Name: _____ Period: _____ Date: _____

Unit Topic: Science and the Scientific Method   Grade Level: 9

Student Learning Map

Key Learning: Science is a verifiable and self-correcting oraganized body of knowledge about nature.

Unit Essential Question: What is and is not science?

Concept: Science	**Concept:** Scientific Process

Lesson Essential Questions:	**Lesson Essential Questions:**
1. What is science? (section 1.1) 2. How do scientific observation and inference differ? 3. How is scientific research conducted? (section 1.3)	4. How do we incorporate good experimental design in investigations? 5. How are scientific results presented?

Vocabulary: science fact observation qualitative quantitative inference scientific method research question hypothesis conclusion law theory	**Vocabulary:** independent variable manipulated variable dependent variable responding variable controlled variable operational definition direct relationship inverse relationship slope

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Objectives

In order to demonstrate one's competence in this area, the student will be able to:

Section One: Science

____1.   Define all vocabulary terms listed on the student learning map.

____2.   Describe the characteristics of science.

____3.   Distinguish between a scientific observation and inference.

____4.   Distinguish between qualitative and quantitative observations.

____5.   Identify the components of the scientific method.

____6.   Explain why the scientific method is a cycle.

____7.   Distinguish between a scientific fact, hypothesis, law, and theory.

Section Two: Scientific Process

____1.   Define all vocabulary terms listed on the student learning map.

____2.   Distinguish between good and poor experimental design.

____3.   Identify independent, dependent and controlled variables.

____4.   Write research questions, hypotheses & conclusions for an experiment in the correct format.

____5.   Identify operational definitions for an experiment.

____6.   Graph and calculate the slope of data from an experiment.

____7.   Interpret a graph and explain the relationship between variables.

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Unit Topic: Science and the Scientific Method

1.   Place a check in front of the phrases that describe science

_____ Is systematic   _____ Involves experiments

_____ Involves opinions   _____ Changes when new evidence arises

_____ Deals with cause and effect   _____ Deals with nature & the physical world

_____ Is testable   _____ Is haphazard & chaotic

_____ Deals with supernatural   _____ Is peer reviewed

_____ Involves superstitions   _____ Involves rational thought

2. Use the numbers 1–5 to identify the order of the steps to the scientific method

_____ Predicting   _____ Questioning

_____ Experimenting   _____ Hypothesizing

_____ Concluding

3. Are the steps of the scientific method always followed in the same order? ***Explain***

_____

_____

_____

4. Complete the following statements by filling in the blank.

Scientific _____ involve the use of the five senses. After making

observations, scientists make _____ which are explanations of observations.

5. Identify whether the following statements are observations or inferences by writing OBS or INF in front of the statement.

_____a. There is glass on the floor.

_____b. A student must have dropped a beaker.

_____c. The velocity cart's batteries must have died.

_____d. The yellow and green velocity cart is at rest.

6. Observations that are descriptions are called _____ observations.

7. Observations that are measurements or involve numbers are called
_____ observations.

Unit Topic: Science and the Scientific Method

1. Identify the following observations as qualitative or quantitative by writing QUAL or QUANT in front of the statement.

_____a. The cup is red.

_____b. The cup is 10 cm wide.

_____c. The temperature is 76 °C.

_____d. The atom is small.

_____e. There are sixteen protons in the atom.

2. How do you determine if an observation is qualitative or quantitative?

_____

3. Observations that have been agreed upon are considered scientific _____.

4. List the terms **theory, fact** & **law** in order from specific to general.

specific observation	→	general explanation

5. List the terms **hypothesis, theory, & law** in sequential order.

Predicts results before the experiment	→ Summarizes results after experiments →	Explains results from many experiments

6. In your own words, explain the difference between a scientific theory and the everyday meaning of the word theory.

_____

_____

_____

_____

_____

_____

Unit Topic: Science and the Scientific Method

1. Identify the following statements as describing an independent (I), dependent (D) or controlled (C) variable.

_____a. Stays the same throughout the experiment

_____b. Is changed by the experimenter

_____c. Is measured as a result of a change

_____d. Also known as the responding variable

_____e. Also known as the manipulated variable

_____f. Is always on the y-axis of a graph

_____g. Is always on the x-axis of a graph

2. Complete the statement with the correct variable name.

When experimenting, scientists change the _____ variable, which is also known as the

_____ variable. The scientist then measures the affect, which is known as the

_____ variable or _____ variable. The conditions that are

kept the same for every trial are called the _____ variables.

3. Complete the following:

a. When writing the research question, it should be written:

_____

b. When writing a hypothesis, it should be written:

_____

c. When writing a conclusion, it should be written:

_____

d. What does an operational definition describe?

_____

4. Explain why the following scenario does not represent good experimental design.

An experiment is done to determine if the type of laundry detergent, the amount of laundry detergent, and the temperature of the water the laundry is washed in affects how clean the clothes get. The students predict that 50 mL of detergent C in warm water will do the best job. The students test different amounts of the 3 different detergents in hot water, warm water, and cold water and repeat the experiment until their hypothesis is supported. They then conclude that the combination of 50 mL of detergent C in warm water is the ultimate combination to clean clothes.

How could the students improve the experiment?

_____

_____

_____Pag

Unit Topic: Science and the Scientific Method

Use the scenario below to answer the following questions.

1. A scientist wanted to study the effect of a drug on the breathing rate of fish. She set up an experiment in which the she filled 6 fish tanks with 10 goldfish in each tank. The fish were the same size and age. The tanks were the same size with the same amount of water and type of filter. The fish were fed the same amount of the same food every day. Using a graduated cylinder she added 1 milliliter of drug to the first tank and increased the amount each tank received by 1 milliliter. One tank remained normal with no drug added. After she added different amounts of the drug to each tank she let them sit for one day. She then measured the breathing rate of each fish by counting the number of breaths in 30 seconds and then multiplying by 2 to determine the number of breaths per minute for each fish.

a. Using the variables from above, identify the independent variable
_____

b. Using the variables from above, identify the dependent variable _____

c. Using the information from above, identify the controlled variables.

_____

_____

d. What is the operational definition of the independent variable?

_____

e. What is the operational definition of the dependent variable?

_____

f. Using the variables from above, correctly write a research question for this experiment.

_____

g. Using the variables from above, correctly write a hypothesis for this experiment.

_____

h. How can she be sure her results will be significant and will not occur by chance?

_____

i. What did she do to ensure multiple trials?

_____

Unit Topic: Science and the Scientific Method

An experiment is done to determine how the distance from an eye chart affects the number of letters a person can correctly identify.

For the data given in the chart:
1. Create the graph using the rules discussed in class.
2. Draw a best-fit line.
3. Write a statement describing the relationship between the variables.

Distance from eye chart (meters)	Number of items correctly identified
1	33
2	31
3	28
4	25
5	17
6	10

Title: _____
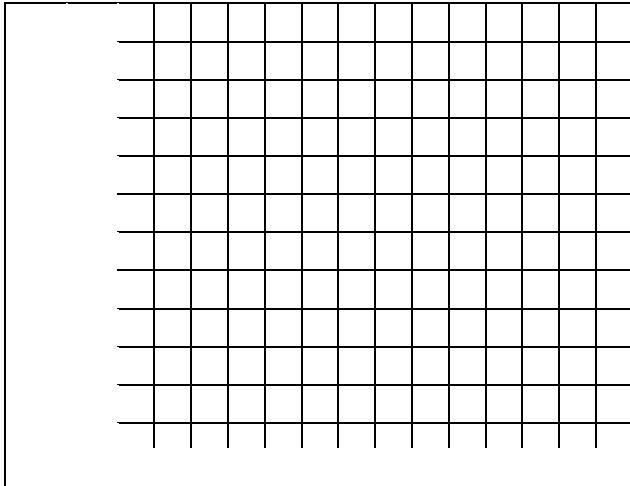
Relationship/Conclusion:

_____

_____

_____

_____

_____
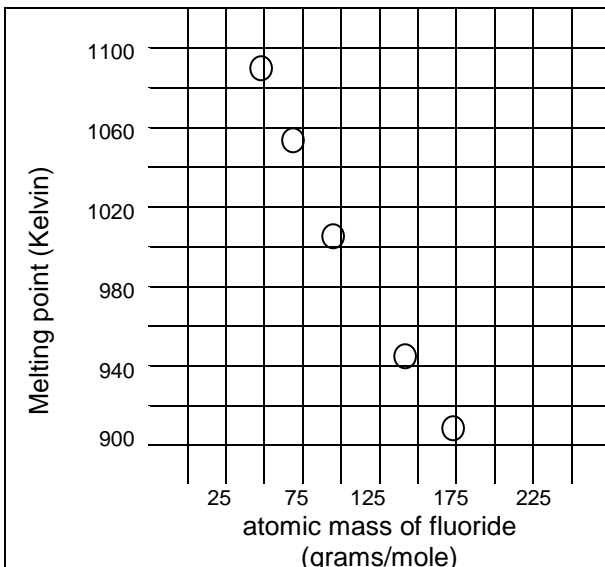
For the graph below:
1. Title the graph
2. Draw a best fit line.
3. Write a statement describing the relationship between the variables.
4. Calculate slope
5. Identify the dependent and independent variables

1. Title: _____

Melting point (Kelvin)

1100
1060
1020
980
940
900

25   75   125   175   225

atomic mass of fluoride (grams/mole)

3. Relationship and conclusion statement

_____

_____

4. Calculate slope here. Show work! Include a unit label!

5. a. What is the dependent variable?_____

5. b. What is the independent variable?

Define each of the following vocabulary terms in your own words. You may use pictures and/or examples in your definition.

science

fact

observation

qualitative

quantitative

inference

scientific method

research question

hypothesis

conclusion

law

theory

independent variable

manipulated variable

dependent variable

responding variable

controlled variable

operational definition

direct relationship

inverse relationship

slope