Study Guide and Reinforcement

Student Edition

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### Chapters:

#### Chapter 1: Minerals—Earth’s Jewels

**Directions:** Match the terms from the word bank with the phrases below.

<table>
<thead>
<tr>
<th>Earth science</th>
<th>health science</th>
<th>physical science</th>
<th>scientific theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>chemistry</td>
<td>life science</td>
<td>physics</td>
<td>technology</td>
</tr>
<tr>
<td>climate</td>
<td>mountain gorillas</td>
<td>science</td>
<td></td>
</tr>
</tbody>
</table>

1. the study of matter and energy
2. something a meteorologist might study
3. an explanation of a pattern in nature that is supported by observations and results from many investigations
4. an endangered species that was studied by Dian Fossey in Rwanda
5. study of living systems and their interactions
6. the study of energy and its ability to change matter
7. a field that is part of life science and includes careers such as dietitians, nurses, and physiotherapists
8. study of nonliving things and systems on Earth and in space
9. a way of learning more about the world, that starts with making observations and asking questions
10. applications of theoretical science. It’s what engineers develop.
11. the study of matter

**Directions:** Use Figure 2 to list four possible outcomes when new information is found about a scientific explanation.

12. 
13. 
14. 
15. 

**Directions:** Fill in the chart with the three interacting parts of a system, and two examples of each of these parts from your school.

<table>
<thead>
<tr>
<th>Three Parts of a System</th>
<th>First Example</th>
<th>Second Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Science in Action

Directions: Circle the term in the puzzle that fits each clue. Then write the term on the line. In the puzzle, terms read across or down.

P E O B S E R V A T I O N
M Q R D Y B X K H E T P I
E K G X I E J N L S B Y H
P Y A F W Z S H A T R M Y
N R N C M J A H T L N J P
F Q I R R W O J I V A D O
U S Z D F V Z B L G C O T
P R E D I C T I O N F M H
L H G K D W C G U S X O E
V T C O N C L U S I O N S
Y Q W A O M U C T U P N I
P G I E Q V S X K Z B E S

1. Using your senses to gather information is called ____________________.
2. A reasonable and educated guess based on what you know and observe is called a(n) ____________________.
3. Making an educated guess on the results of an experiment based on observations and the hypothesis is called making a(n) ____________________.
4. In any good experiment, the scientist needs to ____________________ the hypothesis.
5. You can use a table or a graph to ____________________ your findings.
6. After your investigation, you can use the results of your experiments to draw ____________________.

Directions: Answer the following question on the lines provided.
7. What is a controlled experiment? Give an example.
Directions: Complete the following sentences using the correct terms.

1. A model built using software that you can see on a computer screen is a ____________________ model.

2. E = mc² is Einstein’s ____________________ model of the theory of relativity.

3. A mobile that shows our solar system is a ____________________ model.

4. Some models are used to communicate ____________________ to other people.

5. Some models are used because testing with a model is ____________________ and less expensive than the real thing.

Directions: Answer the following questions on the lines provided.

6. List one example of a model used to test a prediction.

________________________________________________________________________

________________________________________________________________________

7. List one way a computer model could help a scientist studying plants.

________________________________________________________________________

________________________________________________________________________

8. What are the limitations of models?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

9. Ancient scientists thought that Earth was the center of the universe, and imagined the sky as a blanket that covered the planet. Why did this early model change?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Evaluating Scientific Explanation

Directions: Fill in the blanks with the following terms.

repeateable explanations laboratory changing
evaluate inferences data critical thinking conclusions

Scientists often have to evaluate scientific explanations in two parts. Scientists evaluate the observations that are made, and evaluate the 1. ______________ made from those observations. To make a decision, scientists use their 2. ______________ skills to evaluate the evidence. Scientists have to be careful whenever they are collecting any type of 3. ______________. Measurements must be accurate and instruments must be properly calibrated, as scientists cannot afford to be careless in their data collection.

Valid scientific explanations must be 4. ______________ by other scientists. If a scientist’s experiment cannot be recreated accurately by other scientists, it might mean that the experiment is invalid. Once the experiments and evidence have been tested and examined, the scientist might draw 5. ______________ based on the observations. However, when drawing conclusions, scientists should ask themselves if they considered all of the possible 6. ______________. It is important to keep an open mind when drawing conclusions from scientific information. It is also important to remember that scientific information is constantly 7. ______________, and that all scientific models are subject to change.

It is important to know that scientific reasoning is used not only in the 8. ______________. Scientific reasoning and critical thinking skills are used every day. These skills will help you 9. ______________ claims and make good decisions about the world around you.

Directions: Answer the following questions on the lines provided.

10. Why is it important for a scientist to write down every observation, including unexpected observations?  

11. How is evaluating an advertising claim a use of the scientific process?  

12. Does an advertiser’s claim that its results have been verified by an independent laboratory impress you?
Description and Measurement

Directions: Use the word bank to fill in the blanks in the summary statements.

- accuracy
- decimal places
- far
- long
- much
- measurement
- precision

(1) ________________ is a way to describe the world with numbers. It can tell you how
(2) ________________, how (3) ________________, or how
(4) ________________, by measuring time, distance, and mass.

(5) ________________ is a description of how close measurements are to each other. It
can also be used to describe the number of (6) ________________ a number has.

(7) ________________ is a description of how close a measurement is to the true value.

Directions: Decide whether the number in column A or column B answers each question below and write the
letter in the blank provided.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8.</td>
<td>the more accurate number, if the actual value is 10.21 g</td>
<td>10.201</td>
<td>10.19</td>
</tr>
<tr>
<td>9.</td>
<td>the more precise number, if the actual value is 10.21 g</td>
<td>10.201</td>
<td>10.19</td>
</tr>
<tr>
<td>10.</td>
<td>the more accurate number, if the actual value is 750 m</td>
<td>740.3</td>
<td>747</td>
</tr>
<tr>
<td>11.</td>
<td>the more precise number, if the actual value is 750 m</td>
<td>740.3</td>
<td>747</td>
</tr>
<tr>
<td>12.</td>
<td>the number 11.289, rounded to the tenths place</td>
<td>11.2</td>
<td>11.3</td>
</tr>
<tr>
<td>13.</td>
<td>the number 12.4446, rounded to the hundredths place</td>
<td>12.45</td>
<td>12.44</td>
</tr>
<tr>
<td>14.</td>
<td>the number 879,642 rounded to the hundreds place</td>
<td>879,600</td>
<td>879,000</td>
</tr>
<tr>
<td>15.</td>
<td>the number of significant digits in 1280003</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>16.</td>
<td>the number of significant digits in 454.00</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>17.</td>
<td>the number of significant digits in 0.00002405</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>
SI Units

Directions: Complete the chart by filling in the SI unit and the tool you would use for each measurement.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Unit</th>
<th>Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. mass of rock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. your body temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. volume of a plastic block</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. length of your classroom</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. how much water a tablespoon holds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. how long between blinks of your eyes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Directions: Convert each of the following SI measures.
7. 64 km = _____________________ m
8. 373 g = ____________________ kg
9. 897 mm = ____________________ cm
10. 0.25 L = __________________ mL

Directions: Use the following information to answer the questions below.
A train travels at the rate of 120 km per hour.
11. What is its speed in meters per second?

12. What is its speed in meters per minute? Show your work in the space below.
### Directions: Match the information in Column I with the best way to display it from Column II. Write the letter of the correct term in the blank at the left. A letter may be used more than once.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. view of Earth from space</td>
<td>a. bar graph</td>
</tr>
<tr>
<td>2. amount of rainfall in an area each month</td>
<td>b. circle graph</td>
</tr>
<tr>
<td>3. how the constellations change position</td>
<td>c. drawing</td>
</tr>
<tr>
<td>4. percents of the most abundant metals in</td>
<td>d. line graph</td>
</tr>
<tr>
<td>Earth's crust</td>
<td></td>
</tr>
<tr>
<td>5. percents of the different gases in the</td>
<td>e. movie</td>
</tr>
<tr>
<td>atmosphere on Mars</td>
<td></td>
</tr>
<tr>
<td>6. how far a hurricane moves each hour</td>
<td>f. photograph</td>
</tr>
<tr>
<td>7. structure of the human ear</td>
<td></td>
</tr>
<tr>
<td>8. daily high and low tide times for a week</td>
<td>g. table</td>
</tr>
<tr>
<td>9. how a sound wave travels through the air</td>
<td></td>
</tr>
</tbody>
</table>

### Directions: Use the paragraph below to complete question 10.

Some animals can live much longer than others. For example, both the golden eagle and the blue whale have a maximum life span of more than 80 years, while a guppy’s maximum life span is only 5 years. A giant spider may live 20 years, a lobster 50 years, and a crocodile may live 60 years.

10. Make a chart and draw a graph to display the data given in the paragraph.
**Directions:** List five things that are matter and five things that are not matter.

<table>
<thead>
<tr>
<th>Matter</th>
<th>Not Matter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
</tr>
</tbody>
</table>

**Directions:** List the five main points of Democritus’ atom theory.

6. 
7. 
8. 
9. 
10. 

**Directions:** Use the word bank to fill in the blanks to match the phrases below.

<table>
<thead>
<tr>
<th>atom</th>
<th>Chadwick</th>
<th>electron cloud</th>
<th>orbits</th>
<th>Rutherford</th>
<th>Thomson</th>
</tr>
</thead>
<tbody>
<tr>
<td>atomic model</td>
<td>electron</td>
<td>neutron</td>
<td>proton</td>
<td>scientist who discovered that atoms contained electric charge</td>
<td>scientist who proposed the idea of a nucleus</td>
</tr>
</tbody>
</table>
**SECTION 2 Study Guide**

**The Simplest Matter**

**Chapter 3**

**Directions:** Complete the table by writing in the appropriate characteristics for metals, metalloids, and nonmetals.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Metals</th>
<th>Metalloids</th>
<th>Nonmetals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. State of matter at room temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Shininess</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Conductor of heat or electricity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Malleability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Ductility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Location on periodic table</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Directions:** The square below represents one element from the periodic table. Identify and describe the numbered items. Then answer the questions below.

1. State of matter at room temperature
2. Shininess
3. Conductor of heat or electricity
4. Malleability
5. Ductility
6. Location on periodic table

7. ________________
8. ________________
9. ________________

10. What is the atom’s mass number?

   _______________________________________

11. What are isotopes?

   _______________________________________
Compounds and Mixtures

Directions: Select the term below that best describes each food listed.

<table>
<thead>
<tr>
<th>homogeneous mixture</th>
<th>compound</th>
<th>heterogeneous mixture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. milk</td>
<td>6. popsicle</td>
<td></td>
</tr>
<tr>
<td>2. salt</td>
<td>7. chili</td>
<td></td>
</tr>
<tr>
<td>3. sugar</td>
<td>8. taco</td>
<td></td>
</tr>
<tr>
<td>4. soda pop</td>
<td>9. pizza</td>
<td></td>
</tr>
<tr>
<td>5. ice cream</td>
<td>10. water</td>
<td></td>
</tr>
</tbody>
</table>

Directions: Answer the following questions on the lines provided.

11. Describe what a compound’s formula tells us about the compound.

___________________________________________________________________________

___________________________________________________________________________

12. Both compounds and mixtures contain more than one kind of atom. Explain how a compound is different from a mixture.

___________________________________________________________________________

___________________________________________________________________________

Directions: Draw a line from the term on the right to its definition or description on the left.

13. a sample of matter that has the same composition and properties throughout heterogeneous mixture

14. a pure substance whose smallest unit is made up of atoms of more than one element homogeneous mixture

15. two or more substances that are together but do not combine to form a new, pure substance compound

16. a mixture that is the same throughout substance

17. a mixture with visible components mixture
Directions: Unscramble the words in parentheses to fill in this section summary.

(1)____________________ (tramet) is anything that takes up space and has mass. The four states of matter are (2)____________________ (dlois), (3)____________________ (quildi), (4)____________________ (sga), and (5)____________________ (slampa). All matter is made of (6)____________________. (sartpicle). In a liquid, the particles are moving (7)____________________ (strafe) than they do in a solid, but (8)____________________ (lowsre) than they do in a gas. Particles in a gas have more (9)____________________ (ygreen) than particles in a solid or liquid. Honey and tar have higher (10)____________________ (sssicitivo) than water because they are slower to flow. The attractive forces of water molecules for each other creates (11)____________________ (rufaces) (stenino) that allows needles to float and water striders to walk on water. Because of surface tension, water droplets are (12)____________________ (dorun). A liquid takes the (13)____________________ (heaps) of its container, but a gas (14)____________________ (lifs) its container completely.

Directions: Explain what is needed for plasma to exist, and where it can be found.

15. 

Directions: List three amorphous solids

16. 

Directions: List five crystalline solids.

17. 

States of Matter 13
Directions: Write the word that best describes each process illustrated below.

1. _____________

2. _____________

3. _____________

4. _____________

Directions: Use the graphs below to answer the questions that follow.

5. Which graph shows the melting of a crystalline solid? Explain your reasoning.

6. What type of solid does the other graph show? Explain.
**Behavior of Fluids**

*Directions*: Use the clues below to complete the crossword puzzle.

**Across**

2. The amount of force applied per unit of area
3. It is nearly impossible to _____ solids and liquids.
5. Pascal’s principal says that pressure applied to a confined _____ transmits unchanged throughout the _____.
7. One of the factors affecting density
8. An increase in _____ results in an increase in pressure.

**Down**

1. As _____ pressure decreases, boiling points of liquids becomes lower.
2. The pressure produced by a force of one Newton per square meter of surface area is one _____.
4. The _____ force determines whether or not an object will float.
6. Mass divided by volume
**Physical Properties**

**Directions:** List nine physical properties, an example of each one, and how each is measured or observed. Include units if they apply.

<table>
<thead>
<tr>
<th>Property</th>
<th>Example with Units</th>
<th>How It Is Measured or Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Directions:** Name two edible acids.

10. 

**Directions:** Write the pH range for each type of substance.

11. acid: ________________  
    pure water: ________________  
    base: ________________

**Directions:** List two physical properties of bases.

12. 

**Directions:** Name two ways you can tell an acid apart from a base.

13. 

**Directions:** Determine if each of the following properties is size-dependent (SD) or size-independent (SI). Write the appropriate letters in the blank beside each property.

14. color  
15. density  
16. mass  
17. magnetism  
18. volume  
19. weight  
20. boiling point  
21. taste  
22. state  
23. length
### Chemical Properties

**Directions:** Identify each statement as **true** or **false**. Rewrite false statements to make them correct.

1. A sliced apple turning brown is exhibiting the ability to react with oxygen, a physical property.
   - True

2. Chlorine compounds change the chemical properties of pools, making them more acidic.
   - True

3. Bases create a sour taste in your mouth.
   - False. Bases create a bitter taste.

4. Acid rain is made from small amounts of acetic and carbonic acids.
   - True

5. Gold and silver make a good choice for jewelry because they have low reactivity.
   - True

6. A characteristic of matter that allows it to change to something new is called a chemical property.
   - False. A characteristic of matter that allows it to change to something new is called a physical property.

7. Toxicity is a chemical property.
   - True

8. Acids feel slippery between your fingers because they react with the skin cells on your fingers.
   - True

9. When acids and bases react, they form compounds called salts, which are made of a metal and a nonmetal.
   - True

**Directions:** Write **Yes** if the following characteristic is a chemical property, and **No** if it is not.

10. the ability to react with oxygen
    - Yes

11. toxicity
    - Yes

12. color
    - Yes

13. shape
    - No

14. reactivity
    - Yes

15. ability to burn
    - Yes
Directions: Identify each change as chemical or physical.

1. a burning log
2. food being digested
3. rust
4. a rotting pile of leaves
5. a log chopped for firewood
6. leaves falling from a tree

Directions: Answer the following questions on the lines provided.

7. What is the difference between a physical change and a chemical change?

8. How do chemical changes affect our everyday life?

9. What are the signs of a physical change?

10. What are signs of a chemical change?

11. What is the difference between physical and chemical weathering?

12. Explain the chemical change that takes place in tree leaves.

13. Why is chemical weathering a problem?
### Why do atoms combine?

**Directions:** Match the term from the word bank with each phrase below.

<table>
<thead>
<tr>
<th>Term</th>
<th>Phrase</th>
</tr>
</thead>
<tbody>
<tr>
<td>alkali metals</td>
<td>5. the group that needs one more electron to fill its outer energy level</td>
</tr>
<tr>
<td>charged</td>
<td>4. what an atom may be if it has a different number of protons and electrons</td>
</tr>
<tr>
<td>electron cloud</td>
<td>1. the energy level that can hold only 2 electrons</td>
</tr>
<tr>
<td>electron dot diagram</td>
<td>11. what makes up most of an atom</td>
</tr>
<tr>
<td>fourth</td>
<td>8. the area where protons and neutrons can be found</td>
</tr>
<tr>
<td>halogens</td>
<td>2. what an atom will be if it has a different number of protons and electrons</td>
</tr>
<tr>
<td>neutral</td>
<td>3. the energy level that can hold 32 electrons</td>
</tr>
<tr>
<td>noble gases</td>
<td>6. an area of space around the nucleus where electrons are likely to be</td>
</tr>
<tr>
<td>proton</td>
<td>7. the group that has one electron in its outer level</td>
</tr>
<tr>
<td>stable</td>
<td>10. the most stable group on the periodic table</td>
</tr>
<tr>
<td>first</td>
<td>9. the force that holds atoms together</td>
</tr>
<tr>
<td>empty space</td>
<td>12. the particle that must be present in the same number as electrons in a neutral atom</td>
</tr>
<tr>
<td>up</td>
<td>15. a handy way to represent the outer electrons of an atom</td>
</tr>
<tr>
<td>down</td>
<td>14. the reactivities of noble gases increase as you go this direction in the group</td>
</tr>
<tr>
<td>charged</td>
<td>13. the reactivities of alkali metals increase as you go this direction in the group</td>
</tr>
<tr>
<td>chemical bond</td>
<td>16. atoms join with each other to become more like this</td>
</tr>
</tbody>
</table>

**Directions:** Explain why, even though electrons closer to the nucleus have a lower energy than electrons further away from the nucleus, it takes more energy to remove the electrons closer to the nucleus.

17. __________

---

Atomic Structure and Chemical Bonds 21
Directions: Correctly complete the following paragraphs using terms from the list below. Some terms may not be used, and some terms may be used more than once.

- electrons
- molecules
- losing
- protons
- gaining
- neutral
- random
- nonpolar
- gains
- ions
- regular
- gains
- neutral
- polar
- losses
- sharing
- covalent
- negative
- ionic

Elements in Group 1 become more stable by 1. ____________________ an electron. These elements form 2. ____________________ ions because they have more 3. ____________________ than 4. ____________________. Chlorine readily 5. ____________________ an electron, forming a 6. ____________________ ion. The attraction between sodium ions and chlorine ions forms 7. ____________________ bonds. In sodium chloride, the ions are lined up in a 8. ____________________ pattern.

Unlike sodium and chlorine, some atoms become more stable by sharing 9. ____________________, forming 10. ____________________ rather than charged 11. ____________________. The bonds in a molecule of oxygen are 12. ____________________ 13. ____________________ bonds, while the bonds in a molecule of water are 14. ____________________ 15. ____________________ bonds.

Directions: Next to each formula, write the number of atoms of each element found in one unit of the compound.

16. potassium iodide, KI ____________________
17. sodium sulfide, Na₂S ____________________
18. silicon dioxide, SiO₂ ____________________
19. carbonic acid, H₂CO₃ ____________________

Directions: Complete the following activity.

20. Hydrogen combines with sulfur much like hydrogen combines with oxygen. Draw an electron dot diagram showing hydrogen combined with sulfur and write the chemical formula below.
Directions: Use the terms from the word bank to fill in the blanks in front of the correct phrases below.

balanced products
bubbles reactants
chemical reaction iron oxide
conservation of mass precipitate
endothermic silver sulfide
exothermic subscripts

1. substances that are about to take part in a chemical reaction
2. the numbers in a chemical formula that tell you the ratio of atoms in a compound
3. the law Lavoisier devised, that says that matter is neither created nor destroyed during a reaction
4. tarnish on silver
5. what you call a chemical equation when it is written with the same number of each type of atom on both sides
6. the process of changing some substances into other substances
7. a reaction that releases heat to its surroundings. Energy appears on the products side of the equation.
8. a sign that a gas has been produced
9. rust
10. the substances that are formed by a chemical reaction
11. a reaction that absorbs heat. Energy appears on the left side of the equation.
12. a solid formed in a reaction by mixing two solutions

Directions: List four ways you can detect a chemical reaction.

13. 
14. 
15. 
16. 

Directions: Use the clues to complete the puzzle.

Across
2. It speeds up a reaction but is not permanently changed
3. It slows down a chemical reaction
7. The minimum amount of energy needed to start any reaction (2 words)
9. By decreasing this, you can speed up a chemical reaction (2 words)
10. Increasing this speeds up most chemical reactions
11. Enzymes that break down proteins

Down
1. Amount of substance present in a certain volume
4. They are broken before a chemical reaction takes place
5. Measure of how fast a reaction occurs (two words)
6. These must be strong in order to cause a chemical change to take place
8. Catalysts at work in the body

24 Chemical Reactions
What is a solution?

Directions: Match the terms in the word bank with the phrases below by writing the word in the blank. You must use all the words and may use each word only once.

<table>
<thead>
<tr>
<th>alloy</th>
<th>homogeneous mixture</th>
<th>stalactite</th>
</tr>
</thead>
<tbody>
<tr>
<td>compound</td>
<td>precipitate</td>
<td>solute</td>
</tr>
<tr>
<td>heterogeneous mixture</td>
<td>stalagmite</td>
<td>solvent</td>
</tr>
</tbody>
</table>

1. for example, sugar in cola
2. a hanging icicle of rock formed by dripping water in a cave
3. a solid-solid solution, such as brass
4. for example, mixed fruit salad
5. a solid formed when two solutions mix, such as soap scum
6. a column of rock that forms upward from the floor of a cave as water with dissolved rock drips on it
7. something that dissolves a solute, such as the water in the ocean
8. two or more substances that are evenly mixed on a molecular level but are not bonded
9. for example, water, which always has the same ratio of hydrogen and oxygen atoms

Directions: Decide if each process is a physical or chemical process and write your answer in the column. Decide what kind of mixture is described in each case and name it in the second column. Identify the parts of the mixture.

<table>
<thead>
<tr>
<th>Physical or Chemical?</th>
<th>Kind of Mixture</th>
<th>Parts of Mixture</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. a chef caramelizing sugar and butter for a sauce</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. a carpenter pounding nails into a house frame</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. a painter mixing two colors of paint together</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. a clown blowing up balloons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. a cleaner using bleach to clean stains from clothes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Directions: Write true in the blank if the statement is true. If the statement is false, replace the italicized word with a word or term that makes the statement true. Write this new word in the blank.

1. In the water molecule, electrons are equally shared by hydrogen atoms and oxygen atoms.

2. Solutions for which water is the solvent are called aqueous solutions.

3. If electrons are shared equally between atoms that compose a molecule, that molecule is said to be polar.

4. Water readily dissolves most polar compounds.

5. Table salt, NaCl, is a molecular compound.

6. In an ionic compound, one or more atoms loses electrons, and one or more atoms gains electrons.

7. In solution, the charged regions of water molecules can pull a(n) ionic compound apart.

8. Chemists say, “Like dissolves like.” This means that dissolution tends to occur when the solid and the solute are similar in nature.

9. Most oils tend to dissolve best in nonpolar solvents.

10. Solubility tells you how fast a solute will dissolve.

Directions: Answer the following questions on the lines provided.

11. How is the solubility of a substance usually described?

12. What is an unsaturated solution?

13. How can a solution become supersaturated?

14. What happens if you continue to add solute to a saturated solution?

15. Can pressure affect the solubility of a substance in solution? Explain.

16. How does temperature affect the solubility of a solute in solvent?
Acidic and Basic Solutions

Directions: Use the diagram below to answer questions 1 through 5.

[Diagram showing a three-atom molecule reacting with another particle to form a positive and a negative ion]

Directions: Look at the left side of the diagram.
1. What common substance is a three-atom molecule like the one in this illustration?

Directions: Look at the right side of the diagram.
2. Explain what has happened to the two-atom molecule.
3. Identify the four-atom ion formed if the ion from the two-atom molecule is a hydrogen ion.
4. What kind of solution—acid or basic—has been produced?
5. Will this solution conduct electricity? Why or why not?

Directions: Answer the following questions on the lines provided.
7. List three properties of basic solutions.
8. Which ion increases in concentration when a strong acid is added to water?
9. Which ion increases in concentration when a strong base is added to water?
10. How are the relative strengths of acids and bases compared?
11. Name the process that occurs when you drop an antacid tablet into a glass of lemonade.
**Directions:** Unscramble the terms to fill in the summary paragraph.

Carbon can form (1)____________________ (urof) (2)____________________ (votenlac) bonds. This is the basis of (3)____________________ (fiel) on Earth. One of carbon’s most frequent bonding partners is (4)____________________ (droheyg). In the past, it was thought that (5)____________________ (vigiln) organisms were required to make (6)____________________ (rogican) compounds, but in (7)____________________ (1288) scientists learned that they could make organic compounds in the laboratory.

**Directions:** Explain what a saturated hydrocarbon is and give an example.

8. ________________________________________________________

**Directions:** Explain what an unsaturated hydrocarbon is and give an example.

9. ________________________________________________________

**Directions:** Explain what isomers are and draw an example of a pair.

10. ________________________________________________________

**Directions:** Fill in the table about naming organic compounds. Use Figure 8 to help you.

<table>
<thead>
<tr>
<th>Naming Strategy</th>
<th>Meaning of Strategy</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. suffix -ane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. suffix -ene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. suffix -yne</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. prefix cyclo-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. root meth-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. root prop-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. root hex-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. root dec-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. root pent-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. root eth-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. root but-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Directions: Match each organic compound in the left column with the appropriate substitution group or groups in the right column. Some groups may be used more than once.

Organic Compound

1. carboxylic acid
2. amine
3. alcohol
4. amino acid

Substitution Group

hydroxyl group
carboxyl group
amino group

Directions: Complete the table below by placing an X in the appropriate box of the group of substituted hydrocarbons each compound belongs to.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Alcohol</th>
<th>Carboxylic Acid</th>
<th>Amine</th>
<th>Amino Acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. vinegar (acetic acid)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. caffeine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. methanol</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. formic acid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. glycine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. ethanol</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Directions: Study the chemical formulas for the different compounds. Identify the substitute group in each compound, then name the type of group on the lines provided.

11.  
12.  
13.  
14.  

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Directions: Identify whether each statement describes a protein, carbohydrate, sugar, starch, or lipid.

1. In the body, these are broken down into simple sugars that the body can use for energy.
2. These are more concentrated sources of energy than carbohydrates are.
3. These substances are found in fresh fruit and sweet candy.
4. Amino acids bond with each other to form these polymers.
5. Hundreds or thousands of sugar molecules may join together to form these compounds.
6. These polymers are found in butter, ice cream, and beeswax.

Directions: Determine whether the italicized term makes each statement true or false. If the statement is true, write true. If the statement is false, write in the blank the term that makes the statement true.

7. Individual amino acids link together to form carbohydrates.
8. There are twenty amino acids that bond in different combinations to form the proteins in a human body.
9. People who eat a diet high in saturated fats have a higher rate of cardiovascular problems such as heart disease.
10. Lipids contain sugars and starches which make them good pre-race choices for marathon runners.

Directions: Answer the following questions on the lines provided.
11. Give examples of foods that contain the three groups of biological compounds that are part of a balanced diet.

12. How do saturated lipids differ from unsaturated lipids?
What is motion?

Directions: Fill in the chart using information from the chapter.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Includes Direction?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. distance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. displacement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. average speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. instantaneous speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. velocity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Directions: List three ways the velocity of a car can change.

6. 
7. 
8. 

Directions: Explain how the speed of an object is changing if the line representing the object’s motion on a distance-time graph becomes steeper.

9. 

Directions: Explain how the displacement of an object could be zero while the distance the object travels is 150 m.

10. 

Directions: *In the space provided, substitute a word for the word in italics to make the statement correct.*

1. Velocity is a change in an object’s motion.
2. Acceleration is the rate of change of velocity with *distance*.
3. When an object slows down, it has *no* acceleration.

Directions: *Answer the following questions on the lines provided.*


5. What is the unit for speed? For acceleration?

6. If an object has an acceleration of \(-3 \text{ m/s}^2\), describe its motion.

Directions: *Study the velocity-time graph for an object in motion. Then answer the following questions.*

7. In what interval does the object have the fastest acceleration?

8. Over what interval(s) does the object have a negative acceleration?

9. Over what interval is the object stopped?
Directions: In question 1, below, a code letter has been substituted for every letter of the alphabet. To find out what the sentence says, use the following key to decode it. In the key, the code letters are shown directly below the letters they stand for. Write the correct letter above each code letter, then read the sentence.

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
L V Y Q G Z M O B P F S R J D T E N I H X C K M A U

1. _______     __________     ______________     ____     _____________     ________
   HOG     HDHLS     RDRGJXR     DZ     DVPGYHI     HOLH
   YDSSBQG     KBHO     GLYO     DHOGN     QDGI     JDH     YOLJMG

2. What is the law that is stated above?

Directions: Correctly complete each sentence by underlining the best of the three choices in parentheses.

3. A feather floating in the air has (more, less, the same) momentum as a bowling ball on a shelf.

4. The momentum of an object depends on its mass and (velocity, acceleration, inertia).

5. The tendency for an object to resist change in its motion, is its (momentum, inertia, weight).

6. We say that momentum is conserved, yet objects slow down after collisions. This is because of (inertia, friction, mass).

Directions: Answer the following questions on the lines provided.

7. A 500 g model train car traveling at 0.8 m/s collides with a 300 g stationary car. The cars hook up and move off down the track together. How fast are they going?

8. Which has a greater momentum, a car or a bike moving at the same speed?

9. What happens when two objects with the same mass collide?
Newton’s First Law

Directions: Use the terms from the word bank to fill in the blanks in front of the correct phrases below.

balanced net force static unbalanced
force Newton’s first sliding
friction rolling force a push or pull

1. the force that brings nearly everything to a stop, also useful for mountain climbers and baseball players
2. the type of friction that acts on a rolling wheel, easier to overcome than static friction
3. the combination of all forces acting on an object
4. the law that describes the motion of objects that experience balanced forces
5. the forces acting on an object whose motion is not
6. the type of friction that you have to overcome to push a stationary object
7. the type of friction acting on surfaces sliding on each other
8. a push or pull
9. the forces that cause the motion of an object to change

Directions: Unscramble the words to fill in the blanks in this paragraph that explains how Galileo Galilei’s ideas helped Isaac Newton to understand the nature of motion.

Galileo realized that an object could be in motion even if the (10) ________________ (ecsfro) acting on it were (11) ________________ (aaebcdln). In real life, (12) ________________ (cinotfri) is the force that (13) ________________ (lswso) objects down and causes them to (14) ________________ (sptso). Newton’s (15) ________________ (srift) law of motion described how forces cause the motion of objects to (16) ________________ (aehncg): An object at rest remains at rest and an object in motion continues to move in a (17) ________________ (gsahitr) line with constant (18) ________________ (pedes) if the net force acting on it is (19) ________________ (ozer).
Newton’s Second Law

Directions: Select the term from the following list that matches each description. Some terms will not be used.

a. 16 N  
e. \( a = \frac{F}{m} \)  
i. 600 N
b. –16 N  
f. normal forces  
j. Newton's second law of motion
c. gravity  
g. air resistance  
k. terminal velocity
d. \( F = ma \)  
h. \( F = m\left(\frac{9.8 \text{ m/s}^2}{s^2}\right) \)  
l. Newton's first law of motion

1. acts against the direction of motion and gets larger as an object moves faster
2. Force is equal to mass times acceleration.
3. An object acted upon by a net force will accelerate in the direction of that force.
4. the gravitational force on any object near Earth’s surface
5. the outward forces exerted by a surface
6. the speed an object reaches when the force of gravity is balanced by the force of air resistance
7. What force must be applied to a 60-kg object to make it accelerate at 10 m/s²?

Directions: Study the illustration of the diver. Then identify each statement as true or false. If the statement is false, change the word(s) in italics to make it true.

8. After the diver jumps forward from the diving board, the force of gravity will accelerate the diver parallel to the direction of motion.
9. When the diver hits the water, the force of the water against her body can stop it about five times faster than the pull of gravity that accelerated it.
10. If the diver doesn’t have the correct form when she enters the water, the force of the water can accelerate her speed.
11. Air resistance prevents the diver from moving in a straight line once she jumps from the platform.
**Newton’s Third Law**

**Directions:** Complete the table by naming the action and reaction forces in the following examples.

<table>
<thead>
<tr>
<th>Example</th>
<th>Action force</th>
<th>Reaction force</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A flying bird</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Two bumper cars collide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Holding your hand out the window of a moving car</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Walking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Touching your finger to your nose</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Directions:** Complete the following sentences using the correct terms or phrases.

6. Newton’s third law states, “For every action, there is an equal but ____________________.”

7. There is no ____________________ in time between the action and the reaction.

8. One reason it’s often easy to miss an action-reaction pair is because of the ____________________ of one of the objects.

9. Action-reaction forces are always the same ____________________ but are in opposite ____________________.

10. When you swim in water, your arms push the water ____________________. The water reacts by pushing ____________________ on your arms, causing your body to accelerate ____________________.

**Directions:** Answer the following question using complete sentences.

11. How could the action force of a canoe moving through water be increased?

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
Directions: Fill in this chart explaining pressure at different elevations.

<table>
<thead>
<tr>
<th>Location</th>
<th>Elevation</th>
<th>Description and Cause of Pressure</th>
<th>Pressure in kPa or atm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>+ 8850 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>an ocean</td>
<td>beach</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>weight of the atmosphere + 1 atm</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>pressure for each 10 m of water</td>
<td>22 000 kPa (220 atm)</td>
</tr>
</tbody>
</table>

Directions: Write the words from the list beside the proper phrase below.

- barometer
- fluid
- square meter
- newton
- pascal
- pressure
- straw
- plasma
- weight

5. a unit of pressure
6. a device that uses atmospheric pressure to help you drink
7. a device that measures atmospheric pressure
8. force per unit area
9. a unit of area
10. a fluid that is found in the stars
11. a force exerted on a table by a book resting on a table
12. a state of matter that always takes the shape of its container
13. a unit of force

Directions: Explain why the pressure exerted by the tip of a nail on a wooden board will be much greater than the pressure that is exerted on the head of the nail by a hammer.

14.
Why do objects float?

Directions: In question 1, a code letter has been substituted for every letter of the alphabet. To find what the sentence says, use the following key to decode it. In the key, the code letters are shown directly below the letters they stand for. Write the correct letter above each code letter, then read the sentence.

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
L V Y Q G Z M O B P F S R J D T E N I H X C K M A U


2. HD H O G K G B M O H D Z H O G Z S X B Q B H Q B I T S L Y G I

2. The decoded sentence is a statement of what principle?

Directions: In the blank in front of the statement, write true if the statement is true. If the statement is false, change the underlined word or words to make the statement true.

3. The pressure exerted on an object by a fluid is always parallel to the surface of the object.

4. The buoyant force depends on the shape of the object in the fluid.

5. As an object sinks deeper into a fluid, the buoyant force on it remains the same.

6. Density is force/unit area.

Directions: Answer the following questions on the lines provided.

7. Three different cubes, A, B, and C, are 2 cm along each side. Cube A has a mass of 3 g, cube B has a mass of 7 g, and cube C has a mass of 9 g. Which of these cubes will float in water? Explain.

8. If you are floating motionless in a pool, how do you know that a buoyant force exists?
Doing Work with Fluids

Directions: Answer the following questions on the lines provided.

1. State Pascal’s principle.

2. Why are liquids sometimes more practical to use in a hydraulic system than gases?

Directions: Circle the term in parentheses that best completes the statement.

3. If you press against the bottom of a bottle of shampoo, the pressure on the sides of the bottle (increases, decreases, remains the same).

4. Hydraulic systems in shock absorbers in cars use (steel, rubber, fluids) to make the ride smooth.

5. If you increase the force on a small piston connected to a larger piston in a hydraulic system, the pressure on the larger piston will be (greater than, less than, the same as) the pressure on the smaller piston.

6. In the hydraulic system in question 5, the force exerted by the larger piston will be (greater than, less than, the same as) the force on the smaller piston.

7. In the hydraulic system in question 5, the distance the larger piston moves upward will be (greater than, less than, the same as) the distance the smaller piston moves down.

8. According to Bernoulli’s principle, as the speed of a fluid increases, the pressure it exerts (increases, decreases, remains the same).

9. Bernoulli’s principle is responsible for the (thrust, drag, lift) created on the wing of an airplane.

Directions: Answer the following question on the lines provided.

10. The small piston in a hydraulic system has a cross-sectional area of 0.5 m², and the large piston has an area of 3 m². What is the force exerted by the large piston if a force of 500 N is exerted on the small piston?
### Study Guide

**What is energy?**

**Directions:** Label each situation with the type of energy it describes. Some situations may have more than one answer.

<table>
<thead>
<tr>
<th>chemical potential</th>
<th>electrical radiant</th>
<th>kinetic thermal</th>
<th>nuclear</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. sunshine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. a rolling ball gains more of this kind of energy when it moves faster</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. the ocean affects climate because it has so much of this kind of energy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. a rock balanced on a ledge has this kind of energy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. energy in the nuclei of atoms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. energy stored in chemical bonds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. energy produced in your body’s cells</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. energy that operates a toaster</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. energy emitted by a toaster</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. energy emitted by a lightbulb</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. as objects become hotter, they have more of this type of energy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. three kinds of energy a match can help you get from firewood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. energy of moving objects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. energy of position</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. energy stored in gasoline</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Directions:** List two types of energy that depend on the mass of an object.

16. 

17. 

**Directions:** State the type of energy that is carried by light.

18. 

---

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Directions: Fill in the blanks with the terms that best complete the statements.

1. In every energy transformation, some ____________________ is released.

2. When you climb a rope, you change ____________________ energy into ____________________ energy.

3. Energy can never be created or destroyed, just ____________________ or ____________________.

4. As temperature increases, ____________________ energy increases.

5. Fireworks change ____________________ into ____________________ and ____________________ energy.

6. When a pendulum swings, if it is not continuously pushed, it will stop eventually because some of its energy is changed into ____________________ energy.

7. In the muscle cells in your body, ____________________ energy is changed into ____________________ energy.

Directions: Answer the following questions on the lines provided.

8. Trace the energy transformations from a hamburger you eat to riding your bike.

   __________________________________________________________

   __________________________________________________________

9. In most forms of generation of electrical energy in power plants, the last two steps are the same. What are they?

   __________________________________________________________

   __________________________________________________________

10. Trace the energy transformations from a radio signal to the music you hear.

    _________________________________________________________

    _________________________________________________________

     _________________________________________________________

     _________________________________________________________
**Directions:** Circle the term in parentheses that correctly completes the following statements.

1. (Oil, Wind, Water) is a fossil fuel.
2. As you go deeper into Earth, the temperature (increases, decreases, stays the same).
3. (Coal, Oil, Water) is a renewable resource.
4. (Geothermal energy, Fossil fuels, Hydroelectric energy) cause acid rain.
5. A mountainous region would be a likely source for (nuclear, hydroelectric, wind) energy.

**Directions:** Determine whether each of the following statements is true or false. If it is true, write true on the line. If it is false, change the underlined term to make it true.

6. Fossil fuels cause air pollution.
7. Geothermal energy is caused by falling water.
8. A thermal cell produces electricity directly from sunlight.
9. A reflecting panel uses the kinetic energy of moving air.
10. About 68% of the electrical energy in the United States is produced by nuclear fuel.

**Directions:** Answer the following questions on the lines provided.

11. Explain why it would be necessary for a home using solar energy to have some type of an energy storage device.
12. Explain how hydroelectric energy works.
**Directions:** Give an example of how you could apply a force to do work. Describe the necessary condition for the force to do work.

1. 

**Directions:** Give an example of how you could apply a force and not do work. Explain why the applied force is not doing work.

2. 

**Directions:** Write formulas to fill in the following chart.

<table>
<thead>
<tr>
<th>Write a Formula to Calculate</th>
<th>Data That Is Needed</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Power</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Directions:** Decide what each situation describes and write the term in the blank. You may use terms from the bank more than once or not at all.

- **distance energy**
- **force**
- **kinetic energy**
- **heat**
- **potential energy**
- **work**

5. what is done when a baseball is lifted 0.7 m
6. the form of energy you give a chair by pushing it across the floor
7. the form of energy a book has that decreases as it tumbles from a library shelf
8. what a dog did as he pushed his food bowl across the room with his nose
9. measured in newtons
10. something that can not be created nor destroyed
11. measured in watts
12. the form of energy a baseball has that increases when it is lifted 0.7 m
13. a baseball is carried 7 m
14. the rate at which work is done
Directions: Use the formula, efficiency = \( \frac{W_{\text{out}}}{W_{\text{in}}} \times 100\% \), to calculate the efficiency of each of the following machines.

1. A 600-N box is pushed up a ramp that is 2 m high and 5 m long. The person pushing the box exerts a force of 300 N. What is the efficiency of the ramp?

   \[
   \text{efficiency} = \left( \frac{W_{\text{out}}}{W_{\text{in}}} \right) \times 100\%
   \]

2. A person uses a fixed pulley to raise a 75-N object 40 m. The force exerted on the object is 120 N. What is the efficiency of the pulley?

   \[
   \text{efficiency} = \left( \frac{W_{\text{out}}}{W_{\text{in}}} \right) \times 100\%
   \]

Directions: Complete the following sentences using the correct terms.

3. The work input is equal to the work ________________________ in an ideal machine.

4. Machines are useful because they can change the ________________________, ________________________, or ________________________ of the force you need to exert.

5. The force you exert on an object is the effort, or ________________________ force.

6. The ________________________ of a machine compares the input force to the output force.

7. ________________________ can reduce a machine’s efficiency.

8. The ability of a machine to convert input work to output work is called the machine’s ________________________.
Directions: Use the clues to complete the puzzle.

Across
1. A moving inclined plane
4. An inclined plane wrapped around a post
5. The pivot point of a lever
7. A surface that re-directs force using a rope
8. A rod that pivots about a point

Down
1. Two rigidly attached wheels that rotate together
2. A sloped surface
3. An inclined plane
6. Used with a pulley to change the direction of a force
Directions: Unscramble the words to fill in the blanks in the summary statements.

(1) ____________________ (rateeputerm) is a measure of the average kinetic energy of the
(2) ____________________ (oeeuscllm) in a substance. As the temperature increases, the mole-
cules have more (3) ____________________ (tiencikt greeny), and are moving
(4) ____________________ (reastf). For most materials, as the temperature increases, the mole-
cules in the material move (5) ____________________ (feathrr) apart, causing the material to
(6) ____________________ (pandex). When the material cools, its molecules move more
(7) ____________________ (yowlls) and the material (8) ____________________ (strancoct). For
the same temperature increase, (9) ____________________ (udsiqli) usually expand more than
(10) ____________________ (dlsois). On the (11) ____________________ (iueslcs) temperature
scale, the (12) ____________________ (bilingo) point of water is 100° C and the
(13) ____________________ (zengerif) point of water is 0° C. The (14) ____________________
(metlahr ygeren) of an object is the sum of the (15) ____________________ (nkctei) and
(16) ____________________ (lontpetia) energy of all the molecules in the object.

Directions: Use the terms from the word bank to complete the section summary.

greater increases more thermal energy
height kelvin temperature

A practical way to measure (17) ____________________ is to use a thermometer. One type of
thermometer contains a liquid that expands as its temperature (18) ____________________, so
that the (19) ____________________ of the liquid in the tube depends on the temperature. On
the (20) ____________________ temperature scale, the lowest possible temperature is 0 K. If two
glasses of water at the same temperature are poured into a container, the
(21) ____________________ of the water in the container is (22) ____________________ than
the thermal energy of the water in either glass, because there are (23) ____________________
molecules of water in the container.
**SECTION 2**

**Heat**

**Chapter 15**

**Directions:** Answer the following questions on the lines provided.

1. How is heat related to thermal energy? Can an object contain heat?

   ____________________________________________________________

2. Explain how convection could be used to heat a room with a hot radiator on one side of the room.

   ____________________________________________________________

**Directions:** Fill in the blanks with the terms that best complete the statements.

3. Heat always moves from a(n) ____________________ object to a(n) ____________________ object.

4. When two objects are in contact, heat is best transferred by ____________________.

5. Heat is transferred by conduction when ____________________ moving molecules bump into
   ____________________ moving molecules and transfer ____________________ energy.

6. The heat from an electric space heater is transferred to you by ____________________.

7. Radiation transfers thermal energy by ____________________.

8. Heat is transferred in gases or liquids primarily by ____________________.

**Directions:** Correctly complete each sentence by underlining the best of the three choices in parentheses.

9. A small pan of water at 50°C is brought into contact with a larger pan of water at 50°C. Heat is
   transferred (from the large pan to the small pan, from the small pan to the large pan, not at all).

10. Convection involves (molecules moving, molecules colliding, electromagnetic waves).

11. Metals are good (reservoirs, insulators, conductors) because they transfer heat easily.

12. Cooking tools often have plastic handles because plastic is a good (conductor, insulator, reservoir)
    of heat.

13. A measure of how well a substance absorbs heat is its (equivalent heat, calorie content,
    specific heat).

14. Heat transfer by (convection, radiation, conduction) occurs when energy is transferred by
    electromagnetic waves.

---

54  Thermal Energy
3. Study Guide

**Engines and Refrigerators**

**Chapter 15**

**Directions:** Answer the following questions on the lines provided.

1. What is a heat engine?

2. In a car with a four-cycle engine, why is it an advantage to have at least four cylinders?

3. In nature heat only moves from a hotter object to a cooler object. How is it possible for a heat pump to remove heat from a cold object and add it to a hotter object?

**Directions:** Identify each statement as true or false. If it is false, change the italicized term to make the statement true.

4. In an air conditioner heat from inside the house is absorbed by coolant within pipes.

5. If you let the air out of a bicycle tire, the valve becomes cold. This is because when a gas under pressure expands, it releases energy to the environment.

6. When a heat pump is used for heating, it removes heat from the cold air outside and adds heat to the warm air inside.

7. A diesel engine does not use spark plugs.

8. An engine that uses the process of burning fuel within the engine is called a(n) internal combustion engine.

9. A heat engine is any device that converts thermal energy into kinetic energy.

10. In internal combustion engines, fuel burns in a combustion chamber inside the engine.

**Thermal Energy** 55
What are waves?

Directions: Use the words from the word bank to fill in the blanks in front of the correct phrases below.

<table>
<thead>
<tr>
<th>compression</th>
<th>mechanical</th>
<th>sound</th>
<th>water</th>
</tr>
</thead>
<tbody>
<tr>
<td>compressional</td>
<td>medium</td>
<td>transverse</td>
<td>waves</td>
</tr>
<tr>
<td>crest</td>
<td>radiant</td>
<td>trough</td>
<td>X-ray</td>
</tr>
<tr>
<td>electromagnetic</td>
<td>rarefactions</td>
<td>vibrating</td>
<td></td>
</tr>
</tbody>
</table>

1. a type of wave that requires matter to transmit energy
2. part of a compressional wave where molecules are farthest apart
3. all waves are produced by something that is doing this
4. a type of wave that can carry energy without matter
5. rhythmic disturbances that carry energy without carrying matter
6. a type of compressional wave made by a guitar
7. a material in which a mechanical wave is traveling
8. a type of transverse wave
9. a type of wave in which matter moves at right angles to the direction the wave travels
10. high point of a transverse wave
11. the type of energy emitted by the Sun
12. part of a compressional wave where molecules are closest together
13. a type of wave where the matter moves back and forth along the same direction that the wave travels
14. low point of a transverse wave
15. a type of electromagnetic wave

Directions: Explain how ocean water moves within a wave, and how a wave can carry energy without moving matter.

16. 

__________________________

__________________________
**Wave Properties**

**Directions:** Circle the term that correctly completes each sentence.

1. The wavelength of a transverse wave is often measured from (crest to crest, crest to trough).
2. Waves with greater amplitudes carry (more, less) energy than waves with smaller amplitudes.
3. The amplitude of a wave can be measured from the (medium, crest) or the (trough, wavelength) to the rest position of the wave’s medium.
4. The number of waves that pass a point in one (second, minute) is the wave’s (amplitude, frequency).
5. Waves with longer wavelengths have a (lower, higher) frequency and waves with shorter wavelengths have a (lower, higher) frequency.
6. A group of molecules that are squeezed together is called a (rarefaction, compression).
7. Electromagnetic waves travel faster in (gases, solids).

**Directions:** Use the words below to label the diagram. You will use each term more than once. Then answer the questions.

- **amplitude**
- **wavelength**

8.  
9.  
10.  
11. ____________

12. What is the wavelength of the wave shown in the diagram?

13. What is the amplitude of the wave shown in the diagram?
Directions: Study the following picture. Think about light waves and sound waves. Then answer each question.

1. The woman in the building watches the worker through a window. What happens to the light waves as they pass through the window? ________________________________

2. Why is the worker wearing ear protectors? How do ear protectors work to block harmful sound waves?
   ________________________________
   ________________________________

3. The man down the street hears the jackhammer around the corner, although he cannot see it. What behavior of waves is responsible for this? ________________________________

4. The man down the street can see an image of himself in the window. What behavior of waves is responsible for this? ________________________________

5. The man down the street can NOT see an image of himself in the wall of the building. What behavior of waves is responsible for this? ________________________________
What is sound?

Directions: Use the terms from the word bank to fill in the summary sentence blanks.

amplitude decibel energy slower

collide Doppler loudness vibrates

compressions echolocation rarefactions wavelength

Sound waves are produced by something that (1)____________________. Sound waves travel through a material as particles in the material (2)____________________ with each other. Sound waves have regions called (3)____________________, where particles are closer together, and (4)____________________, where particles are farther apart. The distance from one compression to the next, or from one rarefaction to the next is the (5)____________________ of the sound wave. Sound waves usually travel (6)____________________ in gases than in solids or liquids. The more (7)____________________ carried by a sound wave, the larger its (8)____________________. The intensity of sound waves is measured on the (9)____________________ scale. The (10)____________________ of a sound is the human perception of the intensity of the sound waves.

Directions: Decide whether the term that fills in the blank is in column A or column B and write the correct letter in the last column.

<table>
<thead>
<tr>
<th>Sentence</th>
<th>A</th>
<th>B</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. Louder sound waves carry ________ energy than soft sound waves.</td>
<td>more</td>
<td>less</td>
<td></td>
</tr>
<tr>
<td>12. Loud sounds travel ________ soft sounds.</td>
<td>faster than</td>
<td>at the same speed as</td>
<td></td>
</tr>
<tr>
<td>13. Sound waves in cold weather travel ________ than they do in hot weather.</td>
<td>faster</td>
<td>slower</td>
<td></td>
</tr>
<tr>
<td>14. This is because the molecules move faster when they are ________.</td>
<td>warmer</td>
<td>colder</td>
<td></td>
</tr>
<tr>
<td>15. An increase of 20 dB means there is ________ times more sound energy.</td>
<td>20</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>16. An object to be located by sonar can be assumed to be farther away when the echo takes a ________ time to return to the sensor.</td>
<td>longer</td>
<td>shorter</td>
<td></td>
</tr>
<tr>
<td>17. When a sound-emitting object moves toward a person, the pitch of the sound will seem _________.</td>
<td>lower</td>
<td>higher</td>
<td></td>
</tr>
</tbody>
</table>
Directions: Answer the following questions on the lines provided.

1. What is the difference between music and noise?

2. What vibrates in each of the following to produce the initial sound?
   a. your voice
   b. a piano
   c. a trumpet

3. What is resonance?

Directions: Fill in the blanks with the terms that best complete the statements.

4. A musical instrument will vibrate with its ________________ when played.

5. The guitar body of an acoustic guitar resonates to ________________ the sound when a string is plucked.

6. ________________ are repeated echoes of sound.

7. The pitch of the lowest sound produced by an instrument is its ________________.

8. The shorter the string of a violin, the ________________ the pitch.

9. In a xylophone, the longer the bar, the ________________ the pitch.

10. When two notes very close together in pitch interfere, they produce regular changes in loudness called ________________.

11. The purpose of the ________________ ear is to amplify sound.

12. ________________ in the inner ear generate nerve impulses that are transmitted to the brain to be interpreted as sound.

13. As people age, their ________________ frequency hearing tends to decrease.
The Nature of Electromagnetic Waves

Directions: Use the words from the word bank to complete the section summary.

charged  energy  magnetic  Earth
force  matter  electric  gravitational
mechanical  electromagnetic

A wave can transfer (1)____________________ without transferring (2)____________________.

The type of wave that needs matter to transfer energy is a (3)____________________ wave. An (4)____________________ wave can transfer energy through empty space.

A force field enables one object to exert a (5)____________________ on another object, without the two objects touching. (6)____________________ is surrounded by a (7)____________________ field that extends into space and pulls objects downward. Protons and electrons have (8)____________________ charge. A moving (9)____________________ particle is surrounded by an electric field and a (10)____________________ field.

away  light  trough  distance
motion  vibrating  frequency  move
wave  higher  radiant  wavelengths

A charged particle that moves back and forth, or vibrates, produces (11)____________________ electric and magnetic fields. These fields move (12)____________________ from the vibrating charge in many directions, forming an electromagnetic (13)____________________. The (14)____________________ from one crest to the next or from one (15)____________________ to the next is the wavelength. The number of vibrations the charge makes in one second is the (16)____________________ of the wave, and is the same as the number of (17)____________________ that pass any point in one second.

The energy carried by an electromagnetic wave is called (18)____________________ energy. The (19)____________________ the frequency of an electromagnetic wave, the more energy it carries. If an electromagnetic wave strikes a charged particle, the wave causes the particle to (20)____________________. Some of the energy carried by the wave is transferred into the particle's energy of (21)____________________. All electromagnetic waves travel at the speed of (22)____________________.
The Electromagnetic Spectrum

Directions: Answer the following questions on the lines provided.

1. What is the electromagnetic spectrum?

2. Explain how radar helps air traffic controllers.

Directions: Circle the term in parentheses that best completes the statement.

3. The electromagnetic waves with the longest wavelengths are (radio waves, infrared waves, gamma rays).

4. Your body can sense (radio waves, infrared waves, microwaves) as heat.

5. Electromagnetic waves with wavelengths between those of infrared and ultraviolet waves are (microwaves, X rays, visible light).

6. Portable phones use (infrared waves, visible light, microwaves) to operate.

7. Ultraviolet waves have (more energy than, less energy than, the same energy as) X rays.

8. Cellular phones use (microwaves, infrared waves, ultraviolet waves).

9. (Gamma rays, X rays, Ultraviolet waves) are used in hospitals to sterilize equipment.

10. Pit vipers have special organs that detect changes in (infrared, ultraviolet) waves.

11. The ozone layer in the atmosphere is important because it absorbs excess (visible light, radio waves, ultraviolet radiation).

12. The waves with the highest frequencies in the electromagnetic spectrum are (gamma rays, X rays, radio waves).

13. As the frequency of an electromagnetic wave decreases, its wavelength (increases, decreases, remains the same).
Using Electromagnetic Waves

Directions: Answer the following questions on the lines provided.

1. How is information transmitted from a radio station’s disk jockey to your ears?

2. List two advantages of using radio waves for communications.

3. What is the GPS? How does it work?

Directions: Circle the term in parentheses that best completes the statement.

4. When you modulate a radio wave, you (change it, intensify it, make it louder).

5. To tune in a radio station, you move your dial to the frequency of its (signature wave, carrier wave, microwave).

6. AM radio carries information by changing the (amplitude, speed, frequency) of the radio wave.

7. In fiber-optic cables, telephone information is transmitted as (sound, light, ultraviolet) waves.

8. Radio waves that transmit information to the other side of the world are sent (to satellites, directly through Earth).
**Section 1 Study Guide Properties of Light**

**Directions:** Use the words in the word bank to complete the summary statements.

- **absorbs**  - **green**  - **reflected**
- **all**  - **light bulbs**  - **Sun**
- **blue**  - **longest**  - **violet**
- **combining**  - **orange**  - **wavelength**
- **eyes**  - **prism**  - **white**
- **emits**  - **red**  - **yellow**

A light source (1)____________________ countless light rays in (2)____________________ directions. Light sources include (3)____________________ and the (4)____________________.

When light strikes an object, rays are (5)____________________ in all directions. You see the object when some of the rays enter your (6)____________________.

A (7)____________________ separates a beam of white light into many colors. Each different color of light has a different (8)____________________. The color of light with the shortest wavelength is (9)____________________ and the color with the (10)____________________ wavelength is red. A black object (11)____________________ all wavelengths of visible light and a (12)____________________ object reflects all wavelengths of visible light. The color of an object depends on the wavelengths of light that it reflects. For example, a purple leaf reflects (13)____________________ light and absorbs all other wavelengths. Some colors are formed by (14)____________________ colors. The three primary colors of light are (15)____________________, (16)____________________ and (17)____________________.

(18)____________________light, for example, can be formed by a combination of red light and green light.

**Directions:** Define translucent, transparent, and opaque and give an example of an object of each type.

<table>
<thead>
<tr>
<th></th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.</td>
<td>opaque</td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>translucent</td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>transparent</td>
<td></td>
</tr>
</tbody>
</table>
Reflection and Mirrors

Directions: Use the items listed below to label the diagram. Then complete the sentence that describes the diagram.

angle of incidence  angle of reflection  the normal

1. ____________  2. ____________  3. ____________

light ray  surface

The law of reflection states that the 4. ______________ of 5. ______________ is equal to the 6. ______________ of 7. ______________.

Directions: Answer the following questions on the lines provided.

8. Light rays reflect off a rough surface.
   a. Do the rays reflect in many directions or few? ______________
   b. What type of reflection is this? ______________

9. Light rays reflect off a smooth surface.
   a. Do the rays reflect in many directions or few? ______________
   b. What type of reflection is this? ______________

Directions: Label each diagram as a plane mirror, a concave mirror, or a convex mirror. Draw incoming and reflecting light rays.

10. ____________  11. ____________  12. ____________
Directions: Read each pair of statements. One or both of them are correct. Circle the ones that are correct. Cross out any incorrect ones.

1. Light travels at the same speed in all mediums.
   - Light travels at different speeds in different mediums.

2. Refraction is the change of speed of a light wave as it moves from one medium to another.
   - Refraction is the bending of a light wave as it moves from one medium to another.

3. The greater the change in the speed of a light wave, the more it refracts.
   - The greater the change in the speed of a light wave, the less it refracts.

4. A lens is a transparent object with at least one curved side that causes light to refract.
   - A lens is a transparent object with two curved sides that cause light to refract.

5. A convex lens is also called a converging lens.
   - A concave lens is also called a diverging lens.

Directions: Identify each statement as describing a convex lens, a concave lens, or both.

6. a lens that is thicker in the center than at the edges
7. a lens that is thicker at the edges than at the center
8. causes light rays passing through it to meet at a focal point
9. has an optical axis
10. an object more than two focal lengths from the lens will have an inverted image
11. causes light rays passing through it to diverge
12. causes light rays passing through it to refract
13. used to correct nearsightedness
14. used to correct farsightedness
15. creates a focal point
Using Mirrors and Lenses

Directions: Using complete sentences, answer the following questions about microscopes.

1. What is an objective lens?

2. What is an ocular lens?

3. Explain how a microscope allows the viewer to see very small objects?

4. Why is it important to know that the lenses in microscopes are convex lenses?

Directions: The terms below describe reflecting or refracting telescopes. Write the terms that best describe each type in the correct column. Some terms will appear in both lists.

- heavy weight
- gathers as much light as possible
- enlarges gathered light
- convex lens
- reflects gathered light
- less expensive
- does not sag
- sags when too large
- concave mirror
- more expensive
- lighter weight

Refracting Telescope

5. ____________________________
6. ____________________________
7. ____________________________
8. ____________________________
9. ____________________________
10. ____________________________

Reflecting Telescope

11. ____________________________
12. ____________________________
13. ____________________________
14. ____________________________
15. ____________________________
16. ____________________________

Directions: Answer the following question about cameras, using complete sentences.

17. Your friend wants to build a camera and asks you to pick up a concave lens at the hobby shop. You say that is the wrong kind of lens. Explain why you say this and what is important to know about a convex lens in a camera.

__________________________
Directions: Unscramble the terms to fill in the blanks in the summary paragraphs.

When an atom gains electrons, it gains a (1) ________________ (venagtie) charge. When an atom loses electrons, it becomes (2) ________________ (soipviet). When many electrons move from one solid object to another, the charge created is called (3) ________________ (actsti). Unlike electrons, (4) ________________ (roptnos) usually do not move from one object to another. However, in (5) ________________ (loustin) both are positive and negative. (6) ________________ (snio), such as sodium and (7) ________________ (drochlie), can move. This enables (8) ________________ (never) impulses to be transmitted.

Directions: List the four steps that use ions to transmit nerve impulses.

9. __________________________________

10. __________________________________

11. __________________________________

12. __________________________________

Directions: Match the terms from the word bank with the correct phrases below.

- **conductor**: a material in which electrons can move easily, such as gold and copper
- **electric discharge**: electric charge moves quickly from one location to another, as in a lightning strike
- **electric field**: lines that are drawn away from a positive charge and toward a negative charge
- **electric field lines**: something that causes two charged balloons to repel each other without touching
- **electric force**: something charged objects exert on each other, that depends on the amount of charge on each object and the distance between them
- **insulator**: a material in which electrons can not move easily, such as glass and plastic
- **induced charge**: separation of positive and negative charges due to an electric field
- **using Earth as a conductor to avoid lightning damage**: using Earth as a conductor to avoid lightning damage
- **separation of positive and negative charges due to an electric field**: separation of positive and negative charges due to an electric field

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Life as we know it would be impossible without electricity. Think of the number of electrical devices we rely on every day: lights, refrigerators, computers, televisions, flashlights, car headlights, watches—the list is endless. All of these devices, and countless others, need a constant, steady source of electrical energy. This steady source of electrical energy comes from a(n) 1. ________________________, which is the steady flow of electrons through a conductor.

This steady flow of electricity requires a closed path, or 2. ________________________, through which to flow. Its basic elements are a conductor, such as wire, through which electrons flow and a source of electrons, such as a battery.

An electric current carries energy that comes from separating positive and negative charges. Negatively charged electrons “seek out” positively charged electrons to recombine. This can only happen if they travel through the circuit. In a circuit, the electrons flow from the 3. ________________________ end to the 4. ________________________ end.

A familiar source of electrons in electric circuits is a battery. The total stored electrical energy in a battery—the energy available to do work—is called 5. ________________________. This energy is measured in units called 6. ________________________, which is abbreviated 7. ________________________. Batteries rely on 8. ________________________ to separate positive and negative electrical charges. When the negative and positive ends of the charges are connected by a conductor, a circuit forms and the electrical energy is available to do work.

However, the electrons don’t flow completely freely through the circuit. Depending on the material used for the conductor, the electrons have more or less difficulty flowing. The measure of how difficult it is for electrons to flow through a circuit is called 9. ________________________. This is measured in units called 10. ________________________.
**Electric Circuits**

**Directions:** Use the terms and statements from the list below to complete the table.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>kilowatt</td>
<td>amount of electric energy used by a device</td>
</tr>
<tr>
<td>series</td>
<td>a circuit that has only one path for the electric current to follow</td>
</tr>
<tr>
<td>Ohm’s law</td>
<td>power = current ( \times ) voltage</td>
</tr>
<tr>
<td>parallel</td>
<td>a circuit that has more than one path for the electric current to follow</td>
</tr>
<tr>
<td>watt</td>
<td>voltage = current ( \times ) resistance ( \text{kW} )</td>
</tr>
<tr>
<td>( P = I \times V )</td>
<td>parallel circuit ( V = I \times R )</td>
</tr>
</tbody>
</table>

### Important Facts About Electric Circuits

1. There is a relationship among voltage, current, and resistance in an electric circuit.
   a. Name of law: [Blank]
   b. Expression of law: [Blank]
   c. Equation: [Blank]

2. There are two types of electric circuits.
   a. Two types of circuits: (1) [Blank] (2) [Blank]
   b. Definitions of these circuits: (1) [Blank] (2) [Blank]

3. The electrical power of a circuit can be measured.
   a. Definition of electrical power: [Blank]
   b. Unit of electrical power: (1) Name: [Blank] (2) Abbreviation: [Blank] (3) Term for 1000 units: [Blank] (4) Abbreviation for 1000 units: [Blank]
   c. Determining the electrical power of a circuit: (1) Expression: [Blank] (2) Formula: [Blank]
What is magnetism?

**Directions:** You have two bar magnets. Describe or draw different arrangements of the two magnets to make the magnets behave as described.

<table>
<thead>
<tr>
<th>What the magnets will do</th>
<th>Diagram or Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. repel, end on</td>
<td>1.</td>
</tr>
<tr>
<td>2. attract, end on</td>
<td>3.</td>
</tr>
<tr>
<td>3. attract, side by side</td>
<td>5.</td>
</tr>
<tr>
<td>4. repel, side by side</td>
<td>6.</td>
</tr>
</tbody>
</table>

**Directions:** Use the words from the word bank to fill in the blanks in the summary paragraph below.

- away
- magnets
- rocks
- toward
- charged
- iron
- north
- south
- domains
- magnetosphere
- outer
- stronger

Magnetic field lines begin at a magnet’s (7)____________________ pole and end at the (8)____________________ pole. Field lines that curve (9)____________________ each other show attraction. Field lines that curve (10)____________________ from each other show repulsion. When the field is (11)____________________, the lines will be closer together.

The atoms of magnetic materials behave like tiny (12)____________________. Magnetic materials such as (13)____________________ contain groups of atoms called magnetic (14)____________________ in which the magnetic fields of the atoms in the group point in the same direction. Earth is surrounded by a magnetic field that is thought to be produced by the movement of molten iron in Earth’s (15)____________________ core. Earth’s magnetic field affects a region of space called the (16)____________________ that deflects most of the (17)____________________ particles that come from the Sun. The magnetism of some ancient (18)____________________ contains a record of the direction of Earth’s magnetic field and how it has changed over time.
Electricity and Magnetism

Directions: Use the figures below to answer questions 1 through 5.

1. In figure A, when electrons move in the coiled wire what is produced?

2. In figure A, if you changed the direction of electron flow by switching the connections to the battery, what would happen?

3. In figure A, if an iron bar were inserted into the wire coil, what would happen to the iron bar?

4. Suppose you wrapped an iron bar with wire and connected the ends of the wire to a battery. What is this device called? What would happen to this device if you disconnected the battery?

5. In figure B, if you repeatedly moved a bar magnet in and out of the wire coil, what would be produced? What is this process called?

Directions: Answer the following questions on the lines provided.

6. What is the function of an electric motor in terms of electric power and motion?

7. Briefly explain how an electric motor works.

8. What is the function of an electric generator in terms of electric power and motion?

9. Briefly explain how an electric generator works.
**Directions:** Fill in the summary chart below with information from the chapter.

<table>
<thead>
<tr>
<th>Type of Signal</th>
<th>Analog</th>
<th>Digital</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Description of signal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Example of signal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Devices that use that type of signal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Directions:** List four things that information from an electronic signal can be used to produce.

4. ____________________________________________________________

**Directions:** Unscramble the words to complete the section summary statements.

A changing electric current that carries information is called an (5)________________________ (cnoirtlee ainslg).

You could make a digital signal by measuring the temperature every (6)________________________ (uroh) and making a graph with the results. Another way would be to (7)________________________ (alemsp) an analog signal at intervals.

Old televisions used (8)________________________ (umcavu) tubes. They were (9)________________________ (lubyk), used a lot of electrical (10)________________________ (wrope), and created a lot of (11)________________________ (athe).

Modern electronic devices use (12)________________________ (omoissueudtrn), which may be n-type or p-type. A (13)________________________ (oddie) is a device that only allows current to flow in one direction. A (14)________________________ (anssorrtti) is a device that can be used to amplify signals or as an electronic switch.
Computers

Directions: Answer the following questions on the lines provided.

1. What is a computer?

2. Name three places not mentioned in the text where you could find computers.

Directions: Fill in the blanks with the term that best completes each statement.

3. Computers store information as ____________________ information.

4. 0 and 1 are the digits in the ____________________ system.

5. Each 0 or 1 is called a ____________________ and eight of these make one ____________________.

6. Each position in a binary number is based on a(n) ____________________ of 2.

7. Our everyday number system is based on ____________________, the binary system is based on 2.

8. The binary number 1011 is ____________________ in the base 10 system.

9. In a computer, the digits 0 and 1 represent switch positions of ____________________ and ____________________.

10. A computer’s temporary memory is called ____________________ or ____________________.

11. The material stored in RAM will be ____________________ when the computer is turned off.

12. Information that tells a computer how to operate is stored in ____________________ or ____________________.

13. A microprocessor is also called a (n) ____________________.

14. A ____________________ is a list of instructions that tells a computer what to do.

15. Computer hardware consists of ____________________, ____________________, ____________________, and a central processing unit.

16. Information on a hard disk or on a floppy disk is stored ____________________.

17. The Internet is a collection of linked ____________________.