Name: ______________________________ Date: ______________

SKILL and PRACTICE 4.1

Internet Research Skills

READ

The Internet is a valuable tool for finding answers to your questions about the world. A search engine is like an on-line index to information on the World Wide Web. There are many different search engines from which to choose. Search engines differ in how often they are updated, how many documents they contain in their index, and how they search for information. Your teacher may suggest several search engines for you to try.

EXAMPLE

Search engines ask you to type a word or phrase into a box known as a *field*. Knowing how search engines work can help you pinpoint the information you need. However, if your phrase is too vague, you may end up with a lot of unhelpful information.

How could you find out who was the first woman to participate in a space shuttle flight?

First, put **key phrases** in quotation marks. You want to know about the "first woman" on a "space shuttle." Quotation marks tell the engine to search for those words together.

Second, if you only want websites that contain both phrases, **use a + sign** between them. Typing **"first woman" + "space shuttle"** into a search engine will limit your search to websites that contain both phrases.

If you want to broaden your search, use the word **or** between two terms. For example, if you type **"first female" or "first woman" + "space shuttle"** the search engine will list any website that contains either of the first two phrases, as long as it also contains the phrase "space shuttle."

You can narrow a search by using the word **not.** For example, if you wanted to know about marine mammals other than whales, you could type **"marine mammals" not "whales"** into the field. Please note that some search engines use the minus sign (-) rather than the word **not**.

PRACTICE 1

1. If you wanted to find out about science museums in your state that are not in your own city or town, what would you type into the search engine?

2. If you wanted to find out which dog breeds are not expensive, what would you type into the search engine?

3. How could you research alternatives to producing electricity through the combustion of coal or natural gas?

READ

The quality of information found on the Internet varies widely. This section will give you some things to think about as you decide which sources to use in your research.

1. **Authority:** How well does the author know the subject matter? If you search for “Newton’s laws” on the Internet, you may find a science report written by a fifth grade student, and a study guide written by a college professor. Which website is the most authoritative source?
   Museums, national libraries, government sites, and major, well-known “encyclopedia sources” are good places to look for authoritative information.
2. **Bias:** Think about the author’s purpose. Is it to inform, or to persuade? Is it to get you to buy something? Comparing several authoritative sources will help you get a more complete understanding of your subject.
3. **Target audience:** For whom was this website written? Avoid using sites designed for students well below your grade level. You need to have an understanding of your subject matter at or above your own grade level. Even authoritative sites for younger students (children’s encyclopedias, for example) may leave out details and simplify concepts in ways that would leave gaps in your understanding of your subject.
4. **Is the site up-to-date, clear, and easy to use?** Try to find out when the website was created, and when it was last updated. If the site contains links to other sites, but those links don’t work, you may have found a site that is infrequently or no longer maintained. It may not contain the most current information about your subject. Is the site cluttered with distracting advertisements? You may wish to look elsewhere for the information you need.

PRACTICE 2

1. What is your favorite sport or activity? Search for information about this sport or activity. List two sites that are authoritative and two sites that are not authoritative. Explain your reasoning. Finally, write down the best site for finding out information about your favorite sport.
2. Search for information about an earth science topic of your choice on the Internet (for example: “earthquakes,” “hurricanes,” or “plate tectonics”). Find one source that you would NOT consider authoritative. Write the key words you used in your search, the web address of the source, and a sentence explaining why this source is not authoritative.
3. Find a different source that is authoritative, but intended for a much younger audience. Write the web address and a sentence describing who you think the intended audience is.
4. Find three sources that you would consider to be good choices for your research here. Write a two to three sentence description of each. Describe the author, the intended audience, the purpose of the site, and any special features not found in other sites.

Name: ______________________ Date: ______________

SKILL and PRACTICE 4.1

Bibliographies

READ

When you write a research paper or prepare a presentation for your class, it is important to document your sources. A bibliography serves two purposes. First, a bibliography gives credit to the authors who wrote the material you used to learn about your subject. Second, a bibliography provides your audience with sources they can use if they would like to learn more about your subject.

This skill sheet provides bibliography formats and examples for research materials you may use when preparing science papers and presentations

EXAMPLES

Books:

Author last name, First name. (Year published). *Title of book*. Place of publication: Name of publisher.

Vermeij, Geerat. (1997). *Privileged Hands: A Scientific Life*. New York: W.H. Freeman and Company.

Newspaper and Magazine Articles:

Author listed:

Author last name, First name. (Date of publication). Title of Article. *Title of Newspaper or Magazine*, page # or #'s.

Searcy, Dionne. (2006, March 20). Wireless Internet TV Is Launched in Oklahoma. *The Wall Street Journal*, p. B4.

Brody, Jane. (2006, February/March). 10 Kids' Nutrition Myth Busters. *Nick Jr Family Magazine*, pp. 72-73.

No author listed:

Title of article. (Date of publication). *Title of Newspaper or Magazine*, page # or #'s.

Chew on this: Gum may speed recovery. (2006, March 20). *St. Louis Post-Dispatch*, p.H2.

Adventures in Turning Trash into Treasure: (2006, April). *Reader's Digest*, p. 24.

Online Newspaper or Magazine:

Author listed:

Author last name, First name. (Date of publication). Title of Article. *Title of Newspaper or Magazine*, Retrieved date, from web address.

Dybas, Cheryl Lyn. (2006, March 20). Early Spring Disturbing Life on Northern Rivers. *The Washington Post*, Retrieved March 22, 2006, from www.washingtonpost.com.)

No author listed:

Title of Article. (Date of publication). *Title of Newspaper or Magazine*. Retrieved date, from web address.

Comet mystery turns from hot to cold. (2006, March 20). *The Boston Globe*, retrieved March 22, 2006, from Boston.com.

Online document:

Author listed:

Author last name, author first name. (Date of publication). *Title of document*. Retrieved date, from web address.

Martinez, Carolina. (2006, March 9). *NASA's Cassini Discovers Potential Liquid Water on Enceladus*. Retrieved March 22, 2006, from http://www.nasa.gov/mission_pages/cassini/media/cassini-20060309.html

No Author listed:

National Science Foundation. (2005, December 15). *A fish of a different color*. Retrieved March 22, 2206 from http://www.nsf.gov/news/news_summ.jsp?cntn_id=105661&org=NSF&from=news.

Name: ______________________ Date: ______________

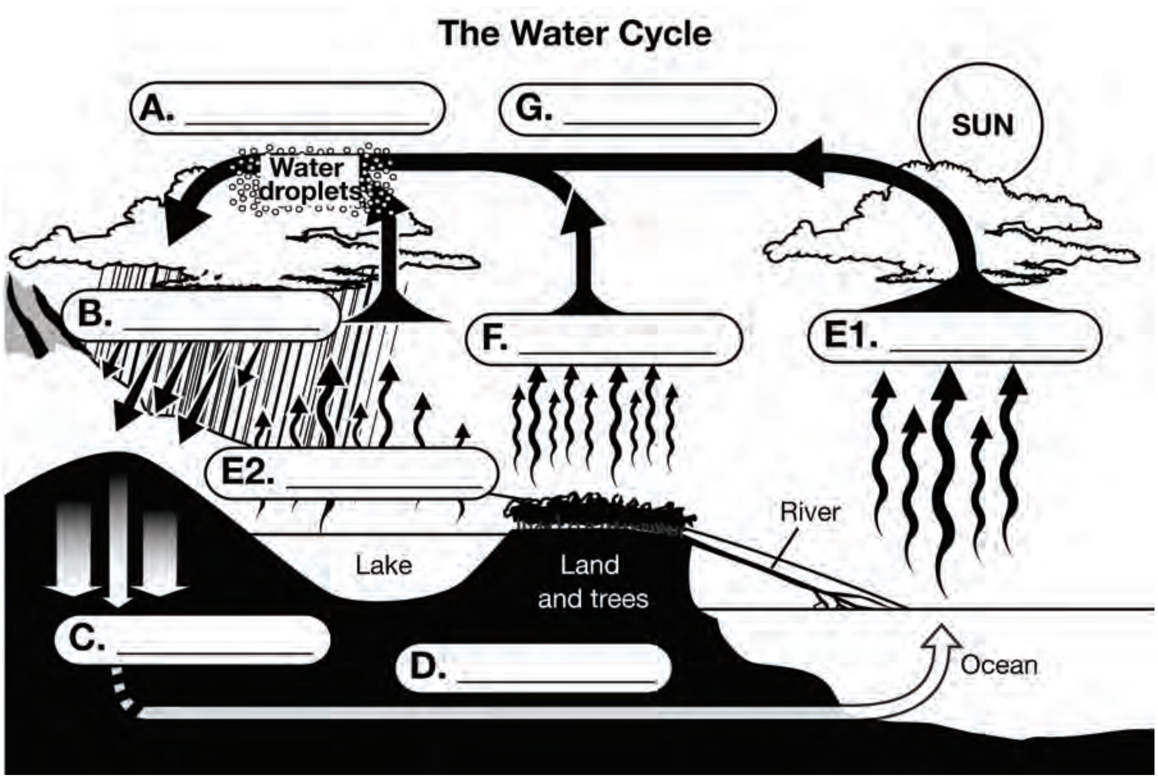
SKILL and PRACTICE 4.2

The Water Cycle

READ

As you study Section 4.2 in your student text, you will learn about the processes that move water around our planet. Together, these processes form the water cycle. Use the word box to help you label the water cycle diagram below. Some words may be used more than once.

• condensation	• groundwater flow	• evaporation	• water vapor transport
• percolation	• transpiration	• precipitation	



PRACTICE

Answer the following questions. Use the diagram above and Section 4.2 of your text to help you.

1. Name two water cycle processes that are driven by the Sun. Explain the Sun's role in each.
2. How is wind involved in the water cycle?
3. How does gravity affect the water cycle?

Name: ______________________ Date: ______________

SKILL and PRACTICE 4.2

Groundwater and Wells Project

READ

When it rains, some of the water that falls on Earth seeps into the ground, while some water flows over the surface into local streams or lakes. Some water is absorbed by plants and some evaporates back into the atmosphere. The water that seeps into the ground flows downward, moving through empty spaces between soil, sand, or rocks. It continues its journey until it reaches rock through which it cannot easily move. Then, it starts to fill the spaces between the rock and soil above. The top of this wedge of water is called the *water table*.

The water that fills the empty spaces is called *groundwater*. Areas that groundwater easily moves through are called *aquifers*. *Aquitards* are bodies of rock where water can move through—but very slowly. If the aquitard does not allow any water to pass, it is called an *aquiclude*. Groundwater comes from precipitation (rain and snow melt), from lakes or rivers that leak water, and even from extra water not used by agricultural crops when they are irrigated.

Groundwater is a very important source of drinking water. According to the US Geological Survey, 51% of Americans get their drinking water from groundwater. 99% of the rural population in the US uses groundwater for drinking. 37% of agricultural water, which is mostly used for irrigation comes from groundwater. Groundwater is obtained by digging wells. The water fills the well underground and a pump inside pumps it up to the surface where it travels through pipes to bring it to our homes and businesses.

This project will help you learn more about groundwater movement and wells.

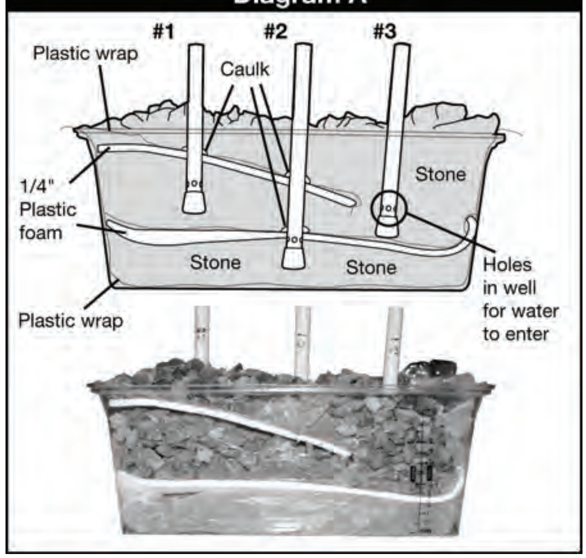
Materials:

• GeoBox	• ½”to 3/4” white stone; rounded is better (approximately 1,800 mL total)	• ¼” plastic foam; one piece 7 3/4” x 13 ¾”; second piece 7 ¾” x 9"	• Caulk or plumbers putty (something that can be molded around the PVC wells for waterproofing)
• Plastic wrap	• Food dye - dark colors	• 8-10 cotton swabs	• Tape
• Wooden skewer or dowel with diameter less than 0.5"	• 3 wells (1/2” inside diameter PVC pipe with caps; 4 well holes near cap drilled with 13/64 drill bit)	• Watering can or beaker	

Constructing the model:

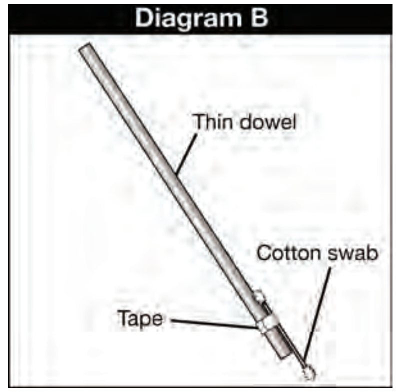
1. Line the inside of the GeoBox with plastic wrap so that it comes up and over the edges of the box.
2. Hold well #2 in the middle of the GeoBox, with the cap end sitting directly on the bottom of the GeoBox. Add approximately 1,800 mL of the rock, surrounding the well. The rock should just cover the holes of the well and the well should stand on its own.
3. The larger plastic foam sheet will be layered next on top of the rock. In order to put it down, carefully poke the well through it so it fits over the well. Now place on top of it the plastic wrap that will come up and over the edges. Because you need to also make a hole in the plastic wrap through which to fit the well, use the caulk or putty to mold around the well and onto the plastic wrap to keep it water proof.
4. Once this is set, hold well #3 in place on the right side (diagram A) and add approximately 2,000 mL of stone down on the surface, so that it surrounds well #3 and holds it upright.
5. Now add approximately 1,300 mL of stone to the left side of the GeoBox to create a diagonal plane of stone that runs highest from the left edge to level just right of well #2.
6. Place well #1 in the built up area of stone on the left side of the GeoBox, just above, but not touching the first plastic foam layer (as well #3 is). Make sure that the stone is covering the holes in the well.
7. Place the smaller plastic foam sheet over well #1 and well #2, again poking holes in the plastic foam so that the sheet can sit on the rock layers below. This sheet will be slanted down towards the middle.

Diagram A



8. Again you will cover just the sheet with plastic wrap which will come up and over the edge on three sides. Caulk the two wells that poke through this sheet.
9. Use the remaining 3,000 mL of stone to fill the tray up to the top so that what is visible is just stone and three well tops. See photo at right.
10. Tape one cotton swab to the end of the skewer or wooden rod so that the cotton swab reaches out from the end of the wood. See diagram B at right.
11. Dye the water that you will be using for precipitation a dark color, such as blue, red, or green.

Diagram B



Making predictions:

a. Which well/s would you expect to collect water when it rains?
b. If contamination entered from the surface, what well would you expect to first show contaminated water?
c. Will well #2 get contaminated from surface contamination? Why?

Testing the model:

1. Watch the water flow closely as you do this experiment.
2. Sprinkle or pour the dyed water into the top layer of rock to simulate precipitation, without allowing the water to precipitate into the wells. The dye will make it easier to see the water as it travels.
3. Regularly check the wells with the cotton swab/dowel rods to see if water has entered the wells. In this way, you can also see which well collected water the quickest.
4. For a demonstration of the movement of surface pollution—dye water another color and allow this contaminated water to percolate through the layers. Use new cotton swabs attached to the wooden rods to visualize if and when the wells will get contaminated. The cotton swab should change color as the two dyes mix.

Thinking about what you observed:

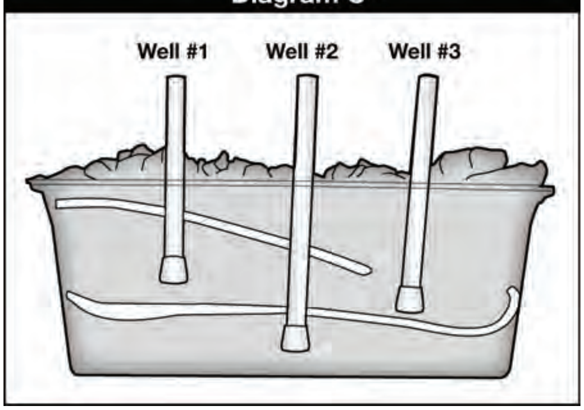
a. Which wells collected water when it rained? Was your hypothesis correct?

b. Which well was first to be contaminated? Was your hypothesis correct?

c. What does the plastic wrap/plastic foam layer represent? Label diagram C appropriately.

d. What do the rock layers represent? Label diagram C appropriately.

Diagram C



e. Did well #2 get contaminated from surface contamination? Why? Was your hypothesis correct?

f. What effect would pumping from well #1 have on movement of surface contamination? Pumping from well #2?

g. What would happen if there was a dry spell and the water table and thus the groundwater was lowered to below well #1? Would any well be able to pump water?

h. If well #3 were located near the coast, what effect might pumping freshwater too quickly have on the water in the well?

i. When you dig a well, how might you decide how deep to dig it?

Name: ______________________________ Date: ______________

Dimensional Analysis

SKILL and PRACTICE 5.1

READ

Dimensional analysis is a way to tell what the correct label (also called units or dimensions) for the solution to a problem should be. In dimensional analysis, we treat the units the same way that we treat the numbers. For example, this problem shows how you can "cancel" the sixes and then perform the multiplication:

$$\frac{5}{\cancel{6}} \bullet \frac{\cancel{6}}{7} = \frac{5}{7}$$

In some problems, there are no numerical cancellations to make, but pay close attention to the units (or dimensions):

$$\frac{9 \text{ weeks}}{1} \bullet \frac{7 \text{ days}}{1 \text{ week}} = \frac{9 \bullet 7 \bullet \text{weeks} \bullet \text{days}}{1 \text{ week}} = \frac{63 \cancel{\text{weeks}} \text{ days}}{\cancel{1 \text{ week}}} = 63 \text{ days}$$

The "weeks" may be cancelled either before or after the multiplication.

The goal of dimensional analysis is to simplify a problem by focusing on the units of measurement (dimensions).

Dimensional analysis is very useful when converting between units (like converting inches to yards, or converting between the metric and English systems of measurement.

EXAMPLE

- How many minutes are there in one day?

Solution:

a. Determine what it is that we want to find out: $\frac{\text{minutes}}{\text{day}}$.

It's important to remember that if the solution is to have the label $\frac{\text{minutes}}{\text{day}}$:

Minutes should be kept in the numerator (or top part of the fraction).
Day(s) should be kept in the denominator (or bottom part of the fraction).

b. Determine what we know. We know that there are **60** minutes in an hour and **24** hours in a day.

c. Write what you know mathematically (fractions). Here, we have: $\frac{60 \text{ min}}{1 \text{ hr}} \bullet \frac{24 \text{ hr}}{1 \text{ day}}$

d. Set up the problem by focusing on the units (dimensions).

Just writing the information from #3 as a multiplication problem, we have: $\frac{60 \text{ min}}{1 \text{ hr}} \bullet \frac{24 \text{ hr}}{1 \text{ day}}$

Looking *only* at the units, hr(s) cancel, leaving just: $\frac{\text{min}}{\cancel{\text{hr}}} \bullet \frac{\cancel{\text{hr}}}{\text{day}} = \frac{\text{min}}{\text{day}}$

e. Calculate:

$$\frac{60 \text{ min}}{1 \text{ hr}} \bullet \frac{24 \text{ hr}}{1 \text{ day}} = \frac{60 \bullet 24 \text{ min} \bullet \cancel{\text{hr}}}{1 \ \cancel{\text{hr}} \bullet \text{day}} = \frac{1{,}440 \text{ min}}{\text{day}}$$

Notice that canceling the units can be done either before or after the multiplication.

f. Check your solution for reasonableness: Since there are 60 minutes in just one hour, it is expected that there would be many minutes in an entire day. It does seem reasonable that there are 1,440 minutes in a day.

PRACTICE

1. Multiply. Be sure to label your answers.

a. $\frac{30 \text{ mi}}{1 \text{ gallon}} \bullet \frac{12 \text{ gallons}}{1 \text{ tank}}$

b. $\frac{70 \text{ feet}}{\text{second}} \bullet 60 \text{ seconds}$

c. $\frac{15 \text{ mi}}{\text{hr}} \bullet \frac{1 \text{ hr}}{60 \text{ min}} \bullet 30 \text{ min}$

2. Use dimensional analysis to convert each. You may need to use a reference to find some conversion factors. Show all of your work.

a. 15 pints to some number of quarts

b. 30,000 feet to some number of miles

c. 28,800 seconds to some number of hours

3. Use dimensional analysis to find each solution. You may need to use a reference to find some conversion factors. Show all of your work.

a. On Saturday, Sammie ran a 5k road race. How far is this in miles?

b. DeAndre earns $6.25 per hour. He works 6 hours each day, five days each week. What are his weekly earnings?

c. Using the information from “b”: If DeAndre has two weeks of unpaid vacation this year, how much does he earn for the year?

d. Simon fills his gas tank. Gas costs $3.39 per gallon. His tank will hold 12 gallons of gas. How much does it cost Simon to fill his tank?

e. A wide receiver for a professional football team has a 40-inch vertical jump. How much is this in centimeters?

f. Lorraine has set a goal of collecting at least 100 pieces of candy during trick-or-treating this Halloween. From past years, she thinks she will average 2 pieces of candy from each home she visits. Her brother expects to do the same. Lorraine can also count on collecting half of her little brother's candy. If she goes with her brother, how many houses must Lorraine visit in order to accomplish her goal?

g. Greg can type 33 words in 1 minute. How many words does he average per second?

Name: ______________________ Date: ______________

SKILL and PRACTICE 5.2

Internet Research Skills

READ

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PRACTICE 1

1. If you wanted to find out about science museums in your state that are not in your own city or town, what would you type into the search engine?

2. If you wanted to find out which dog breeds are not expensive, what would you type into the search engine?

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   Museums, national libraries, government sites, and major, well-known “encyclopedia sources” are good places to look for authoritative information.

2. **Bias:** Think about the author’s purpose. Is it to inform, or to persuade? Is it to get you to buy something? Comparing several authoritative sources will help you get a more complete understanding of your subject.

3. **Target audience:** For whom was this website written? Avoid using sites designed for students well below your grade level. You need to have an understanding of your subject matter at or above your own grade level. Even authoritative sites for younger students (children’s encyclopedias, for example) may leave out details and simplify concepts in ways that would leave gaps in your understanding of your subject.

4. **Is the site up-to-date, clear, and easy to use?** Try to find out when the website was created, and when it was last updated. If the site contains links to other sites, but those links don’t work, you may have found a site that is infrequently or no longer maintained. It may not contain the most current information about your subject. Is the site cluttered with distracting advertisements? You may wish to look elsewhere for the information you need.

PRACTICE 2

1. What is your favorite sport or activity? Search for information about this sport or activity. List two sites that are authoritative and two sites that are not authoritative. Explain your reasoning. Finally, write down the best site for finding out information about your favorite sport.

2. Search for information about an earth science topic of your choice on the Internet (for example: “earthquakes,” “hurricanes,” or “plate tectonics”). Find one source that you would NOT consider authoritative. Write the key words you used in your search, the web address of the source, and a sentence explaining why this source is not authoritative.

3. Find a different source that is authoritative, but intended for a much younger audience. Write the web address and a sentence describing who you think the intended audience is.

4. Find three sources that you would consider to be good choices for your research here. Write a two to three sentence description of each. Describe the author, the intended audience, the purpose of the site, and any special features not found in other sites.

Name: ______________________ Date: ______________

Layers of the Atmosphere

READ

Use the table below to organize the information in Section 5.2 of your text. You can use the table as a study guide as you review for tests.

PRACTICE

Layer	Distance from Earth's Surface	Thickness	Facts
Troposphere			
Stratosphere			
Mesosphere			
Thermosphere			
Exosphere			

Name: ______________________________ Date: ______________

PRACTICE 5.3

Drawing Line Graphs

READ

Graphs allow you to present data in a form that is easy to understand. Line graphs include these important parts:

1. **Data pairs:** Graphs are made using pairs of numbers. Each pair of numbers represents one data point on a graph. The first number in the pair represents the independent variable and is plotted on the *x*-axis. The second number represents the dependent variable and is plotted on the *y*-axis.
2. **Axis labels:** The label on the *x*-axis is the name of the independent variable. The label on the *y*-axis is the name of the dependent variable. Be sure to write the units of each variable in parentheses after its label.
3. **Scale:** The scale is the quantity represented per line on the graph. The scale of the graph depends on the number of lines available on your graph paper and the range of the data. Divide the range by the number of lines. To make the calculated scale easy-to-use, round the value to a whole number.
4. **Title:** The format for the title of a graph is: "Dependent variable name versus independent variable name."

PRACTICE

1. For each data pair in the table, identify the independent and dependent variable. Then, rewrite the data pair according to the headings in the next two columns of the table The first two data pairs are done for you.

	Data pair (not necessarily in order)		Independent (*x*-axis)	Dependent (*y*-axis)
1	Temperature	Hours of heating	Hours of heating	Temperature
2	Stopping distance	Speed of a car	Speed of a car	Stopping distance
3	Number of people in a family	Cost per week for groceries		
4	Stream flow rate	Amount of rainfall		
5	Tree age	Average tree height		
6	Test score	Number of hours studying for a test		
7	Population of a city	Number of schools needed		

2. Using the variable range and number of lines, calculate the scale for an axis. The first two are done for you.

Variable range	Number of lines	Range ÷ Number of lines	Calculated scale	Adjusted scale
13	24	13 ÷ 24 =	0.54	1
83	43	83 ÷ 43 =	1.93	2
31	35			
100	33			
300	20			
900	15			

3. Here is a data set for you to plot as a graph. Follow these steps to make the graph.

   a. Place this data set in the table below. Each data point is given in the format of (x, y). The x- values represent time in minutes. The y-values represent distance in kilometers.
   (0, 5.0), (10, 9.5), (20, 14.0), (30, 18.5), (40, 23.0), (50, 27.5), (60, 32.0).

Independent variable (x-axis)	Dependent variable (y-axis)

   b. What is the range for the independent variable?

   c. What is the range for the dependent variable?

   d. Make your graph using the blank graph below. Each axis has twenty lines (boxes). Use this information to determine the adjusted scale for the x-axis and the y-axis.

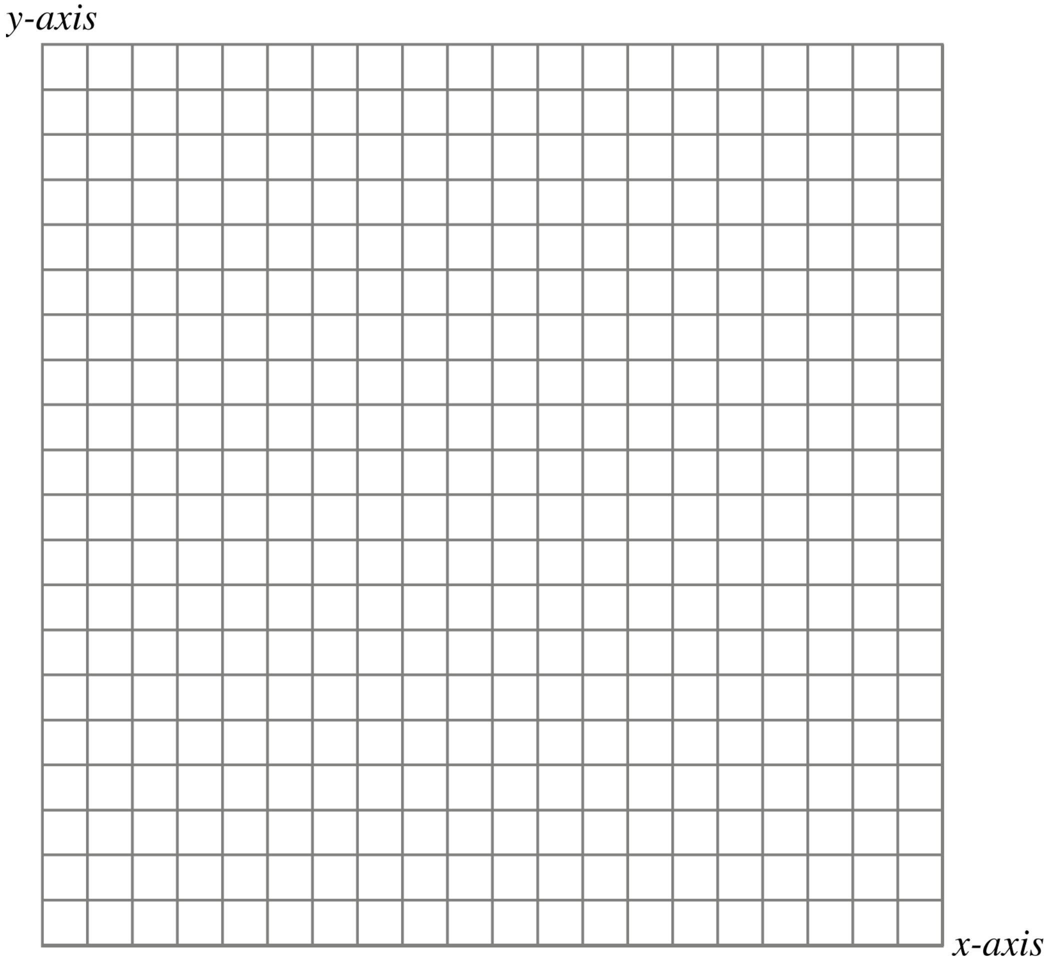
   e. Label your graph. Add a label for the x-axis, y-axis, and provide a title.

   f. Draw a smooth line through the data points.

PRACTICE $\frac{112m}{4 sec}$ =

5.3

g. Question: What is position value after 45 minutes? Use your graph to answer this question.



Name: ______________________ Date: ______________

SKILL and PRACTICE 5.3

Specific Heat

READ

Specific heat is the amount of thermal energy needed to raise the temperature of 1 gram of a substance 1°C.

Specific heat is one physical characteristic of a material. Some materials have high specific heat values. This means it takes a lot of thermal energy to raise their temperature. Materials with high specific heat values also have to release more thermal energy to lower their temperature than materials with lower specific heat values. Some sample specific heat values are presented in the table below:

Material	Specific Heat (J/kg °C)
water (pure)	4,184
aluminum	897
silver	235
oil	1,900
concrete	880
gold	129
wood	1,700

Water has the highest specific heat of the listed types of matter. This means that water is slower to heat but is also slower to lose heat.

PRACTICE

Using the table above, solve the following heat problems.

1. If 100 joules of energy were applied to all of the substances listed in the table at the same time, which would have the greatest temperature change? Explain your answer.

2. Which of the substances listed in the table would you choose as the best thermal insulator? A thermal insulator is a substance that requires a lot of heat energy to change its temperature. Explain your answer.

3. Which substance—wood or silver—is the better thermal conductor? A thermal conductor is a material that requires very little heat energy to change its temperature. Explain your answer.

4. Which has more thermal energy, 1 kg of aluminum at 20°C or 1 kg of gold at 20°C?

5. How much heat in joules would you need to raise the temperature of 1 kg of water by 5°C?

6. How does the thermal energy of a large container of water compare to a small container of water at the same temperature?

Name: ______________________________ Date: ______________

SKILL and PRACTICE 6.1

Using Computer Spreadsheets

READ

Computer spreadsheets provide an easy way to organize and evaluate data that you collect from an experiment. Numbers are typed into boxes called "cells." The cells are organized in rows and columns. You can find the average of a lot of numbers or do more complicated calculations by writing formulas into the cells. Each cell has a name based on its column letter and row number. For example, the first cell in most spreadsheets is "A1."

This skill sheet will show you how to:

1. Record data in a computer spreadsheet program.

2. Do simple calculations for many data values at once using the spreadsheet.

3. Make a graph with the data set.

	A	B	C	D
1	Time (sec)	Temp (deg C)	Slope	
2	0	22.5		
3	30	23.0		
4	60	23.5		
5	90	24.0		
6	120	25.5		
7	150	27.5		
8	180	30.0		
9	210	32.5		
10	240	35.0		
11	270	37.5		
12	300	40.0		
13				
14				
15				

To complete this skill sheet, you will need:

- Simple calculator
- Access to a computer with a spreadsheet program

EXAMPLE

1. **Adding data:** Open the spreadsheet program on your computer. You will see a window open that has rows and columns. The rows are numbered. The columns are identified by a letter.

   a. As shown in the graphic above, add headings for columns A, B, and C:
   cell A1, type "Time (sec)"
   cell B1, type "Temp (deg C)"
   cell C1, type "Slope"
   NOTE: You can change the width of the columns on your spreadsheet by clicking on the right-hand border and dragging the border to the left or right.

   b. Highlight column B. Then, go to the **Format** menu item and click on **Cells**. Make the format of these cells **Number** with one decimal place. Highlight column C and make the format of these cells Number with two decimal places.

   c. Type in the data for Time and Temperature as shown in the graphic above.

2. **Making a graph:** Now, you will use the data you have added to the skill sheet to make a graph.

   a. Use your mouse to highlight the titles and data in columns A and B.

   b. Then, go to **Insert** and click on **Chart**.

   c. In step 1 of the chart wizard, choose the **XY (Scatter)** format for your chart and click "Next."

   d. In step 2 of the chart wizard, you will see a graph of your data. Click "Next" again to get to step 3. Here, you can change the appearance of the graph.

   e. In step 3 of the chart wizard add titles and uncheck the show legend-option. In the box for the chart title write "Temperature vs. Time." In the box for the value *x*-axis, write "Time (seconds)." In the box for the value for *y*-axis, write "Temperature (deg Celsius)."

f. In step 4 of the chart wizard, click the option to show the graph as an object in Sheet 2. At this point you will finish your work with the chart wizard.

g. Setting the scale on the x-axis: Place the cursor on the x-axis and double click. Set the minimum of the scale to be 0, the maximum to be 310. Set the major unit to be 100 and the minor unit to be 20. Then, click OK. *Note: Make sure the boxes to the left of the changed values are NOT checked.*

h. Setting the scale on the y-axis.: Place the cursor on the y-axis and double click. Set the minimum of the scale to be 20, the maximum to be 41. Set the major unit to be 10 and the minor unit to be 2. Then, click OK. *Note: Make sure the boxes to the left of the changed values are UNchecked.*

i. You are now finished with your graph. It is located on Sheet 2 of your spreadsheet.

3. Performing calculations:

a. Return to Sheet 1 of your spreadsheet.

b. The third column of data, "Slope," will be filled by performing a calculation using data in the other two columns.

c. Highlight the second cell from the top in the Slope column (cell C2). Type the following and hit enter:
= (B3-B2)/(A3-A2)
Explanation of the formula: The equal sign (=) indicates that the information you type into the cell is a formula. The formula for the slope of a line is as follows. Do you see why the formula for cell C2 is written the way it is?

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$$

d. Adding the formula to all the cells: Highlight cell C2, then drag the mouse down the column until the cells (C2 to C11) are highlighted. Then click **Edit**, then **Fill**, then **Down**. The formula will copy into each cell in column C. However, the formula pattern will be appropriate for each cell. For example, the formula for C2 reads: = (B3-B2)/(A3-A2). The formula for C3 reads: = (B4-B3)/(A4-A3). Note: The "=" sign is important. Do not forget to add it to the formula.

e. In column C, you will see the slope for pairs of data points. Now, answer the questions below.

PRACTICE

1. Which is the independent variable—time or temperature? Which is the dependent variable?
2. When setting up the data in a spreadsheet, which data set goes in the first column, the independent variable or the dependent variable?
3. Use the graph you created in step 2 of the example to describe the relationship between temperature and the time it takes to heat up a volume of water.
4. Look at the values for slope. How do these values change for the graph of temperature versus time?

5. The following data is from an experiment in which the temperature of a substance was taken as it was heated. Transfer this data into an Excel file and make an XY(Scatter) graph.

Time (seconds) Independent data	Temperature (°C) Dependent data
10	7.5
20	10.8
30	11.6
40	11.9
50	13.3
60	21.9
70	26.3
80	26.6
90	29.1
100	31.1

6. Use the following data set to make a graph in Excel. Find the slope for pairs of data points along the plot of the graph. Is the slope the same for every pair of points?

Independent data	Dependent data
1	5
2	7
2.5	8
3.2	9.4
1.5	6
0.5	4
4	11
2.8	8.6
4.2	11.4
5	13

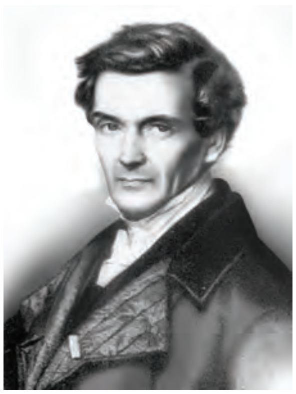
Name:______________________________ Date:______________

HISTORY 6.1

Gaspard Gustave de Coriolis

Gaspard Gustave de Coriolis was a French mechanical engineer and mathematician in the early 1800's. His name is famous today for his work on wind deflection by the Coriolis effect.

From Paris to Nancy to Paris again



Gaspard Gustave de Coriolis (Kor-e-olis) was born in 1792 in Paris, France.

Shortly after his birth, his family left Paris and settled in the town of Nancy, pronounced *nasi* in French. It was here in Nancy that Coriolis grew up and attended school.

He was exceptionally gifted in the area of mathematics, and took the entrance exam for Ecole Polytechnique when he was 16 years old. Ecole is French for school. Ecole Polytechnique is one of the best-known French Grandes ecoles (Great Schools) for engineering. Coriolis ranked second out of all the students entering Ecole Polytechnique that year.

After graduating from Ecole Polytechnique, he continued his studies at Ecole des Ponts et Chaussees (School of Bridges and Roads) in Paris.

Then Coriolis' dreams of becoming an engineer were put on hold. Faced with the responsibility of supporting his family after his father's death in 1816, he accepted a position as a tutor in mathematical analysis and mechanics back at Ecole Polytechnique. At this time, Coriolis was only 24 years old.

The tutor becomes a professor

Coriolis earned great respect for his studies and research in mechanics, engineering, and mathematics. He published his first official work in 1829 titled *On the Calculation of Mechanical Action*. This same year he became professor of mechanics at Ecole Centrales des Artes et Manufactures. Coriolis became one of the leading scientific thinkers by introducing the terms *work* and *kinetic energy*.

In 1830 he once again found himself back at Ecole Polytechnique after accepting the position of professor. Coriolis went on to be elected chair of the Academie des Sciences, and later appointed director of studies at Ecole Polytechnique.

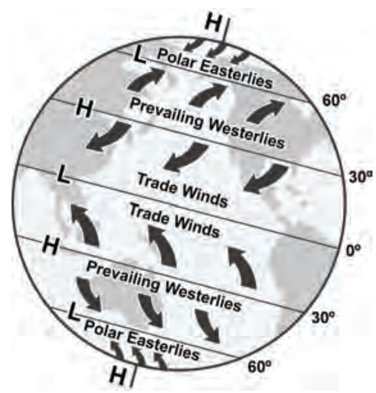
The paper that made him famous

In 1835, Coriolis published the paper that made his name famous: *On the Equations of Relative Motion of Systems of Bodies*. The paper discussed the transfer of energy in rotating systems. Coriolis's research helped explain how the Earth's rotation causes the motion of air to curve with respect to the surface of the Earth.

His name did not become linked with meteorology until the beginning of the twentieth century. He is noted for the explanation of the bending of air currents known as the **Coriolis effect**.

Bending of currents

There are patterns of winds that naturally cover the Earth. The global surface wind patterns in the northern and southern hemisphere bend due to the Earth's rotation.



For example, the Coriolis effect bends the trade winds moving across the surface. They flow from northeast to southwest in the northern hemisphere, and from southwest to northeast in the southern hemisphere.

The Coriolis effect has helped scientist explain many rotational patterns, yet it does not determine the direction of water draining in sinks, bathtubs, and toilets (as some have suggested). However, it does explain the rotation of cyclones.

Gaspard Gustave de Coriolis died in 1843 in Paris, France.

Reading reflection

1. How did Coriolis's education influence his work?
2. Explain the importance of Coriolis's first book titled *On the Calculation of Mechanical Action*.
3. To understand why Earth's rotation affects the path of air currents, imagine the following situation: You are a pilot who wants to fly an airplane from St. Paul, Minnesota, 700 miles south to Little Rock, Arkansas. If you set your compass and try to fly straight south, you will probably end up in New Mexico! Why would you end up in New Mexico instead of Little Rock?
4. Compare the Coriolis effect in the northern hemisphere with the Coriolis effect in the southern hemisphere.
5. Research the following global surface wind patterns: **trade winds, polar easterlies, prevailing westerlies,** and explain the Coriolis effect on each wind pattern.
6. Research why Coriolis's work on Earth's rotation was not accepted until long after his death in 1843.
7. Research the other books that Coriolis wrote, such as *Mathematical Theory of the Game of Billiards* and *Treatise on the Mechanics of Solid Bodies,* and explain their scientific impact.

Name:____ Date: __________________

SKILL and PRACTICE 6.2

Joanne Simpson

Dr. Joanne Simpson was the first woman to serve as president of the American Meteorological Society. Her road to success was not easy. She chose to forge ahead in the field of meteorology for the sake of women who would enter the field after her.

Early goals

Joanne Simpson was born in 1923 in Boston, Massachusetts. At a young age, Simpson was determined to have a career that would provide her with financial independence. Her mother, a journalist, remained in a difficult marriage because she could not afford to provide for her children on her own. Simpson knew at age ten that she wanted to be able to support herself and any future children.

So Simpson's journey began. As a child, Simpson loved clouds. She spent time gazing at clouds when she sailed off the Cape Cod coast. Simpson's father, aviation editor for the Boston Herald newspaper, probably sparked Simpson's interest in flight. Joanne loved to fly and earned her pilot's license at 16. Her interest in weather took off.

The sky's the limit

Simpson earned her degree from the University of Chicago in 1943. It was here that she developed a love for science. She planned to study astrophysics. However, as a student pilot she was required to take a meteorology course. Meteorology was fascinating. She wanted to take more courses. Carl-Gustaf Rossby, a great twentieth century meteorologist, had just started an institute of meteorology at the university. Simpson met with Rossby and enrolled in the World War II meteorology program as a teacher-in-training. She taught meteorology to aviation cadets.

Women temporarily filled the roles of men away at war. At the end of the war, most women returned home, but not Simpson. She completed a master's degree and wanted to earn a Ph.D. Her advisor said that women did not earn Ph.D.s in meteorology. The all-male faculty felt that women were unable to do the work which included night shifts and flying planes. She was even told that if she earned the degree no one would ever hire a woman.

Determined even more, Simpson pursued her dream. She took a course with Herbert Riehl, a leader in the field of tropical meteorology. She asked Riehl if he would be her advisor and he agreed. Not surprisingly, Simpson chose to study clouds. Her new advisor thought it would be a perfect topic "for a little girl to study." Throughout her Ph.D. program, she studied in an unsupportive academic environment. She persevered and became the first woman to earn a Ph.D. in meteorology.

Working woman

As a woman, Simpson did have difficulty finding a job. Eventually she became an assistant physics professor. Two years later, she took a job at Woods Hole Oceanographic Institute to study tropical clouds. People at the time believed clouds were produced by the weather and were not the cause for weather. Simpson, studying cumulus clouds in the tropics, proved that clouds do affect the weather. She found that very tall clouds near the equator created enough energy to circulate the atmosphere. Together, Simpson and Riehl developed the "Hot Tower Theory." Tall cloud towers can carry moist ocean air as high as 50,000 feet into the air, create heat, and release energy.

While studying hurricanes, Simpson discovered that hot towers release energy to the hurricane eye and act as the hurricane's engine. Simpson's work with clouds continued as she created the first cloud model. Using a slide rule, she created a model well before computers were invented. She later became the first person to create a computerized cloud model.

A life of achievement

Simpson's career spans many decades, many institutions, and many positions. She has won numerous awards including the Carl-Gustaf Rossby Research Award. In 1979, she joined NASA's Goddard Space Flight Center and enjoyed finally working with other female scientists. As a NASA chief scientist, Simpson does not plan to retire. Today, she continues to study rainfall, satellite images, and hurricanes.

Reading reflection

1. Dr. Simpson achieved many “firsts” in the field of meteorology. Identify three of these first time achievements.
2. Simpson’s road to success in the field of meteorology was not easy. What obstacles did she overcome on her journey to eventual success?
3. What have you learned about working towards goals based on Simpson’s biography?
4. **Research:** What is a slide rule? What caused the slide rule to fade from use?
5. **Research:** What is the Carl-Gustaf Rossby Research Award?
6. **Research:** Where is the Woods Hole Oceanographic Institute located and what does it do?
7. **Research:** Use a library or the Internet to find a photo or sketch of hot tower clouds. Present the image to your class, citing your source.

Name: ______________________ Date: ______________

SKILL and PRACTICE 6.2

Weather Maps

READ

You have learned how the Sun heats Earth and how the heating of land is different than the heating of water. In this skill sheet, you will analyze the national weather forecast and make inferences as to what causes differences in weather across the nation. To complete this skill sheet, you will need a national weather forecast from a daily newspaper and a map of North America from an atlas.

PRACTICE

Analyzing temperature

Study the national weather forecast from a daily newspaper. Locate the list of the temperature and sky cover in cities around the country. Also, locate the weather map showing sunny regions, the temperature, high- and low-pressure regions, and fronts. Record the high and low temperatures for cities in the table below. Then find the difference between the two temperature readings. Sky cover and pressure will be filled in later.

City	High	Low	Temp difference	Sky cover	Pressure
Seattle, Washington					
Los Angeles, California					
Las Vegas, Nevada					
Phoenix, Arizona					
Atlanta, Georgia					
Tampa, Florida					
San Francisco, California					
Oklahoma City, Oklahoma					
New Orleans, Louisiana					
Kansas City, Kansas					
Tucson, Arizona					
Denver, Colorado					
Dallas, Texas					
Houston, Texas					
Minneapolis, Minnesota					
Memphis, Tennessee					
Chicago, Illinois					
Miami, Florida					
New York, New York					
Baltimore, Maryland					

What causes the wide variety of temperature conditions across the map?

Use the table on the first page to respond to the following questions. It will also be helpful for you to study a map of the United States that includes the Pacific and Atlantic Oceans and details about major topographical features.

1. Give examples of differences in the cities' high temperatures due to latitude. For example, Dallas, Texas is in a lower latitude than Seattle, Washington. Explain why these differences exist.
2. Give examples of differences in the cities' high temperatures due to geographical features such as the Pacific Ocean, the Rocky Mountains, the Great Lakes, or the Atlantic Ocean. Explain why geography influences temperatures.
3. Fill in the table for the sky cover for each city. How does the sky cover affect the temperatures of cities near the same latitude? Why do you think this is?

What does atmospheric pressure tell us about the weather?

4. On your weather map, over which states are areas of high pressure centered? Over which states are low-pressure areas centered?
5. In the sixth column of the table (the heading is Pressure), record whether you think each city is in a region of high pressure, low pressure, or in-between.
6. What kind of cloud cover or weather is associated with high-pressure regions? Look at the sky cover for the cities in the high-pressure regions. What do you think the humidity is like in these regions?
7. What kind of cloud cover or weather is associated with low-pressure regions? Look at the sky cover for the cities in the low-pressure regions. What do you think the humidity is like in these regions?
8. Locate the fronts shown on the weather map. The flags on the fronts tell us the direction of the wind. The cold fronts are symbolized by triangular flags, the warm fronts by semicircular flags. Are fronts associated with high- or low-pressure regions?
9. What type of weather is associated with a warm front? What type of weather is associated with a cold front?
10. Based on what you have learned so far about low- and high-pressure regions, let's investigate the effect they have on the wind. High-pressure regions tend to push air toward low-pressure regions. Do you think the air in a low-pressure region tends to sink or rise? Does the air in a high-pressure region sink or rise?
11. Based on those conclusions, how do you think low-pressure regions contribute to the formation of rainstorms?
12. Precipitation occurs when warm, moist air is cooled to a certain temperature called the dew point. At the dew point temperature water in the air condenses into droplets of water called "dew" and soon these droplets fall out of the sky as precipitation. Why would a low-pressure region be a good place for a volume of air to reach the dew point temperature?

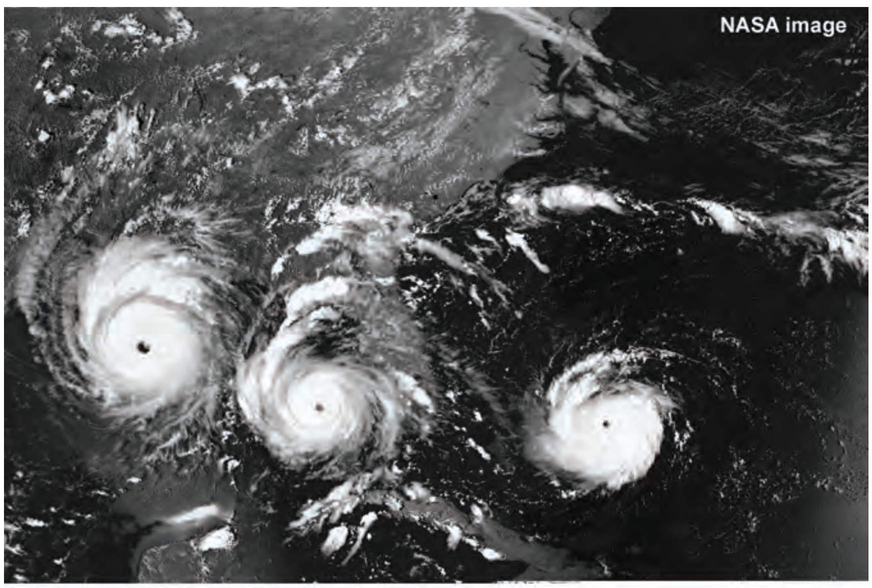
Name: ______________________ Date: ______________________

SKILL and PRACTICE 6.2

Tracking a Hurricane

READ

Hurricane Andrew (August 1992) was one of the most devastating storms of the twentieth century. Originally labelled a Category 4 storm, it was recently upgraded to a Category 5, the most severe type of hurricane. Scientists use satellite data and weather instruments dropped by aircraft to measure the storm's intensity. As research techniques improve, weather experts can more accurately analyze data collected by these instruments. NOAA scientists have now determined that Andrew's sustained winds reached at least 165 miles per hour. In this activity, you will track Hurricane Andrew's treacherous journey.



Time-lapse satellite image of Hurricane Andrew's path

The storm's beginning

Hurricane Andrew was born as a result of a tropical wave which moved off the west coast of Africa and passed south of the Cape Verde Islands. On August 17, 1992, it became a tropical storm. That means it had sustained winds of 39-73 miles per hour.

1. At 1200 Greenwich Mean Time (GMT) on August 17, Tropical Storm Andrew was located at 12.3°N latitude and 42.0°W longitude. The wind speed was 40 miles per hour. Plot the storm's location on your map.
2. For the next four days, Tropical Storm Andrew moved uneventfully west-northwest across the Atlantic. Plot the storm's path as it traveled toward the Caribbean Islands.

Table 1:Tropical Storm Andrew's path

Date	Time (GMT)	Latitude (°N)	Longitude (°W)	Wind speed (mph)
8/18/1992	1200	14.6	49.9	52
8/19/1992	1200	18.0	56.9	52
8/20/1992	1200	21.7	60.7	46
8/21/1992	1200	24.4	64.2	58

The storm intensifies

Late on August 21, a deep high pressure center developed over the southeastern United States and extended eastward to an area just north of Tropical Storm Andrew. In response to this more favorable environment, the storm strengthened rapidly and turned westward. At 1200 GMT on August 22, the storm reached hurricane status, meaning it had sustained winds of at least 74 miles per hour.

1. Plot Hurricane Andrew's path over the next two days.

Table 2:Hurricane Andrew's path

Date	Time (GMT)	Latitude (°N)	Longitude (°W)	Wind speed (mph)
8/22/1992	1200	25.8	68.3	81
8/23/1992	1200	25.4	74.2	138

2. Hurricane watches are issued when hurricane conditions are *possible* in the area, usually within 36 hours. Hurricane warnings are issued when hurricane conditions are *expected* in the area within 24 hours. Look at the distance the hurricane travelled in the last 24 hours and use that information to predict where it might be in 24 hours, and in 36 hours. Name one area that you would declare under a hurricane watch, and an area that you would declare under a hurricane warning.

Landfall

On the evening of August 23, Hurricane Andrew first made landfall. Landfall is defined as when the center of the hurricane's eye is over land.

1. Plot the point of Hurricane Andrew's first landfall.

Table 3:Hurricane Andrew's first landfall

Date	Time (GMT)	Latitude (°N)	Longitude (°W)	Wind speed (mph)
8/23/1992	2100	25.4	76.6	150

2. Where did this first landfall occur?

Hurricane Andrew crosses the Gulf Stream and strikes the U.S.

During the night of August 23, Hurricane Andrew briefly weakened as it moved over land. However, once the storm moved back over open waters, it rapidly regained strength. The warm water of the Gulf Stream increased the intensity of the hurricane's convection cycle. At 0905 GMT on August 24, Hurricane Andrew made landfall again.

1. Plot the point of Hurricane Andrew's next landfall.

Table 4:Hurricane Andrew's next landfall

Date	Time (GMT)	Latitude (°N)	Longitude (°W)	Wind speed (mph)
8/24/1992	0905	25.5	80.3	144

2. Where did this landfall occur?

The final landfall

After making its first landfall in the United States (where it caused an estimated $25 billion in damage), Hurricane Andrew moved northwest across the Gulf of Mexico. On the morning of August 26, 1992, Hurricane Andrew made its final landfall. Afterward, Andrew weakened rapidly to tropical storm strength in about 10 hours, and then began to dissipate.

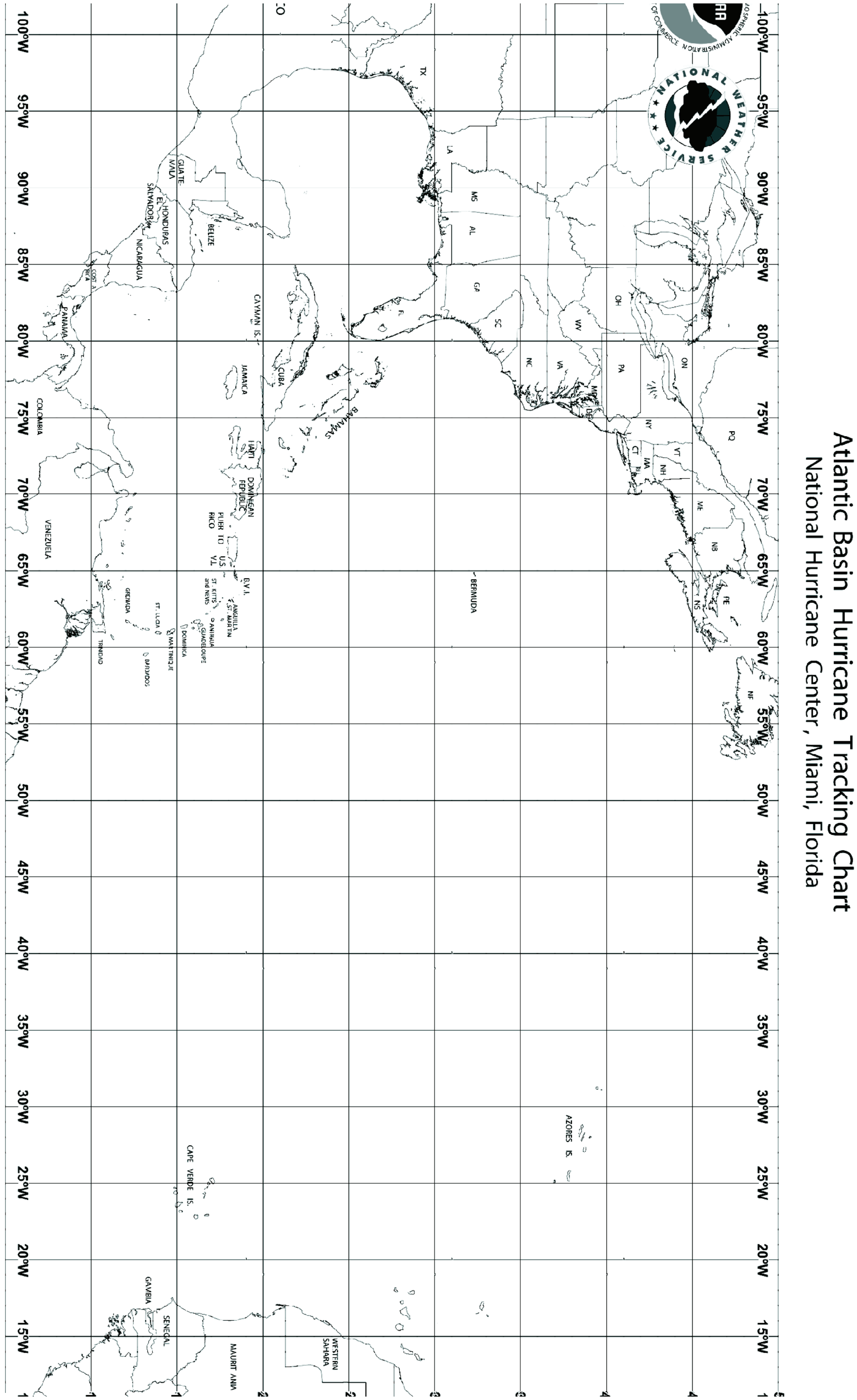
1. Plot Andrew's course across the Gulf of Mexico and its final landfall.

Table 5:Hurricane Andrew's next landfall

Date	Time (GMT)	Latitude (°N)	Longitude (°W)	Wind speed (mph)
8/24/1992	1800	25.8	83.1	133
8/25/1992	1800	27.8	89.6	138
8/26/1992	0830	29.6	91.5	121

2. In which state did Hurricane Andrew's final landfall occur?

Hurricane information provided by National Oceanographic and Atmospheric Administration's National Hurricane Center.



This is a reduced version of the chart used to track hurricanes at the National Hurricane Center

Name: ______________________ Date: ______________

SKILL and PRACTICE 6.3

Degree Days

READ

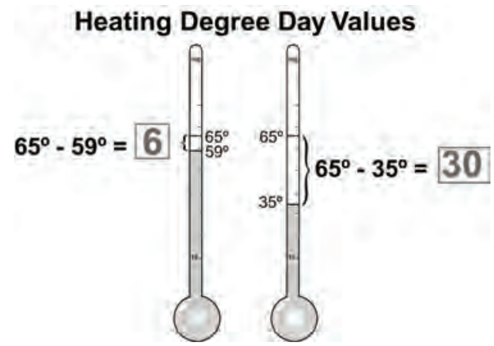
Freezing winter weather or sweltering summer heat—in either condition, people use energy to keep their homes, schools, and businesses comfortable. You can use degree day values to help predict how much energy will be needed each month to heat or cool a building. In this activity, you will learn how degree day values are calculated and how to use them to evaluate energy needs.

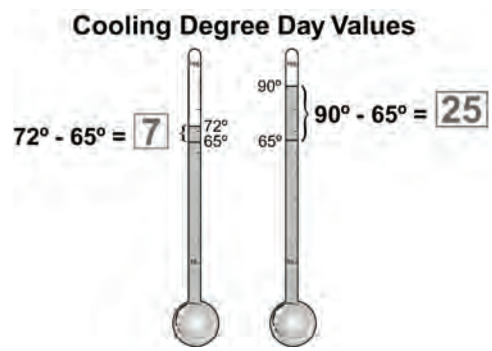
Understanding degree days

Degree day values are calculated by comparing a day's average temperature to 65° Fahrenheit. The more extreme the temperature, the higher the degree day value. For example, if the average daily temperature were 72°F, the degree day value would be 72 minus 65, or 7. On a day with an average temperature of 35°F, the degree day value would be 65 minus 35, or 30.

When the average daily temperature is *lower* than 65°F, we use the term **heating degree day value**, because you need to add heat to a building to bring it to a comfortable temperature. When the average daily temperature is *higher* than 65°F, we talk about the **cooling degree day value**.

We compare the daily average temperature to 65°F because 65°F is a temperature at which most people are comfortable without heating or air conditioning. If the average temperature is close to 65°F, you won't need to spend much money heating or cooling your home that day. However, if the average temperature is well above or below 65°F, you'll be spending a lot more money on electricity or fuel.





PRACTICE

1. On July 22, 2002, the average daily temperature in St. Louis, Missouri, was 88°F. Calculate the cooling degree day value.

____

2. On January 22, 2003, the average daily temperature in St. Louis was 14°F. Calculate the cooling degree day value.

____

3. On which day—July 22, 2002 or January 22, 2003—was the heating degree day value zero? On which day was the cooling degree day value zero?

____

Using temperature data to calculate degree day values

The table below shows temperature data recorded by the National Weather Service in May 2003.

Table 1: Temperature data for St. Louis, May 1-14, 2003

Day	High temp (°F)	Low temp (°F)	Average temp (high +low)÷2	Heating degree day value	Cooling degree day value
1	73	61	(73+61)÷2 = 67	0	2
2	63	52			
3	70	44			
4	65	52			
5	83	58			
6	79	59			
7	74	60			
8	71	53			
9	90	70			
10	82	62			
11	65	52			
12	71	52			
13	74	56			
14	75	60			
			Two week totals:		

1. Calculate the average temperature, the heating degree day value, and the cooling degree day value for each day. Record your answers in the Table 1. The first one is done for you.
2. During the first two weeks of May, on how many days were St. Louis residents more likely to use their heating systems? On how many days were they more likely to cool their homes?

Calculating monthly totals for degree day values

3. Find the sum of the numbers in the fifth column of Table 1. This will give you the *total heating degree day value* for May 1-14, 2003. Record your answer in the table's last row.
4. Find the *total cooling degree day value* for same time period by finding the sum of the sixth column of Table 1. Record your answer in the table's last row.
5. The total heating degree day value for May 15-31, 2003 was 31. The total cooling degree day value was 32. Find the *monthly* total heating and cooling degree day values.

---

6. In St. Louis, the average total heating degree day value for May is 79. The average total cooling degree day value for May is 114. How was May 2003 different from the average? Do you think residents used more energy than usual to keep their homes comfortable, or less?

Using average monthly degree day values

The National Weather Service provides average monthly degree day values to help citizens better evaluate their energy needs.

Average monthly heating degree day (HDD) and cooling degree day (CDD) values for St. Louis

January		February		March		April		May		June	
HDD	CDD	HDD	CDD	HDD	CDD	HDD	CDD	HDD	CDD	HDD	CDD
1097	0	844	0	613	7	294	32	79	114	6	316

Average monthly heating degree day (HDD) and cooling degree day (CDD) values for St. Louis

July		August		September		October		November		December	
HDD	CDD	HDD	CDD	HDD	CDD	HDD	CDD	HDD	CDD	HDD	CDD
0	461	1	396	46	196	246	36	583	3	949	0

1. On a separate piece of paper, make a bar graph showing the average monthly heating and cooling degree day values for St. Louis. Place months on the x-axis and monthly average degree day values on the y-axis. Use red bars for the heating degree day values and blue bars for the cooling degree day values. Use your graph to answer the following questions:

2. In which month should a St. Louis resident budget the most money for heating costs?

3. In which month should a St. Louis resident budget the most money for cooling costs?

4.
   a. In which month do you think a St. Louis resident will spend the least amount of money to keep their home at a comfortable temperature? Explain.

   b. Challenge! What additional information would you need to calculate the actual monthly heating and cooling costs for a particular building?

All climate data courtesy of the National Weather Service St. Louis Weather Station.

Name: ______________________ Date: ______________

SKILL and PRACTICE 7.3

Internet Research Skills

READ

The Internet is a valuable tool for finding answers to your questions about the world. A search engine is like an on-line index to information on the World Wide Web. There are many different search engines from which to choose. Search engines differ in how often they are updated, how many documents they contain in their index, and how they search for information. Your teacher may suggest several search engines for you to try.

EXAMPLE

Search engines ask you to type a word or phrase into a box known as a *field*. Knowing how search engines work can help you pinpoint the information you need. However, if your phrase is too vague, you may end up with a lot of unhelpful information.

How could you find out who was the first woman to participate in a space shuttle flight?

First, put **key phrases** in quotation marks. You want to know about the "first woman" on a "space shuttle." Quotation marks tell the engine to search for those words together.

Second, if you only want websites that contain both phrases, **use a + sign** between them. Typing **"first woman" + "space shuttle"** into a search engine will limit your search to websites that contain both phrases.

If you want to broaden your search, use the word **or** between two terms. For example, if you type **"first female" or "first woman" + "space shuttle"** the search engine will list any website that contains either of the first two phrases, as long as it also contains the phrase "space shuttle."

You can narrow a search by using the word **not.** For example, if you wanted to know about marine mammals other than whales, you could type **"marine mammals" not "whales"** into the field. Please note that some search engines use the minus sign (-) rather than the word **not**.

PRACTICE 1

1. If you wanted to find out about science museums in your state that are not in your own city or town, what would you type into the search engine?

2. If you wanted to find out which dog breeds are not expensive, what would you type into the search engine?

3. How could you research alternatives to producing electricity through the combustion of coal or natural gas?

READ

The quality of information found on the Internet varies widely. This section will give you some things to think about as you decide which sources to use in your research.

1. **Authority:** How well does the author know the subject matter? If you search for "Newton's laws" on the Internet, you may find a science report written by a fifth grade student, and a study guide written by a college professor. Which website is the most authoritative source?
   Museums, national libraries, government sites, and major, well-known "encyclopedia sources" are good places to look for authoritative information.

2. **Bias:** Think about the author's purpose. Is it to inform, or to persuade? Is it to get you to buy something? Comparing several authoritative sources will help you get a more complete understanding of your subject.

3. **Target audience:** For whom was this website written? Avoid using sites designed for students well below your grade level. You need to have an understanding of your subject matter at or above your own grade level. Even authoritative sites for younger students (children's encyclopedias, for example) may leave out details and simplify concepts in ways that would leave gaps in your understanding of your subject.

4. **Is the site up-to-date, clear, and easy to use?** Try to find out when the website was created, and when it was last updated. If the site contains links to other sites, but those links don't work, you may have found a site that is infrequently or no longer maintained. It may not contain the most current information about your subject. Is the site cluttered with distracting advertisements? You may wish to look elsewhere for the information you need.

PRACTICE 2

1. What is your favorite sport or activity? Search for information about this sport or activity. List two sites that are authoritative and two sites that are not authoritative. Explain your reasoning. Finally, write down the best site for finding out information about your favorite sport.

2. Search for information about an earth science topic of your choice on the Internet (for example: "earthquakes," "hurricanes," or "plate tectonics"). Find one source that you would NOT consider authoritative. Write the key words you used in your search, the web address of the source, and a sentence explaining why this source is not authoritative.

3. Find a different source that is authoritative, but intended for a much younger audience. Write the web address and a sentence describing who you think the intended audience is.

4. Find three sources that you would consider to be good choices for your research here. Write a two to three sentence description of each. Describe the author, the intended audience, the purpose of the site, and any special features not found in other sites.

Name: ______________________ Date: ______________

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SKILL and PRACTICE 7.3