab • When heating a test tube, move it around slowly to distribute the heat evenly

D. Handling Biological Materials

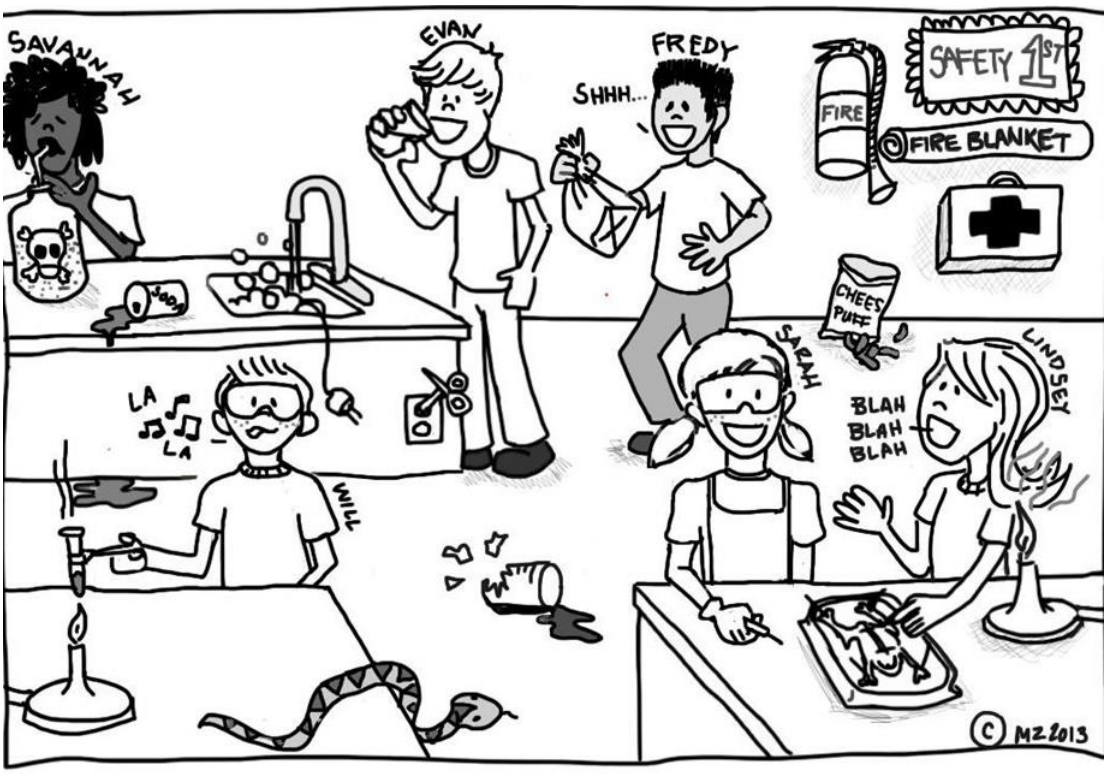
- With any live or preserved specimens, be RESPECTFUL!
- Exercise caution when using sharp tools
- Dispose of all biological materials as directed by the teacher

E. First Aid

Burns	Cuts	Eyes	Poisoning	Spills on skin
Immediately flush area with _____ water until burning sensation is lessened	Do not touch open wounds without safety gloves. _____ directly on minor cuts to stop bleeding within a few minutes	Flush eyes immediately with plenty of _____ for a few minutes (at least 15 minutes)	Find out what substance was responsible and alert the teacher immediately	Flush with large quantities of water

[[*Language Targets for Topic 2: I can identify safe/unsafe lab procedures using an image; I can locate safety equipment in the classroom.*]]

1: Use the following image and identify as many unsafe procedures as you can. Suggest ways to make these unsafe procedures safe.



2: Look around the room and describe the location of the following pieces of safety equipment:

Fire extinguisher: _____ Fire blanket: _____

Eyewash station: _____ Glass box: _____

Goggles: _____ Band aids: _____

Unit 1 Topic 3: Scientific Method

Topic 3 Objectives:

- I can collect quantitative and qualitative data
- I can distinguish between observations and inferences
- I can develop a well-written hypothesis based on observations and research
- I can identify independent and dependent variables in an experiment
- I can identify constants in an experiment
- I can differentiate between a control group and experimental groups

A. Nature of Science

1. Two definitions:
    a. *Science* = an organized way of using _____ to learn about the _____ _____
    b. *Science* = the body of knowledge scientists have built up over _____ using this process
2. Characteristics of science:
    a. Relies on _____
    b. Expands scientific knowledge
    c. Challenges accepted _____ and _____
    d. Questions results
    e. Undergoes _____ _____
        i. *Peer review* = a process by which the procedures used during an experiment and the results are evaluated by _____ _____.
    f. Uses the _____ system (meter, gram, liter, second)

Because of these characteristics, science is always growing and changing as we discover more!

B. Scientists Make Observations Before Experimenting

1. *Observation* = a direct method of _____ in an orderly way.
    - Recording information using the five _____ or tools (like a ruler or scale)
2. *Inference* = a _____ or conclusion **based on** the observations you've made and experiences you've had.
    - *Example:* You leave school and **<u>observe</u>** that the ground is wet. You **<u>infer</u>** **_____.**
3. Practice:

Image #	Observation	Inference
1		
2		
3		
4		
5		
6		

C. Bio pre-assessment

Read the experiment and identify the components on the next page.

Ten seeds were planted in five pots (two seeds per pot) that Erica found around the house. Each contained exactly 500g of Peat's Potting Soil. The pots were given the following amounts of purified water each day for 40 days. Pot 1: 50mL, Pot 2: 100mL, Pot 3: 150mL, Pot 4: 200mL, Pot 5: 250mL. Pot 3 received the recommended amount of water. The dry mass of each pot with soil and plant was measured at the end of the experiment after being placed in a drying oven for 4 days.

1. Independent Variable: _____
2. Dependent Variable: _____
3. Constants: _____
4. Control Group: _____
5. Experimental Group(s): _____
6. Hypothesis: _____
   _____

D. Scientific Method

Remember that all questions come because of an observation that someone has wanted to learn more about

1. **<u>Ask a Question</u>** (sometimes also called "State the Problem")
- A scientific question must be _____
- Scientists based their questions on observations, prior knowledge, and related _____
  - *Write a question you have about the Japanese Macaques behavior below:*

2. **<u>Hypothesis</u>:** a testable _____ of a situation, also based on observations
   a. Written in an "If….. then…." format
   b. "If *[insert what you'll do to CAUSE a change],* then *[insert what measurable change you predict will happen]."*
      - *Example:* If dogs receive 3 training sessions per day, then they will recall tricks faster than dogs that receive one training session per day.

> A hypothesis is not to be confused with:
> - ***Theory*** = a **well-tested explanation** that **unifies** a broad range of observations
> - ***Law =*** a statement of **fact**, deduced from observation, that a natural or scientific phenomenon **always occurs** if certain conditions are present *(ex: law of gravity*).

- *Write a hypothesis about why our Japanese Macaques exhibit this behavior below:*

3. **<u>Design Experiment</u>:** an investigation of a phenomenon in a controlled setting to _____ ___ _____

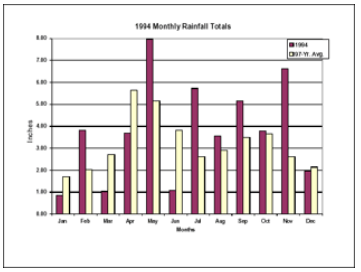
A new experiment to study: a scientist observes that grass grows tallest in his lawn right next to the sprinkler.
Hypothesis:

*Experiments have the following components:
- ***Variable*** = any factor that can _____ or _____ and affect the experiment's outcome
- ***Independent Variable*** *(_____ variable)* = what is changed by the _____
  - *Example:* amount of water
    - Memory Trick: I change the Independent
    - Memory Trick: **CAUSE**
- ***Dependent Variable*** *(_____ variable)* = the _____ we're looking to find.
  - *Example:* change in the height of grass
    - Memory Trick: Dependent Variable depends on the independent variable.
    - Memory Trick: **EFFECT**
- ***Constant =*** a factor/variable that is _____ during an experiment.
  - *Examples:* _____
- ***Control Group =*** a group used for _____ that **does not** receive "the treatment" (IV).
  - *Example:* the plot of grass that **does not** receive any _____
- ***Experimental Group =*** the groups _____ to any amount of "the treatment" (IV)
  - *Example:* the plots of a grass that **were** given any amount of _____
- ***Procedure =*** the planned list of steps to follow in order to test the hypothesis

4. **<u>Perform Experiment and GATHER DATA:</u>** do the experiment you designed and record the results.
   a. *Data* = information gained from observations
   b. ***Quant****itative Data =* _____ data (measurements of quantities like time, _____, length and mass.
      - Example from grass experiment: _____

c. ***Qual****itative Data* = _____ of what our senses detect (_____, not numerical).
   - Example from grass experiment: _____

5. **Analyze the Data:** see what the data actually means!
   a. Questions that scientists may ask:
      - Has my hypothesis been _____?
      - Is more data needed?
      - Are different procedures needed?
      - What are possible _____ _____ _____?
   b. Tables and _____ are good tools for data analysis.



6. **Conclusion:**
   a. Your hypothesis may be supported or _____ by the data, OR indicate more research is needed!
   b. Conclusions should include:
      - Conclusion statement
      - Summary of _____ with specific _____ values.
      - Explanation of how the data actually supports your _____ statement.

7. **Communicate Results**:
   a. Scientists report their conclusions and findings in _____ journals that are peer-reviewed.

E. The Culture of Science

1. Communicate Results
   - Share results with _____
2. Scientists build on what has been learned from _____.
   - They pay close attention to contemporary scientists working on the same problem.
3. Both cooperation and competition characterize the _____.
   - Scientists check the conclusions of others by attempting to repeat experiments.

[[*Language Targets for Topic 3: (1) I can sort examples of qualitative and quantitative observations; (2) I can discuss whether a statement is an observation or an inference with a partner]; (3) I can create an example of a hypothesis, a theory, and a law and defend why I made these choices.*]]

1. *Identify each observation as being qualitative or quantitative. Explain why you made that choice.*
   a. *One leaf is 9cm in length.* _____
   b. *It is light green in color.* _____
   c. *It gets darker over a period of time.* _____
   d. *The veins are 3mm wide.* _____
2. *Identify the following statements as an observation or an inference. Again, explain why.*
   a. *The container is filled to the 350mL mark with water.* _____
   b. *The caterpillar did not eat the moth because it is not a carnivore.* _____
   c. *The plant on the left grew more because it received more water.* _____
   d. *Sound traveled faster through the desk than through the air.* _____

3. *Identify each of the following as a hypothesis, theory, or law:*
   a. *Force is equal to mass multiplied by acceleration (F=ma).* _____
   b. *If I keep a plant in the dark, then it will fail to photosynthesize.* _____
   c. *All living things are made of cells, all cells come from preexisting cells, and cells are the basic unit of function in living things.* _____

Unit 1 Topic 4: Data Analysis

Topic 4 Objectives:

- I can record (quantitative) data in tables and charts, using units
- I can organize data to show the relationship between variables on appropriate graphs
- I can identify and discuss trends using data

	Column 1	Column 2
1		
2		
3		

A. Organizing data

1. Scientists use _____ to record and organize their data.
   a. Vertical _____
   b. Horizontal _____

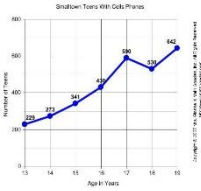
2. The labels of the chart tell us a lot. What could we title this data table?
   _____
   _____

3. We then use the chart to make a _____
   a. _____ the data
   b. Easily and quickly identifies _____ or trends in the data.

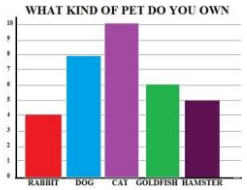
Organism	Direction of Movement		
	Toward Light	Away from Light	Neither
Euglena	X		
Paramecium			X
Fungus			X
Coleus plant	X		
Earthworm		X	

B. Types of Graphs

1. Line Graph
   a. Both sets of variables (data on the x and y axis) are quantitative / _____.
      ➢ Often (_____), the variable on the x-axis is _____.
   b. Connected _____ allow us to see an overall _____ in the data.
   c. *Extrapolation* = when we _____ values beyond our given data points on the x-axis.

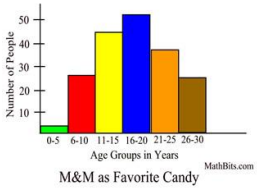


2. Bar Graph
   a. Used to _____ values from different _____
   b. X-axis variable is usually qualitative (category), and y-axis is usually quantitative.



3. Histogram
   a. Similar to bar graph but it compares numerical _____ ____, rather than categories.

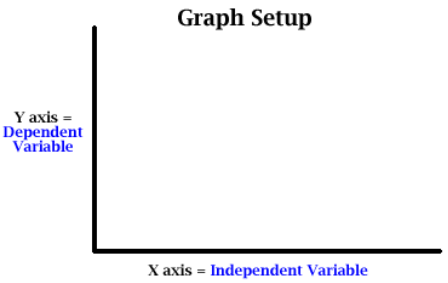
4. Pie Graph (Pie Chart)
   a. Used to compare the _____



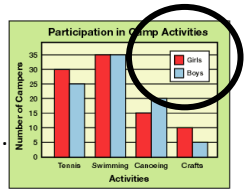
M&M as Favorite Candy

C. What to Include in a Scientific Graph

1. A descriptive title
   ➢ "The effect of _____ on _____"
   ➢ "How _____ effects _____"
      • First blank is the _____ variable and second blank is the _____.
2. Variables placed on the correct axes
   ➢ Independent variable goes on the _____
   ➢ Dependent variable goes on the _____
      • ***Memory Trick:*** *DRY MIX*
      DRY = **D**ependent **R**esponding **Y** axis
      MIX = **M**anipulated **I**ndependent **X** axis



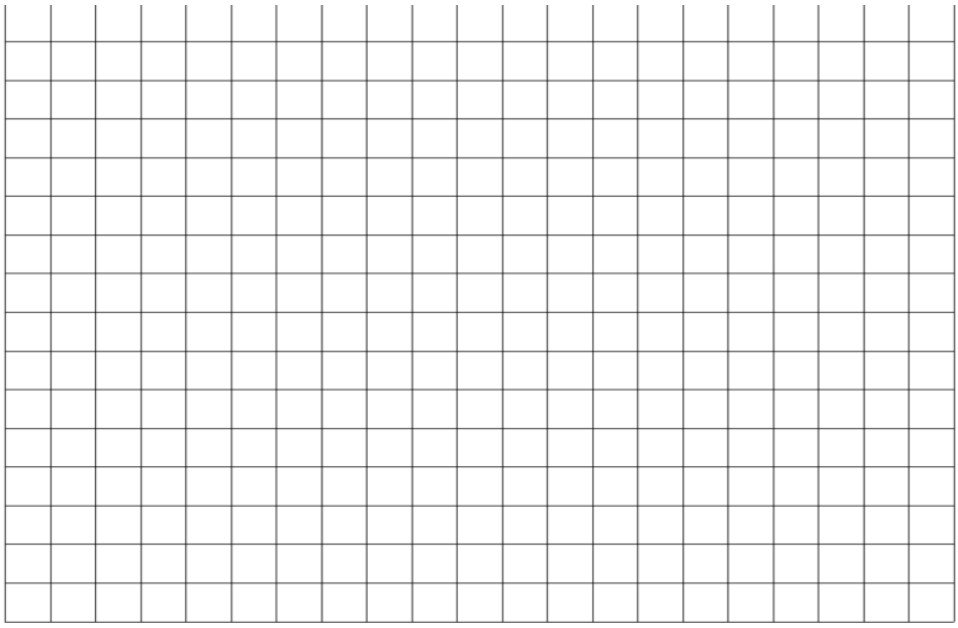
3. Labeled axes with units in parentheses (if applicable)
   ➢ *Example:* Average Height of Grass (_____)
4. Properly scaled axes
   ➢ Number your axes so that the data is spread out across the _____ _____
   ➢ Write values along the _____ axis (even if your data doesn't use the whole axis)
   ➢ You **do not** need to start your axes with zero.
5. Properly plotted points or bars
6. A key/legend (if applicable)
   ➢ Two different sets of data can be plotted on the _____ _____ to compare them.
   ➢ The key helps distinguish between the _____ _____.



D. Graphing Practice Problem #1

Let's say scientists were attempting to determine the effect of changing pH levels (a measure of acidity) in a pond on the number of surviving tadpoles. They counted the number of tadpoles found in ponds at various pH levels. Their data is given below. Please graph the data—making sure to include all the elements of a "proper scientific graph"—and answer the questions on your notes.

pH of water	Number of tadpoles
8.0	45
7.5	69
7.0	78
6.5	88
6.0	43
5.5	23



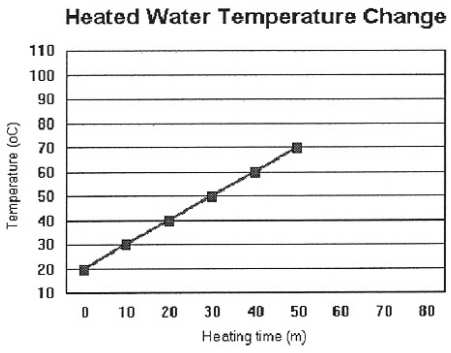
Analysis Questions:

1. What kind of graph did you use to plot the data and why?

2. What is the I.V.?
3. What is the D. V.?
4. What is the OPTIMUM water pH for tadpole survival?

E. How do I analyze a graph?

1. Read the _____ and axes _____ first.
2. Try to identify the independent and dependent _____.
3. Terms to know:
   a. *Maximum / Optimum* = the _____ / _____ value
   b. *Minimum* = the _____ value



Analysis Practice Problem #1

Based on the data in the graph, the temperature of water at 25 minutes is

a) 15˚F
b) 15˚C
c) 45˚F
d) 45˚C

Analysis Practice Problem #2

The information to the right was collected in the field while studying the effect of pH on the growth of the duckweed plant. The data shows that duckweed has optimum growth at a pH of:

a) 4
b) 6
c) 8
d) 12

Field Data

Pond	pH of Pond Water	Number of Duckweed Plants
A	6	150
B	12	300
C	8	500
D	4	80

[[*Language Targets for Topic 4: (1) I can draw and label a graph of given data; (2) I can identify and discuss trends in the data based on charts and graphs]]*

Directions: Read the passage below and complete the questions to show your understanding of Jacob's experiment.

Jacob, a landscaper, wondered if a particular tree would grow better in the sun or in the shade. Without collecting information or doing much research, Jacob claimed that if he could limit the amount of sunlight the tree was exposed to, then the tree would grow taller. To test this idea, Jacob planted 10 trees in a shady area and 10 trees in an area with a significant amount of sunlight. Over the next several months, Jacob watered and fertilized each tree in the exact same way. He also took measurements of the tree's height and averaged them. The data he took is below.

Month	Average Total Tree Height in the Sun (meters)	Average Total Tree Height in Shade (meters)
April	0.2	0.2
May	0.5	0.5
June	0.8	0.6
July	1.1	0.7
August	1.4	0.9
September	1.8	1.0

1. What was Jacob investigating with his experiment?

2. What is a proper hypothesis you can write for this experiment?

3. What was the independent variable?

4. What was the dependent variable?

5. What were the constants for this experiment?

6. What conclusion can you draw from the data above?

7. Graph the data: