Glencoe Science

Chapter Resources

The Nature of Science

Includes:

Reproducible Student Pages

ASSESSMENT

- ✔ Chapter Tests
- ✔ Chapter Review

HANDS-ON ACTIVITIES

- ✔ Lab Worksheets for each Student Edition Lab
- ✔ Two additional Laboratory Activities
- ✔ Foldables–Reading and Study Skills activity sheet

MEETING INDIVIDUAL NEEDS

- ✔ Directed Reading for Content Mastery
- ✔ Directed Reading for Content Mastery in Spanish
- ✔ Reinforcement
- ✔ Enrichment
- ✔ Note-taking Worksheets

TRANSPARENCY ACTIVITIES

- ✔ Section Focus Transparency Activities
- ✔ Teaching Transparency Activity
- ✔ Assessment Transparency Activity

Teacher Support and Planning

- ✔ Content Outline for Teaching
- ✔ Spanish Resources
- ✔ Teacher Guide and Answers

Mc Graw Hill Glencoe

New York, New York Columbus, Ohio Chicago, Illinois Peoria, Illinois Woodland Hills, California

Glencoe Science

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The McGraw-Hill Companies

Send all inquiries to:
Glencoe/McGraw-Hill
8787 Orion Place
Columbus, OH 43240-4027

ISBN 0-07-872522-4

Printed in the United States of America.

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Table of Contents

Additional Assessment Resources available with Glencoe Science:

- Exam*View*® Pro TestMaker
- Assessment Transparencies
- Performance Assessment in the Science Classroom
- Standardized Test Practice Booklet
- MindJogger Videoquizzes
- Vocabulary PuzzleMaker at: **gpescience.com**
- Interactive Chalkboard
- The Glencoe Science Web site at: **gpescience.com**
- An interactive version of this textbook along with assessment resources are available online at: **mhln.com**

To the Teacher

This chapter-based booklet contains all of the resource materials to help you teach this chapter more effectively. Within you will find:

Reproducible pages for

- Student Assessment
- Hands-on Activities
- Meeting Individual Needs (Extension and Intervention)
- Transparency Activities

A teacher support and planning section including

- Content Outline of the chapter
- Spanish Resources
- Answers and teacher notes for the worksheets

Hands-On Activities

MiniLAB and Lab Worksheets: Each of these worksheets is an expanded version of each lab and MiniLAB found in the Student Edition. The materials lists, procedures, and questions are repeated so that students do not need their texts open during the lab. Write-on rules are included for any questions. Tables/charts/graphs are often included for students to record their observations. Additional lab preparation information is provided in the *Teacher Guide and Answers* section.

Laboratory Activities: These activities do not require elaborate supplies or extensive pre-lab preparations. These student-oriented labs are designed to explore science through a stimulating yet simple and relaxed approach to each topic. Helpful comments, suggestions, and answers to all questions are provided in the *Teacher Guide and Answers* section.

Foldables: At the beginning of each chapter there is a *Foldables: Reading & Study Skills* activity written by renowned educator, Dinah Zike, that provides students with a tool that they can make themselves to organize some of the information in the chapter. Students may make an organizational study fold, a cause and effect study fold, or a compare and contrast study fold, to name a few. The accompanying *Foldables* worksheet found in this resource booklet provides an additional resource to help students demonstrate their grasp of the concepts. The worksheet may contain titles, subtitles, text, or graphics students need to complete the study fold.

Meeting Individual Needs (Extension and Intervention)

Directed Reading for Content Mastery: These worksheets are designed to provide students with learning difficulties with an aid to learning and understanding the vocabulary and major concepts of each chapter. The *Content Mastery* worksheets contain a variety of formats to engage students as they master the basics of the chapter. Answers are provided in the *Teacher Guide and Answers* section.

Directed Reading for Content Mastery (in Spanish): A Spanish version of the *Directed Reading for Content Mastery* is provided for those Spanish-speaking students who are learning English.

Reinforcement: These worksheets provide an additional resource for reviewing the concepts of the chapter. There is one worksheet for each section, or lesson, of the chapter. The *Reinforcement* worksheets are designed to focus primarily on science content and less on vocabulary, although knowledge of the section vocabulary supports understanding of the content. The worksheets are designed for the full range of students; however, they will be more challenging for your lower-ability students. Answers are provided in the *Teacher Guide and Answers* section.

Enrichment: These worksheets are directed toward above-average students and allow them to explore further the information and concepts introduced in the section. A variety of formats are used for these worksheets: readings to analyze; problems to solve; diagrams to examine and analyze; or a simple activity or lab that students can complete in the classroom or at home. Answers are provided in the *Teacher Guide and Answers* section.

Note-taking Worksheet: The *Note-taking Worksheet* mirrors the content contained in the teacher version—*Content Outline for Teaching*. They can be used to allow students to take notes during class, as an additional review of the material in the chapter, or as study notes for students who have been absent.

Assessment

Chapter Review: These worksheets prepare students for the chapter test. The *Chapter Review* worksheets cover all major vocabulary, concepts, and objectives of the chapter. The first part is a vocabulary review and the second part is a concept review. Answers and objective correlations are provided in the *Teacher Guide and Answers* section.

Chapter Test: The *Chapter Test* requires students to use process skills and understand content. Although all questions involve memory to some degree, you will find that your students will need to discover relationships among facts and concepts in some questions, and to use higher levels of critical thinking to apply concepts in other questions. Each chapter test normally consists of four parts: Testing Concepts measures recall and recognition of vocabulary and facts in the chapter; Understanding Concepts requires interpreting information and more comprehension than recognition and recall—students will interpret basic information and demonstrate their ability to determine relationships among facts, generalizations, definitions, and skills; Applying Concepts calls for the highest level of comprehension and inference; Writing Skills requires students to define or describe concepts in multiple sentence answers. Answers and objective correlations are provided in the *Teacher Guide and Answers* section.

Transparency Activities

Section Focus Transparencies: These transparencies are designed to generate interest and focus students' attention on the topics presented in the sections and/or to assess prior knowledge. There is a transparency for each section, or lesson, in the Student Edition. The reproducible student masters are located in the *Transparency Activities* section. The teacher material, located in the *Teacher Guide and Answers* section, includes Transparency Teaching Tips, a Content Background section, and Answers for each transparency.

Teaching Transparencies: These transparencies relate to major concepts that will benefit from an extra visual learning aid. Most of these transparencies contain diagrams/photos from the Student Edition. There is one *Teaching Transparency* for each chapter. The *Teaching Transparency Activity* includes a black-and-white reproducible master of the transparency accompanied by a student worksheet that reviews the concept shown in the transparency. These masters are found in the *Transparency Activities* section. The teacher material includes Transparency Teaching Tips, a Reteaching Suggestion, Extensions, and Answers to Student Worksheet. This teacher material is located in the *Teacher Guide and Answers* section.

Assessment Transparencies: An *Assessment Transparency* extends the chapter content and gives students the opportunity to practice interpreting and analyzing data presented in charts, graphs, and tables. Test-taking tips that help prepare students for success on standardized tests and answers to questions on the transparencies are provided in the *Teacher Guide and Answers* section.

Teacher Support and Planning

Content Outline for Teaching: These pages provide a synopsis of the chapter by section, including suggested discussion questions. Also included are the terms that fill in the blanks in the students' *Note-taking Worksheets.*

Spanish Resources: A Spanish version of the following chapter features is included in this section: objectives, vocabulary words and definitions, a chapter purpose, the chapter Labs, and content overviews for each section of the chapter.

Reproducible Student Pages

Reproducible Student Pages

Hands-On Activities

Mini LAB

Determining the Density of a Pencil

Procedure

1. Find a **pencil** that will fit in a **100-mL graduated cylinder** below the 90-mL mark.
2. Measure the mass of the pencil in grams.
3. Put 90 mL of **water** (initial volume) into the 100-mL graduated cylinder. Lower the pencil, eraser first, into the cylinder. Push the pencil down until it is just submerged. Hold it there and record the final volume to the nearest tenth of a milliliter.

Data and Observations

Quantity	Measurement
Mass of pencil	
Volume of water	
Volume displaced by floating pencil	
Volume displaced by submerged pencil	

Analysis

1. Determine the water displaced by the pencil by subtracting the initial volume from the final volume.

2. Calculate the pencil's density by dividing its mass by the volume of water displaced.

3. Is the density of the pencil greater than or less than the density of water? How do you know?

TRY AT HOME Mini LAB

Graphing Temperature Change

Procedure

1. Pour one cup of **cold water** to a **medium-sized plastic bowl.** Add **ice** to the water. Put 2 tbs of **table salt** into the iced water.
2. Fill a **clear-plastic cup** ⅔ full with **room temperature water.** Measure the temperature of the water using a **thermometer**. Place the plastic cup with the thermometer into the bowl of iced water. Make sure the iced water surrounds the liquid in the cup. Do not allow any iced water into the cup.
3. Measure and record the tempertaure every 30 s for 5 min.

Data and Observations

Starting Temperature: _____

Time (min)	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Temp. (°C)										

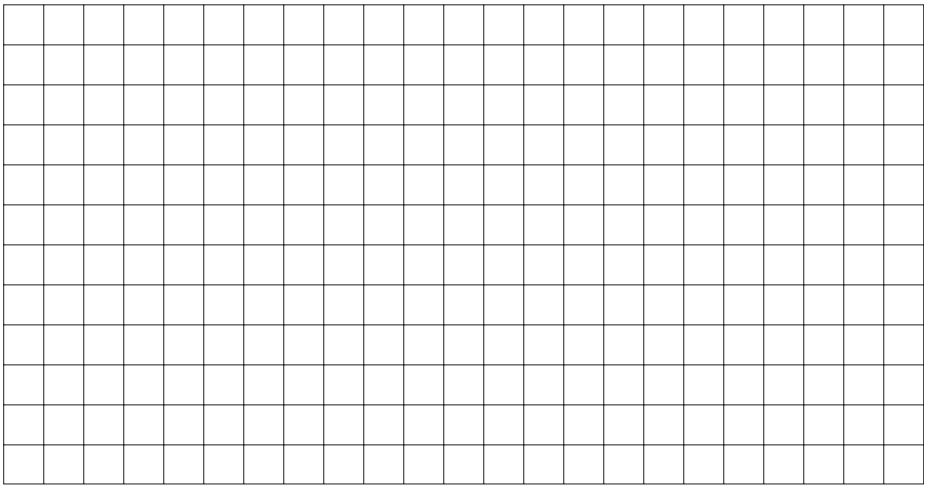
Analysis

1. Identify the dependent and independent variables.

_____

2. Make a line graph of the data recorded in step 3.

Graph 1



What's my graph?

Lab Preview

Directions: *Answer these questions before you begin the Lab.*

1. Will the tools you use to create your graphs affect the accuracy or precision of your results? Explain your answer.

2. How do precision and accuracy affect how you compare the graphs you make to the graphs made by others?

You have heard that a picture is worth a thousand words. For scientists, it is also true that a graph is worth a thousand numbers. Graphs give us a visual display of data collected during experiments. Graphs are also useful in the world of business, sports, or other situations.

Real-World Problem

How are line, bar, and circle graphs used for analyzing different kinds of data?

Goals

- **Compare and contrast** the three different types of graphs and how they are used.
- **Distinguish** between dependent and independent variables.

Materials

small ruler	compass
protractor	**circle template*
pencil	**Alternate material*

Procedure

1. **Examine** the data listed in the tables.
2. **Discuss** with other students the type of graph to be used for each data table.
3. **Graph** the data for each table on a separate sheet of paper.

LAB (continued)

Data and Observations

Data Table 1: Home Energy Use

Type of Energy Use	Percentage
Heating and cooling	.44
Water heating	.14
Refrigerator	.09
Light cooking and other	.33

Data Table 2: Motion of an Object

Time (s)	Distance (m)
0	0
5	3
10	6
15	9

Data Table 3: Average Number of Tornadoes by Month

Month	Average # of Tornadoes
March	53
April	107
May	176
June	168
July	94

Conclude and Apply

1. **Explain** why you chose the type of graph you made for each table.

2. **Define** the independent and dependent variables.

3. **Discuss** the advantages of looking at a graph instead of just looking at numbers in a data table.

Communicating Your Data

As a class, compare the type of graph made for each data table.

Design Your Own

Developing a Measurement System

Lab Preview

Directions: *Answer these questions before you begin the Lab.*

1. Why should the string be stretched tightly when you measure with it?

2. What is a scale division?

To develop the International System of Units, people had to agree on set standards and basic definitions of scale. If you had to develop a new measurement system, people would have to agree with your new standards and definitions. In this lab, your team will use string to devise and test its own SI (String International) system for measuring length.

Real-World Problem

What are the requirements for designing a new measurement system using string?

Form a Hypothesis

Based on your knowledge of measurement standards and systems, form a hypothesis that explains how exact units help keep measuring consistent.

Possible Materials

string
scissors
marking pen
masking tape
miscellaneous objects for standards

Safety Precautions

Goals

- **Design** an experiment that involves devising and testing your own measurement system for length.
- **Measure** various objects with the string measurement system.

Test Your Hypothesis

Make a Plan

1. As a group, agree upon and write out the hypothesis statement.
2. As a group, list the steps that you need to take to test your hypothesis. Be specific, describing exactly what you will do at each step.
3. Make a list of the materials that you will need.
4. **Design** a data table on a separate sheet of paper so it is ready to use as your group collects data.
5. As you read over your plan, be sure you have chosen an object in your classroom to serve as a standard. It should be in the same size range as what you will measure.
6. Consider how you will mark scale divisions on your string. Plan to use different pieces of string to try different-sized scale divisions.
7. What is your new unit of measurement called? Come up with an abbreviation for your unit. What will you name the smaller scale divisions?

LAB (continued)

8. What objects will you measure with your new unit? Be sure to include objects longer and shorter than your string. Will you measure each object more than once to test consistency? Will you measure the same object as another group and compare your findings?

Follow Your Plan

1. Make sure your teacher approves your plan before you start.
2. Carry out the experiment as it has been planned.
3. **Record** observations that you make and complete your data table.

Analyze Your Data

1. **Explain** which of your string scale systems will provide the most accurate measurement of small objects.

2. **Describe** how you recorded measurements that were between two whole numbers of your units.

Conclude and Apply

1. **Explain** when sharing your results with other groups, why it is important for them to know what you used as a standard.

2. **Infer** how it is possible for different numbers to represent the same length of an object.

Communicating Your Data

Compare your conclusions with other students' conclusions. Are there differences? Explain how these may have occurred.

LAB 1 Laboratory Activity

Relationships

Most students will agree that the longer they study for tests, the higher they score. In other words, test grades seem to be related to the amount of time spent studying. If two variables are related, one variable depends on the other. One variable is called the independent variable; the other is called the dependent variable. If test grades and study time are related, what is the independent variable—the test grades or the time spent studying?

One of the most simple types of relationships is a linear relationship. In linear relationships, the change in the dependent variable caused by a change in the independent variable can be determined from a graph. In this experiment you will investigate how a graph can be used to describe the relationship between the stretch of a rubber band and the force stretching it.

Strategy

You will measure the effect of increasing forces on the length of a rubber band.
You will graph the results of the experiment.
You will interpret the graph.

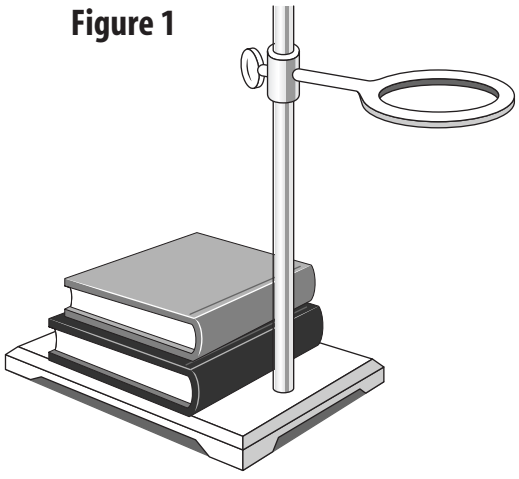
Materials

ring stand
ring clamp
several heavy books
rubber bands, equal lengths, different widths (2)
plastic-coated wire ties, 10 cm and 30 cm long (3)
metric ruler
100-g, 200-g, and 500-g masses

Procedure

1. Set up the ring stand, ring clamp, and books as shown in Figure 1.
2. Choose the narrowest rubber band. Securely attach the rubber band to the ring clamp with the 10-cm plastic-coated wire tie.
3. Measure the width of the rubber band. Record this value in Table 1 in the Data and Observations section.
4. Measure the length of the rubber band as it hangs from the ring clamp. Record this value in Table 1 as zero mass.
5. Attach the 100-g mass to the bottom of the rubber band with the second wire tie. Measure the length of the stretched rubber band. Record this value in Table 1.
6. Remove the mass and attach the 200-g mass to the bottom of the rubber band. Measure the length of the stretched rubber band. Record this value in Table 1.

Figure 1



Laboratory Activity 1 (continued)

7. Remove the 200-g mass from the rubber band. Securely wrap the 100-g and 200-g masses together with the wire tie and tighten it. Attach the combined masses to the rubber band with the wire tie. Measure the length of the rubber band and record the value in Table 1.
8. Repeat measuring the lengths of the stretched rubber band for the 500-g mass and the combined masses of 600 g, 700 g, 800 g. Record the values in the data table.
9. Remove the rubber band.
10. Replace the rubber band with a slightly wider one. Hypothesize how the stretching of the wider rubber band will differ from that of the thinner one. Record your hypothesis in the Data and Observations section.
11. Repeat steps 3–9 for the second rubber band.
12. Replace the rubber band with the widest one and repeat steps 3–9 for the third rubber band.

Data and Observations

Table 1

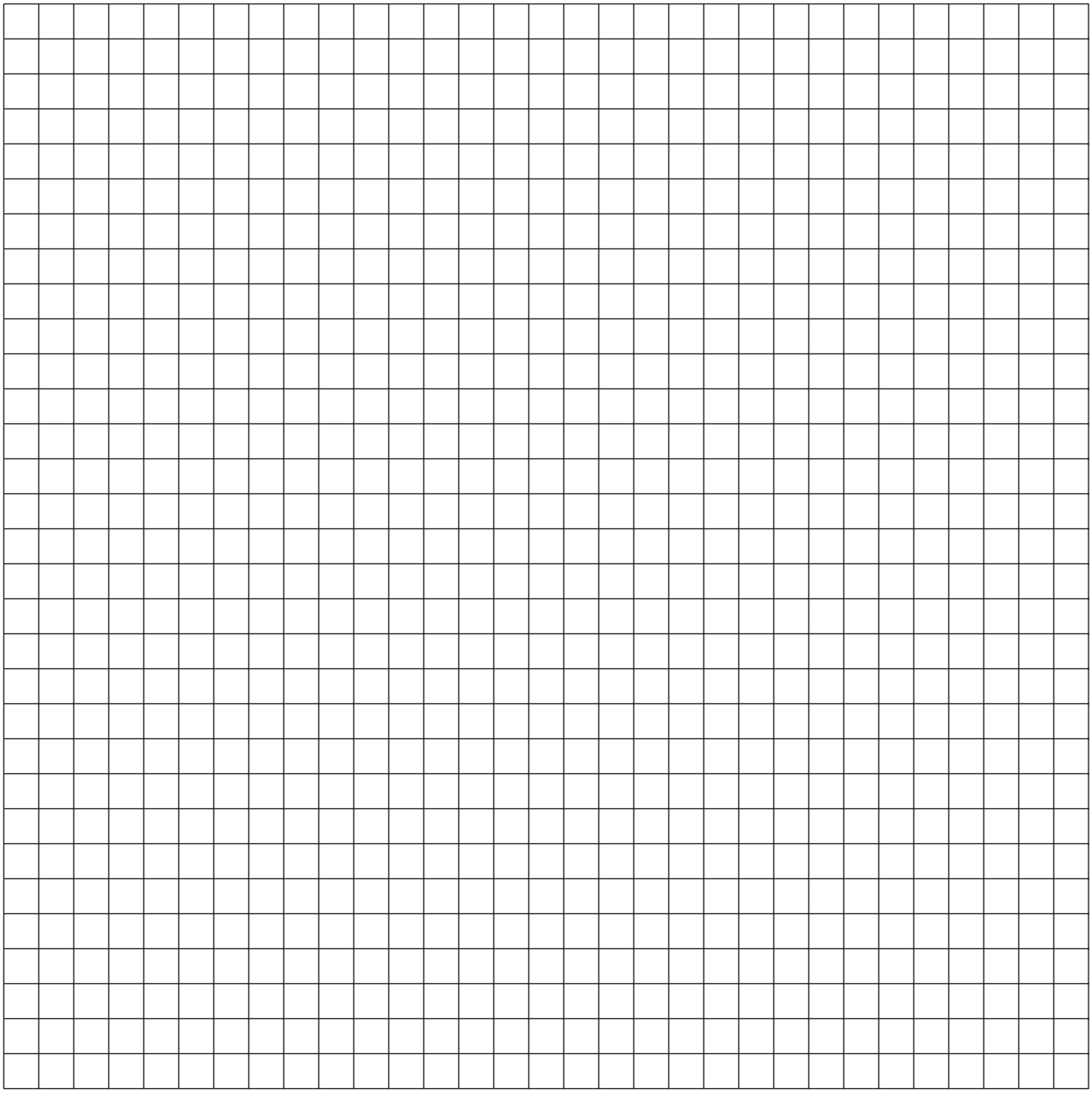
Mass (g)	Length of Rubber Band (cm)		
	_____mm Width	_____mm Width	_____mm Width
0			
100			
200			
300			
500			
600			
700			
800			

1. Hypothesize how the stretching of a wider rubber band will differ from that of a thinner one.

Laboratory Activity 1 (continued)

2. In most experiments, the independent variable is plotted on the *x*-axis, which is the horizontal axis. The dependent variable is plotted on the *y*-axis, which is the vertical axis. In this experiment, the lengths of the rubber bands change as more mass is used to stretch them. The length of each of the rubber bands is the dependent variable. The mass that is used to stretch them is the independent variable. Use Graph 1 to plot the data for all three rubber bands. Plot the values of the masses causing the rubber bands to stretch on the *x*-axis. Plot the lengths of the rubber bands on the *y*-axis. Label the *x*-axis *Mass (g)* and the *y*-axis *Length (cm).*

Graph 1



Laboratory Activity 1 (continued)

Questions and Conclusions

1. What do the graphs you made describe?

2. What does the steepness of the line of the graph measure?

3. How is the steepness of the three graphs related to the width of the rubber band?

4. How is the flexibility of these rubber bands related to their widths?

5. Explain how someone looking at Graph 1 could determine the length of the unstretched rubber band.

6. Predict the length of each rubber band if a 400-g mass is used to stretch it.

7. How could you use the stretching of one of the rubber bands to measure the mass of an unknown object?

Strategy Check

_____ Can you measure the effect of increasing forces on the length of a rubber band?

_____ Can you graph the results of the experiment?

_____ Can you interpret the graph?

LAB 2 Laboratory Activity

No Need to Count Your Pennies

Have you ever saved pennies, nickels, or dimes? If you have, you probably took them to the bank in paper wrappers provided by the bank. Tellers at the bank could take the time to open each roll and count the coins to determine their dollar value. However, counting is not necessary because tellers use a better system. They use the properties of the coins instead.

A penny, a nickel, and a dime each has a particular mass and thickness. Therefore, a roll of coins will have a certain mass and length. These two properties—mass and length of a roll of coins—are often used to determine the dollar value of the coins in the roll.

Strategy

You will develop measuring skills using a balance and a metric ruler.
You will use graphing skills to make interpretations about your data.
You will compare the relationships among the mass, length, and number of coins in a roll.

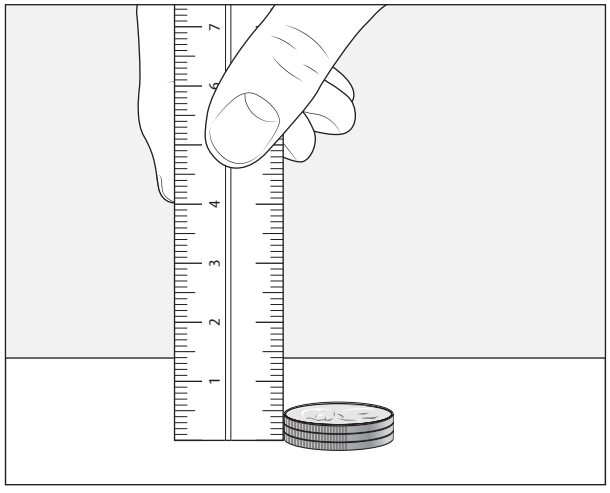
Materials

10 coins (all of the same type)
balance
metric ruler
roll of coins

Procedure

1. Using the balance, determine the mass of one coin, two coins, three coins, four coins, six coins, eight coins, and ten coins to the nearest 0.1 g. Record the masses in Table 1 in the Data and Observations section.
2. Measure the thickness of one coin, two coins, three coins, four coins, six coins, eight coins, and ten coins to the nearest 0.5 mm. See Figure 1. Record these values in the table.
3. Record the number of coins in the roll on the table. Use the balance to find the mass of the roll of coins. Measure the length of the roll. Record these values in the table.

Figure 1



Laboratory Activity 2 (continued)

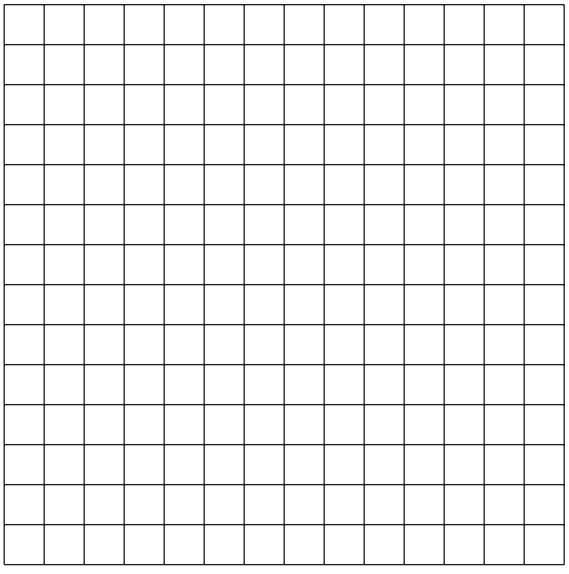
Data and Observations

1. Make two graphs of the information in Table 1. On Graph 1, show the number of coins on the *x*-axis and the mass of the coins on the *y*-axis. Graph 2 should compare the number of coins (*x*-axis) to the total thickness of the stacked coins (*y*-axis). Be sure to label each axis.
2. Draw a line connecting the points on each graph.

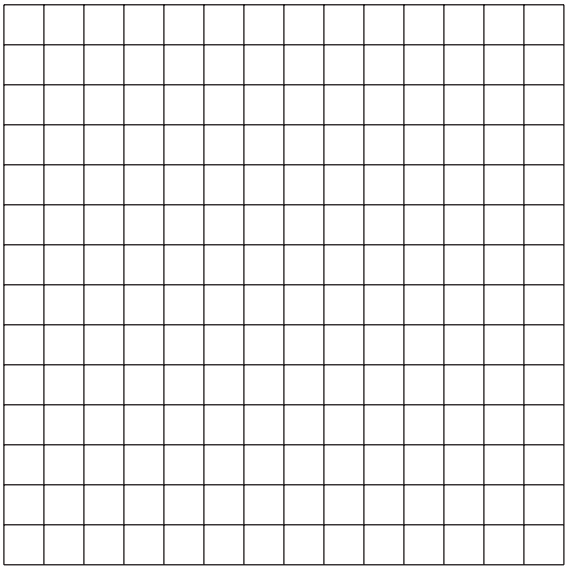
Table 1

Number of Coins	Mass (g)	Thickness (mm)
1		
2		
3		
4		
6		
8		
10		
roll =		

Graph 1



Graph 2



Laboratory Activity 2 (continued)

Questions and Conclusions

1. Describe the appearance of the curve or line in each graph.

2. What errors could exist in your measurement of the mass and the length of the coin roll?

3. Which of the errors in question 2 would have real importance for a bank teller?

4. Do your data show a difference in the mass of different coins? Explain your answer.

5. Do your data show a difference in the thickness of different coins? Explain your answer.

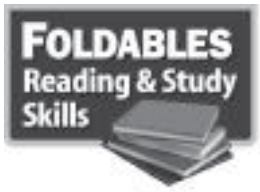
6. Could you use the mass of one coin to determine the mass of two, three, four, six, eight, and ten coins? Why or why not?

Strategy Check

_____ Can you develop measuring skills using a balance and a metric ruler?

_____ Can you use graphing skills to make interpretations about your data?

_____ Can you compare the relationships among the mass, length, and number of coins in a roll?



The Nature of Science

Directions: *Use this page to label your Foldable at the beginning of the chapter.*

KNOW

LIKE TO KNOW

LEARNED

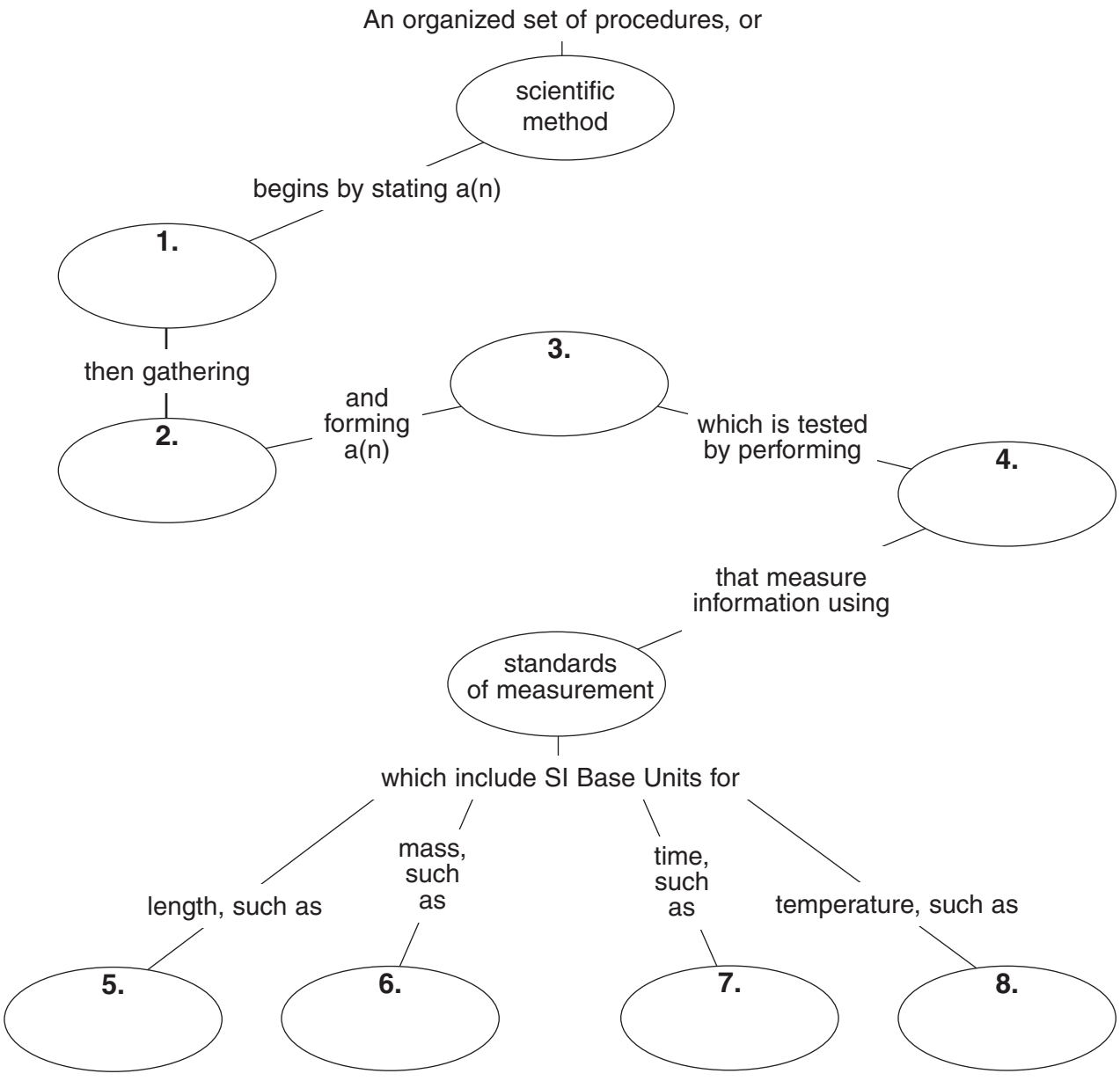
Meeting Individual Needs

Directed Reading for Content Mastery

Overview
The Nature of Science

Directions: *Complete the concept map using the following terms.*

hypothesis	**experiments**	**kelvin**
meters	**grams**	**seconds**
problem	**information**	



Name Date Class

Directed Reading for Content Mastery

Section 1 ▪ The Methods of Science
Section 2 ▪ Standards of Measurement

Directions: *In each of the following statements, a term has been scrambled. Unscramble the term and write it on the line provided.*

_____ **1.** An exact quantity that people agree to use for comparison is a *ndtsarda.*

_____ **2.** A process that uses observation and experimentation to gain knowledge is *nseccie.*

_____ **3.** An explanation based on many observations supported by experimental results is a *yethor.*

_____ **4.** A statement about what happens in nature that seems to be true all the time is a *scenicifit wal.*

_____ **5.** An educated guess using what you know and observe is a *pythoshise.*

_____ **6.** An idea, event, or object that represents something that is being explained is a *domel.*

_____ **7.** A hypothesis can be tested by conducting an *pexetrimne.*

_____ **8.** The solution is not obvious, and important information is missing in a *blepmor.*

_____ **9.** *Acgcauc* compares a measurement to the real or accepted value.

_____ **10.** Mass per unit volume of material is *ndseyit.*

_____ **11.** A quantity that can have more than a single value is called a *lebirava.*

_____ **12.** Solving a problem involves finding missing *timrifonona.*

_____ **13.** SI is an abbreviation for *aiItonanerntl* System of Units.

_____ **14.** The amount of space occupied by a substance is its *lvuoem.*

_____ **15.** Absolute zero is zero on the *lKneiv lsace.*

Meeting Individual Needs

Name Date Class

Directed Reading for Content Mastery

Section 3 ▪ Communicating with Graphs

Directions: *Choose the term from the word list that best completes each statement. Write the term in the blank at the left of each statement.*

graph	**vertical**	**dependent**	**line graph**
horizontal	**independent**	**bar graph**	***x*-axis**
information	**circle graph**	***y*-axis**	**percentages**

_____ **1.** A visual display of data or information is a _____.

_____ **2.** Information collected by counting can best be displayed on a _____.

_____ **3.** In a line graph, the _____ axis is called the *y*-axis.

_____ **4.** In a line graph, the dependent variable is plotted on the _____.

_____ **5.** A graph that shows information as parts of a circle is a _____.

_____ **6.** The type of graph that is useful for showing trends or continuous change is a _____.

_____ **7.** Information in a circle graph is often shown as _____.

_____ **8.** A variable that changes and affects the measure of another variable is called the _____ variable.

_____ **9.** In a line graph, the independent variable is plotted on the _____ axis.

_____ **10.** Graphs are a quick way of communicating a lot of _____ in a small space.

_____ **11.** A variable that changes as a result of the other variable is called a _____ variable.

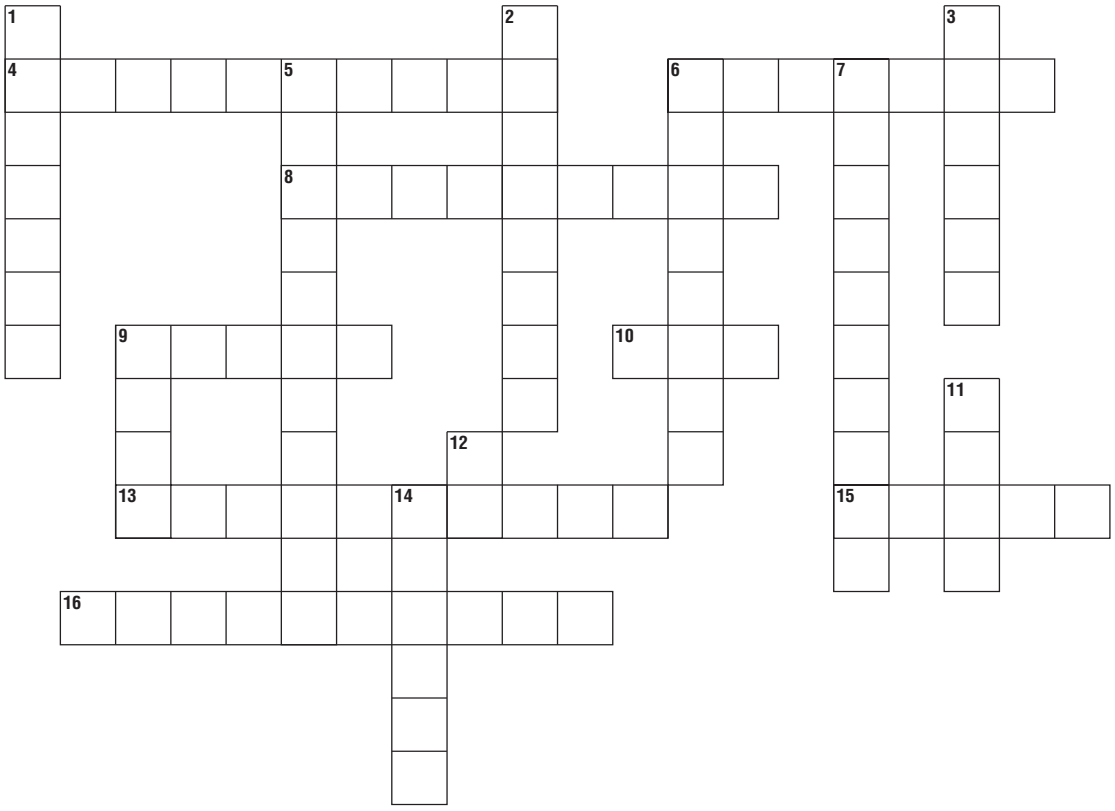
_____ **12.** In a line graph, the horizontal axis is also called the _____.

Meeting Individual Needs

Directed Reading for Content Mastery

Key Terms
The Nature of Science

Directions: *Use the clues below to complete the crossword puzzle.*



Across

4. Test of a hypothesis
6. The standard for comparison in an experiment
8. A factor that depends on the value of the other variable is a _____ variable.
9. Represents an idea or object
10. A statement of nature that seems to be true is a scientific _____.
13. An organized set of investigation procedures is the _____ method.
15. A visual display of data
16. An educated guess about the likely solution to a problem

Down

1. Mass per unit volume
2. An agreed-upon quantity used for comparison
3. The amount of space occupied by an object
5. Variable in an experiment that is adjusted by the experimenter is an _____ variable.
6. Factor that doesn't vary in an experiment
7. Applied science
9. The amount of matter in an object
11. Expectations that change how results are viewed
12. Abbreviation for International System of Units
14. An explanation from observations and experiments

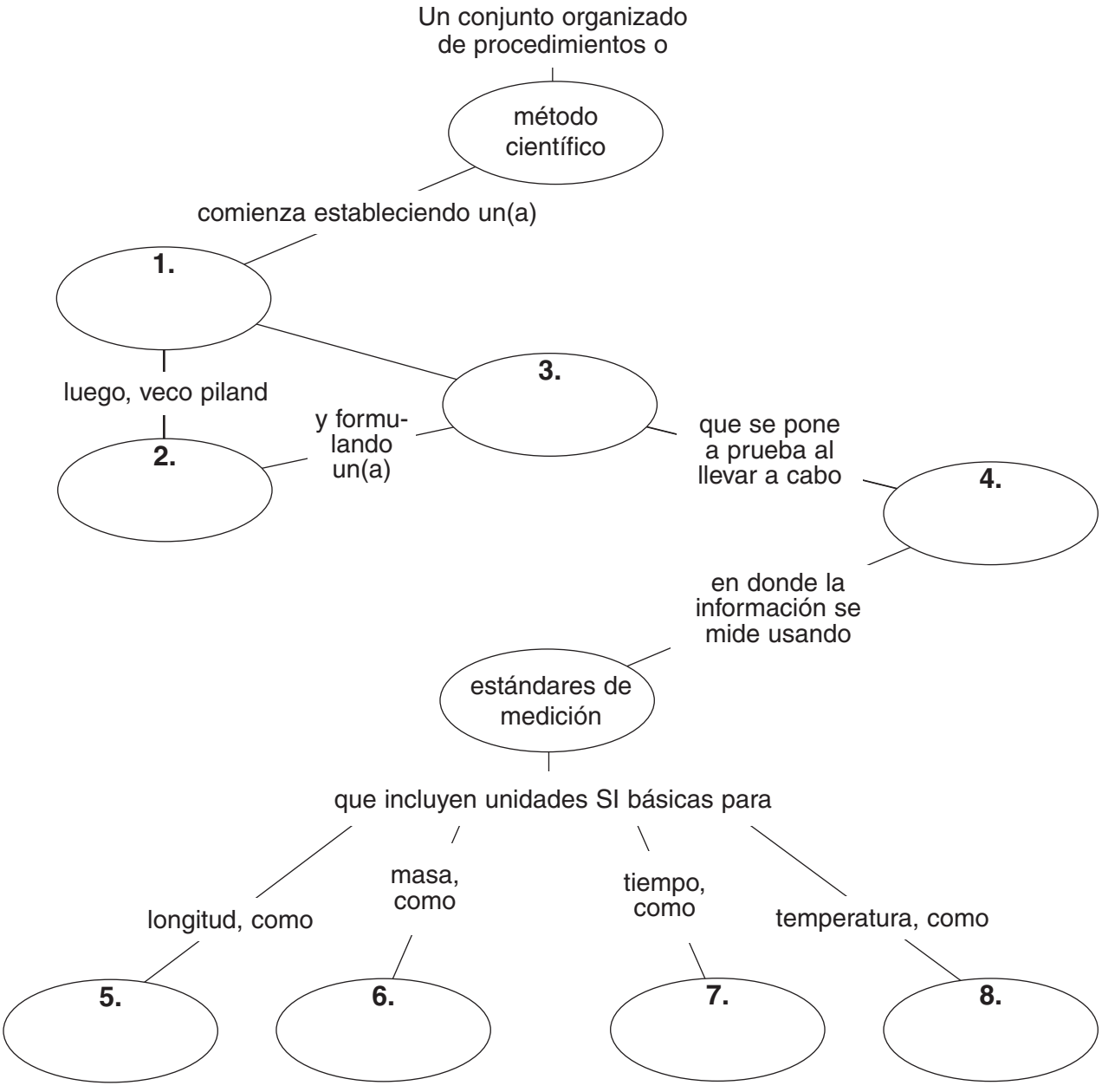
Meeting Individual Needs

Lectura dirigida para
Dominio del contenido

Sinopsis
La naturaleza de la ciencia

Instrucciones: *Usa los siguientes términos para completar el mapa conceptual.*

hipótesis	**los experimentos**	**los kelvins**
los metros	**los gramos**	**los segundos**
problema	**la información**	



Lectura dirigida para Dominio del contenido

Sección 1 ▪ Los métodos científicos
Sección 2 ▪ Los estándares de medición

Instrucciones: *En cada una de las siguientes oraciones hay un término con las letras desordenadas. Ordénalas y escribe cada término en los espacios dados.*

Satisface las necesidades individuales

_____ **1.** Una cantidad exacta que hemos acordado usar para comparación se llama un(a) *teásdran.*

_____ **2.** El proceso que usa observación y experimentación para ganar conocimiento es *aciienc.*

_____ **3.** Las explicaciones que se basan en muchas observaciones apoyadas por resultados experimentales son *aítoesr.*

_____ **4.** Afirmación sobre lo que sucede en la naturaleza que parece ser cierta todo el tiempo: *yel ítceinafci.*

_____ **5.** Una conjetura informada que usa lo que sabes y observas es un(a) *setsóphii.*

_____ **6.** Una idea, evento u objeto que representa algo que se trata de explicar es un(a) *lemood.*

_____ **7.** Una hipótesis se pone a prueba en un *temxpireneo.*

_____ **8.** En un(a) *bralpoem*, la solución no es obvia y falta información importante.

_____ **9.** La exactidad compara una medida con suvalor real o aceptado un(a) *daundi redvidaa.*

_____ **10.** Masa de un objeto por unidad de volumen: *deisnadd.*

_____ **11.** Cantidad que puede tener más de una sola es una *lebirava.*

_____ **12.** La solución de un problema implica encontrar *mironfcóain* faltante.

_____ **13.** SI es la abreviatura de Sistema *linnatreoican* de unidades.

_____ **14.** La cantidad de espacio que ocupa una sustancia es su *moveunl.*

_____ **15.** El cero absoluto es cero en la *claesa vKelni.*

Lectura dirigida para Dominio del contenido

Sección 3 ▪ Comunica con gráficas

Instrucciones: *Escoge el término que completa mejor cada oración. Escribe cada término en los espacios en blanco a la izquierda de las oraciones.*

gráfica	**vertical**	**dependiente**	**gráfica lineal**
horizontal	**independiente**	**gráfica de barras**	**eje *x***
información	**gráfica circular**	**eje *y***	**porcentajes**

_____ **1.** Representación visual de datos o información.

_____ **2.** La información recogida al contar se representa mejor en un(a) _____.

_____ **3.** En una gráfica lineal, el eje _____ se llama eje *y*.

_____ **4.** En una gráfica lineal, la variable dependiente se coloca en el(la) _____.

_____ **5.** Gráfica que muestran información como partes de un círculo es la _____.

_____ **6.** El tipo de gráfica que es útil para mostrar tendencias o cambio continuo es la _____.

_____ **7.** En una gráfica circular, la información frecuentemente se representa como _____.

_____ **8.** La información que permanece constante y no depende de cambios en el valor de otra variable se llama variable _____.

_____ **9.** En una gráfica lineal, la variable independiente se coloca en el(la) _____.

_____ **10.** Las gráficas son una manera rápida de comunicar mucha _____ en un espacio pequeño.

_____ **11.** Una variable que cambia como resultado de las otras variables se llama una variable _____.

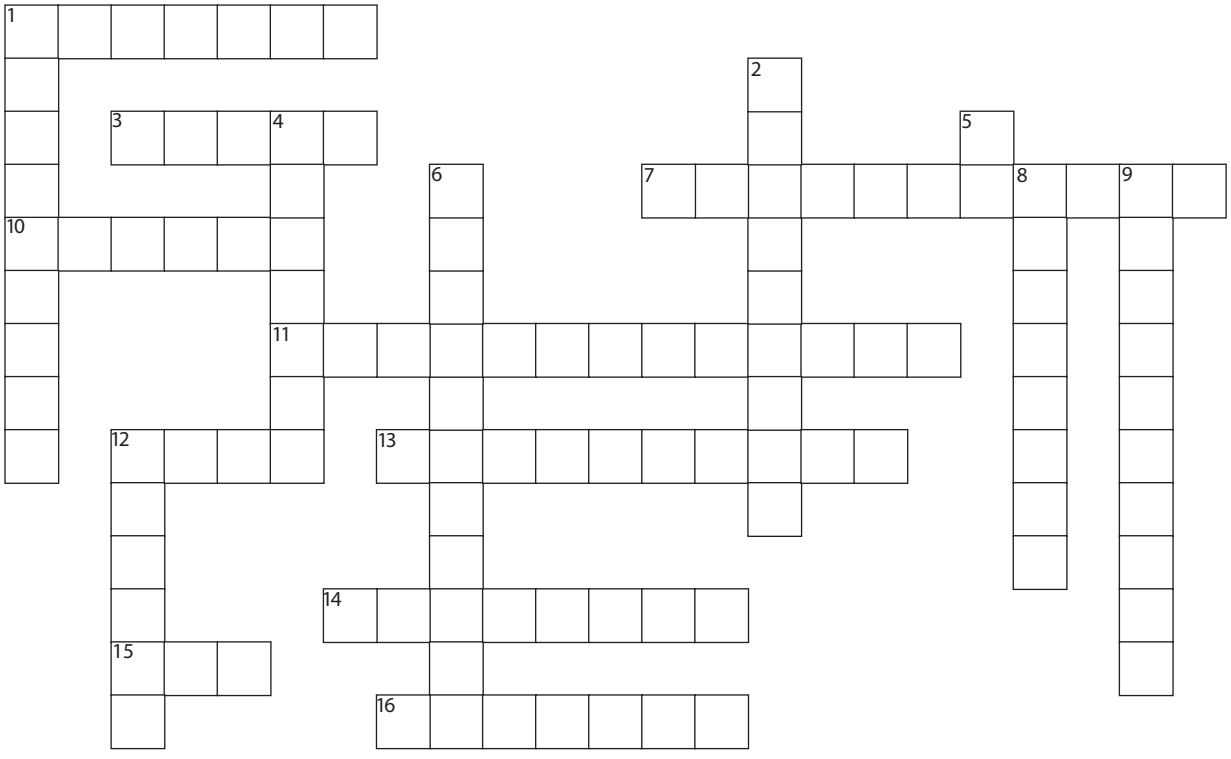
_____ **12.** En una gráfica lineal, el eje horizontal se llama también eje _____.

Satisface las necesidades individuales

Lectura dirigida para Dominio del contenido

Términos claves
La naturaleza de la ciencia

Instrucciones: *Usa las claves para completar el crucigrama.*



Horizontales

1. estándar de comparación en un experimento
3. expectativas de un científico que cambia el modo en que se enfocan los resultados
7. factor que depende del valor de otra variable; variable _____
10. explicación basada en observaciones y experimentos
11. la variable de un experimento que el investigador ajusta; variable _____.
12. representa una idea u objeto.
13. grupo organizado de procedimientos de investigación; método _____.
14. masa por unidad de volumen
15. afirmación sobre la naturaleza que parece ser cierta; _____ científica
16. cantidad de espacio que ocupa un objeto

Verticales

1. factor que no varía en un experimento
2. conjetura informada sobre la posible solución de un problema
4. presentación visual de datos
5. abreviatura para unidades del Sistema internacional de unidades
6. prueba para una hipótesis
8. cantidad determinada que se usa como comparación
9. ciencia aplicada
12. cantidad de materia en un objeto

Satisface las necesidades individuales

Name Date Class

SECTION 1 Reinforcement

The Methods of Science

Directions: *Complete the following.*

1. Place the following in logical order by writing the numbers **1** through **6** in the spaces provided.

_____ **a.** analyze the data

_____ **b.** test the hypothesis

_____ **c.** form a hypothesis

_____ **d.** gather information

_____ **e.** state the problem

_____ **f.** draw conclusions

2. What is an experiment?

_____

_____

3. Why is a control important in an experiment?

_____

4. Why is it important to follow all directions in an experiment carefully?

_____

_____

5. How can a model be useful to a scientist?

_____

_____

6. Why is gravity an example of a scientific law?

_____

_____

7. Does technology always follow science? Explain.

_____

_____

_____

Meeting Individual Needs

Name Date Class

SECTION 2 Reinforcement

Standards of Measurement

Directions: *Complete the table below by supplying the missing information.*

Measurement	Base Unit	Symbol
1.	meter	**5.**
mass	**3.**	**6.**
2.	second	**7.**
temperature	**4.**	**8.**

Directions: *In each of the following, circle the units that would most likely be used to express each kind of measurement. You may circle more than one answer for each term.*

9. volume of a solid: mL m^3 cm^3 L

10. volume of a liquid: mL mg cm^3 L

11. density of a material: g g/cm^3 kg/m^3 L

12. temperature: °K K °C Kg

13. mass: kg K cm^3 mg

14. time: kg K s mm

15. length: K km m cm

Directions: *For each pair of equations, write the letter of the equation that expresses an equal value.*

_____ **16.** **a.** 1 L = 1 dm^3 **b.** 1 L = 1 cm^3

_____ **17.** **a.** 1 mL = 1 cm^3 **b.** 1 cm^3 = 1 L

_____ **18.** **a.** 0°C = –273 K **b.** 0 K = –273°C

_____ **19.** **a.** 1 kg = 100 g **b.** 1,000 g = 1 kg

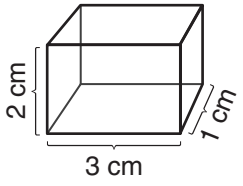
_____ **20.** **a.** 400 cm = 4.0 m **b.** 400 cm = 0.40 m

_____ **21.** **a.** 1 dm = 10 m **b.** 1 dm = 0.10 m

_____ **22.** **a.** 100°C = 373 K **b.** 373 K = 10°C

Directions: *Calculate the volume of the box in the diagram.*

23. _____



Meeting Individual Needs

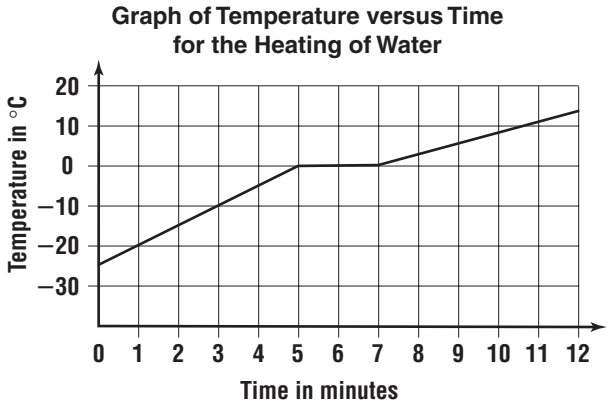
Name Date Class

SECTION 3 Reinforcement

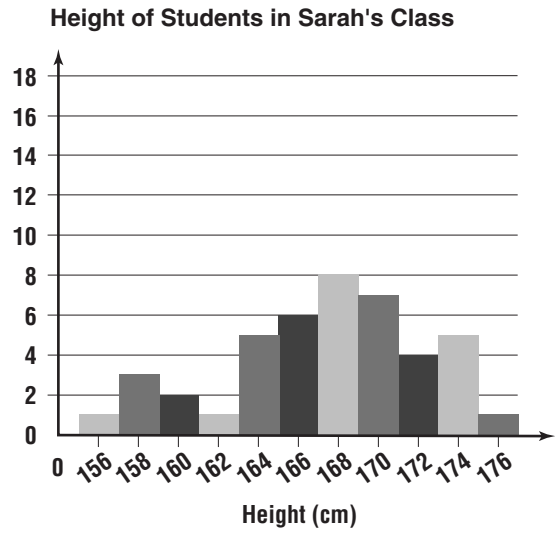
Communicating with Graphs

Directions: *Use the graphs below to answer the following questions.*

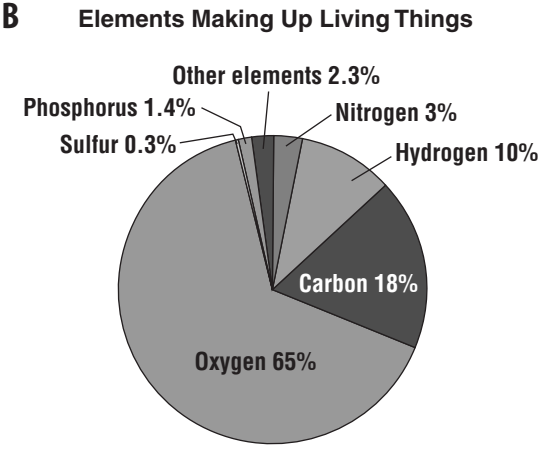
Graph A



Graph C



Graph B



1. What type of graph is shown in A? _____
2. What does graph A show? _____
3. What is the independent variable in graph A? _____
4. On what axis is the independent variable plotted? _____
5. On what axis is the dependent variable plotted? _____
6. What type of graph is graph B? _____
7. What information is shown in graph B? _____
8. What element makes up the largest part of living things? _____
9. What type of graph is graph C? _____
10. What information is shown on graph C? _____
11. What is the most common height for students in Sarah's class? _____

Meeting Individual Needs

Name Date Class

SECTION 1 Enrichment

Solving a Measurement Problem

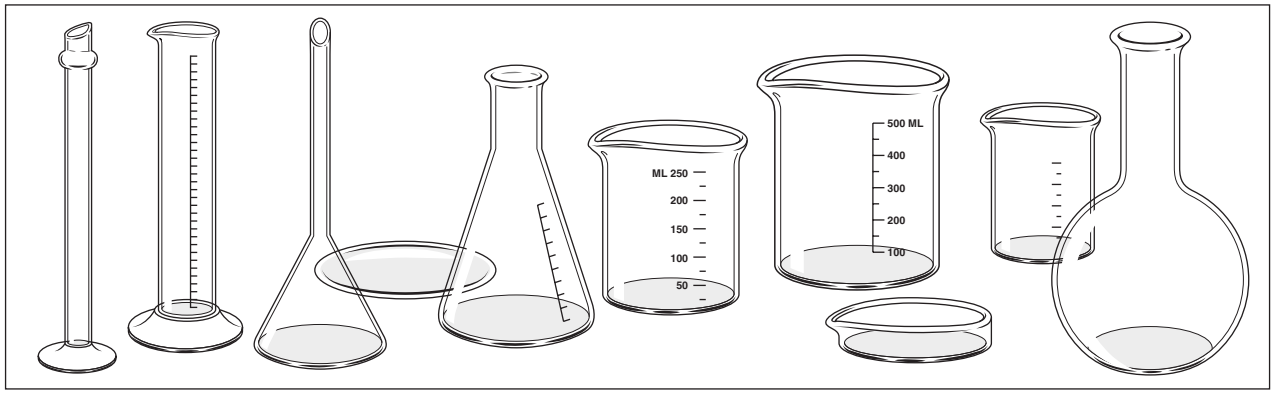
One type of problem-solving that we often encounter is determining the size of something. When this type of problem occurs, we do not always have the appropriate measuring tools available. For example, you may be out shopping and need to know if a large box will fit in the trunk of your parents' car. If you can find the dimensions of the box and the trunk, you can determine if the box will fit before you spend time and energy lifting the box up to the trunk.

In this activity you will use paper clips as your measuring device. You will find the height and width of your textbook with a large paper clip. Then you will use this information and other data to find the height and length of your textbook using a small paper clip.

Procedure

1. Measure the height and width of the figure below using a large paper clip. Record these values in the table.
2. Measure the height and width of the figure using the small paper clip. Record these values in the table.
3. Measure the height and width of your textbook using the large paper clip. Record these values in the table.
4. Predict the height and width of your textbook in small paper clips. Record your prediction in the table for comparison with the actual measurements.

	Large Paper Clip	Prediction	Small Paper Clip
Figure height			
Figure width			
Textbook height			
Textbook width			



Analyze and Conclude

1. How can you find the height and width of your textbook in small paper clips, without measuring it with a small paper clip?

2. Measure your textbook with a small paper clip and record your measurements in the table. Compare your prediction with the actual measurements.

SECTION 2 Enrichment

Working with SI and English Measurements

Only two other nations besides the United States—Myanmar and Liberia—have not converted to the metric system. Since we use two systems, we must make measurements in two different ways.

1. Find the metric and English measurements for each of the following items:

	Metric	English
a. thickness of a dime	_____	_____
b. diameter of a quarter	_____	_____
c. width of a floppy disk	_____	_____
d. your mass	_____	_____
e. soft drink can	_____	_____
f. normal body temperature	_____	_____

2. The English system has many length units such as the inch, foot, yard, fathom, rod, perch, chain, statute mile, nautical mile, and league. Use your dictionary to define these units and their metric equivalents.

_____

_____

_____

_____

_____

_____

3. Jules Verne wrote a book called *Twenty Thousand Leagues Under the Sea.* Is the ocean really that deep? Explain.

_____

_____

4. The field used in the Canadian Football League (CFL) has the midfield marker at the 55-yard line. How long is the field from goal line to goal line?

_____

5. The field used by the National Football League (NFL) in the United States is 100 yards from goal line to goal line. Which field is closer to 100 meters, the CFL's or the NFL's?

_____

Meeting Individual Needs

Name Date Class

SECTION 3 Enrichment

Graphing Scientific Data

Experimental data provide information about the variables from specific measurements. Graphs can be prepared from data. A straight line or curve is drawn using the data points as a guide. The data points are not connected in a "dot-to-dot" manner. Rather, the line that best fits the data is drawn.

Often scientists need to know what the value of a variable will be at a point that was not measured. Interpolation is a method used to approximate values that are between points of a graph. Extrapolation is a method for approximating values that are beyond the range of the data. Data must be extrapolated when values needed are not in the range of the measurements obtained.

The data in the table below were obtained from an experiment conducted to find out how the volume of a gas changes when its temperature changes. Use this data to construct and interpret a graph.

Procedure

1. Draw a graph on a piece of graph paper.
2. Mark the *x*-axis for the independent variable and the *y*-axis for the dependent variable.
3. Plot a point for each temperature/volume set of data in the table. Draw the line that best fits the data points.
4. Extend the line to include all temperatures from 0 K to 600 K.

Table 1

Temperature (K)	Volume (cm^3)
0	**a.**
100	71
140	**b.**
210	155
273	**c.**
280	195
360	257
400	**d.**
600	**e.**

Conclude and Apply

1. Use your graph to predict values for the volume of a gas at 0 K, 140 K, 273 K, 400K, and 600 K and place these values in the data table.
2. Suppose you had drawn the graph in a "dot-to-dot" fashion. Why would it be difficult to extrapolate from this type of graph?

3. Why isn't it necessary for all of the data points to be on the drawn line of the graph?

4. Write a sentence that describes the relationship between the temperature and the volume of a gas.

Meeting Individual Needs

Name Date Class

Note-taking Worksheet

The Nature of Science

Section 1 The Methods of Science

A. _____ studies natural patterns.

1. Science is classified into three main categories: _____ science, _____ science, and _____ science; sometimes a scientific study will overlap the categories.

2. Science explains the natural world; explanations can _____ over time.

3. Scientists _____ nature by observation, experimentation, or modeling.

B. The _____ is an organized set of investigation procedures.

1. _____ a problem.

2. _____ information.

3. Form a _____, or educated guess based on knowledge and observation.

4. An **experiment** with **variables** is a common way to _____ a hypothesis.

a. A _____ **variable** changes value as other variables change.

b. An _____ **variable** is changed to determine how it will affect the dependent variable.

c. A variable that does not change when other variables change is a _____.

d. A _____ is the standard to which test results can be compared.

5. _____ data from an experiment or investigation.

6. Form a _____ based on the data.

7. Reduce _____ by keeping accurate records, using measurable data, and repeating the experiment.

C. _____ represent ideas, events, or objects and can be physical or computerized.

D. A _____ is an explanation based on many observations and investigations; a _____ is a statement that always seems to be true.

E. Science deals with the _____ world; questions of value or emotion cannot be answered.

F. _____ is science applied to help people.

Meeting Individual Needs

Note-taking Worksheet (continued)

Section 2 Standards of Measurement

A. A _____ is an exact quantity that people agree to use for comparison.

B. _____ must be taken carefully.

1. _____ describes how closely measurements are to each other and how carefully they were made.

2. Accuracy compares a measurement to the real or accepted _____.

C. Measurements must have a number and a _____.

1. _____ is an improved version of the metric system used and understood by scientists worldwide.

2. The SI system is based on _____ and uses prefixes to indicate a specific multiple.

D. _____ is measured using a unit appropriate for the distance between two points.

E. _____ is the amount of space an object occupies.

F. _____ is a measure of matter in an object.

1. _____ is the mass per unit volume of a material.

2. A unit obtained by combining different SI units is called a _____.

G. _____ is the interval between two events; _____ is measured using a thermometer.

Note-taking Worksheet (continued)

Section 3 Communicating with Graphs

A. _____—visual display of information or data that is used to detect patterns

B. **A** _____ graph shows a relationship where the dependent variable changes due to a change in the independent variable.

1. The_____ should make the graph readable.

2. The *x*-axis should _____ be used for the independent variable.

3. Units of measurement must be _____.

C. _____ graphs compare information collected by counting.

1. Each _____ represents a quanity counted at a particular time.

D. _____ graphs show how a whole is broken into parts.

1. The parts in a circle graph usually are represented as _____ of the whole.

Assessment

Name Date Class

Chapter Review

The Nature of Science

Part A. Vocabulary Review

Directions: *Write the correct word from the list below next to its definition.*

precision	**bias**	**scientific method**	**variable**
model	**mass**	**graph**	**hypothesis**
accuracy	**dependent variable**	**independent variable**	
technology	**theory**	**control**	**volume**
constant	**experiment**	**scientific law**	**density**

_____ **1.** factor in an experiment that is changed by the experimenter

_____ **2.** visual display of information or data

_____ **3.** representation of an idea, event, or object

_____ **4.** test of a hypothesis

_____ **5.** standard for comparison that is used in an experiment

_____ **6.** rule of nature that tells you what will happen under certain conditions

_____ **7.** organized set of investigation procedures

_____ **8.** what the independent variable in an experiment might change

_____ **9.** factor that can change the results in an experiment

_____ **10.** amount of space occupied by an object

_____ **11.** testable prediction

_____ **12.** another term for applied science

_____ **13.** variable that doesn't change in an experiment

_____ **14.** explanation based on many observations supported by experimental results

_____ **15.** how closely measurements are to each other

_____ **16.** measurement of the quantity of matter

_____ **17.** mass per unit volume of a material

_____ **18.** compares a measurement to an accepted value

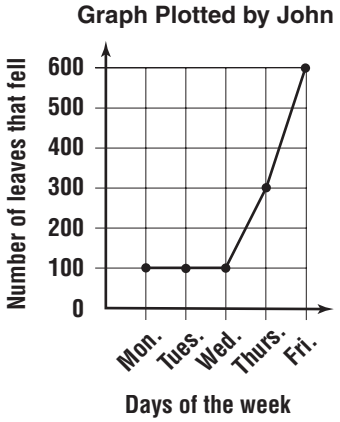
_____ **19.** something that can affect how the results of an experiment are viewed

Assessment

Chapter Review (continued)

Part B. Concept Review

Directions: *John counted the number of leaves that fell from a tree for a five-day period. John used a graph to show his data. Use John's graph to answer questions 1–6.*



1. What type of graph did John use to display his data? _____

2. What is the dependent variable in John's graph? _____

3. What is the independent variable in John's graph? _____

4. On which day of the week did the greatest number of leaves fall? _____

5. On what days of the week did the number of leaves that fell remain constant?

_____

6. On what other type of graph could this data be shown? _____

Directions: *Convert the following.*

7. 200 m = _____ km

8. 1.2 L = _____ mL

9. 0 K = _____ °C

10. 12 cm^3 = _____ mL

11. 10°C = _____ K

12. 1 L = _____ cm^3

13. 124 mm = _____ cm

14. 12,000 mg = _____ g

Directions: *Answer the following questions on the lines provided.*

15. Why are standards of measurement necessary?

_____

_____

_____

16. How are SI units used in the United States?

_____

_____

17. Most of the countries in Europe use SI measurements. How could this be a problem if you went on a trip to Europe?

_____

_____

Assessment

Name Date Class

Chapter Test

The Nature of Science

I. Testing Concepts

Directions: *In the blank at the left, write the letter of the term or phrase that best completes each statement.*

_____ **1.** A testable prediction is a(n) _____.
a. hypothesis **b.** experiment **c.** exercise **d.** variable

_____ **2.** When designing an experiment, the first step is to _____.
a. state a hypothesis **c.** state the problem
b. list a procedure **d.** analyze the data

_____ **3.** A standard for comparison that helps to ensure that the experimental result is caused by the condition being tested is the _____.
a. control **c.** constant
b. independent variable **d.** dependent variable

_____ **4.** A factor that changes in an experiment from manipulation of the independent variable is the _____.
a. control **c.** constant
b. hypothesis **d.** dependent variable

_____ **5.** A factor that does not change in an experiment is the _____.
a. control **c.** constant
b. independent variable **d.** dependent variable

_____ **6.** An organized process used to gather observations and test a hypothesis is a(n) _____.
a. problem **c.** exercise
b. experiment **d.** constant

_____ **7.** A statement that describes what happens in nature is a _____.
a. scientific law **c.** theory
b. hypothesis **d.** variable

_____ **8.** An explanation of an event that is based on repeated observations and experiments is a _____.
a. problem **b.** hypothesis **c.** theory **d.** variable

_____ **9.** An idea, event, or object that can be used to represent something you are trying to explain is a _____.
a. model **b.** constant **c.** hypothesis **d.** variable

_____ **10.** The lightbulb is an example of _____.
a. pure science **c.** a dependent variable
b. technology **d.** an exercise

_____ **11.** In an experiment to determine if the popping of popcorn is affected by the temperature at which it is stored, counting the popped kernels is an example of a(n) _____.
a. conclusion **b.** control **c.** hypothesis **d.** observation

Chapter Test (continued)

_____ **12.** A measurement standard is defined as _____.
- **a.** a system of prefixes
- **b.** the distance between two points
- **c.** an exact quantity people agree to use for comparison
- **d.** the interval between two events

_____ **13.** A beaker contains 0.32 L of water. The beaker's volume is _____ milliliters.
a. 3.2 **b.** 0.032 **c.** 32 **d.** 320

_____ **14.** The correct symbol for the SI unit of temperature is _____.
a. K **b.** °K **c.** C **d.** °C

_____ **15.** In a graph, the variable on the horizontal axis is the _____.
- **a.** variable with the largest range
- **b.** variable with the smallest range
- **c.** dependent variable
- **d.** independent variable

_____ **16.** The type of graph that would be used to show how some fixed quantity is broken down into parts is a _____.
a. line graph **b.** circle graph **c.** bar graph **d.** table

_____ **17.** In a graph showing how the temperature of a material changes over time, temperature change is the _____.
- **a.** dependent variable
- **b.** independent variable
- **c.** variable with the smallest range
- **d.** variable with the largest range

_____ **18.** A unit of measurement that is obtained by combining other units is a _____ unit.
a. standard **b.** metric **c.** dependent **d.** derived

_____ **19.** Of the following, the most correct way to express density is _____.
a. g/m **b.** g/cm^3 **c.** g/cm **d.** kg/cm^3

_____ **20.** Of the following, the only unit that cannot be used to express volume is _____.
a. kg **b.** L **c.** cm^3 **d.** mL

II. Understanding Concepts

Skill: Using SI Units

Directions: *Answer the following questions on the lines provided.*

1. Arrange the following measurements in order from largest to smallest: kilometer, millimeter, meter, centimeter, micrometer.

_____

_____

2. In a network tree concept map showing the SI base units used to measure length, mass, time, and temperature, which unit and abbreviation would be under temperature?

_____

_____

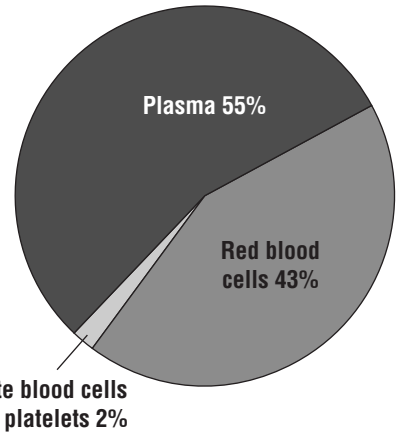
Assessment

Chapter Test (continued)

Skill: Using Graphs and Making Tables

3. A student made a circle graph showing the percentages of the substances that make up human blood. Use the information in the circle graph shown below to complete the table.

Substances Making Up Human Blood



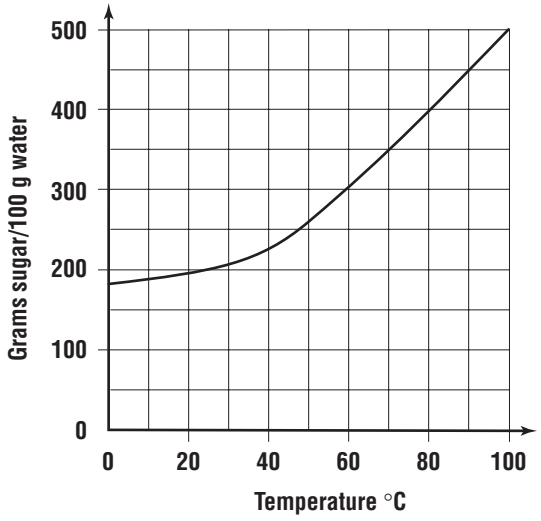
Substance	% of Blood
a.	
b.	
c.	

4. Why can a diagram be used as a model?

_____

III. Applying Concepts

Directions: *Use the following graph to answer questions 1–6.*



1. How many grams of sugar dissolve in water at 80°C? _____

2. At what Celsius temperature will 300 g of sugar dissolve? _____

3. At what kelvin temperature will 300 g of sugar dissolve in water? _____

4. How many kilograms of sugar can be dissolved in water at 100°C? _____

5. What is the dependent variable in this graph? _____

6. What is the independent variable? _____

Chapter Test (continued)

IV. Writing Skills

Directions: *Answer the following questions using complete sentences.*

1. Why is a cubic centimeter an example of a derived unit?

2. Why is it important to make measurements using a standard?

3. List two advantages and two disadvantages to worldwide use of SI.

4. Other than time, how are SI units used in the United States?

Transparency Activities

Name Date Class

SECTION 1 Section Focus Transparency Activity

Splendid Science

Scientists work in different areas and different ways. These photos illustrate the three main divisions of science—life science, Earth science, and physical science. Scientists often work in more than one area, requiring them to have a broad base of knowledge. A biologist, for example, needs to know a good deal of chemistry to understand cell functions.

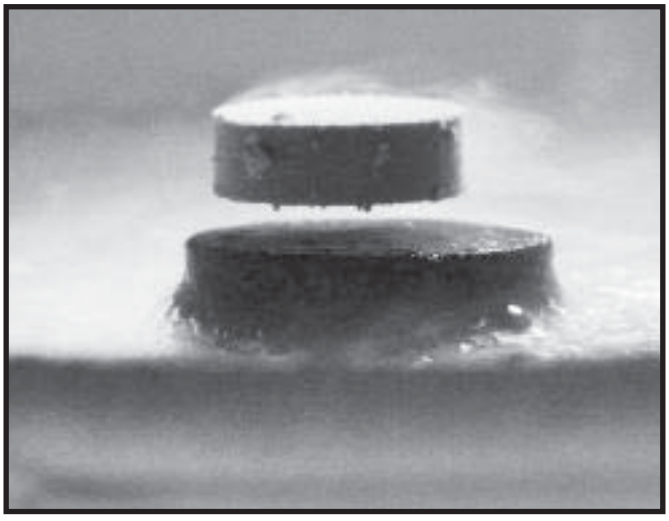
1. **Volcanoes are a topic studied in Earth science. Why might you need to know some physical science when studying volcanoes?**
2. **What is the general purpose of science?**
3. **What do the three divisions of science have in common?**

Name Date Class

SECTION 2 Section Focus Transparency Activity

Pick a Scale and Go with It

What does it mean if someone says that the temperature is 32 degrees? It depends entirely on the scale that they're using. Referring to a temperature of 32 might mean that it's a hot summer's day or that it's so cold that even oxygen is frozen solid.



1. **Label the three pictures *32°F, 32°C,* and *32 K.***
2. **Why must a measurement include the units in order to be meaningful?**
3. **What kind of units do you use to measure length? Mass?**

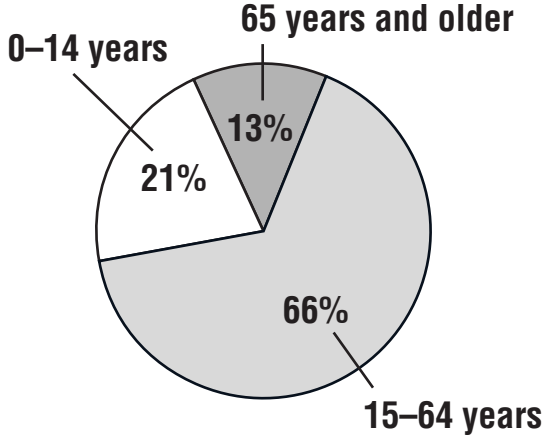
Name Date Class

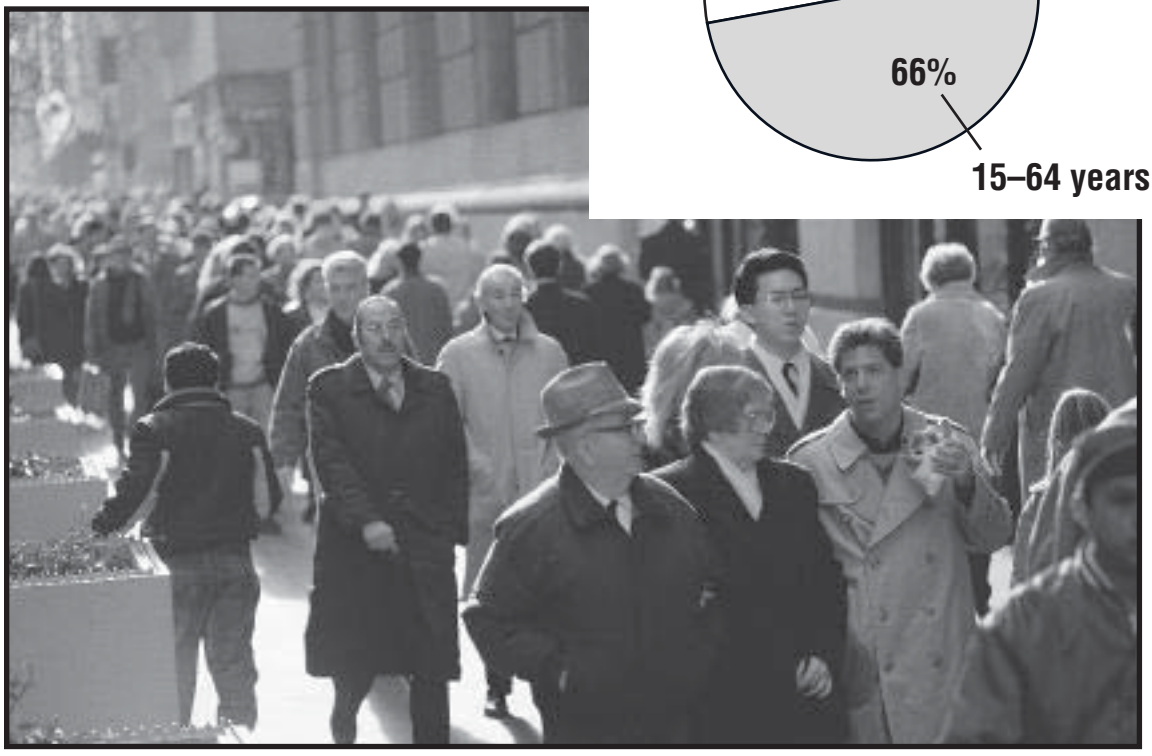
SECTION 3 Section Focus Transparency Activity

Data by Graph

Sometimes the best way to communicate information is with a graph. Circle graphs are a good way to show the parts of a whole—in this case, the U.S. population by age.

United States Population by Age

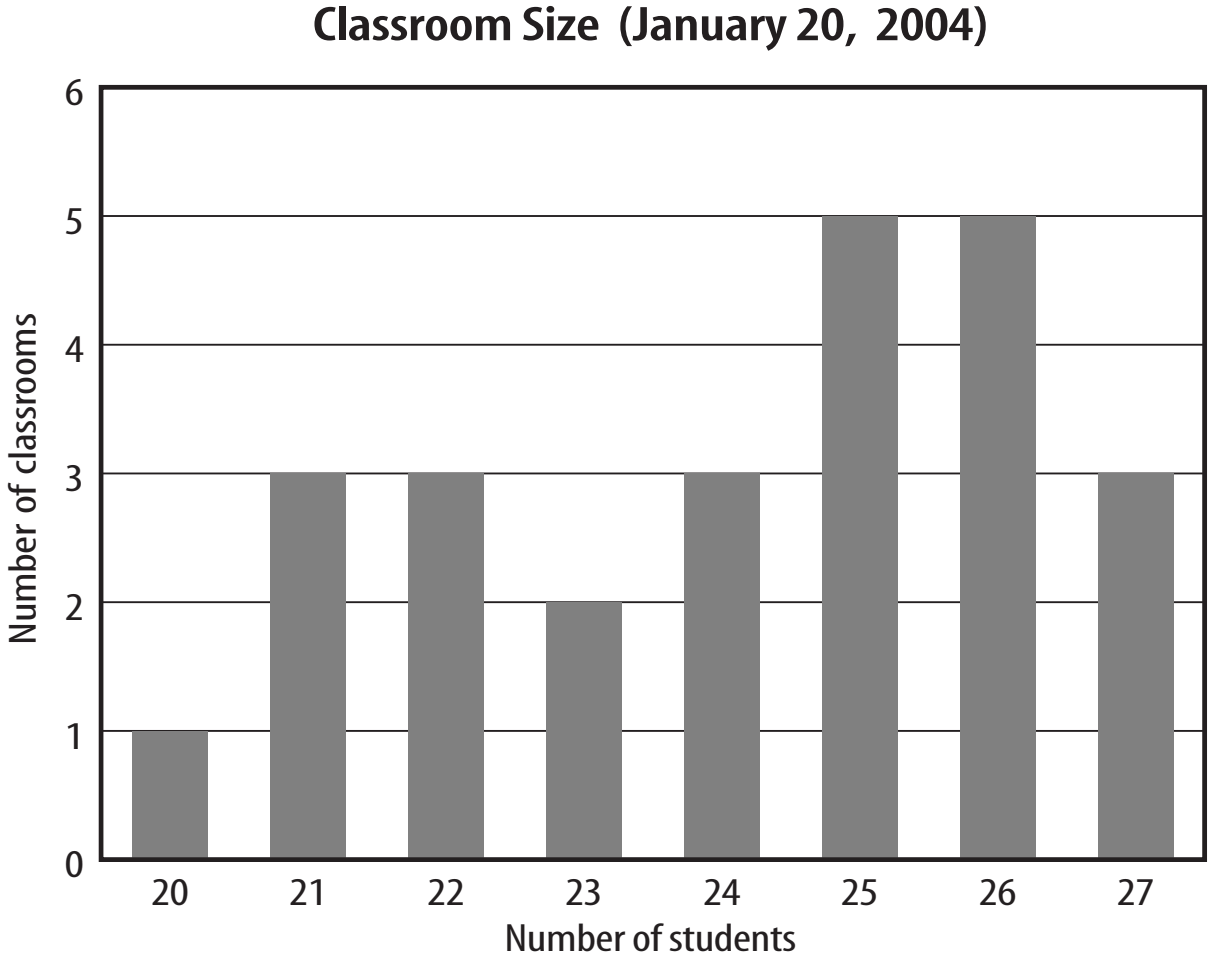




1. **What information does the circle graph provide? Could you have obtained that information by looking at the photograph?**
2. **How else could you display these data?**
3. **Would it be useful to list all the people in the U.S. along with their ages? Why or why not?**

SECTION 3 Teaching Transparency Activity

Reading Graphs



Teaching Transparency Activity (continued)

1. What is a graph?

2. What is measured on the *y*-axis on the graph on the transparency?

3. What are the three common types of graphs?

4. As a scientist, when would you be most likely to use graphing?

5. On which axis of a bar graph would you show the independent variable?

6. When is a bar graph useful?

Assessment Transparency Activity

The Nature of Science

Directions: *Carefully review the tables and answer the following questions.*

Time (s)	Approximate Speed (m/s)
0	0
1	10
2	20
3	30
4	40
5	50

Time (s)	Approximate Speed (m/s)
6	60
7	70
8	80
9	90
10	100
11	?

1. The above data were collected during an experiment to find out the speed of an object dropped from a tall building. Which type of graph would be the best way to display this information?

A bar graph
C circle graph
B pie graph
D line graph

2. According to these data, about how fast would the object be dropping after 11 seconds?

F 90 m/s
H 110 m/s
G 100 m/s
J 120 m/s

3. An independent variable is the factor that affects the measure of the other variable. What independent variable could have been added to this experiment?

A time
C height
B speed
D graph

Teacher Support and Planning

Teacher Support and Planning

Content Outline for Teaching

The Nature of Science

Section 1 The Methods of Science

Underlined words and phrases are to be filled in by students on the Note-taking Worksheet.

A. Science studies natural patterns.

1. Science is classified into three main categories: life science, Earth science, and physical science; sometimes a scientific study will overlap the categories.
2. Science explains the natural world; explanations can change over time.
3. Scientists investigate nature by observation, experimentation, or modeling.

B. **Scientific method**—organized set of investigation procedures

1. State a problem.
2. Gather information.
3. Form a **hypothesis** or educated guess based on knowledge and observation.
4. An **experiment** with **variables** is a common way to test a hypothesis.
   - **a.** A **dependent variable** changes value as other variables change.
   - **b.** An **independent variable** is changed to determine how it will affect the dependent variable.
   - **c.** A variable that does not change when other variables change is a **constant**.
   - **d.** A **control** is the standard to which test results can be compared.
5. Analyze data from an experiment or investigation.
6. Form a conclusion based on the data.
7. Reduce **bias** by keeping accurate records, using measurable data, and repeating the experiment.

C. **Models** represent ideas, events, or objects and can be physical or computerized.

D. A **theory** is an explanation based on many observations and investigations; a **scientific law** is a statement about something that always seems to be true.

E. Science deals with the natural world; questions of value or emotion cannot be answered.

F. **Technology**—applied science helping people

DISCUSSION QUESTION:
What area of questioning is science restricted to? *The natural world*

Section 2 Standards of Measurement

A. **Standard**—exact quantity that people agree to use for comparison

B. Measurements must be taken carefully

1. Precision describes how closely measurements are to each other and how carefully they were made.
2. Accuracy compares a measurement to the real or accepted value.

C. Measurements must have a number and a unit.

1. **SI**—an improved version of the metric system used and understood by scientists worldwide
2. SI system is based on multiples of 10 and uses prefixes to indicate a specific multiple.

D. Length is measured using a unit appropriate for the distance between two points.

E. **Volume**—the amount of space an object occupies

F. **Mass**—measure of matter in an object

1. **Density**—mass per unit volume of a material
2. A unit obtained by combining different SI units is called a **derived unit**.

G. Time is the interval between two events; temperature is measured using a thermometer.

DISCUSSION QUESTION:
What is the SI measurement system? *An improved version of the metric system used by scientists worldwide*

Content Outline for Teaching (continued)

Section 3 Communicating with Graphs

A. **Graph**—visual display of information or data that is used to detect patterns

B. A line graph shows a relationship where the dependent variable changes due to a change in the independent variable.

1. The scale should make the graph readable.

2. The *x*-axis should always be used for the independent variable.

3. Units of measurement must be consistent.

C. Bar graphs compare information collected by counting.

1. Each bar represents a quantity counted at a particular time.

D. Circle graphs show how a whole is broken into parts.

1. The parts in a circle graph usually are represented as percentages of the whole.

DISCUSSION QUESTION:
What axis should always be used for the independent variable? *The* x-*axis*

Spanish Resources

La naturaleza de la ciencia

Sección 1 Los métodos científicos

Lo que aprenderás

- A identificar los pasos que los científicos utilizan para resolver problemas.
- A describir por qué los científicos usan variables.
- A comparar y contrastar la ciencia y la tecnología.

Vocabulario

scientific method / método científico: conjunto organizado de procedimientos de investigación que puede incluir la enunciación de un problema, la formulación de una hipótesis, la investigación y la recopilación de información, el someter a prueba una hipótesis, el análisis de datos y el sacar conclusiones.

hypothesis / hipótesis: estimación razonada o bien fundada que usa el conocimiento y la observación.

experiment / experimento: procedimiento organizado para probar una hipótesis que prueba el efecto de un fenómeno sobre otro bajo condiciones controladas.

variable / variable: factor que puede causar un cambio en los resultados de un experimento.

dependent variable / variable dependiente: factor que cambia conforme cambia la variable independiente.

independent variable / variable independiente: factor que a medida que cambia, afecta la medida de otra variable.

constant / constante: en un experimento, una variable que no cambia cuando cambian otras variables.

control / control: pauta que se usa para efectos de comparar resultados de pruebas en un experimento.

bias / sesgo: se presenta cuando las expectativas de un científico cambian el modo en que se enfocan los resultados de un experimento.

model / modelo: se puede utilizar para representar una idea, un objeto o un evento que es demasiado grande, demasiado pequeño, demasiado complejo o demasiado peligroso para ser observado o probado directamente.

theory / teoría: explicación de fenómenos o eventos que se basa en el conocimiento adquirido a través de la observación y la experimentación.

scientific law / ley científica: enunciado sobre cómo funcionan los elementos en la naturaleza, el cual parece ser siempre cierto.

technology / tecnología: aplicación de la ciencia para ayudar a la gente.

Por qué es importante

El usar métodos científicos te ayudará a resolver problemas.

Sección 2 Los estándares de medición

Lo que aprenderás

- A nombrar los prefijos usados en el SI e indicar qué múltiplo de diez representa cada uno.
- A identificar las unidades y los símbolos del SI para la longitud, el volumen, la masa, la densidad, el tiempo y la temperatura.
- A convertir las unidades del SI relacionadas.

Vocabulario

precision / precisión: describe de qué manera las medidas se acercan unas con otras y con qué detenimiento se tomaron las medidas.

accuracy / exactitud: compara una medida con su valor real o aceptado.

volume / volumen: cantidad de espacio que ocupa un cuerpo.

density / densidad: masa por unidad de volumen de un material.

mass / masa: cantidad de materia que posee un cuerpo.

Por qué es importante

Al usar unidades uniformes, las naciones pueden intercambiar artículos y comparar información fácilmente.

SECCIÓN 3 Comunica con gráficas

Lo que aprenderás

- A identificar los tres tipos de gráficas y explicar las formas en que se usan.
- A distinguir entre variables dependientes e independientes.
- A analizar los datos usando diferentes tipos de gráficas.

Vocabulario

graph / gráfica: exhibición visual de información o de datos que puede ofrecer una manera rápida de comunicar, de manera clara, una gran cantidad de información, en una cantidad pequeña de espacio.

Por qué es importante

Las gráficas son una manera rápida de comunicar mucha información en un espacio pequeño.

¿Qué muestra mi gráfica?

Has oído decir que un cuadro vale mil palabras. Para los científicos, también es cierto que una gráfica vale mil números. Las gráficas nos brindan una muestra visual de datos reunidos durante los experimentos. Las gráficas también resultan útiles en el mundo de los negocios, los deportes u otras situaciones.

Problema del mundo real

¿De qué manera se utilizan las gráficas de tipo lineal, de barra y un círculo para analizar diferentes clases de datos?

Metas

- **Compara y contrasta** las tres distintas clases de gráficas y la forma en que se usan.
- **Distingue** entre variables dependientes e independientes.

Materiales

regla pequeña	lápiz
transportador	compás
**Material alternativo*	**plantilla de círculo*

Procedimiento

1. **Examina** los datos que aparecen en las tablas.
2. **Comenta** con otros estudiantes qué tipo de gráfica se puede usar para cada tabla de datos.
3. **Haz una gráfica** con los datos de las tablas en otra hoja de papel.

Datos y Observaciones

Tabla de datos 1: Uso de la energía en el hogar

Tipo de energía	Porcentaje
Calefacción y refrigeración	44%
Calentador de agua	14%
Refrigerador	09%
Cocina sencilla y otros	33%

Tabla de datos 2: Movimiento de un objeto

Tiempo (s)	Distancia (m)
0	0
5	3
10	6
15	9

Tabla de datos 3: Promedio de tornados en cada mes

Mes	Promedio No. de Tornados
Marzo	53
Abril	107
Mayo	176
Junio	168
Julio	94

Concluye y aplica

1. **Explica** por qué elegiste el tipo de gráfico para cada tabla.
2. **Define** las variables dependientes e independientes.
3. **Comenta** las ventajas de observar una

gráfica en lugar de mirar sólo los números que aparecen en una tabla de datos.

Diseña tu propio Fija estándares altos para la medición

Para desarrollar el Sistema Internacional de Unidades, los interesados tuvieron que ponerse de acuerdo para establecer los estándares y las definiciones básicas de la escala. Si tuvieras que desarrollar un nuevo sistema de medidas todos tendrían que estar de acuerdo con tus nuevos estándares y definiciones. En esta actividad, tu equipo usará una cuerda para inventar y probar un sistema propio CI (Cuerda Internacional) para medir la longitud.

Problema del mundo real

¿Cuáles son los requisitos para diseñar un sistema nuevo de medidas usando una cuerda?

Formula una hipótesis

Basado en tu conocimiento de estándares y sistemas de medida, formula una hipótesis de cómo las unidades exactas te ayudan a mantener una medición siempre consistente.

Materiales posibles

cuerda
tijeras
marcador
cinta pegante
objetos diversos para estándares

Medidas de seguridad 

Metas

- Diseñar un experimento que involucra inventar y probar tu propio sistema de medidas para la longitud.
- Medir varios objetos con el sistema de medidas de la cuerda.

Prueba tu hipótesis

Haz un diseño

1. Como grupo, ponte de acuerdo y escribe el enunciado de la hipótesis.
2. Como grupo, enumera los pasos que se necesitan para probar la hipótesis. Sé específico y describe exactamente lo que harás en cada paso.
3. Haz una lista de los materiales que necesitarás.
4. Diseña una tabla en tu Diario de ciencias de manera que esté disponible para cuando tu grupo colecte los datos.
5. Mientras lees tu plan, asegúrate de haber escogido un objeto del aula que sirva como estándar. Debe estar en el mismo rango de tamaños de lo que vas a medir.
6. Considera cómo marcarás las divisiones de la escala en tu cuerda. Planea usar diferentes piezas de cuerda para probar divisiones de la escala de diferentes tamaños.
7. ¿Cómo se llama tu nueva unidad de medidas? Ponle una abreviatura a tu unidad. ¿Darás nombre a las divisiones menores de la escala?
8. ¿Qué objetos medirás con tu nueva unidad? Asegúrate de incluir objetos más largos y más cortos que tu cuerda. ¿Medirás cada objeto más de una vez para observar la consistencia?

Sigue tu diseño

1. Asegúrate de que tu maestro(a) aprueba tu plan antes de comenzar.
2. Lleva a cabo el experimento tal y como se planificó.
3. Anota las observaciones que hagas y completa la tabla de datos.

Analiza tus datos

1. De las escalas basadas en tu cuerda, ¿cuál proveerá la medida más exacta de los objetos pequeños? Explica.
2. ¿Cómo anotaste las medidas que estaban entre dos números enteros de tus unidades?

Concluye y aplica

1. Cuando compartes tus resultados con otros grupos, ¿por qué es importante para ellos saber lo que usaste como estándar?
2. Infiere cómo es posible que diferentes números representen la misma longitud de un objeto.

Guía de estudio

Repasa las ideas principales

Refiérete a las figuras de tu libro de texto.

Sección 1 Los métodos científicos

1. La ciencia es una forma de aprender acerca del mundo natural a través de la investigación.
2. Las investigaciones científicas pueden involucrar el hacer observaciones, probar modelos o conducir experimentos.
3. Los experimentos científicos investigan el efecto de una variable sobre otra. Las demás variables se mantienen constantes.
4. Las leyes científicas son patrones que se repiten en la naturaleza. Las teorías intentan explicar cómo y por qué se desarrollan estos patrones.

Sección 2 Estándares de medición

1. Un estándar de medición es una cantidad exacta que la gente está de acuerdo en usar como base de comparación.
2. Cuando se establece un estándar de medición, todas las mediciones se comparan exactamente con la misma cantidad (el estándar). Por lo tanto, todas las medidas pueden compararse unas con otras.
3. Las unidades del SI de uso más común incluyen: longitud (metro), volumen (litro), masa (kilogramo) y tiempo (segundo).
4. En el SI, los prefijos se usan para hacer las unidades básicas más grandes o más pequeñas al multiplicarlas por 10. Con 45,190 cm de alto, las torres gemelas Petronas en Malasia, es el edificio más alto del mundo. Usa un factor de conversión para averiguar cuánto mide en metros.
5. Cualquier unidad SI puede usarse para convertirse en otra unidad relacionada con el SI al multiplicar por el factor de conversión apropiado.

Sección 3 Comunica con gráficas

1. Las gráficas de líneas muestran cambios continuos entre variables relacionadas. Las gráficas de barras se usan para mostrar los datos recogidos por conteo. Las gráficas de círculos muestran cómo una cantidad fija puede romperse en partes.
2. En una gráfica de líneas, la variable independiente siempre se grafica en el eje horizontal *x*. La variable dependiente siempre se grafica en el eje vertical *y*.

Hands-On Activities

MiniLAB (page 3)

1. Answer will vary. Remind students that the answer should reflect the difference between final and initial volume.
2. Students should use the equation $d = m/v$. Remind them that 1 mL = 1 cm^3.
3. Because the pencil floats, its density is less than that of water. Also, its calculated density is less than that of water—1.0.

MiniLAB: Try at Home (page 4)

1. Time is the independent variable on the *x*-axis; temperature is the dependent varable on the *y*-axis.
2. Check students' work. The graph will show decreasing temperature as time increases. The slope of the line would be negative.

Lab (page 5)

Lab Preview

1. The tools will assist in making the graphs accurate and closely match the data on the tables.
2. When you compare your graphs, you can see how accurate each student was in making the graphs match the data on the tables. The graphs that match more closely to each other will be more precise. So the more accurate the graphs are relative to the data tables, the more likely they will be precise compared to each other.

Conclude and Apply

1. Table 1 shows percentages, so a circle graph was used. A line graph was used for table 2 to easily show how the distance changed over time. Table 3 compare amounts, which is clear to depict on bar graphs.
2. Table 1: independent variable, type of energy use; dependent variable, percentage; table 2: independent variable, time; distance is dependent variable; table 3, independent variable, month, dependent variable, average number of tornadoes
3. Graphs make it easier to detect patterns in data.

Lab: Design Your Own (page 7)

Lab Preview

1. The measurements will be too long if the string is not held tightly.
2. A scale division divides a scale of measurement into equal parts.

Analyze Your Data

1. the system with the smallest divisions, because it is the most precise
2. Accept all reasonable answers.

Conclude and Apply

1. so they can reproduce your results
2. When the size of the unit of measurement varies, the number of units used to measure an object also must vary.

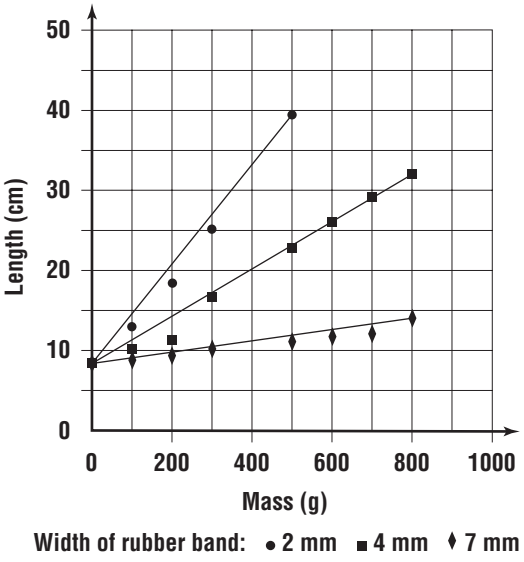
Laboratory Activity 1 (page 9)

Data and Observations

Table 1

Data will vary.

1. Accept all reasonable answers.
2. **Sample data**



Questions and Conclusions

1. The graphs describe how much each rubber band stretches as the mass that is causing it to stretch increases.
2. It measures the "stretchiness" or flexibility of the rubber band.
3. The steepness decreases as the widths of the rubber bands increase.
4. The flexibility of a rubber band decreases as its width increases.
5. Read the length that was measured for a mass of 0 g. A mass of 0 g means that nothing was hanging from the rubber band and the rubber band was unstretched.
6. Answers will vary.
7. Suspend the object from the rubber band and measure the length of the stretched rubber band. Use Graph 1 to determine the mass of the object from the length of the stretched rubber band.

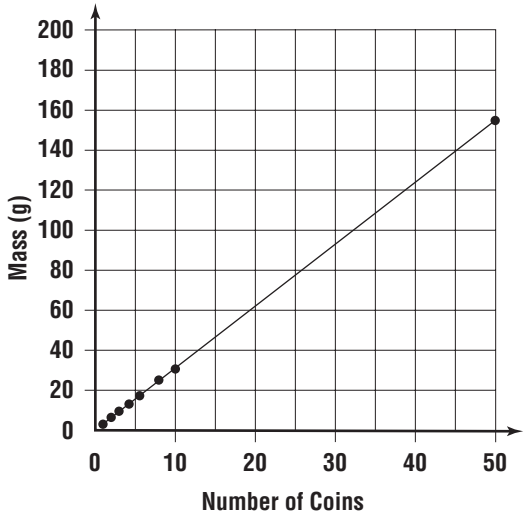
Laboratory Activity 2 (page 13)

Data and Observations

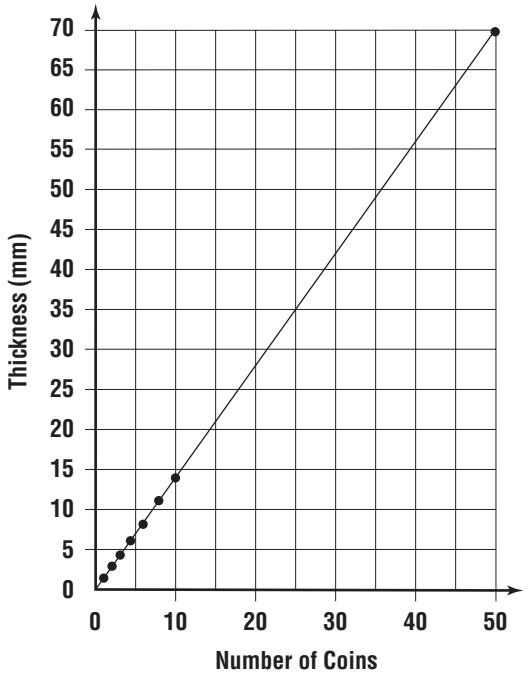
Table 1

Data will vary, depending on coins used.

Graph 1—Sample data



Graph 2—Sample data



Questions and Conclusions

1. Each graph should be a straight line.
2. Answers will vary.
3. Answers will vary.
4. Answers will vary. Differences may be due to accuracy of the measurements, condition of the coins, etc.
5. Answers will vary. Differences may be due to accuracy of the measurements, condition of the coins, etc.
6. Yes. Students can multiply the mass of 1 coin by the number of coins to determine the mass of the coins. However, the masses will be more accurate using an average value.

Meeting Individual Needs

Directed Reading for Content Mastery

Overview (page 19)

1. problem
2. information
3. hypothesis
4. experiments
5. meters
6. grams
7. seconds
8. kelvin

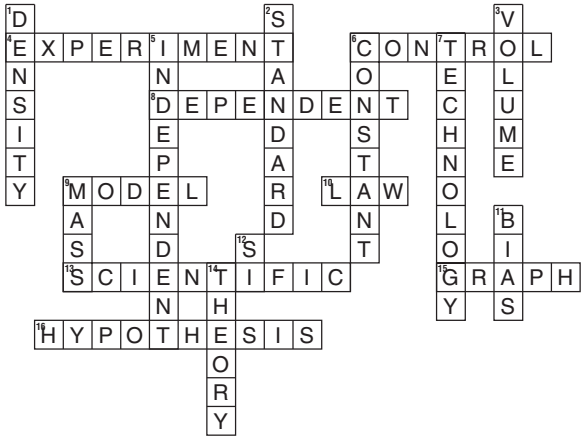
Sections 1 and 2 (page 20)

1. standard
2. science
3. theory
4. scientific law
5. hypothesis
6. model
7. experiment
8. problem
9. accuracy
10. density
11. variable
12. information
13. International
14. volume
15. Kelvin scale

Section 3 (page 21)

1. graph
2. bar graph
3. vertical
4. *y*-axis
5. circle graph
6. line graph
7. percentages
8. independent
9. horizontal
10. information
11. dependent
12. *x*-axis

Key Terms (page 22)



Lectura dirigida para Dominio del contenido

Sinopsis (pág. 23)

1. problema
2. información
3. hipótesis
4. los experimentos
5. los gramos
6. los segundos
7. los kelvins

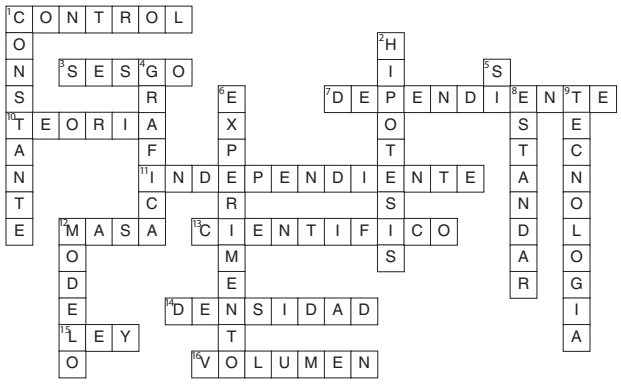
Secciones 1 y 2 (pág. 24)

1. estándar
2. ciencia
3. teoría
4. ley científica
5. hipótesis
6. modelo
7. experimento
8. problema
9. unidad derivada
10. densidad
11. variable
12. información
13. Internacional
14. volumen
15. escala Kelvin

Sección 3 (pág. 25)

1. gráfica
2. gráfica de barras
3. vertical
4. vertical o eje *x*
5. gráfica circular
6. gráfica lineal
7. porcentajes
8. independiente
9. horizontal o eje *y*
10. información
11. dependiente
12. eje *x*

Términos claves (pág. 26)



Reinforcement

Section 1 (page 27)

1. a. 5
b. 4
c. 3
d. 2
e. 1
f. 6

2. An experiment tests a hypothesis by studying the effect of one thing on another.
3. A control is a standard used to compare the test results.
4. Following directions helps to ensure the success of the experiment and helps prevent injuries.
5. A model helps a scientist observe something that is too large, too small, or takes too much time to see completely.
6. No experiments have ever been performed that disprove the law of gravity.
7. No. Sometimes studying technology can produce new scientific knowledge. Carnot and Joule developed ideas about heat from studying the technology of the steam engine.

Section 2 (page 28)

1. length
2. time
3. kilogram
4. kelvin
5. m
6. kg
7. s
8. K
9. m^3, cm^3
10. mL, cm^3, L
11. g/cm^3, kg/m^3
12. K, °C
13. kg, mg
14. s
15. km, m, cm
16. a
17. a
18. b
19. b
20. a
21. b
22. a
23. volume = 6 cm^3

Section 3 (page 29)

1. line graph
2. temperature vs. time for heating of water
3. time
4. horizontal or *x*-axis
5. vertical or *y*-axis
6. circle graph
7. the percentage of elements making up living things
8. oxygen
9. bar graph
10. the height of students in Sarah's class
11. 168 cm

Enrichment

Section 1 (page 30)

1. Multiply the measurements in large paper clips by 1.5. Example: $5.2 \times 1.5 = 7.8$
2. Answers will vary.

Section 2 (page 31)

1. a. 1.0 mm, 1/8 in.
b. 2.5 cm, 15/16 in.
c. 8.9 cm, 3 1/2 in.
d. possible answer:150 lb., 68 kg
e. 360 mL, 12 oz
f. 37°C, 98°F

2. inch = 0.083 feet, 2.540 centimeters; foot = 12 inches, 30.480 centimeters; yard = 3 feet, 0.9144 meter; fathom = 2 yards, 1.829 meters; rod = 16.5 feet, 5.029 meters; perch, used to measure land, another name for a rod, also called a pole; chain = 11 fathoms, 22 yards, 66 feet, 20.12 meters; statute mile = 5,280 feet, 320 rods, 1,760 yards, 1.609 kilometers; nautical mile = 6,080 feet, 1853.2 meters, 1.8532 km; league = 3 nautical miles, 5.5596 kilometers.

3. No; 20,000 leagues would be 60,000 nautical miles. The ocean is only several miles deep.

4. 2 × 55 yards = 110 yards

5. 1 yd = 0.91 m
110 yds × 0.91 m/yd = 100.1 meters for the CFL
100 yds × 0.91 m/yd = 91 meters for the NFL
The CFL field is closer to 100 meters.

Section 3 (page 32)

1. a. 0
b. 98
c. 190
d. 284
e. 426

2. The line is erratic. It would be hard to predict what the shape of the graph beyond the data would be. A straight line allows you to better estimate extrapolated values.

3. Some experimental error will occur when data are collected. The straight line graph averages out these errors and may represent a better picture of the data.

4. As the temperature of a gas increases, its volume increases in a linear fashion.

Note-taking Worksheet (page 33)

Refer to Teacher Outline; student answers are underlined.

Assessment

Chapter Review (page 37)

Part A. Vocabulary Review

1. independent variable (8/3)
2. graph (7/3)
3. model (1/1)
4. experiment (1/1)
5. control (2/1)
6. scientific law (1/1)
7. scientific method (1/1)
8. dependent variable (8/3)
9. variable(2/1)
10. volume (5/2)
11. hypothesis (1/1)
12. technology (3/1)
13. constant (2/1)
14. theory (1/1)
15. precision (/2)
16. mass (5/2)
17. density (5/2)
18. accuracy (/2)
19. bias (1/1)

Part B. Concept Review

1. line graph (7/3)
2. the number of leaves that fell (8/3)
3. the days of the week (8/3)
4. Friday (9/3)
5. Monday, Tuesday, Wednesday (9/3)
6. bar graph (7/3)
7. 0.2 (6/2)
8. 1,200 (6/2)
9. –273 (6/2)
10. 12 (6/2)
11. 283 (6/2)
12. 1,000 (6/2)
13. 12.4 (6/2)
14. 12.0 (6/2)
15. Without standards, measurements made by one person would have little or no value to other people. Also, standards help to keep measurements made by the same person consistent. (5/2)
16. Answers will vary, but may include that time is measured in seconds, medicinal dosages are often given in milligrams and milliliters, and some machines use SI units. (5/2)
17. Answers will vary. Accept all reasonable responses. (6/2)

Chapter Test (page 39)

I. Testing Concepts

1. a (1/1)
2. c (1/1)
3. a (1/1)
4. d (8/3)
5. c (1/2)
6. b (1/1)
7. a (3/1)
8. c (1/1)
9. a (1/1)
10. b (3/1)
11. d (2/1)
12. c (4/2)
13. d (6/2)
14. a (5/2)
15. d (8/3)
16. b (7/3)
17. a (8/3)
18. d (5/2)
19. b (5/2)
20. a (5/2)

II. Understanding Concepts

1. kilometer, meter, centimeter, millimeter, micrometer (4/2)
2. Kelvin, K (5/2)
3. a. plasma, 55% (9/3)
b. red blood cells, 43% (9/3)
c. white blood cells and platelets, 2% (9/3)
4. A diagram can be used to represent an object. (1/1, 7/3)

III. Applying Concepts

1. 400 g (9/3)
2. 60°C (9/3)
3. 333 K (6/2)
4. 0.5 kg (9/3)
5. grams of sugar/100 g of water (8/3)
6. temperature (8/3)

IV. Writing Skills

1. The cubic centimeter is obtained by using a length measurement. This unit is used to express volume. (6/2)
2. Answer will vary. Students should mention that measurements are easier to compare. (6/2)
3. Possible advantages are that SI units are universally accepted and understood. Possible disadvantages are that Kelvin temperatures are large numbers and that changing to SI units would be expensive for some countries. (6/2)
4. Some uses of SI units in the U.S. include measurements in medicine, in science labs, automotive parts, and tools. Accept all reasonable answers. (6/2)

Transparency Activities

Section Focus Transparency 1 (page 44)

Splendid Science

Transparency Teaching Tips

- The methods of science are introduced here. Ask the students to define science. It is the process of observing and studying the world and its related phenomena.
- Science is divided into three major categories—physical, Earth, and life. Physical science is the study of the matter and energy; life science covers the organic world; Earth science is focused on the features and evolution of Earth.
- Scientists conduct their investigations by following the scientific method. Point out that the scientific method is comprised of a number of interrelated steps. In order, these steps are observe, question, hypothesize, predict, test, repeat and verify, organize and analyze data, draw conclusions, and communicate findings.
- Take the statement, "Exercise temporarily raises your heart rate," and walk the students through the steps of the scientific method, changing the idea into an experiment and, in the end, forming a conclusion that can be shared.

Content Background

- Galileo, the early 17th century Italian astronomer, is considered by some scientists to be the founder of experimental science. In his approach to scientific problems, Galileo reduced them to simple terms, analyzed them, sometimes conducted experiments of a sort, came to conclusions, and applied mathematics to validate his ideas.
- Science is about discovery. Observation and questioning lead to attempts at explanation and understanding. It is an exciting and on-going process.

Answers to Student Worksheet

1. Physical science is about matter and energy. Volcanoes are created as a result of the release of energy. Of course, volcanoes and all its components are made of matter. Knowing both sciences would allow you to better understand volcanoes.
2. Science is about discovery and understanding.
3. All three use the scientific method to investigate and understand phenomena.

Section Focus Transparency 2 (page 45)

Pick a Scale and Go with It

Transparency Teaching Tips

- This transparency introduces standards of measurement. Explain that since so much of science is based on experimentation, accurate measurement is crucial. A standardized system of measurement, the International System of Measurements, or SI, has been adopted. This system enables scientists from different countries and cultures to communicate their data to one another.
- Starting with length, work the students through each unit of measurement. Explain the common prefixes (milli-, centi-, and kilo-) used in SI.
- The transparency uses temperature to illustrate the importance of units and labels. In the SI system, temperature is measured in Kelvins. On this scale, zero represents the coldest known temperature, absolute zero. Absolute zero is approximately –273°C (–459°F). Degrees Celsius and Kelvins are the same magnitude, so water freezes around 273K (0°C, 32°F) and boils at 373K (100°C, 212°F). Have the students match each temperature scale, all showing 32°, to the appropriate picture. Ask the students to explain the reasons behind their choices.

Content Background

- The metric system was created by French scientists in the last decade of the 18th century. Officially named the *Systeme Internationale d'Unites,* the system is based on the decimal system and was created to be exact and easy to use.
- The Kelvin scale was named after its creator, Lord Kelvin, a British physicist of the 19th century. He published 661 scientific papers and acquired 70 patents.
- Daniel Fahrenheit, an 18th century German physicist, created a scale that divided the range between the freezing and boiling points of water into 180 segments, beginning at 32°F.

- The slushy water and snow image represents 32°F, and the desert represents 32°C. The superconductor (magnetic levitation) image represents 32 K. Note, however, that the temperature at which electrical resistance entirely disappears is frequently 20K or colder.

Answers to Student Worksheet

1. The slush photograph goes with 32°F, the desert scene is 32°C, and the superconductor image is 32 K.
2. As shown in question one, the same measurement on different scales can mean widely different things. The unit label gives meaning to the measurement by relating it to a specific scale, which provides a frame of reference.
3. Meters are the base unit for length. Mass is measured in grams.

Section Focus Transparency 3 (page 46)

Data by Graph

Transparency Teaching Tips

- The concept introduced here is communicating with graphs. Ask the students what function a graph serves. It represents data visually. Ask the students to explain why graphs are useful in conveying information.
- Explain that graphs turn data into visual representations that are easier to interpret than the data would be if it were left to stand alone.
- Line graphs show the relationship between two variables, such as distance and time. Bar graphs are useful for making numerical comparisons. For example, it might list several students by name and compare their daily amount of exercise time. Circle graphs, like the one on the transparency, show how the parts combine to make a whole.

Content Background

- Graphs can be very useful for showing trends and making predictions, but they can also be misleading. For example, a bar graph with a broken vertical axis exaggerates the difference between two categories.
- The purpose of graphs is to make data more easily understood.

Answers to Student Worksheet

1. It shows that the largest segment, 15–64 year olds, make up 66 percent of the population. No, the photograph is but a small portion of all the people in the United States, and it may be an inaccurate representation of the population.
2. A bar graph or a table could also show this information.
3. Listing every person along with an age gives too much information. In order to be useful, that data needs to be distilled. Researchers break down raw data and use graphs and tables to display it in a comprehensible way.

Teaching Transparency (page 47)

Reading Graphs

Section 3

Transparency Teaching Tips

- Use the transparency to show students the uses of a bar graph.
- List the different types of graphs on the board and have students explain how each is used.

Reteaching Suggestion

- Review the concept that the *x*-axis (horizontal axis) displays the independent variable. As the *x*-axis variable changes, it affects the measure of the other variable. They *y*-axis (vertical axis) is the dependent variable.

Extensions

Activity: Have students, in cooperative groups, create a classroom survey. Have the students choose a topic, pick a question, survey the class, collect the data, put the information into a table, and then transfer the table information to a bar graph.

Challenge: Have students, in pairs, research the life spans of a wide variety of mammals and create a graph to display the results.

Answers to Student Worksheet

1. A graph is a visual display of information or data.
2. number of classrooms
3. line graph, bar graph, and circle graph
4. A scientist would most likely use graphing to show the results of an experiment.
5. *x*-axis
6. A bar graph is useful in comparing information collected by counting.

Assessment Transparency (page 49)

The Nature Science

Section 3

Answers

1. **D.** Students must interpret the data as a trend. Bar graphs and circle graphs do not display trends in data as well as choice D, *Line graphs.*
2. **H.** Students should analyze the data and determine the trend, which is that the object increases its speed by 10 m/s per second. Thus, after 11 seconds, the object will be traveling at a speed of about 110 m/s, which is choice H.
3. **C.** Students should recognize that choice A, *time*, is a variable that already exists in the experiment and choice B, *speed*, is the dependent variable. Choice D, *graph*, is not a variable but a way of communicating results. Choice C, *height*, could be added as an independent variable.

Test-Taking Tip

Review with students the uses and benefits of the three main types of graphs.