Name KEY

Biology Unit 1 Characteristics of Life & Scientific Inquiry Guided Notes

- I can identify examples of the characteristics of life.
- I can generate examples of the characteristics of life.
- I can differentiate between living and non-living.

Biology = the study of life.

A(n) Organism is a living thing that has or once had **ALL** the characteristics of life.

Characteristics of Life Table

Characteristic of Life	Description	Examples
1) Made of cell(s)	Cells are the basic unit of life (smallest living thing = cell)	• Unicellular = bacterium (bacteria) • Multicellular = human(s)
2) Displays organization	How the cell/organism is built or put together atoms/molecules → cells → tissues → organs → organ systems → organism	• Arm - made from cells, tissues, muscles, bones • lipids (fats) made from C, H, O atoms
3) Grows & develops	Growth - increase in size/mass Development - change in abilities	• baby → adult • tadpole → adult frog • caterpillar → butterfly
4) Reproduces	Making more of the species. (Pass on DNA)	• Cat having kittens • Bacteria multiplying
5) Respond to stimuli Stimulus → Response (Cause) (Effect)	Reaction to an internal / external factor	• Zebra sees a tiger (S) → runs away (R) • Touch hot stove → move hand
6) Requires energy (metabolism)	Energy is needed for life processes (Make own food or eat food)	• Plant doing Photosynthesis • Mouse eating cheese
7) Maintains homeostasis homeo — same stasis — not changing	Keep all internal processes in check or balance to survive (equilibrium)	• Body temperature constant (sweating or shivering) • Blood pressure 120/80 • healing a wound / injury
8) Adapts & evolves Adaptations = structural or behavioral changes to environment	Genetic traits allowing for better survival in environment	• Plants having roots to get H_2O • Flowers to attract insects for pollination

Populations NOT individuals evolve!

Is a car a living thing? Yes or (No)

Characteristic(s) of Life Present	Characteristic(s) of Life Absent Missing
• Displays organization	• Made of cell(s)
	• Grows & develops
	• Reproduces
← Responds to stimuli →	
• Requires energy	
← Maintains Homeostasis →	
	• Adapts & evolves

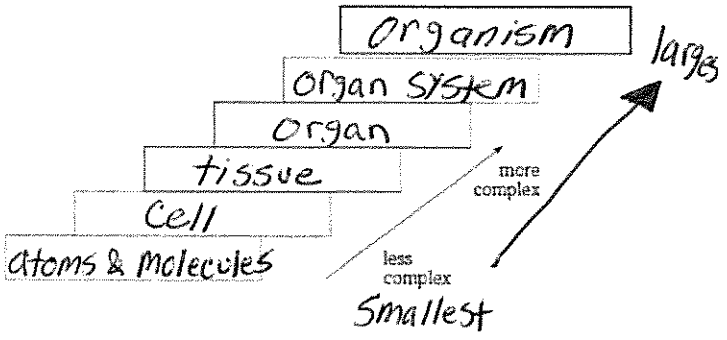
Conclusion: The car is NOT a living thing because it Does not possess ALL of the characteristics of life.

A(n) Organism is a living thing that has or once had **ALL** the characteristics of life.

Levels of Biological Organization

Sequence *the levels of organization listed below in the correct order from least complex to most complex.*

- organ
- cell
- tissue
- atoms and molecules
- organ system
- organism



Nature of Science

Science = a body of knowledge based on study of nature.

Goals of Science:
(1) Deals only with the Natural World.
(2) To collect and organize information.
(3) To propose explanations that can be tested.

What is Science?
1. Relies on evidence.

theory = explanation that is well-supported over time.

2. Expands Scientific Knowledge.

3. Challenges accepted theories.

4. Questions results.

5. Tests claims.

6. Undergoes Peer review.

peer review = Procedures used during experiment may be repeated and the results are evaluated by scientists in same field of research

7. Uses the Metric System. International System of Units (SI

metric system = Measurement system whose divisions are powers of ten.

Science begins with a(n) Observation - orderly, direct information gathered about a natural phenomenon using your senses (sight, sound, smell, taste, and touch).

data - quantitative/qualitative info gained from scientific investigation/experiment.
Quantitative data = numbers Example: 27°C, 60 heart beats/minute
Qualitative data = descriptive Example: green eyes, fur, smooth textu

Inference - assumption based on prior experience.
Example: You leave school and see that the ground is wet, so you infer that it rained outside.

Hypothesis - a proposed scientific explanation that is testable.
Example: **If** fertilizer makes a plant grow faster, **then** seedlings planted with fertilizer will grow taller than ones planted without fertilizer.

Steps of ~~the~~ a Scientific Method

1) Make Observations

2) Define problem/Question

3) Form a hypothesis (If….., then…..)

4) Test the hypothesis (Design and conduct a controlled experiment)

independent – the variable that is deliberately changed (usually plotted on x-axis)

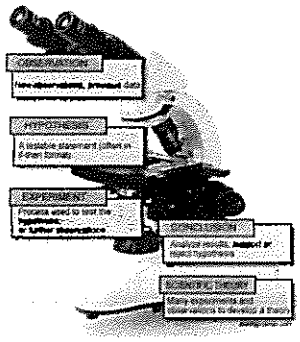
dependent - the variable that is being measured in the experiment (usually plotted on y-axis)

5) Record and analyze results

6) Draw a conclusion

7) Reflect and repeat experiment

8) Make research public for peer review



The Scientific Method in Action

Suppose you observed that a cricket outside your window seems to be chirping every night, but some nights it chirps faster than others. A friend of yours told you once that you can use the sound of a cricket chirp to tell the temperature. Curious, you decide to design an experiment. First you must create a **hypothesis**; here are some examples of possible hypotheses:

The frequency of cricket chirps will change as the temperature changes.

As the temperature decreases, a cricket will chirp fewer times.

Either hypothesis will work, the important thing is that you can -test- the hypothesis by doing an experiment which will confirm or deny the statement.

To set up the experiment, you go out to your yard and capture a few crickets. You bring them inside and place them in a container. But wait, if you have a bunch of crickets together, what if they chirp based on how many crickets there are nearby. The goal in designing an experiment is to eliminate all the variables except the one you are testing. This means all your cricket subject must be housed in the same environment (same lighting, same food, same water...etc.). Okay, so you get that set up and take the temperature of your room. Now you must wait for the crickets to start chirping. You count how many times the cricket chirps for a 5 minute period.

Now you have to compare that number with the chirps that occur at different temperatures. You may use a heating pad, or ice or any other way to lower or raise their temperature. You would then take data for 5 minutes at the new temperature.

In your experiment, the **INDEPENDENT VARIABLE** is the thing you changed – the temperature.

The **DEPENDENT VARIABLE** is what you are measuring that happens as a result of that change – the number of cricket chirps.

The **CONTROL GROUP** is not obvious in this case – but you can consider your original (room temperature) data as your control, and the other temperatures your experimental data. After you have taken data, you can then draw a **conclusion** about whether your hypothesis is accepted (correct) or denied (incorrect).

https://www.biologycorner.com/lesson-plans/scientific-method/scientific-method/

- I can distinguish between science and pseudoscience.
- I can critique the validity of scientific data.
- I can identify reliable sources for peer review and research.

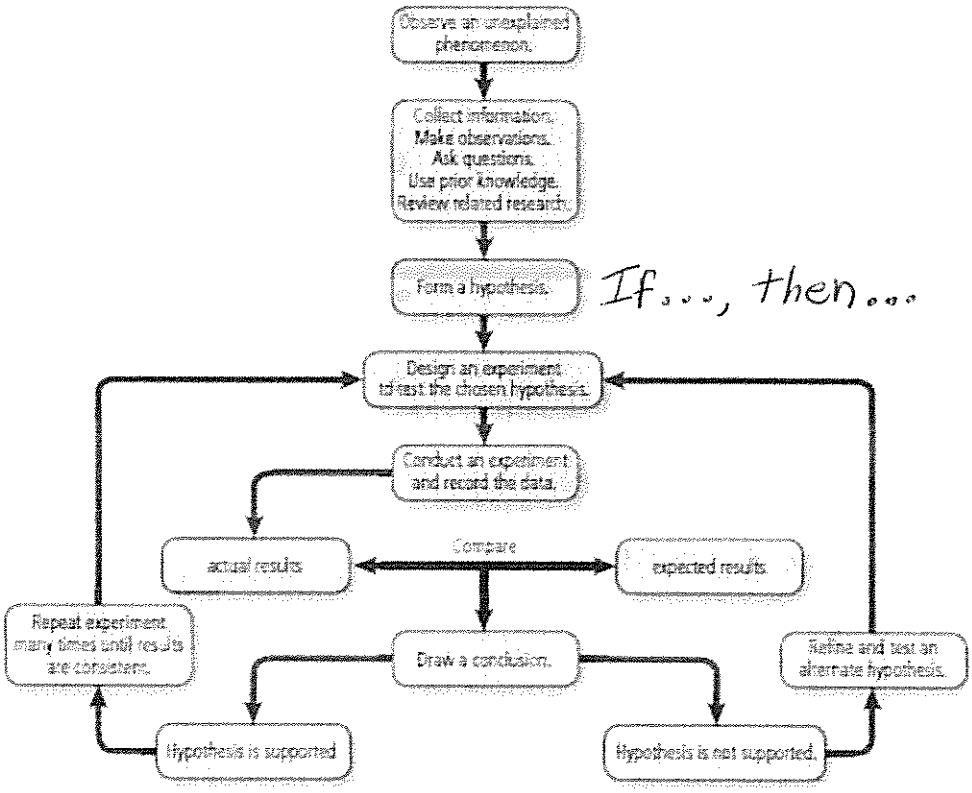
Science	vs	False Pseudoscience (false science)
• Guided by research		• little to no research
• Makes claims that are testable		• Makes claims, but not testable
• Follows evidence wherever it leads		• Starts with a conclusion, then works backwards to confirm
• Peer review		• No peer review
• Embraces criticism		• Hostile to criticism
• Changes with new evidence		• Dogmatic and unyielding
Ex. Biology, Physics, Chemistry, earth science, astronomy		Ex. Astrology, Horoscopes, Psychic readings, Phrenology, tarot card readings

Description	Science	Pseudoscience
1. Studying genes and inheritance	X	
2. Forecasting personality by reading bumps on the head = Phrenology		X
3. Observing interactions of organisms in the environment	X	
4. Peers reviewing investigations and experiments	X	
5. Telling the future by reading lines on the palms		X
6. Forming untestable hypotheses based on nonscientific literature		X
7. Forming testable hypotheses based on observations and questions	X	
8. Communicating experimental findings and offering data for peer review	X	

- I can generate a question to be answered using scientific inquiry.
- I can develop a hypothesis to be tested.
- I can design and conduct a controlled experiment.
- I can identify the independent and dependent variables along with the control and experimental groups in an experiment.
- I can identify strengths and weaknesses in experimental design.

Scientists use a series of problem-solving procedures called Scientific Methods.

Basic Steps used in Scientific Methods



Identify ***the parts of the experiment described in the table below.***

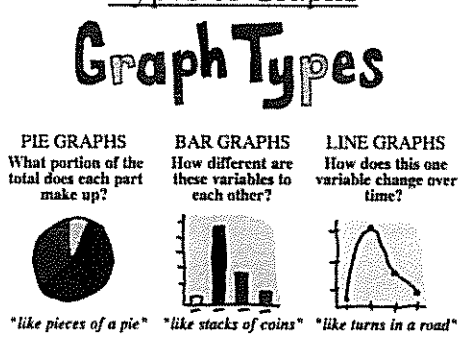
Experiment: A biologist gives a new kind of food to a group of dogs and compares the weight gain of these dogs over time to a group of similar dogs that do not receive the new food.
Experimental group: Dogs given new kind of food
Control group: Dogs NOT given new kind of food
Independent variable: What is factor being tested? New kind of food
Dependent variable: What is being measured? Weight gain in dogs

- I can create data tables and graphs.
- I can analyze data and draw conclusions.

Elements of a Quality Graph

- Descriptive title
- Label axes (x, y) with variables
- Label units on axes (x, y)
- Scales on axes of equal units
- Key / Legend
- Caption explaining/summarizing the data

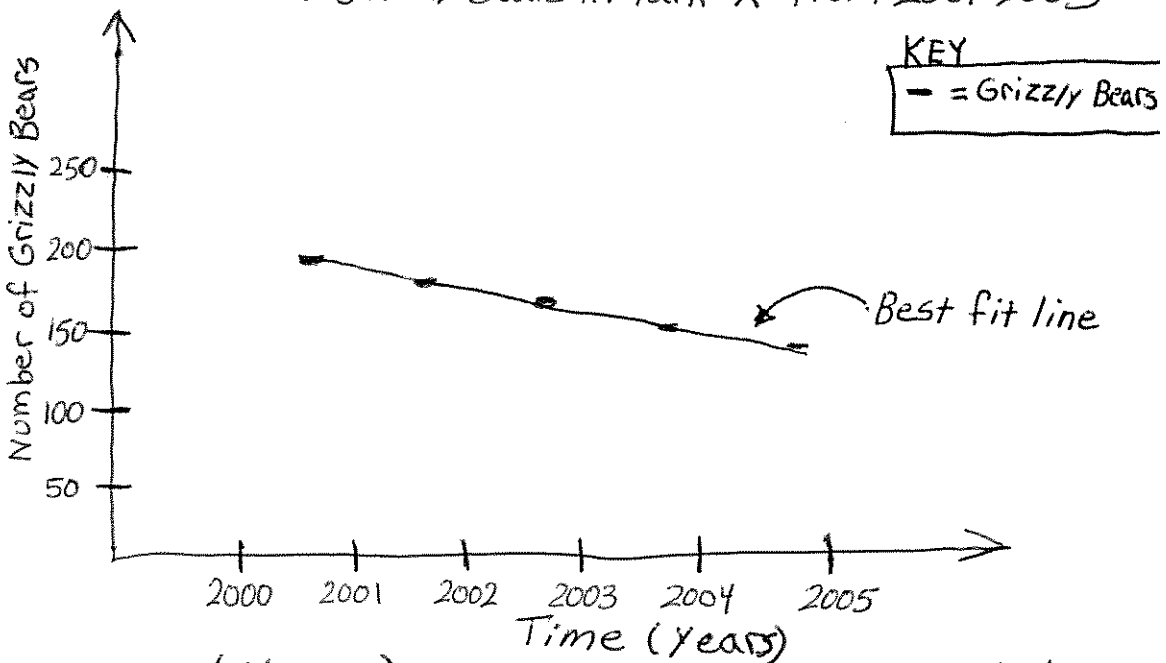
Types of Graphs



Pie – Used to compare parts of a whole (does not show changes over time).
Bar – Used to show comparisons between groups/variables.
Line – Used to show trends & changes over time.

Model *a line graph from the data in the table below. Plot the points, and draw a line connecting the points.* Number of Grizzly Bears in Park X from 2001-2005

Grizzly Bears in Park X	
Year	**Quantity**
2001	195
2002	190
2003	184
2004	164
2005	158

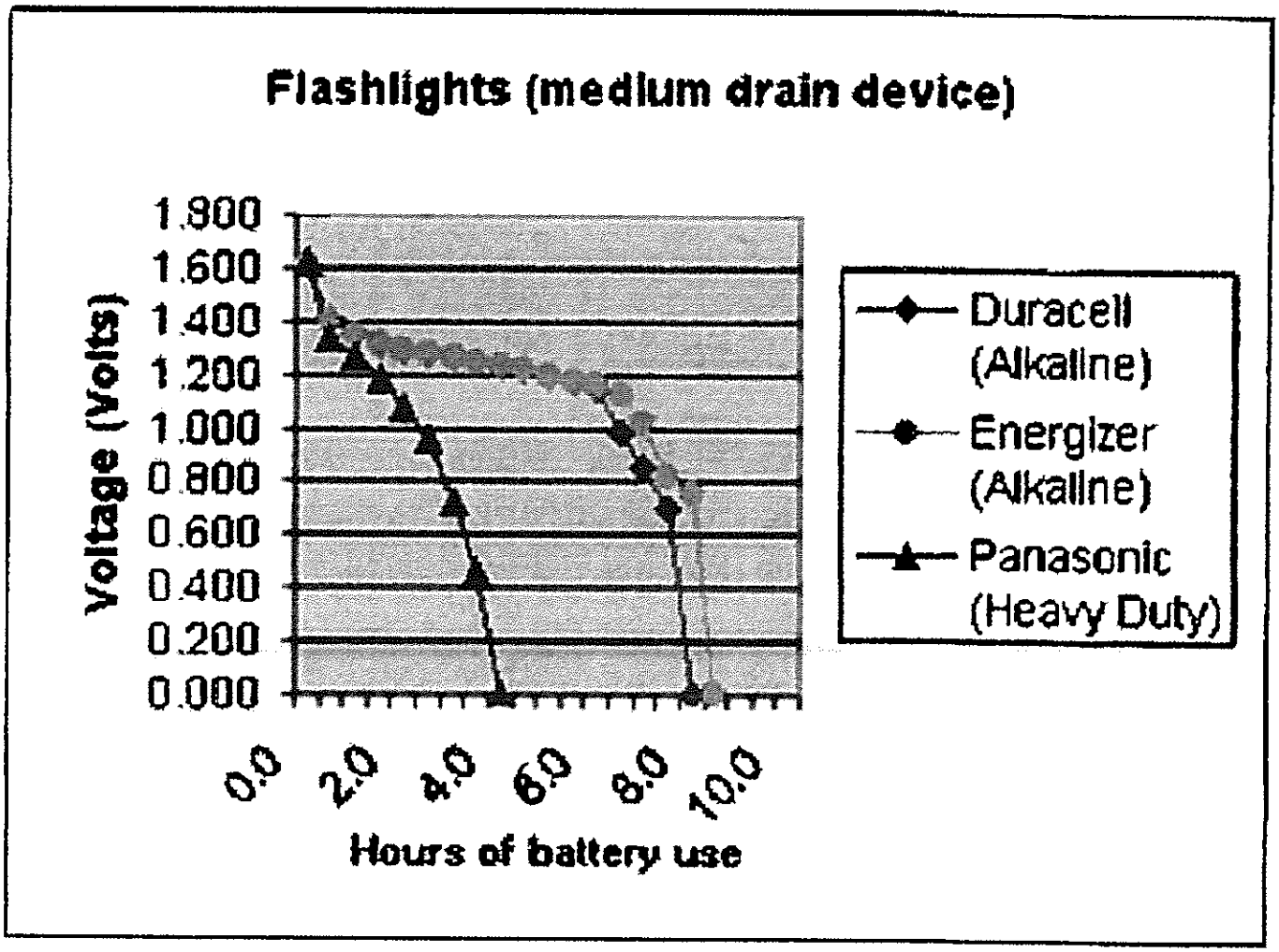


X Independent variable = Time (years)

y Dependent variable = Number of Grizzly Bears in Park X

Figure 1: The graph shows the number of grizzly bears in Park X from 2001-2005. As the years passed the # of grizzly bears decre

Analyze the data below and draw conclusions.



The heavy duty battery by Panasonic holds less voltage over time than the alkaline Duracell and Energizer batteries. The Panasonic battery lasted approximately 5 hours. The two alkaline batteries, Duracell and Energizer lasted approximately 8.5 and 9 hours respectively. Therefore, the flashlights with alkaline batteries can be used almost twice as long as a flashlight with a heavy duty battery.