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Building Process and Thinking Skills

Developing Concepts

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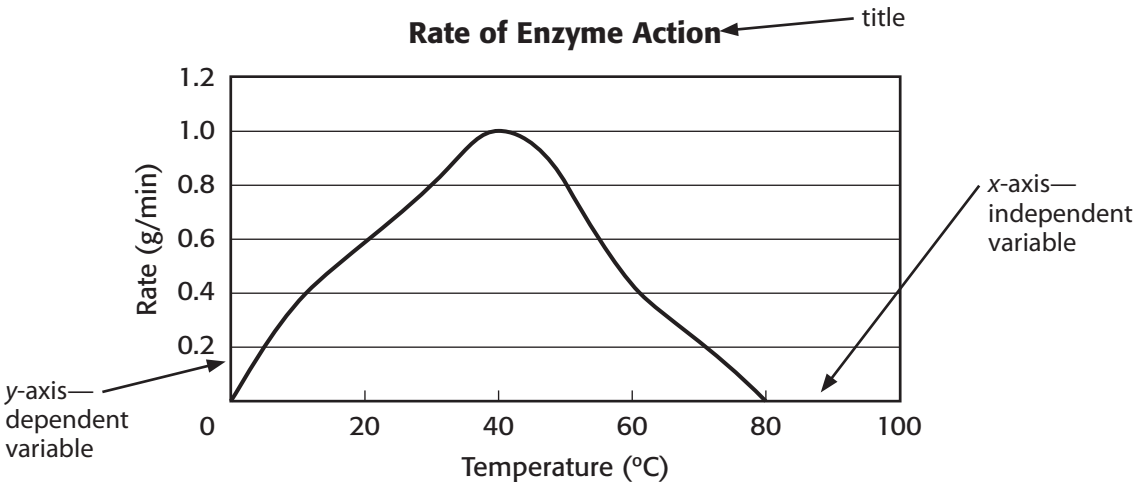
Drawing a Graph

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.



The data in the table below was collected and placed in a data table. The data represents the rate bubbles formed on an underwater plant based on its distance from the light.

Follow the steps below to graph the data.

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

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

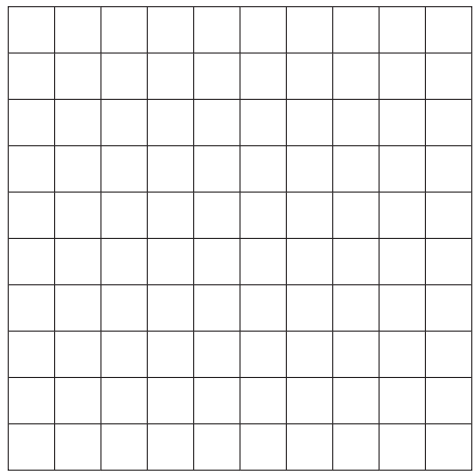
Step 3 Label the *y*-axis with the variable that is the dependent variable—the variable that is a result of changing a variable.

Step 4 Decide on the scale for each axis. Look at your data and 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.

Distance from Light (cm)	Bubbles per Minute
10	40
20	20
30	10
40	5



NAME _____ DATE _____

Reading a Graph

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

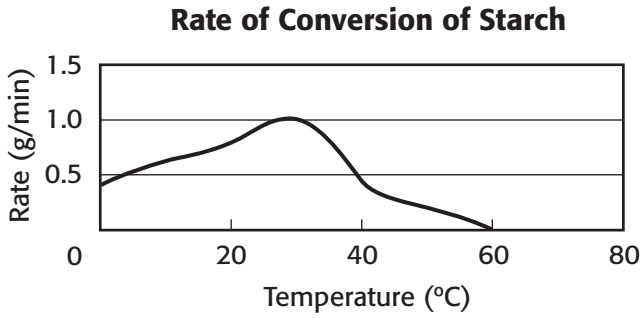
Use the graph to answer the following questions.

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 rate that starch is converted at 30°C?

_____

8. What do you notice about the graph for temperature from 0°C to 40°C?

_____

9. Is this a positive or negative trend? _____
10. What do you notice about the graph for temperature from 40°C to 80°C?

_____

11. Is this a positive or negative trend? _____

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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. Follow the steps below to see how data from the following experiment is organized.

You are trying to find out if there is a difference in how fast a monocot grows compared to a dicot. You conduct an experiment and gather the following data.

Day 1: monocot height = 1 mm; dicot height = 2 mm
Day 2: dicot height = 3 mm; monocot height = 2 mm
Day 3: dicot height = 4 mm; monocot height = 3 mm
Day 4: monocot height = 4 mm; dicot height = 6 mm
Day 5: dicot height = 8 mm; monocot height = 5 mm
Day 6: monocot height = 6 mm; dicot height = 10 mm

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 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 column.

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

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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 sugar on yeast.

- Pour 25 mL of yeast solution into each of 2 test tubes.
- Add 10 mL of water at 30°C to each test tube.
- To one test tube add 5 g of sugar.
- Wait 15 minutes.
- Record your observations.

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

_____

2. Which of the variables stayed the same in each of the two test tubes? _____

_____

3. Which variable was different in the test tubes? _____

_____

4. Is this the independent or dependent variable? _____

5. You observe that the height of the liquid in the tube with the sugar is higher than in the tube without the sugar. Is the height of the liquid in the tube the independent or dependent variable? _____

6. Suppose in the tube without sugar you had added 20 mL of water at 15°C instead of the 10mL at 30°C. Would you be certain the results in the tube with sugar were caused by the addition of the sugar? _____

_____

7. List your variables in an experiment in which you explore the role of temperature on yeast activity. 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 a scientist considers 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 amount of vitamins given to a young mouse affects the growth of that mouse. The experiment is set up with two identical mice.

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 as many other variables you need to consider. These variables need to be kept the same for all of the mice tested. The list is started for you—name four additional variables.

- Temperature
- Amount of food
- _____
- _____
- _____
- _____

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

5. _____ Each morning at the same time give each mouse a certain amount of vitamins. The amount should be the same for each mouse each day.

6. _____ Place each of the mice in it's own cage, all cages should be exactly the same size and in the same location.

7. _____ Weigh each mouse every week for two months. Record the data (the mouse's weight).

8. _____ Select 12 similar mice of the same age.

9. _____ Weigh each mouse before putting it in its cage.

10. _____ Feed the mice 2 grams of food each day, and make sure their water bottle is always full.

NAME _____ DATE _____

Drawing Conclusions

Once you have recorded the result 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 table to the right shows the growth of two newborn organisms over 600 days. Individual A received a drug in its food. Individual B did not receive the drug.

Days	Weight in grams	
	A	B
0	20	20
100	230	140
200	310	200
300	370	240
400	440	245
500	460	250
600	500	250

Draw a conclusion regarding the data above. Answer the questions by filling in the blank.

1. Over the course of 600 days, what happens to the weight of each individual?

_____

_____

2. What is the mass of each individual at birth (0 days)?

_____

3. What is the weight of each individual after 200 days? _____

_____

4. What was the weight of each individual after 600 days? _____

_____

5. How much weight did Individual A gain over the 600 days? _____

Individual B? _____

6. Which individual gained more weight? _____

7. Which individual received the drug? _____

8. What can you say about the effect of the drug on growth? _____

_____

_____