Name _____ Class _____ Date _____

LABORATORY SKILLS WORKSHEET 4

Organizing and Analyzing Data

Materials

paper
pencil

BACKGROUND: Data collected during experiments is not very useful unless it is easy to read and understand. Therefore, scientists often use tables to organize data. A table can display a lot of information in a small space. A table also makes it easy to compare and interpret data. Some tables, such as the one in Figure 1, are very simple and show only a small amount of data. Other tables, such as the one on page 14, are more complex. The type of table you use depends on your data.

PURPOSE: In this activity, you will learn how to make and use tables.

Rainfall	
Day	Amount (cm)
1	0.4
2	0.2
3	1.1
4	1.4
5	0

▲ **Figure 1** A simple table

PROCEDURE

❑ **1.** A group of students wanted to see if plants would grow taller when grown with plant food. Three plants were given 10 mL of liquid plant food twice a week. Three other plants were the control group. They were given 10 mL of water twice a week. All other growing conditions were kept the same. Every week for 3 weeks, the students measured the heights of the six plants. Figure 2 shows what one student's lab manual looked like after 3 weeks. Think about how this data could be organized into a table.

❑ **2. ORGANIZE:** Look at Table 1 on the next page. Like all tables, it has a title. Each column has a heading, and the headings show units for the data. Use the data from the student's lab manual in Figure 2 to complete the table.

	Lab Manual

○	Original height of plants:
	plant 1 = 6.0 cm; plant 2 = 6.5 cm; plant 3 = 6.2 cm;
	plant 4 = 6.1 cm; plant 5 = 6.2 cm; plant 6 = 6.3 cm
	Height after first week:
	plant 1 = 7.5 cm; plant 2 = 8.0 cm; plant 3 = 8.0 cm;
	plant 4 = 7.0 cm; plant 5 = 6.8 cm; plant 6 = 6.9 cm
	Height after second week:

○	plant 1 = 9.5 cm; plant 2 = 10.2 cm; plant 3 = 10.1 cm;
	plant 4 = 8.1 cm; plant 5 = 7.7 cm; plant 6 = 8.0 cm
	Height after third week:
	plant 1 = 11.3 cm; plant 2 = 12.2 cm; plant 3 = 11.3 cm;
	plant 4 = 8.9 cm; plant 5 = 8.8 cm; plant 6 = 9.1 cm

▲ **Figure 2** A student collected this data.

OBSERVATIONS

Table 1: Plant Growth

Week	Experimental Group			Control Group		
	Height (cm)			Height (cm)		
	Plant 1	Plant 2	Plant 3	Plant 4	Plant 5	Plant 6
0						
1						
2						
3						

1. How much did the height of Plant 1 increase during the 3-week period? _____

2. How much did the height of Plant 4 increase during the 3-week period? _____

3. How much did the height of Plant 2 increase in 3 weeks? _____

4. How much did the height of Plant 6 increase in 3 weeks? _____

CONCLUSIONS

5. In general, which group of plants grew more during the 3-week period? _____

6. **ANALYZE:** Do you think that the plant food made the plants grow taller?
   Why or why not? _____
   _____

7. Explain how the table made it easier for you to answer the questions you have answered so far. _____
   _____

8. **ORGANIZE:** Think about the plant growth experiment. How should the table look if the students had tested two types of plant food instead of just one, and if they had only used two plants for each of the three test groups? On a separate sheet of paper, make a table that students could use to present their data.

Name _____ Class _____ Date _____

LABORATORY SKILLS WORKSHEET 5

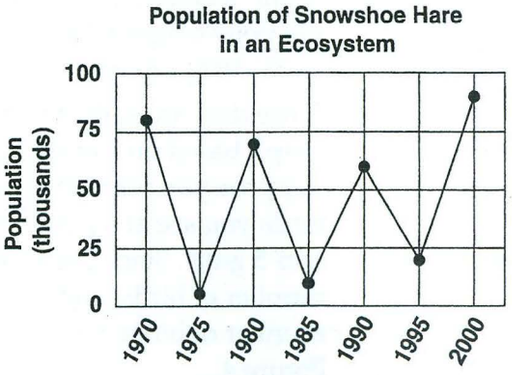
Graphing

Materials

colored pencils

BACKGROUND: Graphs are a useful way to organize and present information. Graphing data helps you see similarities and patterns. It also helps other people understand your data. Four types of graphs that you can use are line graphs, bar graphs, circle graphs, and pictographs.

PURPOSE: In this activity, you will learn how to make different kinds of graphs.



▲ **Figure 1** Line graph

PROCEDURE

Part A: Making a Line Graph

❑ 1. **OBSERVE:** Look at the line graph in Figure 1. Notice that data are plotted as points connected by a line. The horizontal axis shows the range of the independent variable. The vertical axis shows the range of the dependent variable. When graphing, you must decide which values are independent and which are dependent. In Figure 1, the number of hares depends on the year. Therefore, the number of hares is the dependent variable, which goes on the vertical axis. The years go on the horizontal axis.

❑ 2. **GRAPH:** Use the following information and the data in Table 1 to create a line graph in the Observations section on page 17.

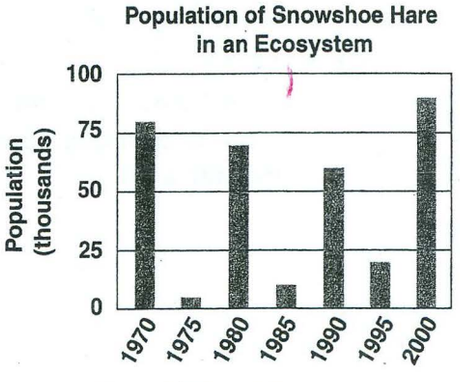
> A scientist measured a lizard's body temperature throughout a day. The temperature was 28°C at 8 AM, 31°C at 10 AM, 34°C at 12 noon, 38°C at 2 PM, 36°C at 4 PM, 33°C at 6 PM, and 30°C at 8 PM.

Think about which variable is independent and which is dependent. Remember to include a title and to label the axes. Notice that the low temperature is 28° and the high is 38°. The temperature range on your graph should be from just below this number to just above it.

Part B: Making a Bar Graph

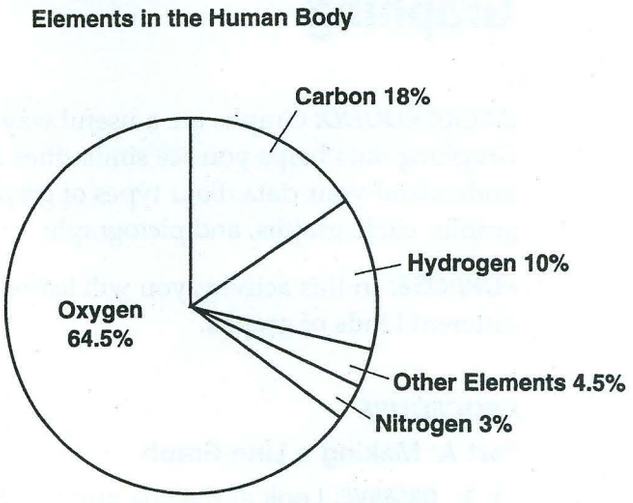
❑ 1. **OBSERVE:** Figure 2 shows a bar graph using the same data as in Figure 1. A bar graph is similar to a line graph except bars rather than points show the data. The bar graph in Figure 2 has the dependent variable on the vertical axis. Bar graphs may also be drawn so that the dependent variable is on the horizontal axis.

❑ 2. **GRAPH:** Use the information about lizard temperature given in Part A Step 2 to create a bar graph in the Observations section. Be sure to label the axes of the graph and to include a title.



▲ **Figure 2** Bar graph

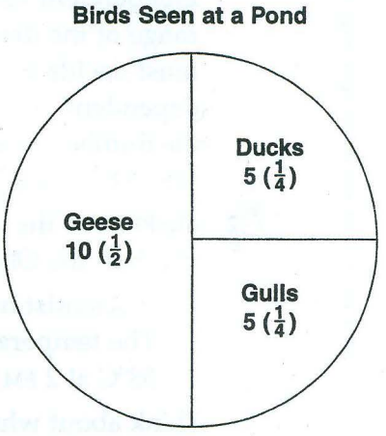
Part C: Making a Circle Graph



▲ **Figure 3** Circle graph using percentages

❑ **1. OBSERVE:** Look at the circle graph shown in Figure 3. You can use a circle graph when your data describe parts of a whole. A circle graph is a circle that is divided into sections. The size of each section shows a percentage of the whole circle. Notice that if you add the percentages of the sections together, they equal 100 percent.

❑ **2.** If the data are simple, you can draw a circle graph based on simple fractions of a whole. Suppose you want to graph the fractions of birds you see at a pond: 5 ducks, 10 geese, and 5 gulls. Since 5 is 1/4 of the total number of birds, and 10 is 1/2 of the total number of birds, your graph should look like Figure 4.



▲ **Figure 4** Circle graph using fractions

❑ **3. GRAPH:** In the Observations section on page 17, draw a circle graph showing the eye colors of students in a class. Assume that there are 24 students in the class: 12 have brown eyes, 8 have blue eyes, and 4 have green eyes. Fill in the three sections using colored pencils to make the graph easier to read. Label the sections and write a title for the graph.

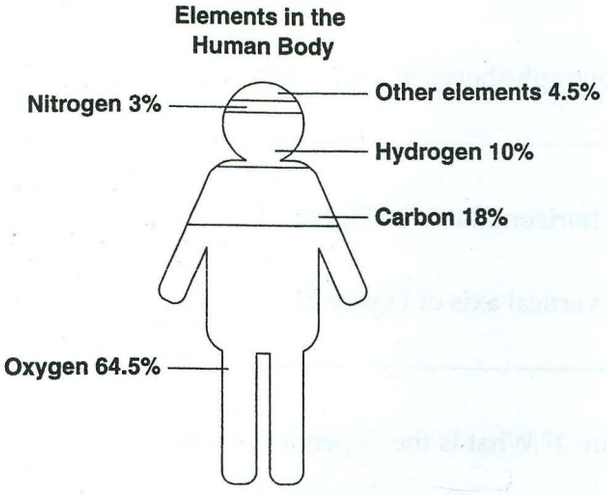
Part D: Making a Pictograph

❑ **1. OBSERVE:** As the name suggests, a pictograph is a graph using pictures. Look at the pictograph in Figure 5. The percentages of the elements in the human body are represented by the amount of space they occupy on the picture. Figure 6 shows another type of pictograph. In this graph, small pictures represent students with different hair color. The number of students is the dependent variable and is drawn horizontally. The graph could also be drawn with the number of students shown vertically.

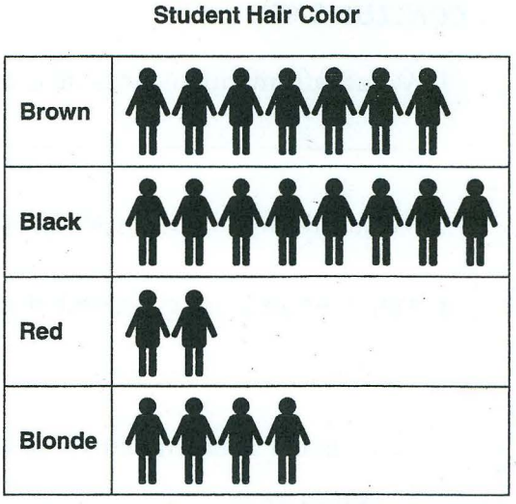
❑ **2. GRAPH:** Make a pictograph in the Observations section showing types of trees found around a school. Use the following data for your graph: 6 elm trees, 3 birch trees, 4 dogwood trees, 7 maple trees, 10 pine trees. Remember to include a title.

Name _____ Class _____ Date _____

LABORATORY SKILLS WORKSHEET 5 *(continued)*

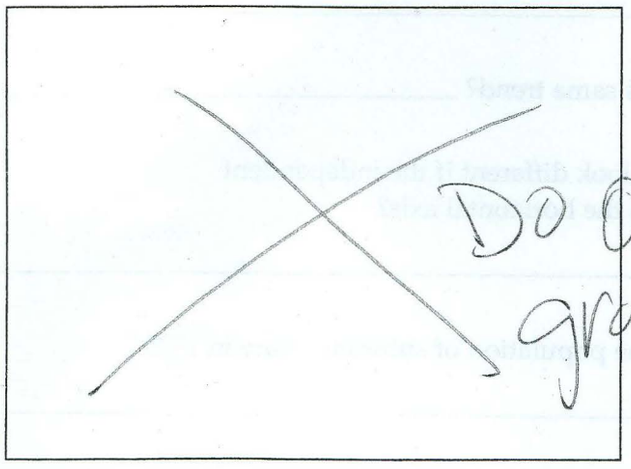


▲ **Figure 5** Pictograph showing percentages

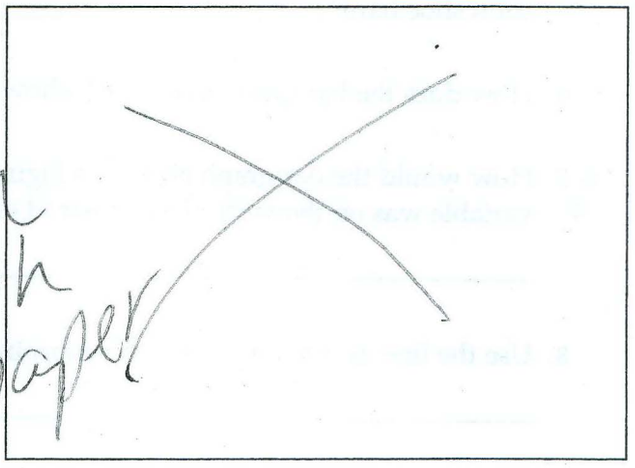


▲ **Figure 6** Pictograph based on numbers

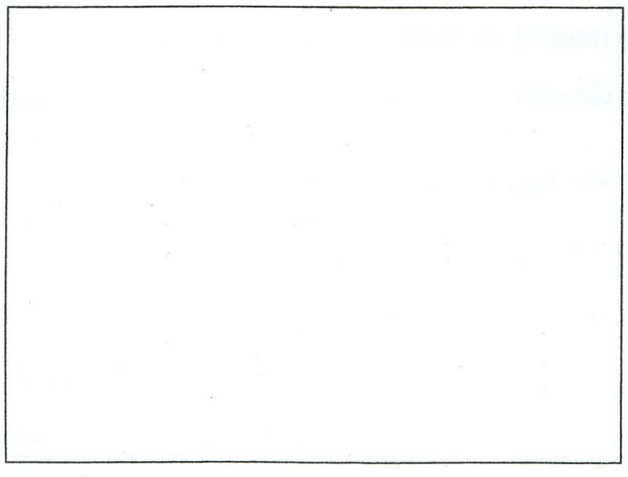
OBSERVATIONS



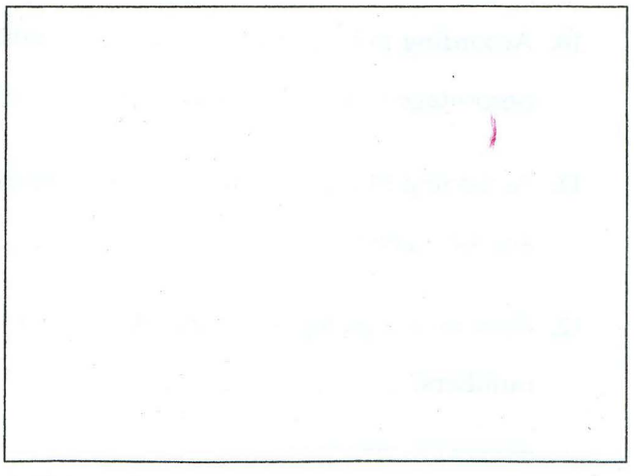
▲ **Line Graph**



▲ **Bar Graph**



▲ **Circle Graph**



▲ **Pictograph**

CONCLUSIONS

1. What information is presented in the line graph shown in Figure 1? _____

2. What information is presented along the horizontal axis of Figure 1? _____

3. What information is presented along the vertical axis of Figure 2? _____

4. What is the independent variable in Figure 2? What is the dependent variable in Figure 2? _____

5. Look at the line graph in Figure 1. What trend do you see in the population of snowshoe hare? _____

6. How does the bar graph in Figure 2 show this same trend? _____

7. How would the bar graph shown in Figure 2 look different if the independent variable was on the vertical axis instead of on the horizontal axis?

8. Use the line graph in Figure 1 to determine the population of snowshoe hare in 1975.

9. What information is shown in the circle graph in Figure 3? _____

10. According to Figure 3, what element makes up most of the human body? What percentage of the total body is made up of this element? _____

11. According to Figure 3, what is the combined percentage of oxygen, hydrogen, and nitrogen? _____

12. How does a pictograph make data easier to understand compared to using only numbers? _____

Analysis of Scientific Experiments **Name**
Period

Compost and Bean Plants

After studying about recycling, members of Paul's biology class investigated the effect of various recycled products on plant growth. Paul's lab group compared the effect of different aged grass compost on bean plants. Compost is organic material that is being naturally recycled by insects and bacteria. The process of composting releases nutrients that are necessary for plants and animals. Paul's group hypothesized that older grass compost would produce taller bean plants. Three flats of bean plants with 25 plants per flat were grown for 5 days. After five days, the plants were fertilized as follows: (a) Flat A: 450 g of three-month –old compost, (b) Flat B: 450 g of six-month-old compost, (c) Flat C: 0g compost. The plants were then allowed to grow for 25 days, receiving the same amount of sunlight and water each day. On the last day of the experiment, the group recorded the height of the plants in centimeters.

1. What is the hypothesis for Paul's experiment?

2. What is the independent variable? (This is changed by the experiment)

3. What is the dependent variable? (This is what is being measured)

4. What is/are the experimental group?

5. What is/are the controlled group?

6. Use the following data table to construct a graph:
   The effect of compost age on plant height over 25 days

Age of compost	Average plant height after 25 days (cm)
3 months	45.69
6 months	60.25
No compost	38.73

7. Based upon the data and graph, was Paul's hypothesis supported? Explain.