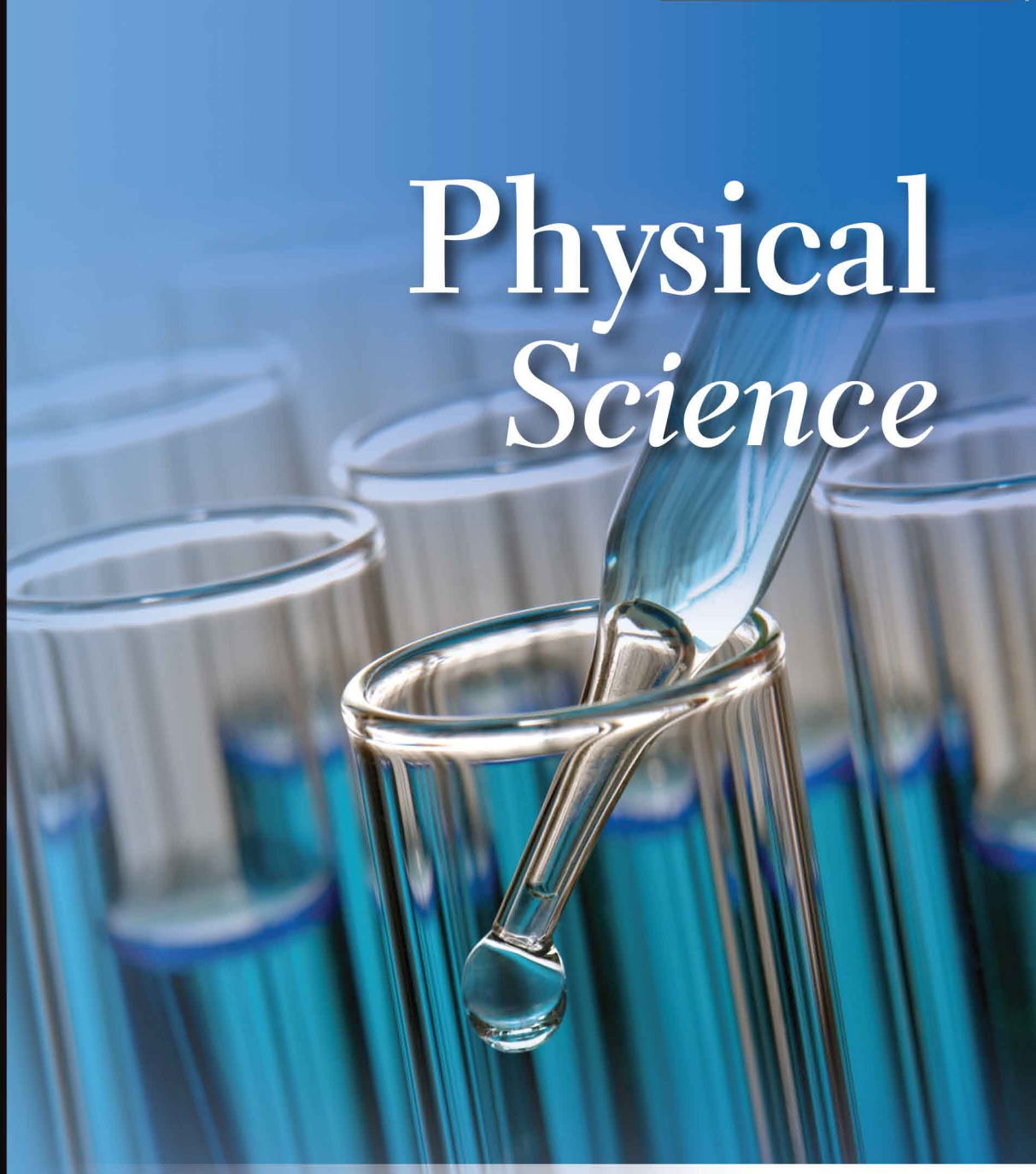
SCIENCE

Physical *Science*



Topics Include:

Acceleration, Changes of State, Density, Electric Charges, Fixed and Moveable Pulleys, Heat Engines, Hydrocarbons, Solutions, Structure of the Atom, and More

SADDLEBACK EDUCATIONAL PUBLISHING

Table of Contents

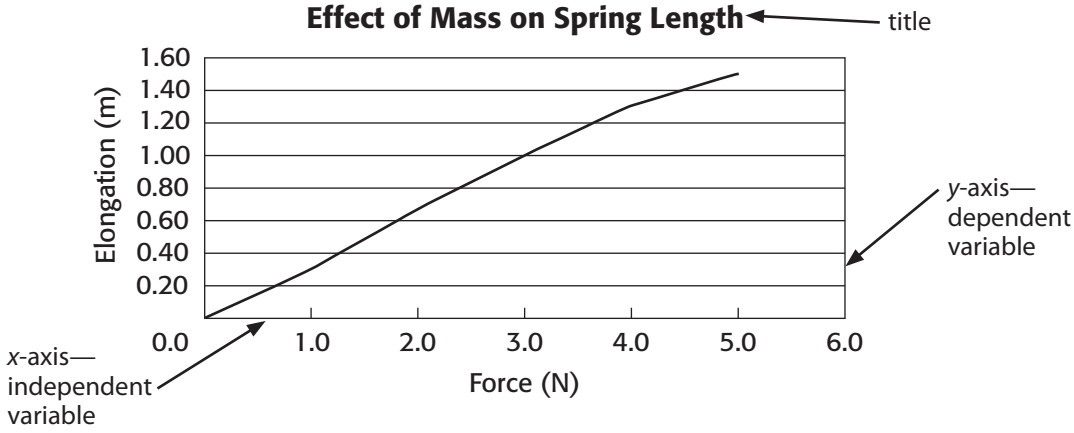
Building Process and Thinking Skills

Developing Concepts

NAME _____ DATE _____

Drawing a Graph

A graph is often used to see if a relationship exists in a set of data. You can use a graph to show how one variable changes in response to another variable changing.



Data on the speed of an object during a certain time interval was collected and placed in a data table. Follow the steps below to graph the data.

Step 1 Draw an *x*-axis and a *y*-axis.

Step 2 Label the *x*-axis with the independent variable—this is the variable you change.

Step 3 Label the *y*-axis with the variable that is the dependent variable—the variable that is a result of changing a variable.

Step 4 Decide on the scale for each axis. Look at your data. Determine the range of the data for each axis. Choose a scale that has the numbers equally spaced.

Step 5 Plot each point.

Step 6 Draw a line connecting the data points.

Time (s)	Speed (m/s)
0	0
10	20
20	45
30	60
40	84

NAME _____ DATE _____

Reading a Graph

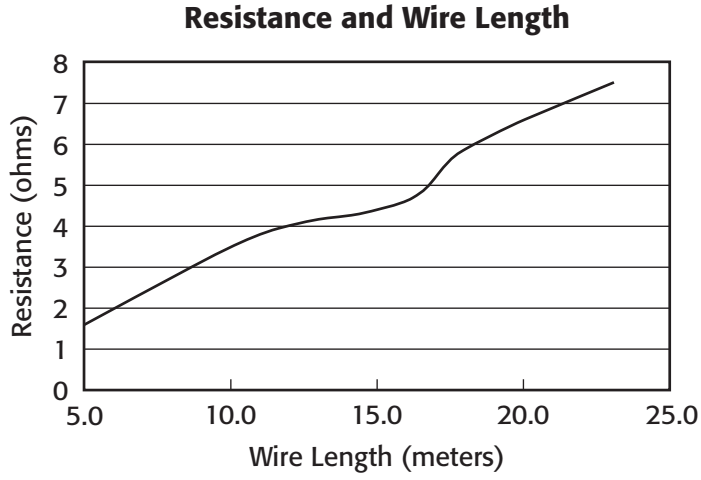
Data collected in an experiment is often displayed on a graph. A graphical display can be an easy way to see the relationship between variables.

1. When both variables increase the trend is _____.
2. When one variable increases and the other decreases the trend is _____.
3. When there is no relationship between variables there is _____ between variables.

Use the graph to answer the following questions.

4. What are the two variables tested in this experiment? _____
5. The horizontal axis (the axis that goes from left to right) is known as the *x*-axis. The independent variable is placed along the *x*-axis. What is the independent variable?

   _____



6. The vertical axis (the axis that goes up and down) is the *y*-axis. The dependent variable is placed along the *y*-axis. What is the dependent variable?

   _____

7. To read a point on the graph, start at the *x*-axis, move up the line, move across to the *y*-axis, and read the point on the *y*-axis. What is the resistance in a 15 m piece of wire? _____
8. What do you notice about the graph as the length of the wire increases?

   _____

9. Is this a positive or negative trend? _____
10. Based on the graph, what will happen if the length of the wire is increased to 25 m?

    _____

NAME _____ DATE _____

Organizing Data

Before you actually conduct your experiment, you need to decide how you will record what happens during the experiment. Often you record data in a science notebook. After you have gathered your data, you need to decide on a way to organize the data to present to others that want to see what you have gathered. Your data must be organized in an orderly way. You can follow the steps below to organize the data from the following experiment.

0 minutes: sand = 20.5ºC; water = 20.5ºC
1 minute: sand = 20.9ºC; water = 20.7ºC
2 minutes: water = 20.9ºC; sand = 21.5ºC
3 minutes: water = 21.2ºC; sand = 22.0ºC
4 minutes: sand = 22.6ºC; water = 21.4ºC
5 minutes: water = 21.6ºC; sand = 23.2ºC

Creating a data table will be the easiest way to organize your data. When you create a data table to organize your data, the independent variable is at the heading of the first column.

Step 1 Place the name of the independent variable in the top of the left column.

Step 2 Place the headings of the dependent variable at the top of the middle and right columns.

Step 3 Enter the data for each dependent variable in its correct column. In other words, place all the sand data in the sand column and the water data in the water column.

1.	**2.**	**3.**
4.	20.5ºC	20.5ºC
5.	20.7ºC	20.9ºC
6.	20.9ºC	21.5ºC
7.	21.2ºC	22.0ºC
8.	21.4ºC	22.6ºC
9.	21.6ºC	23.2ºC

NAME _____ DATE _____

Identifying Variables in an Experiment

In an experiment, you make changes in a situation and see the results. The conditions set in an experiment are known as the *variables*. A variable can be temperature, the amount of water, or amount of food given each day. In an experiment, only one factor (variable) should change. This variable is known as the *independent variable*. The result of your experiment is the *dependent variable*.

The following sample experiment tests the effect of slope of a ramp on how fast a marble goes.

- Make a ramp with a single piece of wood.
- Raise the ramp to a height of 10 cm.
- Place a piece of tape 40 cm from the bottom of the ramp.
- Place a marble at the top of the ramp.
- Release the marble and record the time it takes the marble to reach the piece of tape.
- Raise the ramp 5 cm and determine the time it takes the marble to reach the tape. Repeat for additional heights of the ramp.

1. List all the possible factors, or variables, in the experiment. _____

_____

_____

2. Which of these variables stayed the same in each trial? _____

_____

_____

3. Which variable was different in each trial? _____

4. Is this the independent or dependent variable? _____

5. You observe that it takes less time for the marble to reach the tape as the height of the ramp increases. Is the time it takes the marble to reach the tape the independent or dependent variable? _____

6. List your variables in an experiment in which you explore if the mass of the marble affects the time it takes to reach the tape. Which variables would change?

_____

_____

_____

NAME _____ DATE _____

Designing an Experiment

When a scientist asks a question, the search for the answer to that question leads to a hypothesis. To test that hypothesis, a scientist will design an experiment. When designing an experiment you need to consider the following:

- the variable being tested,
- the variable being recorded,
- other variables that need to be the same all the time during the experiment.

A scientist wants to determine if the time it takes a certain amount of salt to dissolve changes with a change in temperature. The experiment is set up with two test tubes half full of 25°C water.

Answer the following questions regarding the variables in this experiment.

1. What are the variables being tested? _____

_____

2. Which variable is easier to change? This will be the independent variable. _____

_____

3. Which variable will be the dependent variable? _____

4. List the other variables you need to consider. The list is started for you—name four additional variables.

- Size of the test tube
- Amount of water
- _____
- _____
- _____
- _____

Place the steps of the experiment in order. Write *1* in the blank next to the step that comes first, *2* in the space next to the step that comes second, and so on.

5. _____ Add 10 g of salt to the water in each test tube. Do not shake the tubes.

6. _____ As you add the salt, start a timer. Record the time it takes all of the salt to dissolve in the water.

7. _____ Empty the test tubes. Completely clean and dry the tubes. Add 25 mL of water 15°C to each tube. Add 10 g of salt and record the time it takes the salt to dissolve.

8. _____ Label five identical test tubes 1–5. Place them in a test tube rack.

9. _____ Place 25 mL of water at 25°C into each test tube.

NAME _____ DATE _____

Drawing Conclusions

Once you have recorded the results of an experiment, you must review the data to see if any patterns or relationships exist. From the patterns that exist, you can draw a conclusion, or make a statement about the relationships that exist between your variables.

The data in the tables below show the number of swings of a pendulum in 15 seconds. In the first table, the length changed (with a constant mass). In the second table, the mass changed (but the length of the pendulum remained the same).

Draw a conclusion regarding the data in the tables. Answer the questions by filling in the blanks.

Pendulum Length (cm)	Swings
5	32
10	23
20	17
40	12
60	9

Pendulum Mass (g)	Swings
5	23
10	23
20	22
40	24
60	23

1. What happens to the number of swings of the pendulum when the length increases from 5 cm to 10 cm? _____

_____

2. What happens to the number of swings of the pendulum when the length increases from 10 cm to 15 cm? _____

_____

3. Does this trend continue for the remaining pendulum lengths? _____

4. What happens to the number of swings of the pendulum when the mass increases from 5 g to 10 g?

_____

_____

5. Does this trend continue for the remaining pendulum masses? _____

6. What can you say about the number of swings of the pendulum and the length and mass of the pendulum? _____

_____

_____