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"

7th and 8th Grade Summer Work – ELA

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. * * *

10911 Old St. Augustine Rd. Jacksonville, FL 32257 Tel: (904) 855-8010 Email: mandarin-info@rivercityscience.org

RIVER CITY SCIENCE ACADEMY
MANDARIN

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

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.

River City Science Academy Mandarin
10911 Old St. Augustine Rd. Jacksonville, FL 32257

Summer Packet

Science 8

Explore the Nature of Science

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

Name________________________________Date______________Class________

INQUIRY SKILL FOCUS Introduction

Design an Experiment

In science, experiments are carefully planned in advance. When you make an organized plan to test an hypothesis, you are **designing an experiment.** Although every experiment is different, there are some steps that are important to all investigations. There are several different science skills used to plan investigations.

Pose a Question

In science, experiments are designed to answer questions or to solve problems. Suppose you have decided to plant a vegetable garden this summer. You know that your neighbor uses fertilizer in her vegetable garden. You wonder if you should use fertilizer in your garden as well. To find out, you could perform an experiment. The first step of the experiment is to ask a scientific question: Do vegetables grow larger with fertilizer than they do without fertilizer?

Develop a Hypothesis

The next step is to write a hypothesis, a possible explanation for a set of observations or a way to answer to 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 fertilizer, then the vegetables in my garden will grow larger."*

Plan the Procedure

After you've developed a hypothesis, you must plan the procedure you will use to test it. The procedure tells what tests you will perform. It also describes what data you will collect. A complete list of the needed materials is included in the procedure. The procedure also describes the variables in the experiment.

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 fertilizer experiment, the presence or absence of fertilizer is the manipulated variable. The **responding variable** is the variable that changes as a result of changes in the manipulated variable. The size of the vegetables is the responding variable in the fertilizer experiment. All of the other variables in the experiment must be controlled, or kept the same. The plants must receive the same amount of light and water, and be grown in the same soil. When the variables are controlled, you can be sure that changes in the rate of plant growth are due to the presence of fertilizer.

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. In the experiment with fertilizer, you would need to define how the size of the vegetables will be measured.

Interpret the Data

After the experiment is complete, you should review the data that were collected. Interpreting the data means explaining the data. You might look for trends, or patterns, in your results. Graphs, charts, and tables are useful for interpreting data.

Draw Conclusions

After the data have been interpreted, you can compare your results to your hypothesis. Then you can draw a conclusion using your results. A conclusion tells what was learned in the experiment. The conclusion tells whether or not the hypothesis was supported by the data. You might need to complete several trials of an experiment before you can make a conclusion.

TIPS FOR DESIGNING AN EXPERIMENT

- Scientific experiments begin with a testable question.
- Use the question to develop a hypothesis. Use the If…then…form to write a hypothesis.
- Make a plan that describes the procedure you will follow to test the hypothesis. Make sure you have all of the materials you will need to perform the experiment.
- Be certain you have identified the manipulated variable and the responding variable. Also identify the variables that need to be controlled.
- Write an operational definition for any terms that do 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 Can an experiment have two manipulated variables? Why or why not?

____

____

____

Name________________________________Date______________Class________

INQUIRY SKILL FOCUS Introduction

Pose Questions

Newspaper reporters often ask the “5 Ws”—Who? What? Where? When? and Why?—to gather information. Scientists also have a specific way of asking questions to gather information.

Scientific questions are questions about the natural world. Only questions that can be answered by observing, measuring, or investigating are considered scientific questions. Any question that is answered with an opinion or someone’s personal values is not a scientific question. Look at these examples:

Question 1: Which type of apple tree grows most quickly? (scientific question)

Question 2: Which type of apple tastes best? (not a scientific question, because it is based on an opinion)

Some questions in science are very general. Although general questions are useful, they need to be made more specific before they can be answered in a single investigation. Scientists use specific questions to plan investigations.

Question 3: How does pollution affect an ecosystem? (general)

Question 4: Does the amount of water pollution affect the population offish in a river? (specific)

Questions 5: How does the amount of water pollution affect the growth of trout? (more specific)

TIPS FOR POSING QUESTIONS

- Scientific questions are questions about the natural world that can be answered using observation, measurement, or controlled investigations.
- Check your questions to be sure they do not involve personal values or opinions.
- General questions can be used to think about general topics. To plan a scientific investigation, divide general questions into specific questions.

Checkpoint Write an example of a specific scientific question. Describe the investigation you could use to find the answer to this question.

____

____

____

____

____

Name________________________________Date______________Class________

INQUIRY SKILL FOCUS Practice

Pose Questions

Examine the statements below. For each of Questions 1–5, write yes *if the topic can be investigated scientifically. Write* no *if it cannot be investigated scientifically. Then, for each item to which you answered* yes, *rewrite the statement in the form of a scientific question. Write your answers in the space provided. If you need more space, use a separate sheet of paper.*

1. The more quickly water flows, the more erosion it causes.

____

2. It is the responsibility of farmers to find ways to reduce soil erosion.

____

3. Soil is one of the most important natural resources in the world.

____

4. The composition of soil affects the growth rate of plants.

____

5. Some rocks break down into soil more quickly than others.

____

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

6. How do living things in an area interact with one another?

____

____

7. What are some ways that plant species differ from one another?

____

____

____

8. **Think It Over** Why are questions about opinion or personal values considered unscientific?

____

____

____

____

Name________________________________Date______________Class________

INQUIRY SKILL FOCUS Introduction

Develop a Hypothesis

Imagine that you are mixing sugar with icewater and lemon juice to make homemade lemonade. You stir and stir to get the sugar to dissolve. At the same time, your mother makes a cup of hot tea and easily gets the sugar to dissolve. Why are you having so much trouble getting the sugar to dissolve? What's causing the difference between the lemonade and the tea?

Questions, like this one about the lemonade, can lead to hypotheses. A hypothesis (plural: hypotheses) is a possible explanation for a set of observations or 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 the lemon juice in the lemonade keep the sugar from dissolving quickly? (a specific scientific question that does not involve personal opinion)

Hypothesis: If a drink contains lemon juice, then sugar will dissolve more slowly than in other drinks. (a testable and properly worded hypothesis)

Scientific Question: Does the temperature of the drink affect how quickly the sugar dissolves? (a specific scientific question that does not involve personal opinion)

Hypothesis: If a drink is warmer, then sugar will dissolve in it more rapidly than it does in a cooler drink. (a testable and properly worded hypothesis)

TIPS FOR DEVELOPING HYPOTHESES

- Scientific questions are used to make hypotheses. A scientific question is a testable question about the natural world.
- Use the *If…then…*form to write a hypothesis.
- Review your hypothesis to be sure it can be tested through an investigation.
- Remember that hypotheses are not necessarily true. An investigation can prove a hypothesis to be incorrect.

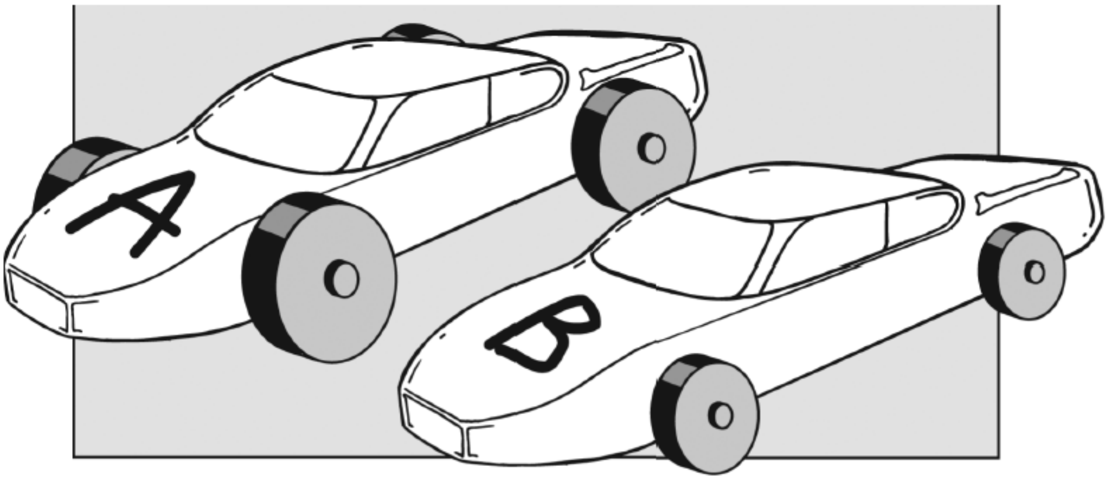
Checkpoint Write a scientific question and a hypothesis about seed germination.

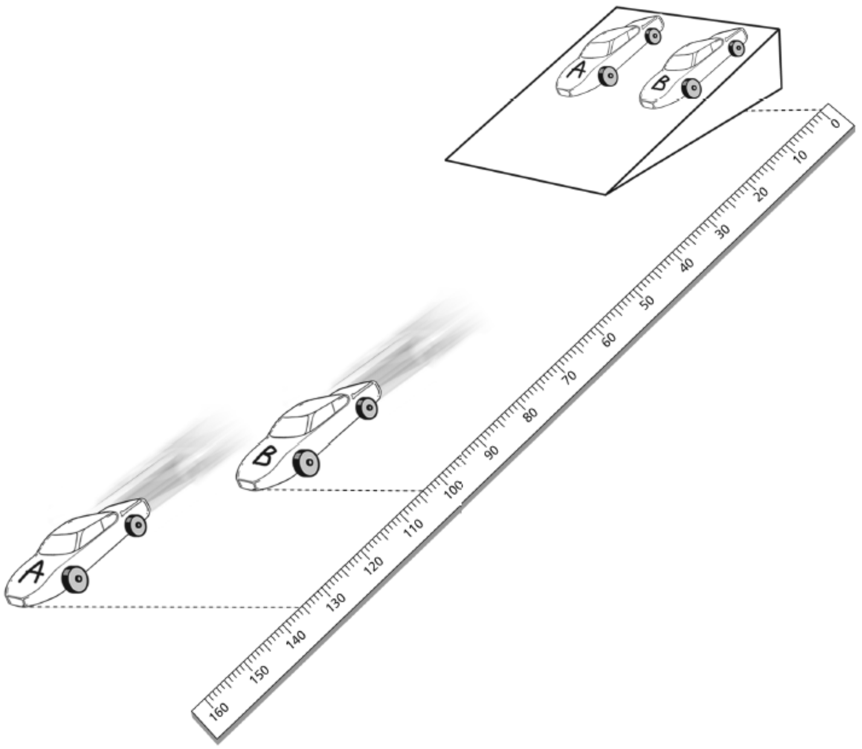
____

INQUIRY SKILL FOCUS Practice

Develop a Hypothesis

Use the diagrams to answer the questions on the next page.





Name________________________________Date_______________Class________

Develop a Hypothesis (*continued*)

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

1. Look at the figure on the previous page. Observe the motion of cars A and B. Use your observations to write a specific scientific question about the motion of cars A and B.

____

____

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

____

____

3. How could your hypothesis be tested? Write a brief description of an investigation that could test your hypothesis. Be sure to explain what variables will affect the cars' motion.

____

____

____

4. Review your hypothesis. List two other possible explanations that could describe any differences in the cars' motion.

____

____

____

5. Write two more hypotheses in the If… then… form based on the two possible explanations you developed to answer Question 4. How can you find out which of your three hypotheses is most correct?

____

____

____

6. **Think It Over** Is a hypothesis always a correct, factual statement?

____

____

____

Name____Date_______________Class________

INQUIRY SKILL FOCUS Introduction

Control Variables

Imagine trying a recipe for homemade granola bars. When you tasted them, you weren't pleased with the results. The next time you made granola bars, you used more oatmeal, fewer raisins, a lower oven temperature, and a longer baking time. This time, the granola bars tasted great! What made the difference between the two batches? Since more than one factor was changed, it is impossible to know.

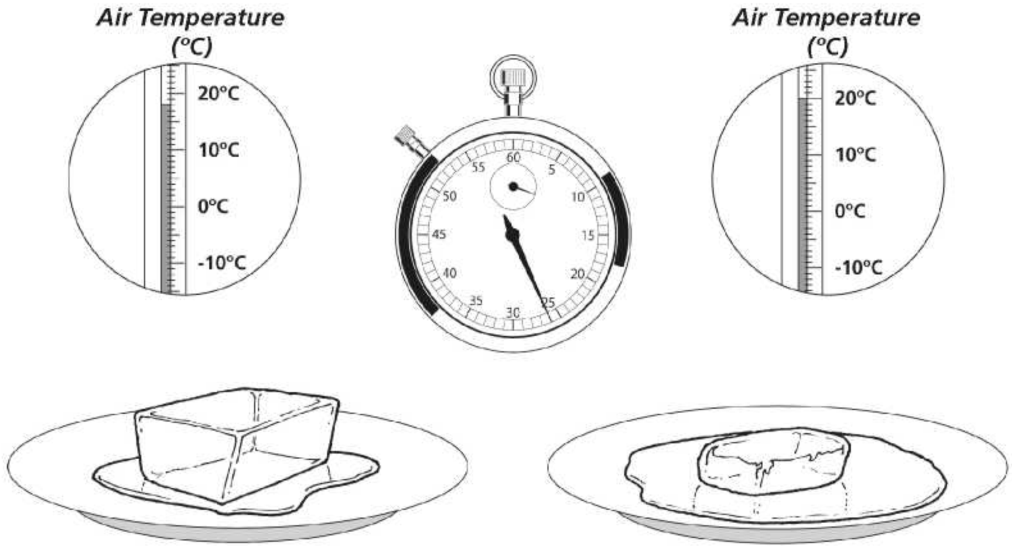
Variables are the factors in an experiment that can change. In the example above, the amount of oatmeal, the number of raisins, the oven temperature, and the baking time are all variables. In a scientific experiment, only one variable is changed at a time. The variable that is purposely changed is called the **manipulated variable.** The factor that might change as a result of the manipulated variable is the **responding variable.**

In a scientific experiment, all of the other variables must be controlled. **Controlling variables** means keeping all conditions the same except for the manipulated variable. Imagine an experiment to test how air temperature affects the rate at which ice melts.

Manipulated Variable: air temperature

Responding Variable: rate at which the ice melts

Controlled Variables: amount of ice; shape of ice (cube, shaved, block); type of container



In a scientific experiment, only the manipulated variable is changed. All of the other variables are controlled. You can be sure that changes in the responding variable are due to changes in the manipulated variable. In this particular experiment, you can tell that changes in the rate at which the ice melts are due to differences in temperature. When all of the variables except the manipulated variable are controlled, the experiment is called a **controlled experiment.**

Control Variables *(continued)*

Experimental Groups and Control Groups Suppose a scientist wants to study how fertilizer affects the growth rate of tomato plants. To carry out an experiment, the scientist uses a set of plants that is divided into two groups. The first group, or experimental group, consists of tomato plants that are given fertilizer. The second group consists of plants that are *not* given fertilizer. This group, known as the control group, would then show how fast such plants would grow without any fertilizer.

The purpose of the control group in an experiment is to serve as a standard of comparison. Both the control group and the experimental group are tested under the same conditions. In other words, all the plants are about the same size and type and in the same kind of soil, and they are given the same amount of water and sunlight. The scientist can then compare the experimental group to the control group to see how the fertilizer affected the rate of growth.

TIPS FOR CONTROLLING VARIABLES

- Use your hypothesis to plan your experiment.
- Identify the manipulated variable and the responding variable in the experiment. Make a plan for how you will change the manipulated variable. Decide how you will measure changes in the responding variable.
- Make a list of all of the other variables that could affect the responding variable. Make a plan to control 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 Make a list of at least three variables that would need to be controlled in an experiment to determine the effect of different-colored lights on plant growth.

____

____

____

____

____

____

____

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 temperatures on the rate at which bananas ripen, what is the manipulated variable and the responding variable?

____

____

2 Name the manipulated variable and the responding variable in an experiment to determine if the mass of a toy car affects the rate at which it rolls.

____

____

3 Name three variables that would need to be controlled in the experiment described in Question 2.

____

____

____

4 Describe the control group and the experimental group in an experiment to determine whether using antibacterial soap affects the total number of illnesses a person gets in one month.

____

____

____

5 Why would it be important to use groups, rather than individuals, in the experiment described in Question 4?

____

____

____

6 **Think It Over** In a student's lab report, she listed two manipulated variables. Could this student make valid conclusions from the results of her experiment? Why or why not?

____

____

Name____Date______________Class________

INQUIRY SKILL FOCUS Introduction

Form Operational Definitions

Suppose the school librarian asked you and one of your friends to organize the books on the library shelves. You decide to organize the books by size. Your friend chooses to organize the books by topic. Unfortunately, the librarian wanted you to organize the books by author. Since you did not have a clear definition of the term *organize the books*, each person chose a different method.

In science, exact definitions are important. Scientists often run several trials of their experiments. They also repeat the work of other scientists. To do so, they need terms that are clearly denned. 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 in which you measure the effect of a healthy diet on the activity of hamsters. The term *healthy diet* does not have a single, clear meaning. It must be denned. How will the *activity* of the hamsters be measured? An operational definition will need to be provided to explain how this variable will be measured.

In the experiment described above, the term *healthy diet* might have the following operational definition: 25 grams per day of Healthy Hamster brand food was provided for each hamster. An operational definition describing how to measure activity might be: The hamster's activities were recorded every hour. A hamster engaged in any activity other than sleeping was considered active.

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 defines a term that does not have a single, clear meaning:

Example 1: The plants were grown in a sunny area. Operational definition: A sunny area is an area that receives an average of 10 or more hours of sunlight each day.

This operational definition tells how a variable will be measured:

Example 2: Toy cars roll faster if they have larger wheels. Operational definition: The size of the wheels was determined using a centimeter ruler to measure the diameter of the wheels.

Form Operational Definitions *(continued)*

The same term can have a different operational definition in different experiments. The term *growth of the plant* can be defined in many ways. Here are some examples: (1) the height of the plant from the soil surface to the plant's highest part; (2) the mass of the total plant, including the roots, measured when dry; (3) the number of leaves that have sprouted. The terms *large plant* and *small plant* might have very different meanings in different investigations.

Some variables can be measured in a variety of ways. You need to choose a definition that works well for a particular experiment. 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 to compare plant growth rates, you might use the following operational definition: The plant's growth will be measured every morning using a centimeter ruler. The total height of the plant will be rounded to the nearest millimeter and recorded.

TIPS FOR WRITING OPERATIONAL DEFINITIONS

- Make a written plan for your experiment or investigation.
- Identify any terms that require an operational definition. Write a clear, complete definition for these terms.
- If there is more than one possible way a variable could be measured, write an operational definition that provides an exact description of the method you will use.
- Read through your definitions. Could you use the information to repeat your experiment exactly?
- Have a friend review your written plan. Ask if your friend could duplicate your work using only the written plan. If not, revise your operational definitions.

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

____

____

____

____

____

____

____

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 The plant <u>grew quickly</u>.

____

____

____

2 Investigate two brands of paper towels to see which is <u>stronger</u>.

____

____

____

3 In the autumn, trees lose their leaves more quickly on <u>windy days</u>.

____

____

____

4 <u>Measure the temperature</u> of a beaker of water.

____

____

____

5 Certain breeds of dogs have <u>long legs</u>.

____

____

____

6 **Think It Over** Look at the definition you wrote for Question 5. How would your operational definition for the term *long legs* be different if you were studying horses? Explain why some terms can have more than one correct operational definition.

____

____

____

Name____Date_______________Class________

INQUIRY SKILL FOCUS Introduction

Interpret Data

Imagine that you are in charge of an aquarium that will be kept in your science classroom. How will you decide what types offish you will keep? To make a good decision, you must know what size aquarium you will use. You need to know what types offish can live together. You need to know how much space and what water conditions each type offish requires. Using all this information, you can make a plan for the classroom aquarium. Carefully examining data to make decisions is similar to the skill of interpreting data, an important part of scientific investigations.

The observations and measurements that are made during a scientific investigation are called **data.** After all of the data for an investigation 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 you collected data about the amount of a particular substance that would dissolve in different volumes of water. You and your lab partner made the following data table with your results.

Amount Dissolved in Different Volumes of Water	
Volume of Water (mL)	**Amount Dissolved (g)**
50	3
100	6
150	9
200	12
250	15

When you and your lab partner examine the data table, you can see that the mass of the substance that dissolves increases as the volume of water increases. To further examine the trend in the data, you make a graph.

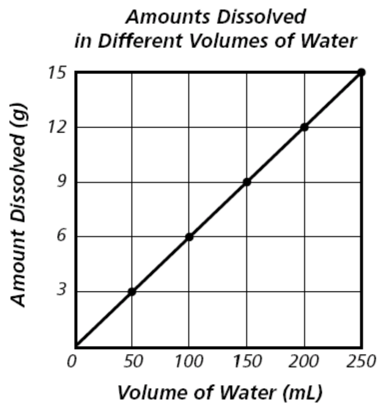
Interpret Data *(continued)*

This line graph would help you to interpret the data from your experiment. Here are some of the inferences you could make using the graphs.

Example 1: A greater mass of the substance will dissolve in a greater volume of water.

Example 2: For every 50 mL increase in the amount of water, the mass of the substance dissolved increases by3g.

Example 3: The mass of this substance dissolved in300 mL of water would be 18 g.



To determine if your inferences are logical, think about what you have learned about solutions in science class. You know that the amount of a substance that will dissolve depends on several factors. You know that a certain amount of a substance will dissolve in a certain volume of water. It makes sense to you that the greater the volume of water, the greater the mass of substance that you can dissolve in it. You and your lab partner decide that your inferences are logical.

TIPS FOR INTERPRETING DATA

- During investigations, use a data table or chart to collect and organize your data.
- Whenever possible, make a graph using the data.
- Identify trends, or patterns, in the data.
- Use the data to make inferences. Do your inferences make sense compared with what you already know about a topic? If not, review your work.

Checkpoint Describe two reasons that your inferences about a set of data might not match your previous knowledge of a topic.

____

____

____

____

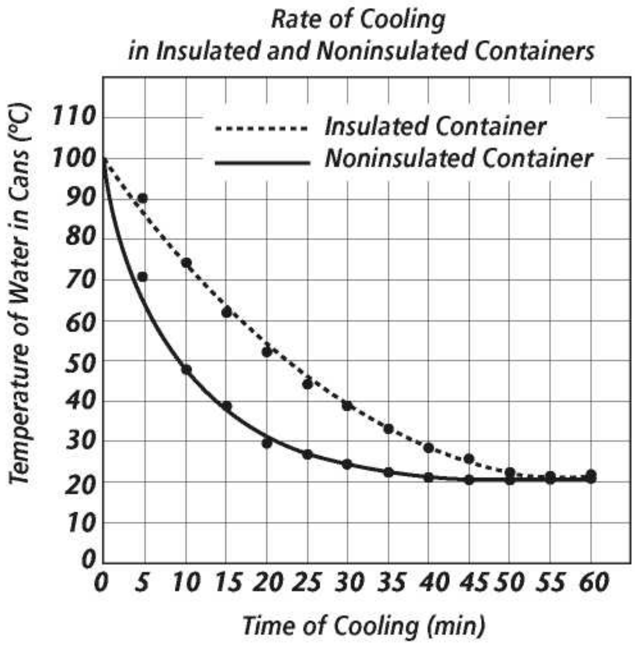
____

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 Name three times at which the water in the two containers have the same temperature.

3 Name one time at which the temperatures of the water in the two cans differed by more than 20°C.

4 Compare the rates at which the water in the two containers cooled.

5 What do you expect the temperatures of the water in the containers would be at 65 minutes? Explain.

6 **Think It Over** Substances that are insulators of heat slow changes in temperature. Knowing this fact, is your answer to Question 4 logical? Why or why not?

____

____

____

____

INQUIRY SKILL FOCUS Introduction

Draw Conclusions

Suppose you find that your basketball is flat. You pump air into the basketball, but it goes flat again. You would probably conclude that there is a leak in the ball. We all make conclusions in everyday situations. In science, the word *conclusion* has a more limited meaning. **Drawing a conclusion** means making a statement summing up what you have learned from an experiment.

Recall that experiments begin with a hypothesis often written in the *If… then…*form. After the experiment is complete, the data are examined to see whether the hypothesis is correct or incorrect. Using the hypothesis and the data, you can write a conclusion that tells what you learned from the experiment. Scientists may repeat their work and compare their work to the work of others before they draw their final conclusions.

Imagine that you and your lab partner have decided to experiment to see if the strength of Brand Y paper towels is changed when they get wet. Your lab partner saw an advertisement that convinced her that Brand Y paper towels have the same strength no matter if they are wet and dry.

This is her hypothesis: *If a Brand Y paper towel is wet*, *then it will be just as strong as when it was dry*.

You don't think the advertisement is true. Here is your hypothesis: *If a Brand Y paper towel is wet*, *then it is weaker than a dry Brand Y paper towel*.

The following data were collected during the experiment.

Brand Y Paper Towel Strength Investigation			
Dry Conditions		**Wet Conditions**	
Trial	Mass Held Before Tearing (g)	Trial	Mass Held Before Tearing (g)
1	86	1	57
2	89	2	51
3	86	3	57
4	88	4	52
5	86	5	53
Average	87	Average	54

After the controlled experiment is complete, you and your lab partner examine the data. Your data clearly show that wet Brand Y paper towels are not as strong as dry Brand Y paper towels.

Draw Conclusions *(continued)*

Here is the conclusion your lab partner writes: *Based on the results of a controlled experiment, wet Brand Y paper towels are not as strong as dry Brand Y paper towels*.

Your conclusion might be: *Wet Brand Y paper towels are weaker than dry Brand Y paper towels*.

It is important to draw conclusions that are based only on the experimental data. Imagine that you drew the following conclusion from the experiment: *Paper towels are weaker when they are wet than when they are dry*.

You cannot reasonably draw this conclusion based on the data from your experiment, because you did not test all brands of paper towels. Only conclusions about Brand Y paper towels can be drawn using your data.

TIPS FOR DRAWING CONCLUSIONS

- Review the hypothesis for the experiment.
- Examine the observations and measurements you made during the experiment. Analyze your data using graphs, tables, and charts.
- Decide whether you need to repeat the experiment. If possible, compare your work to the work of others.
- Write a conclusion that sums up the results of the experiment.
- Review your conclusion. Be certain that 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?

____

____

____

____

____

____

____

____

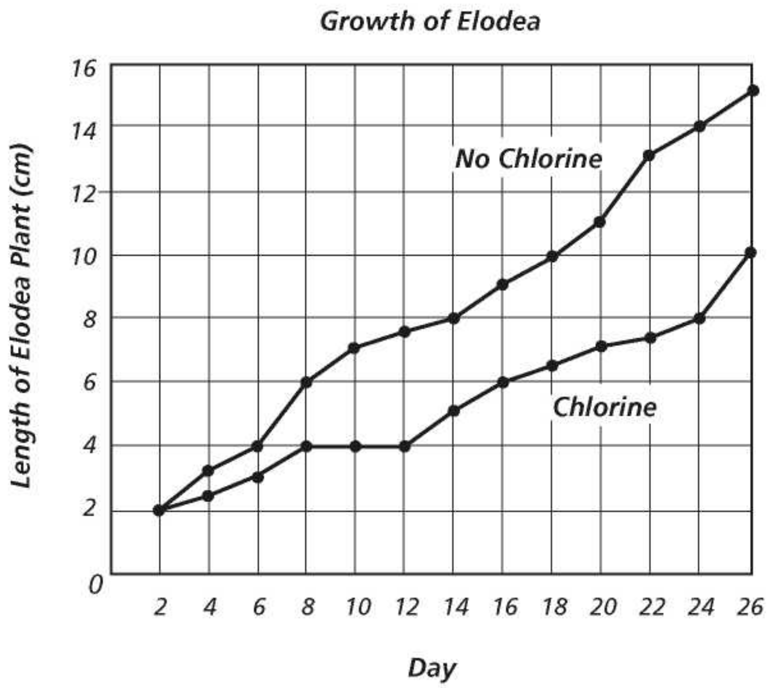
____

INQUIRY SKILL FOCUS Practice

Draw Conclusions

Answer the following questions on a separate sheet of paper.

You and a friend have decided to experiment to find the effects of chlorinated tap water on the growth rate of the aquarium plant elodea. You make the following hypothesis: *If there is chlorine in the elodea's water, then it will grow more slowly.* You've planned a controlled experiment, which you carry out over the course of several weeks. To analyze your data, you make the following graph.



1 Write a sentence that summarizes the data in the graph.

2 Do the data show that your hypothesis is correct or incorrect?

3 Write a conclusion for this experiment.

4 Explain whether you can reasonably draw this conclusion from your data: *Aquarium plants grow more slowly if there is chlorine in their water.*

5 **Think It Over** Imagine you made the following hypothesis: *If there is chlorine in the elodea's water, then the plant will grow more quickly.* Would you have learned anything from the experiment? Why or why not?

____

____

____

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 one brand of plant food work better than another brand?

2 Does the color of a container affect the rate at which water in the container changes temperature when placed in sunlight?

3 Does the depth at which bean seeds are planted affect the rate at which they sprout?

4 Does the amount of salt in a saltwater solution affect the boiling point of the solution?

5 Does the mass of a baseball affect the distance it travels when hit?

6 Does the presence offish affect the growth rate of aquarium plants?

7 Does friction affect the distance a toy car travels when pushed?

8 How is the growth of bacteria affected by antibacterial dish soap?

9 How does the particle size of soil affect the rate at which water flows through it?

10 Does the amount of stirring affect the rate at which salt dissolves in water?

11 **Think It Over** Why is it important to include operational definitions in your experimental design?

____

____

____

____

____

____

____

INQUIRY SKILL FOCUS Introduction

Create Data Tables

Imagine that you and your friends have a lawn-mowing business. You need to keep track of all your customers, their addresses, and their payment schedules. You could use a chart or table to organize all of this information.

During scientific investigations, 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 during experiments to organize measurements and observations. After the experiment is complete, the data table can be used for data analysis.

Think about the manipulated variable and the responding variable when you plan your data table. Use this information to plan the columns and rows of the data table. How will these variables be observed or measured? What units of measure will be used? The units should be inserted in the column heads. Consider how frequently changes in the variables will be measured. Each data table should have a title.

Look at the data table below. This data table was made for an experiment to determine if air temperature affects the rate of plant growth. Notice that this data table includes space for all the required measurements, the units that will be used, and a descriptive title.

Effects of Air Temperature on Plant Growth

	Height of Plant (cm)		
Time (days)	15°C	25°C	35°C
2			
4			
6			

As you plan your experiment, make a rough draft of your data table. Compare the data table to the experimental design to be sure there is a space for each required measurement. Think about the units of measure in the column heads. Do they match the units of measure in the plan for the experiment? Some experiments require several trials. Be certain that there is space in your data table if several trials are needed. Also be sure there is space for observations or measurements of the control group. This will allow direct comparison of the experimental group with the control group when it is time to analyze the data.

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.

Effect of Ramp Angle on Distance Traveled by a Toy Car

	Distance (cm)			
Angle of Ramp	**Trial 1**	**Trial 2**	**Trial 3**	**Average**
20°				
40°				
60°				

After a careful review of your rough draft, create your final data table in your notebook. Having the data table prepared in advance will allow you to focus all of your attention on the experiment as it progresses. It will also remind you to obtain all of the needed measurements and observations.

TIPS FOR CREATING DATA TABLES

- Identify the manipulated and the responding variable in the experiment to determine what observations you will make.
- If you need to make observations at a regular time interval, make sure your data table shows this. Include space for each of the required observations.
- Make a draft of the data table. Include labels on the rows and columns and a title for the table. Include the units of measure in the column labels.
- Make sure your draft has a place for all of the measurements required in your experiment. Be sure there is a place for observations of the control group. If your experiment involves multiple trials, be sure you have included these.
- Revise the draft of the data table as needed. Record the final version of your data table in your notebook.

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

____

____

____

____

Name____Date_______________Class________

INQUIRY SKILL FOCUS Practice

Create Data Tables

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

We experimented to find some of the factors necessary for the growth of bread mold. We placed two identical slices of bread on separate plates. We moistened one of the slices of bread with tap water. The other slice was kept dry. Both slices were left out in the air for 1 hour. Then we put each slice of bread in a sealable bag. We put the bread in the bags in a warm, dark place. Each day for 5 days we measured in centimeters the area of mold on each slice of bread. We compared the growth of mold on the wet bread to the growth of mold on the dry bread.

1 Identify the manipulated variable and the responding variable in this experiment.

2 How many times will the responding variable be measured?

3 What units of measure will be used in this experiment?

4 Using the description of the experiment and the answers to your questions, create 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.

We experimented to see if the surface area of salt affected how quickly it dissolved in water. We used rock salt and table salt. Each type of salt was dissolved in water with the same amount of stirring. We measured the time, in seconds, that it took for identical masses of the two different kinds of salt to dissolve. For each type of salt we performed three trials, and we averaged the results of the three trials.

5 How many trials does this experiment require?

6 What calculation using the experimental data is required?

7 How frequently will measurements be taken in this experiment?

8 Using the description of the experiment and the answers to your questions, make a complete data table for the experiment. Be sure you have included space for multiple trials. Also include space for the results of any required calculations.

9 **Think It Over** Look at the data table you made. Why is it important to include units in the column heads?

Name____Date_______________Class________

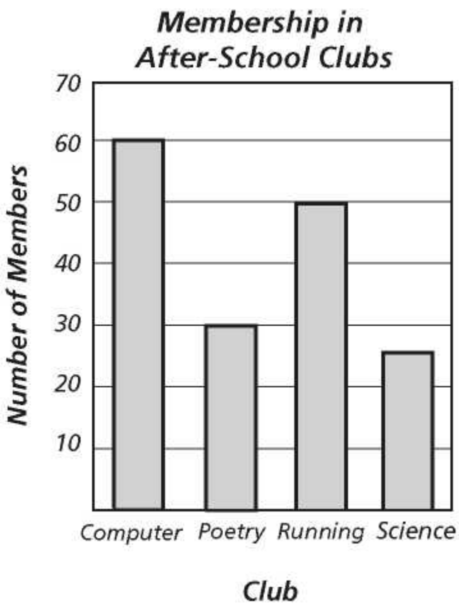
INQUIRY SKILL FOCUS Introduction

Create Bar Graphs

Your school has several choices of after-school clubs. Your principal has asked you to make a graph showing the number of members in each club. How could you use the following data to make a graph?

After-School Clubs	
Club	**Number of Members**
Computer Club	60
Poetry Club	30
Running Club	50
Science Club	25

The first step in graphing this data is choosing the appropriate type of graph. Your data tell the number of students in each club. These are separate categories. Bar graphs show data about separate but related categories. The bar graph shown below shows the number of students in each club.



Each club has a bar that represents the number of members. Each club is listed on the horizontal axis. This axis also has a label that describes the categories. The vertical axis is marked with a scale and a label. In this case, each square on the graph paper represents 5 students. The vertical axis also has a label. The height of the bars indicates the number of students in each club. The title of the graph = describes the data.

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. Consider the largest and the smallest amount you will need to represent on your graph. Decide the amount that will be represented by each square on the graph paper.

Remember that both axes should be labeled. Include units of measure where appropriate. The individual bars also need labels. Be sure to give the graph a descriptive title.

TIPS FOR CONSTRUCTING BAR GRAPHS

- Use a data table to organize the data.
- On your graph paper, draw a vertical and horizontal axis for the graph.
- Determine the scale for the measurements shown on the vertical axis. The scale should be chosen by considering the largest and the smallest measurements. Each square on the graph paper will represent a certain amount.
- Label the vertical axis with the scale and the units of measure.
- Label the horizontal axis. Make a bar for each category on the horizontal axis. The width of all of the bars should be the same. There should be a space between each bar.
- Draw bars to represent the measurements in each category.
- Write a title for the graph that describes the data it shows.

Checkpoint Why is it necessary to consider the smallest and the largest measurement when determining the scale to be used for the vertical axis?

____

____

____

____

____

____

____

____

____

____

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.

Sound waves travel at different speeds through different substances. The speed of sound in different materials is shown in the data table below. Use the data and the answers to your questions to make a bar graph representing the data.

Speed of Sound in Different Substances

Substance	Speed (m/s)
Plastic	1,800
Copper	3,100
Wood	4,000
Iron	5,100
Steel	5,200

1 What label will you use for the vertical axis?

2 Consider the smallest and 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 and labels for each axis.

4 **Think It Over** What things should you consider when you plan a title for your graph?

____

____

____

____

____

____

____

____

____

____

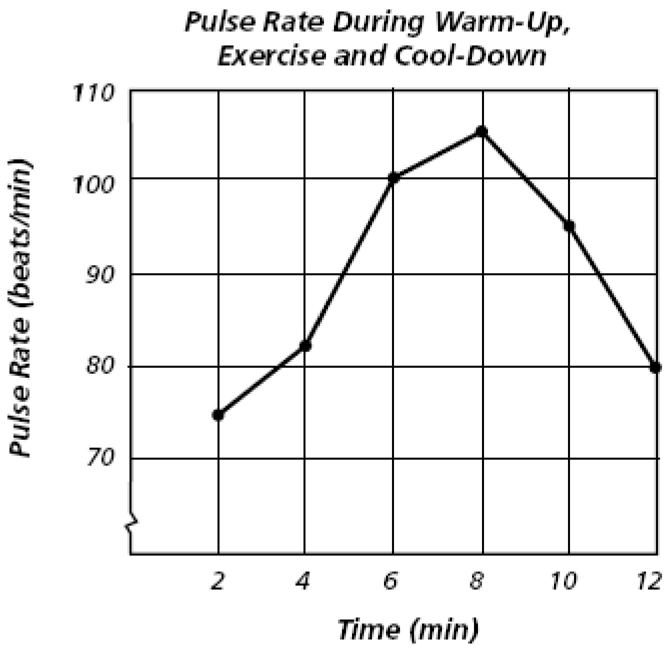
INQUIRY SKILL FOCUS Introduction

Create Line Graphs

Members of a science class were studying the effects of exercise on pulse rates. They measured the pulse rate of one student at regular time intervals as she warmed up, exercised, and cooled down. They used a data table to record their results.

Pulse Rate During Warm-Up, Exercise, and Cool-Down	
Time (min)	**Pulse Rate (beats per minute)**
2	75
4	82
6	100
8	105
10	95
12	80

To show trends in the data more clearly, the class decided to make a line graph. 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, time is a continuous variable. The students could have measured the student's pulse rate every minute, for example. The line graph of the data is shown below.



Line graphs show the relationship between two variables. They are useful for showing trends, or patterns, in the data. They can also be used to make inferences and predictions about data you did not directly measure.

Create Line Graphs (*continued*)

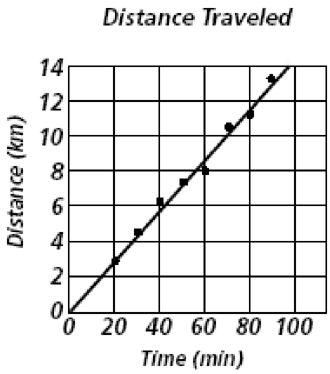
What Is a Best Fit Line Graph? On some line graphs, the lines are not drawn from point to point. On the graphs below, the lines are continuous. The lines do not pass through each data point. These graphs are called “best fit graphs.” These graphs are used to show trends in data.

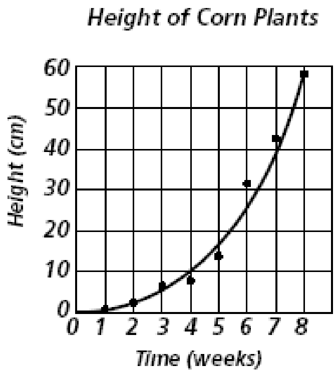
The first graph shown below displays a linear relationship. A linear relationship is shown with a straight line. (The word *linear* comes from the word *line*.) This linear graph shows that as the time increases (the manipulated variable), the distance traveled by the car (the responding variable) also increases. You could use this linear graph to make predictions about data that was not actually measured. For example, you might predict that after 120 minutes the car would have traveled 160 km.

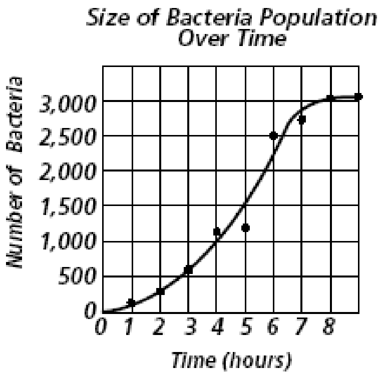
The graph in the center shows a curve. You can immediately see that these two variables do not have a linear relationship. This plant grew more quickly in the beginning weeks of the experiment than it did later in the experiment.

The graph on the right shows another type of relationship between variables. Note that the line is a curve that flattens at the top. Populations of living things often show this pattern of growth. 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.







Name____Date_______________Class________

Create Line Graphs (*continued*)

TIPS FOR CREATING LINE GRAPHS

- Draw a horizontal axis 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 both axes. The horizontal axis should be labeled with the name of the manipulated variable. The vertical axis is labeled with the name of the responding variable. Always include units of measure with your labels.
- Choose a scale for each axis. Determine the least and the greatest value in each set of data to determine the range you will need to represent. Each square of the graph paper should represent the same amount.
- Plot your data points. Follow an imaginary line up from the measurement on the x-axis. Then follow a second imaginary line across from the corresponding value on the y-axis. The data point is the point at which the two imaginary lines intersect.
- Determine if you should plot from point to point or make a best fit graph. If you are plotting from point to point, use a straightedge to connect adjacent data points. On a best fit graph, the connecting line should be smooth.
- Write a title that clearly describes what is shown in the graph.

Checkpoint Explain how to determine if your experimental data can be shows on a line graph instead of a bar graph. (*Hint*: What characteristics of the manipulated variable lets you know a line graph is appropriate?)

____

____

____

____

____

____

____

____

____

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.

Earth is surrounded by air. Since air is made of matter, it has mass. Air exerts pressure on Earth's surface. Air pressure is the result of the weight of a column of air pushing down on an area. Air pressure decreases as altitude increases. The air pressure at several different altitudes is shown in the data table.

Air Pressure at Different Altitudes	
Altitude (km)	**Air Pressure (inches of mercury)**
0	30
3	21
6	14
9	9.1
12	5.7
18	2.2

1. The data show the change in air pressure as a result of a change in altitude. What variable should you plot on the horizontal axis?

2. What scale will you use for the vertical axis? How did you choose this scale?

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

4. **Think It Over** Examine the graph to see the trend, or pattern, in this data. Write a sentence that explains the relationship between these two variables.

____

____

____

____

____

____

____

____

Name____Date_______________Class________

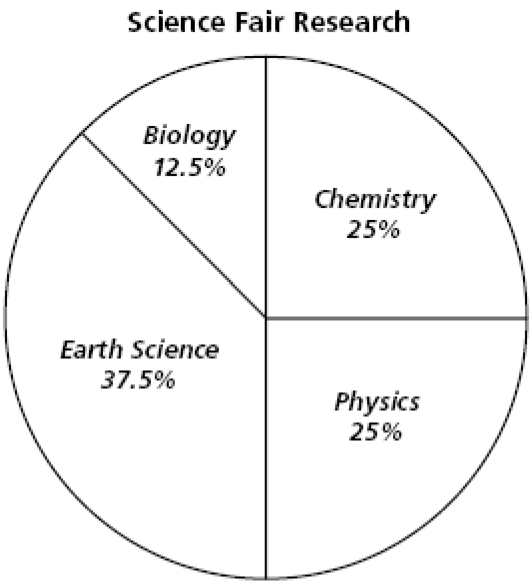
INQUIRY SKILL FOCUS Introduction

Create Circle Graphs

Suppose that you and your classmates have chosen topics for your science fair research. The topics are shown in the data table.

Science Fair Research	
Topic	**Number of Students**
Earth Science	3
Biology	1
Chemistry	2
Physics	2

You could show this data in a circle graph. A **circle graph** shows data as parts of a whole. Circle graphs can be used only when you have data for *all* of the categories that make up a given topic. The entire circle represents the total amount. In this case, the circle would represent the eight students doing research for the science fair. The circle is divided into parts, or segments. Each part of the circle graph shows a segment of the whole. In this graph, each segment represents the number of students researching a particular topic.



Three of the eight students are doing Earth Science research. The segment representing these students is $\frac{3}{8}$ of the circle. Only one of the eight students is doing Biology research. The segment representing this student is $\frac{1}{8}$ of the circle.

The number of students doing research on a particular topic can be expressed as a percentage. The percentages in a circle graph must add up to 100%.

Name____Date_______________Class________

Create Circle Graphs (*continued*)

TIPS FOR MAKING CIRCLE GRAPHS

Suppose that you have been asked to create a circle graph using information about the grade levels of the students in the science club.

Grade Level of Science Club Members	
Grade Level	**Number of Club Members**
3	12
4	6
5	12
6	18

1. Use your compass to make a circle. Mark the center point and then use a straightedge to draw a line from the center point to the top of the circle.

2. To find the size of the segment that represents science club members who are in third grade, use the following formula. (Remember that a circle contains 360 degrees.)

$$\frac{\text{Number of club members in 3rd grade}}{\text{Total number of club members}} = \frac{x}{\text{Total number of degrees in a circle}}$$

$$\frac{12}{48} = \frac{x}{360°}$$

Cross- multiply, and solve for x. $48x = 12 \times 360°$

$$x = 90°$$

As you can see, the graph representing third graders should contain 90 degrees. The same method is used to find the size of each segment.

3. 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.

Grade Level	3	4	5	6
Segment Size	90°	45°	90°	135°

4. Continue around the circle, measuring and drawing 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. Make sure you have labeled each segment.

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

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

Checkpoint

Suppose you survey 500 students and find that basketball is the favorite sport of 125 students. What would the angle measurement be in the segment of a circle graph representing 125 students?

____

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 a separate sheet of paper. Answer the remaining questions in the space provided.

Water is used for drinking and washing in homes, for agriculture, in industries, and in the production of power. This data table shows the percent of the total water use used for each of these purposes.

Water Use in the United States	
Use	**Percentage of Total Water Use**
Industries	9
Households and Businesses	10
Agriculture	42
Power Plants	42

1. Make a circle graph to display the data in this table.
2. What two uses combined account for more than 80% of the water use in the United States? Show the individual percentages and the total.
3. **Think It Over** Could you display this data on a bar graph? Why or why not? What does a circle graph show that a bar graph does not?

____

____

____

____

____

____

____

____

____

____

____

____