Is this data easy to draw conclusions from?
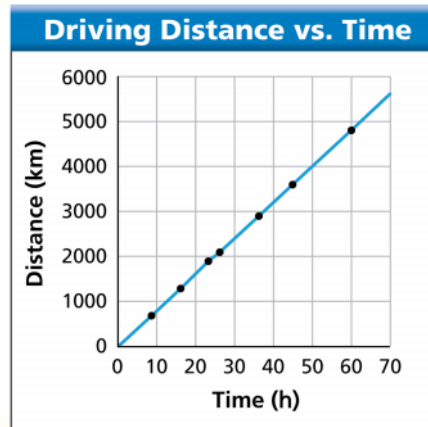
Scientific data become meaningful only when they are organized and communicated. Communication includes visual presentations, such as this graph.

Driving Distance vs. Time

Organizing Data

How do scientists organize data?

Scientists can organize their data by using data tables and graphs.

1

Organizing Data

Data Tables

This table relates two variables—a manipulated variable (location) and a responding variable (average annual precipitation).

City	Average Annual Precipitation (cm)
Buffalo, N.Y.	98.0
Chicago, Ill.	91.0
Colorado Springs, Colo.	41.2
Houston, Tex.	117.0
San Diego, Calif.	25.1
Tallahassee, Fla.	166.9
Tucson, Ariz.	30.5

Average Annual Precipitation for Selected U.S. Cities

Organizing Data

Line Graphs

A line graph is useful for showing changes that occur in related variables.

- In a line graph, the manipulated variable is generally plotted on the horizontal axis, or *x*-axis.
- The responding variable is plotted on the vertical axis, or *y*-axis, of the graph.

Organizing Data

Sometimes the data points in a graph yield a straight line.
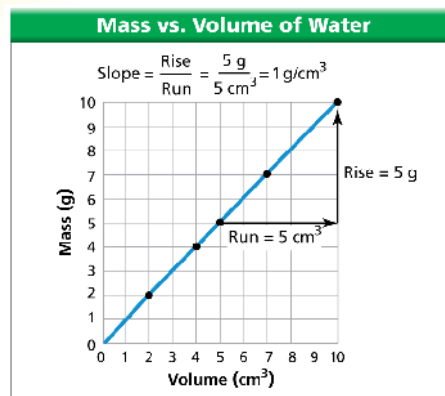
- The steepness, or **slope,** of this line is the ratio of a vertical change to the corresponding horizontal change.
- The formula for the slope of the line is

$$\text{Slope} = \frac{\text{Rise}}{\text{Run}}$$

Organizing Data

Plotting the mass of water against the volume of water yields a straight line.
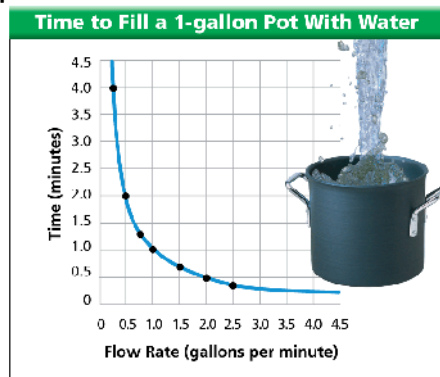
Organizing Data

A **direct proportion** is a relationship in which the ratio of two variables is constant. The relationship between the mass and the volume of water is an example of a direct proportion.

- A 3-cubic-centimeter sample of water has a mass of 3 grams.
- A 6-cubic-centimeter sample of water has a mass of 6 grams.
- A 9-cubic-centimeter sample of water has a mass of 9 grams.

Organizing Data

This graph shows how the flow rate of a water faucet affects the time required to fill a 1-gallon pot.

Time to Fill a 1-gallon Pot With Water

1.4 Presenting Scientific Data

Organizing Data

An **inverse proportion** is a relationship in which the product of two variables is a constant.

- A flow rate of 0.5 gallon per minute will fill the pot in 2 minutes.
- A flow rate of 1 gallon per minute will fill the pot in 1 minute.
- A flow rate of 2 gallons per minute will fill the pot in 0.5 minute.

1.4 Presenting Scientific Data

Organizing Data

Data Analysis

The table shows the data transfer rates for modems used in home computers. Data transfer rates are often measured in kilobits per second, or kbps. The time required to upload a 1-megabyte (MB) file is given for each rate listed.

| Modem Speeds		
Type of Modem	Data Transfer Rate (kbps)	Upload Time for 1 MB (s)
56K dial-up	33.6	238
Cable	64	125
DSL	128	63
Cable	256	31
DSL	640	13

Organizing Data

1. Using Graphs Use the data in the table to create a line graph. Describe the relationship between data transfer rate and upload time.

Modem Speeds

Type of Modem	Data Transfer Rate (kbps)	Upload Time for 1 MB (s)
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DSL	640	13

Data Transfer Rate vs. Modem Speed
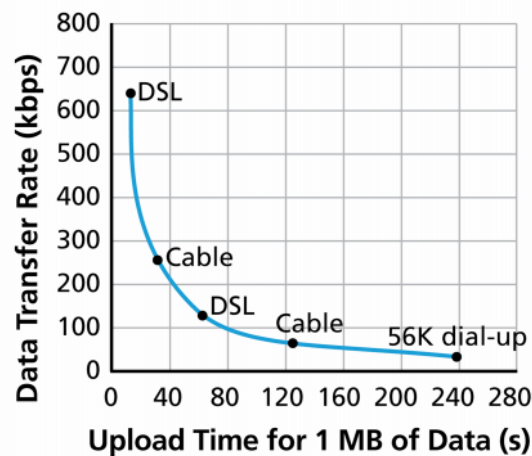
2. Inferring How would doubling the data transfer rate affect the upload time?

Organizing Data

Data Analysis

2. Inferring How would doubling the data transfer rate affect the upload time?

Answer: Doubling the data transfer rate would halve the upload time.

Organizing Data

Bar Graphs

A bar graph is often used to compare a set of measurements, amounts, or changes.

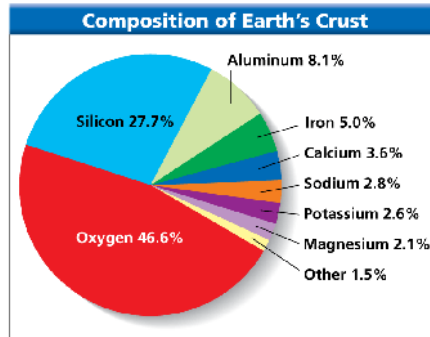| Average Annual Precipitation for Selected U.S. Cities	
City	Average Annual Precipitation (cm)
Buffalo, N.Y.	98.0
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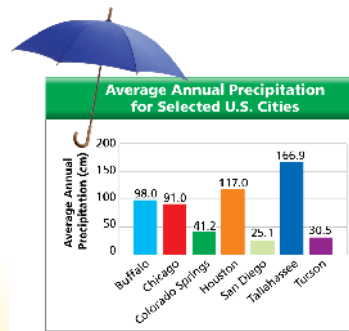
Organizing Data

Circle Graphs

If you think of a pie cut into pieces, you have a mental model of a circle graph. A circle graph shows how a part or share of something relates to the whole.

Composition of Earth's Crust

- Silicon 27.7%
- Aluminum 8.1%
- Iron 5.0%
- Calcium 3.6%
- Sodium 2.8%
- Potassium 2.6%
- Magnesium 2.1%
- Other 1.5%
- Oxygen 46.6%

Communicating Data

How can scientists communicate experimental data?

Scientists can communicate results by writing in scientific journals or speaking at conferences.

Communicating Data

Scientists also exchange information through conversations, e-mails, and Web sites. Young scientists often present their research at science fairs, which we call poster sessions.

Communicating Data

Peer review is a process in which scientists examine other scientists' work.

- Peer review encourages comments, suggestions, questions, and criticism from other scientists.
- Based on their peers' responses, the scientists who submitted their work for review can then reevaluate how to best interpret their data.

Assessment Questions

1. Which type of graph is most useful for showing how part of something relates to the whole?
    a. bar
    b. circle
    c. column
    d. line

Assessment Questions

1. Which type of graph is most useful for showing how part of something relates to the whole?
    a. bar
    b. circle
    c. column
    d. line

    ANS: B

Assessment Questions

2. How does a line graph generally show the relationship between the manipulated variable and the responding variable?

   a. The manipulated variable is plotted on the *x*-axis, and the responding variable is plotted on the *y*-axis.
   b. The responding variable is plotted on the *x*-axis, and the manipulated variable is plotted on the *y*-axis.
   c. The manipulated variable is plotted on the graph, and the responding variable is shown by the slope.
   d. The responding variable is plotted on the graph, and the manipulated variable is shown by the slope.

Assessment Questions

2. How does a line graph generally show the relationship between the manipulated variable and the responding variable?

   a. The manipulated variable is plotted on the *x*-axis, and the responding variable is plotted on the *y*-axis.
   b. The responding variable is plotted on the *x*-axis, and the manipulated variable is plotted on the *y*-axis.
   c. The manipulated variable is plotted on the graph, and the responding variable is shown by the slope.
   d. The responding variable is plotted on the graph, and the manipulated variable is shown by the slope.

   ANS: A

Assessment Questions

3. How do scientists communicate the results of scientific investigations?

    a. by writing in scientific journals or speaking at conferences
    b. using secret code
    c. only through e-mail
    d. by writing in literary journals

Assessment Questions

3. How do scientists communicate the results of scientific investigations?

    a. by writing in scientific journals or speaking at conferences
    b. using secret code
    c. only through e-mail
    d. by writing in literary journals

    ANS: A

Assessment Questions

4. Why is peer review an important part of the scientific process?

    a. Peer review makes sure that the correct researcher gets credit for discoveries.
    b. Peer review helps identify errors or bias in research.
    c. Peer review is the system used to report information to other scientists.
    d. Peer review helps other scientists form theories about a discovery.

ANS: B