Graphing Skills
Reading, Constructing and Analyzing Graphs

Bar Graphs and Histograms

Bar graphs are very common types of graphs. They are found in almost all science books, magazines, and newspapers. They can be useful tools in scientific study by allowing us to visually compare amounts or frequency of occurrences between different data sets. Bar graphs can be used to show how something changes over time or to compare items with one another. When reading or constructing this type of graph you should pay close attention to the title, the label on the axes, the unit or scale of the axes and the bars.

In a simple bar graph the specific group or experimental subject is assigned the *x*-axis (horizontal). The *y*-axis (vertical) is known as the frequency axis. In general, the *x*-axis will be divided into categories while the *y*-axis is designated for the frequency of occurrences. Histograms are very similar to simple bar graphs with one exception — the bar represents a range of values rather than one single value and the intervals must all be of equal magnitude. Study the sample graphs below before completing this exercise.

Simple Bar Graph

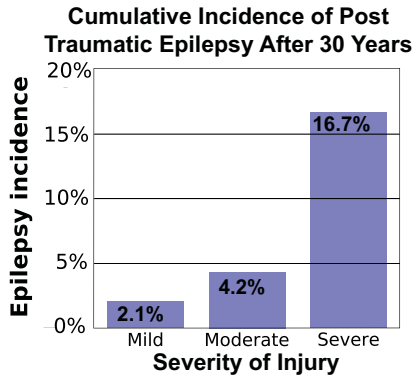

Figure 1

Histogram

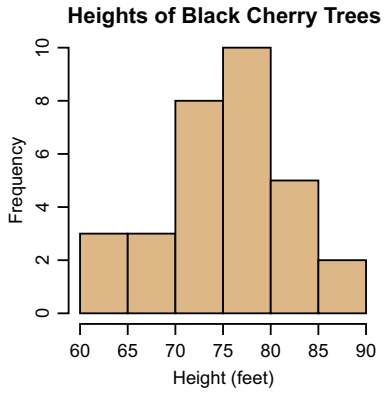

Figure 2

PURPOSE

In this exercise you will create simple bar graphs, and histograms. You will be expected to properly label each of your graphs and analyze each one by making statements about trends in the data.

MATERIALS

2 sheets of graph paper	data
pencils	ruler

PROCEDURE

PART I: SIMPLE BAR GRAPH

1. Obtain one piece of graph paper and a pencil.

2. Study the data table below.

Leading Causes Of Death Worldwide	
Cause	**Deaths Per Year (millions)**
Cardiovascular disease	16.9
Cancers and tumors	7.2
Infectious diseases (includes AIDS, malaria, etc.)	13.5
Accidents and trauma	5.1
Respiratory disease	3.5
Digestive and nutritional	2.3
Diabetes	0.9

3. Choose the data to be graphed on the *x*-axis and the *y*-axis.

4. Survey the data and determine an appropriate scale for each axis. Be sure to utilize as much of the graph paper as possible to display your data. Use your pencil to lightly mark the scale of your *x*- and *y*-axes. Have your teacher check your scale before proceeding any further. When making a bar graph, the individual bars should be constructed with the same width. You should determine the width of your bars.

5. When your teacher approves, construct your simple bar graph. Be sure to label each axis with units and give your graph a title.

PART II: HISTOGRAM

1. Study the following data and follow the same graphing procedure. This data should be graphed as a histogram. It is important that histograms have the same interval and width for each bar. For example, each bar might represent 10 years in the data table below.

Life Expectancies in the US	
Current Age	**Remaining Years Expected**
0-10	72.6
11-20	59.5
21-30	50.1
31-40	40.7
41-50	31.7
51-60	23.2
61-70	15.8
71-80	9.7
81-90	4.5

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CONCLUSION QUESTIONS

Using the graphs that you constructed, answer the following questions.

PART I: SIMPLE BAR GRAPH

1. How many deaths occur due to accidents and trauma each year?

2. Can you predict the number of deaths that are the result of cancers and tumors for the next ten years? Explain.

PART II: HISTOGRAM

1. Make a prediction about the remaining years of life that would be expected for someone in the current age category of 91-100.

2. Is the answer to question 1 an accurate number? Why or why not? Justify your answer.

3. What type of data is easily represented by a bar graph?

4. What is the importance of scaling?

5. Distinguish between the dependent and the independent variable for each of the graphs that were constructed. On which axis should the independent variable be placed?

	Dependent Variable	Independent Variable
Simple Bar Graph		
Histogram		

Graphing Skills
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Line Graphs

There are all kinds of charts and graphs used in the science classroom. Graphs are useful tools in science because trends in data are easy to visualize when represented graphically. A line graph is beneficial in the classroom for many different types of data, and is probably the most widely used scientific graph. Line graphs can be used to show how something changes over time or the relationship between two quantities. They can also be readily used to *interpolate* (predict between measured points on the graph) and *extrapolate* (predict beyond the measured points along the same slope) data points that were not actually measured. Analysis of these graphs provides very valuable information.

PURPOSE
In this activity you will learn the basic procedure for constructing and analyzing line graphs.

MATERIALS

3 sheets of graph paper	data
pencil	ruler

PROCEDURE

1. Follow along with your teacher as a sample line graph is constructed. Label a blank piece of graph paper as your teacher explains the important components of a line graph.

2. When instructed, use the sample sets of data to construct line graphs. Place only one graph on each sheet of graph paper and use as much of the graph as possible to display your points. ***Do not connect the dots!*** Draw the best smooth curve or line of best-fit as your teacher demonstrated.

3. Following the steps below will help ensure that all components of the graph are correctly displayed.
   a. **Identify the variables**. Independent on the *x*-axis and dependent on the *y*-axis
   b. **Determine the range**. For each axis subtract the lowest value data point from the highest value data point.
   c. **Select the scale units**. Divide each axis uniformly into appropriate units using the maximum amount of space available. (Remember that the axes may be divided differently but each square along the same axis must represent the same interval.)
   d. **Number and label each axis**. Be sure to include units where appropriate as part of the axis label.
   e. **Plot the data points as ordered pairs**. (*x,y*)
   f. **Draw the best straight line or best smooth curve**. For a straight line, use a straight edge to draw your line in such a way that equal numbers of points lie above and below the line.
   g. **Title the graph**. The title should clearly describe the information contained in the graph. It is common to mention the dependent variable (*y*-axis) first followed by the independent variable (*x*-axis).

4. After creating graphs for the 3 data sets below, use the graphs to answer the conclusion questions on your student answer page.

Sample Data Set 1: The following set of data was collected while experimenting with position and time of a miniature motorized car traveling on a straight track.

Time (minutes)	Position (meters)
0	0
5	15
10	30
15	45
20	60
25	75

Sample Data Set 2: The following set of data was collected during an experiment to find the density for an unknown metal.

Volume (cm^3)	Mass (g)
0.18	2.00
0.44	5.00
0.66	7.50
1.41	16.00
2.11	24.00

Sample Data Set 3: The following set of data was collected during an experiment studying the effect of light on the process of photosynthesis.

Time (minutes)	Percent Transmittance (%)
0	32.5
5	54.3
10	63.5
15	65.0

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Line Graphs

DATA AND OBSERVATIONS

Staple your completed graphs behind this answer page.

CONCLUSION QUESTIONS

Using the graphs that you constructed, answer the following questions:

Sample Data Set 1:

1. What is the independent variable for this graph? Explain.

2. Determine the position of the car after 2.5 minutes.

3. If the experiment were carried out for 30 minutes, what would be the position of the car?

4. Calculate the slope of the line drawn. What does the slope of this line represent? Explain.

5. Write the equation for the line and substitute the value determined for the slope.

Sample Data Set 2:

6. What values were considered when creating the scale for each axis in this experiment?

7. What does a data point on this graph actually represent?

8. What volume would a 20.00 gram sample of this substance occupy?

9. Calculate the density of the substance. (HINT: calculate the slope of the line.)

10. Write the equation for the line and substitute the value determined for the slope.

11. Use the equation to find the mass when the volume is 5.00 cm3.

Sample Data Set 3:

12. Does this graph represent a linear relationship? Why or why not?

13. Identify the dependent variable in this graph. Explain.

14. If the experiment were continued for 30 minutes, what trend in percent transmittance could be expected?

15. Calculate the slope of the line at 5 minutes. What does this represent?