About the Consultant

Douglas Fisher, Ph.D., is a Professor in the Department of Teacher Education at San Diego State University. He is the recipient of an International Reading Association Celebrate Literacy Award as well as a Christa McAuliffe award for Excellence in Teacher Education. He has published numerous articles on reading and literacy, differentiated instruction, and curriculum design as well as books, such as *Improving Adolescent Literacy: Strategies at Work* and *Responsive Curriculum Design in Secondary Schools: Meeting the Diverse Needs of Students*. He has taught a variety of courses in SDSU’s teacher-credentialing program as well as graduate-level courses on English language development and literacy. He also has taught classes in English, writing, and literacy development to secondary school students.
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Note-Taking Tips

Your notes are a reminder of what you learned in class. Taking good notes can help you succeed in science. These tips will help you take better notes.

• Be an active listener. Listen for important concepts. Pay attention to words, examples, and/or diagrams your teacher emphasizes.

• Write your notes as clearly and concisely as possible. The following symbols and abbreviations may be helpful in your note-taking.

<table>
<thead>
<tr>
<th>Word or Phrase</th>
<th>Symbol or Abbreviation</th>
<th>Word or Phrase</th>
<th>Symbol or Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>for example</td>
<td>e.g.</td>
<td>and</td>
<td>+</td>
</tr>
<tr>
<td>such as</td>
<td>i.e.</td>
<td>approximately</td>
<td>≈</td>
</tr>
<tr>
<td>with</td>
<td>w/</td>
<td>therefore</td>
<td>.:.</td>
</tr>
<tr>
<td>without</td>
<td>w/o</td>
<td>versus</td>
<td>vs</td>
</tr>
</tbody>
</table>

• Use a symbol such as a star (★) or an asterisk (*) to emphasis important concepts. Place a question mark (?) next to anything that you do not understand.

• Ask questions and participate in class discussion.

• Draw and label pictures or diagrams to help clarify a concept.

Note-Taking Don’ts

• Don’t write every word. Concentrate on the main ideas and concepts.

• Don’t use someone else’s notes—they may not make sense.

• Don’t doodle. It distracts you from listening actively.

• Don’t lose focus or you will become lost in your note-taking.
Using Your Science Notebook

This note-taking guide is designed to help you succeed in learning science content. Each chapter includes:

- **Language-Based Activities**: Activities cover the content in your science book including vocabulary, writing, note-taking, and problem solving.

- **Anticipation Guide/KWL Charts**: Think about what you already know before beginning a lesson and identify what you would like to learn from reading.

- **Science Journal**: Write about what you know.

- **Writing Activities**: These activities help you think about what you're learning and make connections to your life.

- **Vocabulary Development**: Vocabulary words help you to better understand your science lessons. Learning the Academic Glossary can help you score higher on standardized tests.

---

**Before You Read**

**The Nature of Science**

Before you read the chapter, respond to these statements:

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

- An important part of science is testing, or experimenting.
- Technology is useful only in the situation for which it was designed.
- People began studying weather in the 1800s.
- Science can answer all of the questions that can be asked.

---

**Science Journal**

Write about what you already know before beginning a lesson and identify what you would like to learn from reading.

**Anticipation Guide/KWL Charts**

Think about what you already know before beginning a lesson and identify what you would like to learn from reading.

**Writing Activities**

These activities help you think about what you're learning and make connections to your life.

**Vocabulary Development**

Vocabulary words help you to better understand your science lessons. Learning the Academic Glossary can help you score higher on standardized tests.
I found this information on page ___.

Chapter Wrap-Up
This brings the information together for you. Revisiting what you thought at the beginning of the chapter provides another opportunity for you to discuss what you have learned.

The Nature of Science
Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers with these.

1. Write A if you agree with the statement.
2. Write D if you disagree with the statement.

<table>
<thead>
<tr>
<th>The Nature of Science</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>An important part of science is testing, or experimenting.</td>
<td></td>
</tr>
<tr>
<td>Technology is useful only in the situation for which it was designed.</td>
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<td>People began studying weather in the 1800s.</td>
<td></td>
</tr>
<tr>
<td>Science can answer all of the questions that can be asked.</td>
<td></td>
</tr>
</tbody>
</table>

Review
Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Review the Self Check at the end of each section.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the charts, graphs, and illustrations.
☐ Look over the Chapter Review at the end of the chapter.

Review Checklist
This list helps you assess what you have learned and prepare for your chapter tests.

1. The Nature of Science

Graphic Organizers
A variety of visual organizers help you to analyze and summarize information and remember content.
Before You Read

Preview the chapter and section titles and the section headings. Complete the two columns of the table by listing at least two ideas in each column.

<table>
<thead>
<tr>
<th>K What I know</th>
<th>W What I want to find out</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Describe how your motion changed as you moved from your school’s entrance to your classroom.

__________________________

__________________________

__________________________

__________________________

__________________________

__________________________

__________________________

__________________________

__________________________

__________________________

__________________________

__________________________

__________________________

__________________________
Motion and Momentum
Section 1 What is motion?

Preview the section by reading the What You’ll Learn statements. Write three questions that come to mind from reading these statements.

1. ____________________________
2. ____________________________
3. ____________________________

Review Vocabulary
Write a sentence that uses the word meter to show its scientific meaning.

meter

Define the new vocabulary terms using your book or a dictionary.

speed

average speed

instantaneous speed

velocity

Academic Vocabulary
Use a dictionary to define displace in its scientific sense.

displace
Main Idea

Changing Position
I found this information on page _________.

Details

Analyze the meaning of relative motion. Complete the sentences.

To determine whether something changes position, you must identify _____________. An object changes position if _____________.

Contrast distance and displacement. Draw a diagram showing distance and displacement for a person jogging halfway around a lake. Label the distance and displacement.

Speed
I found this information on page _________.

Complete the equation for calculating speed.

\[
\text{speed (in meters/second)} = \frac{\text{distance (in meters)}}{\text{time (in seconds)}}
\]

Compare and contrast average speed and instantaneous speed. Give an example of average speed, instantaneous speed, and one in which instantaneous speed changes.

Average speed: __________________________________________

Instantaneous speed: ______________________________________

Example: __________________________________________________
Analyze the distance-time graph. Graph lines to show:

- Person C, whose speed is 2 m/s.
- Person D, who is standing still.

Compare the speed of each person by completing the paragraph.

_ is plotted on the horizontal axis and _ is plotted on the vertical axis. A steeper line indicates _._. On this graph, Person A has a speed of _._ and Person B has a speed of _._. If speed were zero, the line would be _._.

Think of a time recently when you might have run around a track or traveled in a car or bus. Describe the motion thoroughly. Remember to include how your velocity changed.

__________________________________________________________

__________________________________________________________

__________________________________________________________
Motion and Momentum
Section 2 Acceleration

Predict three things you will learn in this section. Read the section title and subheadings to help you make your predictions.

1. ____________________________
2. ____________________________
3. ____________________________

Define kilogram.

kilogram

______________________________
______________________________
______________________________
______________________________

Use your book to write the scientific definition of acceleration.

______________________________
______________________________
______________________________
______________________________

Use a dictionary to find the mathematical definition of positive.

______________________________
______________________________
______________________________
______________________________
Main Idea

**Acceleration and Motion**

I found this information on page _________.

**Calculating Acceleration**

I found this information on page _________.

Details

**Distinguish** the three ways that an object can accelerate. Complete the concept map.

**Acceleration** includes

1. ________
2. ________
3. ________

**Complete** the mathematical equation to calculate acceleration for objects moving in a straight line.

**Acceleration Equation**

\[
\text{acceleration} = \frac{\text{final speed} - \text{initial speed}}{\text{time}} \quad \text{(in m/s)}
\]

**Analyze** the equation above to rewrite it using symbols.

\[
a = \frac{f - i}{t}
\]

**Compare and contrast** positive and negative acceleration by completing the chart.

<table>
<thead>
<tr>
<th>Types of Acceleration</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship of initial speed to final speed</td>
<td>Initial speed is less than final speed.</td>
<td></td>
</tr>
</tbody>
</table>
Analyse the acceleration graph below. Label the parts of the graph showing zero acceleration, positive acceleration, and negative acceleration.

**Summarize** how you can identify each type of acceleration on an acceleration graph. Complete the sentences.

A line for positive acceleration slopes ________________.

A line for negative acceleration slopes ________________.

A line for zero acceleration ________________.

**Synthesize It**

A jogger runs around a circular track. She starts at a speed of 2 m/s, then speeds up to 6 m/s. She runs at that speed for 20 minutes, and then comes to a stop. Describe her acceleration. Is it ever zero?
Scan the headings, bold words, and illustrations in Section 3. Write two facts you discovered about momentum as you scanned the section.

1. [First fact]
   [Second fact]

Use the term triple-beam balance in a sentence.

Define the scientific meanings of the new vocabulary terms using your book or a dictionary.

- **mass**
- **inertia**
- **momentum**
- **law of conservation of momentum**

Use a dictionary to define predict.

- **predict**
Section 3 Momentum (continued)

Main Idea

Mass and Inertia
I found this information on page _________.

Momentum
I found this information on page _________.

Details

Label the arrow below to show the relationship between mass and inertia.

Greater mass
Has ____________ inertia

Less mass
Has ____________ inertia

List two factors that affect an object’s momentum.
1. ____________ affect
2. ____________

Summarize the calculation of momentum in words on the lines below.

__________________________________________

__________________________________________

__________________________________________

Complete the equation used to calculate momentum.

momentum = ____________ (in kg) \times ____________ (in m/s)
            (in kg \cdot m/s)

Analyze the equation above and rewrite it using symbols. Use the letter p to represent momentum.

____________

Summarize the law of conservation of momentum in your own words. Two balls that collide are an example.

__________________________________________

__________________________________________

__________________________________________
Main Idea

Using Momentum Conservation

I found this information on page _________.

Details

Model the law of conservation of momentum when a moving object of small mass collides with an object of greater mass that is initially at rest. In the first row, model what happens if the two objects stick together. In the second, model what happens if the two bounce away from each other.

- Use arrows to show the size and direction of each object’s momentum.
- Label each object with its mass, speed, and direction.

<table>
<thead>
<tr>
<th>Before Impact</th>
<th>After Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stick together</td>
<td></td>
</tr>
<tr>
<td>Bounce off</td>
<td></td>
</tr>
</tbody>
</table>

Connect It

At a science fair, contestants can win a prize if they can roll a ball with a specific momentum chosen by the presenter. The contestants have a choice of two balls. One has greater mass than the other. Which would you choose, and why?

I would choose the ball with greater mass, because it would take less speed to give it enough momentum.
Tie It Together

Work with a partner to perform the experiment below to explore changes in momentum.

Materials

- wooden block
- stopwatch
- ball that will roll easily
- tape
- meterstick
- triple-beam balance

1. Find and record the mass of the block and ball, using the balance.
   
   Block: ___________________________
   
   Ball: ___________________________

2. Mark a line on the floor with tape. Place the block on the line. Measure a distance of 5 m from the line and mark a second line.

3. Practice rolling the ball until you can roll it from the 5-m line to the block.

4. Roll the ball from the 5-m line to the block. Use the stopwatch to time the roll.
   Then measure how far the block moved from the line when the ball hit it. Use a chart like the one below to record your data.

5. Repeat step 4 four more times, varying the speed with which you roll the ball. Record the time and distance for each trial.

6. Use your data to calculate the speed for each trial. Then use that information and the mass of the ball to calculate the momentum of the ball in each trial.

7. Analyze your data. What relationship do you see between the momentum of the ball and the distance the block moved? Why do you think this relationship exists?

<table>
<thead>
<tr>
<th>Trial</th>
<th>Time</th>
<th>Speed</th>
<th>Momentum</th>
<th>Distance Block Moved</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Review the ideas you listed in the chart at the beginning of the chapter. Cross out any incorrect information in the first column. Then complete the chart by filling in the third column.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>K</strong></td>
<td><strong>W</strong></td>
<td><strong>L</strong></td>
</tr>
<tr>
<td>What I know</td>
<td>What I want to find out</td>
<td>What I learned</td>
</tr>
</tbody>
</table>

Review

*Use this checklist to help you study.*

- Review the information you included in your Foldable.
- Study your *Science Notebook* on this chapter.
- Study the definitions of vocabulary words.
- Review daily homework assignments.
- Re-read the chapter and review the charts, graphs, and illustrations.
- Review the Self Check at the end of each section.
- Look over the Chapter Review at the end of the chapter.

**SUMMARIZE IT**

After reading this chapter, identify three things that you have learned about motion and momentum.

---

12  *Motion and Momentum*
Force and Newton’s Laws

Before You Read

Preview the chapter and section titles and the section headings. List at least two ideas for each section in each column.

<table>
<thead>
<tr>
<th>K</th>
<th>What I know</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>What I want to find out</td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Describe three examples of pushing or pulling an object. How did the object move?

Possible responses: Pulling a sled—a person supplied the force to overcome the sled’s inertia; pulling an anchored boat closer to the dock—a person supplied the force to overcome the boat’s inertia.
Force and Newton’s Laws
Section 1 Newton’s First Law

Predict three topics that will be discussed in Section 1 as you scan the headings.
1. _________________________________
2. _________________________________
3. _________________________________

Define velocity.
velocity

Write the correct vocabulary term next to each definition.

force that opposes sliding between two touching surfaces

two or more forces that act on an object and do not cancel each other

combination of all of the forces acting on an object

two or more forces whose effects cancel each other

states that if the net force acting on an object is zero, the object will remain at rest or, if it is moving, continue to move in a straight line with constant speed

a push or pull

Use a dictionary to define constant in its scientific sense.
constant


Main Idea

**Force**

I found this information on page ________.

Details

**Analyze** how forces combine to form a net force.

If forces act in the same direction _________________.

If forces act in opposite directions _________________.

**Create** two drawings to show how an object is affected by balanced and unbalanced forces. Use arrows and labels to show the forces and motion. Below each drawing, explain the effect of the forces.

**Balanced Forces**

[Blank space for drawing]

**Unbalanced Forces**

[Blank space for drawing]
Summarize Newton’s first law of motion in your own words.

Compare the three types of friction. Complete the concept map.

Friction

<table>
<thead>
<tr>
<th>What It Is</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static</td>
<td>A force that resists starting to move a refrigerator across the floor.</td>
</tr>
<tr>
<td>Sliding</td>
<td>A force that slows down a sliding baseball player.</td>
</tr>
<tr>
<td>Rolling</td>
<td>A force that keeps a bicycle wheel rolling on the ground.</td>
</tr>
</tbody>
</table>

SYNTHESIZE IT

A carpenter uses sandpaper to smooth a rough piece of wood. State what type of friction the carpenter is using.
Force and Newton’s Laws

Section 2 Newton’s Second Law

Read the What You’ll Learn statements. Write two questions that come to mind as you read the statements.

1. ____________________________
2. ____________________________

Define acceleration to show its scientific meaning.

acceleration

Use your book to define each term.

Newton’s second law of motion

weight

center of mass

Use a dictionary to define require to show its scientific meaning.

require
Summarize Newton’s second law of motion *in your own words*. Then complete the equation used to calculate acceleration.

Newton’s second law of motion states that when a force acts on an object, the object accelerates in the direction of the force.

\[ \text{acceleration (in meters/second}^2\text{)} = \frac{\text{force (in newtons)}}{\text{mass (in kilograms)}} \]

Complete the chart to show how mass and distance affect gravitational force.

<table>
<thead>
<tr>
<th>If . . .</th>
<th>Then gravity . . .</th>
</tr>
</thead>
<tbody>
<tr>
<td>mass is larger</td>
<td></td>
</tr>
<tr>
<td>mass is smaller</td>
<td></td>
</tr>
<tr>
<td>distance increases</td>
<td></td>
</tr>
<tr>
<td>distance decreases</td>
<td></td>
</tr>
</tbody>
</table>

Distinguish between weight and mass by explaining what would happen to the weight and mass of an object if it were taken from Earth to Mars.

On Mars, the weight would __________ because __________ __________. The mass would __________ because __________ .

Contrast speeding up, slowing down, and turning as forms of acceleration. Identify the direction of the force in each case.

<table>
<thead>
<tr>
<th>Acceleration</th>
<th>Direction of Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>speeding up</td>
<td></td>
</tr>
<tr>
<td>slowing down</td>
<td></td>
</tr>
<tr>
<td>turning</td>
<td></td>
</tr>
</tbody>
</table>
Section 2 Newton’s Second Law (continued)

**Main Idea**

**Circular Motion**

*I found this information on page _________.*

**Details**

**Model** how a satellite stays in orbit around Earth. Label the direction of centripetal force and the direction of the satellite’s motion.

---

**Air Resistance**

*I found this information on page _________.*

**Summarize** the two factors that affect the air resistance on a falling object.

1. __________________________
2. __________________________

---

**Center of Mass**

*I found this information on page _________.*

**Label** the center of mass of common objects. In the space below, draw a wrench, a ball, and a book. Place a dot to represent where you predict the center of mass of each object will be found.

---

**CONNECT IT**

The gravitational force on the Moon is one-sixth the gravitational force on Earth. Hypothesize what it would be like to jump or play ball on the Moon.
Scan the list below to preview Section 3 of your book.

- Read all section titles.
- Read all bold words.
- Look at all of the pictures.
- Think about what you already know about forces and gravity.

Write two facts you discovered about Newton’s third law of motion as you scanned the section.

1. ____________________________

2. ____________________________

Define force to show its scientific meaning.

force ___

Use your book to define Newton’s third law of motion.

Newton’s third law of motion ___

Use a dictionary to define react in its scientific sense.

react ___
Summarize Newton’s third law in your own words.

Model how action and reaction forces act in pairs.
• Draw a situation in which a force pair acts.
• Use arrows to label the action and reaction forces.

Analyze how the forces act and how the motions of the objects change.

Sequence the events in a rocket launch that show Newton’s third law. Complete the flow chart.

Rocket fuel is ignited, producing hot gas.

Action force

Reaction force

Sample response: The first bumper car exerts a force on the second bumper car. The second car exerts an equal and opposite force on the first car. The first car slows down, and the second car moves away.
Weightlessness

I found this information on page _________.

Organize information about weightlessness. Complete the concept web.

- Occurs during:
- Happens because:
- Causes a sensation of:
- Happens in spacecraft because:

Summarize It

Explain why action and reaction forces do not cancel each other’s effects. Give an example.

__________________________________________________________

__________________________________________________________

__________________________________________________________

__________________________________________________________

__________________________________________________________
Tie It Together

Think of an activity that you enjoy in your daily life. Describe how each of Newton’s laws applies to your chosen activity. Then, draw a diagram to show how you use force in the activity.

Newton’s First Law of Motion:  

Newton’s Second Law of Motion:  

Newton’s Third Law of Motion:  

Diagram:
Force and Newton’s Laws

Chapter Wrap-Up

Review the ideas you listed in the chart at the beginning of the chapter. Cross out any incorrect information in the first column. Then complete the chart by filling in the third column.

<table>
<thead>
<tr>
<th>K</th>
<th>W</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I know</td>
<td>What I want to find out</td>
<td>What I learned</td>
</tr>
</tbody>
</table>

After reading this chapter, identify three things you have learned about forces and Newton’s laws.

1. 
2. 
3.

Review

Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

SUMMARIZE IT

After reading this chapter, identify three things you have learned about forces and Newton’s laws.

1. 
2. 
3.

24 Force and Newton’s Laws
Forces and Fluids

Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Forces and Fluids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Snowshoes allow you to decrease your pressure on the surface of snow.</td>
</tr>
<tr>
<td></td>
<td>• The buoyant force pushes an object in a fluid downward.</td>
</tr>
<tr>
<td></td>
<td>• A fluid can transmit force.</td>
</tr>
<tr>
<td></td>
<td>• Wind blowing across a roof is at lower pressure than the air inside the house.</td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Compare and contrast five objects that float with five objects that sink.
### Forces and Fluids

**Section 1 Pressure**

Scan the headings in Section 1 of your book. Predict three topics that will be discussed.

1. [Blank]
2. [Blank]
3. [Blank]

**New Vocabulary**

Define weight using your book or a dictionary.

weight

Use your book or a dictionary to define the vocabulary terms. Then use each term in a sentence that shows its scientific meaning.

**pressure**

[Blank]

[Blank]

[Blank]

**fluid**

[Blank]

[Blank]

[Blank]

**barometer**

[Blank]

[Blank]

[Blank]

**Academic Vocabulary**

Use a dictionary to define definite to show its scientific meaning.

**definite**

[Blank]
Section 1 Pressure (continued)

Main Idea

What is pressure?
I found this information on page 1.

Details

Compare the pressure exerted by equal weights spread over different surface areas. Label the two diagrams to indicate which object applies more pressure, and which applies less.

Summarize the effects of force and area of contact on pressure by completing the diagram.

Define how to calculate pressure. Complete the formula and the chart below.

\[ P = \frac{F}{A} \]

<table>
<thead>
<tr>
<th>Calculating Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbreviation</td>
</tr>
<tr>
<td>( P )</td>
</tr>
<tr>
<td>( F )</td>
</tr>
<tr>
<td>( A )</td>
</tr>
</tbody>
</table>

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**Main Idea**

**Fluids**
I found this information on page __________.

**Details**

**Organize** information about the 3 different kinds of fluid. Identify and provide an example of each.

![Diagram of Fluids]

**Pressure in a Fluid**
I found this information on page __________.

**Model** how pressure is exerted on an object suspended in a fluid. Draw arrows to indicate the directions in which pressure is exerted on the cube in the diagram.

![Diagram of Pressure]

**Atmospheric Pressure**
I found this information on page __________.

**Compare** different atmospheric pressures. Sketch two identical barometers. Show one barometer indicating higher atmospheric pressure than the other.

![Diagram of Barometers]

lower pressure higher pressure
Forces and Fluids
Section 2 Why do objects float?

**Skim** Section 2 of your book. Write three questions that come to mind. Look for answers to your questions as you read the section.

1. _______________________________________________________
2. _______________________________________________________
3. _______________________________________________________

**Define** Newton’s second law of motion using your book or a dictionary.

states that the acceleration of an object is in the direction of the total force and equals the total force divided by the object’s mass

**New Vocabulary**

Read the definitions below. Write the correct vocabulary term on the blank to the left of each definition.

states that the buoyant force on an object is equal to the weight of the fluid displaced by the object

upward force exerted by a fluid on any object in the fluid

physical property of matter that can be found by dividing an object’s mass by its volume

**Academic Vocabulary**

Use a dictionary to define displace to show its scientific meaning.


Section 2 Why do objects float? (continued)

**Main Idea**

**The Buoyant Force**

*I found this information on page _________.

**Details**

**Compare** buoyant force and gravity by completing the Venn diagram with at least three facts.

![Venn diagram]

**Model** the effects of gravity and the buoyant force by labeling the diagram below with arrows indicating the direction of the buoyant force, gravity, and net forces.

![Model diagram]

**Summarize** the relationship between buoyant force and shape.

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

---

Name ____________________________ Date ____________

Forces and Fluids
Complete the formulas for calculating the mass and the density of a fluid or an object.

To find the mass of a fluid or an object, ____________:

\[ m = \, \square \, \times \, \square \]

To find the density of a fluid or an object, ____________:

\[ D = \, \square \, \, \] 

Summarize the relationship between the density of an object and its ability to sink or float by completing the chart.

<table>
<thead>
<tr>
<th>Relationship Between Density and Buoyancy</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>If the density of an object is</td>
<td>Then it will</td>
</tr>
<tr>
<td>Greater than water</td>
<td></td>
</tr>
<tr>
<td>Less than water</td>
<td></td>
</tr>
</tbody>
</table>

Model how an aluminum boat will float while a solid aluminum cube of the same mass will sink. Label the two objects in your diagram as denser than water or less dense than water.

Connect It
A dry sponge may float on the surface of the water, but then eventually sink. Explain why this is true.
Scan the What You’ll Learn statements for Section 3 of your book. Identify three topics that will be discussed.

1. ____________________________
2. ____________________________
3. ____________________________

Define work using your book or a dictionary.

work

Pascal’s principle

hydraulic system

Bernoulli’s principle

Use a dictionary to define input to show its scientific meaning.

input
Section 3 Doing Work with Fluids (continued)

Main Idea

Using Fluid Forces
*I found this information on page __________.

Details

Model the way that pushing on a fluid increases the pressure within it. Draw a piston pressing on fluid in a container. Label the piston and the fluid, and use an arrow to indicate the direction of force.

Pascal’s Principle and Hydraulic Systems
*I found this information on page __________.

Sequence the steps by which force is increased through a hydraulic system. *Then complete the statement.*

Pressure in a Moving Fluid and Bernoulli’s Principle
*I found this information on page __________.

Summarize how Bernoulli’s principle applies to the effects of wind on buildings.

---

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Forces and Fluids 33
Wings and Flight
I found this information on page __________.

Main Idea

Discuss why you think early airplanes were designed with multiple wings.

Connect It

Organize information about the functions of different shapes of birds’ wings by completing the chart.

<table>
<thead>
<tr>
<th>Birds’ Wings</th>
<th>Type of Bird</th>
<th>Shape of Wing</th>
<th>Function of Wing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Seabirds</td>
<td>Long, narrow</td>
<td>Gliding long distances</td>
</tr>
<tr>
<td></td>
<td>Forest and field birds</td>
<td>Short, rounded</td>
<td>Quick take-offs and sharp turns</td>
</tr>
<tr>
<td></td>
<td>Swallows, swifts, and falcons</td>
<td>Small, narrow, tapered</td>
<td>High-speed flight</td>
</tr>
</tbody>
</table>

Complete the diagram to model how the shape of a wing creates lift. Use arrows to indicate the airflow above and below the wing, the action force, and the reaction force.
Tie It Together

Measure It

Apply what you have learned about the shape and function of birds’ wings. Sketch and label three airplanes: one designed for “aerobatics” (aerial acrobatics); one for supersonic flight; and an engineless glider.
Forces and Fluids

Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers with these.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Forces and Fluids</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Snowshoes allow you to decrease your pressure on the surface of snow.</td>
<td></td>
</tr>
<tr>
<td>• The buoyant force pushes an object in a fluid downward.</td>
<td></td>
</tr>
<tr>
<td>• A fluid can transmit force.</td>
<td></td>
</tr>
<tr>
<td>• Wind blowing across a roof is at lower pressure than the air inside the house.</td>
<td></td>
</tr>
</tbody>
</table>

Review

Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

SUMMARIZE IT

After reading this chapter, identify three main ideas from the chapter.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
Work and Simple Machines

Before You Read

Preview the chapter and section titles and the section headings. Complete the first two columns of the chart by listing at least two ideas for each section in each column.

<table>
<thead>
<tr>
<th>K</th>
<th>What I know</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>W</th>
<th>What I want to find out</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Describe three machines you used today and how they made doing a task easier.

________________________

________________________

________________________

________________________

________________________

________________________
Review the objectives for Section 1. Write three questions that come to mind from reading these statements. Look for answers to each question as you read the section.

1. _____________________________________________
   _____________________________________________
   _____________________________________________

2. _____________________________________________
   _____________________________________________
   _____________________________________________

3. _____________________________________________
   _____________________________________________
   _____________________________________________

Define force to show its scientific meaning.

force

New Vocabulary Use each key term in a scientific sentence.

work

power

Academic Vocabulary Use a dictionary to define version. Use version in an original sentence to show its scientific meaning.

version

If you push on a heavy object, you do work only if you make the object move.

Because one car accelerates faster than another, it has more power.

Learning from their mistakes, the engineers designed an improved version of the automobile.
Section 1 Work and Power (continued)

Main Idea

What is work?

I found this information on page __________.

I found this information on page __________.

Details

Summarize what must occur for work to be done.

Model the relationship between an applied force and work by sketching two drawings in the boxes provided. In the top box, show a situation in which work is done. In the bottom box, show a situation in which no work is done.

- Use arrows to show the direction of the applied force and any motion that results.
- Write a caption explaining each illustration.

Work is done.

Caption:

Work is not done.

Caption:
**Main Idea**

**Calculating Work**
*I found this information on page ____________.*

Complete the mathematical equation describing how work is calculated. Complete the same equation below it, using the units in which each measurement is recorded. Then write the same equation below that, using the correct symbols.

\[
\text{work} = \text{________} \times \text{________} \\
\text{joules} = \text{________} \times \text{________} \\
\text{________} = \text{________}
\]

**Define the term power. Complete the mathematical equation describing how power is calculated in word and symbol form.**

Power is ____________________________________________________________________________.

\[
\text{power} = \text{________} \quad P = \text{________}
\]

**Identify the unit in which power is measured.**

____________________________________________________________________________________

**Summarize the way in which work, energy, and power are related by filling in the blanks below.**

When you do ____________ on an object, you _______________ the energy of that object. Energy is _______________ from yourself to _______________. Power is equal to the amount of _______________ transferred over a certain _______________.

---

**Details**

**What is power?**
*I found this information on page ____________.*

---

**CONNECT IT**

Consider an active sport. Describe the work that is done by people as they play the sport.

_________________________________________________________________________________________________________________________________________________
Predict three things that might be discussed in Section 2 after reading the headings in this section.

1. __________________________________________
   __________________________________________
   __________________________________________

2. __________________________________________
   __________________________________________
   __________________________________________

3. __________________________________________
   __________________________________________
   __________________________________________

Define friction to show its scientific meaning.

friction

Write the correct vocabulary word next to each definition.

output work divided by input work

force exerted on a machine

number of times that a machine increases the input force; equal to the output force divided by the input force

force exerted by a machine

Use a dictionary to define device to show its scientific meaning.

device

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
</table>

Work and Simple Machines
Section 2 Using Machines

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Organize information by listing the three ways a machine can make work easier.

A machine makes work easier by changing

1. the amount of input force required.
2. the distance over which the force is applied.
3. the direction over which the force is applied.

Summarize mechanical advantage. Then write the formula for calculating it.

Mechanical advantage is ____________________________

______________________________.

The equation for calculating mechanical advantage is

\[
\text{mechanical advantage} = \ \text{__________________________}
\]

Analyze the diagrams in your book that show the three ways machines make work easier. Complete the chart by describing the effect of the machine on the output force.

<table>
<thead>
<tr>
<th>What Machine Does</th>
<th>How Force Is Changed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increases force</td>
<td></td>
</tr>
<tr>
<td>Increases distance</td>
<td></td>
</tr>
<tr>
<td>Changes direction of force</td>
<td></td>
</tr>
</tbody>
</table>
Section 2 Using Machines (continued)

Main Idea

Efficiency
I found this information on page __________.

Details

Summarize the relationship between efficiency and friction by completing the paragraph.

The __________ of a machine is the ratio of the __________ work to the __________ work. __________ is a force that __________ the motion of one object sliding over another. This __________ a machine’s __________.

Complete the mathematical equation that describes how efficiency is calculated.

\[
\text{efficiency (in percent)} = \frac{\text{output work}}{\text{input work}} \times 100%
\]

Model how oil reduces the friction between two surfaces. Sketch a cross-section view of two horizontal surfaces sliding past each other. Indicate contact points on the upper and lower surfaces and a layer of oil between them.

I found this information on page __________.

I found this information on page __________.

I found this information on page __________.

Have students work in pairs to list various machines and identify places within them where friction can occur.

Think of some machines that you use. List the machines and the parts that may be affected by friction.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
**Work and Simple Machines**

**Section 3 Simple Machines**

**Scan** Use the checklist below to preview Section 3 of your book.

- Read all section titles.
- Read all bold words.
- Read all charts and graphs.
- Look at all the pictures, and read their captions.
- Think about what you already know about machines.

**Write two facts you discovered about simple machines.**

1. ____________________________________________________________________

2. ____________________________________________________________________

**Define** the term **compound** to show its scientific meaning.

___________________________

**New Vocabulary**

Write the correct vocabulary word next to each definition.

- a grooved wheel with a rope or cable wrapped around the groove _______________
- machine that does work only with one movement _______________
- an inclined plane that moves _______________
- a flat, sloped surface, or ramp _______________
- an inclined plane wrapped around a cylinder or post _______________
- machine made up of two or more simple machines _______________
- two circular objects of different sizes that rotate together _______________
- a rigid rod or plank that pivots about a point called the fulcrum _______________

**Define** section. Use section in an original sentence to show its scientific meaning.

___________________________

___________________________

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Main Idea

What is a simple machine?
I found this information on page __________.

Inclined Plane
I found this information on page __________.

Lever
I found this information on page __________.

Details

Contrast simple and compound machines by completing the chart.

<table>
<thead>
<tr>
<th>Simple Machine</th>
<th>Compound Machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>Examples</td>
<td></td>
</tr>
</tbody>
</table>

Compare how the amount of force needed to move an object changes with the length of the inclined plane. Complete the phrases below with less, more, and the most.

Longer Inclined Plane: __________ force is needed to move an object

Shorter Inclined Plane: __________ force is needed to move an object

Lifting Without an Inclined Plane: __________ force is needed to move the object

Model how changing the location of a fulcrum in a lever affects its mechanical advantage. Draw two levers of the same length but with fulcrums at different points.

- Label the input force, output force, and fulcrum in your drawings as well as the distances between the fulcrum and each force.
- Show a calculation of the mechanical advantage of each.
**Main Idea**

**Wheel and Axle**

I found this information on page __________.

**Pulley**

I found this information on page __________.

---

**Details**

**Analyze** the wheel and axle *by filling in the blanks below.*

If the input force is applied to the axle, the mechanical advantage is __________ one. If the input force is applied to the wheel, the mechanical advantage is almost always __________ one.

**Classify** the three types of pulleys *by completing the chart.*

<table>
<thead>
<tr>
<th>Pulley Type</th>
<th>Effect on Force</th>
<th>Mechanical Advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed pulley</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Movable pulley</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulley system</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**CONNECT IT**

Analyze what types of wheel and axles are on a bicycle. List and describe them in terms of their mechanical advantage.

__________________________

__________________________

__________________________

__________________________

__________________________

__________________________
Tie It Together

Synthesize It

You will be loading heavy crates into a truck. The crates are too heavy to lift to the bed of the truck. Make use of as many simple machines as you can to help you. Explain how you would use them.

Accept all reasonable responses.

setting up an inclined plane to reach the bed of the truck; using a lever to lift the crates up enough to slide a device with wheels under them then rolling them up an inclined plane; using a movable pulley or a pulley system to pull the crates up the inclined plane or lift them directly.

Name ___________________________ Date ______________

Work and Simple Machines 47
Work and Simple Machines

Chapter Wrap-Up

Review the ideas you listed in the chart at the beginning of the chapter. Cross out any incorrect information in the first column. Then complete the chart by filling in the third column. How do your ideas about what you know now compare with those you provided at the beginning of the chapter?

<table>
<thead>
<tr>
<th>K</th>
<th>What I know</th>
<th>W</th>
<th>What I want to find out</th>
<th>L</th>
<th>What I learned</th>
</tr>
</thead>
</table>

Review

Use this checklist to help you study.

- Review the information you included in your Foldable.
- Study your Science Notebook on this chapter.
- Study the definitions of vocabulary words.
- Review daily homework assignments.
- Re-read the chapter and review the charts, graphs, and illustrations.
- Review the Self Check at the end of each section.
- Look over the Chapter Review at the end of the chapter.

SUMMARIZE IT

After reading this chapter, identify three things that you have learned about work and simple machines.

____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

48 Work and Simple Machines
Before You Read

Preview the chapter title, the section titles, and the section headings. List at least two ideas for each section in each column.

<table>
<thead>
<tr>
<th>K</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I know</td>
<td>What I want to find out</td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Choose three devices that use electricity and identify the function of each device.

Possible response: A hair dryer produces heat and blows air, a toaster produces heat, a TV produces sound and images, and a CD player produces sound.

Science Journal

Accept all reasonable responses.
Energy and Energy Resources

Section 1  What is energy?

**Analyze** the objectives for Section 1. Write three questions you have. Look for responses to each question as you read the section.

1. __________________________________________
   __________________________________________

2. __________________________________________
   __________________________________________

3. __________________________________________
   __________________________________________

**Define** mass to show its scientific meaning.

mass

mass

**New Vocabulary**

Read each definition below. Write the correct vocabulary term on the blank in the left column.

energy in the nucleus of an atom

ability to cause change

energy stored in chemical bonds

energy that an object has as a result of its motion

current that comes out of batteries and wall sockets

energy that increases with temperature

energy that is stored because of an object’s position

energy carried by light

**Academic Vocabulary**

Use a dictionary to define enormous.

**Academic Vocabulary**

enormous
Section 1 What is energy? (continued)

Main Idea

The Nature of Energy

I found this information on page _________.

Energy of Motion

I found this information on page _________.

Energy of Position

I found this information on page _________.

Details

Create a list of three examples of how energy causes changes that you observe in your classroom.

1. _______________________________________________________________________
2. _______________________________________________________________________
3. _______________________________________________________________________

Complete the graphic organizer by using information from your book to describe energy of motion.

Energy an object has as a result of its motion is ______________________

which increases or decreases with

Complete the graphic organizer by using information from your book to describe energy of position.

Energy an object has as a result of its position is ______________________

which increases or decreases with
Synthesize your knowledge of each form of energy by providing examples of them.

<table>
<thead>
<tr>
<th>Form of Energy</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal</td>
<td></td>
</tr>
<tr>
<td>Chemical</td>
<td></td>
</tr>
<tr>
<td>Radiant</td>
<td></td>
</tr>
<tr>
<td>Electrical</td>
<td></td>
</tr>
<tr>
<td>Nuclear</td>
<td></td>
</tr>
</tbody>
</table>

Choose any three forms of energy discussed in this lesson. Explain how each form of energy is important in your daily life.

Choose three forms of energy. Explain how each form of energy is important in your daily life.

Thermal energy allows homes and schools to be warm. Radiant energy is produced by lamps and candles and is used to see and to power solar-cell devices such as some calculators. Nuclear energy is used to generate electricity for many communities. Chemical energy stored in food provides the fuel for many of the body’s processes, including moving and thinking.
Energy and Energy Resources

Section 2 Energy Transformations

Preview Section 2 of your book using the checklist.

☐ Read all section headings.
☐ Read all bold words.
☐ Look at all of the pictures and read their labels.
☐ Think about what you already know about how energy changes form.

Write three facts you discovered about energy transformations as you scanned the section.

1. __________________________________________
2. __________________________________________
3. __________________________________________

Define the vocabulary terms using your book.

transformation

law of conservation of energy

generator

turbine

Use a dictionary to define convert.

convert
Section 2 Energy Transformations

Main Idea

The Law of Conservation of Energy

I found this information on page 54.

Changing Kinetic and Potential Energy

I found this information on page 54.

Details

State the law of conservation of energy.

The law of conservation of energy states that energy cannot be created nor destroyed. It can only change form.

Model the potential and kinetic energy transformations that take place as a person tosses a ball into the air and then catches it.

- Label the points at which the ball has the greatest potential energy and the greatest kinetic energy.

Energy Changes Form

I found this information on page 54.

Analyze the energy flow in a gasoline-powered engine and complete the diagram below.

Heating of engine

Movement of engine
Section 2 Energy Transformations (continued)

**Main Idea**

**Generating Electrical Energy**

I found this information on page ___________.

**Details**

Compare and contrast energy transformations that occur when electrical energy is generated in coal power plants with energy transformations that occur when energy is used to help you hear. Sequence steps in each process side-by-side.

<table>
<thead>
<tr>
<th>Coal Power Plants</th>
<th>Energy in Hearing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Contrast** a turbine with a generator.

<table>
<thead>
<tr>
<th>Turbine</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Generator</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Synthesize It**

Identify some points in the energy flow through a power plant that might produce unwanted forms of energy and make the plant less efficient.

__________________________
__________________________
__________________________

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Predict what you will learn in this section. Read the title. Then write two topics that might be discussed.

1. __________________________________________
2. __________________________________________

**(New Vocabulary)**

Write a sentence using the word resource that shows its scientific meaning.

resource

________________________________________

Define the key terms using your book or a dictionary.

**nonrenewable resource**

________________________________________

**renewable resource**

________________________________________

**alternative resource**

________________________________________

**inexhaustible resource**

________________________________________

**photovoltaic**

________________________________________

**Academic Vocabulary**

Use a dictionary to define percent.

**percent**

________________________________________

________________________________________
Section 3 Sources of Energy (continued)

Main Idea

Energy Resources
I found this information on page __________.

Fossil Fuels, Nuclear Energy, and Hydroelectricity
I found this information on page __________.

Details

Identify two types of energy from the natural world that Earth’s surface receives.
1. ____________________________________________
   ____________________________________________
2. ____________________________________________
   ____________________________________________

Compare energy resources by completing the table.

<table>
<thead>
<tr>
<th>Energy Resources</th>
<th>Fossil Fuels</th>
<th>Nuclear</th>
<th>Hydroelectric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source of energy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renewable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advantages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disadvantages</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 3 Sources of Energy (continued)

Main Idea

Alternative Sources of Energy

I found this information on page __________.

Details

Complete the concept map by listing four alternative sources of energy.

Alternative sources of energy

Conserving Energy

I found this information on page __________.

Identify two reasons to conserve fossil fuels.

1. ____________________________

   ____________________________

2. ____________________________

   ____________________________

CONNECT IT

List three specific things you can do to conserve fossil fuels.

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Tie It All Together

Energy and Energy Resources

Make a concept map that includes all of the ways energy can be generated that are mentioned in this chapter.

Now imagine you are an energy expert on a planning council for a new town to be built on an island. Evaluate resources and/or methods you will suggest that the new town use. Justify your choices and provide possible challenges to the project.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Energy and Energy Resources
Chapter Wrap-Up

Review the ideas that you listed in the chart at the beginning of the chapter. Cross out any incorrect information in the first column. Then complete the chart by filling in the third column.

<table>
<thead>
<tr>
<th>K What I know</th>
<th>W What I want to find out</th>
<th>L What I learned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

Review
Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

Summarize three main points of the chapter in a paragraph or by using a concept map.
Thermal Energy

Before You Read

Think about the term thermal energy. List as many words as you can think of that use therm- as part of their root word.

<table>
<thead>
<tr>
<th>Word 1</th>
<th>Word 2</th>
<th>Word 3</th>
<th>Word 4</th>
<th>Word 5</th>
</tr>
</thead>
<tbody>
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</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Describe five things that you do to make yourself feel warmer or cooler.

<table>
<thead>
<tr>
<th>Action 1</th>
<th>Action 2</th>
<th>Action 3</th>
<th>Action 4</th>
<th>Action 5</th>
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</thead>
<tbody>
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</tbody>
</table>
Thermal Energy
Section 1 Temperature and Thermal Energy

Skim through Section 1 of your text. Write three topics that might be discussed in this section.

1. ______________________________________________________
2. ______________________________________________________
3. ______________________________________________________

Define the following key terms using your book or a dictionary.

kinetic energy

______________________________
______________________________
______________________________

temperature

______________________________
______________________________
______________________________

thermal energy

______________________________
______________________________
______________________________

random

______________________________
______________________________
______________________________

What is temperature?

I found this information on page ____________.

Complete the statements about temperature.

Molecules are always _______________. Energy of motion is called _______________. Molecules have more _______________ when they are moving _______________. Temperature is _______________.

62  Thermal Energy
Section 1 Temperature and Thermal Energy (continued)

Main Idea

What is Temperature?

I found this information on page __________.

Measuring Temperature

I found this information on page __________.

Details

Sequence the steps to show how temperature changes cause most objects to expand or contract. The first step has been done for you.

<table>
<thead>
<tr>
<th>Object Is Heated</th>
<th>Object Is Cooled</th>
</tr>
</thead>
<tbody>
<tr>
<td>___ molecules move apart</td>
<td>___ molecules move closer together</td>
</tr>
<tr>
<td>___ molecules moves faster</td>
<td>___ molecules moves slower</td>
</tr>
<tr>
<td>1 object becomes warmer</td>
<td>1 object becomes cooler</td>
</tr>
<tr>
<td>___ object expands</td>
<td>___ object shrinks, or contracts</td>
</tr>
</tbody>
</table>

Compare the three temperature scales in the chart below.

<table>
<thead>
<tr>
<th>Characteristics of Each Scale</th>
<th>Fahrenheit</th>
<th>Celsius</th>
<th>Kelvin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature at which water freezes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature at which water boils</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of degrees between water's freezing and boiling points</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Organize the formulas from your book into the conversion chart.

<table>
<thead>
<tr>
<th>Fahrenheit to Celsius</th>
<th>Celsius to Fahrenheit</th>
<th>Celsius to Kelvin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Break it down</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Compare It

Knowing that metals expand when heated, explain how you can apply this knowledge to a metal jar lid that is screwed on too tightly.

Name __________________________ Date _________________

Thermal Energy 63
Potential Energy Ball Analogy

1. molecules in a material exert attractive forces on each other
2. molecules in a material have potential energy
3. as molecules move closer together or farther apart, potential energy changes

**Compare** the potential energy of molecules with the potential energy of a ball. Complete the statements that have been started for you.

<table>
<thead>
<tr>
<th>Potential Energy Statements</th>
<th>Ball Analogy Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. molecules in a material exert attractive forces on each other</td>
<td>Gravity exerts an ____________</td>
</tr>
<tr>
<td>2. molecules in a material have potential energy</td>
<td>A ball ________________ has potential energy.</td>
</tr>
<tr>
<td>3. as molecules move closer together or farther apart, potential energy changes</td>
<td>As a ball moves closer to or farther from Earth’s surface, ____________</td>
</tr>
</tbody>
</table>

**Synthesize** Suppose you have two balls of colored dough, each at 22°C. One ball is blue, the other is yellow. When the two balls are mixed together, their total mass is 100g of green dough. Mark the statements that are true about this thermal energy analogy. Correct any false statements so they become true.

\[
\begin{align*}
50 \text{ g blue} & \quad + \quad 50 \text{ g yellow} \\
22^\circ \text{C} & \quad = \quad 100 \text{ g green}
\end{align*}
\]

- The mass of the green dough is twice the mass of the blue dough.
- The mass of the green dough is equal to the sum of the mass of the yellow and the blue dough.
- The thermal energy of the green dough is equal to twice the sum of thermal energy of the yellow and the blue dough.
Thermal Energy
Section 2 Heat

Skim through Section 2 of your text. Write three facts you discovered about heat.

1. _____________________________________________
   _____________________________________________
   _____________________________________________

2. _____________________________________________
   _____________________________________________
   _____________________________________________

3. _____________________________________________
   _____________________________________________
   _____________________________________________

Use the term electromagnetic wave in a scientific sentence.

Electromagnetic wave

Write the correct vocabulary word next to each definition.

________________________
transfer of thermal energy by the movement of particles in a gas or liquid

________________________
transfer of thermal energy by direct contact by collisions between particles

________________________
thermal energy that is transferred from a substance at higher temperature to a substance at a lower temperature

________________________
material that transfers heat easily

________________________
amount of heat needed to raise the temperature of 1 kg of a substance by 1°C

________________________
transfer of energy by electromagnetic waves

Define occur using a dictionary.

________________________

Thermal Energy 65
Main Idea

Heat and Thermal Energy

Label the two drawings to illustrate the statement: Heat is transferred when objects that differ in temperature are brought into contact.

- Label the temperature of each object
- Draw an arrow showing the direction of heat transfer.

Details

Conduction
Radiation
Convection

Analyze the drawing below to help classify each type of energy transfer as conduction, convection, or radiation.

The Sun’s rays heat the sand particles by ____________.

Body heat transferred to the air by ____________.

Cool air pushes in to replace warm, air flow by natural ____________.

Heat transferred from sand to towel to body by ____________.

Heat from the Sun warms iced tea by ____________.

Fan pushes air molecules by forced ____________.

Warmer molecules move more quickly, transferring heat throughout the iced tea by ____________.
Section 2 Heat (continued)

Main Idea

Thermal Conductors and Thermal Insulators

Compare and contrast thermal conductors and thermal insulators by writing the words and phrases in the Venn diagram.

- does not conduct heat easily
- conducts heat easily
- gold and copper
- air
- material contains some loosely held electrons
- materials do not contain loosely held electrons

Both

Thermal Conductors

Thermal Insulators

depend on how strongly atoms hold electrons

Connect It

Analyze sources of thermal pollution and their effects on organisms and the environment. Design a possible plan to reduce thermal pollution.
Thermal Energy
Section 3 Engines and Refrigerators

Read the What You’ll Learn objectives of Section 3. Write four questions that come to mind from reading these statements.

1. ____________________________

2. ____________________________

3. ____________________________

4. ____________________________

Define the terms using your book or a dictionary.

work

heat engine

internal combustion engine

Use a dictionary to define internal in its scientific sense.

internal
Section 3  Engines and Refrigerators  (continued)

**Main Idea**

**Heat Engines**

*I found this information on page __________.*

**Details**

Identify the six different forms of energy and give an example of each.

<table>
<thead>
<tr>
<th>Types of Energy</th>
</tr>
</thead>
<tbody>
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</table>

Sequence the steps of a four-stroke cycle engine in the chart.

<table>
<thead>
<tr>
<th>Steps in the Four-Stroke Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake stroke</td>
</tr>
<tr>
<td>The piston moves downward.</td>
</tr>
<tr>
<td>Compression stroke</td>
</tr>
<tr>
<td>Power stroke</td>
</tr>
<tr>
<td>Exhaust stroke</td>
</tr>
</tbody>
</table>
Section 3 Engines and Refrigerators (continued)

**Main Idea**

Refrigerators

I found this information on page ________.

**Details**

Sequence steps to show how a refrigerator stays cold inside. Explain what happens as coolant moves through a refrigerator by writing what occurs at each location.

1. Liquid coolant is forced through a pipe.

2. Liquid coolant passes through the expansion valve and changes into a gas.

3. The gas vapor becomes cold and moves through the pipes.

4. The cold gas absorbs heat from inside of the refrigerator and gets warmer.

5. The warmed coolant gas passes through a compressor.

6. The warmer gas releases its heat to the cooler air outside the refrigerator.

7. The coolant gas cools and condenses back into a liquid.

**SYNTHESIZE IT**

Analyze and discuss why the statement “An air conditioned building is like stepping into a giant refrigerator!” is true.

-------------------
Suppose that you are a television weather forecaster. As a part of your job, you have been asked to help educate people about science. On the lines below, plan a weather forecast for your region. After you have finished planning, present your forecast to the class. Explain as many of the following terms as possible during your forecast.

- temperature
- Fahrenheit scale
- Celsius scale
- radiation
- convection
- conduction

**Tomorrow’s Weather Forecast**

Date: ___________________________ Location: ___________________________

Forecast: ___________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

Notes about terms: _________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________
Name ________________________________ Date ____________

Thermal Energy  Chapter Wrap-Up

After You Read

Examine the list of terms that include the root therm- that you wrote at the beginning of this chapter. Write in the space below what you think therm- means.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Review

Use this checklist to help you study.

☐ Review the information you included in your Foldable.
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SUMMARIZE IT

After reading this chapter, identify three things that you have learned about the movement of molecules.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

72  Thermal Energy