Name _____ Date _____

SC.4.N.1.2 Compare the observations made by different groups using the same tools and seek reasons to explain the differences across groups. **SC.4.N.1.5** Compare the methods and results of investigations done by other classmates.

Why Scientists Compare Results

Scientists Gather and Share Evidence

Scientists often learn from other scientists through **research**. When scientists conduct research, they use reference materials like encyclopedias, books, articles, reliable websites, museums, or even interviews with other scientists. Sometimes sources do not agree. When this happens, scientists conduct more research to determine which data are correct.

Tools for Gathering Evidence

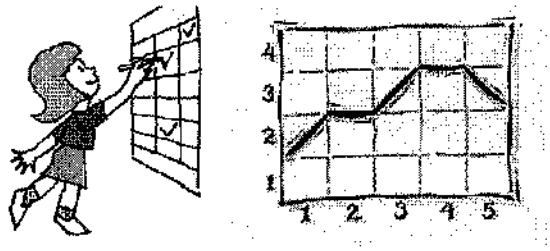
Scientists use tools to help them make observations and accurate measurements. Each tools has a specific purpose. Scientists must choose the correct tools for gathering evidence.

- **Telescopes** help scientists view objects that are far away. **Microscopes** help them view tiny objects.
- **Graduated cylinders** measure the volume of liquids or anything that can be poured.
- **Pan balances** measure mass in grams.
- **Spring balances** measure force in newtons.
- **Thermometers** measure temperature in degrees in Celsius or Fahrenheit.

Recording and Comparing Evidence

The information scientists gather from observations and measurements is called **data**. Scientists use this data as **evidence**. **Claims** are statements that are supported by evidence. After scientists analyze data, they draw **conclusions** that can then be communicated to other team members or even other scientists.

Data can be recorded in **data tables,** which make reading the data easier. **Graphs** can also be used to display the data and to help reveal patterns and relationships in the data. Graphs help scientists communicate their results and compare their results with others.



Scientists also communicate their results to others by giving talks, writing reports, or publishing articles. Sometimes this leads to new questions scientists want to investigate.

Different Results

Scientists like to compare their results with other scientists. Similar results tell the scientists that their results are probably right. Different results force scientists to explore further. They want to determine why the results are different. First they make sure that they used the same procedure. Different procedures can have different results. They also explore the possibility that they made errors in their measurements or in recording their data incorrectly. They may even repeat the experiment to see if they can get the same results the next time.

Name _____ Date _____

Student-Response Activity

1. What is the purpose of each of the following in an experiment?

   tools _____

   data _____

   data tables _____

   graphs _____

   evidence _____

2. Two scientists compare their results and find that they are different. Why might this happen? Why do they want their results to be the same?

   _____

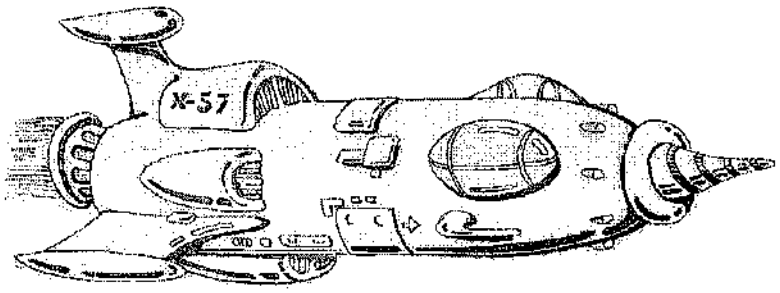
   _____

   _____

   _____

   _____

3. Name two resources you can use to research space travel. Explain what you should do if the sources disagree.



   _____

   _____

   _____

   _____

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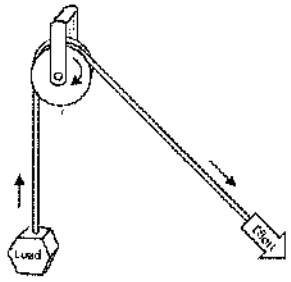
Benchmark Assessment SC.4.N.1.2, SC.4.N.1.5

Fill in the letter of the best choice.

1 Observe this diagram.



Which tool would you use to measure the force of the load?

Ⓐ graduated cylinder
Ⓑ pan scale
Ⓒ spring scale
Ⓓ tape measure

2 Which research source would be **best** to study full-size dinosaur fossils?

Ⓕ books
Ⓖ museum
Ⓗ science articles
Ⓘ website

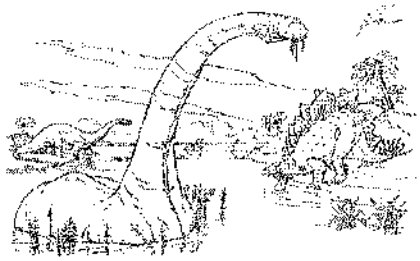
3 How do scientists communicate their results?

Ⓐ giving talks and publishing articles
Ⓑ evidence
Ⓒ confirming their hypothesis
Ⓓ analyzing data in bar graphs

4 What would be the **most likely** reason two teams doing the same investigation draw different conclusions?

Ⓕ They started with a different hypothesis.
Ⓖ One used observations and the other an experiment to collect data.
Ⓗ One used a pan scale and the other a spring scale to weigh their samples.
Ⓘ They recorded their data in tables.

5 Two scientists draw different conclusions about dinosaurs.



Why might this happen?

Ⓐ They read the same website.
Ⓑ Many books agree that dinosaurs existed.
Ⓒ They heard different scientists share their conclusions about dinosaurs.
Ⓓ Scientists make inferences because alligators look like dinosaurs.

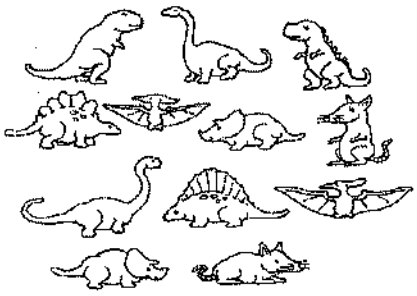
Name _____ Date _____

SC.4.N.1.3 Explain that science does not always follow a rigidly defined method ("the scientific method") but that science does involve the use of observations and empirical evidence.
SC.4.N.1.7 Recognize and explain that scientists base their explanations on evidence.

Observations and Evidence

Using Evidence

Not all scientific questions can be answered through experiments alone. What questions do you think came up when the first dinosaur fossils were found long ago? Through **observation**, or information collected using their senses, scientists could not match the fossils to any animal they knew. In fact, these scientists concluded that these fossils were from an oversized man! Since the 1700s, more fossil evidence has been found and scientists have general agreement that dinosaurs ruled the earth about 150 million years ago. Scientists studied and compared the fossil evidence from many scientists in different countries over a long period of time to reach this conclusion.



Investigation Methods

In the example above, you can have an investigation without an experiment. In an investigation, you still have a hypothesis, but the evidence to support your conclusions comes from different sources. Scientists may use identification guides as evidence when it comes to determining a type of living thing. Pictures and descriptions in the guide can support the scientist's claim.

In other cases, such as why there are different phases of the moon, the best method to gather evidence is to construct a model. Scientists cannot make Earth, the moon, and the sun move at their command, but they can use models of Earth and the moon and a light for the sun to see how the shadows can cause the different moon phases. **Models** are particularly helpful when the objects being studied are very large or very small. Sometimes, models are used because it might be too dangerous to gather data directly.

Scientists also use existing reports to gather evidence. For example, weather data is collected for the purpose of predicting the weather. However, scientists also analyze it to find evidence of seasonal weather patterns.

Research Sources

Another great way to answer scientific questions is to find **research**, or conclusions that other scientists have already reached through their own investigations. When scientists discover something new, they often publish their results in science journal articles, write books, or give talks about their findings. Encyclopedias contain information about a large number of scientific subjects. Museums also contain large amounts of evidence and other findings in one building. Of course, you can also use your computer to find information on reliable websites through Internet searches. All of these sources help scientists and can help you answer scientific questions.

Name _____ Date _____

Benchmark Review
SC.4.N.1.3, SC.4.N.1.7

Student-Response Activity

1. Explain how scientists can gather evidence without doing an experiment.

_____

_____

_____

_____

_____

2. Which is the **best** method (*model, identification guide, data patterns*) a scientist should follow to gather evidence in support of each hypothesis? The answers can be used more than once.

The sun rises in the east due to Earth's rotation. _____

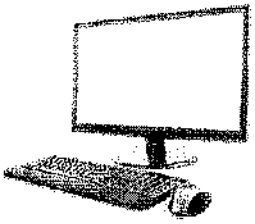
The bird is a male mockingbird. _____

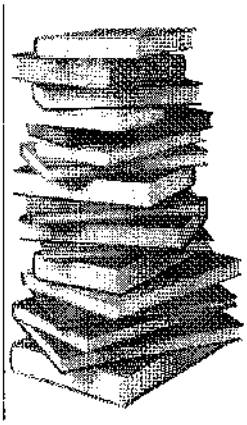
The altitude in Colorado will lead to more home runs in their stadium. _____

The plant is a type of fern. _____

The shape of a cruise boat is what allows it to float. _____

3. Describe how you would use an encyclopedia, books, websites, and museums for a science project.





_____

_____

_____

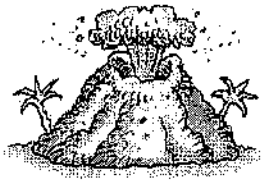
_____

_____

Benchmark Assessment SC.4.N.1.3, SC.4.N.1.7

Fill in the letter of the best choice.

1 Which model would help you study how lava flows?



Ⓐ blender mixing yogurt
Ⓑ water flowing through a straw
Ⓒ ice cubes pouring from a glass
Ⓓ pudding pouring down a ramp

2 Which is **not true** about a hypothesis?

Ⓕ It only applies to investigations that include experiments.
Ⓖ It is a statement about what scientists think will happen in an investigation.
Ⓗ Scientists use evidence to determine if it was right or wrong.
Ⓘ It answers the question being asked in an investigation.

3 Which is the **best** resource for identifying the types of reptiles below?

Ⓐ historical records
Ⓑ model of reptile life cycle
Ⓒ identification guide
Ⓓ experimental data

4 What is common about most research data?

Ⓕ They all have the same hypotheses.
Ⓖ Their results are always based on experiments.
Ⓗ They communicate the evidence of investigations.
Ⓘ They always draw the same conclusion.

5 Which evidence is **not** the result of an observation?

Ⓐ The average mass of the five rocks is 3 grams.
Ⓑ The arrowhead fossils all have the same shape.
Ⓒ The rainfall totals in the summer are half of the totals in the spring.
Ⓓ The volcano's lava flow advanced at 5 feet per second.