RIVER CITY SCIENCE ACADEMY
MANDARIN

Middle School Math Summer Work 2019-2020

Complete assigned lessons on Khan Academy using the provided codes below.

Incoming 7th Grade Math: **USDJS2RK**

Incoming 8th Grade Math: **ZMCEXZ5X**

Incoming Algebra: **A2KWKH6A**

Incoming Geometry: **9GEUP6QF**

If you DO NOT have a Khan Academy account:

Step 1: Go to https://www.khanacademy.org/

Step 2: Click "Sign Up"

Step 3: Select "Learner" and enter date of birth

Step 4: Enter your parent or guardian's email address, then create a username and password. Click "Sign Up"

Step 5: Select your INCOMING grade level & INCOMING Math grade

Step 6: Click "Coaches", then enter the class code and click "join the class"

If you DO have a Khan Academy account:

Step 1: Go to https://www.khanacademy.org/

Step 2: Click "Coaches", then enter the class code and click "join the class"

RIVER CITY SCIENCE ACADEMY
MANDARIN

<u>7th and 8th Grade Summer Work – ELA</u>

You will be responsible for reading at least one FICTION NOVEL of your choice. It must be a book that is NEW TO YOU. Upon completion of reading, you will design a creative, tangible (not digital) project that will be turned in upon your return to school in August.

Photos of Past Projects for Inspiration:

Your project will need to include:

- Description of Characterization – Descriptions of main characters, including personality and physical traits, and any necessary comparisons/contrasts between characters, as well as images (hand-drawn or printed) of each character.
- Description of Setting – Describe the main setting(s) of the story, include (hand-made or printed) maps and drawings of setting.
- Description of the Plot – Include a story board or plot line diagram to highlight introduction, rising action, climax, and falling action/outcomes of the story.
- Student Recommendation – Rate the book from 1 star (worst) to 5 stars (best), and provide reasonable justification for your rating.
- Creativity and Ingenuity in Design – your project needs to show significant evidence of originality and inventiveness. The majority of the content and many of the ideas must be fresh, original, inventive, and based on logical conclusions and accurate reading comprehension.

* * * Each bullet point above will be worth 20% of the overall score for your ELA summer work. * * *
* * * Project is due before the end of the first week of school. Late Submissions will not be accepted. * * *

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<u>7th and 8th Grade Summer Work – Civics/US History</u>

You will be responsible for reading at least one HISTORICAL FICTION NOVEL of your choice. It must be a book that is NEW TO YOU (this book may also be used for your ELA summer work). Upon completion of reading, you will write a minimum five-paragraph essay comparing and contrasting the actual historical event and people with the events and characters presented in the novel. Prior to writing your essay, you will need to answer the following questions about the event:

1. What is the name of the historical event addressed in your novel?
2. When did the event happen? What are the most important dates?
3. Who were the most important people involved in the event?
4. What were the factors that led to your event? Why did it happen?
5. Where did the event take place?
6. Why is this event so significant that an author would create a story around it?

* * * Essay will be scored using the attached Compare and Contrast Rubric. * * *

*** Essay must address compare and contrast, as well as demonstrate understanding of the historical event. ***

* * * Project is due before the end of the first week of school. Late Submissions will not be accepted. * * *

CATEGORY	4	3	2	1
Purpose & Supporting Details	The paper compares and contrasts items clearly. The paper points to specific examples to illustrate the comparison. The paper includes only the information relevant to the comparison.	The paper compares and contrasts items clearly, but the supporting information is general. The paper includes only the information relevant to the comparison.	The paper compares and contrasts items clearly, but the supporting information is incomplete. The paper may include information that is not relevant to the comparison.	The paper compares or contrasts, but does not include both. There is no supporting information or support is incomplete.
Organization & Structure	The paper breaks the information into whole-to-whole, similarities -to-differences, or point-by-point structure. It follows a consistent order when discussing the comparison.	The paper breaks the information into whole-to-whole, similarities -to-differences, or point-by-point structure but does not follow a consistent order when discussing the comparison.	The paper breaks the information into whole-to-whole, similarities -to-differences, or point-by-point structure, but some information is in the wrong section. Some details are not in a logical or expected order, and this distracts the reader.	Many details are not in a logical or expected order. There is little sense that the writing is organized.
Transitions	The paper moves smoothly from one idea to the next. The paper uses comparison and contrast transition words to show relationships between ideas. The paper uses a variety of sentence structures and transitions.	The paper moves from one idea to the next, but there is little variety. The paper uses comparison and contrast transition words to show relationships between ideas.	Some transitions work well; but connections between other ideas are fuzzy.	The transitions between ideas are unclear or nonexistent.
Grammar & Spelling (Conventions)	Writer makes no errors in grammar or spelling that distract the reader from the content.	Writer makes 1-2 errors in grammar or spelling that distract the reader from the content.	Writer makes 3-4 errors in grammar or spelling that distract the reader from the content.	Writer makes more than 4 errors in grammar or spelling that distract the reader from the content.

Summer Packet

Science 7

Explore the Nature of Science

The assignment will be collected during the first two weeks of school and graded by your science teacher.

INQUIRY SKILL FOCUS Introduction 1

Design an Experiment

When you hear the word *experiment*, do you think only of science? Every day you probably perform simple experiments to find the answers to questions. Perhaps you try a shortcut to the library to see if you can get there more quickly, or you buy a new type of food to see if your cat likes it better than the brand you currently buy. These are examples of a simple experiment.

In science, experiments are planned more carefully and completely. **Designing an experiment** is making an organized plan to test a hypothesis. Every experiment is different, but there are some steps that are important to all investigations. Different science skills are used to plan and carry out an experiment.

Pose a Question

Experiments are designed to answer questions. For example, "If I switch gears, can I make my bike go faster?" If you've ever asked a question like that, you've asked a question that can be answered using an experiment. Note that scientific experiments can't answer questions about opinions or values.

Develop a Hypothesis

The next step is to write a hypothesis, a possible explanation for a set of observations or a way to answer a scientific question. A scientific hypothesis must be testable. Hypotheses are sometimes written as *If…then…* sentences. You might decide to design an experiment to test this hypothesis: *"If I use a different gear, then my bike will go faster."*

Plan the Procedure

Once you've written a hypothesis, you can plan the procedure you'll use to test it. The procedure tells what tests you will perform and what data you will collect. It lists the materials you will need to carry out the experiment. A procedure also identifies the variables in the experiment. It tells what variable you will purposely change, and it tells what variable you think will change as a result.

Control Variables In an experiment, only one factor, or variable, should be changed at a time. The **manipulated variable** is the variable you deliberately change during an experiment. In the experiment with your bike, the gear used is the manipulated variable. The **responding variable** is the variable that changes as a result of changes in the manipulated variable. In the bike experiment, the speed of the bike is the responding variable. All of the other variables in the experiment must be controlled, or kept the same.

Name____Date_______________Class________

Design an Experiment (*continued*)

Write Operational Definitions An operational definition is a statement that tells how a variable is measured. It allows others to repeat your experiment and understand your results. Operational definitions are used whenever a term does not have a single, clear meaning. In your experiment, you would need to explain how you measure the bicycle's speed.

Interpret the Data

Data are all of the observations and measurements made during an experiment. When the experiment is finished, the data are analyzed. Trends, or patterns, in the data can let you see if the data support your hypothesis. Data tables, charts, and graphs are good ways to record and display data in order to look for trends.

Draw Conclusions

After the data have been collected and analyzed, you need to compare your results to your hypothesis. A conclusion tells what was learned in the experiment. The conclusion tells whether or not the hypothesis was supported by the data. It may take several trials before a conclusion can be made.

TIPS FOR DESIGNING AN EXPERIMENT

- Start with a testable question. Use the question to write a hypothesis.
- Make a plan that describes the procedure you will follow to test the hypothesis. Make sure you list all of the materials you will need to perform the experiment.
- Decide which variable is the manipulated variable and which variable is the responding variable. Be sure all of the other variables are controlled.
- Develop an operational definition for any term that does not have a single, clear meaning.
- Collect the data carefully and accurately. Use data tables, charts, or graphs to show trends in the data.
- Use your data to draw conclusions.

Checkpoint Scientists often try to repeat and confirm the work of other scientists. Expand this statement by writing a few sentences that explain the importance of operational definitions.

Name____Date_______________Class________

INQUIRY SKILL FOCUS Introduction

Pose Questions

What's for lunch? When did you go to the library? Did you like the book? Asking questions is something you do every day. Questions allow you to gather important information about the world around you. Some questions can be answered with a fact. Your friend might say she went to the library at 3:00 P.M. Other questions are answered with opinions. "I really liked the book" is an opinion that answers a question.

Scientific questions are questions about the natural world. The answers to scientific questions are found by observing, measuring, or investigating. Questions based on an opinion or personal values are not scientific questions.

Question 1: What kind of fabric is the strongest? (scientific question)

Question 2: What kind of fabric makes the best-looking backpack? (not a scientific question, because it is based on an opinion)

Questions can be general or specific. General questions can help you think about topics in science. Scientists often make several specific questions from one general question. Specific questions can be tested in investigations.

Question 3: Does the weather affect plants? (general)

Question 4: Does the amount of rainfall in a region affect the rate at which plants grow? (specific)

Questions 5: Does the average daily temperature affect flower production in roses? (more specific)

TIPS FOR POSING QUESTIONS

- Remember that scientific questions are questions about the natural world.
- Check your questions to be sure they do not involve personal values or opinions.
- Divide general questions into several specific questions.
- Answer specific questions by measuring, observing, or investigating.

Checkpoint Write one example of a question that involves an opinion, and one example of a scientific question.

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Name____Date_______________Class________

INQUIRY SKILL FOCUS Practice

Pose Questions

Examine the statements below. For each item 1-5, write yes if the topic can be investigated scientifically. Write no if it can not be investigated scientifically. Then, for each item to which you answered yes, rewrite the statement in the form of a scientific question.

1. Photographs are more interesting to look at than paintings.

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2. Some toy cars roll more quickly than others.

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3. The government should make laws to decrease pollution.

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4. Sunflowers grow taller than daisies.

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5. It's fun to study the moon using a telescope.

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For each of the general questions below, develop two specific questions that could be answered in an investigation.

6. What can people do to stay healthy?

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7. How does Earth's surface change?

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8. **Think It Over** Write one scientific question that would require measurements to answer. What kind of measuring tools would you need to answer the question? What units would you use when you record the data?

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Name____Date_______________Class________

INQUIRY SKILL FOCUS Introduction

Develop a Hypothesis

After school one day, you see your little sister and her friends playing with toy cars. You observe that the cars seem to move at different speeds and wonder what causes the difference. You could make a hypothesis, or possible explanation, for the different speeds of the cars.

Questions, like your question about the toy cars, can lead to hypotheses. A **hypothesis** (plural: *hypotheses*) is a possible explanation for a set of observations or an answer to a scientific question. Hypotheses must be testable. In other words, you should be able to find out if a hypothesis is true or not by performing an investigation or making observations. Writing your hypothesis in the form of an *If…then…*statement lets you be sure the hypothesis is testable.

These examples show how scientific questions can be used to write properly worded hypotheses.

Scientific Question: Does force affect the motion of toy cars? (a specific scientific question that does not involve personal opinion)

Hypothesis: If a toy car is pushed with a greater force, then it will roll more quickly. (a testable and properly worded hypothesis)

Scientific Question: Does the size of a toy car's wheels affect the rate at which it rolls? (a specific scientific question that does not involve personal opinion)

Hypothesis: If a toy car is fitted with larger wheels, then it can move at a greater speed. (a testable and properly worded hypothesis)

TIPS FOR DEVELOPING HYPOTHESES

- Use scientific questions to develop hypotheses. Remember, scientific questions are testable. Be sure the question is specific and does not involve opinions or values.
- Use the *If…then…* form to write your hypothesis.
- Review your hypothesis to be sure it can be tested through an investigation.

Checkpoint You've noticed that puddles of water evaporate more quickly on sunny days than on cloudy days. Write a scientific question and a testable hypothesis based on this observation.

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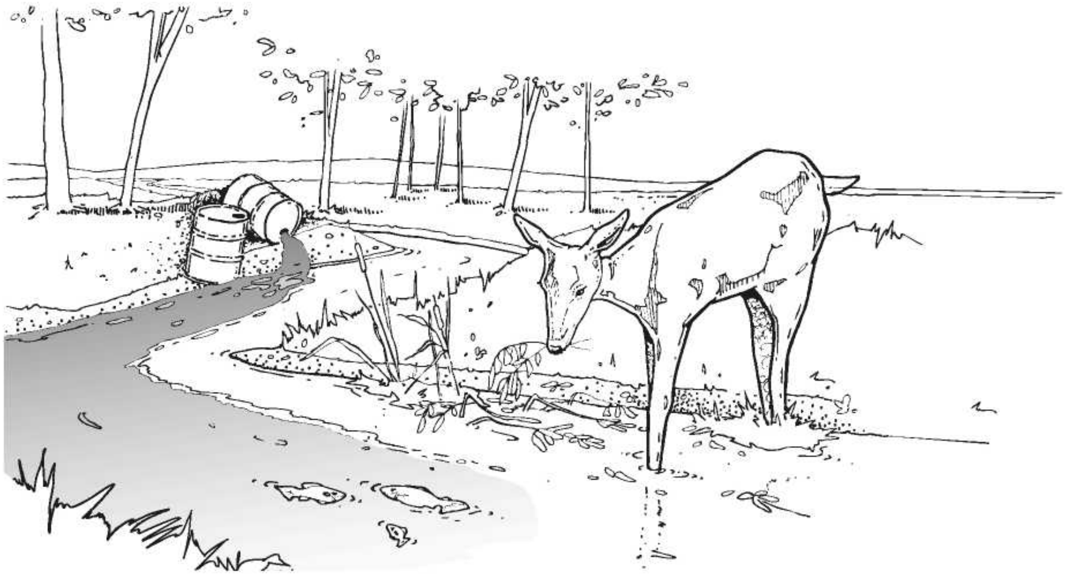
Name____Date_______________Class________

INQUIRY SKILL FOCUS Practice

Develop a Hypothesis

Use the illustration to answer the questions. If you need more space, use a separate sheet of paper.



1. Write two scientific questions about the scene in the illustration.

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2. Review your questions. Use one question to develop a hypothesis that could be tested. Use the *If…then…* form to write your hypothesis.

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3. How could your hypothesis be tested? Write a brief description of an investigation that could test your hypothesis.

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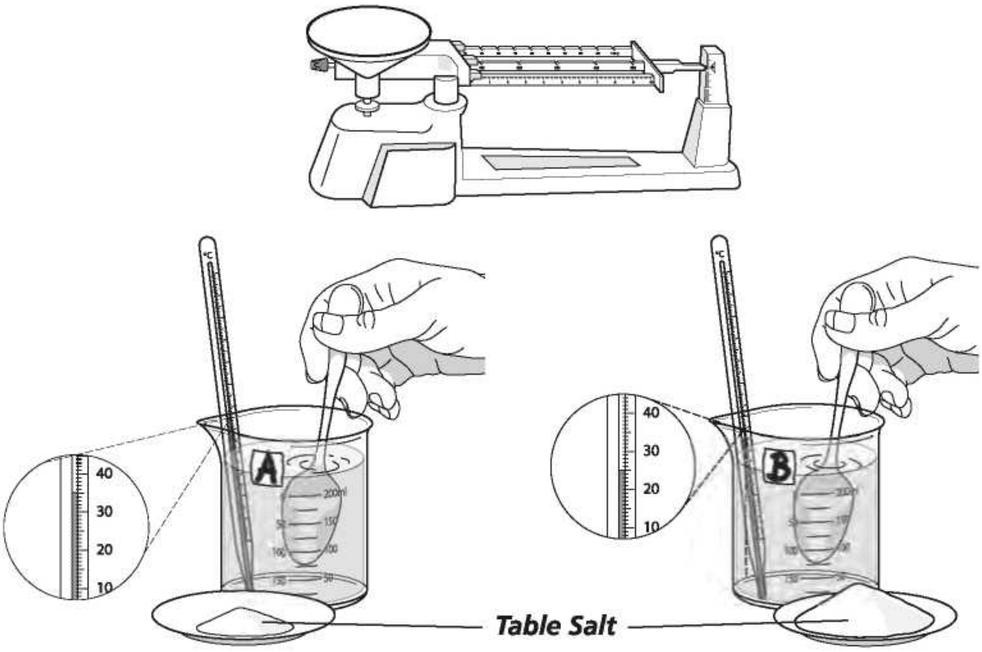
Name____Date_______________Class________

Develop a Hypothesis (*continued*)

Use the illustration to answer the questions in the space provided. If you need more space, use a separate sheet of paper.



4. What are two scientific questions these students might be investigating?

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5. Write two hypotheses in the *If…then…* form based on your answers to Question 4.

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6. Choose one of the hypotheses you developed for Question 5. Explain what data would need to be collected to see if the hypothesis is correct.

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7. **Think It Over** Why is the *If…then…* form for writing hypotheses useful? Describe one way in which this form is helpful when planning investigations.

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Name____Date______________Class________

INQUIRY SKILL FOCUS Introduction

Control Variables

Suppose that one of your friends keeps aquarium fish as pets. Last week, all of the fish in the aquarium died. When your friend got new fish, she decided to use a different aquarium filter, a different type offish food, and a different temperature setting for the water. If the new fish survive, could she tell what caused the old fish to die? No. Since more than one factor was changed, there would be no way to know what the problem was.

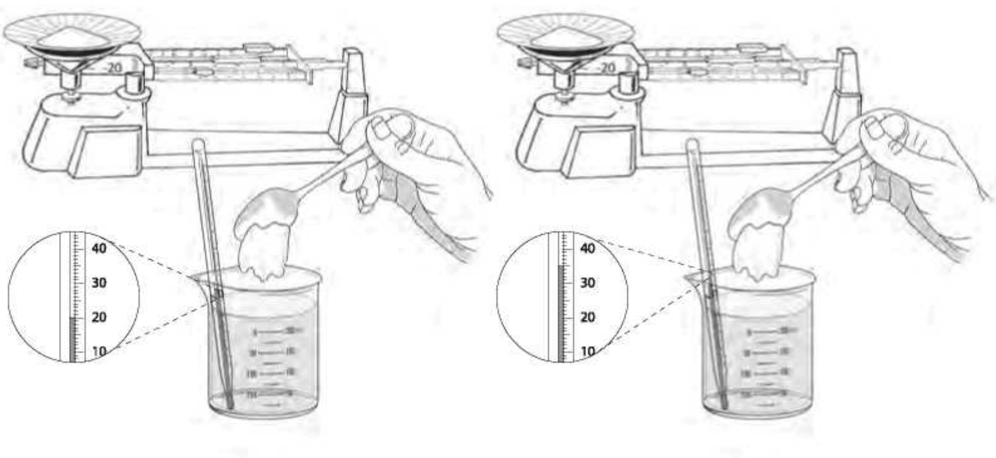
Variables are the factors in an experiment that can change. In the example above, the type of aquarium filter, the brand offish food, and the temperature of the water are all variables. In a scientific experiment, only one variable is changed at a time. The variable that is purposely changed is called the **manipulated variable.** The factor that might change as a result of changes in the manipulated variable is the **responding variable.**

In a scientific experiment, all of the other factors must be controlled. **Controlling variables** means keeping all of the conditions the same except the manipulated variable. Imagine an experiment to test how the amount of sugar that will dissolve in water is affected by the water s temperature. What are the variables in this experiment?

Manipulated Variable: water temperature

Responding Variable: amount of sugar that dissolves

Controlled Variables: the volume of water
the type of sugar (lump, granulated, powdered)
the amount of stirring
the shape of the container



Control Variables (*continued*)

In an experiment, only the manipulated variable is changed. All of the other variables are controlled. That way, you can be sure that any changes in the responding variable are due to the changes in the manipulated variable. In this particular experiment, you can be sure that any change in the amount of sugar that dissolves is due to the change in the temperature of the water. When all of the variables except the manipulated variable are controlled, the experiment is called a **controlled experiment.**

How to Identify the Control Group In science, experiments often involve groups of things, rather than individual objects. The groups being studied are called the experimental group and the control group. For example, a scientist studying the amount of sugar dissolved in water at different temperatures would use more than one beaker of water for each test. The control group would be a set of beakers at room temperature (20°C). The experimental group would be one or more sets of beakers with water of different temperatures.

The purpose of the control group is to serve as a standard of comparison. If a given amount of sugar dissolves in the control group, you contrast the amounts of sugar dissolved in the experimental groups to find the effects of the different temperatures.

TIPS FOR CONTROLLING VARIABLES

- Start your experiment by writing a scientific question. Use the question to develop a hypothesis.
- Use your hypothesis to plan your experiment. Identify the manipulated variable and the responding variable.
- Make a list of all the other variables that could affect the responding variable. Make a plan to control each of these variables.
- Decide if your experiment calls for a control group. If so, plan which group of objects or living things will serve as the control group.

Checkpoint Explain the differences among three kinds of variables in an experiment.

Name____Date_______________Class________

INQUIRY SKILL FOCUS Practice

Control Variables

Answer the following questions in the space provided. Use a separate sheet of paper if you need more space.

1. In an experiment to determine the effect of different brands of fertilizer on the rate of plant growth, what are the manipulated and responding variables?

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2. List four variables that would need to be controlled in the experiment described in Question 1.

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3. In an experiment to determine the effect of exercise on heart rate, name the manipulated variable and the responding variable.

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4. If you performed the experiment in Question 3, what four other variables would you control?

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5. Think It Over A student conducted an experiment in which he tested the effect of different ramp heights on the speed of toy cars. He used a different car to test each different ramp height. Could this student draw valid conclusions from his experiment? Why or why not?

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Name____Date_______________Class________

INQUIRY SKILL FOCUS Introduction

Form Operational Definitions

In science, exact definitions are important. An exact definition allows scientists to repeat their own work and the work of others. An **operational definition** is a statement that describes how a particular variable is to be measured, or how an object or condition is to be recognized. (The word *operational* means “describing what to do.”) Operational definitions are used whenever a term does not have a single, clear meaning.

Imagine an experiment to see how the air temperature in a room affects the growth rate of plants. If the lab report said “Some of the plants were kept in a cold room, and other plants were kept in a warm room,” you would not be able to repeat conditions of the experiment. The words *cold* and *warm* do not have single, clear meanings. Operational definitions for the terms *cold* and *warm* should be used in the lab report. If the lab report said “Some of the plants were kept in a room with an air temperature of 10°C, and other plants were kept in a room with an air temperature of 30°C,” you would have the information that you needed to repeat the experiment’s conditions.

Operational definitions are also used to describe how variables are measured. In the experiment described above, the growth rate of plants is the responding variable. The lab report must provide an operational definition that tells how the rate of plant growth was determined. For example: The height of the plants was measured once every 24 hours using a centimeter ruler. The height was measured to the nearest centimeter. The change in height was determined by subtracting the previous day’s height from the current height. The rate of growth was reported using the unit centimeters per day.

When you write an operational definition, make sure it describes what to do or what to observe. Be sure that any terms in your lab report that do not have a single, clear meaning have an operational definition. Here are some examples of operational definitions.

Notice how this operational definition tells how a variable was measured:

Example 1: The maple tree population in an area of 100 square meters increased compared to last year. Operational definition: The maple tree population in an area was determined by counting the number of maple trees in one tenth of the area and multiplying that number by 10.

This operational definition defines the word *fresh:*

Example 2: Cut flowers stay fresh longer if they are kept in warm water than they do if they are kept in cold water. Operational definition: Cut flowers are considered fresh if they have not lost any petals.

Form Operational Definitions (*continued*)

The same term can have a different operational definition in different experiments. Imagine an experiment to measure the average temperature on rainy days. You might define a rainy day as a day with more than 1 cm of rain in an 8-hour period. In an experiment to study how plant growth is related to the weather, you might define a rainy day as any day with measurable precipitation. Both definitions can be acceptable operational definitions.

Some variables can be measured in a variety of ways. A good operational definition for the measurement of a variable includes the tool used to measure and the unit of measure used. It should also tell how frequently a particular measurement is made. In an experiment that requires the measurement of the temperature of a beaker of water as it heats over a flame, the operational definition might be: The temperature of the water is measured in degrees Celsius with a Celsius thermometer at 5-minute intervals.

TIPS FOR WRITING OPERATIONAL DEFINITIONS

- Develop a written plan for the investigation or experiment.
- Make a note of any terms in your written plan that do not have a single, clear meaning. Write an operational definition for these terms.
- Provide operational definitions to clarify the methods used to measure the variables.
- Does the experimental setup require operational definitions in order for someone else to duplicate your work? If so, develop these definitions before you begin the experiment.
- Have a friend review your written plan. Ask if your friend could duplicate your work using only the written plan.

Checkpoint Explain why there can be more than one correct operational definition for the term *cold*.

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Name____Date_______________Class________

INQUIRY SKILL FOCUS Practice

Form Operational Definitions

Write an operational definition for each underlined idea in the space provided. Use a separate sheet of paper if you need more space.

1. List the plants found in the ecosystem, with the smallest one first.

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2. Investigate antibacterial soaps to see if they help people stay healthy.

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3. Investigate two brands of batteries to see which lasts longer.

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4. Soil erosion increases during a heavy rain.

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5. Measure the speed at which a puddle evaporates on a hot day.

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6. **Think It Over** Look at your answer to Question 1. Write another operational definition that could also be used for the underlined idea.

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Name____Date_______________Class________

INQUIRY SKILL FOCUS Introduction

Interpret Data

Suppose you are in charge of planning a fundraising event for your favorite after-school club. There are three choices of fundraising events you could plan. Each event requires a different amount of time and effort from the club members. Each event will raise a different amount of money for the club. To figure out which event will work best for your club, you need to know how much time and effort the club members can provide. You need to know how much money the club needs to raise. Then you can compare the choices and pick the fundraising event that will work best for your club. Carefully examining information to make a decision is similar to the science skill of interpreting data.

The observations and measurements that are made during a scientific investigation are called **data.** After all of the data have been collected, they need to be carefully examined. **Interpreting data** is the process of finding meaning in data by looking for patterns and trends.

Suppose that scientists measured the speed that sound waves travel at different air temperatures. The results of the experiment were recorded and placed in the following data table.

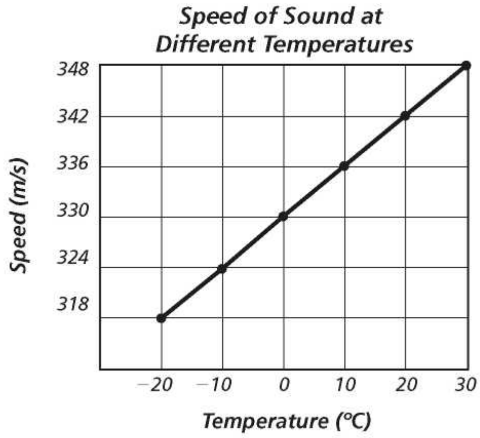
Speed of Sound at Different Temperatures

Air Temperature (°C)	Speed (m/s)
−20	318
−10	324
0	330
10	336
20	342
30	348

By examining the data in the table, you can see that sound waves travel more quickly in warm air than they do in cool air. To find more specific information about this trend in the data, you can make a graph.

Interpret Data (*continued*)

You can use the data to create a line graph like the one shown here. You could then use the graph to interpret the data and make inferences like the ones that follow.



Example 1: The warmer the air temperature, the greater the speed of sound waves.

Example 2: For every 10-degree increase in air temperature, the speed of sound waves increases by 6 m/s.

Example 3: The speed of sound waves in air at 5°C would be 333 m/s.

To determine if your inferences are logical, think about what you have learned about matter in science class: You remember learning that the particles of matter move more rapidly at high temperatures than they do at low temperatures. You also know that sound waves move through particles of matter. If the particles move more quickly at higher temperatures, it makes sense that sound waves would move more quickly at higher temperatures. You decide that your interpretation of the data makes sense.

TIPS FOR INTERPRETING DATA

- Use a data table or chart to organize the information. Make any required calculations, such as finding averages.
- Use the data to make a graph.
- Identify trends in the data.
- Make inferences from the data. Determine if your inferences are logical by comparing your inferences to your previous knowledge about the topic.
- If your inferences contradict your previous knowledge of a topic, review your work and check for errors. You might need to repeat your work to confirm your interpretation of the data.

Checkpoint How do graphs help you to interpret data?

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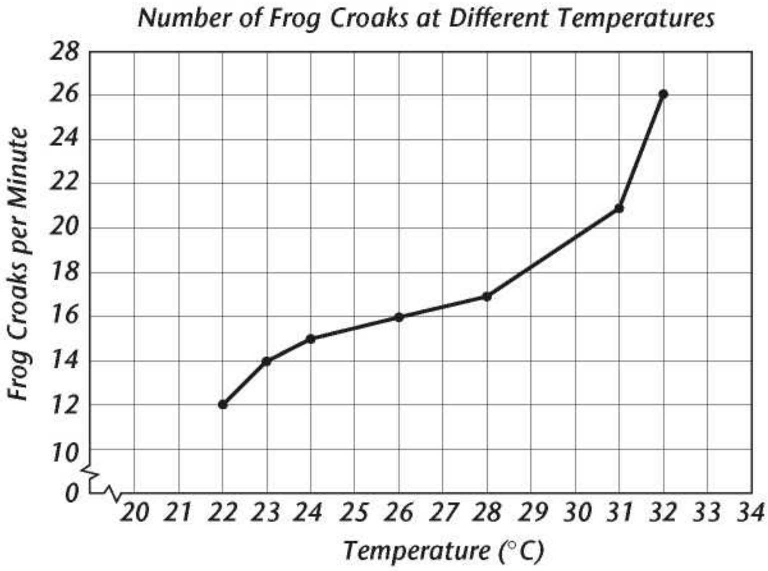
Name____Date_______________Class________

INQUIRY SKILL FOCUS Practice

Interpret Data

Answer the following questions on a separate sheet of paper.



1. Write a sentence that summarizes the data. Use the title of the graph and the axis labels to help you write your sentence.

2. What is the difference between the greatest number of croaks measured in one minute and the fewest number of croaks measured in one minute?

3. What was the greatest temperature at which information about frog croaks was collected?

4. Describe the relationship between the temperature and the number of frog croaks per minute.

5. What number of croaks would you expect to hear if the temperature were 21°C? Why?

6. **Think It Over** Does the number of frog croaks increase the same amount for each degree of temperature increase? Write a sentence that describes any trends you note in the data.

INQUIRY SKILL FOCUS Introduction

Draw Conclusions

We often use the word *conclusion* in everyday conversation. In science, the term *conclusion* has a more limited meaning. **Drawing a conclusion** means making a statement summing up what you have learned from an experiment.

Recall that an experiment begins with a scientific question and a hypothesis. The hypothesis is usually written as an *If…then…* statement. The hypothesis is a possible explanation for a set of observations. A conclusion is a statement that tells whether or not the hypothesis was correct.

Suppose a student has decided to investigate the effect of distilled water on independent living cells. She made a hypothesis and carried out a controlled experiment.

Hypothesis: If independent cells are placed in distilled water, then the cells will expand.

Experiment In the experiment, cells were placed in distilled water and observed. Distilled water has less salt than the water inside of cells. The cells became swollen as water moved into them. Cells in a control group were placed in water that had the same concentration of salt as the water in the cells. The cells in the control group did not change size.

The experimental data show that the student's hypothesis was correct. She wrote the following conclusion about the results:

Conclusion: Cells placed in distilled water expand in size.

It is important to draw conclusions only about variables tested in the experiment. For example, a student has planned an experiment to test the effect of a certain brand of fertilizer on the production of roses on rose bushes.

Hypothesis: If rose bushes are given 10 g of Fertilizer X each week, then they will produce more flowers than rose bushes that are given no fertilizer.

Here is the student's data table:

Effect of Fertilizer on Rose Production

	Number of Roses	
Time (weeks)	**Control Plant**	**Plant With Fertilizer**
1	3	5
2	6	8
3	5	9
4	7	10

Name____Date_______________Class________

Draw Conclusions (*continued*)

Notice that the experimental data show that the student's hypothesis is correct. It is important that the student's conclusion sums up only the experimental data.

Correct Conclusion: Rose bushes treated with 10 g of Fertilizer X each week produce more flowers than rose bushes not treated with Fertilizer X.

Notice that the student made a conclusion using only the experimental data. Examples of conclusions the student should not make are:

Incorrect Conclusion: All plants produce more flowers if they are treated with 10 g of Fertilizer X each week. (The student cannot make this conclusion, because the experiment did not test all plants.)

Incorrect Conclusion: Rose bushes produce more flowers if they are treated with any fertilizer. (Because only Fertilizer X was tested, the student cannot make a conclusion about all fertilizers.)

TIPS FOR DRAWING CONCLUSIONS

- Review the hypothesis for the experiment. Compare the hypothesis to the observations and measurements recorded during the experiment.
- Determine whether the data support the hypothesis.
- Decide whether you need to repeat the experiment.
- Write a conclusion that sums up the results of the experiment.
- Review your conclusion to be sure that you have used only your experimental data to make your conclusion.

Checkpoint Can you make a conclusion if your data do not agree with your hypothesis? Why or why not?

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Name____Date_______________Class________

INQUIRY SKILL FOCUS Practice

Draw Conclusions

Answer the following questions on a separate sheet of paper. A scientist made the following hypothesis: If a dog is fed a strong sugar solution, then the dog's blood sugar concentration will rise, then return to normal within 60 minutes. The scientist conducted a controlled experiment to collect data. Her data table is shown here.

Dog's Blood Sugar Levels After Eating a Strong Sugar Solution

Time After Eating Sugar (minutes)	**Blood Sugar Concentration (mg/100 mL)**
0	75
30	125
60	110
90	90
120	75
150	75
180	75

1 Write a sentence that summarizes the data.

2 Do the data show that the scientist's hypothesis is correct or incorrect?

3 Write a conclusion for this experiment.

4 What is wrong with the following conclusion? Animals that are fed a strong sugar solution will have a normal blood sugar level after 120 minutes.

5 **Think It Over** What are two steps the scientist could take in order to be more confident of her conclusion?

Name____Date_______________Class________

INQUIRY SKILL FOCUS Practice

Design an Experiment

Choose a question from the list below as a topic for an experiment. Alternatively, pose a scientific question of your own, and obtain your teacher's approval to use that question. Remember, as one of the first steps in planning your investigation, you may need to narrow your original question. Then write a hypothesis and design an experiment to answer the question. Be sure to include all the necessary parts of an experiment, such as naming the manipulated and responding variables and identifying the variables you will control. Write any operational definitions that are needed. Include a data table you could use for recording your observations. Use a separate sheet of paper for your work.

1 Does the amount of humus in soil affect the rate of seed germination?

2 Does water freeze more quickly in a plastic container or a metal container?

3 What effect do light bulbs of different wattage have on the rate of plant growth?

4 Does the mass of a marble affect the rate at which it rolls down a ramp?

5 Is the amount of algae in the classroom aquarium affected by its location in the classroom?

6 How is the volume of the air in a balloon affected by its temperature?

7 How do different types of surfaces affect the rate at which a skateboard travels?

8 Does the mass of an object affect how quickly it falls when dropped?

9 Does regular hand washing by students affect the absence rate at school?

10 Does the air pressure inside a basketball affect how high the basketball bounces?

11 **Think It Over** Review your experimental design. Write a sentence that tells how you know that any changes in the responding variable in your experiment are due to changes in the manipulated variable.

INQUIRY SKILL FOCUS Introduction

Create Data Tables

During a scientific investigation, there is often a large amount of information to organize. A **data table** is an organized arrangement of information in labeled rows and columns. Data tables are used in science to record observations during investigations and experiments. Data tables are also useful in the process of analyzing data.

When you design an experiment, you should plan the data table you will use to record your observations. The data table should be planned and made before the investigation is performed.

To plan a data table, first identify the manipulated variable and the responding variable in the experiment. Think about how these variables will be observed and measured. Consider how frequently changes in the variables will be measured. Use this information to plan the columns and rows of the data table. Also consider the units you will use for your measurements. The units should be inserted in the column heads. Data tables should also have a title.

Look at the data table below. This data table was made for an experiment to determine whether the angle of a light source affects the temperature change of a surface. Notice that the data table has a title describing the information. The columns are labeled and the units are included. A space is provided for each measurement.

Temperature Change of Surfaces With Light at Different Angles

Time	**Temperature (°C)**		
(minutes)	**0° Angle**	**45° Angle**	**90° Angle**
Start			
1			
2			
3			
4			
5			

As you develop your experimental plan, make a draft of your data table. Review the data table to be sure that there is a space for each measurement required in the experiment. Make sure the units are correct. Will your experiment involve more than one trial? If so, be sure you have included space for the measurements from each trial. Is there a control group you will be observing? Make sure there is space in your data table for these observations. This will allow direct comparison of the experimental group with the control group.

Name____Date______________Class________

Create Data Tables (*continued*)

The data table below shows one way of recording data from multiple trials of an experiment. Note that there is also space to record the average of the data from the three trials.

Speed of Skateboard

Angle of Ramp (degrees)	Trial Number	Time (s)	Average Time (s)
	1		
	2		
	2		
	1		
	2		
	3		

After you have reviewed your draft, create the final data table in your notebook. It is important to have your data table made before you begin your experiment. It helps you remember to make all of the necessary measurements. Also, there is often no time to make tables during an experiment.

TIPS FOR CREATING DATA TABLES

- Identify the manipulated and the responding variable in the experiment to determine what observations you will make.
- Determine the time interval at which you will make your observations.
- Make a draft of the data table. Label the columns and rows. Make a title for the table.
- Determine the units you will use for measuring. Include units in the column labels.
- Review your draft. Be sure you have a place for all the observations you will need to make during your experiment.
- Make any required revisions to your draft. Draw the final version of your table in your notebook.

Checkpoint Why is it important to have the data table planned and written in your notebook before an experiment begins?

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Name____Date_______________Class________

INQUIRY SKILL FOCUS Practice

Create Data Tables

Read the description of the experiment. Then answer the questions on a separate sheet of paper.

To find out whether the amount of substance that dissolves in water will change when the temperature of water changes, we set up the following experiment:

First we used a heat source to heat identical beakers, each containing 100 g of water, to the following temperatures (°C) 20, 40, 60, 80, and 100.

Then, we measured the amount (grams) of potassium nitrate that would dissolve completely in the water. We did this by measuring a 300-g portion of potassium nitrate for each beaker. We then added potassium nitrate from the measured amount to each beaker until no more would dissolve.

We then measured the mass of the remaining potassium nitrate. We could subtract to find out how much potassium nitrate dissolved at each temperature.

We completed two trials of this experiment.

1 What is the manipulated variable in this experiment?

2 What is the responding variable?

3 What will be measured during this experiment?

4 Using the description of the experiment and the answers to your questions, make a complete data table for the experiment. Be sure that you have included units for each column and a title for the data table.

Name____Date_______________Class________

INQUIRY SKILL FOCUS Practice

Create Data Tables

Read the description of the experiment. Then answer the questions on a separate sheet of paper.

To find out if polluted water affects the growth rate of bean seedlings, we conducted the following experiment:

We made two groups of three seeds each. All seedlings were planted in the same type of soil, received the same amount of light, and were grown at the same temperature.
Every day we watered the seedlings. The seedlings received the same amount of water, but the experimental group was given water that was polluted by adding three drops of detergent.
Once a week for four weeks, we measured the height of the bean seedlings with a centimeter ruler.

5 What is the manipulated variable in this experiment?

6 What is the responding variable in this experiment?

7 What units are used to measure the responding variable?

8 How many trials does this experiment involve?

9 Using the description of the experiment and the answers to your questions, make a complete data table for the experiment. Be sure that you have included units for each column and a title for the data table.

10 **Think It Over** Which group in Question 9 is the control group? Why is it important to include measurements made on a control group in your data table?

INQUIRY SKILL FOCUS Introduction

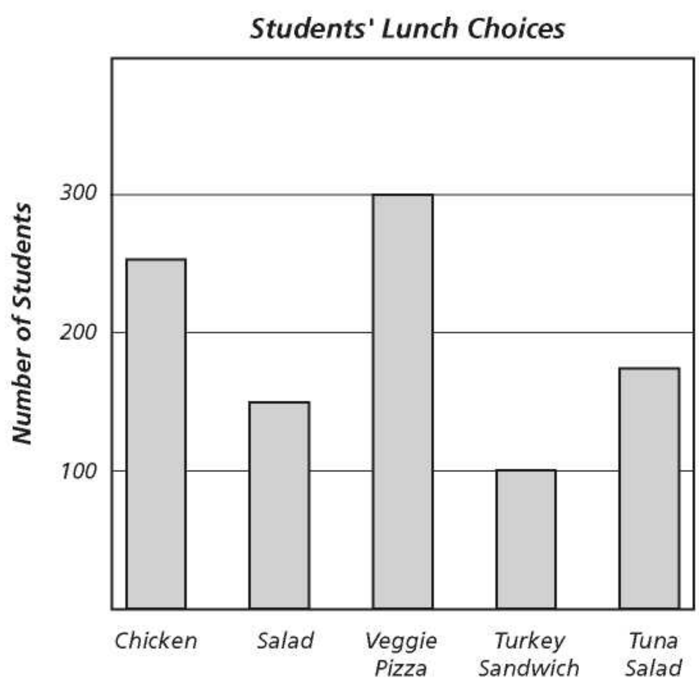
Create Bar Graphs

Your school cafeteria offers a different lunch choice each day of the week. The manager of the cafeteria keeps track of the average number of students who buy each lunch choice. The manager has asked you to make a graph of the data in order to show more clearly which lunch choices are the most popular.

Number of Students Purchasing Lunch

Lunch Choice	Number
Chicken	250
Salad	150
Veggie Pizza	300
Turkey on Whole Wheat	100
Tuna Salad	175

First you have to decide what type of graph would best show the data. In this case, each lunch choice is a separate category. To display data about separate but related categories, a bar graph is used. The bar graph below shows the data.



The categories—in this case the different lunch choices—are shown on the horizontal axis. The measurements or amounts are on the vertical axis. Each category has a separate bar.

Create Bar Graphs (*continued*)

When you make a bar graph, it is important to choose a scale for the vertical axis that will accommodate all of the different measurements. Be certain that the vertical axis has a label that includes units of measure. Each separate category should be clearly labeled along the horizontal axis. The bar graph also should have a title that tells what data the graph contains.

TIPS FOR CONSTRUCTING BAR GRAPHS

- Organize the information in a table.
- Draw a horizontal axis and a vertical axis for the graph.
- Label the axes. Include units of measure where appropriate.
- Determine the scale for the measurements shown on the vertical axis. The scale needs to accommodate all of the measurements. Each square on the graph paper should represent the same value.
- Make a bar for each category on the horizontal axis. The width of all the bars should be the same. There should be a space between each bar.
- Draw the bars using your data.
- Write a title for the graph that describes the data it shows.

Checkpoint

You are making a bar graph to show how many birds visited your bird feeder each day. Each square on the graph paper represents 5 birds. How many squares high should the bar be to represent 35 birds?

Name____Date_______________Class________

INQUIRY SKILL FOCUS Practice

Create Bar Graphs

Answer the questions below on a separate sheet of paper. Use a sheet of graph paper to make the graph.

Viruses cause diseases in humans, animals, and plants. Virus particles are very small, smaller even than bacteria cells. The table below shows the particle size of different types of viruses. The abbreviation "nm" stands for nanometer, which is one billionth of a meter.

Size of Viruses

Type of Virus	**Diameter (nm)**
Smallpox	250
Cold sore	130
Influenza	90
Cold	75
Yellow fever	22

1 On which axis will you place the names of the different viruses?

2 Consider the largest measurement you will need to represent on the graph. What scale will you use in your graph?

3 On a sheet of graph paper, make a bar graph that shows the data. Be sure to include a title for the graph.

4 **Think It Over** Explain how you showed the measurement of the yellow fever virus on the graph. Did the measurement fall exactly at one of the scale intervals on the vertical axis? If not, how did you determine how high to make the bar?

INQUIRY SKILL FOCUS Introduction

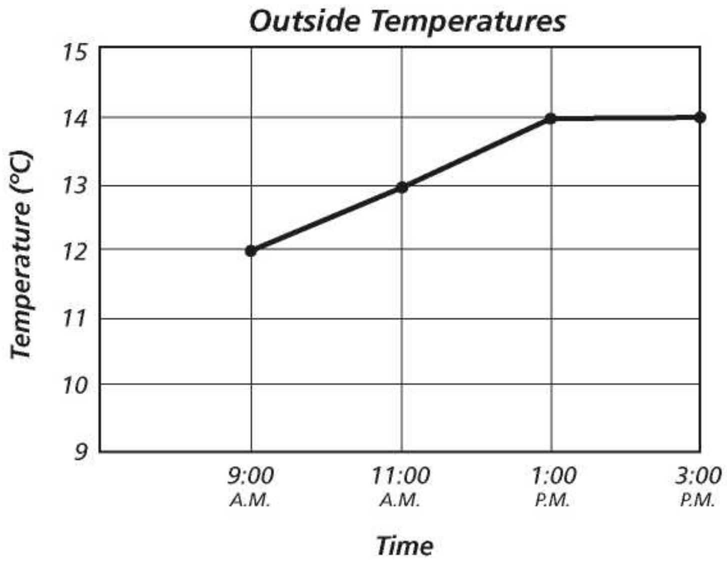
Create Line Graphs

A science class studying weather measured the outside temperature every second hour during the school day.

The students recorded their results in the data table shown here. The students decided to make a graph to help them analyze the data. A **line graph** is used to display data that show how one variable (the responding variable) changes in response to another variable (the manipulated variable). A line graph is used when the manipulated variable is continuous, that is, when there are other measurements possible between the measurements you recorded. In this example, the time is a continuous variable. The students could have measured the temperature every hour, every half hour, or every minute, for example. The line graph of the student's data is shown below.

Outside Temperature During the School Day

Time	**Temperature (°C)**
9:00 A.M.	12
11:00 A.M.	13
1:00 P.M.	14
3:00 P.M.	14



A line graph shows the relationship between two variables. This graph shows how the temperature changes as the time of day changes. Line graphs are useful for showing trends, or patterns, in data. They can also be used to make inferences and predictions about data you did not directly measure. A student might use this line graph to predict that the temperature at 4:00 P.M. will be 14°C. To check his prediction, the student would need to measure the temperature at 4:00 P.M.

Create Line Graphs (*continued*)

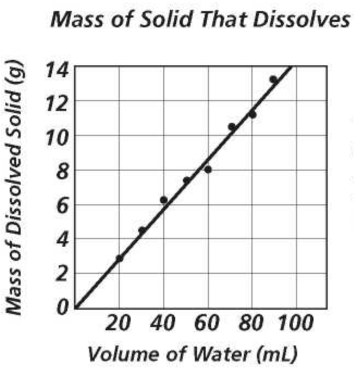
What Is a Best-Fit Line Graph? The lines on some line graphs are not drawn from point to point. The lines on the graphs below are smooth and continuous, and do not necessarily pass through each data point. These graphs are called "best-fit graphs." These graphs are used to show trends in data.

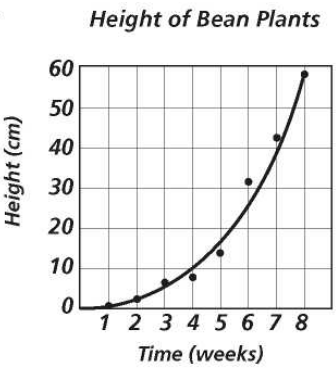
The first graph shown below displays a linear relationship. A linear relationship is shown with a straight line. (The word *linear* comes from the word *line*.) This linear graph shows that the amount of a substance that will dissolve increases as the volume of water increases. You can see that for every 20-mL increase in volume of water, there is an increase of about 3 g of substance that will dissolve. These variables have a linear relationship.

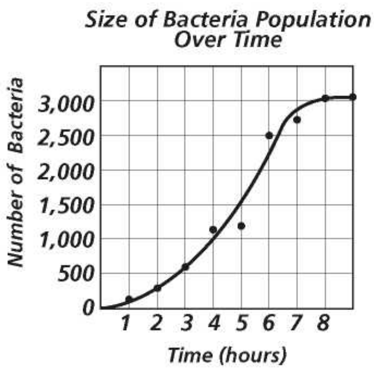
The next two graphs are nonlinear, meaning they are not straight lines. The graph in the center shows a curve that continues to rise. You can immediately see that these two variables do not have a linear relationship. The height of this bean plant does not change by the same amount each week.

The graph on the right shows another type of relationship between variables. Note that the line is a curve that flattens at the top. This relationship is often seen in populations of living things. The population rises until it reaches a certain size, and then it becomes almost constant.

These line graphs all show the relationship between variables. Using line graphs can help you to show the trend, or pattern, in your experimental data.







Create Line Graphs (*continued*)

TIPS FOR CREATING LINE GRAPHS

- Draw a horizontal and a vertical axis on graph paper. The horizontal axis is called the *x*-axis, and the vertical axis is called the *y*-axis.
- Label the axes. The manipulated variable goes on the horizontal axis. The responding variable goes on the vertical axis. Be sure to include units in the labels.
- Create a scale on each axis. Be sure that the scales you choose will allow you to show the least and the greatest measurements in your data.
- Plot each data point. Place a dot where the values for the manipulated and the responding variable intersect.
- Decide if you will connect each data point or if you will make a best fit graph. If you connect the data points, use a straightedge to connect the data points. If you make a best fit graph, the connecting line should be smooth.
- Write a descriptive title for your graph.

Checkpoint For the three graphs shown on page 61, predict which graphs would continue to show the same pattern if measurements were taken for much longer periods or for larger volumes of water. Explain your predictions.

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Name____Date_______________Class__________

INQUIRY SKILL FOCUS Practice

Create Line Graphs

Answer the questions that follow on a separate sheet of paper. Then use a sheet of graph paper to make a graph of the data given below.

Students studying motion measured the total distance traveled by an object over a period of time. They recorded their results in the data table below.

Time vs. Distance Traveled

Time (seconds)	Total Distance (m)
0	0
4	100
8	200
12	200
16	350
20	500

1 What is the responding variable in this experiment? What axis will you use to show the responding variable?

2 On a sheet of graph paper, make a line graph that shows the data. Be sure to include a title for the graph.

3 **Think It Over** What time interval on the graph shows a time at which the object is not moving? How can you tell?

Name____Date_______________Class________

INQUIRY SKILL FOCUS Introduction

Create Circle Graphs

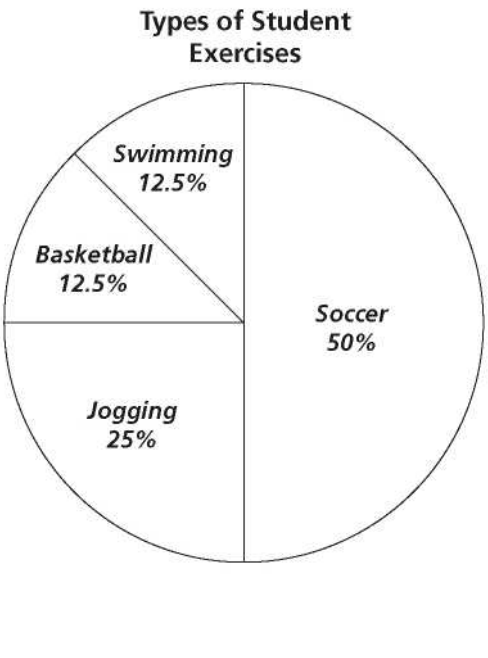
Imagine that you and seven of your classmates have started exercise programs as a part of a health class project. Each student has chosen an exercise activity that he or she enjoys. For your health project you've created a data table that shows the number of students participating in each activity.

Type of Exercise Chosen by Students

Type of Exercise	**Number of Students**
basketball	1
jogging	2
soccer	4
swimming	1
Total Number of Students	8

Your health teacher has asked you to make a graph to show the data in your data table. A **circle graph** shows data as parts of a whole. Circle graphs can only be used when you have data for *all* the categories that make up a given topic.

Here the circle would represent the eight students participating in the health project. The circle is divided into segments. Each segment represents parts of the whole. Each segment represents a type of exercise. The total of the amounts represented by the segments must be equal to the total amount.



That the segment representing soccer is one half of the circle—one half (4/8 = 1/2) of the total students chose soccer for their exercise activity. The segment representing basketball is one eighth of the circle—one eighth of the total students chose basketball.

The number of students participating in each activity can also be expressed as a percentage of the whole. The percentages in a circle graph must add up to 100 percent.

Create Circle Graphs (*continued*)

TIPS FOR MAKING CIRCLE GRAPHS

Imagine that you have been asked to create a circle graph showing the favorite type of cafeteria lunch of the students in your grade. The information is shown in the table.

Favorite Lunch	**Number of Students**
Salad	40
Veggie Pizza	30
Pasta	20
Sandwich	90

1. Make a circle using your compass. Mark the center point. Use a straightedge to draw a line from the center to the top of the circle.

2. To find the size of the segment to represent students who like salad best, use the following formula:

$$\frac{\text{Number of students who like salad best}}{\text{Total number of students}} = \frac{x}{\text{Total number of degrees in a circle}}$$

$$\frac{40}{180} = \frac{x}{360°}$$

Cross-multiply, then solve for x. $180x = 40 \div 360$

$$x = 80$$

So, the salad segment of the graph should contain 80 degrees.

3. The same method is used to find the size of each segment. Use a protractor to measure the angle of the first segment. Use the line you drew to the top of the circle as the 0° line. Draw a line from the center of the circle to the edge to make the first segment. Label the segment to show what it represents.

Favorite Lunch	Salad	Veggie Pizza	Pasta	Sandwich
Segment Size	80°	60°	40°	180°

4. Continue clockwise around the circle, measuring and marking the segments. For each new segment, use the edge of the last segment as the 0° mark. After you have drawn all of the segments, the circle should be full.

5. Find the percentage represented by each segment using the following formula:

$$\frac{\text{Degrees in a segment}}{\text{Degrees in the whole circle}} \times 100\% = \text{Percentage represented by a segment}$$

Checkpoint How many degrees would the angle be in a segment representing one half of the total?

Name____Date_______________Class________

INQUIRY SKILL FOCUS Practice

Create Circle Graphs

To complete this activity, you will need a compass and a protractor. Use these tools to answer Question 1 on the back of this page or on a separate sheet of paper. Answer the remaining questions in the space provided or on the back of this page.

Soil is made of many different components, or parts. Loam is a particular type of soil. A scientist determined the percentage of each component found in a sample of loam. She listed her results in the data table below.

Composition of Loam

Component	**Percent**
Air	25
Water	25
Silt	18
Sand	18
Clay	9
Organic matter	5

1 Make a circle graph to display the data in this table.

2 Name two facts you can learn by examining your circle graph.

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3 **Think It Over** A student collected data about the favorite lunch choice of 500 students, and displayed his results in a circle graph. If a segment with an angle measuring 180° is labeled *pizza*, how many students chose pizza as their favorite lunch? How do you know?

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