Name: _____ Period: ____ Date: _____
Teacher: Ms. Ramirez

Essential questions:
Why is it important to think like a scientist? How can we apply Scientific method in our everyday life?

Vocabulary words:

Scientific inquiry-

Hypothesis-

Observation-

Independent variable-

Dependent variable-

Theory-

Bias-

Skepticism-

Ethics-

Do know: Fill in the K-W-L chart describing what is Biology.

What is Biology?

K **K** is what you **know**	**W** **W** is **What** you want to learn	**L** L is for what you **learned** AFTER the lesson

Answer the following questions after watching video:

- ✓ What is science? _____
- ✓ What do scientists look like? _____
- ✓ List 3 different things scientist do.
  -
  -
  -

4. Review your KWL chart, add in your **W** section what other aspects of science would you like to learn.

Class assignment:
read pages 13-15 (Learning about the world). Highlight the most important concepts/ vocabulary words and write **2** questions in your notebook on what is unclear or comments.

Homework:

Exit Ticket:

1. What did you learn today in class that you know that you will not forget a year from today?

_____

_____

2. What will slip your mind a year from today?

_____

_____

3. How did your view of science change with what we presented today in class

---

Do Now:

- Place homework in the blue mailbox (In Section).
- Read the following and highlight most important concepts and answer section I.

Scientific Method Investigation

Scientific Inquiry: The Scientific Method

Name: _____ Date: _____

Chapter 1

The Scientific Method

Scientific inquiry is a process scientists use to find answers to questions they have about the world around them. They use the steps in the **scientific method** to design and conduct scientific investigations to explore possible answers.

Steps in the scientific method answer a question.

1. Purpose: What do you want to learn from the experiment?
2. Research: What is already known about the topic?
3. Hypothesis: What do you think will happen in the experiment?
4. Procedure: How will you test the hypothesis and record the results?
5. Analysis: What do the results tell about the experiment?
6. Conclusion: Do the results support your hypothesis?

Test Yourself

I. A **mnemonic device** is a special word or phrase used to help a person remember something, particularly lists. Create a mnemonic device for the steps in the scientific method.

Steps	Example	Your Mnemonic
Purpose	Peter	P
Research	Rabbit	R
Hypothesis	Hates	H
Procedure	Peas	P
Analysis	And	A
Conclusion	Carrots	C

✓ SCIENTIFIC METHOD:

_____

✓ Create flow chart or graphic organizer describing steps:

✓ **Class Activity:**

- **You are the scientist! Answer the questions and create your own plan to find a solution. Each student must fill in this section!**

A. What is the purpose of this activity?

_____

_____

B. Is there a problem or situation that needs to be resolved? If so what is the problem?

_____

_____

C. What do you believe will be the outcome once you are done "figuring it out"?

_____

_____

D. Create a plan to resolve the problem.

_____

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E. Make a list of steps to fix the problem.

_____

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_____

✓ **Purpose:**

- Asking _____
- _____
- Choosing a Topic for investigation.
- _____

✓ Observation: _____

Read-Think-Pair-share:
Read the scientific method-purpose section, answer section I & II and pair-share with your partner

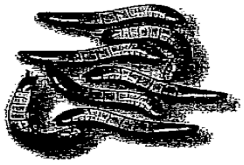
The Scientific Method—Purpose

Chapter 1

Scientists are problem solvers. They ask many questions about what they see going on in their world. They conduct scientific investigations to find the answers to these questions. Most investigations follow a general pattern.

Choosing a Topic for Investigation

A good topic is one that can be tested with an experiment. It is important that the topic is not too general.



Example:	Too General	Good Topic
	meal worms	food meal worms eat

Stating the Purpose

Scientists explain exactly what they want to learn from their investigation in the purpose. The purpose is written as a question, often called the "Big Question." The purpose of an investigation includes three components. (1) It is clearly written. (2) It usually starts with the verb "does." (3) It can be answered by measuring something.

Example: Topic	Purpose (What do you want to learn about the topic?)
plant growth rates	Does fertilizer affect the growth rate of a plant?
fireflies' flash rates	Does temperature affect the flash rate of fireflies?
paper airplanes' design	Does the design of a paper airplane affect its hang time?

Test Yourself

I. Decide which topics are good ideas and which are too general for scientific investigation. Record your answers below.

Topic	Too General /Good
1. best brand of batteries	
2. volcanoes around the world	
3. water conservation	
4. materials used as insulators	

II. Practice writing a purpose for each topic. Record your answers below. Remember to start the purpose with the word "Does."

Topic	Purpose
1. temperature and bread mold	
2. texture of paper towels	
3. colored light and plant growth	
4. light and the activity of meal worms	
5. rust and the strength of magnets	

✓ **Create your own topic:**

✓ **Write the purpose of investigation:**

Research: _____

- ✓ Collecting data:
  - ➢ Observing
  - ➢ Measuring
  - ➢ Quantitative data:

    _____
  - ➢ Qualitative data:

    _____
  - ➢ Sampling:

    _____
  - ➢ Organizing data:

    _____

Read-Think-Pair-share:

Read the Scientific Method-Research section, answer section I & II and pair-share with your partner

Chapter 1

The Scientific Method—Research

Before carrying out any experiment, a scientist finds out what is already known about the topic being investigated. A good starting point is to identify the key words in the purpose. Next, look up each key word in an encyclopedia, dictionary, or textbook. Then, expand the research to the Internet.

Example: Does fertilizer affect the growth rate of a sunflower?

The goal of the search is to find information that will help in forming a prediction about what will occur in the experiment. Scientists use questions to direct their investigations.

Fertilizer

Why *do we need fertilizers?*
How *do fertilizers affect plant growth?*
Who *invented fertilizer?*
What *are the ingredients in fertilizers that affect plant growth?*
When *do plants need fertilizer?*
Where *should fertilizer be applied to the plant to get the best results?*

Sunflowers

Why *does soil type affect plant growth?*
How *do minerals and nutrients affect plant growth?*
Who *would be a good resource in my community to contact about plants?*
What *are the elements required for plant growth?*
When *does photosynthesis affect plant growth?*
Where *in the plant does photosynthesis occur?*

Test Yourself

I. Underline the key words for each purpose below.
   1. Does the depth a seed is planted affect its ability to sprout?
   2. Does eating breakfast affect short-term memory?

II. Write questions to direct the research for the purpose: Does temperature affect the strength of a magnet?

Temperature	Magnet
1. Why	1. Why
2. How	2. How
3. Who	3. Who
4. What	4. What
5. When	5. When
6. Where	6. Where

Read-Think-Pair-share:
Read the Scientific Method-Hypothesis section, answer section I & II and pair-share with your partner.

The Scientific Method—Hypothesis

Chapter 1

After completing the research, a scientist is able to make an educated guess or prediction about what will happen in the experiment. This prediction is called the **hypothesis**. A clearly written hypothesis follows a set pattern. It answers the question stated in the purpose. It is brief and to the point. It uses the same word pattern as the purpose.

Example: Purpose: Does the depth of a seed affect its sprouting time?
Hypothesis: An increase of the depth of a seed will increase its sprouting time.

The hypothesis is worded so that it can be tested. It identifies the independent variable and dependent variable. These variables are often referred to as factors, traits, or conditions. The terms increase and decrease are often used to predict what will happen in the experiment.

- **Independent Variable:** The factor that is changed in an experiment. (depth of seed)
- **Dependent Variable:** The factor that responds to the change. The change is measured and recorded in metric units. (sprouting time)

Example: Hypothesis: Warmer **water temperatures** will increase the **amount of sugar** dissolved.
Independent Variable: water temperature
Dependent Variable: amount of sugar that dissolves, measured in grams

Test Yourself

I. Write a hypothesis for each purpose.
1. Purpose: Does fertilizer affect the growth rate of a plant?
Hypothesis: _____
2. Purpose: Does air pressure affect the height a basketball will bounce?
Hypothesis: _____
3. Purpose: Does age affect the heart rate of humans?
Hypothesis: _____

II. Identify the independent and dependent variables for each hypothesis below.
1. Hypothesis: Warmer water temperatures will increase the heart rate of fish.
Independent Variable: _____
Dependent Variable: _____
2. Hypothesis: The design of a paper airplane will affect the distance traveled.
Independent Variable: _____
Dependent Variable: _____
3. Hypothesis: More light will increase the movement of meal worms.
Independent Variable: _____
Dependent Variable: _____

Hypothesis: _____.

- ✓ Answers question stated in the purpose.
- ✓ _____.
- ✓ Brief & to the point!

Read-Think-Pair-share:
Read the Scientific Method-Procedure, answer section I & II and pair-share with your partner

Chapter 1

The Scientific Method—Procedure

The **procedure** is a step-by-step set of directions for testing the hypothesis. A good procedure is so detailed and complete that other scientists can duplicate the experiment. The procedure includes several components.

Materials: Materials are a list of items needed to conduct the experiment. The list is written similar to a recipe. Materials and supplies are listed in the order they are to be used in the experiment. Measurements are written using metric units.

Experiment: The experiment is a test designed to answer the question stated in the purpose. The test consists of two groups.

- Experimental Group: This group includes the part or parts of the experiment that are changed and tested. The results are then compared to the control group to determine what changes have taken place.
- Control Group: This group includes the part or parts of the experiment that are left unchanged. The conditions a scientist wants to remain the same during the experiment are called **constants**.

Variables: When conducting a test, scientists change certain things and then observe how they affect the experiment. These "things" are called variables. The variables in an experiment are often referred to as factors, traits, or conditions. An experiment usually has two variables.

- Independent Variable: The factor that is changed and tested in the experiment. A good experiment has only one independent variable.
- Dependent Variable: The factor that responds to the change. The change is measured and recorded in metric units.

Data: Data is a record of the results of the experiment, and it is usually recorded in a data table. Later, the data is organized in a graph to make the information easy to read and analyze.

Test Yourself

I. Matching

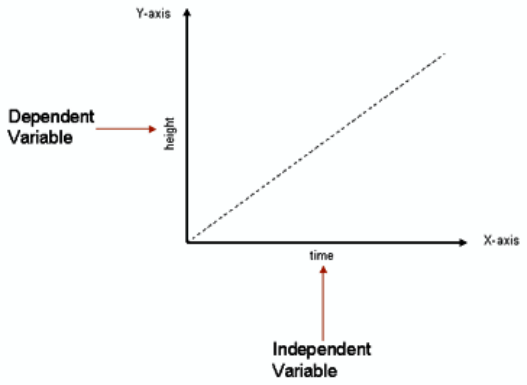
_____ 1.	data	a. the items needed to conduct an experiment
_____ 2.	variable	b. a test designed to answer the question in the purpose
_____ 3.	experiment	c. a record of the results observed in an experiment
_____ 4.	materials	d. a factor that can be changed and tested in an experiment

II. Fill in the Blanks

1. The _____ is a step-by-step set of directions for testing the hypothesis.
2. A good experiment has only _____ independent variable.
3. Changes in the _____ _____ are measured with the metric system.
4. The _____ is organized in a graph to make it easy to read and analyze.
5. During the experiment, the data is usually recorded in a _____ _____.

Procedure:

- ✓ _____
- ✓ _____
- ✓ _____
- ✓ _____
- ✓ _____
- ✓ _____

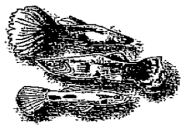


Read-Think-Pair-share:
Read the Scientific Method-Data section, complete test yourself section & T chart. Pair-share with your partner

The Scientific Method—Data

Chapter 1

A scientist keeps a careful record of the data collected during an experiment. The results are often organized in a data table. A table is divided into columns and rows. It includes a title, clearly labeled parts, units of measurement are identified, and if appropriate, the average (mean) for different trials is included.



Hypothesis: Warmer water temperatures will increase the respiration rate of fish.

Respiration Rate of Guppies (Breaths per minute)

Temperature of Water	Trial #1 Respiration Rate	Trial #2 Respiration Rate	Trial #3 Respiration Rate	Trial #4 Respiration Rate	Average (Mean)
20°C	78	78	77	79	78
24°C	120	124	122	126	123
26°C	170	180	161	177	172
28°C	201	202	203	202	202

*Respiration rate was determined by counting the number of times the fish's gills opened in one minute.

Finding the Average

The mean is the average of a set of numbers. To calculate the average, add up all the numbers in the set, and then divide by how many numbers there are in the set. (Remember: It is the *sum* divided by the *count*.)

Example: What is the average of these numbers? 78, 78, 77, 79

- Step #1: Add the numbers: 78 + 78 + 77 + 79 = 312 (sum)
- Step #2: Divide the sum by how many numbers were added (4 numbers were added): 312 ÷ 4 = 78
- Step # 3: Identify the average: The average is 78.

Test Yourself

Complete the data table by finding the average.

Height of Ball Bounce

Air Pressure	Trial #1	Trial #2	Trial #3	Trial #4	Average (Mean)
4 PSI (lbs.)	53 cm	53 cm	52 cm	54 cm	1.
6 PSI (lbs.)	66 cm	68 cm	70 cm	64 cm	2.
8 PSI (lbs.)	122 cm	126 cm	128 cm	124 cm	3.
12 PSI (lbs.)	176 cm	167 cm	175 cm	174 cm	4.

✓ **Compare & contrast: control** and **experimental group** include **independent** and **dependent variables** in your explanation using the following T chart:

BOTH groups have in common:

Control Group	Experimental Group

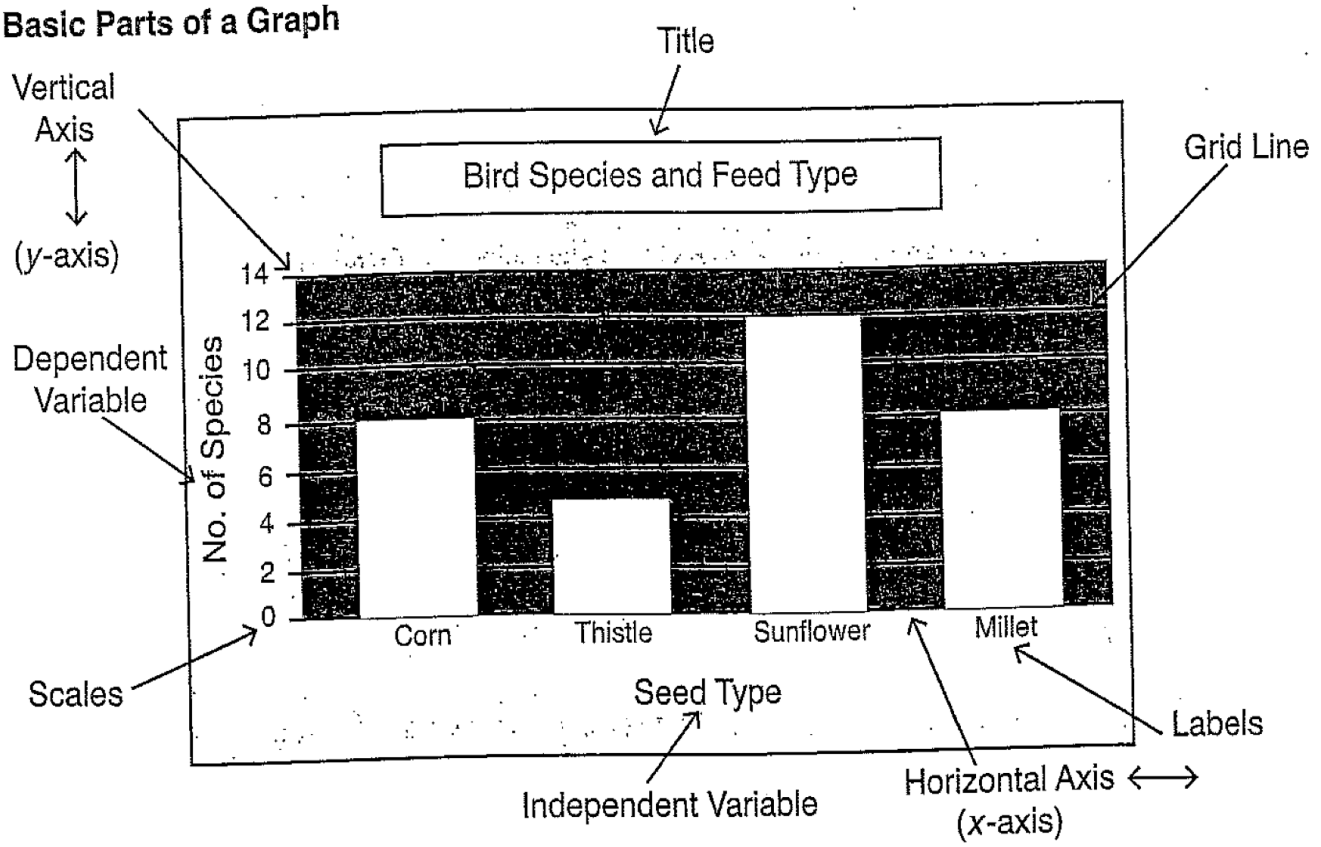
Read-Think-Pair-share:
Read the Scientific Method-Analysis section pages 9-10 and complete the test yourself section. Pair-share with your partner

Chapter 1

The Scientific Method—Analysis

After scientists complete an experiment, they need to decide what the results mean. They often organize their data using a graph. A graph makes it easy to read the results of the experiment and identify patterns. Most kinds of graphs have the same basic parts.

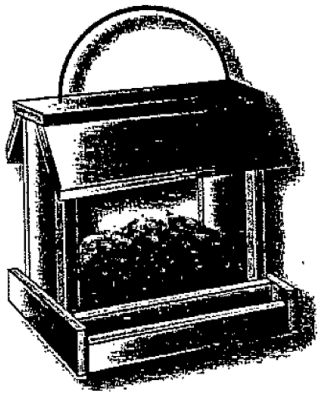
Basic Parts of a Graph



Graph Title: The graph title gives an overview of the information being presented in the graph. The title is given at the top of the graph.

Axes and Their Labels: Each graph has two axes. The labels indicate what information is presented on each axis.

- Horizontal axis (*x*-axis)–Independent Variable: the factor that is changed or tested by the experimenter
- Vertical axis (*y*-axis)–Dependent Variable: the factor that responds to the change



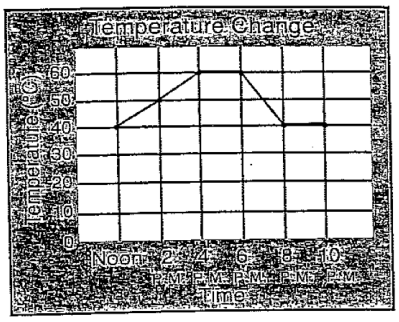
Scale: The range of values being represented is placed at **equal** intervals along the vertical axis. Numbers on the scale are lined up with the grid lines. Do not place numbers in between the lines.

The Scientific Method—Analysis (cont.)

Three Types of Graphs

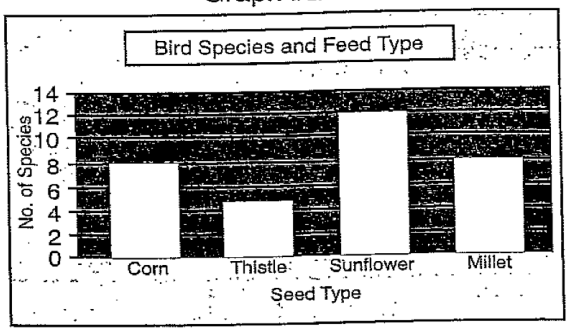
Different types of graphs are appropriate for different experiments. Three common types of graphs are line, bar, and circle.

Graph #1



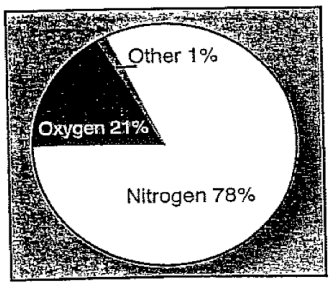
Line Graph: A line graph is used to show how data changes over time. Both variables in a line graph must be numbers. One variable (time) is shown on the horizontal axis (⟷), or *x*-axis, of the graph. The other variable (temperature) is placed along the vertical axis (↕), or *y*-axis. The data is connected by a rising or falling line. The line shows changes or trends usually over time.

Graph #2



Bar Graph: A bar graph uses bars to show the relationship among the variables. It can be drawn either horizontally (⟷) or vertically (↕). A bar graph is used to compare results that are totals, such as time, width, distance, temperature, height, and length. One variable is shown on the horizontal axis, or *x*-axis, of the graph. The other variable is placed along the vertical axis, or *y*-axis.

Graph #3
Earth's Atmosphere



Circle Graph: A circle graph is used to show percentage or fractions of the whole. Circle graphs are sometimes called pie charts. Each slice of the pie represents a fraction of the total.

Test Yourself
Analyze the data represented in each graph above. What do the results tell you?

Graph #1: _____

_____

Graph #2: _____

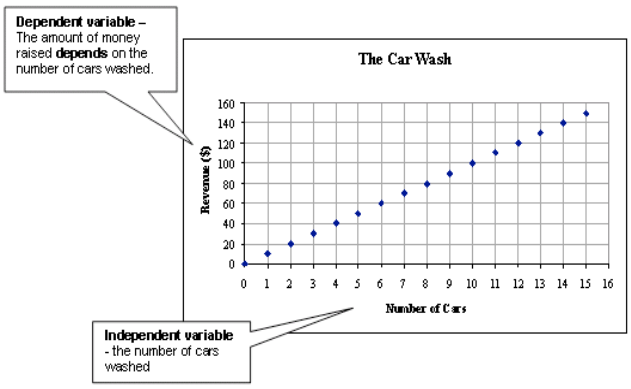
_____

Graph #3: _____

_____

Analysis:

- ✓ Analyzing data:
- ✓ Graphs:
  - ➢ Title
  - ➢ Axes & labels
  - ➢ Scale
- ✓ Types of graphs:
  - ➢ _____
  - ➢ _____
  - ➢ _____



ALMOST DONE: :O)

Read-Think-Pair-share:
Read the Scientific Method-Conclusion section, complete section I &II. Pair-share with your partner

Chapter 1

The Scientific Method—Conclusion

A scientist carefully studies the data collected during a scientific investigation. The information is used to write a **conclusion** that summarizes the results of the experiment. It includes the purpose, a brief description of the procedure, and whether or not the hypothesis was supported by the data. Scientists use key facts from their research to help explain the results.

Sometimes scientists find that the results do not support their hypothesis. When this happens, they don't change or manipulate the results to fit their hypothesis. Scientists do not consider negative results as bad. They just explain why things did not go as expected. They use the negative results as the first step in constructing a new hypothesis and designing a new experiment.

Test Yourself
Study the hypothesis and results of the scientific investigations below. Write a conclusion that summarizes the results of the experiment. Does the information support the hypothesis?

I. Hypothesis: Warmer water temperatures will increase the respiration rate of fish.

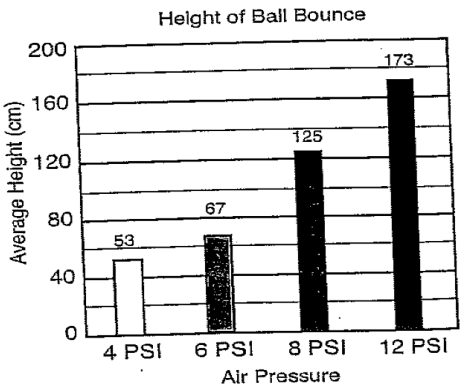
Respiration Rate of Guppies (Breaths per minute)

Temperature of Water	Trial #1 Respiration Rate	Trial #2 Respiration Rate	Trial #3 Respiration Rate	Trial #4 Respiration Rate	Average (Mean)
20°C	78	78	77	79	78
24°C	120	124	122	126	123
26°C	170	180	161	177	172
28°C	201	202	203	202	202

Conclusion: _____

II. Hypothesis: Greater air pressure will increase the height a basketball bounces.

Conclusion: _____



Drawing conclusions:

- ✓ Inferring: _____
- ✓ Restate:_____, describe procedure, and _____.
- ✓ Forming a theory: _____
- ✓ Do negative results exist?

Implementing Scientific Method:

- ✓ Problem solving:
- ✓ Communicating: _____
  - Journals

Exit Ticket:

- ✓ 3:2:1 reflection:

  3 things you learned today:

  a) _____

  b) _____

  c) _____

  2 things you liked about the activity:

  a) _____

  b) _____

  1 thing you still do not understand from today's lesson.

  a) _____

BCT practice: Circle the correct answer

Chapter 1 Review

Multiple Choice

1. Dr. Jones met a man who had been bitten by venomous snakes several times over many years, yet he was not sick. The doctor thinks that something produced in the man's blood protects him from harmful effects of the poison. This idea, or possible answer to a scientific question, is called a (an)
   A. hypothesis C. observation
   B. inference D. theory

2. A student placed slices of moist bread in a closed cupboard and noticed that mold grew faster on them than on slices of moist bread left out on a counter. The one difference in this experiment—the presence or absence of light—is called the
   A. theory C. control
   B. hypothesis D. variable

3. A logical explanation of natural phenomena that is supported by scientific observations and experiments is called a (an)
   A. hypothesis C. factor
   B. inference D. theory

4. A student wants to test how much water is necessary to produce the most bread mold. She kept one slice of bread dry while using varying amounts of water on other slices. The dry bread in this experiment is called a
   A. hypothesis C. observation
   B. control D. theory

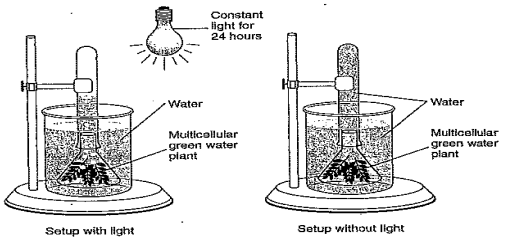
5. The number of organisms that are tested in an experiment is called the
   A. variable size C. sample size
   B. controlled size D. experimental factor

6. The scientific method is
   A. a way of posing a research question only
   B. used to organize data that is already known
   C. an organized approach to problem solving
   D. used by all scientists in an identical way

7. The best way to be sure that your experimental results are valid is to
   A. ignore information from other sources
   B. conduct your experiment one time only
   C. use more than one variable in the experiment
   D. test as large a sample size as possible

8. A researcher is reviewing another scientist's experiment and conclusions. The reviewer would most likely consider the experiment *invalid* if
   A. the sample size produced a great deal of data
   B. other individuals are able to duplicate the results
   C. it has conclusions that are not explained by the evidence
   D. the hypothesis was not supported by the data obtained

9. An experimental setup is shown in the diagram below. Which hypothesis would most likely be tested using this setup?



   A. Water plants release a gas in the presence of light.
   B. Roots of plants absorb minerals in the absence of light.
   C. Green plants need light for cell division.
   D. Plants grow best in the absence of light.

10. Which statement best describes a scientific theory?
    A. It is a collection of data designed to provide support for a prediction.
    B. It is an educated guess that can be tested by experimentation.
    C. It is a scientific fact that no longer requires any evidence to support it.
    D. It is a general statement that is supported by many scientific observations.

Homework:

Complete The Simpson's worksheet applying the scientific method.