

Answer Key

Dinosaur Scene - Observation and Inference Worksheet

A time machine has been invented that travels into the past and takes pictures, sending them to the present. You are asked to look at one of the pictures and interpret what you see.

- O 1. The volcano is erupting.
- I 2. The camptosaurus is going to eat the stegosaurus.
- I 3. The stegosaurus will run into the water to escape.
- O 4. The camptosaurus is leaving tracks in the ground.
- O 5. The ground where the camptosaurus is walking is wet.
- O 6. There are plants growing in the water.
- I 7. The camptosaurus is going into the water to eat the plants.
- O 8. There is a tree growing next to the river.
- I 9. The tree looks like a palm tree.
- I 10. The climate is warm.
- O 11. The stegosaurus is eating the plant.
- I 12. The stegosaurus is an herbivore.
- O 13. There are bones from a dead animal by the shore.
- I 14. The camptosaurus killed the animal.
- O 15. Some more bones are in the water.
- I 16. The camptosaurus can't swim and will drown.
- O 17. Lava is coming down the sides of the volcano.
- I 18. The camptosaurus has sharp teeth for eating meat.

O = Observation

I = Inference

Reflection 1: How would you define an inference, in your own words?

Answers will vary.

Inferences are an explanation for an observation that you have made.

Reflection 2: What is the difference between an observation and an inference?

Answers will vary.

Observations are information we gather using our five senses while inferences help explain those observations.

Reflection 3: Is it alright to change your inference over time? Explain your answer.

Yes! As new observations are made our ~~obs~~ inferences will change, especially as we get closer to a solution.

These were written
as directional
hypotheses using
If / then

Number _____

Hypothesis Worksheet 2

Name _____

Hour _____ Date _____

Underline the IV (what is the experimenter changing) and circle the DV (what is being measured) and then write your hypothesis in an "If, then" format.

1. Can reading small print cause a headache?

Hypothesis: If students frequently read small print, then the occurrence of headaches will increase.

2. Does the amount of iron in the water affect plant growth?

Hypothesis: If the amount of iron in the water that plants are given increases, then plant growth will increase.

3. Can plant growth be increased by increasing the brightness of the light?

Hypothesis: If the brightness of light that plants are exposed to increases, then plant growth will increase.

4. Will toddlers grow taller if they drink more milk?

Hypothesis: If toddlers drink more milk, then they will grow taller.

5. Will being in the sun too long without sunscreen cause skin cancer?

Hypothesis: If people spend too long in the sun without sunscreen, then the rates of skin cancer will increase.

6. Will the apples be sweeter when the tree gets enough water?

Hypothesis: If apple trees are given more water, then their apples will be sweeter.

7. Will test scores increase if studying is done every day?

Hypothesis: If students study every day, then test scores will increase.

8. Will mushroom grow more if the moisture is increased?

Hypothesis: If moisture in the soil is increased, then mushroom growth will increase.

9. Does consuming too much salt cause high blood pressure?

Hypothesis: If people consume too much salt, then the occurrence of high blood pressure will increase.

10. Will brushing your teeth for 10 minutes a day prevent cavities?

Hypothesis: If people brush their teeth for at least 10 minutes, then the rate of cavities will decrease.

Hypothesis Worksheet

These were
written as
measurable
hypotheses using:
IF / THEN ... BECAUSE

Directions: Take the following inferences and turn them into formal hypotheses.

Formal Hypothesis Format:

If *Independent variable*, then *Dependent variable and prediction* because *what you already know* (an explanation).

- Your hypothesis should:
 - make sense to anyone who can read it
 - be something that can be tested
 - answer the Problem

Example: Increased sleep may cause higher grades.

Independent variable: amount of sleep Dependent variable: grade percent average

Formal hypothesis: If the amount of sleep is increased then the grade percent average will increase because sleep allows students to be alert and focused during class.

1. Chocolate may cause pimples

Independent variable: amount of chocolate Dependent variable: # of pimples

Formal hypothesis: If the amount of chocolate eaten is increased, then the number of pimples on that person's face will also increase because eating a lot of sugar leads to breakouts

2. Salt in soil may affect plant growth.

Independent variable: amount of salt in soil Dependent variable: plant growth

Formal hypothesis: If the amount of salt in the soil is increased, then the growth of plants in that soil will decrease because it prevents plants from getting the necessary water and nutrients.

3. Plant growth may be affected by the color of the light.

Independent variable: the color of light Dependent variable: plant growth

Formal hypothesis: If the color of light that plants are exposed to changes, then plant growth will change accordingly because some colors of light allow for more photosynthesis than others.

4. Bacterial growth may be affected by temperature.

Independent variable: temperature Dependent variable: bacterial growth

Formal hypothesis: If the temperature is increased, then bacterial growth will increase because bacteria are better able to replicate in warm climates

5. Ultraviolet light may cause skin cancer.

Independent variable: amount of UV light Dependent variable: skin cancer

Formal hypothesis: If people are exposed to more UV light, then the occurrence of skin cancer will increase because UV light mutates skin cells.

6. Temperature may cause leaves to change color.

Independent variable: temperature Dependent variable: color of leaves

Formal hypothesis: If the temperature is increased, then leaves will change color because trees use temperature as an environmental cue for the seasons.

3-ANSWER KEY

Qualitative Observations vs. Quantitative Observations Worksheet

All of the observations in this worksheet were qualitative; that is, you observed a quality about an object (it smelled good, it was green, etc.). Another type of observation is quantitative, meaning that it can be described or measured in concrete numerical terms.

- The following observations are quantitative: There are 30 students in my class. I weigh 98 pounds. I ate a pound of potatoes.

Determine which of the following statements are quantitative and which are qualitative.

- B 1. The cup had a mass of 454 grams.
B 2. The temperature outside is 250° C.
A 3. It is warm outside.
B 4. The tree is 30 feet tall.
B 5. The building has 25 stories.
A 6. The building is taller than the tree.
A 7. The sidewalk is long.
B 8. The sidewalk is 100 meters long.
A 9. The race was over quickly.
B 10. The race was over in 10 minutes.
A 11. The petunia had purple petals.
B 12. Teddy is 61" tall, Christian is 6" taller than that.
A 13. The liquid in the beaker was cloudy.
B 14. There was 500 milliliters of water used.
A 15. The doughnut shop had a sweet smell
____ 16. }
____ 17. } STUDENT CHOICE
____ 18. }

A. Qualitative

B. Quantitative

Reflection 1: Describe how you can use the prefixes of the words above to understand what type of observation you are using.

Qual = quality = a term that describes a characteristic of something observed

Quant = quantity = an amount that is counted or measured that helps describe something observed.

For numbers 16-18 above, write your own quantitative and qualitative observation. You must create one of each and the remaining is your choice.

Scientific Method - Controls and Variables

Definition of Key Terms

- **Control** - A part of the experiment that is not changed so it can be compared to the experimental variables.
- **Variable** - Any part of an experiment that can be changed, or manipulated by the scientist.
- **Independent Variable** - The variable of the experiment that is changed, or manipulated by the scientist or person performing the experiment.
- **Dependent Variable** - The part of the experiment that is affected by the independent variable. Also called the responding variable as it responds to the change made by the scientist. This is the variable that is measured. Also compared to the control to see how large the change is.

SpongeBob and his Bikini Bottom pals have been busy doing a little research. Read the description for each experiment and answer the questions that follows each scenario. Circle the most correct answer.

Scenario 1: Krusty Krabs Breath Mints

Mr. Krabs created a secret ingredient for a breath mint that he thinks will "cure" the bad breath people get from eating crabby patties at the Krusty Krab. He asked 100 customers with a history of bad breath to try his new breath mint. He had fifty customers (Group A) eat a breath mint after they finished eating a crabby patty. The other fifty (Group B) also received a breath mint after they finished the sandwich; however, it was just a regular breath mint and did not have the secret ingredient. Both groups were told that they were getting the breath mint that would cure their bad breath. Two hours after eating the crabby patties, thirty customers in Group A and ten customers in Group B reported having better breath than they normally had after eating crabby patties.

1. Which people are in the control group?

a. Group A

b. Group B

2. What is the variable?

a. The actual breath mint.

b. The crabby patties.

c. The secret ingredient in the breath mint.

d. How many crabby patties eaten.

3. What should Mr. Krabs' conclusion be?

a. The breath mint with the secret ingredient does reduce breath odor.

b. The breath mint with the secret ingredient reduces breath odor over 50% of the time.

c. The breath works, but it is not 100% effective.

d. All of the above.

**Scenario 2: SpongeBob Clean Pants**

SpongeBob noticed that his favorite pants were not as clean as they used to be. His friend Sandy told him that he should try using Clean-O detergent, a new laundry soap she found at Sail-Mart.

SpongeBob made sure to wash one pair of pants in plain water and another pair in water with the Clean-O detergent. After washing both pairs of pants a total of three times, the pants washed in the Clean-O detergent did not appear to be any cleaner than the pants washed in plain water.

4. What was the problem SpongeBob wanted to investigate?

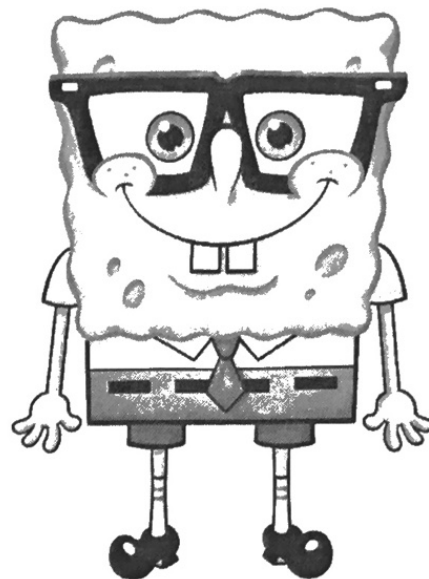
- a. Is Clean-O detergent effective?
- b. Is the length of time the pants are washed important?
- c. How does water temperature affect cleaning pants?
- d. Does how often I wash my pants affect how clean they are?

5. What is the variable?

- a. Water temperature.
- b. Length of wash time.
- c. Laundry soap
- d. Size of washing tub.

6. What should Sponge Bob's conclusion be?

- a. Clean-O best cleans his pants.
- b. Plain water best cleans his pants.
- c. Cold water best cleans his pants.
- d. Clean-O is not effective cleaning his pants.



Scenario 3: Squidward's Symphony

Squidward loves playing his clarinet and believes it attracts more jellyfish than any other instrument he has played. In order to test his hypothesis, Squidward played a song on his clarinet for a total of 5 minutes and counted the

number of jellyfish he saw in his front yard. He played the song a total of three times on his clarinet and repeated the experiment using a flute and a guitar. He also recorded the number of jellyfish he observed when he was not playing an instrument. The results are shown in the chart.

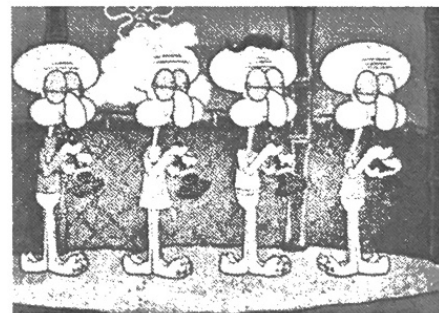
<i>Number of Jellyfish/Instrument</i>				
<i>Trial</i>	<i>No Music</i>	<i>Clarinet</i>	<i>Flute</i>	<i>Guitar</i>
1	5	15	5	12
2	3	10	8	18
3	2	12	9	7

7. What is the variable?

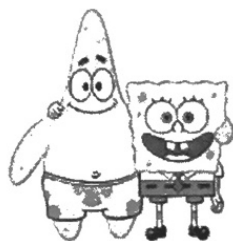
- a. Number of jellyfish.
- b. Instrument.
- c. Length the music was played.
- d. The song he played.

8. What should Squidward's conclusion be?

- a. The clarinet and guitar attracted the same number of jellyfish.
- b. The flute attracted more fish than the control (no music).
- c. Music attracts more jellyfish than does no music.
- d. All of the above.



Scenario 4: Super Bubbles



Patrick and SpongeBob love to blow bubbles! Patrick found some Super Bubble Soap at Sail-Mart. The ads claim that Super Bubble Soap will produce bubbles that are twice as big as bubbles made with regular bubble soap. Patrick and SpongeBob made up two samples of bubble solution. One sample was made with 5 oz. of Super Bubble Soap and 5 oz. of water, while the other was made with the same amount of water and 5 oz. of regular bubble soap. Patrick and SpongeBob used their favorite bubble wands to blow 10 different bubbles and did their best to measure the diameter of each one. The results are shown in the chart

9. What did the Super Bubble ads claim?

- a. Super Bubble produces bubbles twice as large as regular bubble soap.
- b. Super Bubble makes twice as many bubbles as regular bubble soap.
- c. Super Bubble bubbles last twice as long as bubbles made using regular bubble soap.
- d. Super Bubble is cheaper than regular bubble soap.

10. What is the variable?

- a. Bubble size.
- b. Number of bubbles made.
- c. Length of time bubbles last.
- d. Type of bubble solution.

11. What should their conclusion be?

- a. Super Bubble solution did not produce bubbles twice as large as those made with regular bubble soap.
- b. Regular bubble soap lasts twice as long as Super Bubble.
- c. Bubbles made with Super Bubble last twice as long as bubbles made with regular bubble soap.
- d. There was no difference between Super Bubble and regular bubble soap.

<i>Bubbles</i> (Diameter in centimeters)		
<i>Bubble</i>	<i>Super Bubble</i>	<i>Regular Soap</i>
1	15	10
2	10	5
3	12	16
4	18	14
5	22	11
6	13	12
7	16	11
8	18	15
9	15	15
10	12	6

Scenario 5: Slimotosis

Sponge Bob notices that his pal Gary is suffering from slimotosis, which occurs when the shell develops a nasty slime and gives off a horrible odor. His friend Patrick tells him that rubbing seaweed on the shell is the perfect cure, while Sandy says that drinking Dr. Kelp will be a better cure. Sponge Bob decides to test this cure by rubbing Gary with seaweed for 1 week and having him drink Dr. Kelp. After a week of treatment, the slime is gone and Gary's shell smells better.

12. What was the initial observation?

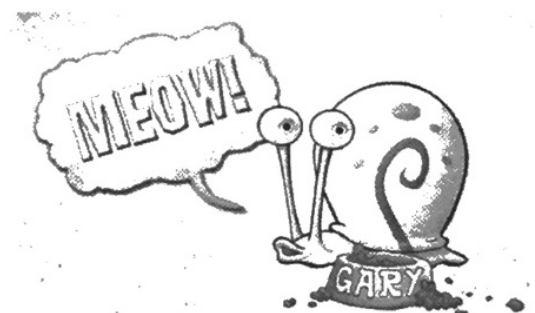
- a. Gary's shell is dull in color and hard to see.
- b. Gary's shell is glowing in the dark.
- c. Gary's shell has a nasty slime and gives off a horrible odor.
- d. Gary's shell is developing holes in it.

13. What is the variable?

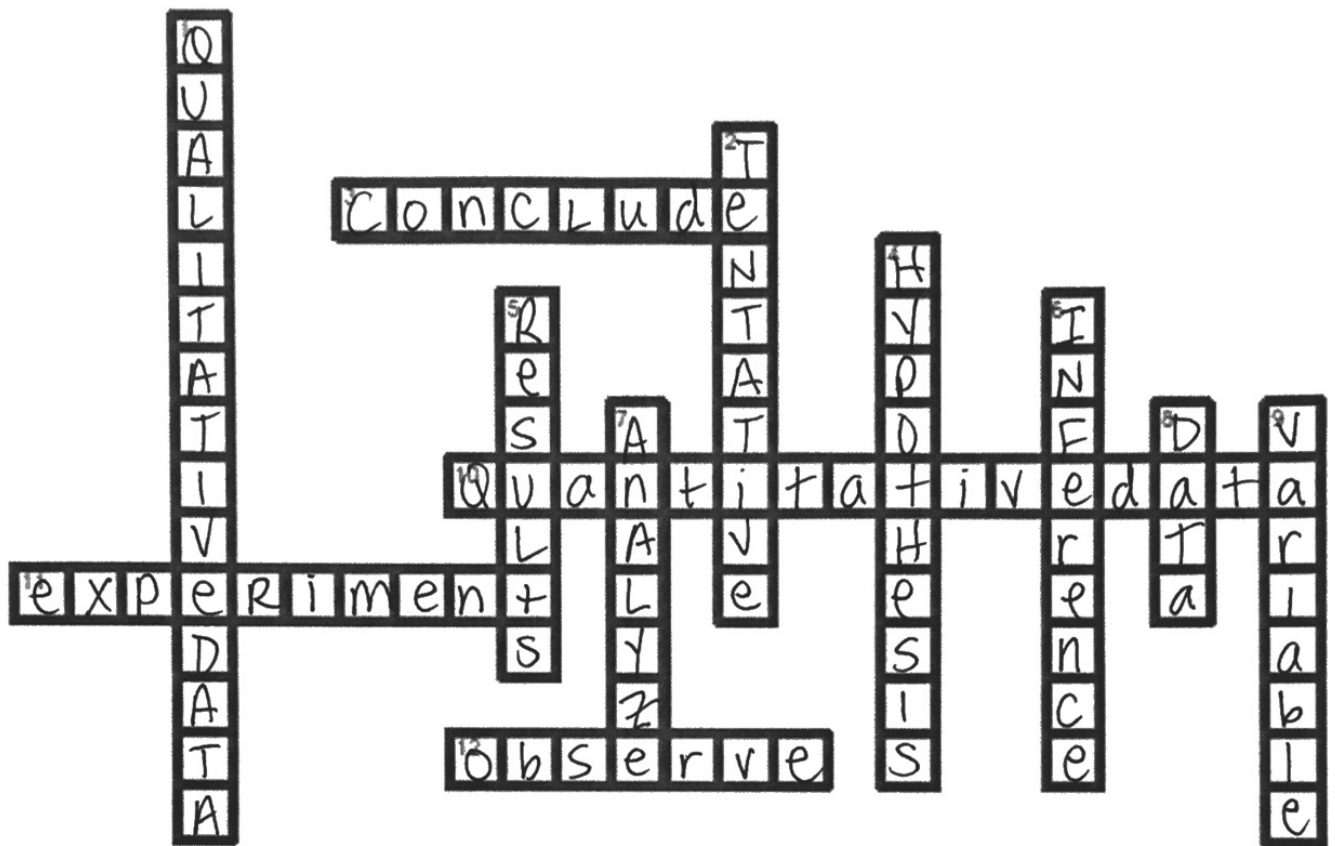
- a. Rubbing seaweed on the shell.
- b. Drinking Dr. Kelp.
- c. Both a and b.

14. What should Sponge Bob's conclusion be?

- a. Rubbing seaweed cured the slimotosis.
- b. Drinking Dr. Kelp cured the slimotosis.
- c. Both rubbing seaweed and drinking Dr. Kelp cured the slimotosis.
- d. We cannot determine which cured the slimotosis. The experiment must be re-done, testing one variable at a time.



Complete the puzzle using the clues shown below.



Across

- ~~3~~ Reach a decision based on the analysis of data.
- ~~10~~ Data which can be measured (length, height, area, volume, weight, speed, time, temperature, etc.).
- ~~11~~ A test that is done to determine if a hypothesis is correct or not.
- ~~12~~ Watch something carefully.

Down

- ~~1~~ Data dealing with descriptions; data is observed (colors, textures, smells, tastes, appearance, beauty, etc.).
- ~~2~~ Basic results that may or may not be accurate; or may need further testing.
- ~~4~~ Your proposed answer to the question or solution to the problem.
- ~~5~~ Outcome of an experiment.
- ~~6~~ Arriving at a conclusion based on your existing knowledge. (Example, seeing a student wearing a sports team jersey and concluding the student likes that team.)
- ~~7~~ Examine data collected in an experiment to determine what it means.
- ~~8~~ Information collected during an experiment.
- 9. Something that can be changed.

Word Bank: Each word is only used once.

Analyze, Conclude, Data, Experiment, Hypothesis, Inference, Observe, Qualitative data, Quantitative data, Results, Tentative, Variable

Name ANSWER KEY Date _____ Period _____

Asking Good Scientific Questions

Questions are an essential part of science. What makes a good scientific question is that it can be answered by direct observations or with scientific tools. Examples of questions that are not scientific are based on values or opinions like what people believe is right or wrong, or beautiful or ugly.

Scientists may start with a broad question such as "Why do people get colds?" Next, they break the question down into smaller questions: Can you catch a cold from someone else? Is there a relationship between getting chills and catching a cold? They state the final question in a way that can be answered by investigation or experiment. A good scientific question is "Does getting chilled cause colds?"

Tips on Asking Good Scientific Questions

1. Begin by asking several questions about a topic.
2. Eliminate questions that cannot be answered by direct observation or by gathering evidence.
3. Break broad questions into smaller questions that can be investigated one at a time.
4. Word questions in a way that allows them to be answered by an experiment.
Here are some good ways to begin scientific questions: "What is the relationship between . . . ?" "What factors cause . . . ?" "What is the effect of . . . ?"

Directions:

1. Read each statement 1 – 10 below and write yes if the topic can be investigated scientifically. Write no if it cannot be investigated scientifically.
2. Then, for each item to which you answered yes, rewrite the topic on lines below each in the form of a scientific question.
3. Also answer Question 11 on the back of this sheet.

Statements 1 – 10:

1. Some people work better in the morning, and other people work better in the afternoon.

Yes. How does time of day affect work productivity?

2. Taking something that belongs to another person is wrong.

NO.

3. Snakes travel in pairs.

YES/NO. How does a snake's social nature affect how it travels?

4. Animals behave in strange ways before an earthquake.

YES. How do quakes affect animal behavior?

challenging

5. People shouldn't use things unless they can be recycled.

NO.

6. Basketball is a better sport than soccer.

NO.

7. You will remember best whatever you read just before you fall asleep.

YES. How does the time of day you read affect the amount you remember?

8. Maria's bike is faster than Rob's bike.

YES. How does bike design affect its speed?

9. Each year when the weather gets cold, birds fly to warmer regions.

YES. How does time of year affect bird migration?

10. Trucks use more gasoline than cars.

YES. How does car/vehicle size affect gas consumption?

Think About It

11. Choose one of the scientific questions you developed in 1-10 above and tell what kind of evidence you would need to answer the question. How do you think a researcher could collect that evidence?

Answers vary.