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8

McGraw-Hill Education

Advanced Science Program

United Arab Emirates Edition

Activity Lab Manual

Mc Graw Hill Education

Answer Key

McGraw-Hill Education

Advanced Science Program

United Arab Emirates Edition

GRADE 8 • VOLUME 2

Activity Lab Manual

Mc Graw Hill Education

Brief Contents

Name _____ Date _____

Electricity

How do electric circuits transform energy in electric devices?

Before You Read

Before you read the chapter, think about what you know about electricity. Record your ideas in the fir column. Pair with a partner, and discuss his or her thoughts. Write those ideas in the second column. Th record what you both would like to share with the class in the third column.

Think	Pair	Share

Chapter Vocabulary

Lesson 1	Lesson 2	Lesson 3
NEW static charge insulator conductor polarized electric discharge grounding	**NEW** electric current electric circuit electrical resistance voltage Ohm's law	**NEW** series circuit parallel circuit **ACADEMIC** device

A Lesson Content Vocabulary page for each lesson is provided in the Chapter Resources Files.

Lesson 1 Electric Charge and Electric Forces

Skim *Lesson 1 in your book. Read the headings and look at the photos and illustrations. Identify three things you want to learn more about as you read the lesson. Record your ideas in your Science Journal.*

Main Idea

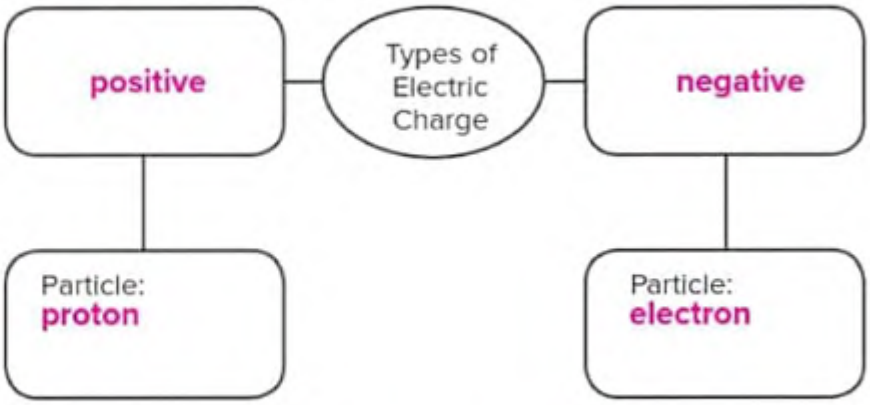
Electric Charges

Details

Classify *atomic particles.*

Have Electric Charge	Have No Electric Charge
· protons · electrons	· neutrons

Differentiate *types of electric charge.*



Explain *how objects develop a* static charge.

Loosely-held electrons move from one object to another, forming an unbalanced charge on the objects.

Electric Forces

Point out *the effects of electric force applied by the electric field of a charged object.*

Charged objects attract when the electric force pulls the objects together.	Charged objects repel when the electric force pushes the objects apart.

Main Idea

Details

Relate *factors to the strength of electric force between charged objects.*

Cause	Effect
The negative charge on a hairbrush and the positive charge of hair both increase.	The force of attraction between them increases.
The distance between a negatively charged brush and positively charged hair increases.	The force of attraction between them decreases.

Transferring Electrons

Distinguish insulators *and* conductors.

Sample examples and uses are shown.

Insulator	Conductor
Definition: a material through which electrons cannot easily move	Definition: a material through which electrons can easily move
Examples: glass, rubber, wood, air	Examples: most metals, such as copper and aluminum
Common use: plastic and rubber coating on an extension cord	Common use: copper wire in an extension cord

Describe *a* polarized *object.*

an object with electrons concentrated at one end

Main Idea

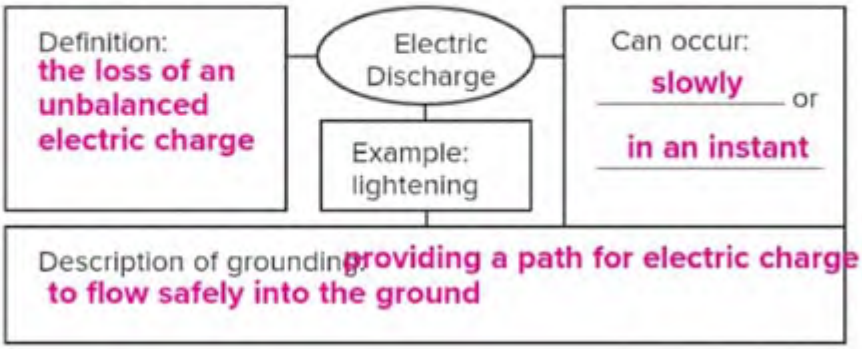
Details

Evaluate *ways that materials transfer charge. Circle the way in which* insulators *can be charged.*

Method	Description
Contact	When objects touch, loosely held electrons collect on the object that holds electrons more tightly.
Induction	Two conducting objects are polarized as if they are one object when they touch.
Conduction	Conducting objects with unequal charge touch; electrons flow from the more negatively charged object to the more positively charged object.

Electric Discharge

Organize *information about* electric discharge.



Paraphrase *three lightening safety tips.*

Sample answers are shown.

1. Seek shelter.
2. Do not touch metal.
3. Avoid water.

Synthesize It Summarize how the behaviors of electric charges produce lightening.

Accept all reasonable responses. Sample answer: Currents in a storm cloud cause positive charge to collect at the top of the cloud and negative charge to collect at the bottom. Negative charge at the bottom of the cloud repels negative charge in the ground and induces a positive charge there. Accumulated negative charge in the cloud discharges to the nearby positively charged ground.

Lesson 2 Electric Current and Simple Circuits

Scan *Lesson 2. Read the lesson titles and bold words. Look at the pictures. Identify three facts you discovered about electric current and simple circuits. Record your facts in your Science Journal.*

Main Idea

Electric Current and Electric Circuits

Details

Contrast *three terms associated with electrons and the movement of electrons.*

Term	Description
Electric charge	produced by unbalanced numbers of protons and electrons in the atoms that make up an object
Electric current	the movement of electrically charged particles
Electric circuit	a closed, or complete, path in which an electric current travels

Differentiate *units for measuring* electric current.

Coulomb	Ampere
six quintillion electrons	about one coulomb of electrons flowing past a point in a circuit in one second

What is electrical resistance?

Characterize *the ohm.*

Unit for **electrical resistance**

Ohm

Symbol: **the Greek letter Ω (omega)**

Definition **a measure of how difficult it is for an electric current to flow in an object**

Main Idea

Details

Classify *the* electrical resistance *of objects.*

Conductors	Insulators
low electrical resistance	high electrical resistance

Relate *length and thickness of a material to* electrical resistance.

Greater thickness → less resistance

Greater length → more resistance

What is voltage?

Distinguish *current,* electrical resistance, *and* voltage.

Current	Resistance	Voltage
the movement of electrically charged particles	how difficult it is for electron current to flow	the amount of energy a source uses to move one coulomb of electrons through a circuit

Ohm's Law

Identify *the components of the* Ohm's law *equation.*

voltage = current × resistance

Unit: volt	Unit: ampere	Unit: ohm

Express *the relationship between* electrical resistance *and* voltage *in electrical devices.*

A device with more resistance transforms more energy and has a higher voltage.

Connect It Rephrase this sentence using everyday language: "Complete the circuit so that electric current from the energy source (the nearest power plant) can flow through the device and be transformed into light energy where the resistance increases the voltage (the light bulb)."

Accept all reasonable responses. Sample answer: Plug in the lamp and turn it on so that it lights up.

Lesson 3 Describing Circuits

Predict *three facts that will be discussed in Lesson 3 after reading the headings. Record your predictions in your Science Journal.*

Main Idea

Parts of an Electric Circuit

Details

Identify *the parts of a battery. Specify the two parts that are electrically charged.*

Express *roles of the basic parts of an electric circuit.*

Energy source	causes electrons to flow in the circuit
Electric device	transforms flowing electric current into other forms of energy
Wires	connect energy source and electrical device(s) in a complete circuit

Series and Parallel Circuits

Compare and contrast *the definitions of* series circuit *and* parallel circuit.

Series	Both	Parallel
one closed path	electrical circuit for electric current to follow	more than one path, or branch

Main Idea

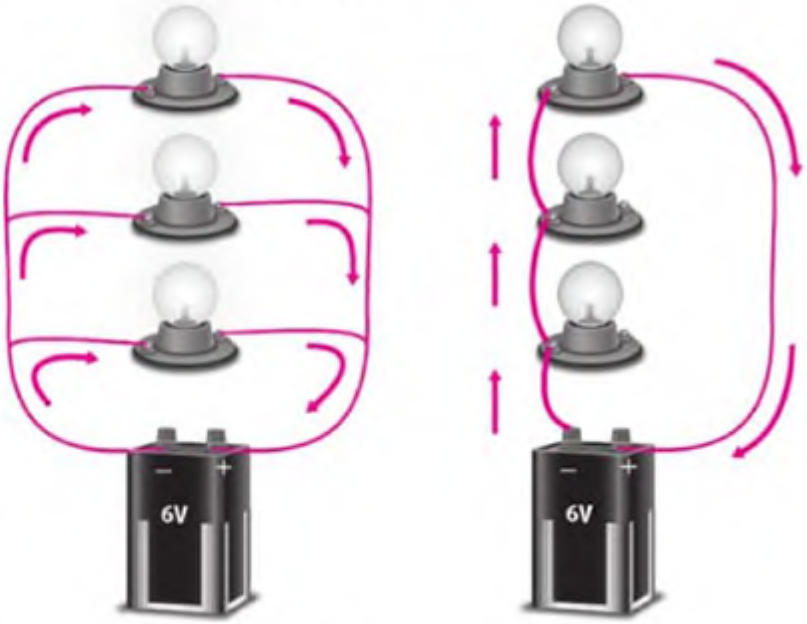
Accept all reasonable responses. A sample answer is shown.

Details

Evaluate *whether you would rather decorate with a strand of lights wired in series or in parallel, and why.*

I would rather use lights wired in parallel so that the whole strand does not go out if one bulb burns out or is missing.

Model *the 2 types of circuits.*



Parallel Circuit Series Circuit

1. Draw wires to complete each type of circuit.
2. Draw arrows to show the flow of electric current.
3. Explain what happens if you make one opening...
   - **A.** in the parallel circuit on either side of the top bulb;

     The top bulb goes out, but the middle and bottom bulbs remain lit.
   - **B.** in the parallel circuit at the source of electric charge on either side;

     All of the bulbs go out.
   - **C.** anywhere in the series circuit. Show this above.

     All of the bulbs go out. (Students should erase a section of the wire they drew on the series circuit.)

Main Idea

Electric Circuits in the Home

Details

Describe *parts of home electrical circuits.*

Part	Description
Power plant	where electric energy is generated, sometimes many kilometers from the home
Transmission cables	carry electric energy from the power plant
Main wire	carries electric energy from the transmission wire into the home
Electric meter	measures the electric energy used in the circuits of the home
Main panel with circuit breakers or fuses	automatically opens a circuit when the current is too high to prevent fire

Electric Safety

Explain *what causes an electric shock.*

Current passes through the human body, which is mostly water and a good conductor.

Record *three ways to protect yourself from electric shock.*

Sample answers are shown. Students might provide others.

1. Never use devices with damaged cords.
2. Stay away from water with plugged-in electric devices.
3. Avoid using extension cords.

Connect It Why would you not want the electric current in your home to flow through on big series circuit nor one giant parallel circuit?

Accept all reasonable responses. Sample answer: I wouldn't want it to be a series circuit because devices on the circuit would only work when *all* devices on the circuit were connected and working at the same time. I wouldn't want a single parallel circuit because all of the home's devices plugged into one parallel circuit would overload it with too much current.

Review

Electricity

Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned.

Use this checklist to help you study.

- ❑ Complete your Foldables® Chapter Project.
- ❑ Study your *Science Notebook* on this chapter.
- ❑ Study the definitions of vocabulary words.
- ❑ Reread the chapter, and review the charts, graphs, and illustrations.
- ❑ Review the Understanding Key Concepts at the end of each lesson.
- ❑ Look over the Chapter Review at the end of the chapter.

THE BIG IDEA

Summarize It Reread the chapter Big Idea and the lesson Key Concepts. Describe the path of an electron from the electric power plant that supplies your home, through the production of light from a bulb in your bedroom.

Accept all reasonable responses. Sample answer: The electron flows with the current from the power plant, through transmission wires and transformers, to the main wire that enters my home. It moves into one of my house's parallel circuits and travels through a circuit breaker in the main panel. In the parallel circuit that includes my bedroom, it enters the branch of the circuit made by the light on my nightstand being plugged into the wall socket. The electron flows into the light's cord, and through the light bulb, where the resistance in the filament causes it to collide with the atoms in the filament wire. This increase in kinetic energy of the atoms transforms into thermal and light energy. Then the electron continues with the flow of current out of the bulb, back out through the lamp wire, and back into the parallel circuit in the home that includes my bedroom.

Challenge *Do research to learn about how compact fluorescent light bulbs work differently from traditional incandescent light bulbs. Design a poster that compares and contrasts the two. Display your poster in your class.*

tricity

Name _____ Date _____

Thermal Energy

How can thermal energy be used?

Before You Read

Before you read the chapter, think about what you know about thermal energy. Record your ideas in first column. Pair with a partner, and discuss his or her thoughts. Write those ideas in the second colu Then record what you both would like to share with the class in the third column.

Think	Pair	Share

Chapter Vocabulary

Lesson 1	Lesson 2	Lesson 3
NEW thermal energy temperature heat **REVIEW** kinetic energy potential energy	**NEW** radiation conduction thermal conductor thermal insulator specific heat thermal expansion thermal contraction convection convection current	**NEW** heating appliance thermostat refrigerator heat engine

Lesson 1 Thermal Energy, Temperature, and Heat

Predict *three facts that will be discussed in Lesson 1 after reading the headings. Record your predictions in your Science Journal.*

Main Idea	Details
Kinetic and Potential Energy	**Relate** *descriptions of energy.*

	Kinetic Energy	Potential Energy
Mechanical energy	the energy an object or particle has because it is moving	stored energy (due to the interaction between two objects)

What is Thermal Energy?

Characterize thermal energy, *and explain why matter has it.*

kinetic energy of particles

potential energy of particles

→ thermal energy of material

Explanation: All particles within matter are in motion (kinetic energy), and they interact with one another (potential energy).

What is temperature?

Explain *how kinetic energy of the particles relates to differences in* temperature *represented by the pictures.*

A B

The particles in B are moving faster than the particles in A. Because the particles in B are moving faster, they have more kinetic energy. The higher average kinetic energy means B represents a higher temperature.

Main Idea

Details

Assess *the difference between* thermal energy *and* temperature.

Thermal energy is the sum of kinetic and potential energy of particles in a material; temperature is a measure of the average kinetic energy only.

What is heat?

Evaluate *the difference between* heat *and* thermal energy.

All objects have thermal energy, but the energy must transfer from one object to another to be considered heat.

Relate temperature *of objects to rate of* heat *transfer.*

Temperature Difference Between Objects	Rate Heating Occurs
greater	faster
lesser	slower

Analyze It Describe a hot summer day using the vocabulary terms and Key Concepts fr this lesson.

Accept all reasonable responses. Sample answer: The temperature of the air is high, whi means that the air has greater average kinetic energy than air does when it feels cooler outside. The temperature rises in the house as the day goes on and the warmer outside heats (transfers thermal energy to) the cooler air in the house.

Lesson 2 Thermal Energy Transfers

Scan *Lesson 2. Read the lesson titles and bold words. Look at the pictures. Identify three facts you discovered about thermal energy transfers. Record your facts in your Science Journal.*

Main Idea

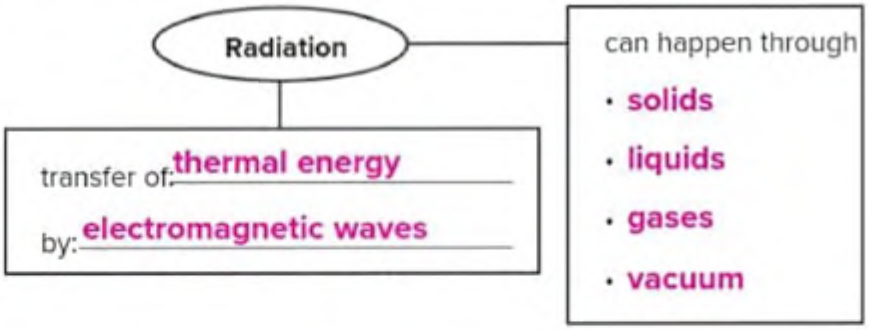
How is thermal energy transferred?

Radiation

Identify *3 ways thermal energy is transferred.*

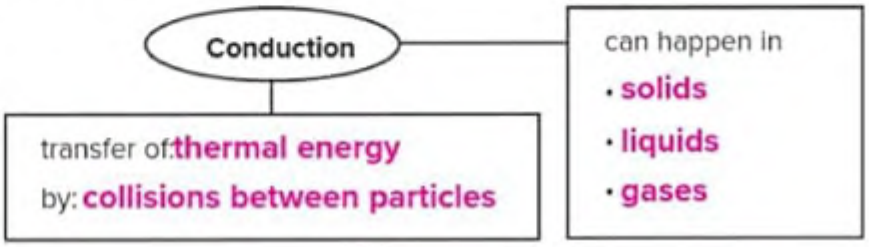
1. radiation
2. conduction
3. convection

Characterize radiation.



Conduction

Describe conduction.



Contrast *the* conduction *and* specific heat *of* thermal conductors *and* thermal insulators.

	Thermal Conductor	Thermal Insulator
Ease of conduction	easy	not easy
Relative specific heat	lower	higher
Reason	electrons move easily	electrons do not move as easily

Main Idea

Details

Thermal Expansion and Contraction

Classify *characteristics of* thermal expansion *and* thermal contraction.

Thermal Expansion	Thermal Contraction
Definition: an increase in a material's volume when the temperature is increased	Definition: a decrease in a material's volume when the temperature is decreased
Effect in a hot air balloon: The air inside the balloon heats and expands. Some of the air is pushed out of the balloon, making it less dense than the surrounding air, and the balloon rises.	Effect in a hot air balloon: The air inside the balloon cools and contracts; air from outside the balloon rushes in to fill the space, the balloon's density increases, and the balloon descends.

Convection

Characterize convection.

Convection — occurs in: fluids

transfer of: thermal energy

by: movement of particles from one part of a material to another

Explain *atmospheric* convection currents.

warmer, less dense air heat surrounding air

becomes more dense and sinks

cooler, denser air absorbs thermal energy

becomes less dense and rises

Analyze It Explain how all three processes that transfer thermal energy occur as you he soup on a stove.

Accept all reasonable responses. Sample answer: The burner heats the pan through conduction; convection currents transfer thermal energy throughout the fluid of the soup and I can feel the heat through radiation when I place my hand near the pan.

Lesson 3 Using Thermal Energy

Skim *Lesson 3 in your book. Read the headings and look at the photos and illustrations. Identify three things you want to learn more about as you read the lesson. Record your ideas in your Science Journal.*

Main Idea

Thermal Energy Transformations

Heating Appliances

Sample examples are shown.

Thermostats

Details

Complete *the concept of thermal energy transformation.*

Thermal energy can convert to **other forms of energy**.

Devices that **convert energy** can perform many useful tasks.

Other forms of energy can convert to **thermal energy**.

Characterize heating appliances.

Heating Appliances

convert: **electric energy**
to: **thermal energy**

Examples
- **curling iron**
- **coffee maker**
- **clothes iron**

Sequence *concepts and steps in the function of a* thermostat *in a home heating system.*

1. The thermostat contains a **bimetallic coil**.
2. The two types of metal **expand and contract** differently during **temperature changes**.
3. Warm air in the room causes the coil to **uncurl slightly**,
4. which **moves a switch** that **turns the furnace off**.

Main Idea

Refrigerators

Details

Describe *the transfers of thermal energy that occur in the function of a* refrigerator.

Step in the Process	Effect on Thermal Energy
Mechanical energy in the compressor compresses the coolant.	Compression increases the thermal energy of the coolant.
Thermal energy of the coolant is greater than the surrounding air.	Thermal energy moves from the coolant to the air.
Coolant becomes a liquid.	Coolant loses thermal energy.
Expander changes coolant from liquid to gas.	Gas has less thermal energy, becomes colder.
Cold gas passes through pipes in the refrigerator compartment.	Coolant gas absorbs thermal energy from the refrigerator interior.
The gas becomes warmer.	The food becomes cooler.
Warmed gas passes through compressor.	

Heat Engines

Order *the energy conversions in the* heat engine *of a car.*

Chemical energy from fuel → converts to **thermal energy** during combustion. → About **20** % converted to **mechanical energy**

Synthesize It Identify one device in or near your home that converts chemical energy thermal energy, one device that converts electric energy to thermal energy, and one device th converts thermal energy to mechanical energy.

Accept all reasonable responses. Sample answer: The toaster converts electric energy to thermal energy. The gas stove converts chemical energy to thermal energy. The refrigerator thermostat converts thermal energy to mechanical energy.

Review

Thermal Energy

Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned.

Use this checklist to help you study.

- ❑ Study your *Activity Lab Manual* on this chapter.
- ❑ Study the definitions of vocabulary words.
- ❑ Reread the chapter, and review the charts, graphs, and illustrations.
- ❑ Review the Understanding Key Concepts at the end of each lesson.
- ❑ Look over the Chapter Review at the end of the chapter.

THE BIG IDEA

Summarize It Reread the chapter Big Idea and the lesson Key Concepts. Model what you have learned by drawing and labeling a diagram of a device that works because of its transfer and conversion of thermal energy.

Accept all reasonable responses. Student drawing should represent a device that functions based on the behavior of thermal energy between materials. Labels should indicate whether the transfer of energy occurs by radiation, conduction, or convection; they should describe the conversion of thermal energy into or from other forms of energy.

Challenge *Do an inventory of all of the useful devices in your home. Make a large chart that shows the thermal energy conversions that occur during the use of each device. Hint: Be sure not to overlook very simple devices. When you rub a pencil on paper to write a line, does a change in kinetic or thermal energy occur?*

Name_____ Date_____

States of Matter

What physical changes and energy changes occur as matter goes from one state to another?

Before You Read

Before you read the chapter, think about what you know about states of matter. Record three things that y already know about matter in the first column. Then write three things that you would like to learn abo changes in matter in the second column. Complete the final column of the chart when you have finish this chapter.

K What I Know	W What I Want to Learn	L What I Learned

Chapter Vocabulary

Lesson 1	Lesson 2	Lesson 3
NEW solid liquid viscosity surface tension gas vapor **REVIEW** matter	**NEW** kinetic energy temperature thermal energy vaporization evaporation condensation sublimation deposition	**NEW** kinetic molecular theory pressure Boyle's Law Charles's Law **ACADEMIC** theory

Lesson 1 Solids, Liquids, and Gases

Scan *Lesson 1. Read the lesson titles and bold words. Look at the pictures. Identify three facts you discovered about matter. Record your facts in your Science Journal.*

Main Idea

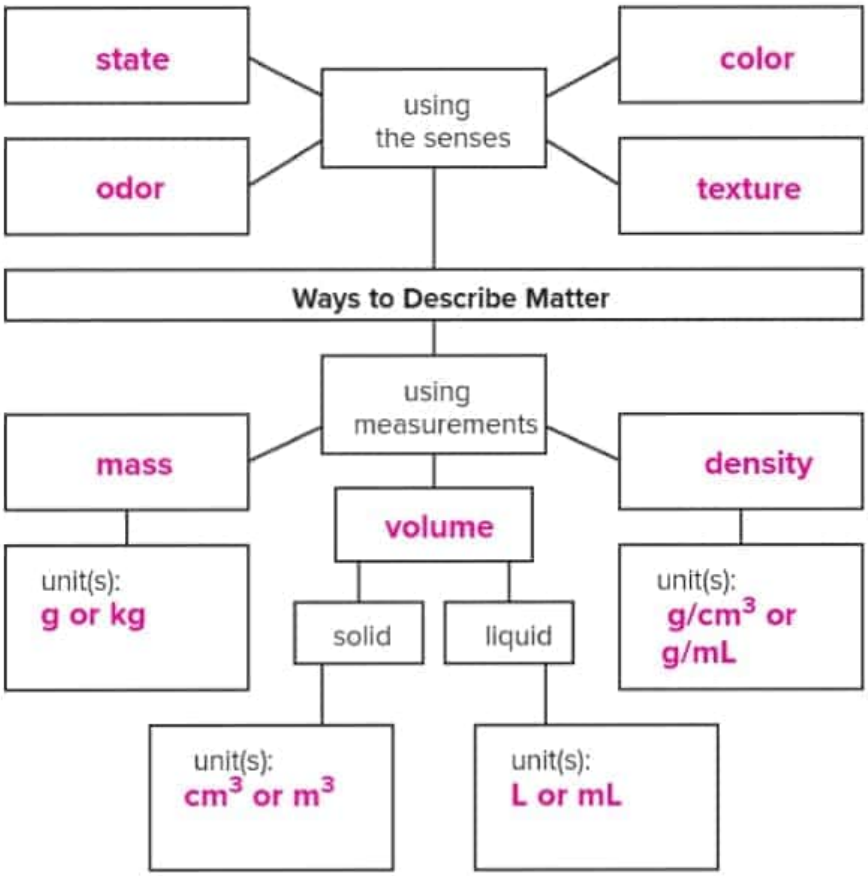
Describing Matter

Details

Recall *the states of matter.*

1. solid
2. gas
3. liquid
4. plasma

Characterize *ways to describe matter.*



Identify *two factors that determine the state of matter.*

1. particle motion
2. particle forces

Explain *the free motion of particles.*

If particles are free to move, they move in a straight line until they collide with something.

Main Idea

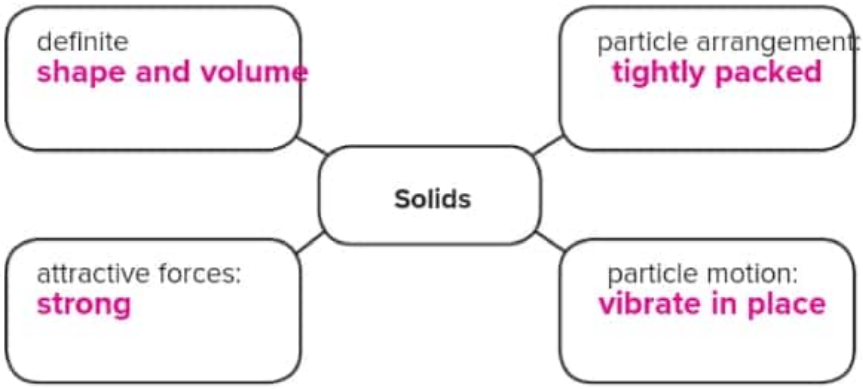
Details

Relate *particle motion to the distance between particles.*

Particle Speed	slow	faster	fastest
Strength of attractive forces	strong	weaker	very weak
Space between particles	tight	increased	spread out
Particle motion	vibrate in place	slide past one another	move randomly

Solids

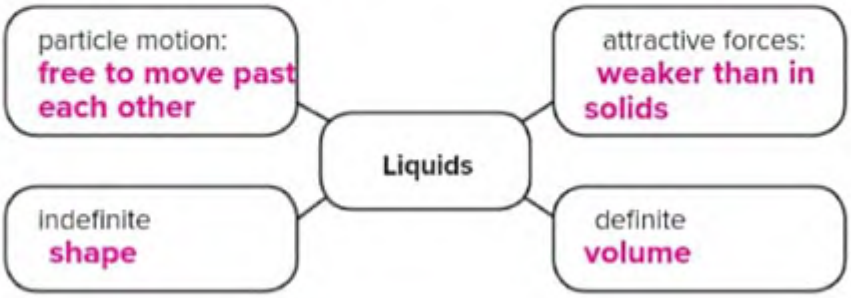
Characterize solids.



Differentiate *crystalline* solids *from amorphous* solids.

Crystalline Solids	Amorphous Solids
Particle arrangement: specific repeating order	Particle arrangement: random
Example property: very hard material	Example property: brittle

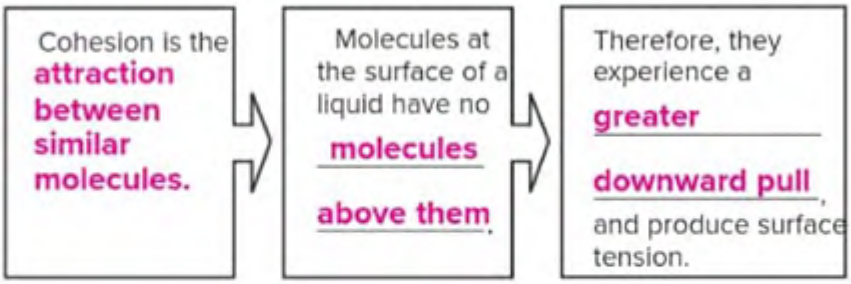
Main Idea	Details
Liquids	**Characterize** liquids.



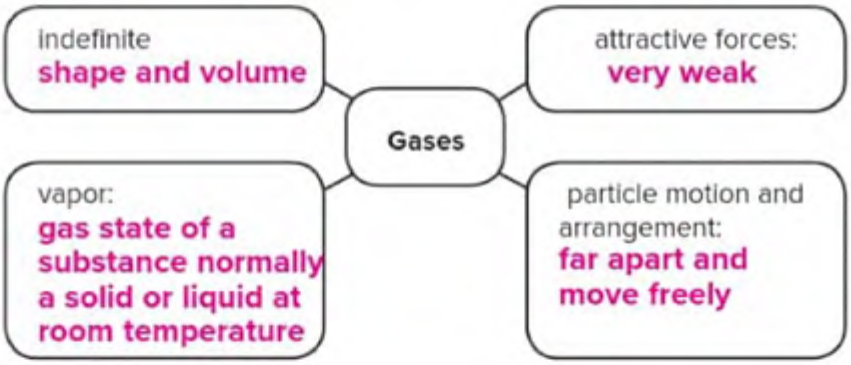
Define viscosity.

measurement of a liquid's resistance to flow

Relate *cohesion to* surface tension.



Gases	**Describe** gases.



Analyze It Hypothesize what would happen if the attractive forces between all of the particles of matter on Earth were equal.

Accept all reasonable responses. Sample answer: There would only be one state of matter at any given time. If all particles of matter had strong attractive forces, everything would be solid; if all particles had weaker attractive forces, everything might be liquid or gas.

Lesson 2 Changes in State

Predict *three facts that will be discussed in Lesson 2 after reading the headings. Write your facts in your Science Journal.*

Main Idea

Kinetic and Potential Energy

Details

Relate kinetic energy *and* temperature *to particle motion. Draw arrows to show correlating increase or decrease.*

Particle Motion	Kinetic Energy of Particles	Temperature
↑	↑	↑

Contrast *the potential energy of particles.*

Particles farther apart	Particles closer together
more potential energy	less potential energy

Thermal Energy

Detail *changes in* thermal energy.

Add thermal energy	particles move **faster**	increased **kinetic energy**
	particles get **farther apart**	increased **potential energy**
Remove thermal energy	particles move **slower**	**decreased** kinetic energy
	particles get **closer together**	**decreased** potential energy

Compare thermal energy *with* temperature.

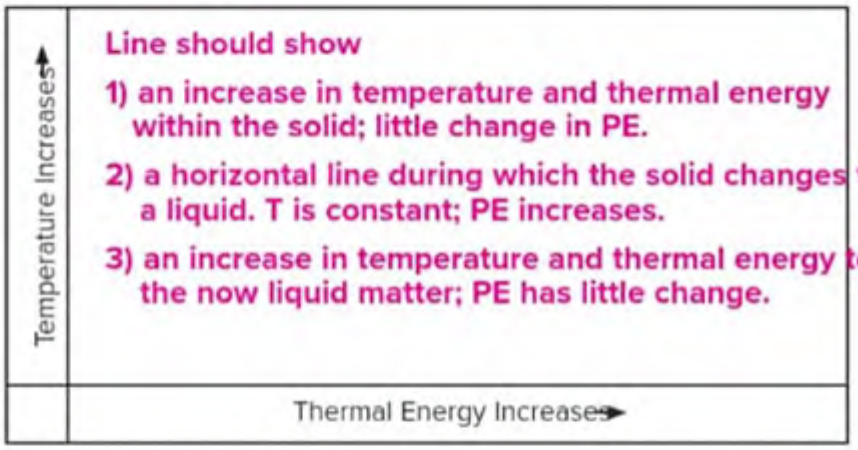
Thermal energy is the total kinetic and potential energy of an object; temperature is the average of the kinetic energy only.

Main Idea

Details

Solid to Liquid or Liquid to Solid

Model *the process of melting. Draw a line to indicate the* thermal energy *versus* temperature *changes as a solid changes to a liquid. Label the line to indicate the changes in* temperature *(T) and potential energy (PE).*



Line should show

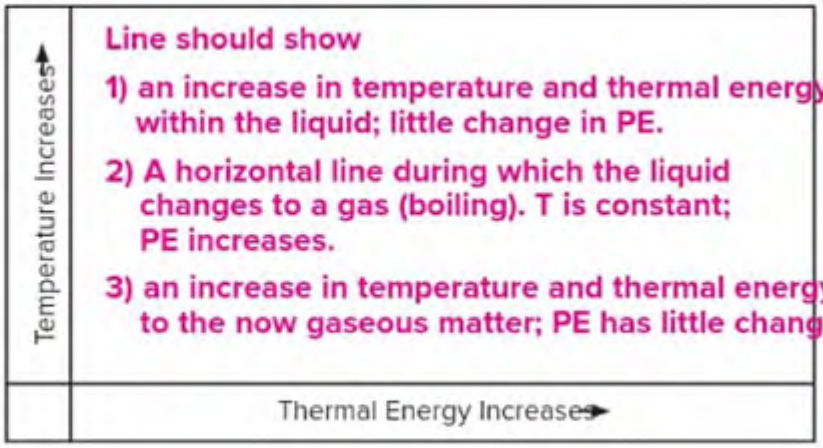
1) an increase in temperature and thermal energy within the solid; little change in PE.
2) a horizontal line during which the solid changes to a liquid. T is constant; PE increases.
3) an increase in temperature and thermal energy to the now liquid matter; PE has little change.

Contrast *freezing with melting.*

Freezing is the process of matter changing from liquid to solid; melting is the process of matter changing from solid to liquid. The temperature and thermal energy changes that occur during freezing are opposite those during melting.

Liquid to Gas or Gas to Liquid

Represent *the process of boiling. Draw a line to indicate the* thermal energy *versus* temperature *changes as a liquid changes to a gas. Label the line to indicate the changes in* temperature *(T) and potential energy (PE).*



Line should show

1) an increase in temperature and thermal energy within the liquid; little change in PE.
2) A horizontal line during which the liquid changes to a gas (boiling). T is constant; PE increases.
3) an increase in temperature and thermal energy to the now gaseous matter; PE has little change.

Main Idea

Details

Differentiate *terms associated with changes of state.*

Term	Description
Vaporization	change in state of a liquid into a gas
Evaporation	vaporization that occurs on the surface of a liquid
Boiling	vaporization that occurs within a liquid
Condensation	change in state of a gas into a liquid

Solid to Gas or Gas to Solid

Compare sublimation *with* deposition.

Both are changes between solid and gaseous states without passing through the liquid state.

States of Water

Characterize *water.*

Melting point: 0° C Boiling point: 100° C

Unique because: It exists as a solid, liquid, and gas within Earth's temperature range.

Conservation of Mass and Energy

Restate *concepts of conservation of mass and energy.*

Mass: Matter changes state, but the total amount of the matter remains the same.

Energy: Thermal energy is sometimes absorbed by surrounding matter, but the total energy is conserved.

Connect It Suppose that you want to compare the mass of a block of ice to its mass liquid water. You mass the ice, and then you mass a pan. You put the ice in the pan and pla it over high heat. What will you find if you measure the mass of the water after it has be boiling for several minutes?

Accept all reasonable responses. Sample answer: After the water has been boiling for a while, its mass will be less than the mass of the ice. Some of the water will have left the pan as water vapor.

Lesson 3 The Behavior of Gases

Skim *Lesson 3 in your book. Read the headings and look at the photos and illustrations. Identify three things you want to learn more about as you read the lesson. Record your ideas in your Science Journal.*

Main Idea

Understanding Gas Behavior

What is pressure?

Pressure and Volume

Boyle's Law

Details

Paraphrase *the basic ideas in* kinetic molecular theory.

1. Small particles make up all matter.
2. Particles are in constant, random motion.
3. Particles collide with other particles, other objects, and the walls of their container.
4. When particles collide, no energy is lost.

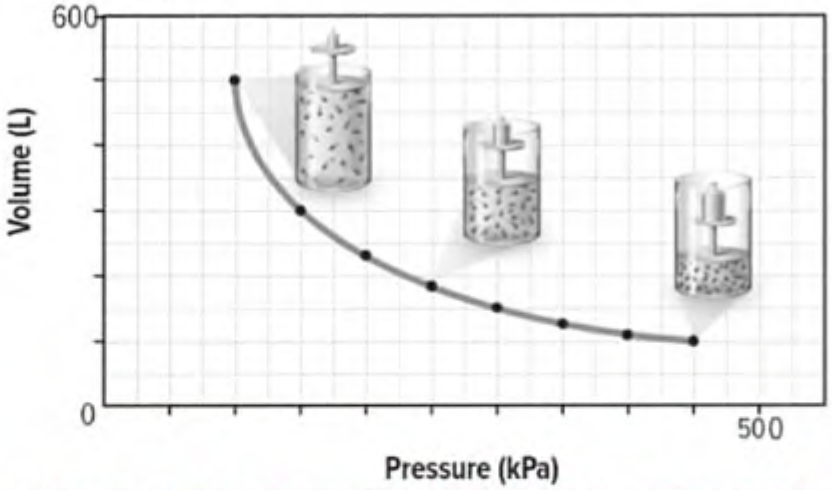
Describe pressure.

the amount of force applied per unit of area

Relate *volume to* pressure *of a gas at a constant temperature.*

Greater volume →	less pressure
Less volume →	more pressure

Explain *the principle represented by the graph if the gas is at a constant temperature.*



Boyle's Law—As volume increases, pressure decreases; as volume decreases, pressure increases.

Main Idea

Details

Restate Boyle's Law.

Pressure of a gas increases if the volume decreases, and pressure of a gas decreases if the volume increases, when temperature is constant.

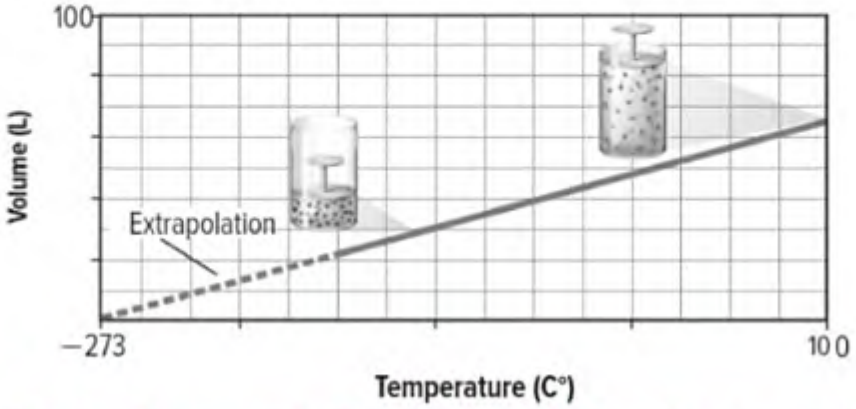
Temperature and Volume

Relate *temperature to volume of gas.*

higher temperature →	more volume
lower temperature →	less volume

Charles's Law

Paraphrase *the principle represented by the graph if the gas is at a constant* pressure.



The graph represents Charles's Law. Volume increases with increasing temperature; volume decreases with decreasing temperature.

Analyze It Explain the design of the type of gas container shown in the illustrations and graphs in Lesson 3.

Accept all reasonable responses. Sample answer: The container is enclosed so that the gas being measured does not escape into the air. It has a plunger top, which is pushed upward by the pressure of the gas to indicate the volume the gas occupies in the container. The container is often shown with a weight sitting on top of the plunger to measure the pressure of the gas.

Review States of Matter

Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned. Complete the final column in the chart on the first page of this chapter.

Use this checklist to help you study.

- ❑ Study your *Activity Lab Manual* on this chapter.
- ❑ Study the definitions of vocabulary words.
- ❑ Reread the chapter, and review the charts, graphs, and illustrations.
- ❑ Review the Understanding Key Concepts at the end of each lesson.
- ❑ Look over the Chapter Review at the end of the chapter.

Summarize It Reread the chapter Big Idea and the lesson Key Concepts. Why do you think the chapter includes an entire lesson, Lesson 3, about the behavior of gases, but does not include whole lessons about the behavior of solids and liquids? Write a paragraph with examples about water to explain your answer.

Accept all reasonable responses. Sample answer: The behavior of gases is affected by more variables than the behavior solids or liquids is. Solids and liquids both have a definite volume. The volume of a gas can only be measured in a closed container, and that measurement is only constant if the temperature and pressure of the gas remain constant. In contrast, a liter of liquid water is still a liter of water whether it is warm or cold; a gram of ice is a gram of ice, regardless of its shape.

Challenge *Do research to determine a type of matter other than water that people use in a gaseous, liquid, and solid state. Write a summary report about the substance and its properties and behaviors in all three states. Read your report to your class.*

Name _____ Date _____

Elements and Chemical Bonds

How do elements join together to form chemical compounds?

Before You Read

Before you read the chapter, think about what you know about elements and chemical bonds. Rec your thoughts in the first column. Pair with a partner, and discuss his or her thoughts. Write th thoughts in the second column. Then record what you both would like to share with the class in third column.

Think	Pair	Share

Chapter Vocabulary

Lesson 1	Lesson 2	Lesson 3
NEW chemical bond valence electron electron dot diagram **REVIEW** compound	**NEW** chemical formula covalent bond molecule polar molecule	**NEW** ion ionic bond metallic bond **ACADEMIC** conduct

Lesson 1 Electrons and Energy Levels

Scan *Lesson 1. Record three questions you have about electrons and energy levels in your Science Journal. Try to answer your questions as you read.*

Main Idea

The Periodic Table

Details

Describe *characteristics of the periodic table.*

Characteristic	Description
Atomic number	the number of protons in an atom of the element
Atomic mass	the average mass of all of the different isotopes of the element
Period	a row of elements
Group	a column of elements
Metals	the elements arranged on the left side of the periodic table, except H
Metalloids	the elements arranged in a stair-step pattern between metals and nonmetals
Nonmetals	the elements on the right side of the periodic table, plus hydrogen

Atoms Bond

Describe compounds.

Compounds are composed of atoms of two or more elements held together by chemical bonds.

Summarize *the relationship between an electron's energy level and its location in an atom. Circle the word that makes each statement true.*

The closer to the nucleus, the (lower) / higher an electron's energy level.	The farther from the nucleus, the lower / (higher) an electron's energy level.

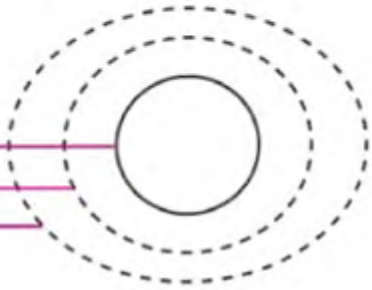
Main Idea

Drawings should show 6 "+" and 6 "n" in the center circle, 2 "–" on the inner dashed line, and 4 "–" on the outer dashed line.

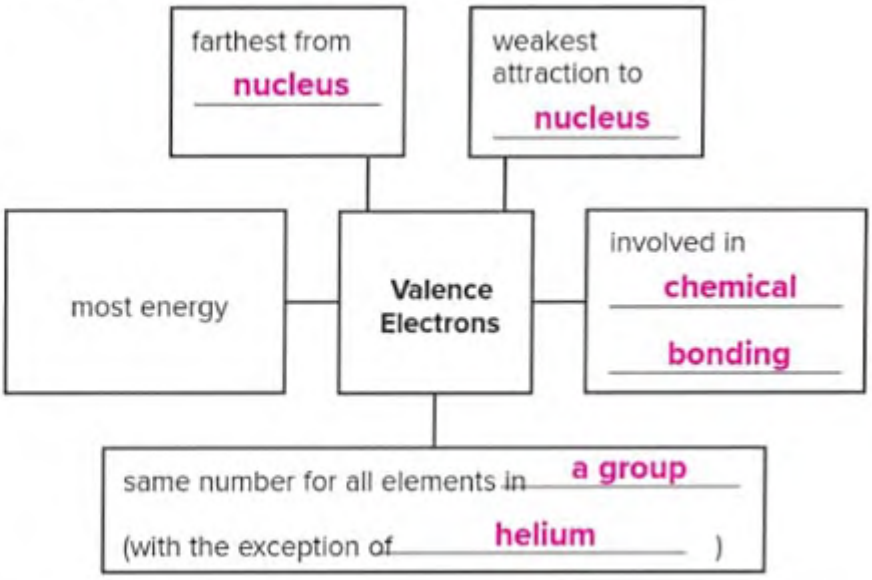
Details

Model *the structure of an atom. Use the labels listed below to indicate the location of protons, neutrons, and electrons. Draw lines from the labels to indicate the position of the nucleus, the lowest energy level, and the highest energy level.*

6 protons (label "+")
6 neutrons (label "n")
6 electrons (label "–")
nucleus
lowest energy level
highest energy level



Analyze *details about* valence electrons.



Sequence *the steps in constructing and interpreting an* electron dot diagram.

1. Identify the element's group number.
2. Identify the number of valence electrons, which is the same as the ones digit of the group number.
3. Place one dot at a time on each side of the element symbol. Pair up the dots until all are used.
4. Identify an atom as stable if all dots are paired.
5. Count the unpaired dots to determine how many bonds an unstable atom can form.

Main Idea

Details

Explain *why noble gases are stable.*

All noble gases (except helium) have eight valence electrons, so all of their valence electrons are paired.

Complete *the flowchart about the behavior of atoms with* ***unpaired*** valence electrons.

An atom has unpaired valence electrons.

↓

The atom is chemically **unstable**.

↓

The atom must **gain**, **lose**, or **share** unpaired **electrons**.

↓

The atom forms **bonds** with **other atom(s)**.

↓

When an atom's **unpaired valence electrons** become **paired**, the atom becomes **stable**.

Analyze It Use what you have learned in Lesson 1 to explain why elements are rarely found in their pure forms.

Accept all reasonable responses. Sample answer: Atoms of most elements are unstable because they have unpaired valence electrons. Therefore, they have a strong tendency to bond with other atoms and form compounds with completed electron pairs.

Lesson 2 Compounds, Chemical Formulas, and Covalent Bonds

Predict *three facts that will be discussed in Lesson 2 after reading the headings. Record your predictions in your Science Journal.*

Main Idea

From Elements

Covalent Bonds—Electron Sharing

Details

Recall *information about elements and compounds. Read each statement. If it is true, write* T *in the center column. If it is false, write* F *in the center column and rewrite the underlined words to make the statement true.*

Statement	T or F	Correction
Compounds are chemical combinations of elements.	T	
Compounds usually have the same properties as the bonds they are made from.	F	seldom, elements
Atoms form bonds by sharing physical properties.	F	valence electrons

Define covalent bond.

a chemical bond formed when two nonmetal atoms share one or more pairs of valence electrons

Describe *types of* covalent bonds.

Covalent Bond	Description of Valence Electron Sharing	Comment on the Strength of the Bond
Single	2 atoms share 1 pair of valance electrons	weakest type of covalent bond
Double	2 atoms share 2 pairs of valance electrons	stronger than single covalent bonds
Triple	2 atoms share 3 pairs of valance electrons	stronger than double covalent bonds

Main Idea

Covalent Compounds

Details

Identify *4 common properties of covalent compounds.*

1. low melting point
2. low boiling point
3. poor conductor of electricity or thermal energy
4. usually gas or liquid at room temperature

Complete *the analogy.*

Atom is to element as molecule is to compound.

Summarize *the structure of* polar molecules.

unequal sharing of electrons results in → a partial positive end and a partial negative end → polar molecule

Explain *why water is a* polar molecule.

Water molecules are polar because the negative electrons are more strongly attracted to the oxygen atom, leaving a slightly positive charge near the hydrogen atoms.

Differentiate *polar and nonpolar molecules with regard to shared electrons.*

Polar Molecules	Nonpolar Molecules
Electrons are shared unequally.	Electrons are shared equally.

Relate *the saying "like dissolves like" to the ability of compounds to dissolve one another.*

Sample answer: Polar compounds can dissolve in other polar compounds, and nonpolar compounds can dissolve in other nonpolar compounds, but polar and nonpolar compounds do not dissolve in each other.

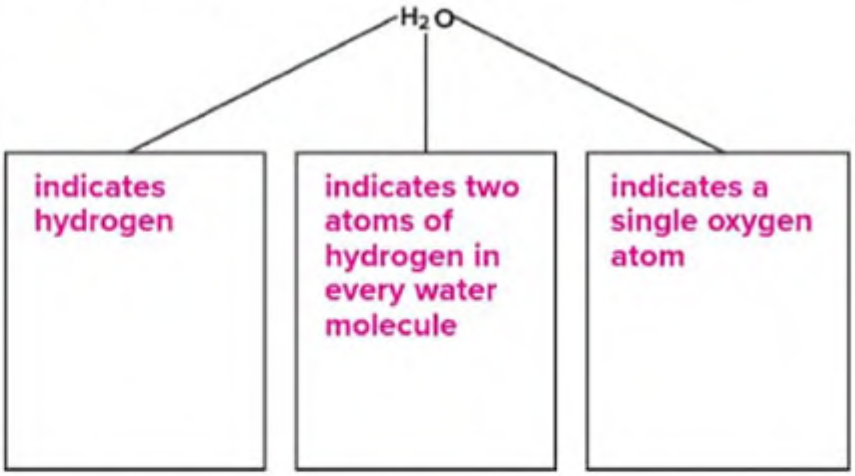
Main Idea

Details

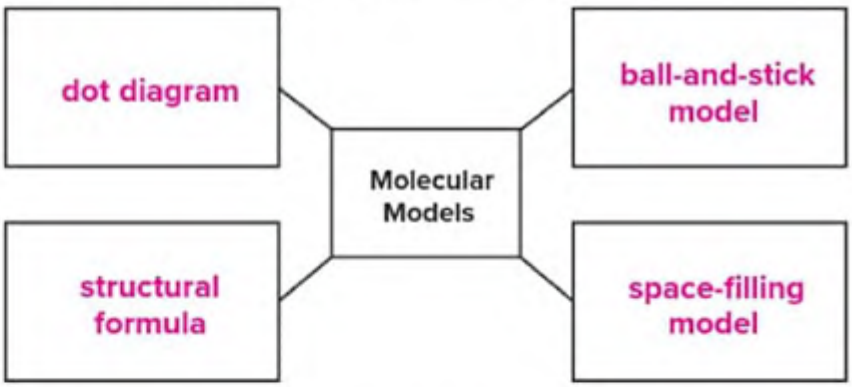
Define chemical formula.

A chemical formula is a group of symbols and numbers that represent the elements and the number of atoms of each element that compose a compound

Explain *the* chemical formula *for a* molecule *of water. Describe what each symbol represents.*



Identify *four types of molecular models.*



Connect It Explain why there are many more covalent compounds than there are pure elements.

Accept all reasonable responses. Sample answer: There are several combinations of possible ways that valence electrons can be shared, and unstable atoms have a tendency to bond in order to become more stable.

Lesson 3 Ionic and Metallic Bonds

Scan *Lesson 3. Read the lesson titles and bold words. Look at the pictures. Identify three facts you discovered about ionic and metallic bonds. Record your facts in your Science Journal.*

Main Idea

Understanding Ions

Details

Organize *information about* ions.

An atom gains an electron	→	Overall charge becomes **negative**
An atom loses an electron	→	Overall charge becomes **positive**

Analyze *what happens to sodium and chlorine atoms in the formation of the compound sodium chloride.*

	Na (sodium)	**Cl** (chlorine)
Type of element	metal	nonmetal
Atomic number	11	17
Number of valence electrons	1	7
Stable or unstable?	unstable	unstable
Electron transfer	1 lost	1 gained
Description after transfer	stable, 10 electrons like neon	stable, 18 electrons like argon
Type of ion	positive (+)	negative (−)

Ionic Bonds—Electron Transferring

Complete *the diagram of an* ionic bond.

positive ion → (+) (−) ← negative ion

Ionic Bond

Explanation: The oppositely charged ions attract one another and form an ionic compound.

Main Idea

Details

Ionic Compounds

Sample answers are shown.

Identify *five common properties of ionic compounds.*

1. ions strongly attracted to each other
2. good conductors of electricity when in water
3. usually solid at room temperature
4. high melting point
5. high boiling point

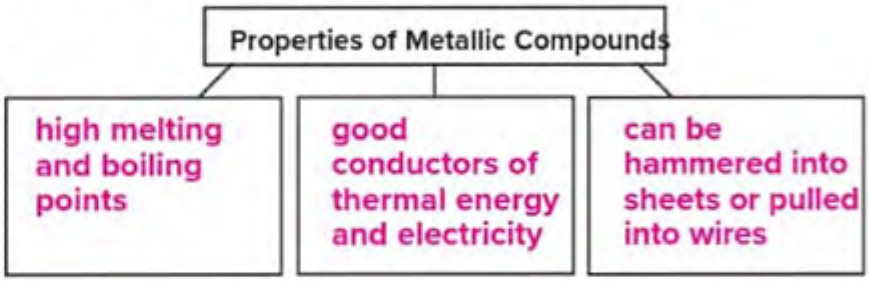
Metallic Bonds—Electron Pooling

Explain *how a* metallic bond *forms.*

A metallic bond forms when many metal atoms share their pooled valence electrons.

Describe *three properties of metallic compounds.*

Sample answers are shown.



Contrast *3 ways atoms can bond and become stable.*

Process	Electron Pooling	Electron Transfer	Electron Sharing
Type of chemical bond	metallic	ionic	covalent
Description	Valence electrons of metal atoms are not bonded to any one atom.	Valence electrons are transferred from nonmetal to metal atoms.	Valence electrons are shared by nonmetal atoms.

Analyze It Explain the difference between a neutral atom and a stable atom.

An atom is stable if its highest energy level contains the maximum number of paired electrons. An atom is electrically neutral if it has the same number of protons and electrons, the positive and negative charges of which balance.

Review

Elements and Chemical Bonds

Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned.

Use this checklist to help you study.

- ❑ Study your *Activity Lab Manual* on this chapter.
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- ❑ Reread the chapter, and review the charts, graphs, and illustrations.
- ❑ Review the Understanding Key Concepts at the end of each lesson.
- ❑ Look over the Chapter Review at the end of the chapter.

THE BIG IDEA

Summarize It Reread the chapter Big Idea and the lesson Key Concepts. Use what you have learned to describe why it is important in the modern world to understand the types of chemical bonds and the properties of types of compounds. Give at least one example.

Accept all reasonable responses. Sample answer: All the technologies we rely on in modern society are made of matter that behaves in certain ways. The way matter behaves determines what it can be used for; for example, our electrical circuits are made of metal because metal can be pulled into wire and is a good conductor of electricity. The pooling of electrons in metallic bonding allows the metal to be flexible. Because valence electrons can move easily from atom to atom, they can carry an electric charge.

Challenge *Research the uses of noble gases in technological devices. Why do the properties of the gases make them useful? Summarize your discoveries in your Science Journal.*

Lesson 1 Understanding Chemical Reactions

Scan *Lesson 1. Read the lesson titles and bold words. Look at the pictures. Identify three facts you discovered about chemical reactions. Record your facts in your Science Journal.*

Main Idea

Changes in Matter

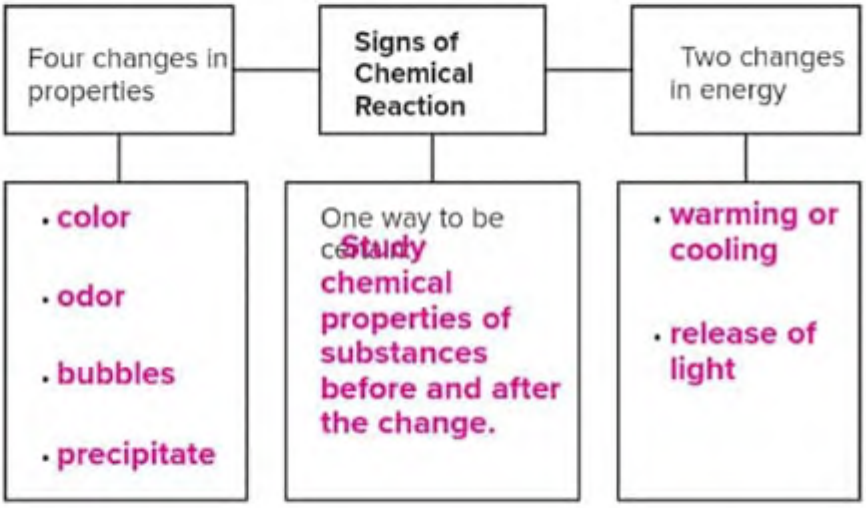
Details

Differentiate *a physical change from a chemical change.*

Physical Change	Chemical Change
New substances are not produced, but the substances that exist before and after the change might have different physical properties.	One or more substances change into new substances with different physical and chemical properties.

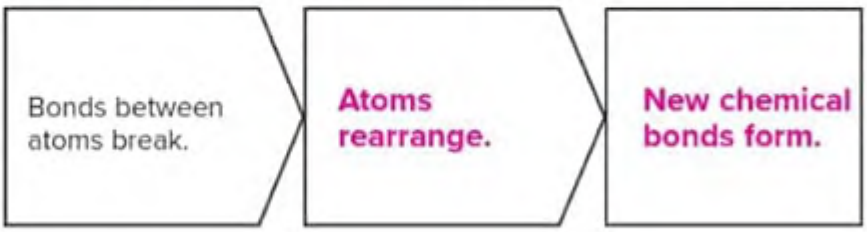
Signs of a Chemical Reaction

Identify *signs of a* chemical reaction.



What happens during a chemical reaction?

Sequence *changes in atoms during a* chemical reaction.

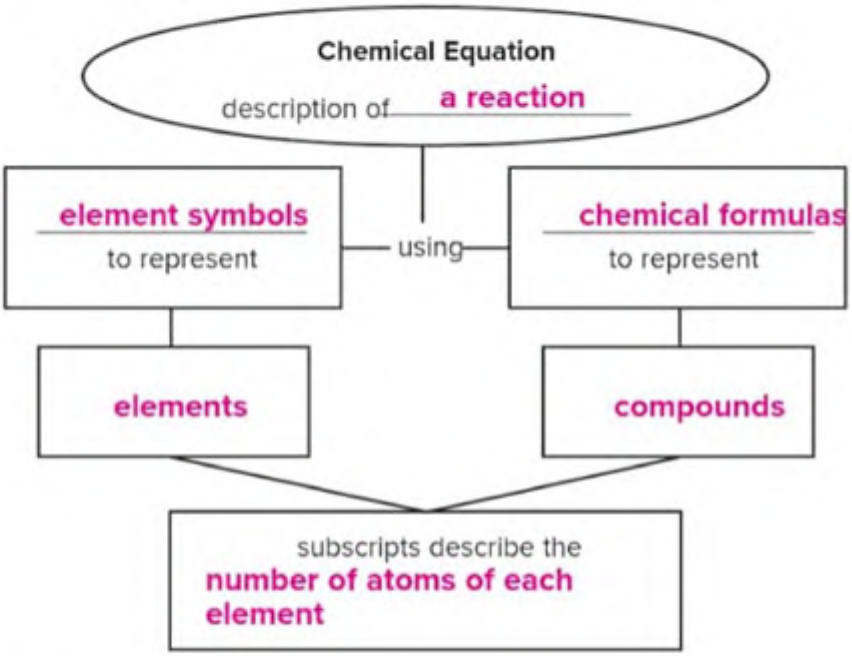


Main Idea

Chemical Equations

Details

Distinguish *the parts of a* chemical equation.



Detail *information regarding the writing of* chemical equations.

Define *reactant*.	the starting substances in a chemical reaction
Define *product*.	the substances produced by a chemical reaction
Write the general structure for a chemical equation.	reactant + reactant → product + product
How is the arrow sign read?	as "produces" or "yields"
Write the equation for "carbon plus oxygen produces carbon dioxide."	$C + O_2 \longrightarrow CO_2$

Conservation of Mass

Restate *the* law of conservation of mass.

The total mass before a chemical reaction is the same as the total mass after a chemical reaction.

Main Idea

Details

Relate *atoms to mass in a* chemical reaction.

Mass before a chemical reaction	is equal to	mass after a chemical reaction
Number of atoms in the reactants		number of atoms in the products

Paraphrase *what it means when you say a* chemical equation *is balanced.*

The specific numbers of types of atoms are the same on both sides of the equation.

Explain *the meaning of chemical formulas. Circle the* coefficient.

H_2O	$2H_2O$
means one water molecule	means two water molecules

Order *the steps in balancing a* chemical equation.

1. Write the unbalanced equation.
2. Count atoms of each element in the reactants and products.
3. Add coefficients to balance the atoms.
4. Write the balanced chemical equation.

Balance *the* chemical equation *for carbon monoxide.*

$$2C + O_2 \longrightarrow 2\ CO$$

Analyze It Look back at the picture of the firefly on the first page of Lesson 1. How could you conclude that the firefly's blinking is a chemical rather than a physical change simply by viewing the picture and without reading the text on the page?

Accept all reasonable responses. Sample answer: The firefly's blink gives off light energy. The release of light is an energy change, which is characteristic of a chemical change, not a physical change.

Lesson 2 Types of Chemical Reactions

Predict *three facts that will be discussed in Lesson 2 after reading the headings. Write your facts in your Science Journal.*

Main Idea

Patterns in Reactions

Details

Generalize *the concept of patterns in chemical reactions.*

Major Types of Chemical Reactions

- Number of types: **4**
- Determined by: **the way atoms recombine**

Types of Chemical Reactions

Describe and model *synthesis and decomposition reactions. First, describe the reactions. Then draw simple shapes to model how substances behave during these reactions.*

	Synthesis	Decomposition
Explanation	Two or more substances combine and form one compound.	One compound breaks down and forms two or more substances.
Diagram	Student drawing should show different shapes for two or more elements on the left side of the equation and the shapes side by side to represent a single compound on the right side of the equation.	Student drawing should show different shapes side by side to represent a single compound on the left side of the equation and the shapes separated to represent two or more elements on the right side of the equation.

Main Idea

Details

Describe *replacement reactions. Include a model of* single- *and* double-replacement *reactions with your descriptions.*

Replacement Reactions
An atom or group of atoms replaces part of a compound.

Single-replacement
One element replaces another element in a compound.
● ■ + ▲ → ● ▲ + ■

Double-replacement
The negative ions in two compounds switch places.
● ■ + ▲ ✱ → ● ✱ + ▲ ■

Characterize combustion.

Combustion

Always a reactant: oxygen

Always releases: energy

Often produces: carbon dioxide and water

Identify *the two types of energy typically released during* combustion *reactions.*

1. thermal energy
2. light energy

Synthesize It Summarize the four major types of chemical reactions you learned about in Lesson 2.

Synthesis reactions combine two or more elements or compounds into one compound; decomposition breaks one compound into two or more substances. In replacement reactions, component parts of compounds recombine to form different compounds. Combustion always involves oxygen as a reactant and releases energy.

Lesson 3 Energy Changes and Chemical Reactions

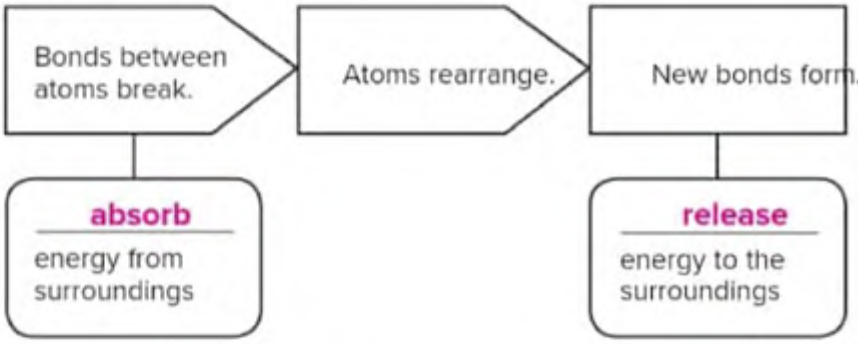
Skim *Lesson 3 in your book. Read the headings and look at the photos and illustrations. Identify three things you want to learn more about as you read the lesson. Record your ideas in your Science Journal.*

Main Idea

Energy Changes

Details

Expand *the model of a chemical reaction to represent energy changes that occur.*



Differentiate endothermic *and* exothermic *reactions.*

Reaction	reactants + thermal energy → products
Type	endothermic
Energy change	thermal energy absorbed
Bonds that contain more energy	products
Reaction	reactants → thermal energy + products
Type	exothermic
Energy change	thermal energy released
Bonds that contain more energy	reactants

Define activation energy, *and identify types of reactions that use it.*

Activation energy: the minimum amount of energy needed to start a chemical reaction

Types of reactions: both exothermic and endothermic

Main Idea

Reaction Rates

Details

Record *two factors about particle collisions that affect the rate of chemical reactions.*

1. how often particles collide
2. how fast particles are moving when they collide

Relate *surface area to reaction rate in the following example.*

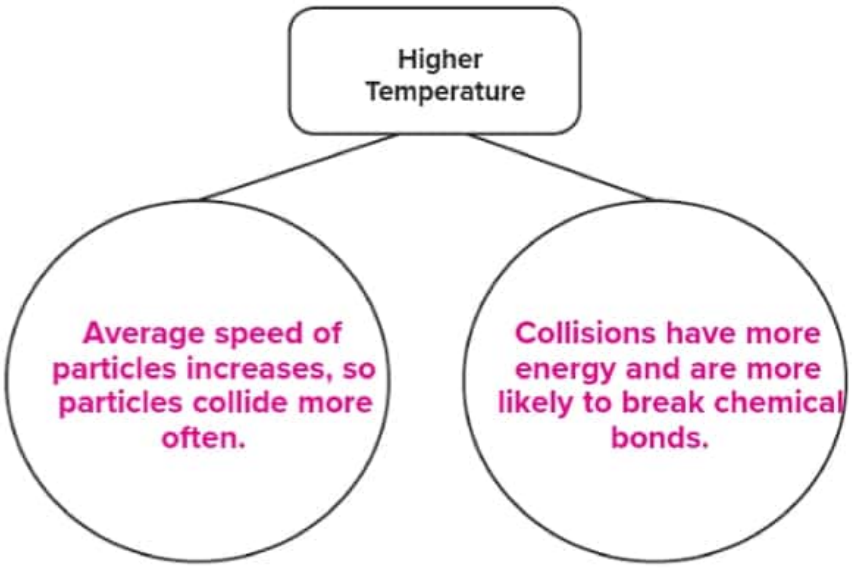
A chunk of chalk reacts with vinegar.

Speed of reaction rate: slower
Explanation: Acid is in contact only with particles on the surface of the chalk.

Crushed chalk powder reacts with vinegar.

Speed of reaction rate: faster
Explanation: More chalk particles are in contact with the acid.

Distinguish *two reasons that higher temperature speeds reaction rate.*



Lesson 3 Energy Changes and Chemical Reactions

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Main Idea

Energy Changes

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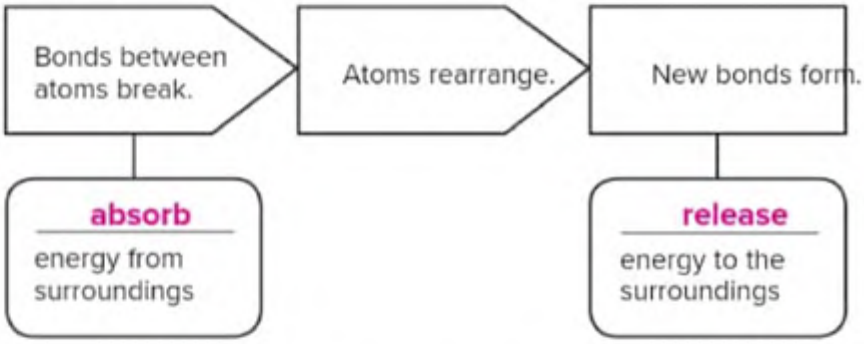

Differentiate *endothermic and exothermic reactions.*

Reaction	reactants + thermal energy → products
Type	endothermic
Energy change	thermal energy absorbed
Bonds that contain more energy	products
Reaction	reactants → thermal energy + products
Type	exothermic
Energy change	thermal energy released
Bonds that contain more energy	reactants

Define activation energy, *and identify types of reactions that use it.*

Activation energy: the minimum amount of energy needed to start a chemical reaction

Types of reactions: both exothermic and endothermic

Main Idea

Reaction Rates

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Record *two factors about particle collisions that affect the rate of chemical reactions.*

1. how often particles collide
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Relate *surface area to reaction rate in the following example.*

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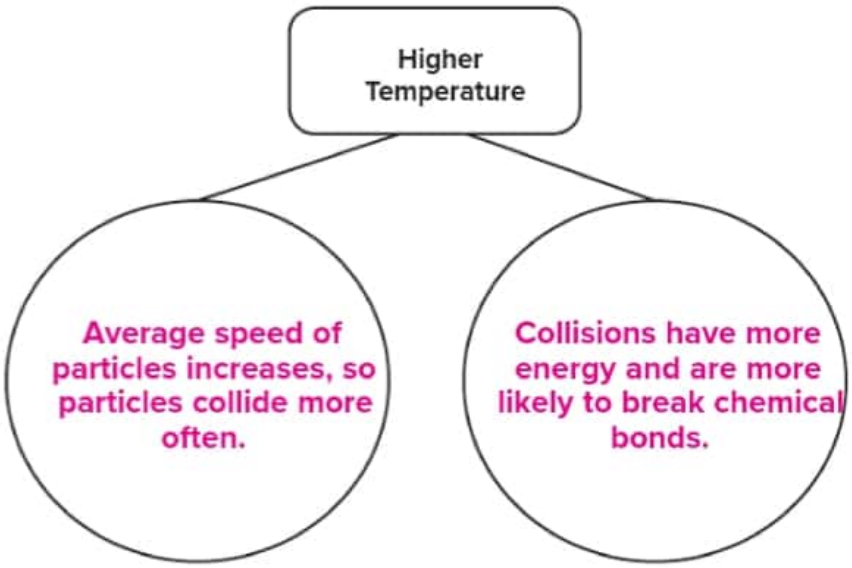


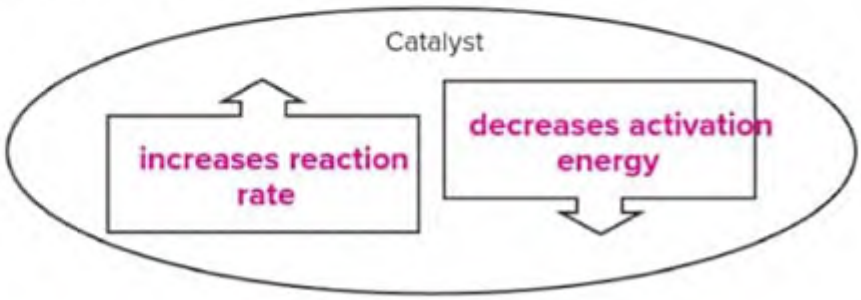
Main Idea

Details

Compare *higher concentration and increased pressure as means to increase reaction rate.*

In both situations, particles are closer together, which causes more collisions between particles to occur.

Relate *the presence of a* catalyst *in a chemical reaction to* activation energy *and reaction rate.*



Express *the relationship between* catalysts *and* enzymes.

An enzyme is a type of catalyst. It speeds up chemical reactions in living cells.

Contrast catalysts *and* inhibitors

	Catalyst	Inhibitor
Description	increases reaction rate by lowering activation energy	slows, or even stops, a chemical reaction

Connect It Consider the example of the rocket launch shown in the picture on the fi page of Lesson 3. Hypothesize why it would be important to understand both catalysts a inhibitors in this series of chemical reactions.

Accept all reasonable responses. Sample answer: A rocket launch requires a massive amount of energy to be released rapidly, so catalysts that speed the reaction are helpful However, rocket fuel sources can react so quickly, in fact, that they can be highly explosive. Inhibitors keep the fuel under control until the right time.

Review

Chemical Reactions and Equations

Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned. Complete the final column in the chart on the first page of the chapter.

Use this checklist to help you study.

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THE BIG IDEA

Summarize It Reread the chapter Big Idea and the lesson Key Concepts. Summarize what you have learned by converting each of the Key Concept questions into a factual answer**Accept all reasonable responses. Sample answers:**

Lesson 1 (three Key Concepts)

1. Warming or cooling and the release of light are some signs that a chemical reaction might have occurred. 2. Atoms are conserved during a chemical reaction. 3. Total mass is conserved in a chemical reaction.

Lesson 2 (two Key Concepts)

1. You can recognize a synthesis reaction by the multiple reactants that combine to form one compound as a product. 2. The four main types of chemical reactions are synthesis, decomposition, replacement, and combustion.

Lesson 3 (three Key Concepts)

1. Chemical reactions always involve a change in energy because chemical bonds contain chemical energy. 2. The difference between endothermic and exothermic reactions is that endothermic reactions absorb energy and exothermic reactions release energy. 3. Surface area, temperature, and pressure affect the rate of a chemical reaction.

Challenge*Choose a chemical reaction that you routinely observe. This could be anything from rust forming on playground equipment, to photosynthesis in grass, to the combustion of fuel in your family's car. Make an illustrated poster that describes the reactants, products, and energy processes in the reaction. Be sure to use balanced chemical equations in your captions. Display your poster in your class.*