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 Activity
- ✔ 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

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Additional Assessment Resources available with Glencoe Science:

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- Vocabulary PuzzleMaker at: **gpscience.com**
- Interactive Chalkboard
- The Glencoe Science Web site at: **gpscience.com**
- An interactive version of this textbook along with assessment resources are available online at: **mhln.com**

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Reproducible Student Pages

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Hands-On Activities

Mini LAB

Determining the Density of a Pencil

Procedure

1. Measure the mass of a **pencil** (unsharpened) in grams.
2. Put 90 mL of **water** into a 100-mL **graduated cylinder.** Lower the pencil, eraser end down, into the cylinder. Push the pencil until it is just submerged. This is known as water displacement. Hold it there and read the new 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 change in volume of the water level.

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

TRY AT HOME Mini LAB

Observing Change Through Graphing

Procedure

1. Place a **thermometer** in a **plastic foam cup** of hot, but not boiling, **water.**
2. Measure and record the temperature every 30 s for 5 min.
3. Repeat the experiment with freshly heated water. This time, cover the cup with a **plastic lid** in between measurements.

Data and Observations

Time	Temperature without cover	Temperature with cover
30 s		
1 min		
1 min 30 s		
2 min		
2 min 30 s		
3 min		
3 min 30 s		
4 min		
4 min 30 s		
5 min		

Analysis

1. Make a line graph of the changing temperature from step 2, showing time on the *x*-axis and temperature on the *y*-axis. Then plot the changing temperature from step 3 on the same graph.

2. Use the graph to describe the cooling process in each of the trials.

Converting Kitchen Measurements

Lab Preview

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

1. Why should none of the foods in this lab be eaten?

2. What SI units are measured by a balance and a graduated cylinder?

Look through a recipe book. Are any of the amounts of ingredients stated in SI units? Chances are, English measurements are used. How can you convert English measurements to SI units?

Real World Questions

How do kitchen measurements compare with SI measurements?

Safety Precautions

Materials

balance
100-mL graduated cylinder
measuring cup
measuring teaspoon
measuring tablespoon
corn meal
dried beans
dried rice
potato flakes
water
vinegar
salad oil

Goals

- **Determine** a relationship between two systems of measurements.
- **Calculate** the conversion factors for converting English units into SI units.

Procedure

1. Use the appropriate English measuring cup or spoon to measure the amounts of each ingredient shown in the table.
2. Use a balance to measure the mass in grams of each dry ingredient. Use a graduated cylinder to measure the volume in milliliters of each liquid ingredient.
3. **Record** each SI measurement in the table in the Data and Observations section.

Data and Observations

Table 1

English to SI Conversions

Ingredient	English measure	SI measure
Water	1/2 cup	
Corn meal	2 cups	
Salad oil	4 tablespoons	
Dried rice	1/2 cup	
Potato flakes	3 cups	
Vinegar	1 teaspoon	
Dried beans	3 cups	

LAB (continued)

Conclude and Apply

1. **Calculate** the number of grams in one cup of each dry ingredient. Calculate the number of milliliters in one cup, one teaspoon, and one tablespoon of each liquid ingredient.

2. **Write** conversion factors that will convert each English unit to an SI unit for each ingredient.

3. **Calculate** how many milliliters you would measure if a recipe called for three tablespoons of salad oil.

4. **Compare and contrast** your conversion factors for the dry ingredients and your conversion factors for the liquid ingredients.

Communicating Your Data

Write a recipe used in your home converting all the English units to SI units.

Design Your Own

Setting High Standards for Measurement

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 activity, your team will use string to devise and test its own SI (String International) system for measuring length.

Real World Question

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 to 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. 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. Which of your string scale systems will provide the most accurate measurement of small objects? Explain.

2. How did you record measurements that were between two whole numbers of your units?

Conclude and Apply

1. When sharing your results with other groups, why is it 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.

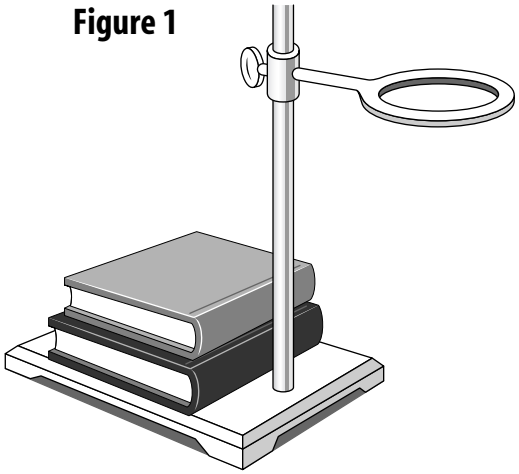
Materials

ring stand
ring clamp
several heavy books
3 rubber bands, equal lengths, different widths
2 plastic-coated wire ties, 10 cm and 30 cm long
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 0 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

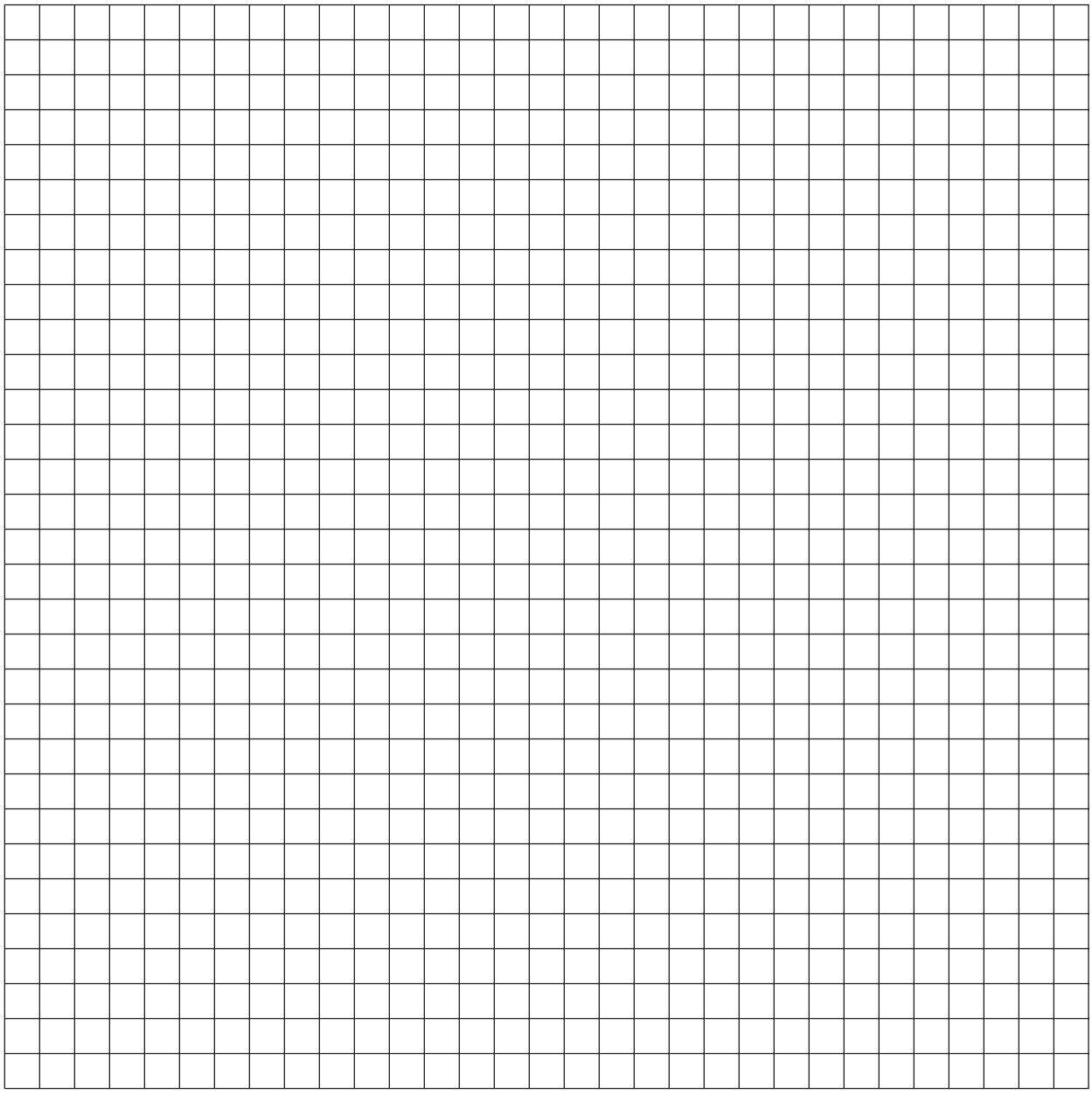
Mass (g)	Length of rubber band (cm)		
	_____ mm width	_____ mm width	_____ mm width
0			
100			
200			
300			
500			
600			
700			
800			

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.

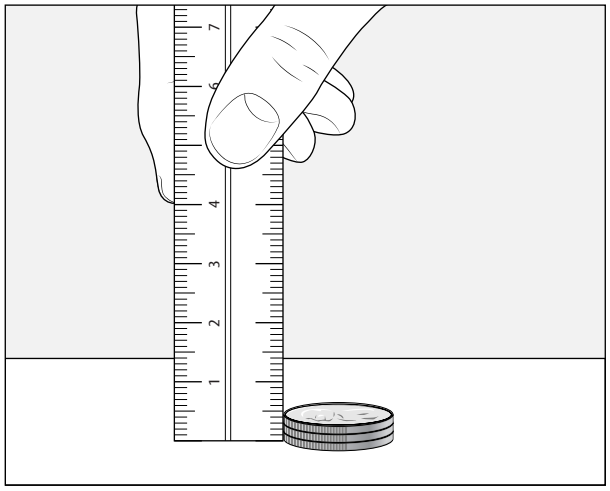
Materials

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

Procedure

1. Using the balance, determine the mass of 1 coin, 2 coins, 3 coins, 4 coins, 6 coins, 8 coins, and 10 coins to the nearest 0.1 g. Record the masses in Table 1 in the Data and Observations section.
2. Measure the thickness of 1 coin, 2 coins, 3 coins, 4 coins, 6 coins, 8 coins, and 10 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)

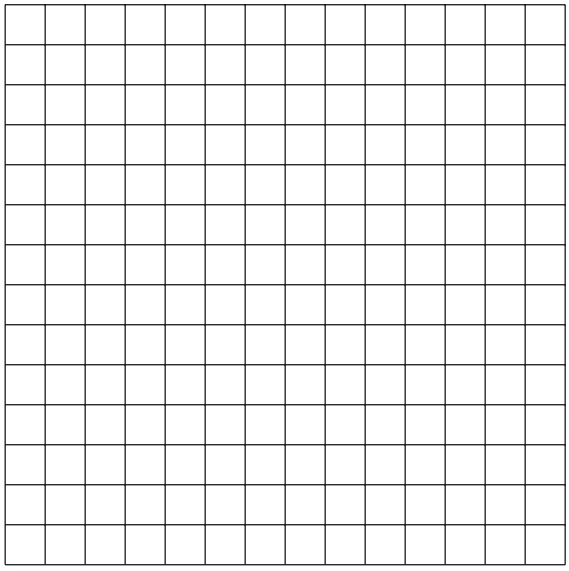
Data and Observations

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.

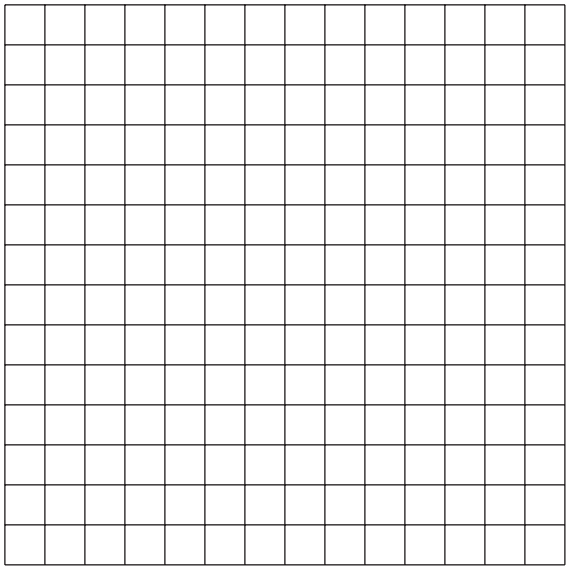
Table 1

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.

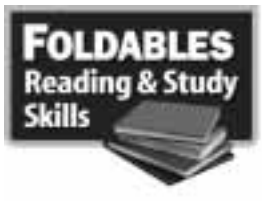
6. Could you use the mass of 1 coin to determine the mass of 2, 3, 4, 6, 8, and 10 coins? Why or why not?

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?

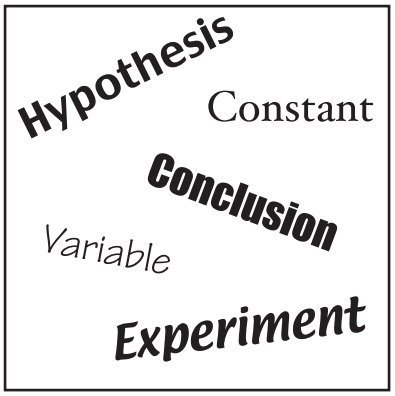
_____ Can you compare the relationships among the mass, length, and number of coins in a roll?

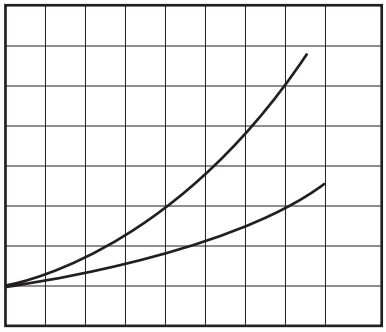


The Nature of Science

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

Scientific Processes





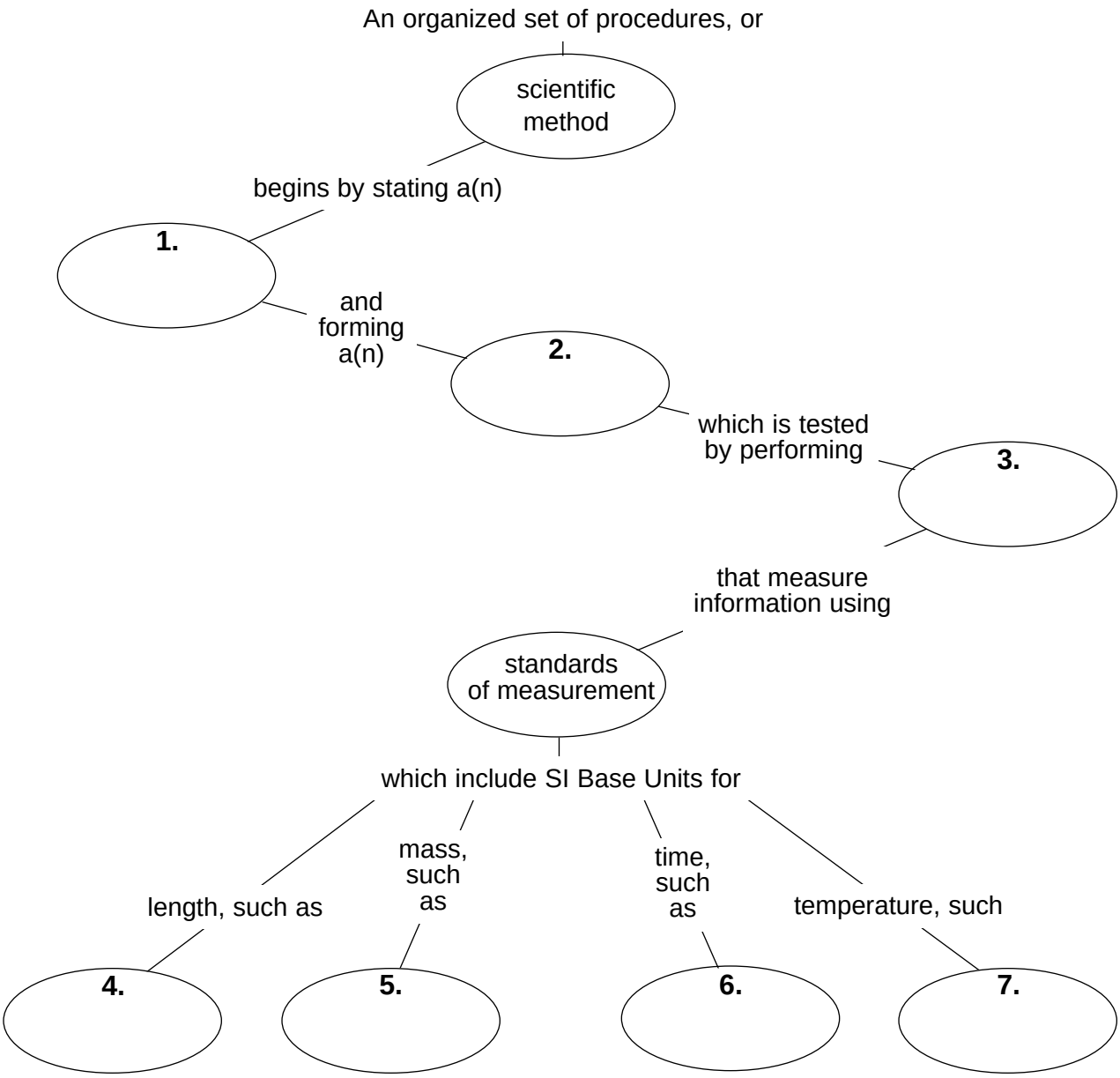
Meeting Individual Needs

Directed Reading for Content Mastery

Overview The Nature of Science

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

hypothesis	**experiments**	**kelvins**
meters	**grams**	**seconds**
problem		



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.** Different SI units are combined to obtain a *rvidede tniu.*

_____ **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 _____.

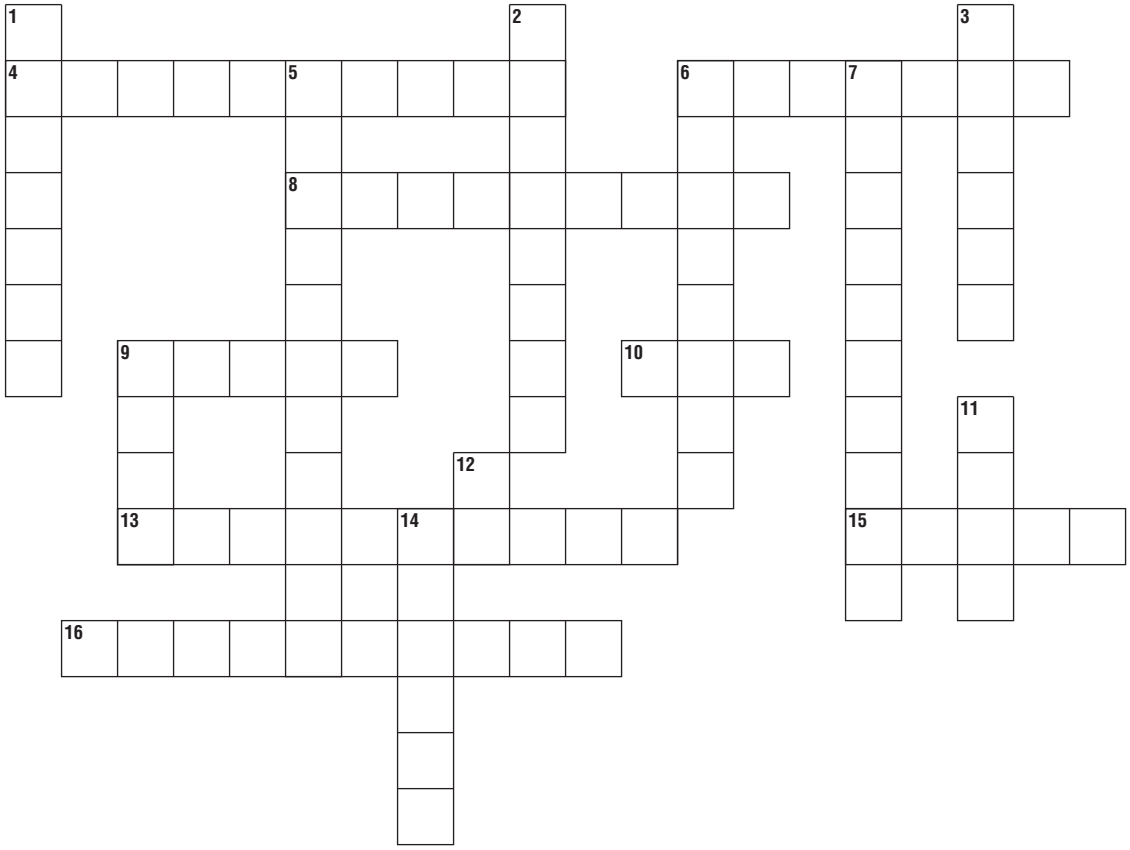
Meeting Individual Needs

Name Date Class

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. Factor that depends on the value of the other variable; _____ 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; _____ 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; _____ variable
6. Factor that doesn't vary in an experiment
7. Applied science
9. The amount of matter in an object
11. Expectations change how results are viewed
12. Abbreviation for International System of Units
14. An explanation from observations and experiments

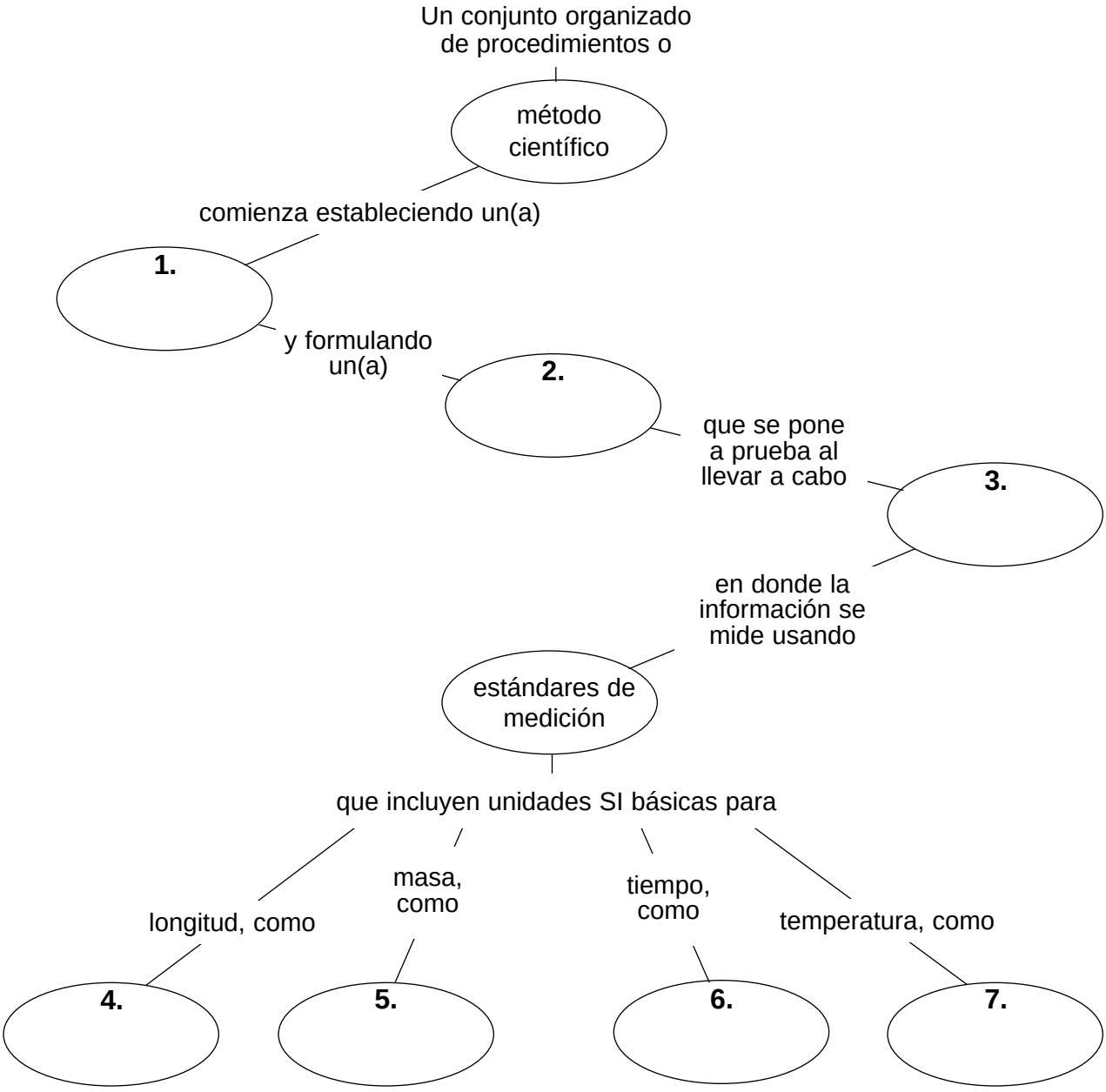
Meeting Individual Needs

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



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.*

_____ **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.** Las diferentes unidades SI se combinan para obtener un(a) *daunid raddeaiv.*

_____ **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.*

Satisface las necesidades individuales

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 _____.

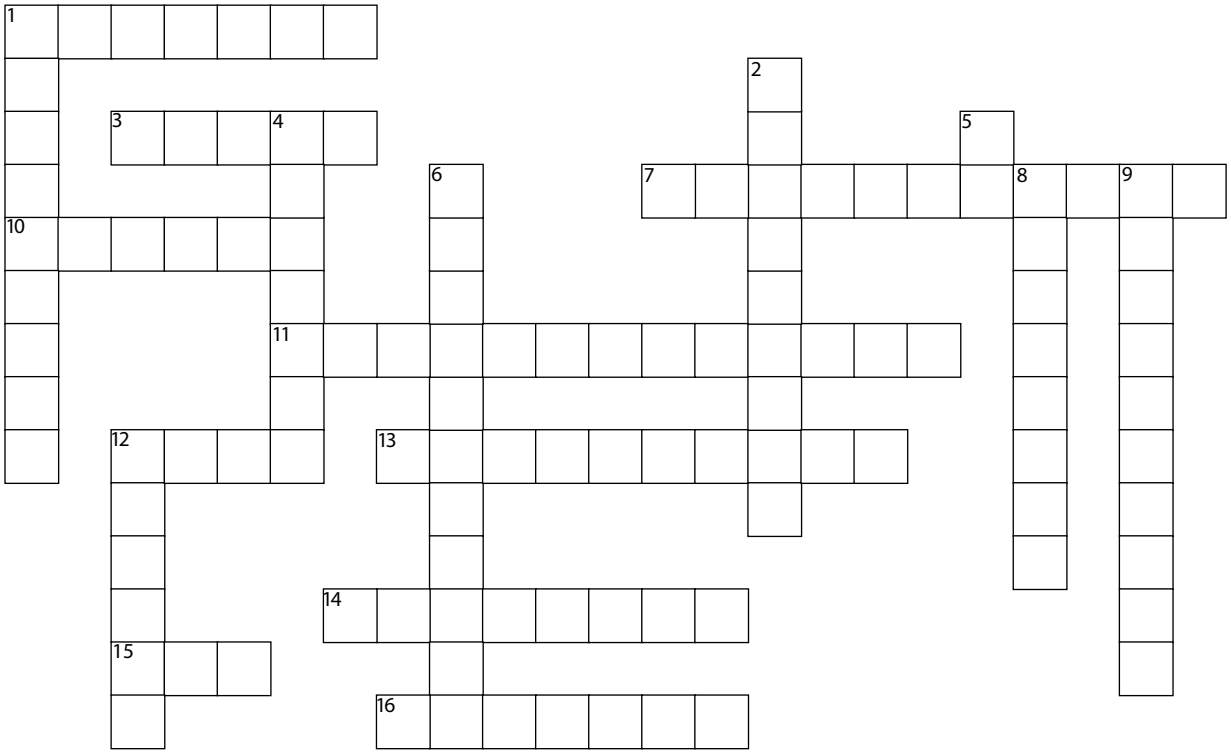
_____ **12.** En una gráfica lineal, el eje horizontal se llama también eje _____.

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
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. estándar de comparación de 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

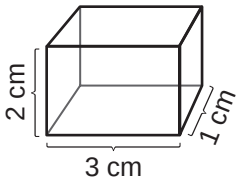
_____ **20.** **a.** 400 cm = 4.0 m **b.** 400 cm = 0.40 m

_____ **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

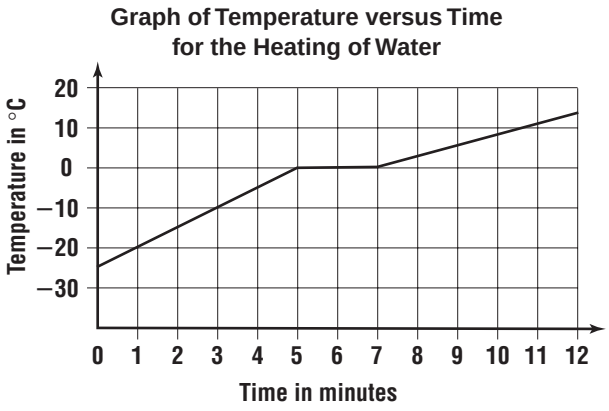
Name Date Class

SECTION 3 Reinforcement

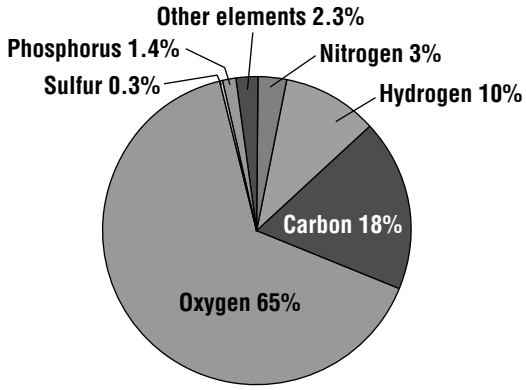
Communicating with Graphs

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

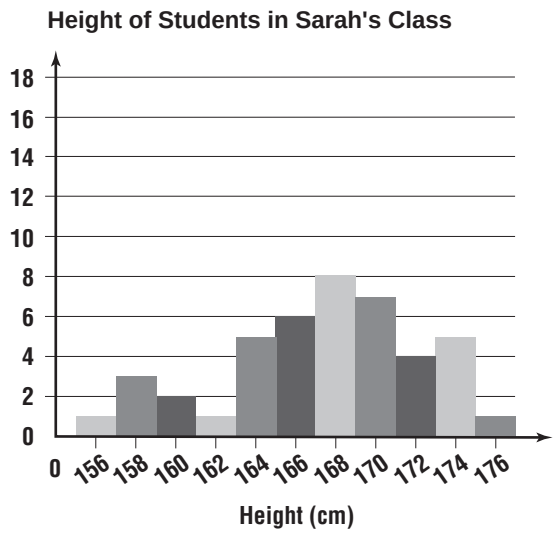
Graph A



Graph B



Graph C



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

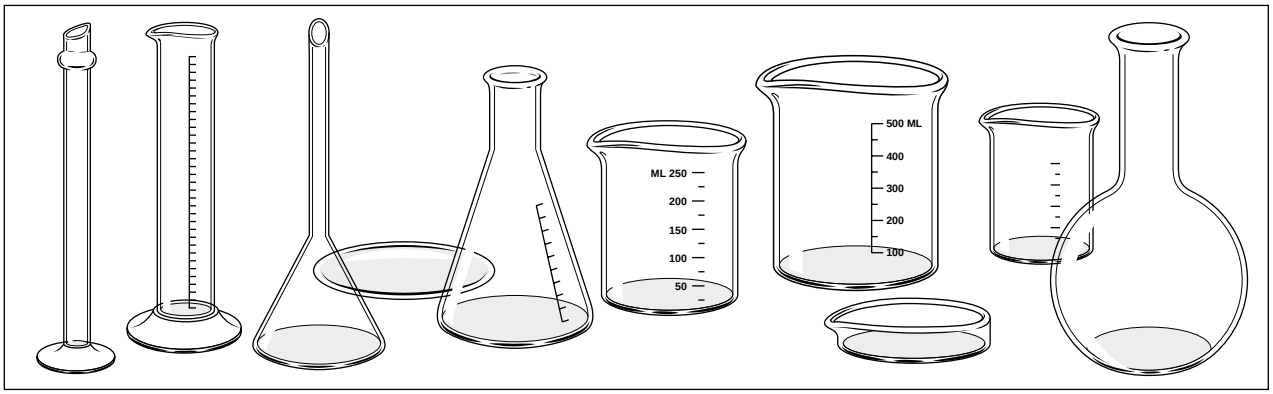
One type of problem solving that we often encounter is determining the size of something. When this type of problem occurs, we do not always have the appropriate measuring tools available. For example, you may be out shopping and need to know if a large box will fit in the trunk of your parents' car.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

Meeting Individual Needs

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. the thickness of a dime	_____	_____
b. the 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?

_____

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 known 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. _____—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 about something that always seems to be true.

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

Meeting Individual Needs

Note-taking Worksheet (continued)

F. _____—applied science helping people

Section 2 Standards of Measurement

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

B. Measurements must have a number and a _____.

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

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

D. _____—the amount of space an object occupies

E. _____—measure of matter in an object

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

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

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.

Assessment

Name Date Class

Chapter Review

The Nature of Science

Part A. Vocabulary Review

Directions: *Complete the following sentences using the terms listed below.*

model	**mass**	**graph**	**hypothesis**
standard	**dependent variable**		**independent variable**
technology	**theory**	**control**	**volume**
constant	**experiment**	**scientific law**	**density**

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

_____ **2.** A visual display of information or data is a(n) _____.

_____ **3.** An idea, event, or object is represented by a(n) _____.

_____ **4.** A test of a hypothesis is a(n) _____.

_____ **5.** A standard for comparison that is used in an experiment is a(n) _____.

_____ **6.** A rule of nature that tells you what will happen under certain conditions is a(n) _____.

_____ **7.** The independent variable in an experiment may cause a change in the _____.

_____ **8.** The amount of space occupied by an object is called its _____.

_____ **9.** A testable prediction is a(n) _____.

_____ **10.** Another term for applied science is _____.

_____ **11.** A variable that doesn't change in an experiment is called a _____.

_____ **12.** An explanation based on many observations supported by experimental results is a(n) _____.

_____ **13.** An exact quantity that people agree to use for comparison is a(n) _____.

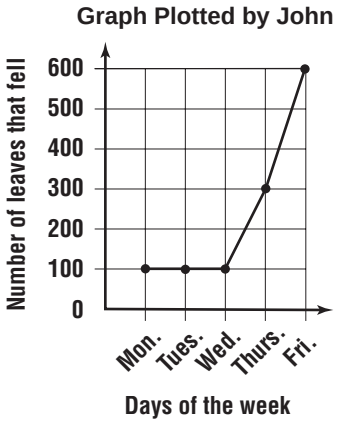
_____ **14.** A measurement of the quantity of matter is _____.

_____ **15.** The mass per unit volume of a material is _____.

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

Transparency Activities

Name Date Class

SECTION 1 Section Focus Transparency Activity

Splendid Science

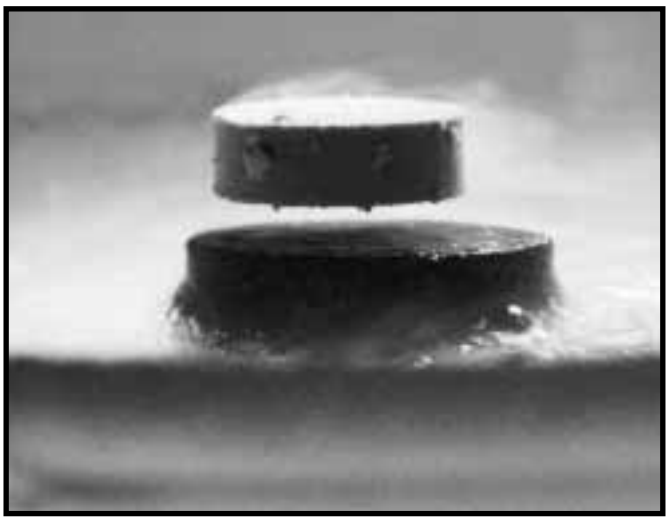
Scientists work in different areas and different ways. These photos illustrate the three main divisions of science—life science, Earth science, and physical science. Scientists often work in more than one area, requiring them to have a broad base of knowledge. A biologist, for example, needs to know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

SECTION 2 Section Focus Transparency Activity

Pick a Scale and Go with It

What does it mean if someone says that the temperature is thirty-two 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?**

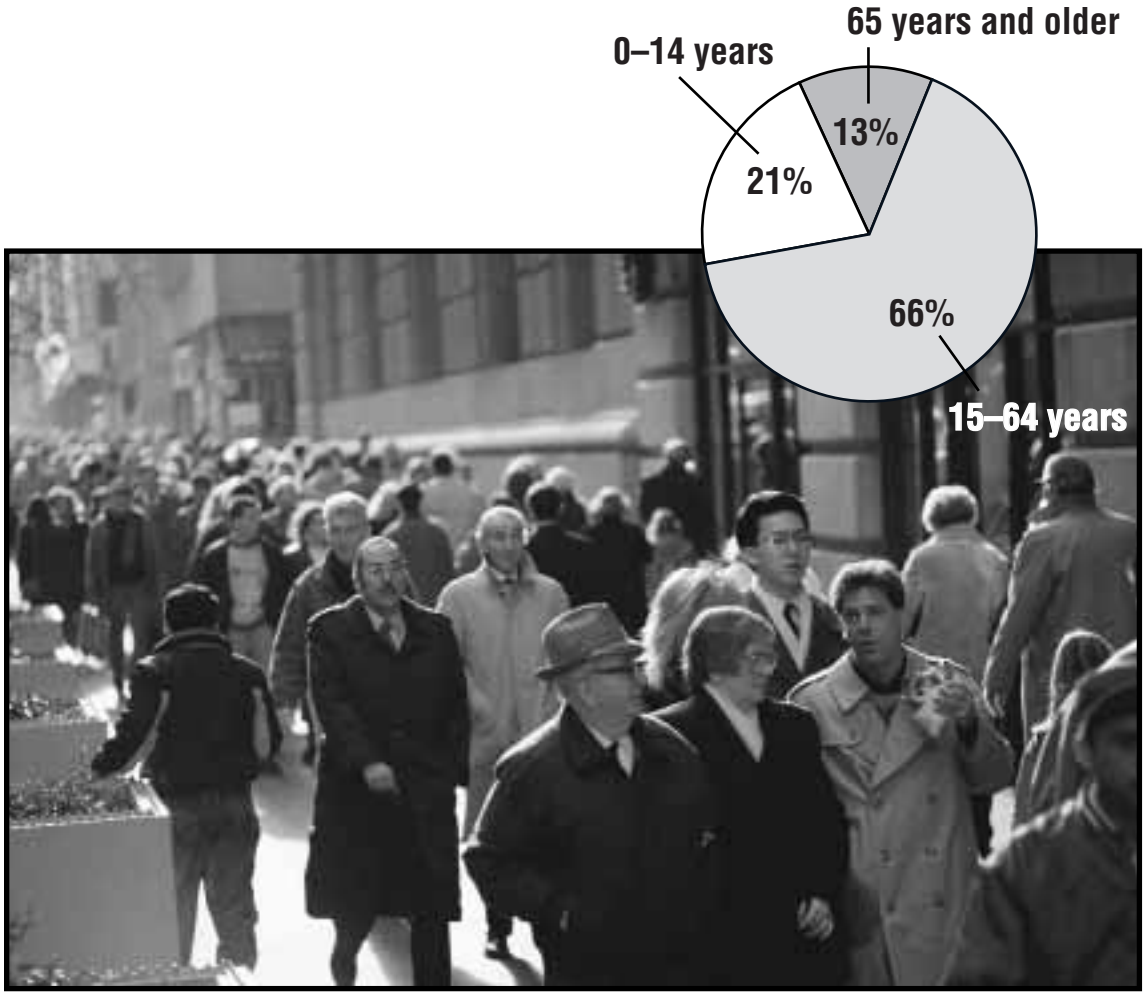
Name Date Class

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.

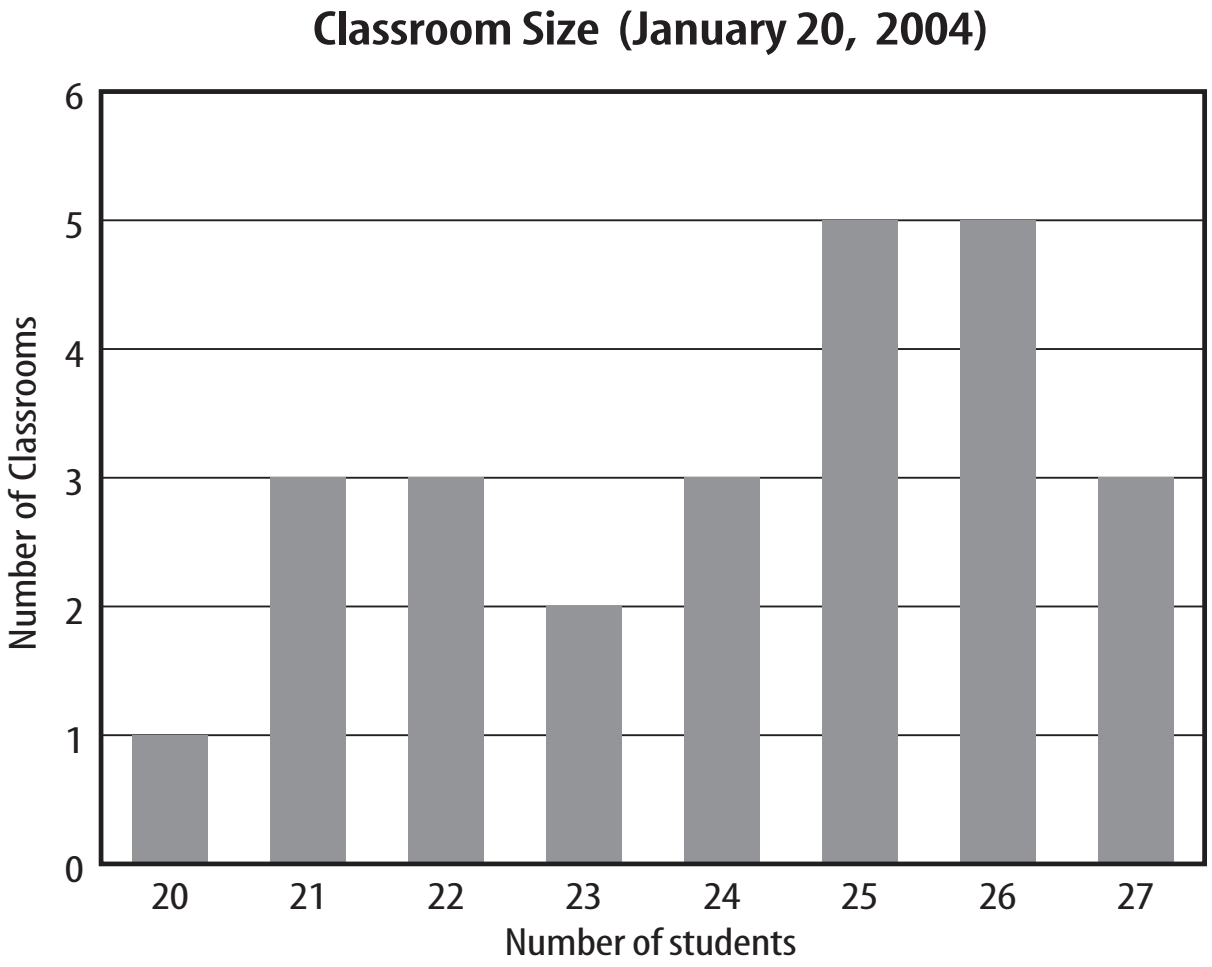
United States Population by Age



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
B pie graph
C circle graph
D line graph

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

F 90 m/s
G 100 m/s
H 110 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
B speed
C height
D graph