

STUDENT RESOURCES

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Rubberball/Getty Images

PROBLEM-SOLVING SKILLS

Make Comparisons

Why Learn this Skill?

Suppose you want to buy a portable MP3 music player, and you must choose among three different models. You would probably compare the characteristics of the three models, such as price, amount of memory, sound quality, and size to determine which model is best for you.

In the study of Earth science, you often compare the structures and functions of one type of rock or planet with another. You will also compare scientific discoveries or events from one time period with those from a different time period. This helps you gain an understanding of how the past has affected the present.

Learn the Skill

When making comparisons, you examine two or more groups, situations, events, or theories. You must first decide what items will be compared and determine which characteristics you will use to compare them. Then identify any similarities and differences.

For example, comparisons can be made between the two minerals shown on this page. The physical properties of halite can be compared to the physical properties of quartz.

Practice the Skill

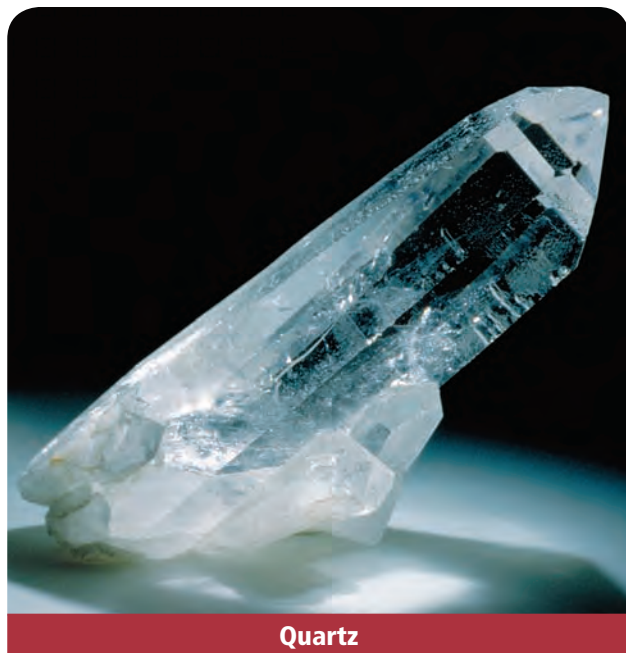
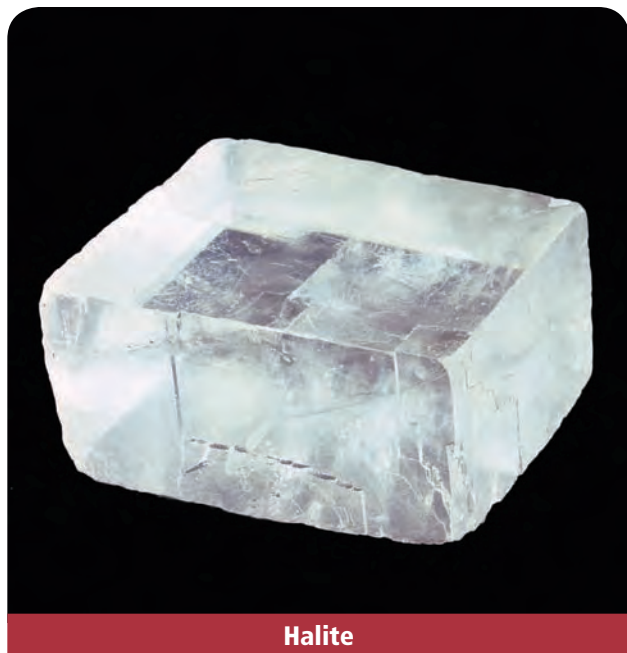
Create a table with the title *Mineral Comparison*. Make two columns. Label the first column *Halite*, and the second column *Quartz*. List all of your observations of these two minerals in the appropriate column of your table. Similarities you might point out are that both minerals are solids that occur as crystals, and both are inorganic compounds. Differences might include that halite has a cubic crystal structure, whereas quartz has a hexagonal crystal structure.

When you have finished the table, answer these questions.

1. What items are being compared? How are they being compared?
2. What properties do the minerals have in common?
3. What properties are unique to each mineral?

Apply the Skill

Make Comparisons Read two editorial articles in a science journal or magazine that express different viewpoints on the same issue. Identify the similarities and differences between the two points of view.



Analyze Information

Why Learn this Skill?

Analyzing, or looking at separate parts of something to understand the entire piece, is a way to think critically about written work. The ability to analyze information is important when determining which ideas are more useful than others.

Learn the Skill

To analyze information, use the following steps:

- Identify the topic being discussed.
- Examine how the information is organized—identify the main points.
- Summarize the information in your own words, and then make a statement based on your understanding of the topic and what you already know.

Practice the Skill

Read the following excerpt from *National Geographic*. Use the steps listed above to analyze the information and answer the questions that follow.

His name alone makes Fabien Cousteau, grandson of the late Jacques, a big fish in the world of underwater exploration. Now he's taking that big-fish status to extremes. The Paris-born, New York-based explorer had become a virtual shark, thanks to his new shark-shaped submarine. He uses the sub to dive incognito among the oceans' top predators, great white sharks.

Created at a cost of more than \$100,000, the 4.3-meter-long contraption is designed to look and move as much like the real thing as possible. It carries a single passenger, who fits inside lying down, propped up on elbows to navigate and observe. "This is akin to being the first human being in the space capsule in outer space," Cousteau said. "It's pretty similar. You have no idea what's going to happen; it's a prototype."

Cousteau used the submarine to make a documentary intended to demystify the notion that great white sharks are ruthless, mindless killers. Great whites have been around for more than 400 million years. Anything that has survived that long isn't "stupid," he said.

Cousteau calls the sub Troy, in reference to the mythical Trojan horse statue, in which Greek soldiers were spirited into the fortress kingdom of Troy. Propelled by a wagging tail and covered in a flexible, skinlike material, the sub—created by Cousteau and a team of scientists



Fabien Cousteau

Fabien Cousteau enters his shark-shaped submarine

and engineers—swims silently. The steel-ribbed, womb-like interior is filled with water, requiring Cousteau to wear a wet suit and use scuba gear to breathe.

Importantly, Troy allows Cousteau to be a shark, not shark bait. At the heart of the project is a desire to observe what great white sharks do when people aren't around to watch. Prior to this, most shark observations have come from humans sitting in cages and enticing the predators with bait—conditions that spawn unnatural behaviors, Cousteau said. "Now all of the sudden we can see what they do as white sharks rather than as trained circus animals," he said.

While Cousteau is reluctant to guess what the sharks thought when Troy invaded their space, the explorer said they seemed to act naturally. Some even puffed their gills and gaped toward Troy — actions thought to be communication signals. And though a few sharks made aggressive gestures, none of the predators attacked the shark-shaped sub.

1. What topic is being discussed?
2. What are the main points of the article?
3. Summarize the information in this article, and then provide your analysis based on this information and your own knowledge.

Apply the Skill

Analyze Information Find a short, informative article on a new scientific discovery or new application of science technology, such as hybrid-car technology. Analyze the information and make a statement of your own.

Synthesize Information

Why Learn this Skill?

The skill of synthesizing involves combining and analyzing information gathered from separate sources or at different times to make logical connections. Being able to synthesize information can be a useful skill for you as a student when you need to gather data from several sources for a report or a presentation.

Learn the Skill

Follow these steps to synthesize information:

- Select important and relevant information.
- Analyze the information and build connections.
- Reinforce or modify the connections as you acquire new information.

Suppose you need to write a research paper on global levels of atmospheric carbon dioxide (CO₂) levels. You need to synthesize what you learn to inform others. You can begin by detailing the ideas and information from sources you already have about global levels of atmospheric carbon dioxide. A table such as **Table 1** could help you categorize the facts from these sources.

Year	Global Atmospheric CO ₂ Concentration (ppm)	Year	Global Atmospheric CO ₂ Concentration (ppm)
1745	279	1935	307
1791	280	1949	311
1816	284	1958	312
1843	287	1965	318
1854	288	1974	330
1874	290	1984	344
1894	297	1995	361
1909	299	1998	367
1921	302	2005	385

Then you might select an additional article about greenhouse gases, such as the one below.

According to the National Academy of Scientists, Earth's surface temperature has risen about one degree Fahrenheit in the past 100 years. This increase in temperature can be correlated to an increase in the concentration of carbon dioxide and other greenhouse gases in the atmosphere. How might this increase in temperature affect Earth's climate?

Carbon dioxide is one of the greenhouse gases that helps keep temperatures on Earth warm enough to support life. However, a buildup of carbon dioxide and other greenhouse gases such as methane and nitrous oxide can lead to global warming, an increase in Earth's average surface temperature. Since the industrial revolution in the 1800s, atmospheric concentrations of carbon dioxide have increased by almost 30 percent, methane concentrations have more than doubled, and nitrous oxide concentrations have increased approximately 15 percent. Scientists attribute these increases to the burning of fossil fuels for automobiles, industry, and electricity, as well as deforestation, increased agriculture, landfills, and mining.

Practice the Skill

Use the table and the passage on this page to answer these questions.

1. What information is presented in the table?
2. What is the main idea of the passage? What information does the passage add to your knowledge about the topic?
3. By synthesizing the two sources and using your own knowledge, what conclusions can you draw about global warming?

Apply the Skill

Synthesize Information Find two sources of information on the same topic and write a short report. In your report, answer these questions: What kinds of sources did you use? What are the main ideas of each source? How does each source add to your understanding of the topic? Do the sources support or contradict each other?

Take Notes and Outline

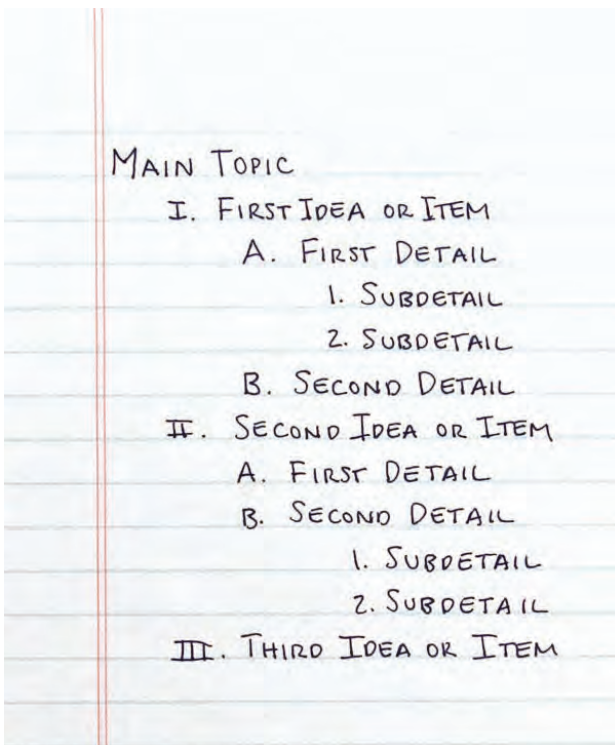
Why Learn this Skill?

One of the best ways to remember something is to write it down. Taking notes—writing down information in a brief and orderly format—not only helps you remember, but also makes studying easier.

Learn the Skill

There are several styles of note-taking, but the goal of every style is to explain information and put it in a logical order. As you read, identify and summarize the main ideas and details that support them and write them in your notes. Paraphrase—that is, state in your own words—the information rather than copying it directly from the text. Use note cards or develop a personal “shorthand”—using symbols to represent words—to represent the information in a compact manner.

You might also find it helpful to create an outline when taking notes. When outlining material, first read the material to identify the main ideas. In textbooks, look at the section headings for clues to main topics. Then identify the subheadings. Place supporting details under the appropriate headings. The basic pattern for outlines is shown below:



Practice the Skill

Read the following excerpt from *National Geographic*. Use the steps you just read about to take notes and create an outline. Then answer the questions that follow.

Dinosaur fans still have a lot to look forward to. According to a new estimate of dinosaur diversity, the 21st century will bring an avalanche of new discoveries. “We only know about 29 percent of all dinosaurs out there to be found,” said study co-author Peter Dodson, a paleobiologist and anatomy professor at the University of Pennsylvania in Philadelphia.

Dodson and statistics professor Steve Wang of Swarthmore College, in Swarthmore, Pennsylvania, made a statistical analysis of an exhaustive database of all known dinosaur genera (the taxonomic group one notch above species). They then used this data to estimate the total number of genera preserved in the fossil record.

The pair predicts that scientists will eventually discover 1,844 dinosaur genera in total—at least 1,300 more than the 527 recognized today from remains other than isolated teeth. What’s more, the duo believes that 75 percent of these dinos will be discovered within the next 60 to 100 years and 90 percent within 100 to 140 years, based on an analysis of historical discovery patterns.

The tally applies only to specimens preserved as fossils. Many other types of dinosaurs likely roamed the Earth during the dinosaurs’ 160-million-year reign, but remains from these species will never be known to science, the researchers say.

1. What is the main topic?
2. What are the first, second, and third ideas?
3. Name two details for each of the ideas.
4. Name two subdetails for each of the details.

Apply the Skill

Take Notes and Outline Scan a science journal for a short article about a new laboratory technique. Take notes by using shorthand or by creating an outline. Summarize the article using only your notes.

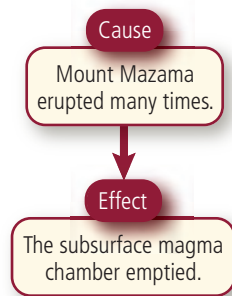
Understand Cause and Effect

Why Learn this Skill?

In order to understand an event, you should look for how that event or chain of events came about. When scientists are unsure of the cause for an event, they often design experiments. Although there might be an explanation, an experiment should be performed to be certain the cause created the event you observed. This process examines the causes and effects of events.

Learn the Skill

Calderas can form when the summit or side of a volcano collapses into the magma chamber that once fueled the volcano. An empty magma chamber can *cause* the volcano to collapse. The caldera that forms is the *effect*, or result. The figure below shows how one event — **he cause** — led to another — **he effect**.



You can often identify cause-and-effect relationships in sentences from clue words such as the following.

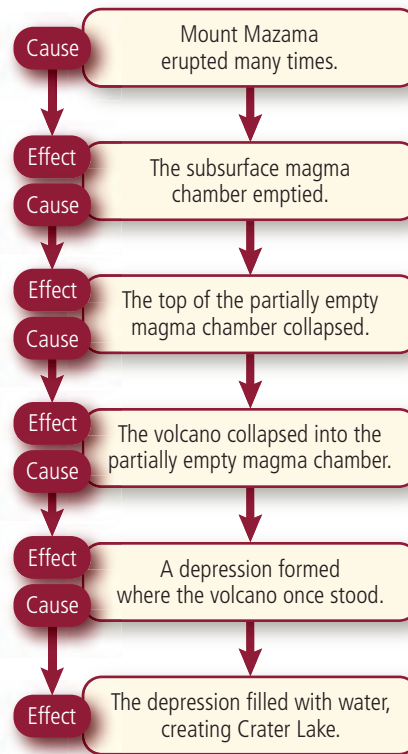
because	reduced
due to	as a result
so that	that is why
therefore	for this reason
thus	consequently
led to	in order to

Read the sample sentences below.

“The volcano collapsed into the partially empty magma chamber. As a result, a depression was formed where the volcano once stood.”

In the example above, the cause is the collapse of the volcano. The cause-and-effect clue words “as a result” tell you that the depression is the effect of the collapsing volcano.

In a chain of events, an effect often becomes the cause of other events. The next chart shows the complete chain of events that occur when a caldera forms.



Practice the Skill

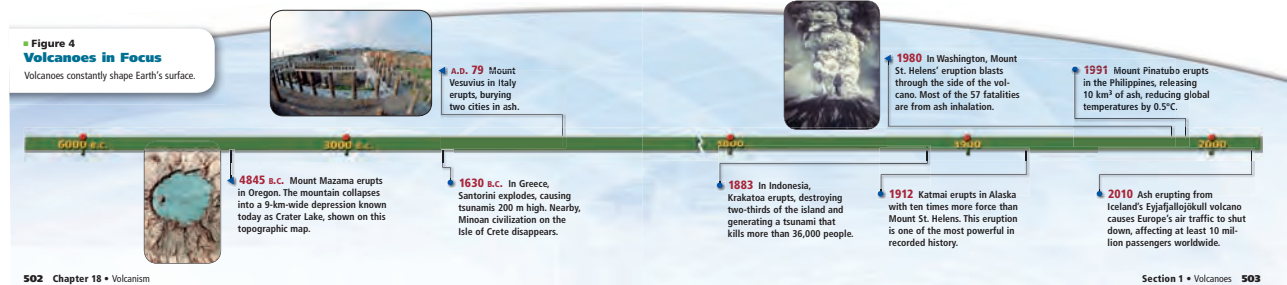
Make a chart like the one above showing which events listed below are causes and which are effects.

- As water vapor rises, it cools and changes back to a liquid.
- Droplets inside clouds join to form bigger drops.
- Water evaporates from oceans, lakes, and rivers.
- Water vapor rises into the atmosphere.
- Water droplets become heavy and fall as rain or snow.

Apply the Skill

Understand Cause and Effect Read an account of a recent scientific event or discovery in a science journal. Determine at least one cause and one effect of that event. Show the chain of events in a chart.

Read a Time Line



Why Learn this Skill?

When you read a time line such as the one above, you see not only when an event took place, but also what events took place before and after it. A time line can help you develop the skill of chronological thinking. Developing a strong sense of chronology—when and in what order events took place—will help you examine relationships among the events. It will also help you understand the causes or results of events.

Learn the Skill

A time line is a linear chart that lists events that occurred on specific dates. The number of years between dates is the time span. A time line that begins in 1910 and ends in 1920 has a ten-year time span. Some time lines are divided into centuries. The twentieth century includes the 1900s, the nineteenth century includes the 1800s, and so on.

Time lines are usually divided into smaller parts, or time intervals. On the two time lines below, the first time line has a 300-year time span divided into 100-year time intervals. The second time line has a six-year time span divided into two-year time intervals.

Practice the Skill

Study the time line above and then answer these questions.

1. What time span and intervals appear on this time line?
2. How much more powerful was Katmai's eruption than Mount St. Helens' eruption?
3. How many years after Santorini erupted did Vesuvius erupt?
4. How many years apart were Krakatoa's eruption and Mt. Pinatubo's eruption?

Apply the Skill

Read a Time Line Sometimes a time line shows events that occurred during the same period but are related to two different subjects. The time line above shows events related to volcanoes between 6000 b.c. and a.d. 2000. Copy the time line and events onto a piece of paper. Then use a different color to add in events related to earthquakes during this same time span.



Analyze Media Sources

Why Learn this Skill?

To stay informed, people use a variety of media sources, including print media, broadcast media, and electronic media. The Internet has become an especially valuable research tool. It is convenient to use, and the information it contains is plentiful. Whichever media source you use to gather information, it is important to analyze the source to determine its accuracy and reliability.

Learn the Skill

There are a number of issues to consider when analyzing a media source. The most important one is to check the accuracy of the source and content. The author and publishers or sponsors should be credible and clearly indicated. To analyze print media or broadcast media, ask yourself the following questions.

- Is the information current?
- Are the sources revealed?
- Is more than one source used?
- Is the information biased?
- Does the information represent both sides of an issue?
- Is the information reported firsthand or secondhand?

For electronic media, ask yourself these questions in addition to the ones above.

- Is the author credible and clearly identified?
- Are the facts on the Web site documented?
- Are the links within the Web site appropriate and current?
- Does the Web site contain links to other useful resources?

Practice the Skill

To practice analyzing print media, choose two articles on global warming, one from a newspaper and the other from a news-magazine. Then answer these questions.

1. What points are the authors of the articles trying to make? Were they successful? Can the facts be verified?

2. Did either article reflect a bias toward one viewpoint or another? List any unsupported statements.
3. Was the information reported firsthand or secondhand? Do the articles seem to represent both sides fairly?
4. How many sources can you identify in the articles? List them.

To analyze electronic media, read through the list of links provided by your teacher. Choose one link from the list, read the information on that Web site, and then answer these questions.

1. Who is the author or sponsor of the Web site?
2. What links does the Web site contain? How are they appropriate to the topic?
3. What sources were used for the information on the Web site?

Apply the Skill

Analyze Media Sources Think of a national issue on which public opinion is divided. Read newspaper features, editorials, and Web sites, and monitor television reports about the issue. Which news sources more fairly represents the issue? Which news sources have the most reliable information? Can you identify any biases? Can you verify the credibility of the news source?



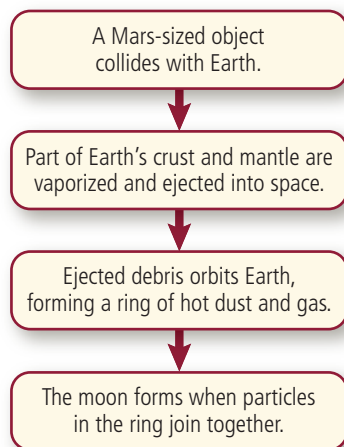
Use Graphic Organizers

Why Learn this Skill?

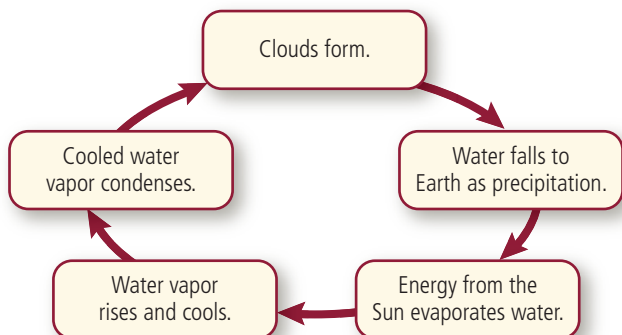
While you read this textbook, you will be looking for important ideas or concepts. One way to arrange these ideas is to create a graphic organizer. In addition to Foldables®, you will find various other graphic organizers throughout your book. Some organizers show a sequence, or flow, of events. Other organizers emphasize the relationship among concepts. Developing your own organizers while you read will help you better understand and remember what you read.

Learn the Skill

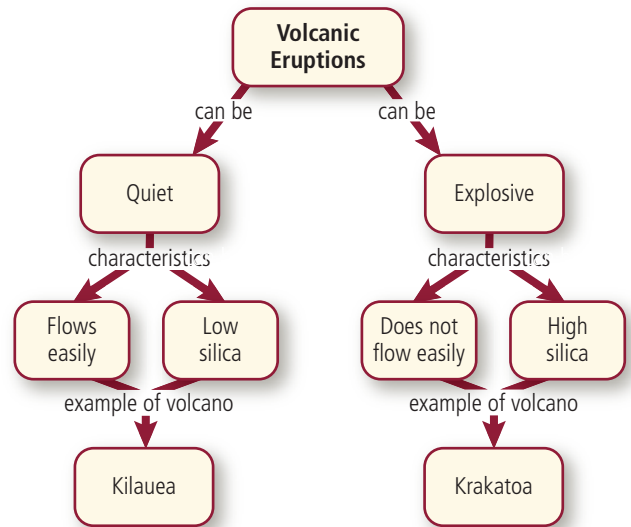
An **events chain concept map** is used to describe a sequence of events, such as a stage of a process or procedure. When making an events-chain map, first identify the event that starts the sequence and add events in chronological order until you reach an outcome.



In a **cycle concept map**, the series of events do not produce a final outcome. The event that appears to be the final event relates back to the initiating event. Therefore, the cycle repeats itself.



A **network tree concept map** shows the relationship among concepts, which are written in order from general to specific. The words written on the lines between the circles, called linking words, describe the relationships among the concepts. The concepts and the linking words can form sentences.



Practice the Skill

1. Create an events chain concept map of the events in sedimentary rock formation.
2. Create a cycle concept map of the nitrogen cycle. Make sure that the cycle shows the event that appears to be the final event relating back to the starting event.
3. Create a network tree concept map with these words: *Cenozoic, trilobites, eras, Paleozoic, mammals, dinosaurs, first land plants, Gondwana, Mesozoic, early Pangaea, late Pangaea*. Add linking words to describe the relationships between the concepts.

Apply the Skill

Use Graphic Organizers Create an events chain concept map of the scientific method. Create a cycle concept map of the water cycle. Create a network tree concept map of pollution that includes air and water, sources of each pollution type, and examples of each type of pollution.

Debate Skills



Frances Roberts/Alamy Images

New research always is leading to new scientific theories. There are often opposing points of view on how this research is conducted, how it is interpreted, and how it is communicated. *The Earth Science and Society* features in your book offer a chance to debate a current controversial topic. Here is an overview on how to conduct a debate.

Choose a Position and Research

First, choose an Earth science issue that has at least two opposing viewpoints. The issue can come from current events, your textbook, or your teacher. These topics could include global warming or fossil fuel use. Topics are stated as affirmative declarations such as “Global warming is not detrimental to the environment.”

One speaker will argue the positive position—the viewpoint that supports the statement—and another speaker will argue the negative position—the viewpoint that disputes the statement. Either individually or with a group, choose your position for the debate. The viewpoint that you choose does not have to reflect your personal belief. The purpose of debate is to create a strong argument supported by scientific evidence.

After choosing your position, conduct research to support your viewpoint. Use the Internet, find articles in your library, or use your textbook to gather evidence to support your argument.

A strong argument contains scientific evidence, expert opinions, and your own analysis of the issue. Research the opposing position also. Becoming aware of what points the other side might argue will help you to strengthen the evidence for your position.

Hold the Debate

You will have a specific amount of time, determined by your teacher, in which to present your argument. Organize your speech to fit within the time limit: explain the viewpoint that you will be arguing, present an analysis of your evi-

dence, and conclude by summing up your most important points. Try to vary the elements of your argument. Your speech should not be a list of facts, a reading of a newspaper article, or a statement of your personal opinion, but an organized analysis of your evidence presented in your own manner of speaking. It is also important to remember that you must never make personal attacks against your opponent. Argue the issue. You will be evaluated on your overall presentation, organization and development of ideas, and strength of support for your argument.

Additional Roles There are other roles that you can play in a debate. You can act as the timekeeper. The timekeeper times the length of the debaters’ speeches and gives quiet signals to the speaker when time is almost up (usually a hand signal).

You can also act as a judge. There are important elements to look for when judging a speech: an introduction that tells the audience what position the speaker will be arguing, strong evidence that supports the speaker’s position, and organization. It is helpful to take notes during the debate to summarize the main points of each side’s argument. Then, decide which debater presented the strongest argument for his or her position. You can have a class discussion about the strengths and weaknesses of the debate and other viewpoints on this issue that could be argued.

Experimental data is often expressed using numbers and units. The following sections provide an overview of the common system of units and some calculations involving units.

Measure in SI

The International System of Measurements, abbreviated SI, is accepted as the standard for measurement throughout most of the world. The SI system contains seven base units. All other units of measurement can be derived from these base units.

Table 2 SI Base Units

Measurement	Unit	Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Temperature	kelvin	K
Amount of substance	mole	mol
Intensity of light	candela	cd

Some units are derived by combining base units. For example, units for volume are derived from units of length. A liter (L) is a cubic decimeter (dm^3 , or $\text{dm} \times \text{dm} \times \text{dm}$). Units of density (g/L) are derived from units of mass (g) and units of volume (L).

When units are multiplied by factors of ten, new units are created. For example, if a base unit is multiplied by 1000, the new unit has the prefix *kilo-*. One thousand meters is equal to one kilometer. Prefixes for some units are shown in **Table 3**.

To convert a given unit to a unit with a different factor of ten, multiply the unit by a conversion factor. A conversion factor is a ratio equal to one. The equivalents in **Table 3** can be used to make such a ratio. For example, $1 \text{ km} = 1000 \text{ m}$. Two conversion factors can be made from this equivalent.

$$\frac{1000 \text{ m}}{1 \text{ km}} = 1 \quad \text{and} \quad \frac{1 \text{ km}}{1000 \text{ m}} = 1$$

To convert one unit to another factor of ten, choose the conversion factor that has the unit you are converting from in the denominator.

$$1 \text{ km} \times \frac{1000 \text{ m}}{1 \text{ km}} = 1000 \text{ m}$$

A unit can be multiplied by several conversion factors to obtain the desired unit.

Table 3 Common SI Prefixes

Prefix	Symbol	Equivalents
mega-	M	1×10^6 base units
kilo-	k	1×10^3 base units
hecto-	h	1×10^2 base units
deka-	da	1×10^1 base units
deci-	d	1×10^{-1} base units
centi-	c	1×10^{-2} base units
milli-	m	1×10^{-3} base units
micro-	μ	1×10^{-6} base units
nano-	n	1×10^{-9} base units
pico-	p	1×10^{-12} base units

Practice Problem 1 How would you convert 1000 micrometers to kilometers?

Convert Temperature

The following formulas can be used to convert between Fahrenheit and Celsius temperatures. Notice that each equation can be obtained by algebraically rearranging the other. Therefore, you only need to remember one of the equations.

Conversion of Fahrenheit to Celsius

$$^{\circ}\text{C} = \frac{(^{\circ}\text{F}) - 32}{1.8}$$

Conversion of Celsius to Fahrenheit

$$^{\circ}\text{F} = 1.8(^{\circ}\text{C}) + 32$$

Make and Use Tables

Tables help visually organize data so that it can be interpreted more easily. Tables are composed of several components—a title describing the contents of the table, columns and rows that separate and organize information, and headings that describe the information in each column or row.

Depth (m)	Distance (m)	Average Speed (m/day)
0	13.1	0.198
20	13.1	0.198
60	12.8	0.194
100	12.2	0.185
140	11.2	0.170
180	9.6	0.145

Looking at this table, you should not only be able to pick out specific information, but you should also notice trends.

Practice Problem 2 If scientists drilled another 40 m into the glacier, what would the speed of the glacier's movement be at that depth?

Make and Use Graphs

Scientists often organize data in graphs. The types of graphs typically used in science are the line graph, the bar graph, and the circle graph.

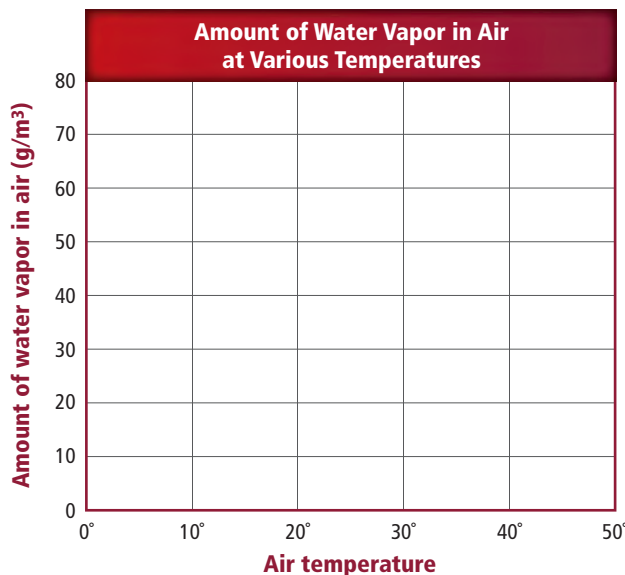
Line Graphs A line graph is used to show the relationship between two variables. The independent variable is plotted on the horizontal axis, called the x -axis. The dependent variable is plotted on the vertical axis, called the y -axis. The dependent variable (y) changes as a result of a change in the independent variable (x).

Suppose your class wanted to collect data about humidity. You could make a graph of the amount of water vapor that air can hold at various temperatures. **Table 5** shows the data.

Table 5 Amount of Water Vapor in Air at Various Temperatures

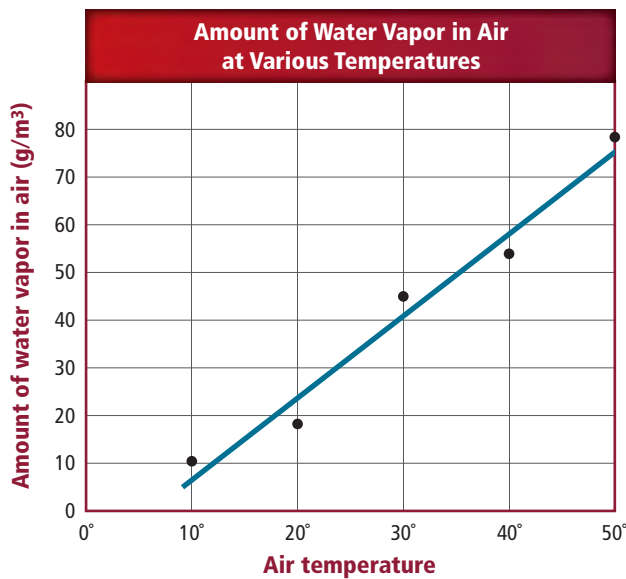
Air Temperature ($^{\circ}\text{C}$)	Air (g/m^3)
10	10
20	18
30	31
40	50
50	80

To make a graph of the amount of water vapor in air, start by determining the dependent and independent variables. The average amount of water vapor found per cubic meter of air is the dependent variable and is plotted on the y -axis. The independent variable, air temperature, is plotted on the x -axis.

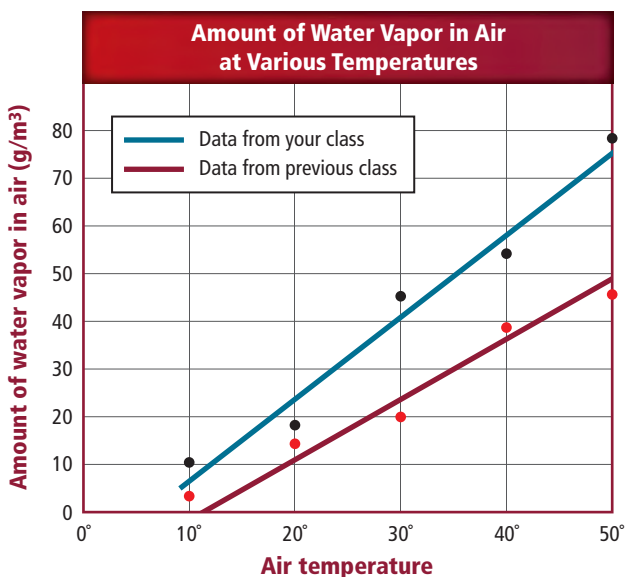


Plain or graph paper can be used to construct graphs. Draw a grid on your paper or a box around the squares that you intend to use on your graph paper. Give your graph a title and label each axis with a title and units. In this example, label the x -axis *Air temperature*. Because the lowest temperature was 10 and the highest was 50, you know that you will have to start numbers on the y -axis at least at 0 and number to at least 50. You decide to start numbering at 0 and number by equally spaced intervals of ten.

Label the y -axis of your graph *Amount of water vapor in air (g/m^3)*. Begin plotting points by locating 0°C on the x -axis and $5\text{ g}/\text{m}^3$ on the y -axis. Where an imaginary vertical line from the x -axis and an imaginary horizontal line from the y -axis meet, place the first data point. Place other data points using the same process. After all the points are plotted, draw a “best fit” straight line through all the points.



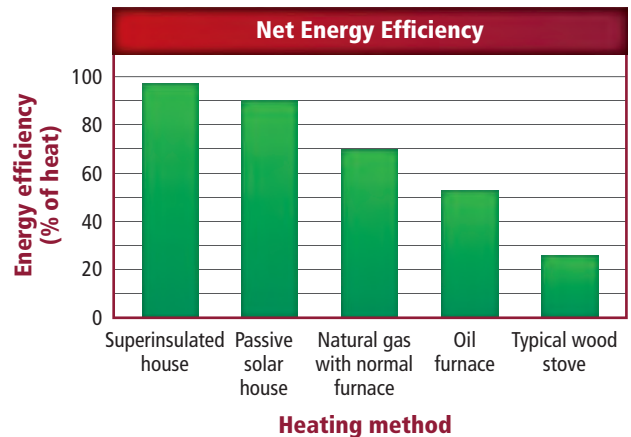
Practice Problem 3 According to the graph, does the amount of water vapor in air increase or decrease with air temperature?



What if you wanted to compare the data about humidity collected by your class with similar data collected a year ago by a different class? The data from the other class can be plotted on the same graph to make the comparison. Include a key with different lines indicating different sets of data.

Practice Problem 4 How did the data from your class compare to the data from the previous class?

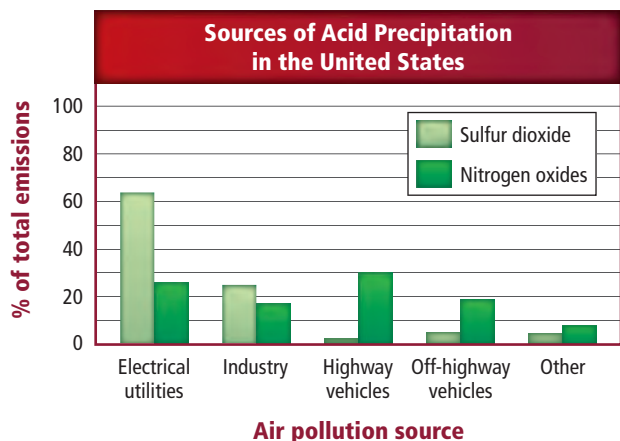
Bar Graphs A bar graph displays a comparison of different categories of data by representing each category with a bar. The length of the bar is related to the category’s frequency. To make a bar graph, set up the x -axis and y -axis as you did for the line graph. Plot the data by drawing thick bars from the x -axis up to the y -axis point.



Look at the graph above. The independent variable is the energy efficiency. The dependent variable is the heating method.

Practice Problem 5 Which type of heating method has the second greatest efficiency? Is this more than twice as efficient as the lowest efficiency? Explain.

Bar graphs can also be used to display multiple sets of data in different categories at the same time. A bar graph that displays two sets of data is called a double-bar graph. Double-bar graphs have a legend to denote which bars represent each set of data. The graph below is an example of a double-bar graph.



Circle Graphs A circle graph consists of a circle divided into sections that represent parts of a whole. When all the sections are placed together, they equal 100 percent of the whole.

Suppose you want to make a circle graph to show the percentage of solid wastes generated by various industries in the United States each year. The total amount of solid waste generated each year is estimated at ten billion metric tons. The whole circle graph will therefore represent this amount of solid waste. You find that 7.5 billion metric tons of waste is generated by mining and oil and gas production. The total amount of solid waste generated each year by mining and oil and gas production makes up one section of the circle graph, as follows.

$$\begin{aligned}
 \text{Segment of circle for total waste} &= \frac{\text{waste from mining and oil and gas production}}{\text{total waste}} \\
 &= \frac{7.5}{10} \\
 &= 0.75 \quad \times 360^\circ \\
 &= 270^\circ
 \end{aligned}$$

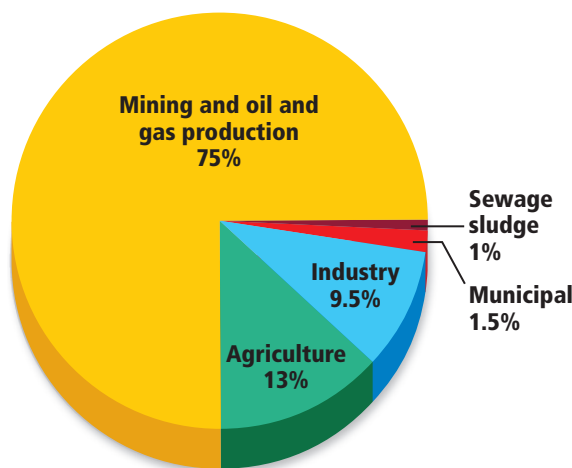
To draw your circle graph, you will need a compass and a protractor. First, use the compass to draw a circle.

Then, draw a straight line from the center to the edge of the circle. Place your protractor on this line, and mark the point on the circle where 270° angle will intersect the circle. Draw a straight line from the center of the circle to the intersection point. This is the section for the waste generated from mining and oil and gas production.

Now, try to perform the same operation for the other data to find the number of degrees of the circle that each represents, and draw them in as well: agriculture, 1.3 billion metric tons; industry, 0.95 billion metric tons; municipal, 0.15 billion metric tons; and sewage sludge, 0.1 billion metric tons.

Complete your graph by labeling the sections of the graph and giving the graph a title. Your completed graph should look similar to the one below.

Solid Waste in the United States



Practice Problem 6 There are 25 varieties of flowering plants growing around the high school. Construct a circle graph showing the percentage of each flower's color. Two varieties have yellow blooms, five varieties have blue-purple blooms, eight varieties have white blooms, and ten varieties have red blooms.

Safety in the Laboratory

The Earth science laboratory is a safe place to work if you are careful to observe the following important safety rules. You are responsible for your own safety and for the safety of others. The safety rules given here will protect you and others from harm in the laboratory. While carrying out procedures in any of the activities or GeoLabs, take note of the safety symbols and warning statements.

Safety Rules

1. Always read and complete the lab safety form and obtain your teacher's permission before beginning an investigation.
2. Study the procedure outline in the text. If you have questions, ask your teacher. Make sure that you understand all safety symbols shown on the page.
3. Use the safety equipment provided for you. Safety goggles and an apron should be worn during all investigations that involve the use of chemicals.
4. When heating test tubes, always slant them away from yourself and others.
5. Never eat or drink in the lab, and never use lab glassware as food or drink containers. Never inhale chemicals. Do not taste any substances or draw any material into a tube or pipet with your mouth.
6. If you spill any chemical, wash it off immediately with water. Report the spill immediately to your teacher.

7. Know the location and proper use of the fire extinguisher, eye wash, safety shower, fire blanket, fire alarm, and first aid kit. First aid procedures in the science laboratory are listed in **Table 1**.
8. Keep materials away from flames. Tie back hair and loose clothing when you are working with flames.
9. If a fire should break out in the lab, or if your clothing should catch fire, smother it with the fire blanket or a coat, get under a safety shower, or use the fire department's recommendation for putting out a fire on your clothing: stop, drop, and roll. NEVER RUN.
10. Report any accident or injury, no matter how small, to your teacher.

Clean-Up Procedures












1. Turn off the water and gas. Disconnect electrical devices.
2. Return all materials to their proper places.
3. Dispose of chemicals and other materials as directed by your teacher. Place broken glass and solid substances in the proper containers. Never discard materials in the sink.
4. Clean your work area.
5. Wash your hands thoroughly after working in the laboratory.






Table 1 First Aid in the Science Laboratory

Injury	Safe Response
Burns	Apply cold water. Call your teacher immediately.
Cuts and bruises	Stop any bleeding by applying direct pressure. Cover cuts with a clean dressing. Apply cold compresses to bruises. Call your teacher immediately.
Fainting	Leave the person lying down. Loosen any tight clothing and keep crowds away. Call your teacher immediately.
Foreign matter in eye	Flush with plenty of water. Use an eyewash bottle or fountain.
Poisoning	Note the suspected poisoning agent and call your teacher immediately.
Any spills on skin	Flush with large amounts of water or use safety shower. Call your teacher immediately.

Safety Symbols

Safety symbols in the following table are used in the lab activities to indicate possible hazards. Learn the meaning of each symbol. **It is recommended that you wear safety goggles and apron at all times in the lab. This might be required in your school district.**

Safety Symbols	Hazard	Examples	Precaution	Remedy
Disposal 	Special disposal procedures need to be followed.	certain chemicals, living organisms	Do not dispose of these materials in the sink or trash can.	Dispose of wastes as directed by your teacher.
Biological 	Organisms or other biological materials that might be harmful to humans	bacteria, fungi, blood, unpreserved tissues, plant materials	Avoid skin contact with these materials. Wear mask or gloves.	Notify your teacher if you suspect contact with material. Wash hands thoroughly.
Extreme Temperature 	Objects that can burn skin by being too cold or too hot	boiling liquids, hot plates, dry ice, liquid nitrogen	Use proper protection when handling.	Go to your teacher for first aid.
Sharp Object 	Use of tools or glassware that can easily puncture or slice skin	razor blades, pins, scalpels, pointed tools, dissecting probes, broken glass	Practice common-sense behavior and follow guidelines for use of the tool.	Go to your teacher for first aid.
Fume 	Possible danger to respiratory tract from fumes	ammonia, acetone, nail polish remover, heated sulfur, moth balls	Be sure there is good ventilation. Never smell fumes directly. Wear a mask.	Leave foul area and notify your teacher immediately.
Electrical 	Possible danger from electrical shock or burn	improper grounding, liquid spills, short circuits, exposed wires	Double-check setup with teacher. Check condition of wires and apparatus. Use GFI-protected outlets.	Do not attempt to fix electrical problems. Notify your teacher immediately.
Irritant 	Substances that can irritate the skin or mucous membranes of the respiratory tract	pollen, moth balls, steel wool, fiberglass, potassium permanganate	Wear dust mask and gloves. Practice extra care when handling these materials.	Go to your teacher for first aid.
Chemical 	Chemicals that can react with and destroy tissue and other materials	bleaches such as hydrogen peroxide; acids such as sulfuric acid, hydrochloric acid; bases such as ammonia, sodium hydroxide	Wear goggles, gloves, and an apron.	Immediately flush the affected area with water and notify your teacher.
Toxic 	Substance may be poisonous if touched, inhaled, or swallowed.	mercury, many metal compounds, iodine, poinsettia plant parts	Follow your teacher's instructions.	Always wash hands thoroughly after use. Go to your teacher for first aid.
Flammable 	Flammable chemicals may be ignited by open flame, spark, or exposed heat.	alcohol, kerosene, potassium permanganate	Avoid open flames and heat when using flammable chemicals.	Notify your teacher immediately. Use fire safety equipment if applicable.
Open Flame 	Open flame in use, may cause fire.	hair, clothing, paper, synthetic materials	Tie back hair and loose clothing. Follow teacher's instruction on lighting and extinguishing flames.	Notify your teacher immediately. Use fire safety equipment if applicable.

 Eye Safety Proper eye protection should be worn at all times by anyone performing or observing science activities.	 Clothing Protection This symbol appears when substances could stain or burn clothing.	 Animal Safety This symbol appears when safety of animals and students must be ensured.	 Radioactivity This symbol appears when radioactive materials are used.	 Handwashing After the lab, wash hands with soap and water before removing goggles.
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Physiographic Map of Earth





Marie Tharp

Topographic Map Symbols

ROADS AND RAILROADS

Primary highway, hard surface	
Secondary highway, hard surface	
Light-duty road, hard or improved surface	
Unimproved road	
Railroad: single track and multiple track	
Railroads in juxtaposition	

BUILDINGS AND STRUCTURES

Buildings	
School, church, and cemetery	
Barn and warehouse	
Wells, not water (with labels)	
Tanks: oil, water, etc. (labeled if water)	
Open-pit mine, quarry, or prospect	
Tunnel	
Benchmark	
Bridge	
Campsite	

HABITATS

Marsh (swamp)	
Wooded marsh	
Woods or brushwood	
Vineyard	
Submerged marsh	
Mangrove	
Coral reef, rocks	
Orchard	

Urban area	
Perennial streams	
Elevated aqueduct	
Water well and spring	
Small rapids	
Large rapids	
Intermittent lake	
Intermittent stream	
Glacier	
Large falls	
Dry lake bed	

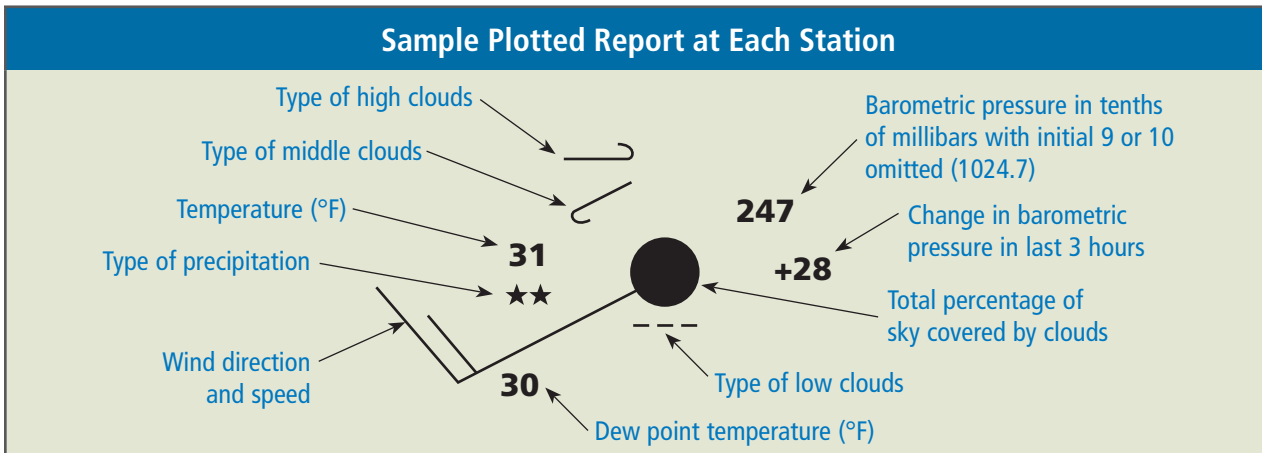
SURFACE ELEVATIONS

Spot elevation	
Water elevation	
Index contour	
Intermediate contour	
Depression contour	

BOUNDARIES

National	
State	
County, parish, municipal	
Civil township, precinct, town, barrio	
Incorporated city, village, town, hamlet	
Reservation, national or state	
Small park, cemetery, airport, etc.	
Land grant	
Township or range line, United States land survey	
Township or range line, approximate location	

Weather Map Symbols



Symbols Used in Plotting Report			
Precipitation	Wind Direction and Speed	Sky Coverage	Fronts and Pressure Systems
☰ Fog	○ 0 calm	○ No cover	(H) or High Center of high- or
★ Snow	↙ 1–2 knots	⊖ 1/10 or less	(L) or Low low-pressure system
● Rain	↘ 3–7 knots	⊗ 2/10 to 3/10	▲▲▲▲ Cold front
⚡ Thunderstorm	↘↘ 8–12 knots	⊕ 4/10	◐◐◐◐ Warm front
● Drizzle	↘↘↘ 13–17 knots	⊖ 1/2	▲◐◐◐ Occluded front
▽ Showers	↘↘↘↘ 18–22 knots	⊕ 6/10	▲◐◐◐ Stationary front
	↘↘↘↘↘ 23–27 knots	⊖ 7/10	
	↘↘↘↘↘↘ 48–52 knots	⊖ Overcast with openings	
	1 knot = 1.852 km/h	● Completely overcast	
Clouds			
Some Types of High Clouds	Some Types of Middle Clouds	Some Types of Low Clouds	
☁ Scattered cirrus	☁ Thin altostratus layer	☁ Cumulus of fair weather	
☁ Dense cirrus in patches	☁ Thick altostratus layer	☁ Stratocumulus	
☁ Veil of cirrus covering entire sky	☁ Thin altostratus in patches	☁ Fractocumulus of bad weather	
☁ Cirrus not covering entire sky	☁ Thin altostratus in bands	☁ Stratus of fair weather	

PERIODIC TABLE OF THE ELEMENTS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18																															
Hydrogen 1 H 1.008	Lithium 3 Li 6.941	Sodium 11 Na 22.990	Potassium 19 K 39.098	Rubidium 37 Rb 85.468	Cesium 55 Cs 132.905	Francium 87 Fr (223)	Beryllium 4 Be 9.012	Magnesium 12 Mg 24.305	Calcium 20 Ca 40.078	Strontium 38 Sr 87.62	Barium 56 Ba 137.327	Radium 88 Ra (226)	Boron 5 B 10.811	Aluminum 13 Al 26.982	Gallium 31 Ga 69.723	Indium 49 In 114.82	Thallium 81 Tl 204.383	Ununtrium 113 Uut (284)	Carbon 6 C 12.011	Silicon 14 Si 28.086	Germanium 32 Ge 72.61	Tin 50 Sn 118.710	Lead 82 Pb 207.2	Ununquadium 114 Uuq (289)	Nitrogen 7 N 14.007	Phosphorus 15 P 30.974	Arsenic 33 As 74.922	Antimony 51 Sb 121.757	Bismuth 83 Bi 208.980	Ununpentium 115 Uup (288)	Oxygen 8 O 15.999	Sulfur 16 S 32.066	Selenium 34 Se 78.96	Tellurium 52 Te 127.60	Polonium 84 Po 208.982	Ununhexium 116 Uuh (291)	Fluorine 9 F 18.998	Chlorine 17 Cl 35.453	Bromine 35 Br 79.904	Iodine 53 I 126.904	Astatine 85 At 209.987	Ununheptium 117 Uuhs (290)	Neon 10 Ne 20.180	Argon 18 Ar 39.948	Krypton 36 Kr 83.80	Xenon 54 Xe 131.290	Radon 86 Rn 222.018	Ununoctium 118 Uuo (294)

* The names and symbols for elements 113, 114, 115, 116, and 118 are temporary. Final names will be selected when the elements' discoveries are verified.

The number in parentheses is the mass number of the longest lived isotope for that element.

Lanthanide series		Actinide series	
Cerium 58 Ce 140.115	Praseodymium 59 Pr 140.908	Neodymium 60 Nd 144.242	Uranium 92 U 238.029
Europium 63 Eu 151.965	Samarium 62 Sm 150.36	Promethium 61 Pm (145)	Neptunium 93 Np (237)
Gadolinium 64 Gd 157.25	Curium 96 Cm (247)	Terbium 65 Tb 158.925	Plutonium 94 Pu (244)
Dysprosium 66 Dy 162.50	Americium 95 Am (243)	Erbium 68 Er 167.259	Californium 98 Cf (251)
Ytterbium 70 Yb 173.04	Lawrencium 103 Lr (262)	Thulium 69 Tm 168.934	Mendelevium 101 Md (258)
Lutetium 71 Lu 174.967		Fermium 100 Fm (257)	

Table 2 Relative Humidity %

Dry-Bulb Temperature	Dry-Bulb Temperature Minus Wet-Bulb Temperature (°C)									
	1	2	3	4	5	6	7	8	9	10
0°C	81	64	46	29	13					
1°C	83	66	49	33	18					
2°C	84	68	52	37	22	7				
3°C	84	69	55	40	25	12				
4°C	85	71	57	43	29	16				
5°C	85	72	58	45	32	20				
6°C	86	73	60	48	35	24	11			
7°C	86	74	61	49	38	26	15			
8°C	87	75	63	51	40	29	19	8		
9°C	87	76	65	53	42	32	21	12		
10°C	88	77	66	55	44	34	24	15	6	
11°C	89	78	67	56	46	36	27	18	9	
12°C	89	78	68	58	48	39	29	21	12	
13°C	89	79	69	59	50	41	32	22	15	7
14°C	90	79	70	60	51	42	34	26	18	10
15°C	90	80	71	61	53	44	36	27	20	13
16°C	90	81	71	63	54	46	38	30	23	15
17°C	90	81	72	64	55	47	40	32	25	18
18°C	91	82	73	65	57	49	41	34	27	20
19°C	91	82	74	65	58	50	43	36	29	22
20°C	91	83	74	66	59	51	44	37	31	24
21°C	91	83	75	67	60	53	46	39	32	26
22°C	92	83	76	68	61	54	47	40	34	28
23°C	92	84	76	69	62	55	48	42	36	30
24°C	92	84	77	69	62	56	49	43	37	31
25°C	92	84	77	70	63	57	50	44	39	33
26°C	92	85	78	71	64	58	51	46	40	34
27°C	92	85	78	71	65	58	52	47	41	36
28°C	93	85	78	72	65	59	53	48	42	37
29°C	93	86	79	72	66	60	54	49	43	38
30°C	93	86	79	73	67	61	55	50	44	39
31°C	93	86	80	73	67	62	56	50	45	40
32°C	93	86	80	74	68	62	57	51	46	41

Table 3 Minerals with Metallic Luster

Mineral (Formula)	Color	Streak	Hardness	Specific Gravity	Crystal System	Breakage Pattern	Uses and Other Properties
Bornite (Cu ₅ FeS ₄)	bronze, tarnishes to dark blue purple	gray-black	3	4.9–5.4	tetragonal	uneven fracture	source of copper; called “peacock ore” because of the purple shine when it tarnishes
Chalcopyrite (CuFeS ₂)	brassy to yellow	greenish black	3.5–4	4.2	tetragonal	uneven fracture	main ore of copper
Chromite ((Fe, Mg) (Cr, Al) ₂ O ₄)	black or brown	brown to black	5.5	4.6	cubic	irregular fracture	ore of chromium, stainless steel, metallurgical bricks
Copper (Cu)	copper red	copper red	3	8.5–9	cubic	hackly	coins, pipes, gutters, wire, cooking utensils, jewelry; malleable and ductile
Galena (PbS)	gray	gray to black	2.5	7.5	cubic	cubic cleavage perfect	source of lead, used in pipes, shields for X rays, fishing equipment sinkers
Gold (Au)	pale to golden yellow	yellow	2.5–3	19.3	cubic	hackly	jewelry, money, gold leaf, fillings for teeth, medicines; does not tarnish
Graphite (C)	black to gray	black to gray	1–2	2.3	hexagonal	basal cleavage (scales)	pencil lead, lubricants for locks, rods to control some small nuclear reactions, battery poles
Hematite (specular) (Fe ₂ O ₃)	black or reddish brown	red or reddish brown	6	5.3	hexagonal	irregular fracture	source of iron; roasted in a blast furnace, converted to “pig” iron, made into steel
Magnetite ((Fe, Mg) Fe ₂ O ₄)	black	black	6	5.2	cubic	conchoidal fracture	source of iron, naturally magnetic, called lodestone
Pyrite (FeS ₂)	light, brassy yellow	greenish black	6.5	5.0	cubic	uneven fracture	source of iron, “fool’s gold,” alters to limonite
Pyrrhotite (Fe _{1-x} S)*	bronze	gray-black	4	4.6	hexagonal	uneven fracture	an ore of iron and sulfur; may be magnetic
<small>*contains one less atom of Fe than S</small>							
Silver (Ag)	silvery white, tarnishes to black	light gray to silver	2.5	10–12	cubic	hackly	coins, fillings for teeth, jewelry, silverplate, wires; malleable and ductile

Table 4 Minerals with Nonmetallic Luster

Mineral (Formula)	Color	Streak	Hardness	Specific Gravity	Crystal System	Breakage Pattern	Uses and Other Properties
Augite ((Ca, Na) (Mg, Fe ²⁺ , Al) (Al, Si) ₂ O ₆)	black	colorless	6	3.3	monoclinic	2-directional cleavage	square or 8-sided cross section
Corundum (Al ₂ O ₃)	colorless, blue, brown, green, white, pink, red	colorless	9	4.0	hexagonal	fracture	gemstones: ruby is red, sapphire is blue; abrasive
Fluorite (CaF ₂)	colorless, white, blue, green, red, yellow, purple	colorless	4	3–3.2	cubic	cleavage	manufacture of optical equipment; glows under UV light
Garnet ((Mg, Fe ²⁺ , Ca, Mn ²⁺) ₃ , (Al, Fe ³⁺ , Mn ³⁺ , V, Cr) ₂ , (SiO ₄) ₃)	deep yellow-red, green, black	colorless	7.5	3.5	cubic	conchoidal fracture	used in jewelry; also used as an abrasive
Hornblende ((Ca Na) _{2,3} (Mg, Fe ²⁺ , Fe ³⁺ , Al) ₅ , (Al, Si) ₈ O ₂₂ (OH) ₂)	green to black	gray to white	5–6	3.4	monoclinic	cleavage in two directions	will transmit light on thin edges; 6-sided cross section
Limonite (hydrous iron oxides)	yellow, brown, black	yellow, brown	5.5	2.7–4.3	N/A	conchoidal fracture	source of iron; weathers easily, coloring matter of soils
Olivine ((Mg, Fe) ₂ SiO ₄)	olive green	colorless	6.5	3.5	orthorhombic	conchoidal fracture	gemstones, refractory sand
Plagioclase feldspar ((Na, Ca) Al(Si, Al) Si ₂ O ₈)	gray, green, white	colorless	6	2.5	triclinic	two cleavage planes meet at 86° angle	used in ceramics; striations present on some faces
Potassium feldspar (KAlSi ₃ O ₈)	colorless, white to gray, green, yellow, pink	colorless	6	2.5	monoclinic	two cleavage planes meet at 90° angle	insoluble in acids; used in the manufacture of porcelain
Quartz (SiO ₂)	colorless, various colors	colorless	7	2.6	hexagonal	conchoidal fracture	glass manufacture, electronic equipment, radios, computers, watches, gemstones
Topaz ((Al ₂ SiO ₄ (F, OH) ₂)	colorless, white, pink, yellow, pale blue	colorless	8	3.5	orthorhombic	basal cleavage	valuable gemstone

Table 5 Common Rocks

Rock Type	Rock Name	Characteristics
Igneous (intrusive)	granite	large mineral grains of quartz, feldspar, hornblende, and mica; usually light in color
	diorite	large mineral grains of feldspar, hornblende, and mica; less quartz than granite; intermediate in color
	gabbro	large mineral grains of feldspar, hornblende, augite, olivine, and mica; no quartz; dark in color
Igneous (extrusive)	rhyolite	small or no visible grains of quartz, feldspar, hornblende, and mica; light in color
	andesite	small or no visible grains of quartz, feldspar, hornblende, and mica; less quartz than rhyolite; intermediate in color
	basalt	small or no visible grains of feldspar, hornblende, augite, olivine, and mica; no quartz; dark in color; vesicles may be present
	obsidian	glassy texture; no visible grains; volcanic glass; fracture is conchoidal; color is usually black, but may be red-brown or black with white flecks
	pumice	frothy texture; floats; usually light in color
Sedimentary (clastic)	conglomerate	coarse-grained; gravel- or pebble-sized grains
	sandstone	sand-sized grains 1/16 to 2 mm in size; varies in color
	siltstone	grains smaller than sand but larger than clay
	shale	smallest grains; usually dark in color
Sedimentary (chemical or biochemical)	limestone	major mineral is calcite; usually forms in oceans, lakes, rivers, and caves; often contains fossils; effervesces in dilute HCl
	coal	occurs in swampy, low-lying areas; compacted layers of organic material, mainly plant remains
Sedimentary (chemical)	rock salt	commonly forms by the evaporation of seawater
Metamorphic	gneiss	well-developed banding because of alternating layers of different minerals, usually of different colors; common parent rock is granite
	schist	well-developed parallel arrangement of flat, sheetlike minerals, mainly micas; common parent rocks are shale and phyllite
	phyllite	shiny or silky appearance; may look wrinkled; common parent rocks are shale and slate
	slate	harder, denser, and shinier than shale; common parent rock is shale
Metamorphic (nonfoliated)	marble	interlocking calcite or dolomite crystals; common parent rock is limestone
	soapstone	composed mainly of the mineral talc; soft with a greasy feel
	quartzite	hard and well-cemented with interlocking quartz crystals; common parent rock is sandstone

Solar System Charts The Planets

	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune
Mass (kg)	3.3020×10^{23}	4.8685×10^{24}	5.9736×10^{24}	6.4185×10^{23}	1.8986×10^{27}	5.6846×10^{26}	8.6832×10^{25}	1.0243×10^{26}
Equatorial radius (km)	2439.7	6051.8	6378.1	3396.2	71,492	60,268	25,559	24,764
Mean density (kg/m ³)	5427	5243	5515	3933	1326	687	1270	1638
Albedo	0.068	0.900	0.306	0.250	0.343	0.342	0.300	0.290
Semimajor axis (km)	5.791×10^7	1.0821×10^8	1.4960×10^8	2.2792×10^8	7.7857×10^8	1.43353×10^9	2.87246×10^9	4.49506×10^9
Orbital period (Earth days)	87.969	224.701	365.256	686.980	4332.589	10,759.220	30,685.4	60,189
Orbital inclination (degrees)	7.000	3.390	0.000	1.850	1.304	2.485	0.772	1.769
Orbital eccentricity	0.2056	0.0067	0.0167	0.0935	0.0489	0.0565	0.0457	0.0113
Rotational period (hours)	1407.6	5832.5 ^R	23.9345	24.6229	9.9250	10.656	17.24 ^R	16.11
Axial tilt (degrees)	0.01	177.36	23.45	25.19	3.13	26.73	97.77	28.32
Average surface temperature (K)	440	737	288	210	165	134	76	72
Number of known moons*	0	0	1	2	63	62	27	13

*Number as of 2007.

^R indicates retrograde rotation.

The Moon

Mass (kg)	7.349×10^{22}
Equatorial radius (km)	1738.1
Mean density (kg/m ³)	3350
Albedo	0.12
Semimajor axis (km)	3.844×10^5
Orbital period (Earth days)	27.3217
Lunar period (Earth days)	29.53
Orbital inclination (degrees)	5.145
Orbital eccentricity	0.0549
Rotational period (hours)	655.728

The Sun

Mass (kg)	1.989×10^{30}
Equatorial radius (km)	6.96×10^5
Mean density (kg/m ³)	1408
Absolute magnitude	4.83
Luminosity (W)	384.6
Spectral type	G2
Rotational period (hours)	609.12
Average temperature (K)	5778

GLOSSARY • GLOSARIO

Multilingual eGlossary

The multilingual science glossary includes Arabic, Bengali, Chinese, English, Haitian Creole, Hmong, Korean, Portuguese, Russian, Tagalog, Urdu, and Vietnamese.

Como usar el glosario en español:

1. Busca el término en inglés que desees encontrar.
2. El término en español, junto con la definición, se encuentran en la columna de la derecha.

Pronunciation Key

Use the following key to help you sound out words in the glossary.

a	back (BAK)	ew	food (FEWD)
ay	day (DAY)	yoo	pure (PYOOR)
ah	father (FAH thur)	yew	few (FYEW)
ow	flower (FLOW ur)	uh	comma (CAHM uh)
ar	car (CAR)	u (+con)	rub (RUB)
e	less (LES)	sh	shelf (SHELF)
ee	leaf (LEEF)	ch	nature (NAY chur)
ih	trip (TRIHP)	g	gift (GIHFT)
i (i+con+e)	idea, life (i DEE uh, life)	j	gem (JEM)
oh	go (GOH)	ing	sing (SING)
aw	soft (SAWFT)	zh	vision (VIHZH un)
or	orbit (OR but)	k	cake (KAYK)
oy	coin (COYN)	s	seed, cent (SEED, SENT)
oo	foot (FOOT)	z	zone, raise (ZOHN, RAYZ)

ENGLISH

abrasion: (p. 203) process of erosion in which wind-blown or waterborne particles, such as sand, scrape against rock surfaces or other materials and wear them away.

absolute-age dating: (p. 601) method that enables scientists to determine the actual age of certain rocks and other objects.

absolute magnitude: (p. 842) brightness an object would have if it were placed at a distance of 10 pc; classification system for stellar brightness that can be calculated only when the actual distance to a star is known.

abyssal plain: (p. 451) smooth, flat part of the seafloor covered with muddy sediments and sedimentary rocks that extends seaward from the continental margin.

acid: (p. 71) solution containing a substance that produces hydrogen ions: (H⁺) in water.

acid precipitation: (p. 745) any precipitation with a pH of less than 5.0 that forms when sulfur dioxide and nitrogen oxides combine with moisture in the atmosphere to produce sulfuric acid and nitric acid.

A

ESPAÑOL

abrasión: (pág. 203) proceso de erosión en que las partículas por el viento o el agua, como la arena, chocan y raspan superficies rocosas u otros materiales y los desgastan.

datación absoluta: (pág. 601) permite a los científicos determinar la antigüedad real de ciertas rocas y objetos.

magnitud absoluta: (pág. 842) brillo que tendría un objeto si estuviera a una distancia de 10 pc; sistema de clasificación del brillo estelar que se puede calcular sólo cuando se conoce la distancia verdadera hasta la estrella.

llanura abisal: (pág. 451) parte plana y lisa del fondo del mar cubierta con sedimentos fangosos y rocas sedimentarias y que se extiende desde el margen continental hacia el mar.

ácido: (pág. 71) solución que contiene una sustancia que produce iones hidrógeno (H⁺) en agua.

precipitación ácida: (pág. 745) toda precipitación con un pH menor que 5.0 que se forma cuando se combinan el dióxido de azufre y óxidos de nitrógeno con la humedad en la atmósfera para producir ácido sulfúrico o ácido nítrico.

active galactic nucleus (AGN)/acuifer

active galactic nucleus (AGN): (p. 875) a galaxy's core in which highly energetic objects or activities are located.

aggregate: (p. 684) mixture of sand, gravel, and crushed stone that accumulates naturally; found in floodplains, alluvial fans, or glacial deposits.

air mass: (p. 316) large volume of air that has the characteristics of the area over which it forms.

air-mass thunderstorm: (p. 346) type of thunderstorm in which air rises because of unequal heating of Earth's surface within a single air mass and is most common during the afternoon and evening.

albedo: (p. 771) percentage of sunlight that is reflected by the surface of a planet or a satellite, such as the Moon.

altered hard part: (p. 607) fossil whose organic material has been removed and whose hard parts have been changed by recrystallization or mineral replacement.

amino acid: (p. 634) a building block of proteins.

Amniotic (am nee AH tihk) egg: (p. 658) egg with a shell, providing a complete environment for a developing embryo.

amplitude: (p. 539) the size of the seismic waves; an increase of 1 in the scale represents an increase in amplitude of a factor of 10.

analog forecast: (p. 331) weather forecast that compares current weather patterns to patterns that occurred in the past.

anemometer (a nuh MAH muh tur): (p. 325) weather instrument used to measure wind speed.

apogee: (p. 783) farthest point in the Moon's elliptical orbit to Earth.

apparent magnitude: (p. 842) classification system based on how bright a star appears to be; does not take distance into account so cannot indicate how bright a star actually is.

aquiclude: (p. 255) impermeable layer that is a barrier to groundwater; such as silt, clay, and shale.

aquifer: (p. 255) permeable underground layer through which groundwater flows relatively easily.

núcleo galáctico activo (NGA)/acuifero

núcleo galáctico activo (NGA): (pág. 875) centro de la galaxia donde se ubican cuerpos o suceden eventos con gran cantidad de energía.

agregado: (pág. 684) mezcla natural de arena, grava y piedra triturada que se acumula naturalmente; se encuentra en llanuras aluviales, abanicos aluviales o depósitos glaciales.

masa de aire: (pág. 316) gran volumen de aire que tiene las características del área sobre la que se forma.

tormenta eléctrica de masa de aire: (pág. 346) tipo de tormenta en que el aire asciende debido al calentamiento desigual de la superficie terrestre bajo una misma masa de aire; es más común durante la tarde y la noche.

albedo: (pág. 771) porcentaje de luz solar que refleja la superficie de un planeta o un satélite, como por ejemplo, la Luna.

partes duras alteradas: (pág. 607) fósiles cuya materia orgánica ha desaparecido y cuyas partes duras han sido transformadas por recristalización o sustitución de minerales.

aminoácido: (pág. 634) unidad básica de las proteínas.

huevo amniótico: (pág. 658) huevo con cascarón; provee un ambiente completo para el embrión en desarrollo.

amplitud: (pág. 539) la magnitud de las ondas sísmicas; un aumento de 1 unidad en esta escala representa un aumento en amplitud de un factor de 10.

pronóstico análogo: (pág. 331) pronóstico del tiempo que compara los patrones actuales del clima con patrones ocurridos en el pasado.

anemómetro: (pág. 325) instrumento meteorológico que se utiliza para medir la velocidad de viento.

apogeo: (pág. 783) punto de la órbita elíptica de la Luna en que ésta se encuentra más alejada de la Tierra.

magnitud aparente: (pág. 842) sistema de clasificación basado el brillo aparente de una estrella; no toma en cuenta la distancia y por lo tanto no indica el brillo real de la estrella.

acuicludos: (pág. 255) capas impermeables que sirven de barrera a las aguas subterráneas, como por ejemplo limo, arcilla o esquistos.

acuifero: (pág. 255) capa subterránea permeable por la cual el agua subterránea fluye de manera relativamente fácil.

artesian well/batholith

artesian well: (p. 264) fountain of water that spurts above the land surface when a well taps a deep, confined aquifer containing water under pressure.

asteroid (AS tuh royd): (p. 622) metallic or silica-rich object, 1 km to 950 km in diameter, that bombarded early Earth, generating heat energy; (p. 795) rocky remnant of the early solar system found mostly between the orbits of Mars and Jupiter in the asteroid belt.

astronomical unit (AU): (p. 800) the average distance between the Sun and Earth, 1.496×10^8 km.

astronomy: (p. 6) study of objects beyond Earth's atmosphere.

atmosphere: (p. 8) blanket of gases surrounding Earth that contains about 78 percent nitrogen, 21 percent oxygen, and 1 percent other gases such as argon, carbon dioxide, and water vapor.

atomic number: (p. 62) number of protons contained in an atom's nucleus.

avalanche: (p. 198) landslide that occurs in a mountainous area when snow falls on a icy crust, becomes heavy, slips off, and slides swiftly down a mountainside.

banded-iron formations: (p. 630) alternating bands of iron oxide and chert; an iron-poor sedimentary rock.

barometer: (p. 324) instrument used to measure air pressure.

barrier island: (p. 442) long ridges of sand or other sediment deposited or shaped by the longshore current, that are separated from the mainland and can be up to tens of kilometers long.

basaltic rock: (p. 118) rock that is dark colored, has lower silica contents, and is rich in iron and magnesium; contains mostly plagioclase and pyroxene.

base: (p. 72) substance that produces hydroxide ions (OH^-) in water.

base level: (p. 233) the elevation at which a stream enters another stream or body of water.

batholith: (p. 515) coarse-grained, irregularly shaped, igneous rock mass that covers at least 100 km², generally forms 10–30 km below Earth's surface, and is common in the interior of major mountain chains.

pozo artesiano/batolito

pozo artesiano: (pág. 264) fuente de agua que brota hacia la superficie terrestre, cuando un pozo conecta con un acuífero profundo y confinado que contiene agua bajo presión.

asteroide: (pág. 622) cuerpo metálico o rico en sílice que mide de 1 a 950 km de diámetro y que bombardeó la Tierra primitiva generando energía calórica; (pág. 795) restos rocosos del sistema solar primitivo que se hallan principalmente en las órbitas de Marte y Júpiter, en el cinturón de asteroides.

unidad astronómica (UA): (pág. 800) la distancia promedio entre el Sol y la Tierra, equivale a 1.496×10^8 km.

astronomía: (pág. 6) el estudio de los cuerpos que se encuentran más allá de la atmósfera de la Tierra.

atmósfera: (pág. 8) manto de gases que rodea la Tierra; está compuesta aproximadamente por 78 por ciento de nitrógeno, 21 por ciento de oxígeno y 1 por ciento de otros gases como el argón, el dióxido de carbono y el vapor del agua.

número atómico: (pág. 62) número de protones que contiene el núcleo de un átomo.

avalancha: (pág. 198) deslizamiento que ocurre en un área montañosa cuando la nieve cae sobre una capa helada, aumenta de peso, se desprende y se resbala rápidamente montaña abajo.

B

formaciones de hierro en bandas: (pág. 630) bandas alternadas de óxido ferroso y pedernal; roca sedimentaria deficiente en hierro.

barómetro: (pág. 324) instrumento que se usa para medir la presión atmosférica.

barrera litoral: (pág. 442) grandes lomas de arena u otro sedimento que son depositadas, o que adquieren su forma, por la acción de las corrientes litorales; están separadas del continente y pueden llegar a medir decenas de kilómetros de largo.

roca basáltica: (pág. 118) roca oscura con bajo contenido en sílice pero rica en hierro y magnesio; contiene principalmente plagioclasa y piroxenos.

base: (pág. 72) sustancia que produce iones hidróxido (OH^-) en agua.

nivel base: (pág. 233) elevación a la cual una corriente entra a otra corriente o masa de agua.

batolito: (pág. 515) masa rocosa ignea de gran grueso y de forma irregular que cubre por lo menos 100 km²; generalmente se forma de 10 a 30 km bajo la superficie terrestre y es común en el interior de las principales cadenas montañosas.

beach: (p. 438) area in which loose sediment is deposited and moved about by waves along the shore.

bedding: (p. 137) horizontal layering in sedimentary rock that can range from a few millimeters to several meters thick.

bed load: (p. 228) describes sediments that are too heavy or large to be kept in suspension or solution and are pushed or rolled along the bottom of a streambed.

bedrock: (p. 684) unweathered, solid parent rock that can consist of limestone, marble, granite, or other quarried rock.

belt: (p. 812) low, warm, dark-colored cloud that sinks and flows rapidly in the Jovian atmosphere.

Big Bang theory: (p. 878) theory that proposes that the universe began as a single point and has been expanding ever since.

binary star: (p. 838) describes two stars that are bound together by gravity and orbit a common center of mass.

biomass fuels (p. 709) fuels derived from living things; renewable resources.

bioremediation: (p. 742) use of organisms to clean up toxic waste.

biosphere: (p. 9) all of Earth's organisms and the environments in which they live.

bipedal: (p. 665) walking upright on two legs.

black hole: (p. 851) small, extremely dense remnant of a star whose gravity is so immense that not even light can escape its gravity field.

Bowen's reaction series: (p. 114) sequential, predictable, dual-branched pattern in which minerals crystallize from cooling magma.

breaker: (p. 422) collapsing wave that forms when a wave reaches shallow water and becomes so steep that the crest topples forward.

caldera: (p. 505) large crater, up to 50 km in diameter, that can form when the summit or side of a volcano collapses into the magma chamber during or after an eruption.

playa: (pág. 438) área en que sedimentos sueltos son depositados y transportados por las olas a lo largo de la costa.

estratificación: (pág. 137) capas horizontales de roca sedimentaria que pueden medir de un milímetro a varios metros de grosor.

carga de fondo: (pág. 228) término que describe los sedimentos que no se mantienen en suspensión, o en solución, porque son demasiado pesados o grandes y son empujados o arrastrados sobre el fondo del cauce de una corriente.

roca firme: (pág. 684) roca madre sólida no metamorfozada que puede consistir en piedra caliza, mármol, granito o alguna otra piedra de cantera.

cinturón: (pág. 812) nube baja, tibia y oscura que desciende y fluye rápidamente en la atmósfera joviana.

teoría de la Gran Explosión: (pág. 878) propone que el universo empezó en un solo punto y se ha estado expandiendo desde entonces.

estrella binaria: (pág. 838) describe dos estrellas unidas por la gravedad que giran alrededor de un centro común de masa.

biocombustible: (pág. 709) combustibles derivados de los seres vivos; recursos renovables.

biorremediación: (pág. 742) uso de organismos para limpiar desechos tóxicos.

biosfera: (pág. 9) incluye a todos los organismos de la Tierra y los ambientes en que éstos viven.

bipedalismo: (pág. 665) que camina erguido sobre dos piernas.

agujero negro: (pág. 851) restos de una estrella muy densos y pequeños cuya gravedad es tan grande que ni la luz puede escapar de su campo de gravedad.

serie de reacción de Bowen: (pág. 114) patrón de dos ramas, predecible y secuencial que siguen los minerales al cristalizarse a partir de magma que se enfría.

rompiente: (pág. 422) ola que se colapsa; se forma cuando una ola alcanza aguas poco profundas y se vuelve tan empinada que la cresta de la ola se cae hacia adelante.

caldera: (pág. 505) cráter grande, de hasta 50 km de diámetro, que se forma cuando la cumbre o la ladera de un volcán se desploman en la cámara de magma durante o después de una erupción.

C

Cambrian explosion/clastic

Cambrian explosion: (p. 653) sudden appearance of a diverse collection of organisms in the Cambrian fossil record.

Canadian shield: (p. 625) name given to the Precambrian shield in North America because much of it is exposed in Canada.

carrying capacity: (p. 735) number of organisms that a specific environment can support.

cartography: (p. 30) science of mapmaking.

cast: (p. 608) fossil formed when an earlier fossil of a plant or animal leaves a cavity that becomes filled with minerals or sediment.

cave: (p. 260) natural underground opening connected to Earth's surface, usually formed when groundwater dissolves limestone.

cementation: (p. 137) process of sedimentary rock formation that occurs when dissolved minerals precipitate out of groundwater and either a new mineral grows between the sediment grains or the same mineral grows between and over the grains.

chemical bond: (p. 67) force that holds the atoms of elements together in a compound.

chemical reaction: (p. 70) change of one or more substances into other substances.

chemical weathering: (p. 166) process by which rocks and minerals undergo changes in their composition due to chemical reactions with agents such as acids, water, oxygen, and carbon dioxide.

chromosphere: (p. 831) layer of the Sun's atmosphere above the photosphere and below the corona that is about 2500 km thick and has a temperature around 30,000 K at its top.

cinder cone: (p. 507) steep-sided, generally small volcano that is built by the accumulation of tephra around the vent.

cirque: (p. 209) deep depression scooped out by a valley glacier.

cirrus (SIHR us): (p. 301) high clouds made up of ice crystals that form at heights of 6000 m; often have a wispy, indistinct appearance.

clastic: (p. 141) rock and mineral fragments produced by weathering and erosion and classified according to particle size and shape.

explosión del Cámbrico/clástico

explosión del Cámbrico: (pág. 653) aparición repentina de un conjunto diverso de organismos en el registro fósil del Cámbrico.

escudo canadiense: (pág. 625) nombre que recibe el escudo Precámbrico en Norteamérica porque la mayor parte está expuesto en Canadá.

capacidad de carga: (pág. 735) número de organismos que un ambiente específico puede sustentar.

cartografía: (pág. 30) ciencia de la elaboración de mapas.

molde: (pág. 608) fósil que se forma cuando un fósil precedente de una planta o un animal forma una cavidad que se rellena con minerales o sedimentos.

caverna: (pág. 260) cavidad subterránea abierta a la superficie terrestre, generalmente se forma cuando el agua subterránea disuelve la piedra caliza.

cementación: (pág. 137) proceso de formación de roca sedimentaria que ocurre cuando los minerales disueltos del agua subterránea se precipitan y se forma un nuevo mineral entre los granos de sedimento o se acumula el mismo mineral entre y sobre los granos.

enlace químico: (pág. 67) fuerza que mantiene unidos los átomos de los elementos en un compuesto.

reacción química: (pág. 70) sucede cuando una o más sustancias se convierten en otras sustancias.

meteorización química: (pág. 166) proceso mediante el cual las rocas y los minerales experimentan cambios en su composición, debido a reacciones químicas con agentes como ácidos, agua, oxígeno o dióxido de carbono.

cromosfera: (pág. 831) capa de la atmósfera del Sol situada encima de la fotosfera y debajo de la corona; mide aproximadamente 2500 km de ancho y tiene una temperatura cercana a 30,000 K en su parte superior.

cono de carbonilla: (pág. 507) volcán generalmente pequeño, de laderas muy inclinadas, que se forma debido a la acumulación de tephra alrededor de la chimenea.

circo: (pág. 209) depresión profunda formada por un glaciar de valle.

cirro: (pág. 301) nubes altas formadas por cristales de hielo que se forman a alturas de 6000 m; con frecuencia parecen espigas borrosas.

clástico: (pág. 141) describe los fragmentos de roca y de mineral producidos por la meteorización y la erosión; se clasifican según su tamaño y forma de partícula.

clastic sedimentary rock/condensation nucleus

clastic sedimentary rock: (p. 141) most common type of sedimentary rock, formed from the abundant deposits of loose sediments that accumulate on Earth's surface; classified according to the size of their particles.

cleavage: (p. 92) the manner in which a mineral breaks along planes where atomic bonding is weak.

climate: (p. 314) the long-term average of variation in weather for a particular area.

climatology: (p. 376) study of Earth's climate in order to understand and predict climatic change, based on past and present variations in temperature, precipitation, wind, and other weather variables.

coalescence (koh LEH sunts): (p. 302) process that occurs when cloud droplets collide and form larger droplets, which eventually become too heavy to remain aloft and can fall to Earth as precipitation.

cogeneration: (p. 723) production of two usable forms of energy at the same time from the same process, which can conserve resources and generate income.

cold wave: (p. 364) extended period of below-average temperatures caused by large, high-pressure systems of continental polar or arctic origin.

comet: (p. 819) small, eccentrically orbiting body made of rock and ice which have one or more tails that point away from the Sun.

composite volcano: (p. 507) generally cone-shaped with concave slopes; built by violent eruptions of volcanic fragments and lava that accumulate in alternating layers.

compound: (p. 66) substance composed of atoms of two or more different elements that are chemically combined.

compressive force: (p. 567) squeezing force that can cause the intense deformation—folding, faulting metamorphism, and igneous intrusions—associated with mountain building.

condensation: (p. 75) process by which a cooling gas changes into a liquid and releases thermal energy.

condensation nucleus: (p. 297) small particle in the atmosphere around which cloud droplets can form.

roca sedimentaria clástica/núcleos de condensación

roca sedimentaria clástica: (pág. 141) el tipo más común de roca sedimentaria; se forma a partir de los abundantes depósitos de sedimentos sueltos que se acumulan sobre la superficie de la Tierra; se clasifican según el tamaño de sus partículas.

crucero: (pág. 92) la forma en la cual un mineral se rompe a lo largo de los planos donde los enlaces atómicos son débiles.

clima: (pág. 314) promedio durante un largo periodo de las variaciones en las condiciones del tiempo de un área determinada.

climatología: (pág. 376) estudio del clima de la Tierra para entender y pronosticar los cambios climáticos; se basa en variaciones pasadas y presentes de temperatura, precipitación, viento y otras variables del tiempo.

coalescencia: (pág. 302) proceso que ocurre cuando las gotas de nube chocan entre sí, formando gotas cada vez más grandes; estas gotas pueden llegar a ser demasiado pesadas para seguir suspendidas en el aire y entonces caen a la Tierra como precipitación.

cogeneración: (pág. 723) producción simultánea de dos formas útiles de energía a partir del mismo proceso; puede ayudar a conservar recursos y obtener ganancias.

onda fría: (pág. 364) período prolongado de temperaturas más bajas que el promedio, causado por grandes sistemas de alta presión de origen polar continental o ártico.

cometa: (pág. 819) cuerpo pequeño de órbita excéntrica compuesto por roca y hielo y que contiene una o más colas que apuntan hacia el lado opuesto al Sol.

volcán compuesto: (pág. 507) volcán que en general tiene forma cónica y laderas cóncavas; se forma por erupciones violentas de fragmentos y lava volcánicos que se acumulan creando capas alternadas.

compuesto: (pág. 66) sustancia compuesta por átomos de dos o más elementos diferentes unidos químicamente.

fuerzas de compresión: (pág. 567) fuerzas de aplastamiento que pueden causar intensas deformaciones como plegamientos, fallas, metamorfismo e intrusiones ígneas; asociadas con la formación de montañas.

condensación: (pág. 75) proceso por el cual un gas enfriador se transforma en un líquido y libera energía térmica.

núcleos de condensación: (pág. 297) partículas pequeñas de la atmósfera alrededor de las cuales se pueden formar las gotas de nubes.

conduction/contour line

conduction: (p. 288) the transfer of thermal energy between objects in contact by the collisions between the particles in the objects.

conduit: (p. 505) a tubelike structure that allows lava to reach the surface.

conic projection: (p. 35) map that is highly accurate for small areas, made by projecting points and lines from a globe onto a cone.

constellation: (p. 837) group of stars that forms a pattern in the sky that resembles an animal, mythological character, or everyday object.

contact metamorphism: (p. 149) local effect that occurs when molten rock meets solid rock.

continental drift: (p. 469) Wegener's hypothesis that Earth's continents were joined as a single landmass, called Pangaea, that broke apart about 200 mya and slowly moved to their present positions.

continental glacier: (p. 208) glacier that forms over a broad, continent-sized area of land and usually spreads out from its center.

continental margin: (p. 447) area where edges of continents meet the ocean; represents the shallowest part of the ocean that consists of the continental shelf, the continental slope, and the continental rise.

continental rise: (p. 449) gently sloping accumulation of sediments deposited by a turbidity current at the foot of a continental margin.

continental shelf: (p. 447) shallowest part of a continental margin, with an average depth of 130 m and an average width of 60 km, that extends into the ocean from the shore and provides a nutrient-rich home to large numbers of fish.

continental slope: (p. 448) sloping oceanic region found beyond the continental shelf that generally marks the edge of the continental crust and may be cut by sub-marine canyons.

contour interval: (p. 36) difference in elevation between two side-by-side contour lines on a topographic map.

contour line: (p. 36) line on a topographic map that connects points of equal elevation.

conducción/curva de nivel

conducción: (pág. 288) transferencia de energía entre cuerpos en contacto debida a la colisión entre las partículas de los cuerpos.

conductor: (pág. 505) estructura tubular que permite que la lava llegue a la superficie.

proyección cónica: (pág. 35) mapa de gran exactitud para áreas pequeñas que se elabora mediante la proyección de puntos y líneas de un globo a un cono.

constelación: (pág. 837) grupo de estrellas que forman en el firmamento un patrón que semeja un animal, un personaje mitológico o un objeto cotidiano.

metamorfismo de contacto: (pág. 149) efecto local que ocurre cuando la roca fundida se encuentra con roca sólida.

deriva continental: (pág. 469) hipótesis de Wegener que propone que los continentes de la Tierra estaban unidos en una sola masa terrestre, llamada Pangaea, la cual se separó hace aproximadamente 200 millones de años y que los fragmentos resultantes se movieron lentamente a sus ubicaciones actuales.

glaciar continental: (pág. 208) glaciar que se forma sobre una amplia área del tamaño de un continente y que generalmente se extiende a partir de su centro.

margen continental: (pág. 447) área donde los límites de los continentes se unen con el océano; representa la parte menos profunda del océano y consiste en la plataforma continental, el talud continental y el pie del talud continental.

pie del talud continental: (pág. 449) acumulación de sedimentos, con pendiente leve, depositados por una corriente de turbidez al pie de un margen continental.

plataforma continental: (pág. 447) parte más superficial del margen continental, tiene una profundidad promedio de 130 m y una anchura promedio de 60 km, se extiende hacia el océano desde la costa y proporciona un lugar rico en nutrientes a un gran número de peces.

talud continental: (pág. 448) región oceánica inclinada que se encuentra más allá de la plataforma continental; generalmente marca el límite de la corteza continental y puede estar seccionada por cañones submarinos.

intervalo entre curvas de nivel: (pág. 36) diferencia en la elevación entre dos curvas de nivel contiguas en un mapa topográfico.

curva de nivel: (pág. 36) curva en un mapa topográfico que conecta puntos de igual elevación.

- control:** (p. 12) standard for comparison in an experiment.
- convection:** (p. 288) the transfer of thermal energy by the movement of heated material from one place to another.
- convergent boundary:** (p. 482) place where two tectonic plates are moving toward each other; is associated with trenches, island arcs, and folded mountains.
- Coriolis effect:** (p. 318) effect of a rotating body that influences the motion of any object or fluid; on Earth, air moving north or south from the equator appears to move right or left, respectively; the combination of the Coriolis effect and Earth's heat imbalance creates the trade winds, polar easterlies, and prevailing westerlies.
- corona:** (p. 831) top layer of the Sun's atmosphere that extends from the top of the chromosphere and ranges in temperature from 1 million to 2 million K.
- correlation:** (p. 599) matching of rock outcrops of one geographic region to another.
- cosmic background radiation:** (p. 880) weak radiation that is left over from the early, hot stages of the Big Bang expansion of the universe.
- cosmology:** (p. 878) study of the universe, including its current nature, origin, and evolution, based on observation and the use of theoretical models.
- covalent bond:** (p. 67) attraction of two atoms for a shared pair of electrons that holds the atoms together.
- crater:** (p. 505) bowl-shaped depression that forms around the central vent at the summit of a volcano.
- craton (KRAY tahn):** (p. 625) continental core formed from Archean or Proterozoic microcontinents; deepest (as far as 200 km into the mantle) and most stable part of a continent.
- creep:** (p. 195) slow, steady downhill movement of loose weathered Earth materials, especially soils, causing objects on a slope to tilt.
- crest:** (p. 421) highest point of a wave.

- control:** (pág. 12) estándar de comparación en un experimento.
- convección:** (pág. 288) transferencia de energía térmica debido al movimiento de material caliente de un lado a otro.
- límite convergente:** (pág. 482) lugar donde dos placas tectónicas se mueven aproximándose cada vez más entre sí; está asociado con fosas abisales, arcos insulares y montañas plegadas.
- efecto de Coriolis:** (pág. 318) efecto producido por un cuerpo en rotación que influye en el movimiento de todo cuerpo objeto o fluido; en la Tierra, las corrientes de aire que se mueven desde el norte o desde el sur parecen desplazarse hacia la derecha o hacia la izquierda, respectivamente; la combinación del efecto de Coriolis y el desequilibrio térmico de la Tierra originan los vientos alisios, los vientos polares del este y los vientos dominantes del oeste.
- corona:** (pág. 831) capa superior de la atmósfera del Sol que se extiende desde la parte superior de la cromosfera y tiene un rango de temperatura de 1 a 2 millones K.
- correlación:** (pág. 599) correspondencia entre los afloramientos rocosos de una región geográfica y otra.
- radiación cósmica de fondo:** (pág. 880) radiación residual débil proveniente de las calientes etapas iniciales de la expansión del universo causada por la Gran Explosión.
- cosmología:** (pág. 878) estudio del universo; abarca su naturaleza actual, su origen y evolución y se basa en la observación y el uso de modelos teóricos.
- enlace covalente:** (pág. 67) atracción de dos átomos hacia un par compartido de electrones que mantienen a los átomos unidos.
- cráter:** (pág. 505) depresión en forma de tazón que generalmente se forma alrededor de la abertura central en la cumbre de un volcán.
- cratón:** (pág. 625) zona central de un continente formada a partir de microcontinentes del arcaico o del Proterozoico; son la parte más profunda (penetran hasta 200 km hacia el manto) y estable de un continente.
- deslizamiento:** (pág. 195) movimiento cuesta abajo constante y lento de materia meteorizada suelta de la Tierra, especialmente los suelos, lo que ocasiona que se inclinen los objetos en una ladera.
- cresta:** (pág. 421) punto más alto de una onda.

cross-bedding/dendrochronology

cross-bedding: (p. 138) depositional feature of sedimentary rock that forms as inclined layers of sediment are carried forward across a horizontal surface.

cross-cutting relationships: (p. 597) the principle that an intrusion is younger than the rock it cuts across.

cryosphere: (p. 8) the frozen portion of water on Earth's surface.

crystal: (p. 87) solid in which atoms are arranged in repeating patterns.

crystalline structure: (p. 73) regular geometric pattern of particles in most solids, giving a solid a definite shape and volume.

cumulus (KYEW myuh lus): (p. 301) puffy, lumpy-looking clouds that usually occur below 2000 m.

cyanobacteria: (p. 629) microscopic, photosynthetic prokaryotes that formed stromatolites and changed early Earth's atmosphere by generating oxygen.

estratificación cruzada/dendrocronología

estratificación cruzada: (pág. 138) característica de la deposición de roca sedimentaria que se forma a medida que capas inclinadas de sedimentos son arrastradas hacia delante, a lo largo de una superficie horizontal.

relaciones de corte transversal: (pág. 597) principio que establece que una intrusión es menos antigua que la roca que atraviesa.

criosfera: (pág. 8) la parte de agua congelada sobre la superficie de la Tierra.

crystal: (pág. 87) sólido cuyos átomos están ordenados en patrones repetitivos.

estructura cristalina: (pág. 73) patrón geométrico y regular que tienen las partículas en la mayoría de los sólidos; da al sólido una forma y volumen definidos.

cúmulo: (pág. 301) nubes esponjosas con aspecto de madejas de algodón que generalmente se hallan a alturas menores de 2000 m.

cianobacterias: (pág. 629) organismos procariontes fotosintéticos microscópicos que formaron estromatolitos y modificaron la atmósfera primitiva de la Tierra al producir oxígeno.

D

dark matter: (p. 870) invisible material thought to be made up of a form of subatomic particle that interacts only weakly with other matter.

deep-sea trench: (p. 451) elongated, sometimes a re-shaped depression in the seafloor that can extend for thousands of kilometers, is the deepest part of the ocean basin, and is found primarily in the Pacific Ocean.

deflation: (p. 202) lowering of land surface caused by wind erosion of loose surface particles, often leaving coarse sediments behind.

deforestation: (p. 739) removal of trees from a forested area without adequate replanting, often using clear-cutting, which can result in loss of topsoil and water pollution.

delta: (p. 236) triangular deposit, usually made up of silt and clay particles, that forms where a stream enters a large body of water.

dendrochronology: (p. 604) science of using tree rings to determine absolute age; helped to date relatively recent geologic events and environmental changes.

materia oscura: (pág. 870) sustancia invisible formada por algún tipo de partícula subatómica que interactúa débilmente con otros tipos de material.

fosa abisal: (pág. 451) depresión alargada y en algunas ocasiones con forma de arco, que se puede extender miles de kilómetros; es la parte más profunda de la cuenca oceánica y se halla principalmente en el océano Pacífico.

deflación: (pág. 202) depresión de la superficie terrestre causada por la erosión eólica de partículas superficiales sueltas; a menudo sólo contiene sedimentos gruesos.

deforestación: (pág. 739) eliminación de árboles de un área forestal, sin realizar una adecuada reforestación; a menudo es resultado de una corta a hecho, lo que puede ocasionar la pérdida del manto y la contaminación de las aguas.

delta: (pág. 236) depósito triangular compuesto generalmente por partículas de limo y arcilla, que se forma en el sitio donde una corriente de agua entra a una gran masa de agua.

dendrocronología: (pág. 604) ciencia que usa los anillos de crecimiento anual de los árboles para determinar la edad absoluta; permite datar eventos geológicos y cambios ambientales relativamente recientes.

density current: (p. 427) movement of ocean water that occurs in depths too great to be affected by surface winds and is generated by differences in water temperature and salinity.

density-dependent factor: (p. 736) environmental factor, such as disease, predators, or lack of food, that increasingly affects a population as the population's size increases.

density-independent factor: (p. 736) environmental factor that does not depend on population size, such as storms, flood, fires, or pollution.

dependent variable: (p. 12) factor in an experiment that can change if the independent variable is changed.

deposition: (p. 171) occurs when eroded materials are dropped in another location.

desalination: (p. 697) process that removes salt from seawater in order to provide freshwater.

desertification: (p. 683) process by which productive land becomes desert; in arid areas can occur through the loss of topsoil.

dew point: (p. 295) temperature to which air is cooled at a constant pressure to reach saturation, at which point condensation can occur.

differentiation (dih fu h ren shee AY shun): (p. 623) process in which a planet becomes internally zoned, with the heavy materials sinking toward the center and the lighter materials accumulating near its surface.

digital forecast: (p. 331) weather forecast that uses numerical data to predict how atmospheric variables change over time.

dike: (p. 516) pluton that cuts across preexisting rocks and often forms when magma invades cracks in surrounding rock bodies.

discharge: (p. 229) measure of a volume of stream water that flows over a specific location in a particular amount of time.

divergent boundary: (p. 481) place where two of Earth's tectonic plates are moving apart; is associated with volcanism, earthquakes, and high heat flow, and is found primarily on the seafloor.

divide: (p. 227) elevated land that divides one watershed from another.

corriente de densidad: (pág. 427) movimiento de las aguas oceánicas que ocurre a grandes profundidades, no se ve afectado por los vientos superficiales y es generado por las diferencias en temperatura y salinidad del agua.

factor dependiente de la densidad: (pág. 736) factor ambiental como las enfermedades, los depredadores o la falta de alimento, que afecta con creciente intensidad a una población a medida que aumenta el tamaño de su población.

factor independiente de la densidad: (pág. 736) factor ambiental, como las tempestades, las inundaciones, los incendios o la contaminación, que no son afectados por el tamaño de la población.

variable dependiente: (pág. 12) factor de un experimento que puede cambiar al variar la variable independiente.

depositación: (pág. 171) ocurre cuando los materiales erosionados son depositados en otro sitio.

desalinización: (pág. 697) proceso de eliminación de la sal del agua marina para obtener agua dulce.

desertificación: (pág. 683) proceso mediante el cual las tierras productivas se convierten en desierto; en áreas áridas puede ocurrir debido a la pérdida del mantillo del suelo.

punto de rocío: (pág. 295) temperatura a la cual el aire que se enfría a una presión constante alcanza la saturación, punto en el cual ocurre la condensación.

diferenciación: (pág. 623) proceso en que un planeta se divide internamente en zonas, los materiales pesados se hunden hacia el centro, mientras que los materiales más ligeros se acumulan cerca de su superficie.

pronóstico digital: (pág. 331) pronóstico del tiempo que se basa en datos numéricos para predecir el cambio de las variables atmosféricas con el tiempo.

dique: (pág. 516) plutón que atraviesa las rocas preexistentes; suele formarse cuando el magma invade las grietas de los cuerpos rocosos circundantes.

descarga: (pág. 229) medida del volumen de agua corriente que fluye sobre una ubicación dada en cierto lapso de tiempo.

límite divergente: (pág. 481) lugar donde dos placas tectónicas terrestres se alejan entre sí; se asocia con actividad volcánica, terremotos, un alto flujo de calor y se hallan principalmente en el fondo marino.

divisoria: (pág. 227) terreno elevado que separa una cuenca hidrográfica de otra.

Doppler effect/El Niño

Doppler effect: (p. 327) change in the wave frequency that occurs due to the relative motion of the wave as it moves toward or away from an observer.

downburst: (p. 351) violent downdrafts that are concentrated in a local area.

drawdown: (p. 263) difference between the water level in a pumped well and the original water-table level.

drought: (p. 362) extended period of well-below-average rainfall, usually caused by shifts in global wind patterns, allowing high-pressure systems to remain for weeks or months over continental areas.

drumlin: (p. 210) elongated landform that results when a glacier moves over an older moraine.

dune: (p. 204) pile of windblown sand that develops over time, whose shape depends on sand availability, wind velocity and direction, and amount of vegetation present.

dwarf planet: (p. 816) an object that, due to its own gravity, is spherical in shape, orbits the Sun, is not a satellite, and has not cleared the area of its orbit of smaller debris.

eccentricity: (p. 801) ratio of the distance between the foci to the length of the major axis; defines the shape of a planet's elliptical orbit.

ecliptic plane: (p. 776) plane of Earth's orbit around the Sun.

Ediacaran biota (ee d ee A k uh r uhn • by O H t uh): (p. 636) fossils of various multicellular organisms from about 630 mya.

ejecta: (p. 771) material that falls back to the lunar surface after being blasted out by the impact of a space object.

elastic deformation: (p. 529) causes materials to bend and stretch; proportional to stress, so if the stress is reduced or returns to zero the strain or deformation is reduced or disappears.

El Niño: (p. 388) a band of anomalously warm ocean temperatures that occasionally develops off the western coast of South America and can cause short-term climatic changes felt worldwide.

efecto Doppler/El Niño

efecto Doppler: (pág. 327) cambio en la frecuencia de onda que ocurre debido al movimiento relativo de la onda a medida que se acerca o se aleja de un observador.

reventón: (pág. 351) vientos c horros de viento descendientes que se concentran en un área local.

tasa de agotamiento: (pág. 263) diferencia entre el nivel de agua en un pozo artesanal en uso y el nivel original del manto freático.

sequía: (pág. 362) período prolongado con precipitación muy por debajo del promedio, generalmente es causado por cambios en los patrones globales de vientos, lo que permite que los sistemas de alta presión permanezcan sobre áreas continentales durante semanas o meses.

drumlin: (pág. 210) formación alargada de tierra que se forma cuando un glaciar se mueve sobre una morrena más antigua.

duna: (pág. 204) pila de arena formada a lo largo del tiempo por el arrastre de partículas por el viento, cuya forma depende de la disponibilidad de arena, la velocidad y dirección del viento y la cantidad de vegetación presente.

planeta menor: (pág. 816) cuerpo que debido a su propia gravedad tiene forma esférica, tiene una órbita alrededor del Sol, no es un satélite y no ha eliminado restos más pequeños del área de su órbita.

E

excentricidad: (pág. 801) razón de la distancia entre los focos y la longitud del eje mayor; define la forma de la órbita elíptica de un planeta.

plano de la eclíptica: (pág. 776) plano de la órbita de la Tierra alrededor del Sol.

biota Ediacarana: (pág. 636) fósiles de diversos organismos multicelulares de hace cerca de 630 millones de años.

eyecta: (pág. 771) material que cae de regreso a la superficie lunar luego de ser expulsado por el impacto de un cuerpo espacial.

deformación elástica: (pág. 529) ocasiona que los materiales se doblen y se estiren; es proporcional al grado de tensión, por lo que si la tensión se reduce o desaparece, la deformación también se reduce o desaparece.

El Niño: (pág. 388) una banda de agua oceánica que tiene temperaturas anormalmente cálidas que en ocasiones se desarrolla frente a la costa occidental de Sudamérica; puede causar cambios climáticos a corto plazo que afectan a todo el mundo.

electromagnetic spectrum: (p. 764) all types of electromagnetic radiation arranged according to wavelength and frequency.

electron: (p. 61) tiny atomic particle with little mass and a negative electric charge; an atom's electrons are equal in number to its protons and are located in a cloudlike region surrounding the nucleus.

element: (p. 60) natural or artificial substance that cannot be broken down into simpler substances by physical or chemical means.

ellipse: (p. 800) an oval that is centered on two points called foci; the shape of planets' orbits.

energy efficiency: (p. 721) a type of conservation in which the amount of work produced is compared to the amount of energy used.

Enhanced Fujita Tornado Damage scale: (p. 353) classifies tornadoes according to their wind speed, duration, and path of destruction on a scale ranging from EF0 to EF5.

environmental science: (p. 7) study of the interactions of humans with environment.

eon: (p. 592) longest time unit in the geologic time scale.

epicenter (EH pih sen tur): (p. 533) point on Earth's surface directly above the focus of an earthquake.

epoch: (p. 593) time unit in the geological time scale, smaller than a period, measured in hundreds of thousands to millions of years.

equator: (p. 30) imaginary line that lies at 0° latitude and circles Earth midway between the north and south poles, dividing Earth into the northern hemisphere and the southern hemisphere.

equinox: (p. 777) time of year during which Earth's axis is at a 90° angle to the Sun; both hemispheres receive exactly 12 hours of sunlight and the Sun is directly overhead at the equator.

era: (p. 593) second-longest time unit in the geologic time scale, measured in tens to hundreds of millions of years, and defined by differences in life forms that are preserved in rocks.

erosion: (p. 171) removal and transport of weathered materials from one location to another by agents such as water, wind, glaciers, and gravity.

esker: (p. 210) long, winding ridge of layered sediments deposited by streams that flow beneath a melting glacier.

espectro electromagnético: (pág. 764) clasificación de todos los tipos de radiación electromagnética de acuerdo con su frecuencia y longitud de onda.

electrón: (pág. 61) partícula atómica diminuta con masa pequeña y carga eléctrica negativa; los electrones están ubicados en una región con forma de nube que rodea al núcleo del átomo y su número es igual al número de protones del átomo.

elemento: (pág. 60) sustancia natural o artificial que no puede separarse en sustancias más simples por medios físicos o químicos.

elipse: (pág. 800) óvalo centrado en dos puntos llamados focos; la forma de las órbitas de los planetas.

eficiencia energética: (pág. 721) tipo de conservación en el cual la cantidad de trabajo producido se compara con la cantidad de energía utilizada.

escala mejorada de Fujita para daños de tornados: (pág. 353) clasifica los tornados según la velocidad de sus vientos, su duración y el daño que causan a su paso, en una escala que va de EF0 a EF5.

ciencias ambientales: (pág. 7) estudio de las interacciones del hombre con su entorno.

eon: (pág. 592) unidad más larga de tiempo en la escala de tiempo geológico.

epicentro: (pág. 533) punto en la superficie terrestre ubicado directamente encima del foco de un sismo.

época: (pág. 593) unidad de tiempo en la escala de tiempo geológico, es más pequeña que un período y se mide en millones a centenares de millares de años.

ecuador: (pág. 30) línea imaginaria que yace en la latitud 0° y que circunda la Tierra entre los polos norte y sur, dividiendo a la Tierra en dos hemisferios iguales: norte y sur.

equinoccio: (pág. 777) época del año durante la cual el eje de la Tierra forma un ángulo de 90° con el Sol, ambos hemisferios reciben exactamente 12 horas de luz solar y el Sol se halla exactamente sobre el ecuador.

era: (pág. 593) segunda unidad más grande de tiempo en la escala del tiempo geológico; se mide en decenas a centenas de millones de años y se define según las diferencias en las formas de vida preservadas en las rocas.

erosión: (pág. 171) eliminación y transporte de materiales meteorizados de un lugar a otro por agentes como el agua, el viento, los glaciares y la gravedad.

ésker: (pág. 210) formación larga y sinuosa de sedimentos estratificados, depositados por corrientes que fluyen debajo de un glaciar que se derrite.

estuary/eyewall

estuary: (p. 414) coastal area of lowest salinity often occurs where the lower end of a freshwater river or stream enters the ocean.

eukaryote (yew KE ree oht): (p. 635) organism composed of one or more cells each of which usually contains a nucleus; larger and more complex than a prokaryote.

eutrophication: (p. 239) process by which lakes become rich in nutrients from the surrounding watershed, resulting in a change in the kinds of organisms in the lake.

evaporation: (p. 74) vaporization—change of state from a liquid to a gas, involving thermal energy.

evaporite: (p. 143) the layers of chemical sedimentary rocks that form when concentrations of dissolved minerals in a body of water reach saturation due to the evaporation of water; crystal grains precipitate out of solution and settle to the bottom.

evolution (eh vuh LEW shun): (p. 606) the change in species over time.

exfoliation: (p. 165) mechanical weathering process in which outer rock layers are stripped away, often resulting in dome-shaped formations.

exosphere: (p. 286) outermost layer of Earth's atmosphere that is located above the thermosphere with no clear boundary at the top; transitional region between Earth's atmosphere and outer space.

exponential growth: (p. 735) pattern of growth in which a population of organisms grows faster as it increases in size, resulting in a population explosion.

extrusive rock: (p. 118) fine-grained igneous rock that is formed when molten rock cools quickly and solidifies on Earth's surface.

eye: (p. 356) calm center of a tropical cyclone that develops when the winds around its center reach at least 120 km/h.

eyewall: (p. 356) band where the strongest winds in a hurricane are usually concentrated, surrounding the eye.

estuario/pared del ojo de huracán

estuario: (pág. 414) área costera de aguas salobres que se forma en el sitio donde la desembocadura de un río o corriente de agua dulce entra al océano; provee una fuente excelente de alimento y refugio para organismos marinos comercialmente importantes.

eucariota: (pág. 635) organismo compuesto por una o más células nucleadas; generalmente es más grande y más complejo que un procariota.

eutrofización: (pág. 239) proceso de aumento de la cantidad de nutrientes que contiene un lago, alimentado por los nutrientes provenientes de la cuenca circundante, lo que causa un cambio en los tipos de organismos que habitan el lago.

evaporación: (pág. 74) vaporización: cambio de estado de un líquido a gas que implica energía térmica.

evaporita: (pág. 143) capas de roca química sedimentaria que se forman cuando la concentración de minerales disueltos en una masa de agua alcanza el punto de saturación debido a la evaporación del agua; los cristales se precipitan de la solución y se asientan en el fondo.

evolución: (pág. 606) cambios de las especies a lo largo del tiempo.

exfoliación: (pág. 165) proceso de meteorización mecánica que causa la eliminación de los estratos rocosos exteriores, a menudo produce formaciones en forma de domo.

exosfera: (pág. 286) capa más externa de la atmósfera terrestre, está localizada por encima de la termosfera y no tiene un límite definido en su parte más alejada; región de transición entre la atmósfera de la Tierra y el espacio exterior.

crecimiento exponencial: (pág. 735) patrón de crecimiento en que una población de organismos crece cada vez más rápidamente a medida que aumenta de tamaño, causando una explosión demográfica.

roca extrusiva: (pág. 118) roca ígnea de grano fino que se forma cuando la roca fundida se enfría rápidamente y se solidifica en la superficie terrestre.

ojo: (pág. 356) centro de calma de un ciclón tropical que se desarrolla cuando los vientos a su alrededor alcanzan por lo menos 120 km/h.

pared del ojo de huracán: (pág. 356) banda que rodea el ojo de un huracán donde generalmente se concentran los vientos más fuertes.

F

fault: (p. 530) fracture or system of fractures in Earth's crust that occurs when stress is applied too quickly or stress is too great; can form as a result of horizontal compression (reverse fault), horizontal shear (strike-slip fault), or horizontal tension (normal fault).

fault-block mountain: (p. 574) mountain that forms when large pieces of crust are tilted, uplifted, or dropped downward between large normal faults.

fission: (p. 834) process in which heavy atomic nuclei split into smaller, lighter atomic nuclei.

fissure: (p. 504) long crack in Earth's crust.

flood: (p. 230) potentially devastating natural occurrence in which water spills over the sides of a stream's banks onto adjacent land areas.

flood basalt: (p. 504) huge amounts of lava that erupt from fissures.

floodplain: (p. 230) broad, flat, fertile area extending out from a stream's bank that is covered with water during floods.

focus: (p. 533) point of the initial fault rupture where an earthquake originates that usually lies at least several kilometers beneath Earth's surface.

foliated: (p. 146) metamorphic rock, such as schist or gneiss, whose minerals are squeezed under high pressure and arranged in wavy layers and bands.

fossil fuel: (p. 710) nonrenewable energy resource formed over geologic time from the compression and partial decomposition of organisms that lived millions of years ago.

fractional crystallization: (p. 115) process in which different minerals crystallize from magma at different temperatures, removing elements from magma.

fracture: (p. 93) when a mineral breaks into pieces with arclike, rough, or jagged edges.

front: (p. 322) boundary between two air masses of differing densities; can be cold, warm, stationary, or occluded and can stretch over large areas of Earth's surface.

falla: (pág. 530) fractura o sistema de fracturas en la corteza terrestre que ocurren simultáneamente se aplica tensión rápidamente o donde la tensión es demasiado grande; se puede formar como resultado de una compresión horizontal (falla invertida), un cizallamiento horizontal (falla de transformación) o una tensión horizontal (falla normal).

montañas de bloque de falla: (pág. 574) montañas que se forman cuando trozos grandes de corteza se inclinan, se elevan o se hunden entre fallas normales grandes.

fisión: (pág. 834) proceso mediante el cual los núcleos atómicos pesados se dividen en núcleos más livianos y pequeños.

fisura: (pág. 504) grandes grietas en la Tierra.

inundación: (pág. 230) acontecimiento natural potencialmente devastador en que el agua se desborda de las riberas de una corriente y cubre los terrenos adyacentes.

basalto de meseta: (pág. 504) grandes cantidades de lava que salen por las fisuras.

llanura aluvial: (pág. 230) área fértil, plana y ancha que se extiende desde las riberas de una corriente y queda cubierta por agua durante las inundaciones.

foco: (pág. 533) punto inicial de ruptura de la falla donde se origina un terremoto; generalmente se halla varios kilómetros debajo de la superficie terrestre.

foliada: (pág. 146) roca metamórfica, como el esquisto o el gneis, cuyos minerales son comprimidos bajo presiones altas, formando ordenadas capas y bandas onduladas.

combustible fósil: (pág. 710) recurso energético no renovable que se forma a lo largo del tiempo geológico, a partir de la compresión y descomposición parcial de organismos que vivieron hace millones de años.

crystalización fraccionaria: (pág. 115) proceso en el cual diferentes minerales se cristalizan a diferentes temperaturas a partir del magma, eliminando elementos del magma.

fractura: (pág. 93) sucede cuando un mineral se rompe en pedazos con bordes ásperos, arqueados o serrados.

frente: (pág. 322) límite entre dos masas de aire con diferentes densidades; puede ser frío, cálido, estacionario u oculto y puede extenderse sobre grandes áreas de la superficie de la Tierra.

frontal thunderstorm/geyser

frontal thunderstorm: (p. 346) type of thunderstorm usually produced by an advancing cold front, which can result in a line of thunderstorms hundreds of kilometers long, or, more rarely, an advancing warm front, which can result in a relatively mild thunderstorm.

frost wedging: (p. 164) mechanical weathering process that occurs when water repeatedly freezes and thaws in the cracks of rocks, often resulting in rocks splitting.

fuel: (p. 709) material, such as wood, peat, or coal, burned to produce energy.

fusion: (p. 834) The combining of lightweight nuclei into heavier nuclei; occurs in the core of the Sun where temperatures and pressure are extremely high.

gas giant planet: (p. 811) large, gaseous planet that is very cold at its surface; has ring systems, many moons, and lacks solid surfaces—Jupiter, Saturn, Uranus, and Neptune.

gem: (p. 101) rare, precious, highly prized mineral that can be cut, polished, and used for jewelry.

Geographic Information System (GIS): (p. 44) mapping system that uses worldwide databases from remote sensing to create layers of information that can be superimposed upon each other to form a comprehensive map.

geologic map: (p. 38) a map that shows the distribution, arrangement, and types of rocks below the soil, and other geologic features.

geologic time scale: (p. 590) record of Earth's history from its origin 4.6 bya to the present.

geology: (p. 7) study of materials that make up Earth and the processes that form and change these materials, and the history of the planet and its life-forms since its origin.

geosphere: (p. 8) the part of Earth from its surface to its center.

geothermal energy: (p. 717) energy produced by Earth's naturally occurring heat, steam, and hot water.

geyser: (p. 258) explosive hot spring that erupts regularly.

tormenta frontal/géiser

tormenta frontal: (pág. 346) tipo de tormenta que es producida generalmente por el avance de un frente frío, pudiendo producir una línea de tormentas de cientos de kilómetros de largo, o en menor frecuencia por el avance de un frente cálido, produciendo tormentas relativamente ligeras.

erosión periglacial: (pág. 164) proceso mecánico de meteorización que ocurre cuando el agua se congela y se descongela, en repetidas ocasiones, en las grietas de las rocas, ocasionando el rompimiento de las mismas.

combustible: (pág. 709) materiales como la leña, la turba o el carbón, que se queman para producir energía.

fusión: (pág. 834) combinación de núcleos livianos para formar núcleos más pesados: sucede en el núcleo del Sol donde las temperaturas y la presión son extremadamente altas.

G

gigantes gaseosos: (pág. 811) planetas grandes y gaseosos con superficies muy frías; tienen sistemas de anillos, muchas lunas y carecen de superficie sólida: Júpiter, Saturno, Urano y Neptuno.

gema: (pág. 101) mineral sumamente valioso, precioso y es caso que se puede cortar, pulir y utilizar en joyería.

Sistema de Información Geográfica (SIG): (pág. 44) sistema para la elaboración de mapas que usa bases de datos mundiales obtenidos por sensores remotos, para crear capas de información que se pueden superponer para elaborar mapas que combinan dicha información.

mapa geológico: (pág. 38) mapa que muestra la distribución, el orden y los tipos de roca del subsuelo, así como otras características geológicas.

escala del tiempo geológico: (pág. 590) registro de la historia de la Tierra desde su origen, hace 4.6 billones de años, hasta el presente.

geología: (pág. 7) estudio de los materiales que conforman la Tierra y de los procesos de formación y cambio de estos materiales, así como la historia del planeta y sus formas de vida desde su origen.

geosfera: (pág. 8) región que abarca desde la superficie hasta el centro de la Tierra.

energía geotérmica: (pág. 717) energía producida naturalmente en la Tierra por el calor, el vapor y el agua caliente.

géiser: (pág. 258) manantial térmico explosivo que hace erupción regularmente.

glacier: (p. 207) large, moving mass of ice that forms near Earth's poles and in mountainous regions at high elevations.

glass: (p. 73) solid that consists of densely packed atoms with a random arrangement and lacks crystals or has crystals that are not visible.

Global Positioning System (GPS): (p. 44) satellite-based navigation system that permits a user to pinpoint his or her exact location on Earth.

global warming: (p. 393) rise in global temperatures, which might be due to increases in atmospheric CO₂ from deforestation and burning of fossil fuels

gnomonic (noh MAHN i hk) projection: (p. 35) map useful in plotting long-distance trips by boat or plane, made by projecting points and lines from a globe onto a piece of paper that touches the globe at a single point.

graded bedding: (p. 138) type of bedding in which particle sizes become progressively heavier and coarser toward the bottom layers.

granitic rock: (p. 118) light-colored rock that has high silica content, and contains quartz and potassium feldspar.

greenhouse effect: (p. 393) natural heating of Earth's surface by certain atmospheric gases, which helps keep Earth warm enough to sustain life.

gully erosion: (p. 172) erosion that occurs when a rill channel widens and deepens.

guyot: (p. 452) large, extinct, basaltic volcanoes with flat, submerged tops.

H

half-life: (p. 602) period of time it takes for a radioactive isotope, such as carbon-14, to decay to one-half of its original amount.

halo: (p. 863) spherical region where globular clusters are located; surrounds the Milky Way's nuclear bulge and disk.

hardness: (p. 91) measure of how easily a mineral can be scratched, which is determined by the arrangement of a mineral's atoms.

heat island: (p. 385) urban area where climate is warmer than in the surrounding countryside due to factors such as numerous concrete buildings and large expanses of asphalt.

glaciar: (pág. 207) enormes masas móviles de hielo que se forman cerca de los polos de la Tierra o en grandes elevaciones en regiones montañosas.

vidrio: (pág. 73) sólido formado por átomos densamente comprimidos en un ordenamiento aleatorio; carece de cristales o sus cristales no son visibles.

Sistema de posicionamiento global (SPG): (pág. 44) sistema de navegación por satélite que permite al usuario localizar su ubicación exacta sobre la Tierra.

calentamiento global: (pág. 393) aumento en las temperaturas globales, que es probablemente producto del aumento en el CO₂ atmosférico, causado por la deforestación y la quema de combustibles fósiles

proyección gnomónica: (pág. 35) mapa útil para trazar viajes de distancias largas por barco o por avión; se elabora proyectando los puntos y las líneas de un globo sobre una hoja de papel que toca el globo en un solo punto.

estratificación graduada: (pág. 138) característica de la depositación de rocas sedimentarias en la cual las partículas son progresivamente más pesadas y gruesas hacia las capas inferiores de la estratificación.

roca granítica: (pág. 118) roca de color claro que tiene un alto contenido de sílice y contiene cuarzo y potasio feldespato.

efecto invernadero: (pág. 393) calentamiento natural de la superficie terrestre por ciertos gases atmosféricos; ayuda a mantener en la Tierra una temperatura lo suficientemente cálida para mantener la vida.

erosión en barrancos: (pág. 172) erosión que ocurre cuando el cauce de un arroyuelo se ensancha y profundiza.

guyot: (pág. 452) grandes volcanes basálticos extintos cuya cima es plana y está sumergida.

vida media: (pág. 602) período de tiempo que demora un isótopo radiactivo, como el carbono 14, en desintegrarse a la mitad de su cantidad radiactiva original.

halo: (pág. 863) región esférica donde se ubican los cúmulos globulares; rodea el disco y el núcleo central de la Vía Láctea.

dureza: (pág. 91) medida de la facilidad con la que un mineral es rayado; está determinada por el ordenamiento de los átomos del mineral.

isla de calor: (pág. 385) área urbana donde el clima es más caliente que en el área rural circundante, debido a factores como los numerosos edificios de concreto y las grandes extensiones de asfalto.

heat wave/hypothesis

heat wave: (p. 362) extended period of above-average temperatures caused by large, high-pressure systems that warm by compression and block cooler air masses.

Hertzsprung-Russell diagram (H-R diagram): (p. 845) graph that relates stellar characteristics—class, mass, temperature, magnitude, diameter, and luminosity.

highland: (p. 771) light-colored, mountainous, heavily cratered area of the Moon, composed mostly of lunar breccias.

Homo sapiens: (p. 665) species to which modern humans belong.

hot spot: (p. 502) unusually hot area in Earth's mantle where high-temperature plumes of mantle material rise toward the surface.

hot spring: (p. 258) thermal spring with temperatures higher than that of the human body.

Hubble constant: (p. 874) value (H) used to calculate the rate at which the universe is expanding; measured in kilometers per second per megaparsec.

humidity: (p. 294) amount of water vapor in the atmosphere at a given location on Earth's surface.

hydrocarbon: (p. 709) molecules with hydrogen and carbon bonds only; the result of the combination of carbon dioxide and water during photosynthesis.

hydroelectric power: (p. 716) power generated by converting the energy of free-falling water to electricity.

hydrogen bond: (p. 693) forms when the positive ends of some water molecules are attracted to the negative ends of other water molecules; cause water's surface to contract and allow water to adhere to and coat a solid.

hydrosphere: (p. 8) all the water in Earth's oceans, lakes, seas, rivers, and glaciers plus all the water in the atmosphere.

hydrothermal metamorphism: (p. 149) occurs when very hot water reacts with rock, altering its mineralogy and chemistry.

hygrometer (hi GRAH muh tur): (p. 325) weather instrument used to measure humidity.

hypothesis: (p. 10) a testable explanation of a situation.

ola de calor/hipótesis

ola de calor: (pág. 362) período extenso de temperaturas más altas que el promedio; es usado por grandes sistemas de alta presión que se calientan por compresión y bloquean las masas de aire más frías.

diagrama de Hertzsprung-Russell (diagrama H-R): (pág. 845) gráfica que relaciona características estelares: incluyendo la clase, la masa, la temperatura, la magnitud, el diámetro y la luminosidad.

tierras altas: (pág. 771) áreas de la Luna de color claro, con muchos cráteres y montañas, compuestas en su mayor parte de brechas lunares.

Homo sapiens: (pág. 665) especie a la cual pertenecen los seres humanos modernos.

punto caliente: (pág. 502) área muy caliente del manto de la Tierra donde plumas de material del manto a gran temperatura ascienden a la superficie.

fuelle caliente: (pág. 258) manantial termal con temperaturas más altas que las del cuerpo humano.

constante de Hubble: (pág. 874) valor (H) que sirve para calcular la velocidad de expansión del universo; se mide en kilómetros por segundo por megaparsec.

humedad: (pág. 294) cantidad de vapor de agua en el aire en un sitio determinado de la Tierra.

hidrocarburo: (pág. 709) molécula que sólo contiene enlaces entre átomos de hidrógeno y de carbono; es producto de la unión del dióxido de carbono y el agua durante la fotosíntesis.

energía hidroeléctrica: (pág. 716) se genera al convertir la energía de una caída de agua en electricidad.

enlace de hidrógeno: (pág. 693) se forma cuando el extremo positivo de algunas moléculas de agua son atraídas por el extremo negativo de otras moléculas de agua; ocasiona que la superficie del agua se contraiga y permite al agua adherirse y recubrir un sólido.

hidrosfera: (pág. 8) toda el agua en los océanos, los lagos, los mares, los ríos y los glaciares de la Tierra, además de toda el agua en la atmósfera.

metamorfismo hidrotérmico: (pág. 149) ocurre cuando agua muy caliente reacciona con la roca, alterando su mineralogía y su química.

higrómetro: (pág. 325) instrumento meteorológico que se usa para medir la humedad.

hipótesis: (pág. 10) explicación de una situación que se puede poner a prueba.

ice age: (p. 387) period of extensive glacial coverage, producing long-term climatic changes, where average global temperatures decreased by 5°C.

igneous rock: (p. 112) intrusive or extrusive rock formed from the cooling and crystallization of magma or lava.

impact crater: (p. 771) crater formed when space material impacted on Moon's surface.

inclusion: (p. 597) the principle that fragments, called inclusions, in a rock layer must be older than the rock layer that contains them.

independent variable: (p. 12) factor that is manipulated by the experimenter in an experiment.

index fossils: (p. 609) remains of plants or animals that were abundant, widely distributed, and existed briefly that can be used by geologists to correlate or date rock layers.

infiltration: (p. 253) Process by which precipitation that has fallen on land surfaces enters the ground and becomes groundwater.

interferometry: (p. 767) process that links separate telescopes so they act as one telescope, producing more detailed images as the distance between them increases.

International Date Line: (p. 33) the 180° meridian, which serves as the transition line for calendar days.

intrusive rock: (p. 118) coarse-grained igneous rock that is formed when molten rock cools slowly and solidifies inside Earth's crust.

ion: (p. 64) an atom that gains or loses an electron.

ionic bond: (p. 68) attractive force between two ions with opposite charge.

iridium (ih RID ee um): (p. 659) metal that is rare in rocks at Earth's surface but is relatively common in asteroids.

isobar: (p. 329) line on a weather map connecting areas of equal pressure

isochron (I suh krahn): (p. 477) imaginary line on a map that shows points of the same age; formed at the same time.

isostasy (I SAHS tuh see): (p. 563) condition of equilibrium that describes the displacement of Earth's mantle by Earth's continental and oceanic crust.

glaciación: (pág. 387) período de formación de una amplia cobertura glacial que produce cambios climáticos de largo plazo en que las temperaturas globales promedio disminuyen 5°C.

roca ígnea: (pág. 112) roca intrusiva o extrusiva formada a partir del enfriamiento y cristalización del magma o lava.

cráter de impacto: (pág. 771) cráter que se forma cuando material proveniente del espacio impacta la superficie de la Luna.

inclusión: (pág. 597) principio que establece que los fragmentos, llamados inclusiones, contenidos por un estrato rocoso deben ser más antiguos que la roca que los contiene.

variable independiente: (pág. 12) factor que es manipulado por el investigador en un experimento.

fósiles guía: (pág. 609) restos de plantas o animales que fueron abundantes, tuvieron una amplia distribución y existieron poco tiempo, que sirven a los geólogos para correlacionar o para datar estratos rocosos.

infiltración: (pág. 253) proceso mediante el cual la precipitación que cae sobre la superficie terrestre entra al suelo y se convierte en agua subterránea.

interferometría: (pág. 767) proceso que combina telescopios separados para que funcionen como un solo telescopio, produciendo imágenes más detalladas al aumentar la distancia entre ellos.

línea internacional de cambio de fecha: (pág. 33) el meridiano 180°; sirve como la línea de transición para los días del calendario.

roca intrusiva: (pág. 118) roca ígnea de grano grueso que se forma cuando la roca fundida se enfría lentamente y se solidifica en el interior de la corteza terrestre.

ion: (pág. 64) átomo que gana o pierde un electrón.

enlace iónico: (pág. 68) fuerza de atracción entre dos iones con cargas opuestas.

iridio: (pág. 659) metal escaso en las rocas de la superficie terrestre, pero relativamente común en los meteoritos y los asteroides.

isobara: (pág. 329) línea de un mapa meteorológico que conecta áreas con igual presión.

isocrona: (pág. 477) línea imaginaria en un mapa que conecta puntos con la misma antigüedad; que se formaron al mismo tiempo.

isostasia: (pág. 563) condición de equilibrio que describe el desplazamiento del manto terrestre por las cortezas continental y oceánica de la Tierra.

isostatic rebound/Kuiper belt

rebote isostático/cinturón de Kuiper

isostatic rebound: (p. 565) slow process of Earth's crust rising as the result of the removal of overlying material.

isotherm: (p. 329) line on a weather map connecting areas of equal temperature.

isotope: (p. 62) an atom of an element that has a different mass number than the element but the same chemical properties.

rebote isostático: (pág. 565) proceso lento de elevación de la corteza terrestre producto de la eliminación del material sobreyacente.

isoterma: (pág. 329) línea en un mapa meteorológico que conecta áreas con la misma temperatura.

isótopo: (pág. 62) átomo de un elemento que tiene un distinto número de masa que el elemento, pero las mismas propiedades químicas.

J

jet stream: (p. 321) narrow wind band that occurs above large temperature contrasts and can flow as fast as 185 km/h.

corriente de chorro: (pág. 321) banda de vientos estrecha situada por encima de áreas con grandes contrastes de temperatura y que puede alcanzar una rapidez de 185 km/h.

K

kame: (p. 210) a conical mound of layered sediment that accumulates in a depression on a retreating glacier.

karst topography: (p. 261) irregular topography with sinkholes, sinks, and sinking streams caused by groundwater dissolution of limestone.

kettle: (p. 212) a lake formed when runoff and precipitation filled a kettle hole, which is a depression that formed when an ice block from a continental glacier became covered with sediment and melted.

key bed: (p. 599) a rock or sediment layer that serves as a time marker in the rock record and results from volcanic ash or meteorite-impact debris that spread out and covered large areas of Earth.

kimberlite: (p. 123) rare, ultramafic rock that can contain diamonds and other minerals formed only under very high pressures.

Köppen classification system: (p. 383) classification system for climates, divided into five types, based on the mean monthly values of temperature and precipitation and types of vegetation.

Kuiper (KI pur) belt: (p. 818) region of the space that lies outside the orbit of Neptune, 30 to 50 AU from the Sun, where small solar system bodies that are mostly rock and ice probably formed.

kame: (pág. 210) montículo cónico de sedimento estratificado que es depositado por corrientes que fluyen bajo un glaciar que se derrite.

topografía cárstica: (pág. 261) topografía irregular con sumideros, hundimientos y corrientes que desaparecen, causada por la disolución de la piedra caliza por el agua subterránea.

marmita: (pág. 212) lago que se forma cuando la escorrentía y la precipitación llenan el hueco de una marmita, que es la depresión que se forma cuando un bloque de hielo de un glaciar continental queda cubierto con sedimento y se derrite.

estrato guía: (pág. 599) capa de sedimento que sirve como marcador de tiempo del registro geológico; está formado por cenizas volcánicas o por los restos del impacto de un meteorito que se esparcen y cubren grandes áreas de la Tierra.

kimberlita: (pág. 123) roca ultramáfica poco común que puede contener diamantes y otros minerales que sólo se forman bajo presiones muy altas.

sistema de clasificación de Köppen: (pág. 383) sistema de clasificación de los climas; los clasifica en cinco tipos básicos en base a los valores mensuales promedio de temperatura y precipitación y a los tipos de vegetación.

cinturón de Kuiper: (pág. 818) pequeños cuerpos del sistema solar formados principalmente por roca y hielo, yacen más allá de la órbita de Neptuno, entre 30 a 50 UA del Sol, y es muy probable que se hayan formado en esta región.

laccolith (LA kuh li hth): (p. 515) relatively small, mushroom-shaped pluton that forms when magma intrudes into parallel rock layers close to Earth's surface.

lake: (p. 238) natural or human-made body of water that can form when a depression on land fills with water.

Landsat satellite: (p. 41) information-gathering satellite that uses visible light and infrared radiation to map Earth's surface.

landslide: (p. 197) rapid downslope movement of a mass of loose soil, rock, or debris that has separated from the bedrock; can be triggered by an earthquake.

latent heat: (p. 295) stored energy in water vapor that is not released to warm the atmosphere until condensation takes place.

latitude: (p. 30) distance in degrees north and south of the equator.

Laurentia (law REN shuh): (p. 627) ancient continent formed during the Proterozoic that is the core of modern-day North America.

lava: (p. 112) magma that flows out onto Earth's surface.

Le Système International d'Unités (SI): (p. 13) replacement for the metric system; based on a decimal system using the number 10 as the base unit; includes the meter: (m), second: (s), and kilogram: (kg).

liquid metallic hydrogen: (p. 812) form of hydrogen with both liquid and metallic properties that exists as a layer in the Jovian atmosphere.

lithification: (p. 136) the physical and chemical processes that transform sediments into sedimentary rocks.

loess (LUSS): (p. 206) thick, windblown, fertile deposit of silt that contains high levels of nutrients and minerals.

longitude: (p. 31) distance in degrees east and west of the prime meridian.

longshore bar: (p. 440) submerged sandbar located in the surf zone of most beaches.

longshore current: (p. 441) current that flows parallel to the shore, moves large amounts of sediments, and is formed when incoming breakers spill over a long shore bar.

luminosity: (p. 842) energy output from the surface of a star per second; measured in watts.

lacolito: (pág. 515) plutón relativamente pequeño con forma de champiñón que se forma cuando se introduce el magma entre estratos rocosos paralelos, cerca de la superficie terrestre.

lago: (pág. 238) masa de agua, natural o hecha por el hombre, que se forma cuando una depresión terrestre se llena de agua.

satélite Landsat: (pág. 41) satélite que recoge información, usando luz visible y radiación infrarroja para mapear la superficie terrestre.

derrumbe: (pág. 197) rápido deslizamiento cuesta abajo de una masa de tierra, rocas o escombros sueltos que se han separado del lecho rocoso; puede ser causado por un terremoto.

calor latente: (pág. 295) energía almacenada en el vapor de agua que no es liberada para calentar la atmósfera, hasta que ocurre la condensación.

latitud: (pág. 30) distancia en grados hacia el norte o el sur del ecuador.

Laurencia: (pág. 627) antiguo continente que se formó durante el Proterozoico y que en la actualidad corresponde al centro de Norteamérica.

lava: (pág. 112) magma que fluye por la superficie terrestre.

Le Système International d'Unités/Sistema Internacional de Unidades (SI): (pág. 13) sustituto del sistema métrico; se basa en el sistema decimal por lo que usa el número 10 como unidad base; incluye el metro: (m), el segundo: (s) y el kilogramo: (kg).

hidrógeno metálico líquido: (pág. 812) forma de hidrógeno con propiedades de líquido y de metal que forma una capa en la atmósfera joviana.

litificación: (pág. 136) procesos físicos y químicos que transforman los sedimentos en roca sedimentaria.

loes: (pág. 206) amplio depósito fértil de limo que es arrastrado por el viento y contiene niveles altos de nutrientes y minerales.

longitud: (pág. 31) distancia en grados hacia el este o el oeste del primer meridiano.

barra litoral: (pág. 440) barra de arena sumergida ubicada en la zona de oleaje de la mayoría de las playas.

corriente litoral: (pág. 441) corriente que fluye paralela a la costa, transporta grandes cantidades de sedimentos y se forma cuando las olas rompen a lo largo de una larga barra litoral.

luminosidad: (pág. 842) energía que irradia la superficie de una estrella por segundo; se mide en vatios.

lunar eclipse/Maunder minimum

lunar eclipse: (p. 784) when Earth passes between the Sun and the Moon, and Earth's shadow falls on the Moon; occurs only during a full moon,

luster: (p. 90) the way that a mineral reflects light from its surface; two types—metallic and nonmetallic.

magnetic reversal: (p. 476) when Earth's magnetic field changes polarity between normal and reversed.

magnetometer (mag n uh TAH m uh tur): (p. 473) device used to map the ocean floor that detects small changes in magnetic fields.

magnitude: (p. 539) measure of the energy released during an earthquake, which can be described using the Richter scale.

main sequence: (p. 845) in an H-R diagram, the broad, diagonal band that includes about 90 percent of all stars and runs from hot, luminous stars in the upper-left corner to cool, dim stars in the lower-right corner.

map legend: (p. 39) key that explains what the symbols on a map represent.

map scale: (p. 39) ratio between the distances shown on a map and the actual distances on Earth's surface.

maria (MAH ree uh): (p. 771) dark-colored, smooth plains on the Moon surface.

mass extinction: (p. 594) occurs when an unusually large number of organisms disappear from the rock record at about the same time.

mass movement: (p. 194) downslope movement of Earth materials due to gravity that can occur suddenly or very slowly, depending on the weight of the material, its resistance to sliding, and whether a trigger, such as an earthquake, is involved.

mass number: (p. 62) combined number of protons and neutrons in the nucleus of an atom.

matter: (p. 60) anything that has volume and mass.

Maunder minimum: (p. 390) period of very low sunspot activity that occurred between 1645 and 1716 and closely corresponded with a cold climatic episode known as the "Little Ice Age."

eclipse lunar/mínimo de Maunder

eclipse lunar: (pág. 784) sucede cuando la Tierra pasa entre el Sol y la Luna y la sombra de la Tierra cae sobre la Luna; ocurre sólo durante la luna llena.

lustre: (pág. 90) manera en que la superficie de un mineral refleja la luz; existen dos tipos: metálico o no metálico.

M

inversión magnética: (pág. 476) sucede cuando el campo magnético de la Tierra cambia polaridad entre normal e invertida.

magnetómetro: (pág. 473) aparato que sirve para mapear el fondo marino; detecta cambios pequeños en los campos magnéticos.

magnitud: (pág. 539) medida de la energía liberada durante un sismo; se puede describir usando la escala de Richter.

secuencia principal: (pág. 845) la anchura banda diagonal de un diagrama H-R que contiene cerca del 90 por ciento de todas las estrellas; contiene desde estrellas calientes y luminosas en la esquina superior izquierda, hasta estrellas frías de brillo débil en la esquina inferior derecha.

leyenda del mapa: (pág. 39) clave que explica los símbolos en un mapa.

escala del mapa: (pág. 39) razón entre las distancias que se muestran en un mapa y las distancias reales en la superficie terrestre.

mar: (pág. 771) planicie lunar lisa y de color oscuro.

extinción masiva: (pág. 594) ocurre cuando un número insólitamente grande de organismos desaparece del registro geológico a proximadamente al mismo tiempo.

movimiento de masa: (pág. 194) movimiento cuesta abajo de materiales terrestres debido a la gravedad; puede ocurrir de manera repentina o muy lentamente: dependiendo del peso del material, la resistencia del material a deslizarse y de si ha ocurrido algún evento que lo desencadene, como un sismo.

número de masa: (pág. 62) número combinado de protones y neutrones en el núcleo de un átomo.

materia: (pág. 60) todo aquello que tiene volumen y masa.

mínimo de Maunder: (pág. 390) período de muy baja actividad de manchas solares, ocurrido entre 1645 y 1716, que se correspondió con un episodio climático frío llamado "La Pequeña Glaciación."

meander: (p. 234) curve or bend in a stream formed when a stream's slope decreases, water builds up in the stream channel, and moving water erodes away the sides of the streambed.

mechanical weathering: (p. 164) process that breaks down rocks and minerals into smaller pieces but does not involve any change in their composition.

Mercator projection: (p. 34) map with parallel lines of latitude and longitude that shows true direction and the correct shapes of landmasses but distorts areas near the poles.

mesosphere: (p. 284) layer of Earth's atmosphere above the stratopause.

metallic bond: (p. 68) positive ions of metal held together by the negative electrons between them; allows metals to conduct electricity.

meteor: (pp. 818, 621) streak of light produced when a meteoroid falls toward Earth and burns up in Earth's atmosphere.

meteorite (MEE tee u h rite): (p. 818) a small fragment of an orbiting body that has fallen to Earth, generating heat; does not completely burn up in Earth's atmosphere and strikes Earth's surface, sometimes causing an impact crater.

meteoroid: (p. 818) piece of interplanetary material that falls toward Earth and enters its atmosphere.

meteorology: (p. 6) the study of the atmosphere, which is the air surrounding Earth.

meteor shower: (p. 819) occurs when Earth intersects a cometary orbit and comet particles burn up as they enter Earth's upper atmosphere.

microclimate: (p. 385) localized climate that differs from the surrounding regional climate.

microcontinent: (p. 624) a small fragment of granite-rich crust formed during the Archean.

mid-ocean ridge: (p. 451) chain of underwater mountains that run throughout the ocean basins, have a total length over 65,000 km, and contain active and extinct volcanoes.

mineral: (p. 86) naturally occurring, inorganic solid with a specific chemical composition and a definite crystalline structure.

mineral replacement: (p. 607) the process where pore spaces of an organism's buried parts are filled in with minerals from groundwater.

meandro: (pág. 234) curva o desviación en una corriente; se forma cuando disminuye la pendiente de la corriente, por lo que el agua se acumula en el cauce y el movimiento del agua erosiona los costados del cauce.

meteorización mecánica: (pág. 164) proceso de rompimiento de rocas y minerales en trozos más pequeños que no afecta la composición del material.

proyección de Mercator: (pág. 34) mapa con líneas de latitud y longitud paralelas que muestra la dirección real y las formas correctas de las masas terrestres, aunque las áreas cercanas a los polos aparecen distorsionadas.

mesosfera: (pág. 284) capa de la atmósfera terrestre ubicada encima de la estratopausa.

enlace metálico: (pág. 68) iones metálicos positivos que se mantienen unidos debido a la carga negativa de los electrones que se encuentran entre ellos; permite a los metales conducir electricidad.

estrella fugaz: (pág. 818, 621) rayo luminoso que se produce cuando un meteoroido cae a la Tierra y se quema en la atmósfera terrestre.

meteorito: (pág. 818) fragmento pequeño de un cuerpo en órbita que cae a la Tierra generando calor; como no se quema completamente en la atmósfera, choca con la superficie terrestre y produce un cráter de impacto.

meteoroido: (pág. 818) trozo de material interplanetario que cae a la Tierra y entra a la atmósfera terrestre.

meteorología: (pág. 6) estudio de la atmósfera, la capa de aire que rodea la Tierra.

lluvia de estrellas: (pág. 819) ocurre cuando la Tierra interseca la órbita de un cometa y las partículas del cometa se queman al entrar a las capas superiores de la atmósfera terrestre.

microclima: (pág. 385) clima localizado que difiere del clima regional circundante.

microcontinentes: (pág. 624) trozos pequeños de corteza rica en granito que se formaron durante el Arcaico.

dorsales mediooceánicas: (pág. 451) cadenas montañosas submarinas que se extienden a través de las cuencas oceánicas, tienen una longitud total de más de 65,000 km y contienen innumerables volcanes activos y extintos.

mineral: (pág. 86) sólido inorgánico natural con una composición química específica y una estructura cristalina definida.

sustitución de minerales: (pág. 607) proceso en que los poros de las partes enterradas de un organismo se llenan con los minerales provenientes de aguas subterráneas.

modified Mercalli scale/neutron star

modified Mercalli scale: (p. 540) measures earthquake intensity on a scale from I to XII; the higher the number, the greater the damage the earthquake has caused.

mold: (p. 608) fossil that can form when a shelled organism decays in sedimentary rock and is removed by erosion or weathering, leaving a hollowed-out impression.

molecule: (p. 67) combination of two or more atoms joined by covalent bonds.

moment magnitude scale: (p. 540) scale used to measure earthquake magnitude—taking into account the size of the fault rupture, the rocks' stiffness, and amount of movement along the fault—using values that can be estimated from the size of several types of seismic waves.

moraine: (p. 210) ridge or layer of mixed debris deposited by a melting glacier.

mountain thunderstorm: (p. 346) occurs when an air mass rises from orographic lifting, which involves air moving up the side of a mountain.

mudflow: (p. 196) rapidly flowing, often destructive mixture of mud and water that may be triggered by an earthquake, in tense rainstorm, or volcanic eruption.

natural resource: (p. 678) resources provided by Earth, including air, water, land, all living organisms, nutrients, rocks, and minerals.

neap tide: (p. 424) tide that occurs during first- or third-quarter Moon, when the Sun, the Moon, and Earth form a right angle; this causes solar tides to diminish lunar tides, causing high tides to be lower than normal and low tides to be higher than normal.

nebula: (p. 848) large cloud of interstellar gas and dust that collapses on itself, due to its own gravity, and forms a hot, condensed object that will become a new star.

neutron: (p. 60) tiny atomic particle that is electrically neutral and has about the same mass as a proton.

neutron star: (p. 850) collapsed, dense core of a star that forms quickly while its outer layers are falling inward, has a radius of about 10 km, a mass 1.5 to 3 times that of the Sun, and contains mostly neutrons.

escala de Mercalli modificada/estrella de neutrones

escala de Mercalli modificada: (pág. 540) mide la intensidad de un sismo en una escala de I a XII; a medida que aumenta el número, mayor es el daño causado.

molde: (pág. 608) fósil que se forma cuando un organismo con concha se descompone en roca sedimentaria y es removido por erosión o meteorización, quedando una impresión hueca.

molécula: (pág. 67) combinación de dos o más átomos unidos por enlaces covalentes.

escala de magnitud momentánea: (pág. 540) escala que sirve para medir la intensidad de un sismo (tomando en cuenta el tamaño de la ruptura de la falla, la rigidez de la roca y la cantidad del movimiento a lo largo de la falla) usando valores estimados a partir de la magnitud de varios tipos de ondas sísmicas.

morrena: (pág. 210) loma o estrato de detritos mezclados que deposita un glaciar al derretirse.

tormenta orográfica: (pág. 346) sucede cuando una masa de aire sube por ascenso orográfico, lo que implica el ascenso por la ladera de una montaña.

flujo o corriente de lodo: (pág. 196) mezcla de lodo y agua que fluye rápidamente y que a menudo es destructiva; puede ser causada por un terremoto, una lluvia intensa o una erupción volcánica.

N

recursos naturales: (pág. 678) recursos que provee la Tierra: incluyendo el aire, el agua, la tierra, todos los organismos vivos, los nutrientes, las rocas y los minerales.

marea muerta: (pág. 424) durante el primer o el tercer cuartos lunares, el Sol, la Luna y la Tierra se encuentran en ángulo recto, causando que las mareas solares reduzcan la intensidad de las mareas lunares, lo que provoca que la marea alta sea menor que lo normal y la marea baja sea mayor que lo normal.

nebulosa: (pág. 848) extensa nube de gas y polvo interestelares que se colapsa en sí misma debido a su propia gravedad, formando un cuerpo condensado caliente que se convertirá en una estrella nueva.

neutrón: (pág. 60) partícula atómica diminuta, eléctricamente neutra; tiene una masa similar a la de un protón.

estrella de neutrones: (pág. 850) núcleo denso y colapsado de una estrella que se forma rápidamente, al mismo tiempo que sus capas exteriores se contraen; tiene un radio aproximado de 10 km, una masa de 1.5 a 3 veces la del Sol y contiene principalmente neutrones.

nitrogen-fixing bacteria/orographic lifting

nitrogen-fixing bacteria: (p. 688) bacteria found in water or soil; can grow on the roots of some plants, capture nitrogen gas, and change into a form that plants use to build proteins.

nonfoliated: (p. 147) metamorphic rocks like quartzite and marble, composed mainly of minerals that form with blocky crystal shapes.

nonpoint source: (p. 749) water-pollution source that generates pollution from widely spread areas, such as runoff from roads.

nonrenewable resource: (p. 680) resource that exists in Earth's crust in a fixed amount and can be replaced only by geologic, physical, or chemical processes that take hundreds of millions of years.

normal: (p. 377) standard value for a location, including rainfall, wind speed, and temperatures, based on meteorological records compiled for at least 30 years.

nuclear fission: (p. 718) the process in which a heavy nucleus divides to form smaller nuclei and one or two neutrons and produces a large amount of energy.

nucleus (NEW klee us): (p. 60) positively charged center of an atom, made up of protons and neutrons and surrounded by electrons in energy levels.

bacteria fijadora de nitrógeno/ascenso orográfico

bacteria fijadora de nitrógeno: (pág. 688) bacteria que habita el suelo o el agua; puede crecer en las raíces de algunas plantas, capturar el gas nitrógeno y convertirlo a una forma que las plantas pueden usar para fabricar proteínas.

no foliada: (pág. 147) roca metamórfica, como la cuarcita y el mármol, compuesta principalmente de minerales que forman bloques cristalinos.

fuentes no puntuales: (pág. 749) fuentes de contaminación del agua que genera contaminación a partir de áreas muy extensas, como la escorrentía de los caminos.

recurso no renovable: (pág. 680) recurso que existe en la corteza terrestre en una cantidad fija y que sólo puede ser regenerado por procesos geológicos, físicos o químicos que demuestran centenares de millones de años.

normales: (pág. 377) valores estándar para un sitio: incluyen la lluvia, la velocidad del viento y las temperaturas; se basan en los registros meteorológicos recopilados durante por lo menos 30 años.

fisión nuclear: (pág. 718) proceso de división de un núcleo pesado en núcleos más pequeños y uno o dos neutrones, produciendo una gran cantidad de energía.

núcleo: (pág. 60) centro del átomo, tiene carga positiva, está compuesto por protones y neutrones y está rodeado por electrones localizados en niveles de energía.

O

oceanography: (p. 7) study of Earth's oceans including the creatures that inhabit its waters, its physical and chemical properties, and the effects of human activities.

ore: (pp. 100, 684) mineral that contains a valuable substance that can be mined at a profit.

original horizontality: (p. 596) the principle that sedimentary rocks are deposited in horizontal or nearly horizontal layers.

original preservation: (p. 607) describes a fossil with soft and hard parts that have undergone very little change since the organism's death.

orogeny (oh RAH juh nee): (p. 567) cycle of processes that form all mountain ranges, resulting in broad, linear regions of deformation that you know as mountain ranges but in geology are known as orogenic belts.

orographic lifting: (p. 299) cloud formation that occurs when warm, moist air is forced to rise up the side of a mountain.

oceanografía: (pág. 7) estudio de los océanos de la Tierra: incluyendo sus propiedades físicas y químicas, los seres que los habitan y los efectos de las actividades humanas sobre ellos.

mena: (pág. 100, 684) mineral que contiene una sustancia valiosa que se puede extraer con fines de lucro.

horizontalidad original: (pág. 596) principio que establece que las rocas sedimentarias se depositan formando estratos horizontales o casi horizontales.

preservación de material original: (pág. 607) describe un fósil cuyas partes blandas y duras han sufrido muy pocos cambios desde la muerte del organismo.

orogenia: (pág. 567) ciclo de procesos que forman todas las cadenas montañosas, dando como resultado grandes regiones lineares de deformación llamadas cadenas montañosas, pero que en geología se conocen como cinturones orogénicos.

ascenso orográfico: (pág. 299) formación de nubes que se produce cuando el aire húmedo caliente es forzado a ascender por la ladera de una montaña.

outwash plain/photochemical smog

outwash plain: (p. 210) area at the leading edge of a glacier, where outwash is deposited by meltwater streams.

oxidation: (p. 166) chemical reaction of oxygen with other substances.

ozone hole: (p. 745) a seasonal decrease in ozone over Earth's polar regions.

llanura aluvial/smog fotoquímico

llanura aluvial: (pág. 210) área en el borde frontal de un glaciar donde las corrientes del agua que se derrite depositan los derrubios.

oxidación: (pág. 166) reacción química del oxígeno con alguna otra sustancia.

agujero de ozono: (pág. 745) disminución estacional del ozono sobre las regiones polares de la Tierra.

P

paleogeography (pay lee oh jee e AH g ruh fee): (p. 648) the ancient geographic setting of an area.

paleomagnetism: (p. 476) study of Earth's magnetic record using data gathered from iron-bearing minerals in rocks that have recorded the orientation of Earth's magnetic field at the time of their formation.

Pangaea (pan JEE u h): (p. 469) ancient landmass made up of all the continents that began to break apart about 200 mya.

parallax: (p. 841) apparent positional shift of an object caused by the motion of the observer.

parsec (pc): (p. 840) the distance equal to 3.26 ly and 3.086×10^{13} km.

partial melting: (p. 114) process in which different minerals melt into magma at different temperatures, changing its composition.

passive margin: (p. 648) edge of a continent along which there is no tectonic activity.

peat: (p. 710) light, spongy, organic fossil fuel derived from moss and other bog plants.

pegmatite: (p. 122) vein deposits of extremely large-grained minerals that can contain rare ores such as lithium and beryllium.

perigee: (p. 783) closest point in the Moon's elliptical orbit to Earth.

period: (p. 593) third-longest time unit in the geologic time scale, measured in tens of millions of years.

permeability: (p. 255) ability of a material to let water pass through, is high in material with large, well-connected pores and low in material with few pores or small pores.

pesticide: (p. 741) chemical applied to plants to kill insects and weeds.

photochemical smog: (p. 744) a type of air pollution, a yellow-brown haze formed mainly from automobile exhaust in the presence of sunlight.

paleogeografía: (pág. 648) características geográficas antiguas de un área.

paleomagnetismo: (pág. 476) estudio del registro magnético de la Tierra; utiliza la información recogida a partir de minerales ferrosos en las rocas porque este tipo de minerales registran la orientación del campo magnético de la Tierra en el momento en que se forman.

Pangaea: (pág. 469) antigua masa terrestre compuesta por todos los continentes, los cuales se empezaron a separar hace cerca de 200 millones de años.

paralaje: (pág. 841) cambio aparente de la posición de un cuerpo ca usado por el movimiento del observador.

parsec: (pág. 840) distancia de 3.26 ly y 3.086×10^{13} km.

fundición parcial: (pág. 114) proceso en el cual diferentes minerales se funden en el magma a diferentes temperaturas, cambiando su composición.

margen pasivo: (pág. 648) límite de un continente a lo largo del cual no ocurre actividad tectónica.

turba: (pág. 710) combustible fósil liviano, esponjoso y orgánico derivado del musgo y otras plantas de ciénegas.

pegmatita: (pág. 122) vetas de minerales de grano extremadamente grueso que pueden contener minerales raros como el litio y el berilio.

perigeo: (pág. 783) punto más cercano a la Tierra en la órbita elíptica de la Luna.

período: (pág. 593) tercera unidad de tiempo más grande en la escala del tiempo geológico; se mide en decenas de millones de años.

permeabilidad: (pág. 255) capacidad de un material de permitir el paso del agua; es grande en materiales con poros grandes y bien conectados y baja en materiales con pocos poros o con poros pequeños.

pesticida: (pág. 741) sustancia química que se aplica a las plantas para eliminar insectos y malas hierbas.

smog fotoquímico: (pág. 744) tipo de contaminación del aire; niebla color amarillo marrón que se forma debido principalmente a las emisiones de los autos en presencia de la luz solar.

photosphere: (p. 831) lowest layer of the Sun's atmosphere that is also its visible surface, has an average temperature of 5800 K, and is about 400 km thick.

photovoltaic cell: (p. 716) thin, transparent wafer that converts sunlight into electrical energy and is made up of two layers of two types of silicon.

phytoplankton: (p. 658) microscopic organisms that are the basis of marine food chains; abundant during the Cretaceous and the remains of their shell-like hard parts are found in chalk deposits worldwide.

planetesimal: (p. 798) space object built of solid particles that can form planets through collisions and mergers.

plasma: (p. 74) hot, highly ionized, electrically conducting gas.

plastic deformation: (p. 529) permanent deformation caused by strain when stress exceeds a certain value.

plateau: (p. 573) a relatively flat-topped area.

pluton (PLOOR tahn): (p. 514) intrusive igneous rock body, including batholiths, stocks, sills, and dikes, formed through mountain-building processes and oceanic-oceanic collisions; can be exposed at Earth's surface due to uplift and erosion.

point source: (p. 749) water-pollution source that generates pollution from a single point of origin, such as an industrial site.

polar easterlies: (p. 320) global wind systems that lie between latitudes 60° N and 60° S and the poles and is characterized by cold air.

polar zones: (p. 378) areas of Earth where solar radiation strikes at a low angle, resulting in temperatures that are nearly always cold; extend from 66.5° north and south of the equator to the poles.

pollutant: (p. 690) substance that enters Earth's geochemical cycles and can harm the health of living things or adversely affect their activities.

Population I stars: (p. 866) stars in the disk and arms that have small amounts of heavy elements.

Population II stars: (p. 866) stars in the halo and bulge that contain traces of heavy elements.

fotosfera: (pág. 831) capa más baja de la atmósfera solar; corresponde a su superficie visible, tiene una temperatura promedio de 5800 K y mide aproximadamente 400 km de ancho.

celdas fotovoltaicas: (pág. 716) láminas delgadas y transparentes que convierten la luz solar en energía eléctrica; están compuestas de dos capas con dos tipos de silicio.

fitoplancton: (pág. 658) organismos microscópicos que son la base de las cadenas alimenticias marinas; fueron muy abundantes durante el Cretáceo y los restos de sus caparazones se encuentran en depósitos de carbonato de calcio por todo el mundo.

planetesimal: (pág. 798) cuerpo espacial formado por partículas sólidas y los cuales pueden formar planetas mediante choques y fusiones.

plasma: (pág. 74) gas caliente, altamente ionizado y conductor de electricidad.

deformación dúctil: (pág. 529) cuando la presión excede cierto valor; la tensión producida causa una deformación permanente.

altiplanicie: (pág. 573) área relativamente plana en la parte más alta.

plutones: (pág. 514) cuerpos rocosos ígneos intrusivos: incluye batolitos, macizos magmáticos, intrusiones y diques formados durante los procesos orogénicos y durante la colisión de placas oceánicas; pueden quedar expuestos a la superficie terrestre debido a levantamientos y erosión.

fuentes puntuales: (pág. 749) fuente de contaminación de agua que genera contaminación a partir de un solo punto de origen, por ejemplo, una zona industrial.

vientos polares del este: (pág. 320) sistemas globales del viento que se encuentran entre los polos y las latitudes 60°N y 60°S; se caracterizan por tener aire frío.

zonas polares: (pág. 378) áreas de la Tierra donde la radiación solar llega con un ángulo bajo, ocasionando que las temperaturas casi siempre sean frías; se extienden desde los 66.5° hasta los polos, en ambos hemisferios.

contaminante: (pág. 690) sustancia que entra a los ciclos geoquímicos de la Tierra y puede causar daños a la salud de los seres vivos o afectar adversamente sus actividades.

estrellas de la población I: (pág. 866) aquellas ubicadas en el disco y los brazos y que contienen pequeñas cantidades de elementos pesados.

estrellas de la población II: (pág. 866) aquellas ubicadas en el halo y en el núcleo y que contienen trazas de elementos pesados.

porosity/quasar

porosity: (p. 142) percentage of open spaces between grains in a material.

porphyritic (por fuh RIH tihk) texture: (p. 120) rock texture characterized by large, well-formed crystals surrounded by finer-grained crystals of the same or different mineral.

Precambrian (pree KAM bree un): (p. 592) informal unit of geologic time consisting of the first three eons during which Earth formed and became habitable.

Precambrian shield: (p. 625) the top of a craton exposed at Earth's surface

precipitation: (p. 302) all solid and liquid forms of water—including rain, snow, sleet, and hail—that fall from clouds.

prevailing westerlies: (p. 320) global wind system that lies between 30° and 60° north and south latitudes, where surface air moves toward the poles in a westerly direction.

primary wave: (p. 532) seismic wave that squeezes and pushes rocks in the same direction that the wave travels, known as a P-wave.

prime meridian: (p. 31) imaginary line representing 0° longitude, running from the north pole, through Greenwich, England, to the south pole.

prokaryote (proh KE ree oh t): (p. 635) unicellular organism that lacks a nucleus.

prominence: (p. 833) arc of gas ejected from the chromosphere, or gas that condenses in the Sun's inner corona and rains back to the surface, that can reach temperatures over 50,000 K and is associated with sunspots.

proton: (p. 60) tiny atomic particle that has mass and a positive electric charge.

protostar: (p. 848) hot, condensed object at the center of a nebula that will become a new star when nuclear fusion reactions begin.

pulsar: (p. 850) a spinning neutron star that exhibits a pulsing pattern.

pyroclastic flow: (p. 513) swift-moving, potentially deadly clouds of gas, ash, and other volcanic material produced by a violent eruption.

quasar: (p. 875) starlike, very bright, extremely distant object with emission lines in its spectra.

porosidad/cuásares

porosidad: (pág. 142) porcentaje de espacios abiertos entre los granos de una roca.

textura porfírica: (pág. 120) textura rocosa caracterizada por cristales grandes bien formados, rodeados por cristales de grano más fino del mismo mineral o de uno diferente.

Precámbrico: (pág. 592) unidad del tiempo geológico que consiste en los primeros tres eones; periodo durante el cual la Tierra se formó y adquirió condiciones aptas para la vida.

escudo Precámbrico: (pág. 625) parte alta de un cratón que está expuesta en la superficie de la Tierra.

precipitación: (pág. 302) toda forma líquida o sólida de agua: lluvia, nieve, aguanieve o granizo, que cae de las nubes.

vientos dominantes del oeste: (pág. 320) sistema de vientos globales ubicado entre los 30° y los 60° de latitud, en ambos hemisferios, donde el aire superficial se desplaza hacia los polos en dirección este.

onda primaria: (pág. 532) onda sísmica que comprime y empuja las rocas en la misma dirección en que viaja la onda; se conocen como ondas P.

primer meridiano: (pág. 31) línea imaginaria que representa la longitud 0°; va desde el polo norte hasta el polo sur, pasando por Greenwich, Inglaterra.

procariota: (pág. 635) organismo unicelular que carece de núcleo.

protuberancia solar: (pág. 833) arco de gas expulsado de la cromosfera o gas que se condensa en la corona interna del Sol y que se precipita de nuevo sobre su superficie; puede alcanzar temperaturas mayores a los 50,000 K y está asociada a la presencia de manchas solares.

protón: (pág. 60) partícula atómica diminuta que tiene masa y una carga eléctrica positiva.

protoestrella: (pág. 848) cuerpo condensado, caliente, ubicado en el centro de una nebulosa, que se convertirá en una estrella nueva cuando inicien las reacciones de fusión nuclear.

pulsar: (pág. 850) estrella de neutrones giratoria que exhibe un patrón de pulsaciones.

flujo piroclástico: (pág. 513) nubes de gas, cenizas y otros materiales volcánicos, potencialmente mortales, que se desplazan rápidamente y que son producidas por una erupción violenta.

Q

cuásares: (pág. 875) cuerpos semejantes a estrellas, muy brillantes y extremadamente lejanos, con líneas de emisión en sus espectros.

R

radiation: (p. 287) the transfer of thermal energy electromagnetic waves; the transfer of thermal energy from the Sun to Earth by radiation.

radioactive decay: (p. 601) emission of radioactive particles and its resulting change in to other isotopes over time.

radiocarbon dating: (p. 603) determines the age of relatively young organic objects; objects that are alive or were once alive.

radio galaxy: (p. 875) very bright, often giant, elliptical galaxy that emits as much or more energy in the form of radio wavelengths as it does wavelengths of visible light.

radiometric dating: (p. 602) process used to determine the absolute age of a rock or fossil by determining the ratio of parent nuclei to daughter nuclei within a given sample.

radiosonde (RAY dee oh sahnd) : (p. 326) balloon-borne weather instrument whose sensors measure air pressure, humidity, temperature, wind speed, and wind direction of the upper atmosphere.

ray: (p. 771) long trail of ejecta that radiates outward from a Moon crater.

recharge: (p. 263) process by which water from precipitation and runoff is added to the zone of saturation.

reclamation: (p. 738) process in which a mining company restores land used during mining operations to its original contours and replants vegetation.

red bed: (p. 631) a sedimentary rock deposit that contains oxidized iron; provides evidence that free oxygen existed in the atmosphere during the Proterozoic.

reflecting telescope: (p. 766) telescope that uses mirrors to focus visible light.

refracting telescope: (p. 766) telescope that uses lenses to focus visible light.

regional metamorphism: (p. 149) process that affects large areas of Earth's crust, producing belts classified as low, medium, or high grade, depending on pressure on the rocks, temperature, and depth below the surface.

regolith: (p. 772) layer of loose, ground-up rock on the lunar surface.

radiación: (pág. 287) transferencia de energía mediante ondas electromagnéticas; la transferencia de energía térmica del Sol a la Tierra por radiación.

desintegración radiactiva: (pág. 601) emisión de partículas atómicas que a lo largo del tiempo produce nuevos isótopos.

datación radiocarbónica: (pág. 603) permite determinar la edad de cuerpos orgánicos relativamente recientes, cuerpos que están vivos o que alguna vez estuvieron vivos.

radiogalaxia: (pág. 875) galaxia elíptica muy brillante, a menudo gigantesca, cuya emisión de energía en forma de ondas de radio es similar a la que emite como ondas de luz visible.

datación radiométrica: (pág. 602) proceso que permite establecer la edad absoluta de una roca o un fósil, al determinar la razón entre los núcleos originales y los núcleos derivados de una muestra dada.

radiosonda: (pág. 326) instrumento meteorológico que se monta en un globo y cuyos sensores miden la presión atmosférica, la humedad, la temperatura, así como la velocidad y dirección del viento en la atmósfera superior.

rayo: (pág. 771) largo rastro de ejecta que irradia de un cráter lunar.

recarga: (pág. 263) proceso mediante el cual el agua de la precipitación y de la escorrentía entra a la zona de saturación.

recuperación: (pág. 738) proceso en que una compañía minera restaura los terrenos usados en las actividades mineras a sus contornos originales y reforesta con nueva vegetación.

lecho rojo: (pág. 631) depósito de roca sedimentaria que contiene hierro oxidado; es evidencia de que había oxígeno libre en la atmósfera durante el Proterozoico.

telescopio reflector: (pág. 766) telescopio que usa espejos para enfocar la luz visible.

telescopio refractor: (pág. 766) telescopio que usa lentes para enfocar la luz visible.

metamorfismo regional: (pág. 149) proceso que afecta grandes áreas de la corteza terrestre; produce cinturones de bajo, medio o alto grado, dependiendo de la presión sobre las rocas, la temperatura y la profundidad bajo la superficie.

regolito: (pág. 772) estrato de roca suelta y molida en la superficie lunar.

regression/root

regression: (p. 649) occurs when sea level falls, causing the shoreline to move seaward, and results in shallower-water deposits overlying deeper-water deposits.

rejuvenation: (p. 237) process during which a stream resumes downcutting toward its base level, increasing its rate of flow.

relative-age dating: (p. 596) establishing the order of past geologic events.

relative humidity: (p. 294) ratio of water vapor contained in a specific volume of air compared with how much water vapor that amount of air actually can hold; expressed as a percentage.

remote sensing: (p. 41) process of gathering data about Earth from instruments far above the planet's surface.

renewable resource: (p. 678) natural resource, such as fresh air and most groundwater, that can be replaced by nature in a short period of time.

residual soil: (p. 177) soil that develops from parent material which is similar to local bedrock.

retrograde motion: (p. 799) a planet's apparent backward movement in the sky.

return stroke: (p. 348) a branch channel of positively charged ions that rushes upward from the ground to meet the stepped leader.

Richter scale: (p. 539) numerical rating system used to measure the amount of energy released during an earthquake.

ridge push: (p. 488) tectonic process associated with convection currents in Earth's mantle that occurs when the weight of an elevated ridge pushes an oceanic plate toward a subduction zone.

rift valley: (p. 481) long, narrow depression that forms when continental crust begins to separate at a divergent boundary.

rill erosion: (p. 172) erosion in which water running down the side of a slope carves a small stream channel.

rille: (p. 771) valleylike structure that meanders across some regions of the Moon's maria.

rock cycle: (p. 151) continuous, dynamic set of processes by which rocks are changed into other types of rock.

root: (p. 563) thickened areas of continental material, detected by gravitational and seismic studies.

regresión/raíz

regresión: (pág. 649) ocurre cuando baja el nivel del mar, provocando que la costa avance hacia el mar, ocasiona que depósitos de agua más superficiales cubran depósitos de agua más profundos.

rejuvenecimiento: (pág. 237) proceso en que una corriente reanuda la erosión hacia su nivel base, aumentando su tasa de flujo.

datación relativa: (pág. 596) ordenamiento por antigüedad de eventos geológicos pasados.

humedad relativa: (pág. 294) razón del vapor de agua que contiene un volumen específico de aire, en comparación con la cantidad de vapor de agua que ese volumen de aire podría contener, expresado como porcentaje.

percepción remota: (pág. 41) proceso de recopilación de datos sobre la Tierra con instrumentos alejados de la superficie del planeta.

recurso renovable: (pág. 678) recurso natural, como el aire y la mayoría de las aguas subterráneas, que la naturaleza puede reemplazar en un período corto de tiempo.

suelo residual: (pág. 177) suelo que se desarrolla a partir del material original y es similar a la roca madre local.

movimiento retrógrado: (pág. 799) movimiento aparentemente en retroceso de un planeta en el cielo.

descarga de retorno: (pág. 348) un canal con iones de carga positiva que asciende desde el suelo para encontrarse con la descarga líder o guía escalonada.

escala de Richter: (pág. 539) escala numérica que se emplea para medir la cantidad de energía liberada durante un sismo.

empuje de la dorsal: (pág. 488) proceso tectónico asociado con las corrientes de convección en el manto de la Tierra, que ocurre cuando el peso de una cordillera eleva empuja una placa oceánica hacia una zona de subducción.

valle del rift: (pág. 481) depresión larga y estrecha que se forma cuando la corteza continental se empieza a separar en un límite divergente.

erosión por surcos: (pág. 172) erosión en la cual el agua que corre cuesta abajo forma un canal pequeño.

surco: (pág. 771) formación tipo valle que serpentea a través de algunas regiones de los mares lunares.

ciclo de las rocas: (pág. 151) conjunto de procesos continuos y dinámicos a través de los cuales las rocas se transforman en otros tipos de roca.

raíz: (pág. 563) gruesas áreas de material continental que son detectadas en estudios sísmicos o gravitacionales.

RR Lyrae variable/sea-breeze thunderstorm

RR Lyrae variable: (p. 863) stars with pulsation periods ranging from 1.5 hours to 1 day, generally having the same luminosity, regardless of pulsation period length.

runoff: (p. 225) water that flows downslope on Earth's surface and may enter a stream, river, or lake; its rate is influenced by the angle of the slope, vegetation, rate of precipitation, and soil composition.

estrellas variables tipo RR Lyrae/tormenta eléctrica de brisa marina

estrellas variables tipo RR Lyrae: (pág. 863) estrellas con períodos de pulsación que duran de 1.5 horas a 1 día; en general tienen la misma luminosidad, independientemente de la duración de la pulsación.

escorrentía: (pág. 225) agua que corre cuesta abajo sobre la superficie terrestre y que puede incorporarse a una corriente, río o lago; su tasa de flujo está influenciada por el ángulo de la pendiente, la vegetación, la tasa de precipitación y la composición del suelo.

S

Saffir-Simpson Hurricane Wind scale: (p. 358) clasifies hurricanes according to wind speed on a scale ranging from Category 1 to Category 5.

salinity: (p. 413) measure of the amount of salts dissolved in seawater, which is 35 ppt, or 3.5‰ on average.

saturation: (p. 294) the point at which water molecules leaving the water's surface equals the rate of water molecules returning to the surface.

scarp: (p. 805) cliff on Mercury; similar to those on Earth but much higher.

scientific law: (p. 19) a principle that describes the behavior of a natural phenomenon.

scientific methods: (p. 10) a series of problem-solving procedures that help scientists conduct experiments.

scientific model: (p. 18) an idea, a system, or a mathematical expression that represents the idea being explained.

scientific notation: (p. 16) a method used by scientists to express a number as a value between 1 and 10 multiplied by a power of 10.

scientific theory: (p. 19) an explanation based on many observations during repeated experiments; valid only if consistent with observations, can be used to make testable predictions, and is the simplest explanation; can be changed or modified with the discovery of new data.

sea-breeze thunderstorm: (p. 346) local air-mass thunderstorm that commonly occurs along a coastal area because land and water store and release thermal energy differently.

escala de Vientos Huracanados Saffir-Simpson: (pág. 358) clasifica los huracanes según la velocidad de sus vientos en una escala que va desde la Categoría 1 hasta la Categoría 5.

salinidad: (pág. 413) medida de la cantidad de sales disueltas en el agua de mar; en promedio es de 35 ppt ó 3.5‰.

saturación: (pág. 294) sucede en el punto en el cual la tasa de salida de moléculas de agua en la superficie es igual a la tasa de retorno de las moléculas a la superficie.

escarpes: (pág. 805) fracturas en la superficie de Mercurio, similares a las de la Tierra, pero con mayor profundidad.

ley científica: (pág. 19) principio que describe el comportamiento de un fenómeno natural.

métodos científicos: (pág. 10) serie de procedimientos para resolver problemas que ayudan a los científicos a realizar experimentos.

modelo científico: (pág. 18) idea, sistema o expresión matemática que representa la idea que se quiere explicar.

notación científica: (pág. 16) método que usan los científicos para expresar un número como un valor entre 1 y 10 multiplicado por una potencia de 10.

teoría científica: (pág. 19) explicación basada en muchas observaciones realizadas durante experimentos repetidos; sólo es válida si es consistente con las observaciones, permite hacer predicciones comprobables y es la explicación más sencilla; puede ser modificada debido al descubrimiento de nuevos hechos.

tormenta eléctrica de brisa marina: (pág. 346) tormenta local de masa de aire que ocurre comúnmente a lo largo de un área costera; ocurren porque la tierra y el agua almacenan y liberan energía térmica de manera distinta.

seafloor spreading/sill

seafloor spreading: (p. 479) the hypothesis that new ocean crust is formed at mid-ocean ridges and destroyed at deep-sea trenches; occurs in a continuous cycle of magma intrusion and spreading.

sea level: (p. 410) level of the oceans' surfaces, which has risen at a rate of about 3 mm per year.

seamount: (p. 452) basaltic, submerged volcano on the seafloor that is more than 1 km high.

season: (p. 388) short-term periods with specific weather conditions caused by regular variations in temperature, hours of daylight, and weather patterns that are due to the tilt of Earth's axis as it revolves around the Sun, causing different areas of Earth to receive different amounts of solar radiation.

secondary wave: (p. 532) seismic wave that causes rock particles to move at right angles to the direction of the wave, known as an S-wave.

sediment: (p. 134) small pieces of rock that are moved and deposited by water, wind, glaciers, and gravity.

seismic gap: (p. 550) place along an active fault that has not experienced an earthquake for a long time.

seismic wave: (p. 532) the vibrations of the ground during an earthquake.

seismogram (SIZE muh gram): (p. 534) record produced by a seismometer that can provide individual tracking of each type of seismic wave.

seismometer (size MAH muh tur): (p. 534) instrument used to measure horizontal or vertical motion during an earthquake.

shield volcano: (p. 507) broad volcano with gently sloping sides built by nonexplosive eruptions of basaltic lava that accumulates in layers.

side-scan sonar: (p. 407) technique that directs sound waves at an angle to the seafloor or deep-lake floor, allowing underwater topographic features to be mapped.

silicate: (p. 96) mineral that contains silicon (Si), oxygen (O), and usually one or more other elements.

sill: (p. 515) pluton that forms when magma intrudes parallel rock layers.

expansión del suelo marino/intrusión

expansión del suelo marino: (pág. 479) hipótesis que propone que la nueva corteza oceánica se forma en las dorsales medio oceánicas y se destruye en las fosas submarinas profundas; ocurre según un ciclo continuo de intrusión y expansión del magma.

nivel del mar: (pág. 410) nivel de la superficie del océano; actualmente sube a una velocidad de 3 mm por año.

montaña submarina: (pág. 452) volcán basáltico sumergido en el fondo marino que mide más de 1 km de altura.

estación: (pág. 388) períodos de corto plazo con específicas de tiempo causados por variaciones regulares en temperatura, horas de luz solar y patrones meteorológicos, provocadas por la inclinación del eje de la Tierra cuando gira alrededor del Sol, lo que ocasiona que las distintas áreas de la Tierra reciban diferentes cantidades de radiación solar.

onda secundaria: (pág. 532) onda sísmica que ocasiona que las partículas de las rocas se muevan en ángulo recto con respecto a la dirección de la onda.

sedimentos: (pág. 134) partículas pequeñas de roca que el agua, el viento, los glaciares y la gravedad mueven y depositan.

vacío sísmico: (pág. 550) lugar a lo largo de una falla activa que no ha sufrido un terremoto durante mucho tiempo.

onda sísmica: (pág. 532) vibraciones del terreno durante un sismo.

sismograma: (pág. 534) registro producido por un sismógrafo que proporciona un registro individual de cada tipo de onda sísmica.

sismógrafo: (pág. 534) instrumento que sirve para medir los movimientos horizontales y verticales durante un sismo.

volcán de escudo: (pág. 507) volcán ancho, de laderas con inclinación suave, formado por erupciones no explosivas de lava basáltica que se acumula en estratos.

sonar de escaneo lateral: (pág. 407) técnica que dirige las ondas sonoras en ángulo hacia el fondo del mar o de un lago profundo, lo que permite trazar el relieve topográfico submarino.

silicato: (pág. 96) mineral que contiene silicio (Si), oxígeno (O) y generalmente uno o más elementos adicionales.

intrusión: (pág. 515) plutón que se forma cuando el magma penetra estratos rocosos paralelos.

sinkhole: (p. 261) depression in Earth's surface formed when a cave collapses or bedrock is dissolved by acidic rain or moist soil.

slab pull: (p. 488) tectonic process associated with convection currents in Earth's mantle that occurs as the weight of the subducting plate pulls the trailing lithosphere into a subduction zone.

slump: (p. 198) mass movement that occurs when Earth materials in a landslide rotate and slide along a curved surface, leaving a crescent-shaped scar on a slope.

soil: (p. 176) loose covering of weathered rock and decayed organic matter overlying Earth's bedrock that is characterized by texture, fertility, and color and whose composition is determined by its parent rock and environmental conditions.

soil horizon: (p. 178) distinct layer within a soil profile.

soil liquefaction (**lih kwuh FAK shun**): (p. 547) process associated with seismic vibrations that occur in areas of sand that is nearly saturated; resulting in the ground behaving like a liquid.

soil profile: (p. 178) vertical sequence of soil layers, containing A-horizon B-horizon C-horizon.

solar eclipse: (p. 781) when the Moon passes between Earth and the Sun and the Moon casts a shadow on Earth, blocking Earth's view of the Sun; can be partial or total.

solar flare: (p. 833) violent eruption of radiation and particles from the Sun's surface that is associated with sunspots.

solar wind: (p. 832) wind of charged particles (ions) that flows throughout the solar system and begins as gas flowing outward from the Sun's corona at high speeds.

solstice: (p. 777) period when the Sun is overhead at its farthest distance either north or south of the equator.

solution: (p. 71) homogeneous mixture whose components cannot be distinguished and can be classified as liquid, gaseous, solid, or a combination; (p. 228) the method of transport for materials that are dissolved in a stream's water.

sonar: (p. 43) use of sound waves to detect and measure objects underwater.

source region: (p. 316) area over which an air mass forms.

sumidero: (pág. 261) depresión en la superficie terrestre que se forma cuando una caverna se colapsa o cuando el lecho rocoso es disuelto por lluvia ácida o suelo húmedo.

tracción de placa: (pág. 488) proceso tectónico asociado con las corrientes de convección del manto de la Tierra, que ocurre cuando el peso de la placa subductora jala la litosfera hacia una zona de subducción.

deslizamiento rotacional: (pág. 198) movimiento en masa que ocurre cuando los materiales terrestres de un derumbe giran y se deslizan a lo largo de una superficie curva, dejando una cicatriz con forma de medialuna en la pendiente.

suelo: (pág. 176) cubierta suelta de roca meteorizada y materia orgánica en descomposición que cubre el lecho rocoso terrestre; se caracteriza por su textura, fertilidad y color y su composición está determinada por la roca madre y las condiciones ambientales.

horizonte del suelo: (pág. 178) capa distintiva dentro de un perfil del suelo.

licuefacción del suelo: (pág. 547) proceso asociado con las vibraciones sísmicas que ocurren en las áreas arenosas casi saturadas; el resultado es que el suelo actúa como un líquido.

perfil del suelo: (pág. 178) sucesión vertical de capas del suelo, comprende los horizontes A (mantillo), B (subsuelo) y C (material original meteorizado).

eclipse solar: (pág. 781) sucede cuando la Luna pasa entre la Tierra y el Sol y la Luna proyecta su sombra sobre la Tierra, bloqueando la luz del Sol; puede ser parcial o total.

erupción solar: (pág. 833) violenta erupción de radiación y partículas desde la superficie del Sol que está asociada con las manchas solares.

viento solar: (pág. 832) viento de partículas cargadas (iones) que fluye a través del sistema solar y comienza como un gas que es despedido a gran velocidad por la corona del Sol.

solsticio: (pág. 777) sucede cuando el Sol se halla en el horizonte a su mayor distancia al norte o al sur del ecuador.

solución: (pág. 71) mezcla homogénea cuyos componentes no se pueden distinguir; puede clasificarse como líquida, gaseosa, sólida o una combinación de éstas; (pág. 228) el método de transporte de materiales que están disueltos en las aguas de una corriente.

sonar: (pág. 43) uso de ondas sonoras para detectar y medir objetos submarinos.

región fuente: (pág. 316) área sobre la cual se forma una masa de aire.

specific gravity/stream bank

specific gravity: (p. 95) ratio of the mass of a substance to the mass of an equal volume of H₂O at 4°C.

spiral density wave: (p. 868) spiral regions of alternating density which rotates as a rigid pattern.

spring: (p. 256) natural discharge of groundwater at Earth's surface where an aquifer and an aquiclude come in contact.

spring tide: (p. 424) during full or new moon, the Sun, the Moon, and Earth are all aligned; this causes solar tides to enhance lunar tides, causing high tides to be higher than normal and low tides to be lower than normal.

stalactite: (p. 261) cone-shaped or cylindrical dripstone deposit of calcium carbonate that hangs like an icicle from a cave's ceiling.

stalagmite: (p. 261) mound-shaped dripstone deposit of calcium carbonate that forms on a cave's floor beneath a stalactite.

station model: (p. 329) record of weather data for a specific place at a specific time, using meteorological symbols.

stepped leader: (p. 348) The channel of partially charged air; the breakdown in charges in between positive and negative regions.

stock: (p. 515) irregularly shaped pluton that is similar to a batholith but smaller, generally forms 5–30 km beneath Earth's surface, and cuts across older rocks.

storm surge: (p. 359) occurs when powerful, hurricane-force winds drive a mound of ocean water toward shore, where it washes over the land, often causing enormous damage.

strain: (p. 528) deformation of materials in response to stress.

stratosphere: (p. 284) layer of Earth's atmosphere that is located above the tropopause and is made up primarily of concentrated ozone.

stratus (STRAY tus): (p. 301) a layered sheetlike cloud that covers much or all of the sky in a given area.

streak: (p. 93) color a mineral leaves when it is rubbed across a non-glazed porcelain plate or when it is broken up and powdered.

stream bank: (p. 232) ground bordering each side of a stream that keeps the moving water confined.

gravedad específica/margen de una corriente de agua

gravedad específica: (pág. 95) razón de la masa de una sustancia con relación a la masa de un volumen igual de H₂O a 4°C.

ondas de densidad espirales: (pág. 868) regiones en espiral con densidad variable que giran siguiendo un patrón rígido.

manantial: (pág. 256) descarga natural de agua subterránea en la superficie terrestre, en el punto donde un acuífero y un acuiclude entran en contacto.

marea viva: (pág. 424) durante la luna nueva o la luna llena, el Sol, la Luna y la Tierra se encuentran alineados; esto ocasiona que la marea solar aumente el efecto de la marea lunar y provoca que la marea alta sea más alta que lo normal y que la marea baja sea más baja que lo normal.

estalactita: (pág. 261) depósito rocoso de carbonato de calcio, de forma cónica o cilíndrica, que se forma por goteo y que cuelga como un cámbano del techo de una caverna.

estalagmita: (pág. 261) depósito de carbonato de calcio, con forma de montículo, que se forma por goteo en el piso de una caverna, debajo de una estalactita.

código meteorológico: (pág. 329) registro de los datos del tiempo para un lugar específico en un tiempo dado, usando símbolos meteorológicos.

guía escalonada: (pág. 348) el canal con aire parcialmente cargado; la separación de cargas que forma regiones positivas y negativas.

macizo magmático: (pág. 515) plutón de forma irregular, similar a un batolito pero más pequeño; generalmente se forma de 5 a 30 km bajo la superficie terrestre y atraviesa rocas más antiguas.

marejada ciclónica: (pág. 359) ocurre cuando poderosos vientos huracanados arrojan una gran masa de agua del océano hacia la costa, desparramándose por el terreno y causando a menudo un daño enorme.

tensión: (pág. 528) deformación de los materiales en respuesta a un estrés.

estratosfera: (pág. 284) capa de la atmósfera terrestre ubicada por encima de la tropopausa; está compuesta principalmente de ozono concentrado.

estrato: (pág. 301) nube con forma de capas delgadas que cubre la mayoría o todo el cielo en cierta área.

veta: (pág. 93) color que deja un mineral cuando es frotado contra un plato de porcelana sin barnizar o cuando se rompe y se pulveriza.

margen de una corriente de agua: (pág. 232) terreno que limita a ambos lados de una corriente, manteniendo confinada la corriente de agua en movimiento.

stream channel/synchronous rotation

stream channel: (p. 232) narrow pathway carved in to sediment or rock by the movement of surface water.

stress: (p. 528) forces per unit area that act on a material—compression, tension, and shear.

stromatolite (stroh MA tuh lite): (p. 629) large mat or mound composed of billions of photosynthesizing cyanobacteria that dominated shallow oceans during the Proterozoic.

subduction: (p. 482) process by which one tectonic plate slips beneath another tectonic plate.

sublimation: (p. 75) process by which a solid slowly changes to a gas without first entering a liquid state.

sunspot: (p. 832) dark spot on the surface of the photosphere that typically lasts two months, occurs in pairs, and has a penumbra and an umbra.

supercell: (p. 350) extremely powerful, self-sustaining thunderstorm characterized by intense, rotating updrafts.

supercluster: (p. 873) gigantic threadlike or sheetlike cluster of galaxies that is hundreds of millions of light-years in size.

supernova: (p. 851) massive explosion that occurs when the outer layers of a star are blown off.

superposition: (p. 596) the principle that, in an undisturbed rock sequence, the oldest rocks are on the bottom and each consecutive layer is younger than the layer beneath it.

surface current: (p. 425) wind-driven movement of ocean water that primarily affects the upper few hundred meters of the ocean.

suspension: (p. 228) the method of transport for all particles small enough to be held up by the turbulence of a stream's moving water.

sustainable energy: (p. 723) involves global management of Earth's natural resources to ensure that current and future energy needs will be met without harming the environment.

sustainable yield: (p. 679) replacement of renewable resources at the same rate at which they are consumed.

synchronous rotation: (p. 780) the state at which the Moon's orbital and rotational periods are equal.

cauce fluvial/rotación sincronizada

cauce fluvial: (pág. 232) estrecha vía labrada en el sedimento, o en la roca, por el movimiento del agua en la superficie.

estrés: (pág. 528) fuerza por unidad de área que actúa sobre un material: puede ser por compresión, tensión o cizallamiento.

estromatolitos: (pág. 629) microestructuras grandes compuestas de billones de cianobacterias fotosintéticas que dominaron los océanos superficiales durante el Proterozoico.

subducción: (pág. 482) proceso en que una placa tectónica se desliza por debajo de otra.

sublimación: (pág. 75) proceso en que un sólido se convierte lentamente en gas, sin convertirse primero al estado líquido.

mancha solar: (pág. 832) mancha oscura en la superficie de la fotosfera que normalmente dura dos meses, ocurren en pares y tienen una penumbra y una umbra.

supercelda: (pág. 350) tormenta autosostenible extremadamente poderosa, caracterizada por tener intensas corrientes ascendentes giratorias.

supercúmulo: (pág. 873) cúmulo gigantesco de galaxias con forma de filamento o lámina que mide centenares de millones de años luz.

supernova: (pág. 851) enorme explosión que ocurre cuando estallan las capas exteriores de una estrella.

superposición: (pág. 596) principio que establece que en una sucesión rocosa no perturbada, los estratos rocosos más antiguos se encuentran en el fondo y que cada capa sucesiva es más reciente que la capa subyacente.

corriente superficial: (pág. 425) movimiento de las aguas del océano producido por el viento, que afecta principalmente los primeros cientos de metros superiores de las aguas del océano.

suspensión: (pág. 228) método de transporte de todas las partículas que son suficientemente pequeñas como para ser mantenidas en el agua por la turbulencia de la corriente del agua en movimiento.

energía sostenible: (pág. 723) implica la administración global de los recursos naturales de la Tierra para asegurar que se satisfagan las necesidades energéticas actuales y futuras, sin causar daños al ambiente.

rendimiento sostenible: (pág. 679) regeneración de los recursos renovables a la misma velocidad con que se consumen.

rotación sincronizada: (pág. 780) estado en que los periodos de la órbita y de rotación de la Luna son iguales.

T

tailings: (p. 686) material left after mineral ore has been extracted from parent rock; can release harmful chemicals into groundwater or surface water.

tectonic plate: (p. 480) huge pieces of Earth's crust that cover its surface and fit together at their edges.

temperate zone: (p. 378) area of Earth that extends between 23.5° and 66.5° north and south of the equator and has moderate temperatures.

temperature inversion: (p. 292) increase in temperature with height in a n atmospheric layer, which inverts the temperature-altitude relationship and can worsen air-pollution problems.

temperature profile: (p. 418) plots changing ocean water temperatures against depth, which varies, depending on location and season.

tephra: (p. 512) rock fragments, classified by size, that are thrown into the air during a volcanic eruption and fall to the ground.

terrestrial planet: (p. 804) one of the rocky-surfaced, relatively small, dense inner planets closest to the Sun—Mercury, Venus, Earth, and Mars.

tetrahedron: (p. 96) a geometric solid having four sides that are equilateral triangles

texture: (p. 119) the size, shape, and distribution of the crystals or grains that make up a rock.

thermocline: (p. 418) transitional ocean layer that lies between the relatively warm, sunlit surface layer and the colder, dark, dense bottom layer and is characterized by temperatures that decrease rapidly with depth.

thermometer: (p. 324) instrument used to measure temperature using either the Fahrenheit or Celsius scale.

thermosphere: (p. 284) layer of Earth's atmosphere that is located above the mesopause; oxygen atoms absorb solar radiation causing the temperature to increase in this layer.

tide: (p. 423) periodic rise and fall of sea level caused by the gravitational attraction among Earth, the Moon, and the Sun.

escombreras: (pág. 686) material que queda después de que se ha extraído la mena de la roca madre; puede liberar sustancias químicas tóxicas hacia las aguas subterráneas y superficiales.

placa tectónica: (pág. 480) enormes fragmentos de corteza que cubren la superficie terrestre; sus límites se corresponden entre sí.

zonas templadas: (pág. 378) áreas de la Tierra que se extienden entre los 23.5° y los 66.5°, al norte y al sur del ecuador; experimentan temperaturas moderadas.

inversión de temperatura: (pág. 292) aumento de temperatura que ocurre al aumentar la altitud en alguna capa de la atmósfera; invierte la relación entre la altitud y la temperatura y puede empeorar los problemas de contaminación del aire.

perfil de temperatura: (pág. 418) diagramas que muestran cómo cambia la temperatura del océano con la profundidad; varía según la ubicación y la temporada.

tefrita: (pág. 512) fragmentos rocosos que se clasifican por tamaño; son lanzados al aire durante una erupción volcánica y luego caen al suelo.

planetas terrestres: (pág. 804) planetas internos, densos, relativamente pequeños, con superficie rocosa y cercanos al Sol: Mercurio, Venus, la Tierra, y Marte.

tetraedro: (pág. 96) sólido geométrico que tiene cuatro lados con forma de triángulo equilátero.

textura: (pág. 119) tamaño, forma y distribución de los granos o cristales que forman una roca.

termoclina: (pág. 418) capa de transición del océano que se halla entre la capa superficial iluminada por el Sol, que tiene una temperatura relativamente tibia, y la capa inferior, que es densa, oscura y fría; se caracteriza por tener temperaturas que disminuyen rápidamente con la profundidad.

termómetro: (pág. 324) instrumento que sirve para medir la temperatura en grados Fahrenheit o Celsius.

termosfera: (pág. 284) capa de la atmósfera terrestre ubicada por encima de la mesopausa; los átomos de oxígeno absorben radiación solar, haciendo que la temperatura aumente en esta capa.

marea: (pág. 423) ascenso y descenso periódicos del nivel del mar causados por la atracción gravitacional entre la Tierra, la Luna y el Sol.

topographic map: (p. 36) map that uses contour lines, symbols, and color to show changes in the elevation of Earth's surface and features such as mountains, bridges, and rivers.

topography: (p. 562) the change in elevation of the crust.

tornado: (p. 352) violent, whirling column of air in contact with the ground that forms when wind direction and speed suddenly change with height, is often associated with a supercell, and can be extremely damaging.

trace fossil: (p. 608) the only indirect fossil evidence of an organism; traces of worm trails, footprints, and tunneling burrows.

trade winds: (p. 320) two global wind systems that flow between 30° north and south latitudes, where air sinks, warms, and returns to the equator in a westerly direction.

transform boundary: (p. 484) place where two tectonic plates slide horizontally past each other; is characterized by long faults and shallow earthquakes.

transgression: (p. 649) occurs when sea level rises and causes the shoreline to move inland, resulting in deeper-water deposits overlying shallow-water deposits.

transported soil: (p. 177) soil that has been moved away from its parent material by water, wind, or a glacier.

tropical cyclone: (p. 355) large, low-pressure, rotating tropical storm that gets its energy from the evaporation of warm ocean water and the release of heat.

tropics: (p. 378) area of Earth that receives the most solar radiation, is generally warm year-round, and extends between 23.5° south and 23.5° north of the equator.

troposphere: (p. 284) layer of the atmosphere closest to Earth's surface, where most of the mass of the atmosphere is found and in which most weather takes place and air pollution collects.

trough: (p. 421) lowest point of a wave.

tsunami (soo NAH me e): (p. 548) large, powerful ocean wave generated by the vertical motions of the seafloor during an earthquake; in shallow water, can form huge, fast-moving breakers exceeding 30 m in height that can damage coastal areas.

mapa topográfico: (pág. 36) mapa que usa curvas de nivel, símbolos y colores para mostrar los cambios en la elevación de la superficie terrestre, e incluye rasgos como las montañas, los puentes y los ríos.

topografía: (pág. 562) el cambio en la elevación de la corteza.

tornado: (pág. 352) violenta columna giratoria de aire en contacto con el suelo; se forma cuando la dirección y la velocidad del viento cambian repentinamente con la altura; a menudo está asociada con una supercelda y puede ser extremadamente dañina.

fósiles traza: (pág. 608) pruebas fósiles indirectas de un organismo: incluye rastros de gusanos, huellas de pasos y madrigueras.

vientos alisios: (pág. 320) dos sistemas globales de vientos que se desplazan entre los 30° de latitud norte y sur, donde el aire desciende, se calienta y regresa al ecuador con dirección oeste.

límite transformante: (pág. 484) lugar donde dos placas tectónicas se deslizan horizontalmente, una al lado de la otra y en sentidos opuestos; se caracteriza por presentar grandes fallas y terremotos superficiales.

transgresión: (pág. 649) ocurre cuando el nivel del mar aumenta y hace que el litoral retroceda hacia el interior; ocasiona depósitos de agua más profunda que cubren depósitos de agua menos profunda.

suelo transportado: (pág. 177) suelo que ha sido transportado lejos de su roca madre por el agua, el viento o un glaciar.

cyclón tropical: (pág. 355) gran tormenta giratoria de baja presión que obtiene su energía de la evaporación de las tibias aguas del mar y la liberación de calor.

tropicales: (pág. 378) área de la Tierra que recibe la mayor cantidad de radiación solar, generalmente es caliente todo el año y se extiende entre 23.5° sur y 23.5° norte del ecuador.

troposfera: (pág. 284) capa de la atmósfera más cercana a la superficie terrestre; en ella se halla la mayoría de la masa atmosférica, ocurren la mayoría de los fenómenos meteorológicos y se concentran la mayoría de los contaminantes.

seno: (pág. 421) punto más bajo de una onda.

tsunami: (pág. 548) enorme y poderosa ola marina generada por los movimientos verticales del fondo del mar durante un sismo; en aguas superficiales, puede formar inmensas olas muy rápidas de más de 30 m de altura que pueden causar daños en las áreas costeras.

turbidity current/volcanism

turbidity current: (p. 448) rapidly flowing ocean current that can cut deep-sea canyons in continental slopes and deposit the sediments in the form of a continental rise.

unconformity: (p. 598) gap in the rock record caused by erosion or weathering.

uniformitarianism: (p. 595) the theory that geologic processes occurring today have been occurring since Earth formed.

uplifted mountain: (p. 573) mountain that forms when large regions of Earth are forced slowly upward without much deformation.

upwelling: (p. 426) upward movement of ocean water that occurs when winds push surface water aside and it is replaced with cold, deeper waters that originate below the thermocline.

valley glacier: (p. 208) glacier that forms in a valley in a mountainous area and widens V-shaped stream valleys into U-shaped glacial valleys as it moves downslope.

variable star: (p. 862) star in the giant branch of the Hertzsprung-Russell diagram that pulsates in brightness due to its outer layers expanding and contracting.

varve: (p. 605) alternating light-colored and dark-colored sedimentary layers of sand, clay, and silt deposited in a lake that can be used to date cyclic events and changes in the environment.

vent: (p. 505) opening in Earth's crust through which lava erupts and flows out onto the surface.

ventifact: (p. 203) rock shaped by windblown sediments.

vesicular texture: (p. 120) a spongy-looking rock; lava whose gas bubbles do not escape.

viscosity: (p. 509) a substance's internal resistance to flow.

volcanism: (p. 500) describes all the processes associated with the discharge of magma, hot water, and steam.

corriente de turbidez/vulcanismo

corriente de turbidez: (pág. 448) corriente oceánica de flujo rápido que puede formar cañones en los taludes continentales y depositar los sedimentos para formar el pie del talud continental.

disconformidad: (pág. 598) discontinuidad en el registro geológico causada por la erosión o la meteorización.

uniformitarianismo: (pág. 595) este principio establece que los procesos geológicos que ocurren actualmente han estado ocurriendo desde que la Tierra se formó.

levantamiento montañoso: (pág. 573) montañas que se forman cuando grandes regiones de la Tierra son levantadas lentamente sin que ocurra mucha deformación.

corriente resurgente: (pág. 426) movimiento ascendente de las aguas del océano que ocurre cuando los vientos remueven las aguas superficiales, causando que sean reemplazadas por aguas más frías y profundas provenientes de profundidades mayores que la termoclina.

glaciar de valle: (pág. 208) glaciar que se forma en un valle de un área montañosa; al deslizarse cuesta abajo, ensancha los valles de corrientes con forma en V y los convierte en valles glaciales con forma de U.

estrella variable: (pág. 862) estrella en la rama de las gigantes del diagrama Hertzsprung-Russell, cuya luminosidad presenta pulsaciones debidas a la expansión y contracción de sus capas exteriores.

varve: (pág. 605) estratos sedimentarios de colores claros y oscuros alternados, compuestos de arena, arcilla y limo, depositados en un lago, que sirven para datar acontecimientos cíclicos y cambios en el ambiente.

chimenea: (pág. 505) abertura en la corteza terrestre por la cual fluye lava hacia la superficie.

ventifacto: (pág. 203) roca moldeada por sedimentos arrastrados por el viento.

textura vesicular: (pág. 120) roca de aspecto esponjoso; lava cuyas burbujas de gas no se escapan.

viscosidad: (pág. 509) resistencia interna a fluir de una sustancia.

vulcanismo: (pág. 500) describe todos los procesos asociados con la descarga de magma, agua caliente y vapor.

W

watershed: (p. 227) land area drained by a stream system.

water table: (p. 254) upper boundary of the zone of saturation that rises during wet seasons and drops during dry periods.

wave: (p. 421) rhythmic movement that carries energy through matter or space and, in oceans, is generated mainly by wind moving over the surface of the water.

wave refraction: (p. 439) process in which waves advancing toward shore slow when they encounter shallower water, causing the initially straight wave crests to bend toward the headlands.

weather: (p. 314) short-term variations in atmosphere phenomena that interact and affect the environment and life on Earth.

weathering: (p. 164) chemical or mechanical process that breaks down and changes rocks on or near Earth's surface and whose rate is influenced by factors such as precipitation and temperature.

well: (p. 263) deep hole drilled or dug into the ground to reach a reservoir of groundwater.

wetland: (p. 240) any land area, such as a bog or marsh, that is covered in water a large part of the year and supports specific plant species.

windchill index: (p. 365) measures the windchill factor, by estimating the heat loss from human skin caused by a combination of wind and cold air.

cuenca: (pág. 227) área de terreno drenada por un sistema de corrientes de agua.

capa freática: (pág. 254) límite superior de la zona de saturación; aumenta durante la temporada de lluvias y disminuye durante los períodos de sequía.

onda (ola): (pág. 421) movimiento rítmico que transporta energía a través de la materia o el espacio; en los océanos, es generado principalmente por el movimiento del viento sobre la superficie del agua.

refracción de onda: (pág. 439) proceso en que las olas avanzan hacia la costa y reducen su velocidad, cuando llegan a aguas menos profundas, ocasionando que las crestas de las olas, inicialmente rectas, se inclinen hacia los promontorios.

tiempo: (pág. 314) variaciones a corto plazo en los fenómenos que suceden en la atmósfera, que interactúan y afectan el entorno de la vida en la Tierra.

meteorización: (pág. 164) proceso químico o mecánico que rompe y modifica las rocas que se hallan sobre o cerca de la superficie terrestre; su velocidad se ve influida por factores como la precipitación y la temperatura.

pozo: (pág. 263) hoyo profundo perforado o excavado en el suelo para alcanzar un depósito de agua subterránea.

humedal: (pág. 240) toda área, como un pantano o una ciénaga, que se encuentra cubierta de agua gran parte del año y que alberga especies específicas de plantas.

índice de sensación térmica: (pág. 365) índice que toma en cuenta el efecto del viento en la sensación térmica, al estimar la pérdida de calor de la piel humana causada por la combinación de viento y aire frío.

Z

zircon: (p. 620) very stable and common mineral that scientists often use to age-date old rocks.

zone: (p. 812) high, cool, light-colored cloud that rises and flows rapidly in the Jovian atmosphere.

zone of aeration (p. 254) region above the water table where materials are moist, but pores contain mostly air.

zone of saturation: (p. 254) region below Earth's surface where all the pores of a material are completely filled with groundwater.

circón: (pág. 620) mineral sumamente estable que los científicos usan para datar rocas antiguas.

zona: (pág. 812) nubes altas, relativamente frías y de color claro, que se elevan y desfilan con rapidez en la atmósfera joviana.

zona de aeración: (pág. 254) región sobre el manto freático en que los materiales están húmedos, pero los poros contienen principalmente aire.

zona de saturación: (pág. 254) región profunda bajo la superficie terrestre donde todos los poros del material están completamente llenos con agua subterránea.

Italic numbers = illustration/photo **Bold numbers = vocabulary term**
act = activity

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