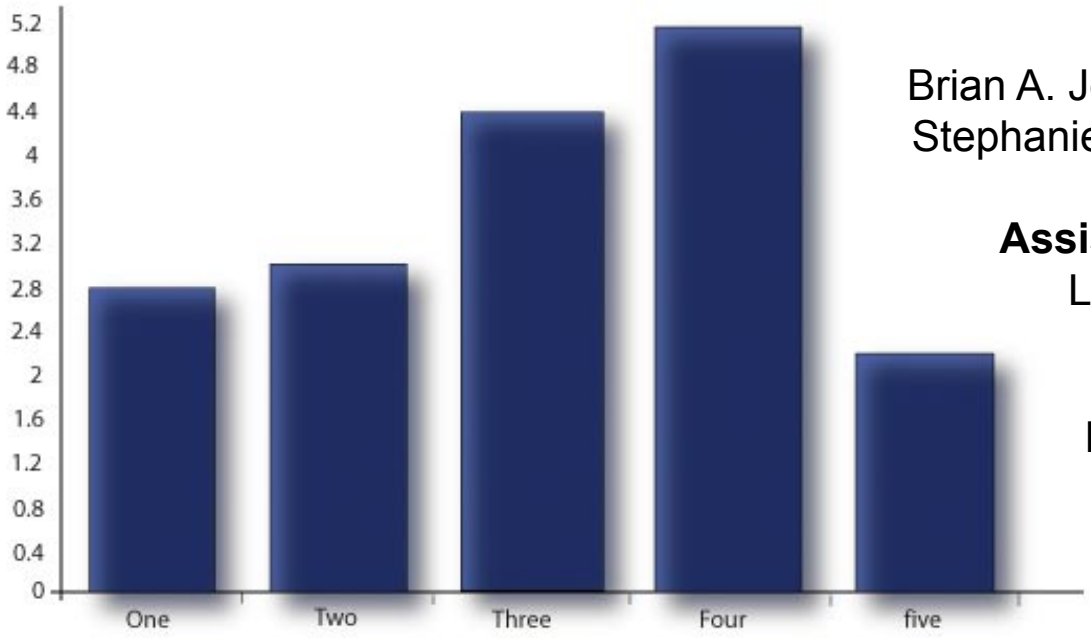
Observations and Data

Teacher's Guide
Middle School



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ISBN 1-59234-110-1

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A Message from our Company. . .

Dear Educator:

Thank you for your interest in the educational videos produced by the Visual Learning Company. We are a Vermont-based, family owned and operated business specializing in the production of quality educational science videos and materials.

We have a long family tradition of education. Our grandmothers graduated from normal school in the 1920's to become teachers. Brian's mother was an elementary teacher and guidance counselor, and his father was a high school teacher and superintendent. This family tradition inspired Brian to become a science teacher, and to earn a Ph.D. in education, and led Stephanie to work on science educational programs at NASA.

In developing this video, accompanying teacher's guide, and student activities, our goal is to provide educators with the highest quality materials, thus enabling students to be successful. In this era of more demanding standards and assessment requirements, supplementary materials need to be curricular and standards based - this is what we do!

Our videos and accompanying materials focus on the key concepts and vocabulary required by national and state standards and goals. It is our mission to help students meet these goals and standards, while experiencing the joy and thrill of science.

Sincerely,

Brian and Stephanie Jerome

National Standards Correlations

National Science Education Standards

(Content standards: 5-8, National Academy of Sciences, c. 1996)

Science as Inquiry (Content Standard A)

Think critically and logically to make the relationships between evidence.

- Thinking critically about evidence includes deciding what evidence should be used and accounting for anomalous data. Specifically, students should be able to review data from a simple experiment, summarize the data, and form a logical argument about the cause-and-effect relationship in the experiment.

Design and conduct a scientific investigation.

- Students should develop general abilities, such as systematic observation, making accurate measurements, and identifying and controlling variables.

Benchmarks for Science Literacy

(Project 2061 – AAAS, c. 1993)

Habits of Mind (12D)

By the end of the 8th grade, students should be able to:

- Organize information in simple tables and graphs and identify relationships they reveal.
- Read simple tables and graphs produced by others and describe in words what they show.
- Understand writing that incorporates circle, charts, bar and line graphs, two-way data tables, diagrams, and symbols.

Student Learning Objectives

Upon viewing the video and completing the enclosed student activities, students will be able to do the following:

- Provide some examples of observations we make everyday.
- Understand that our senses are essential to making observations.
- List some common examples of everyday tools/instruments we use to make observations.
- Differentiate between qualitative observations and quantitative observations.
- Understand that measurements include both a number and a unit.
- Describe data as consisting of recorded observations - whether they be qualitative or quantitative.
- Explain the importance of data in creating new knowledge in science.
- Create a data table to record data for an experiment.
- Explain the purpose of graphs and why they are useful.
- Differentiate between circle charts, line graphs, and bar graphs.
- Given a data table, create a line graph, circle chart, or bar graph.
- Discuss the importance and purpose of data analysis.

Assessment

Preliminary Assessment:

The Preliminary Assessment, provided in the Student Masters section, is an assessment tool designed to gain an understanding of students' pre-existing knowledge. It can also be used as a benchmark upon which to assess student progress based on the objectives stated on the previous pages.

Video Review:

The Video Review, provided in the Student Masters section, can be used as an assessment tool or as a student activity. There are two main parts. The first part contains questions that can be answered during the video. The second series of ten questions consists of a video quiz to be answered at the conclusion of the video.

Post Assessment:

The Post Assessment, provided in the Student Masters section, can be utilized as an assessment tool following completion of the video and student activities. The results of the Post Assessment can be compared against the results of the Preliminary Assessment to evaluate student progress.

Introducing the Video

Before showing the program, hold up a brick and a blackboard eraser in front of the class. Write the word "brick" and "eraser" on the board. Ask students to describe the characteristics of each of these different objects. Write their observations under the appropriate object on the board. Encourage class members to touch and hold the objects to add to their observations. Explain to students that the observations they have just recorded are qualitative observations.

After discussing qualitative observations, describe the meaning of quantitative observations. Pull out a balance and a meter stick. Ask a student volunteer to measure the mass of each object. Ask another student volunteer to measure the dimensions of each object using a meter stick. Write these quantitative observations on the board. Explain to students that the process of measuring involves using tools to make observations using numbers. A quantitative observation includes a number and a unit of measurement. Tell students to pay close attention to the video to learn more about the process of measurement, and how data plays an important role in science.

Video Viewing Suggestions

The student Master "Video Review" is provided for distribution to students. You may choose to have your students complete this Master while viewing the program or to do so upon its conclusion.

The program is approximately twenty minutes in length and includes a ten question video quiz. Answers are not provided to the Video Quiz on the video, but are included in this teacher's guide. You may choose to grade student quizzes as an assessment tool or to review the answers in class.

The video is content-rich with numerous vocabulary words. For this reason you may want to periodically stop the video to review and discuss new terminology and concepts.

Video Script: Observations and Data

1. You know this forest is full of trees because you can see their green leaves and woody trunks.
2. And, you know these animals are deer by the color of their fur and the shape of their body.
3. Similarly, you can identify this sound as a spray can being activated.
4. And, you can tell this sound is water coming from a sprinkler.
5. These are just a couple of examples of observations we make every day.
6. In many cases, we can record our observations in the form of data. Let us take a look at some familiar examples of data.
7. At one time or another, you have played a game and kept score.
8. If you are a baseball fan, you may be interested in all kinds of data such as batting averages…
9. …or earned run averages of pitchers.
10. These are all data we use in sports.
11. Other examples of data which you are familiar with include your age…
12. …your height…
13. …and your shoe size
14. Observations and data are very important in science.
15. Through observing and gathering data we learn a great deal about our world.
16. During the next few minutes we are going to explore how observations and data are used not only in scientific processes, but in our daily lives.
17. **Graphic Transition - Observations**
18. When you place a tea bag in a cup of hot water you notice that the water becomes darker the longer you let the tea bag steep.
19. And, if you take a walk in the evening as the sun is setting you may notice that ,…
20. …it does not get dark all of a sudden, but gets dark gradually.
21. And, you may have noticed that if you let your morning bowl of cereal sit in a bowl with milk too long…
22. …the cereal gets soggy.
23. These are all examples of observations we make everyday.
24. What exactly are observations? Observations are things we observe about our surroundings using our senses.
25. Our senses include those of sight, touch, taste, smell, and hearing.
26. What sense would you use to describe the texture of this tree trunk?
27. You would use your sense of touch to describe it as feeling hard, dry, and rough.
28. Our senses are very important in making not only everyday observations, but observations in science as well.

Script (cont.)

29. In both every day life and in science, it is common to use instruments to make observations.
30. When you use a scale in your home you are using an instrument to make an observation about your weight.
31. In the science lab you may use a microscope to make observations about the characteristics or habits of microorganisms.
32. Let us now take a look at some different types of observations.
33. **Graphic Transition – Qualitative and Quantitative Observations**
34. If you describe this rose as being red…
35. …or cake as being sweet, you are making qualitative observations.
36. A qualitative observation includes descriptions of sights, sounds, smells, or textures.
37. **You Observe!** Make a qualitative observation of this tennis ball.
38. A qualitative observation would describe this tennis ball as being round, yellow, and fuzzy.
39. You also might say that it bounces and is relatively light.
40. The other type of observations we can make are quantitative observations.
41. Quantitative observations are based on numbers.
42. For example, instead of saying it is very cold outside we can say it is minus 18 degrees Celsius.
43. Or, instead of saying it is a long walk, we can say it is 15 kilometers.
44. Quantitative observations tell us how much, and quite often involve measuring.
45. **Graphic Transition – Measuring**
46. Every day you measure things.
47. One of the most common things we measure throughout the course of a day is time.
48. When you cook, you measure ingredients.
49. And, if you play sports you often measure the number of points in a game…
50. …or measure the distance of a race, or the distance an object is thrown.
51. Measurements describe an observation by comparing it to standard units such as minutes, grams, or yards.
52. Measurements include both a number and a unit.
53. In science, thousands of different kinds of instruments, from simple to complex, are used to make measurements,…
54. …measurement of length…
55. …volume…
56. …mass and weight…
57. …time…

Script (cont.)

58. …and temperature to name just a few.
59. In making measurements, a number along with the unit it represents provide a quantitative description of the thing that is being observed.
60. **Graphic Transition - Data**
61. **You Decide!** What is data?
62. Data consists of recorded observations. These observations can be in the form of qualitative or quantitative data.
63. Data is incredibly important to all kinds of scientists.
64. Why? Data is very important because it not only describes observations, but it shows relationships and identifies patterns.
65. In short, data can teach us new things.
66. Graphic Transition – Recording and Organizing Data
67. You know that ice melts into liquid water, and that when water boils it bubbles and produces steam. These processes can be qualitatively observed and described with words.
68. But, how can you quantitatively describe these processes?
69. The most logical thing to do is to take temperature readings of these processes using a thermometer.
70. We will begin our experiment with a beaker of ice placed over a burner, and we will record the temperature every two minutes.
71. To organize data scientists often use data tables. A data table, like this one, is a simple chart that often has labels pointing out where recorded data should be logged.
72. The data table for this experiment has time in minutes on the left side. We will take temperature readings every two minutes which will be recorded in the second column.
73. In the course of our experiment, it is important to take readings exactly at two minute intervals, and to read the thermometer as accurately as possible.
74. After several minutes you can see the ice melted at 0 degrees Celsius, turning from solid ice to liquid water.
75. The information here in the data table shows this process.
76. After several more minutes, the water gradually got warmer, and eventually boiled at 100 degrees Celsius.
77. **Graphic Transition – Displaying Data**
78. Have you ever heard the expression that a picture can paint a thousand words?
79. Well, it is possible to make a picture out of data.
80. There are many different pictures, or ways that data can be displayed.
81. Graphs are one of the most common ways to display data. A graph is basically a picture of data.

Script (cont.)

82. Graphs illustrate how one set of observations compares to another set of observations.
83. Data recorded in data tables can often be put into a graph, making it easier to see the relationship between variables.
84. Let us use our data from the experiment demonstrating melting and boiling to make a graph.
85. We can compare the variables of time in minutes which we put along this axis of the graph…
86. …and compare it to the variable of temperature which we will put along this axis of the graph.
87. All we need to do now is to take the data from the data table and graph it.
88. This is done by taking each data point and matching it up with its time and temperature, and placing a mark on the graph.
89. **Graphic Transition - Types of Graphs**
90. Let us now take a look at how this graph looks when all the data is entered.
91. After we enter all the data from the data table we can connect the data points with a line.
92. This type of graph is called a line graph.
93. Line graphs are very common, and are easy to understand.
94. This helps us to quickly see change and patterns in data. Line graphs are particularly useful in showing changes over time.
95. This line graph, for example, shows worldwide population growth over the past 2,000 years.
96. And, this line graph illustrates the average monthly temperature of New York City during the course of a year.
97. Another common type of graph is the bar graph. In bar graphs the lengths of the bars are used to represent data.
98. A numerical scale on the left axis allows the bars to be compared to values.
99. Each bar on the graph represents a data point.
100. The data from our melting and boiling of water experiment can be placed in a bar graph to look like this, where temperature in degrees Celsius is on the left axis and time in minutes is on the bottom axis.
101. This bar graph shows the average temperature in the month of January for five cities in North America.
102. **You Decide!** How could we change the graph to compare January temperatures to July temperatures?
103. All we need to do is to place the July temperatures next to the January temperatures for the correct city.

Script (cont.)

104. This type of graph is called a double bar graph. A double bar graph shows two sets of data.
105. The last major type of graph we will discuss are circle graphs.
106. A circle graph, sometimes called a pie chart, shows how each group of data relates to all the data.
107. Each section of the circle represents a different type of data.
108. In this circle graph titled “Land Use in the United States”, each section represents a different type of land use expressed as a percentage. All the percentages add up to 100%.
109. Whereas, in this circle graph each section represents a type of energy source.
110. Graphic Transition – Analyzing Data
111. As you know, it is possible to take your body temperature with a thermometer.
112. We can take this person’s temperature every three hours for 48 hours, and record it in a data table…
113. …and then graph it in the form of a line graph.
114. You Observe! What pattern do you see in this data?
115. From looking at this data you can see that this person’s temperature rose and then gradually decreased.
116. From this data you might conclude that this person had some type of infection.
117. Analyzing data is a very important process and an important step in understanding the story behind the data.
118. Scientists exert a great deal of effort identifying patterns and trends in data before they draw conclusions.
119. In many cases they need to repeat experiments to gather additional data, or even revise their experiments.
120. It is important to realize that many of the advances in technology and science...
121. …are the result of the people observing, recording, and analyzing data.
122. Graphic Transition – Summing Up
123. During the past few minutes we have discussed observations, data, and the display of data.
124. We discussed some of the ways we make observations every day, and how we use our senses to make observations.
125. And, we saw how qualitative observations are used to describe things we see, hear, smell, or feel.
126. Quantitative observations, on the other hand, are based on numbers.
127. We briefly explored how quantitative observations are frequently based on measurements.
128. Measurements include both a number and a unit.

Script (cont.)

129. We investigated the importance of data…
130. …and saw how data can be recorded and organized in data tables.
131. Some of the ways data can be displayed were explored.
132. Special emphasis was placed on the importance of graphs, and how they can be used to visually represent data.
133. The three main types of graphs included line graphs, bar graphs, and circle graphs.
134. In conclusion, the importance of data analysis in identifying patterns and relationships in data was stressed.
135. So, the next time you observe something unusual…
136. …weigh yourself on a scale…
137. …or see a graph, think about some of the things we discussed during the past few minutes.
138. You just might think about observations and data a little differently.

Fill in the correct word to complete the sentence. Good luck and let us get started!

1. We observe things using our _____.
2. A _____ observation describes sights, sounds, or smells.
3. Quantitative observations are based on _____.
4. Measurements include both a number and a _____.
5. _____ consists of recorded observations.
6. This chart is called a data _____.
7. A _____ is a diagram that shows relationships between variables.
8. This is a _____ graph.
9. This is a ____ graph.
10. Data _____ identifies patterns and trends.

Answers on page 17

Student Assessments and Activities

Assessment Masters:

- Preliminary Assessment
- Video Review
- Post Assessment

Student Activity Masters:

- Observation Skills
- Graphing Your Heart Rate
- Interpreting Graphs
- Vocabulary of *Observations and Data*

Answers to Student Assessments

Preliminary Assessment (pgs. 20-21)

1. observations
2. qualitative
3. numbers
4. unit
5. data
6. table
7. graph
8. variables
9. circular
10. trends
11. true
12. false
13. true
14. false
15. false
16. true
17. false
18. true
19. true
20. false

Video Review (pg. 22)

1. A qualitative observation would describe the tennis ball as being round, yellow, and fuzzy.
2. Data consists of recorded observations. These observations can be in the form of qualitative or quantitative data.
3. Place the July temperatures next to the January temperatures for the correct city.
4. From looking at the data you can see that the person's temperature rose and then gradually decreased. You could conclude that this person had a type of infection.

Video Quiz (p. 22)

1. senses
2. qualitative
3. numbers
4. unit
5. data
6. table
7. graph
8. line
9. bar
10. analysis

Post Assessment (pgs. 23-24)

1. data
2. trends
3. graph
4. observations
5. circular
6. numbers
7. variables
8. unit
9. table
10. qualitative
11. true
12. false
13. true
14. false
15. true
16. false
17. false
18. true
19. true
20. false

Answers to Student Activities

Observation Skills (p. 25)

Object	Qualitative Observations	Quantitative Observations
Tennis Ball	Examples: round, fuzzy, rough, hard, yellow or green	Answers will vary - students may write in the mass of the tennis ball
Cup of Water	Examples: liquid, wet, cold, warm, clear, colorless, freezing, and hot	Answers will vary - students may write in the temperature of the water and the volume of the water.
Flashlight	Examples: hard, bright, has a switch, has a handle, rough, smooth, or the color	Answers will vary - students may write in the length and the mass of the flashlight

Graphing Your Heart Rate (pgs. 26 - 28)

Answers for the data table will vary from student to student.

The line graph and the bar graph will vary from student to student.

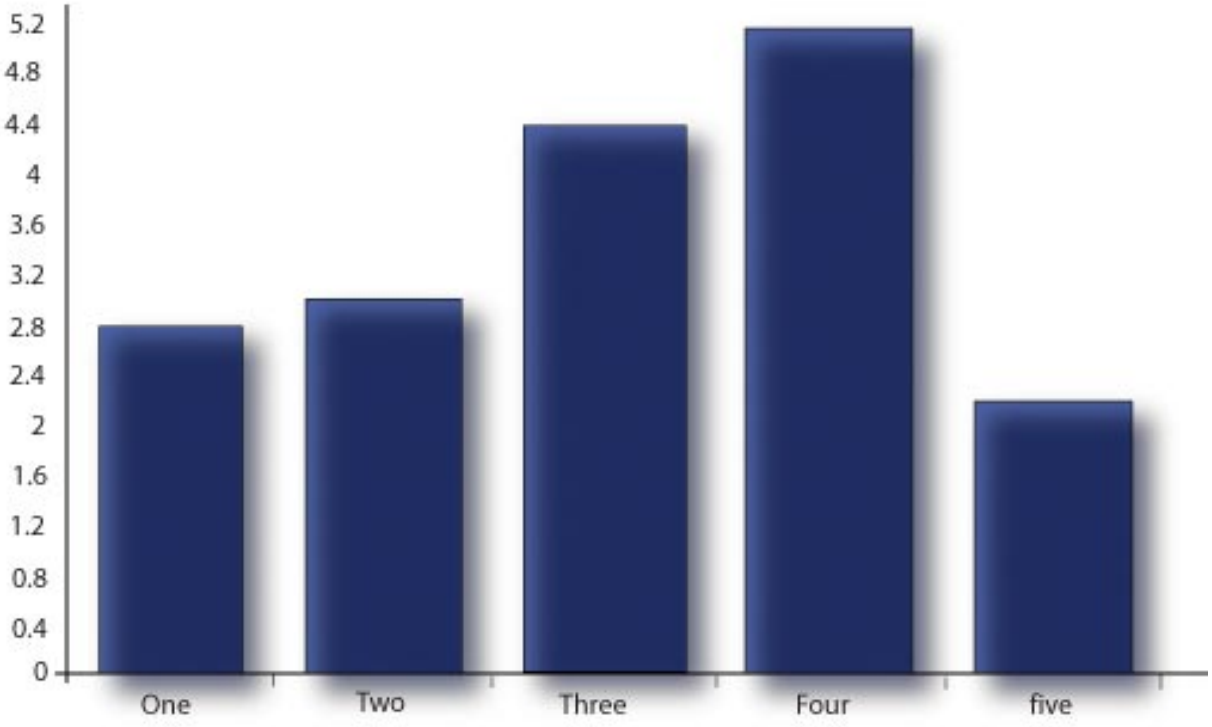
Interpreting Graphs (p. 29)

1. Graph A is a pie chart or pie graph, graph B is a line graph, and graph C is a bar graph.
2. Graph A is describing how the land in the United States is used and what type of land it is.
3. The biggest types of land are forest land, grassland, and cropland.
4. The two variables being compared in graph B are a person's temperature and the time (in hours) or intervals of when the temperature was taken.
5. It is probable that the person had an infection and the person was feeling better after 48 hours.
6. The two variables being compared in graph C are the average January temperature and different cities in the United States.
7. The warmest city in January is Honolulu. The coldest city in January is New York.

Vocabulary of *Observations and Data* (p. 30)

1. h - qualitative observations
2. f - senses
3. d - quantitative observations
4. j - measurements
5. a - data
6. b - data table
7. i - graph
8. c - bar graph
9. e - circle graph
10. g - data analysis

Assessment and Student Activity Masters



Name _____

Preliminary Assessment

Directions: Fill in the blank with the correct word. A list of possible answers is provided at the bottom of the page.

1. _____ are things we observe about our surroundings using our senses.

2. A _____ observation includes description of smells, sounds, or textures.

3. Quantitative observations are based on _____.

4. Measurements include both a number and a _____.

5. _____ consists of recorded observations.

6. Data is frequently recorded in a data _____.

7. A _____ can be thought of as a picture of data.

8. Graphs enable one to visually see the relationship between _____.

9. A pie chart has a _____ shape.

10. Data analysis involves looking for relationships and _____.

circular	variables
unit	numbers
observations	table
graph	qualitative
trends	data

Preliminary Assessment

Directions: Decide whether the statement is true (T) or false (F).

11. You make observations using your senses. T F

12. Qualitative observations are based on numbers. T F

13. Measurements provide a quantitative description of something being observed. T F

14. Data is generally considered to not be very important to scientists. T F

15. Data tables usually have four legs and are used to shelve data. T F

16. A graph is basically a picture of data. T F

17. Data recorded in data tables can rarely be put into graphs. T F

18. In bar graphs the lengths of bars are used to represent data. T F

19. In a circle graph all the sectors add up to 100%. T F

20. Scientists do not spend much time analyzing data before developing conclusions. T F

Name _____

Video Review

Directions: During the course of the program, answer the questions as they are presented in the video. At the end of the video, answer the Video Quiz questions.

You Observe!

1. Make a qualitative observation of this tennis ball.

You Decide!

2. What is data?

You Decide!

3. How could we change the graph to compare January temperatures to July temperatures?

You Observe!

4. What pattern do you see in this data?

Video Quiz:

1. We observe things using our _____.
2. A _____ observation describes sights, sounds, or smells.
3. Quantitative observations are based on _____.
4. Measurements include both a number and a _____.
5. _____ consists of recorded observations.
6. This chart is called a data _____.
7. A _____ is a diagram that shows relationships between variables.
8. This is a _____ graph.
9. This is a _____ graph.
10. Data _____ identifies patterns and trends.

Post Assessment

Directions: Fill in the blank with the correct word. A list of possible answers is provided at the bottom of the page.

1. _____ consists of recorded observations.

2. Data analysis involves looking for relationships and _____.

3. A _____ can be thought of as a picture of data.

4. _____ are things we observe about our surroundings using our senses.

5. A pie chart has a _____ shape.

6. Quantitative observations are based on _____.

7. Graphs enable one to visually see the relationship between _____.

8. Measurements include both a number and a _____.

9. Data is frequently recorded in a data _____.

10. A _____ observation includes description of smells, sounds, or textures.

numbers	table
qualitative	trends
data	circular
unit	variables
graph	obsrvations

Post Assessment

Directions: Decide whether the statement is true (T) or false (F).

11. In bar graphs the lengths of bars are used to represent data. T F

12. Data tables usually have four legs and are used to shelve data. T F

13. Measurements provide a quantitative description of something being observed. T F

14. Scientists do not spend much time analyzing data before developing conclusions. T F

15. You make observations using your senses. T F

16. Data recorded in data tables can rarely be put into graphs. T F

17. Data is generally considered to not be very important to scientists. T F

18. In a circle graph all the sectors add up to 100%. T F

19. A graph is basically a picture of data. T F

20. Qualitative observations are based on numbers. T F

Observation Skills

Background: Starting from the time you wake up in the morning you start observing things. You observe the time, the weather outside, and your appearance in the mirror. We could not live without observing our environment. Our senses of sight, touch, taste, smell, and hearing enable us to observe things. It is common to use tools or instruments to make observations as well. Simple things like scales, measuring cups, and thermometers help us make observations.

Generally speaking, there are two different categories of observations: qualitative and quantitative observations. A qualitative observation includes descriptions of sights, sounds, smells or textures. Qualitative observations most often take the form of words. Quantitative observations, on the other hand, are expressed as numbers. Records of time, temperature, volume, mass, and distance are all examples of quantitative observations.

Directions: In this activity your teacher will provide you with three examples of objects. You will make both qualitative and quantitative descriptions of these objects. Your teacher will provide you with a tape measure, measuring cup, and balance as well. Record your observations in the data table.

Object	Qualitative Observations	Quantitative Observations
Tennis Ball		
Cup of Water		
Flashlight		

Name

Graphing Your Heart Rate

Background: As you probably already know, data is extremely important in the scientific process. Data consists of recorded observations. These recorded observations may be in the form of words, numbers or even pictures. Data is very important because it not only describes observations, but it shows relationships and identifies patterns.

Data is commonly recorded and organized in data tables. Data tables are simple charts most often consisting of rows or columns. The data is recorded in the correct blank spaces in a data table. The rows and columns have labels to guide you to the correct space. When recording data it is important to be as precise, accurate and neat as possible.

Once you have finished collecting data it is easy to make a picture with the data. Graphs are one of the most common ways to display data. A graph is basically a picture of data. Graphs are great ways to visualize the relationships and trends in data.

In this activity you will perform an activity that will produce data. You will record the data in a data table and then graph it.

Directions:

1. In this activity you will produce data by increasing your heart rate through moderate exercise. The data you collect will be recorded in a data table. First, look at the data table titled, Heart Rate and Exercise. Notice you will record your heart rate in thirty second intervals.

2. Assign one person to be the data recorder and one person to be the data source (the person exercising).

3. Obtain a stop watch or a watch with a second hand. The person should begin exercising by running in place for 30 seconds. Time the person for 30 seconds then have him/her stop.

4. Immediately take their pulse for 10 seconds. Your teacher will show you how to take a pulse. Record their pulse in the data table in the first blank space next to “30 seconds”.

5. Continue to do this for 30 second intervals ten times. Every 30 seconds stop and take the person’s pulse for 10 seconds. Record your data in the data table.

6. After the ten intervals of 30 seconds stop exercising. Then, take your pulse again for 10 seconds with a 30 second rest in between. Do this for another 10 intervals (11 - 20 intervals on graph).

7. After you have recorded your data, graph it as both a line graph and as a bar graph.

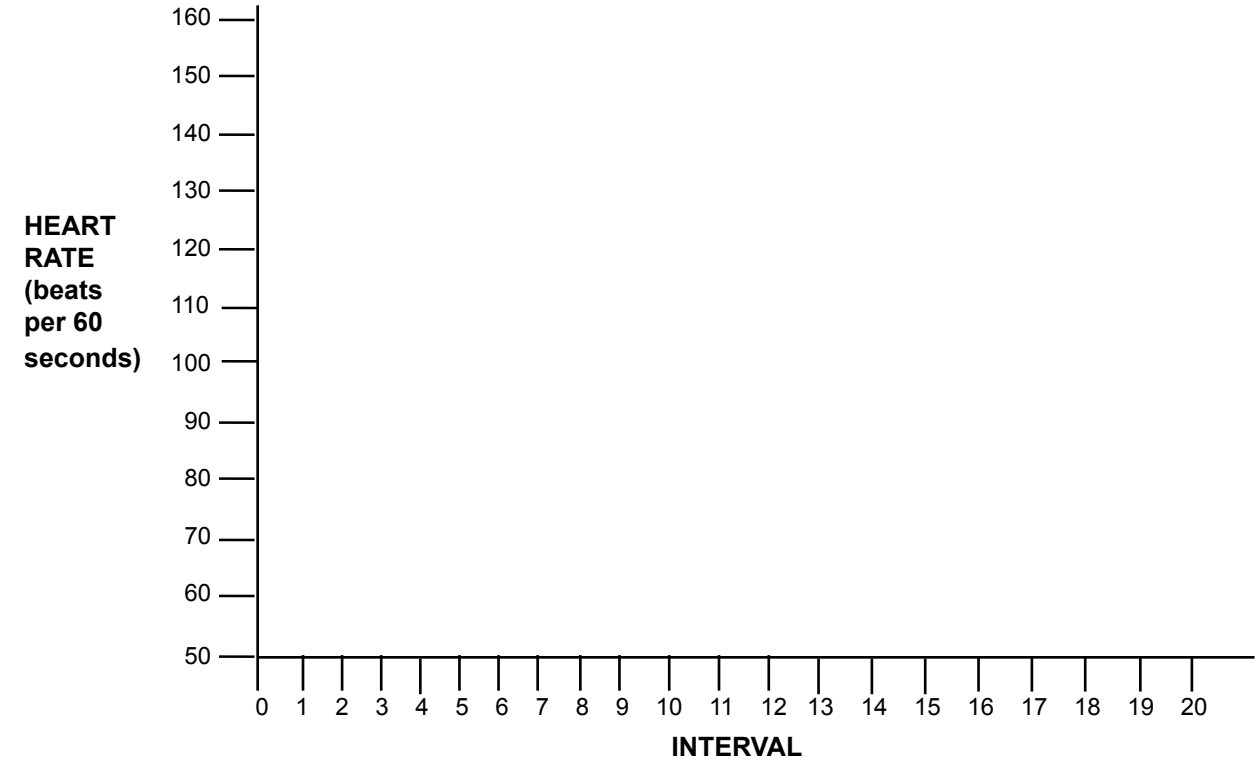
Name _____

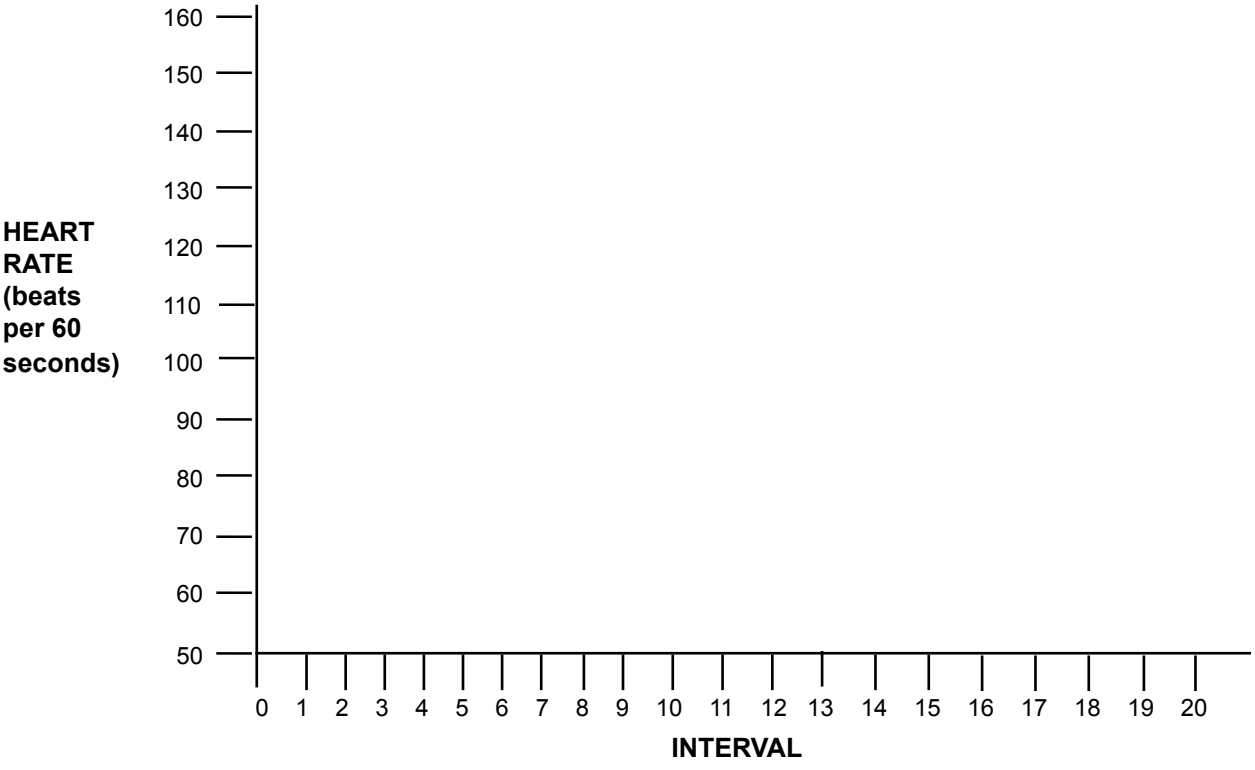
Heart Rate Data Table

Interval Number	Heart Rate for 10 seconds	Heart Rate for 60 seconds (multiply 10 second rate by six)
Interval 1 - after 30 seconds exercising		
Interval 2 - after exercise		
Interval 3 - after exercise		
Interval 4 - after exercise		
Interval 5 - after exercise		
Interval 6 - after exercise		
Interval 7 - after exercise		
Interval 8 - after exercise		
Interval 9 - after exercise		
Interval 10 - after exercise		
Interval 11 - after 30 seconds of rest		
Interval 12 - after rest		
Interval 13 - after rest		
Interval 14 - after rest		
Interval 15 - after rest		
Interval 16 - after rest		
Interval 17 - after rest		
Interval 18 - after rest		
Interval 19 - after rest		
Interval 20 - after rest		

Name _____

Graphing Your Heart Rate

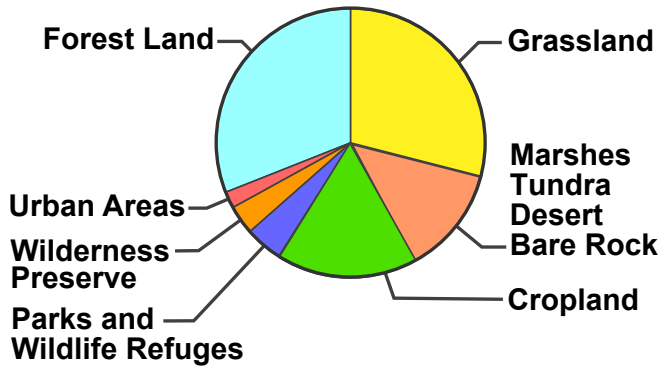




Interpreting Graphs

Directions: Answer the following questions using the graphs below.

Graph A

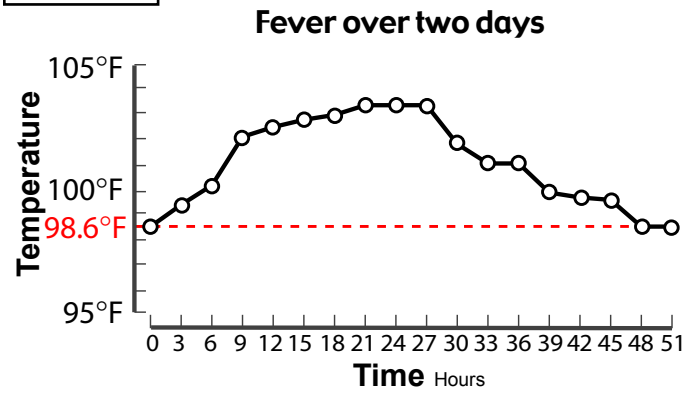


1. State what type of graphs A, B, and C are.

2. What information is graph A describing?

3. What are the three biggest types of land use as described in graph A?

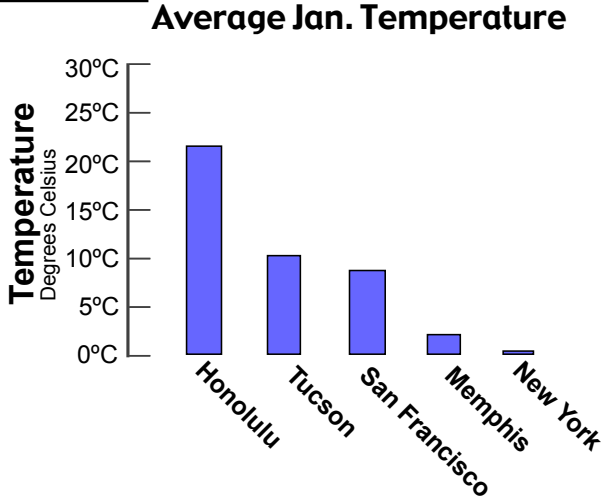
Graph B



4. What two variables are being compared in graph B?

5. What does graph B tell you about the person?

Graph C



6. What two variables are being compared in graph C?

7. Which is the warmest city in January and which is the coldest city?

Vocabulary of Observations and Data

Directions: Unscramble the vocabulary words in the first column. Match the words to the definitions in the second column.

____ 1. ltvqaiaieut vsorbinosaet
_____
_____

____ 2. eessns _____

____ 3. ttuaatevqiin sroanbesovit
_____
_____

____ 4. rmtaesnmuese
_____

____ 5. taad _____

____ 6. adat btela _____
_____

____ 7. ahgpr _____

____ 8. rba hgarp _____ _____

____ 9. creicl rpahg _____
_____

____ 10. aatd aanslsiy _____
_____

a. consists of recorded observations.

b. a chart designed for recording data

c. a graph in which the length of bars represents data points.

d. descriptions based on numbers and units.

e. a graph in which each section represents a different type of data, also called a pie chart.

f. enables us to make observations about our world.

g. process of looking for patterns and trends in the data.

h. includes a description of sights, sounds, smells, or other properties.

i. a picture of data.

j. describe an observation by comparing a number to specific units.