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Oklahoma OCCT

5

Science

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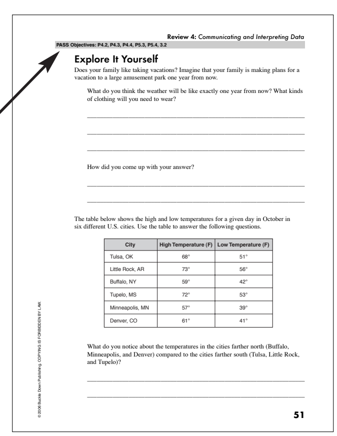
To the Teacher:

"PASS Objective" codes are listed for each review in the table of contents and for each page in the shaded gray bars that run across the tops of the pages in the workbook (see example to the right). These codes indicate which PASS Objectives are covered in a given review or on a given page.

A "(3)" or "(4)" at the end of a code indicates that the code refers to an Objective from Grade 3 or Grade 4.


Review 4: *Communicating and Interpreting Data*

PASS Objectives: P4.2, P4.3, P4.4, P5.3, P5.4, 3.2

Explore It Yourself

Does your family like taking vacations? Imagine that your family is making plans for a vacation to a large amusement park one year from now.

What do you think the weather will be like exactly one year from now? What kinds of clothing will you need to wear?

How did you come up with your answer?

The table below shows the high and low temperatures for a given day in October in six different U.S. cities. Use the table to answer the following questions.

City	High Temperature (F)	Low Temperature (F)
Tulsa, OK	68°	51°
Little Rock, AR	73°	56°
Buffalo, NY	59°	42°
Tupelo, MS	72°	53°
Minneapolis, MN	57°	39°
Denver, CO	61°	41°

What do you notice about the temperatures in the cities farther north (Buffalo, Minneapolis, and Denver) compared to the cities farther south (Tulsa, Little Rock, and Tupelo)?

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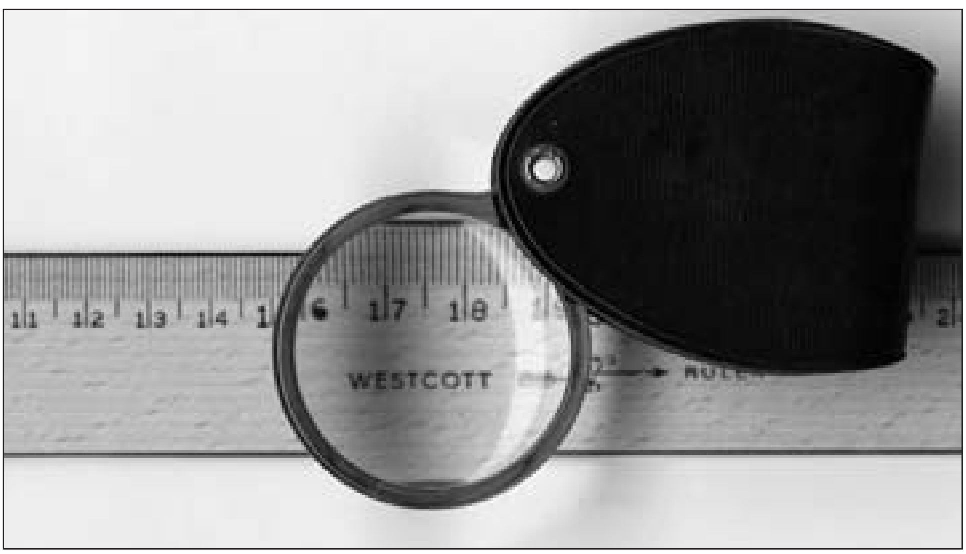
Review 1

Measuring

Before starting their experiments, scientists almost always research the question they are about to test. They read books and articles, and they speak with other scientists who might be able to help. Not all of the information a scientist uncovers is useful. Scientists must judge what information will be important for their experiments and what information they should ignore. Scientists take many measurements during an experiment, sometimes measuring the same thing over and over. They do this to be sure that their findings are as accurate and error free as possible. Careful measurements are important because they help strengthen the results of the experiment. If the person performing an experiment takes careless measurements, the outcome of the experiment may not be reliable. This process may sound hard, but it can be creative and fun, too. Are you ready to collect data like a scientist?



Words to Know

balance	hand lens	ruler
compass	instrument	spring scale
data	magnet	stopwatch
error	meterstick	thermometer
fair test	metric system	U.S. customary system
graduated cylinder	microscope	

PASS Objectives: P.1.1, P.5.2, 1.2

Thinking like a scientist

You have probably already performed some simple measurements, such as using a meterstick to determine your height or stepping on a scale to weigh yourself. These are scientific measurements and the results (your height and weight) are called **data**. How would you go about collecting data in the following examples?

The length of your shoelaces: ____________________

The distance from one classroom to the next: ____________________

The length of your favorite song: ____________________

The hottest day of the past month: ____________________

The heaviest rock in a park that you can lift: ____________________

To collect data like a scientist, you must make measurements. By measuring things, you can put them into mathematical terms. Math is like a language that anyone can understand. If we use numbers to describe our world, we make sure that anyone who reads our results thinks of them in roughly the same way. If you call a boat *huge*, for example, someone might imagine a rowboat, while someone else might imagine an ocean liner. But if you said that the boat was 110 meters long, then everyone would know exactly how long the boat is.

Here is an example to show why it is important to use mathematical language to describe observations. Mandy and her classmate Felix were observing an icicle that formed outside their classroom window to see whether the icicle would grow or shrink over the next few days. On Monday, they made their first observations and wrote them down in a journal. On Tuesday, they made another set of observations and compared their findings. Surprisingly, Felix thought the icicle shrank, but Mandy thought it grew. Neither of them used measurements to describe their observations.

Why do you think that Mandy and Felix observed different things?

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By themselves, human senses are not very reliable for scientific observations. Our senses can play tricks on us in many ways; that's why measuring is so important. If Mandy and Felix get the chance to observe another icicle, they'll measure its changes, day by day. This way, they'll have an easier time figuring out what happens to it.

In science, a **fair test** usually involves doing an experiment more than once. Repeating an experiment helps you judge your experiments correctly. In other words, if an unusual event happens during any one test, you will know that the event is unusual because you can compare it to the other times you ran the test. Repeating tests gives you a chance to see a pattern.

Wilton wants to figure out if QuickGrow plant food will make his tomato plant grow faster. He grows three tomato plants: one with no plant food, one with QuickGrow plant food, and one with Jasper's Plant Food. Why does Wilton use three tomato plants instead of growing just one with QuickGrow?

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Measurements are very important in science because science is about observing natural events and looking for patterns in data. Measurements allow us to make sure that our observations are correct. For precise measurements, you need to use measuring **instruments** such as metersticks, balances, stopwatches, and so on. Even these precise measurements will have some small amount of **error**. There is error in every experiment and in every measurement. Scientists understand that no measurement is exact and they prepare for errors in their experiments.

Heather wants to time how long it takes her dog to fetch a ball. Can you think of any ways in which an error could be made in this measurement?

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PASS Objectives: P1.1, 1.2

Because most measurements involve a small amount of error, it is extremely important to take more than one measurement. Multiple measurements can be checked against each other to show which ones are most accurate. This is one reason why scientists prefer multiple sources of data, and why experiments need to be repeated many times before their results can be accepted.

When you use a measuring tool, you need to know what unit of measurement it uses. You need to remember two major systems of measurement:

(1) The **metric system** is the most commonly used system in the world for making measurements. The basic units in the metric system are the meter for length, the kilogram for weight, and the liter for volume (the amount of space something takes up).

(2) The **U.S. customary system** was developed in England, so its units are often called *English unit*s. This system is used by most people in the United States for everyday measurements, though most scientists in the United States use the metric system. This system uses inches, feet, gallons, ounces, and pounds.

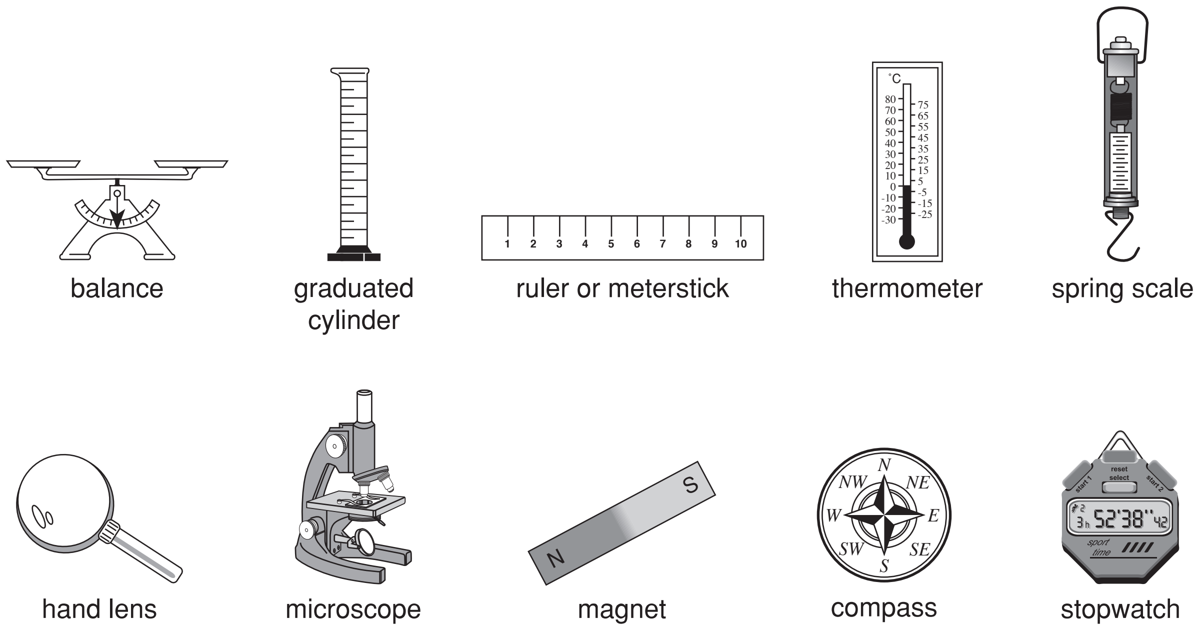
Using scientific instruments

Part of what makes science so much fun is that you get to work with many different instruments to collect data. **Balances** are used to measure mass in units called grams (g), kilograms (kg), or milligrams (mg). One kilogram is equal to 1,000 grams. You may have a type of balance in your home—a measuring scale. **Spring scales** are used to measure mass or weight (to find the gravitational force that an object has). The object being measured is hung on the scale, and the more the spring stretches out, the more gravitational force it has. A **graduated cylinder** is a glass or plastic container used to measure an amount of liquid. Graduated cylinders often measure liquid in milliliters (mL) and normally hold between 10 and 100 mL. One liter (L) is equal to 1,000 milliliters. **Thermometers** determine how warm or cold things are, such as the weather outside or your bath water. To find temperature, scientists normally use units called degrees Celsius. **Rulers** and **metersticks** measure the length of different objects.

Hand lenses are used to see small details on an object, such as the structure of a bird's feather. When you need to get an even closer view, you would use a **microscope**; these incredible tools allow you to see very tiny objects. Microscopes let scientists see details that are too small to see by eyesight alone. You can even see individual cells. You can use **magnets** to attract metal objects, and a **compass** can detect a magnetic field. With an ordinary clock, you can figure out how many hours, minutes, or seconds an event lasts. A **stopwatch** lets you figure out the time an event takes to occur (such as a race) to a fraction of a second. None of the instruments you will use are toys, however, so be mindful of the safety rules for each one.

PASS Objectives: P1.1, 1.2

Science Instruments



Name the instrument that a scientist should use in each situation.

Observing the blood cells of a giraffe: ______________________

Measuring the speed of a sprinter: ______________________

Finding out how much rain fell last night: ______________________

Figuring out the mass of a quarter: ______________________

Keys to Keep

- You can measure objects, liquids, events, organisms, and distances by using scientific instruments and recording your data.
- When you record your data, remember to account for any error in the measuring process.
- Repeat your experiment over and over to check your results for accuracy. Remember that the more you repeat your work, the stronger your data will become.
- When you use a scientific instrument, note what unit of measurement you are using. Make sure that you record your results using the same unit.

PASS Objectives: P1.1, P5.2, 1.2

Explore It Yourself

Step 1: What is your wingspan? (Hint: Stretch your arms and fingers out as far as they will go at the sides of your body. The measurement from your left fingertips to your right fingertips is your wingspan.)

Your teacher will give you a meterstick for this activity.

Before measuring, estimate your wingspan in centimeters (cm).

Record your estimate here: __________ cm

Have three people in your group each use a meterstick to measure your wingspan (in cm). Record each person's measurement in the spaces below. Don't peek at each other's measurements; just record whatever each person gets.

__________ cm __________ cm __________ cm

Step 2: What is the temperature in the classroom?

Your teacher will give you a thermometer for this activity.

Before measuring, estimate the temperature in degrees Celsius (° C).

Record your estimate here: __________° C

Have three people in your group each use a thermometer to measure the temperature in the classroom. Don't peek at each other's measurements; just record whatever each person gets.

__________° C __________° C __________° C

Step 3: What is the mass of one of your notebooks?

Your teacher will give you a gram scale for this activity.

Before measuring, estimate the mass of the notebook in grams (g).

Record your estimate here: __________ g

Have three people in your group each use a gram scale to measure the mass of the notebook. Don't peek at each other's measurements; just record whatever each person gets.

__________ g __________ g __________ g

PASS Objectives: P1.1, P5.2, 1.2

What Does It Mean?

1. Look at the first measurements your group took. Were all of the measurements the same?

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   ____

   If not, why do you think this is? Could your group have done anything different to make sure that the measurements were equal?

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2. Did you record the same classroom temperature as the rest of your group?

   ____

   What do you think would happen if you were to record the temperature of the classroom near an open window or by an air vent? Do you think the measurement would change?

   ____

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   ____

   ____

   ____

PASS Objectives: P1.1, P5.2, 1.2

3. Imagine that you weighed one of your partner's notebooks instead of your own. Would you expect the mass to change?

____

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Imagine that you weighed your notebook at the beginning of the year and again at the end of the year. In what ways would the measurement of mass be affected?

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4. Were any of your estimates close to your actual measurements?

____

Can you think of some examples in which estimates would be better to use than precise scientific measurements?

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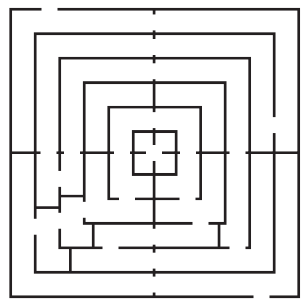
5. Imagine that you are building a maze and you need to determine the shortest route through the maze.



Think about all of the instruments you have read about in this review. Which instruments and units would you use in order to find the shortest route through the maze? Explain your choices.

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People in Science

Have you ever wondered how some packaged foods seem to stay fresh forever? It's because they're filled with *preservatives*. We can thank Lloyd A. Hall for the preservative industry that allows meats, breads, cereals, spices, and even medicines to stay fresh for long periods of time. Before Hall did his work, people had trouble keeping foods fresh. When preservatives were added, they often ruined the taste of food. Then along came Hall, who was a food chemist working with sodium nitrates and nitrites. He developed a successful combination of these salts that keeps foods fresh without changing their flavors. Hall worked for various food companies during his career. During World War II, he worked for the U.S. government to create foods for soldiers. He developed more than 100 patents in the United States, Britain, and Canada. After his retirement, he worked as a consultant to the Food and Agriculture Organization of the United Nations.

Lloyd A. Hall
(United States 1894–1971)

OCCT Practice

1

Milligrams are the <u>best</u> units to use to measure the

A mass of a penny.

B temperature of a pool.

C mass of a person.

D length of a paper clip.

2

What is the best way to cut down on errors in your data?

A Estimate the results before you do the experiment.

B Let someone else perform the experiment and record data.

C Repeat the experiment multiple times and record data.

D Use different units of measurement for each experiment.

3

Which units would be <u>best</u> to measure the length of a housefly's body?

A milliliters

B millimeters

C grams

D meters

4

Aba and Victor want to determine how much water they drink each day. Aba is using milliliters for his measurements, while Victor is using liters for his measurements. Can Aba and Victor compare their measurements?

A Yes, but they will have to convert their data to the same unit.

B Yes, milliliters and liters can be compared in an experiment.

C No, milliliters and liters are different and cannot be compared.

D No, milliliters and liters are not units used to measure liquid.

5

Which of the following could change how deep the water is in a swimming pool?

A the temperature of the water

B the length of the swimming pool

C the color of the pool water

D the number of swimmers in the pool

6

Three fifth graders want to find out which of their bicycles is the fastest at coasting down a hill. Which of the following scientific instruments would provide the most useful data?

A meterstick and stopwatch

B telescope and camera

C microscope and balance

D barometer and thermometer

7

What would you use to measure the volume of a cup of soup?

A ruler

B thermometer

C graduated cylinder

D gram scale