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GRADES
4–6

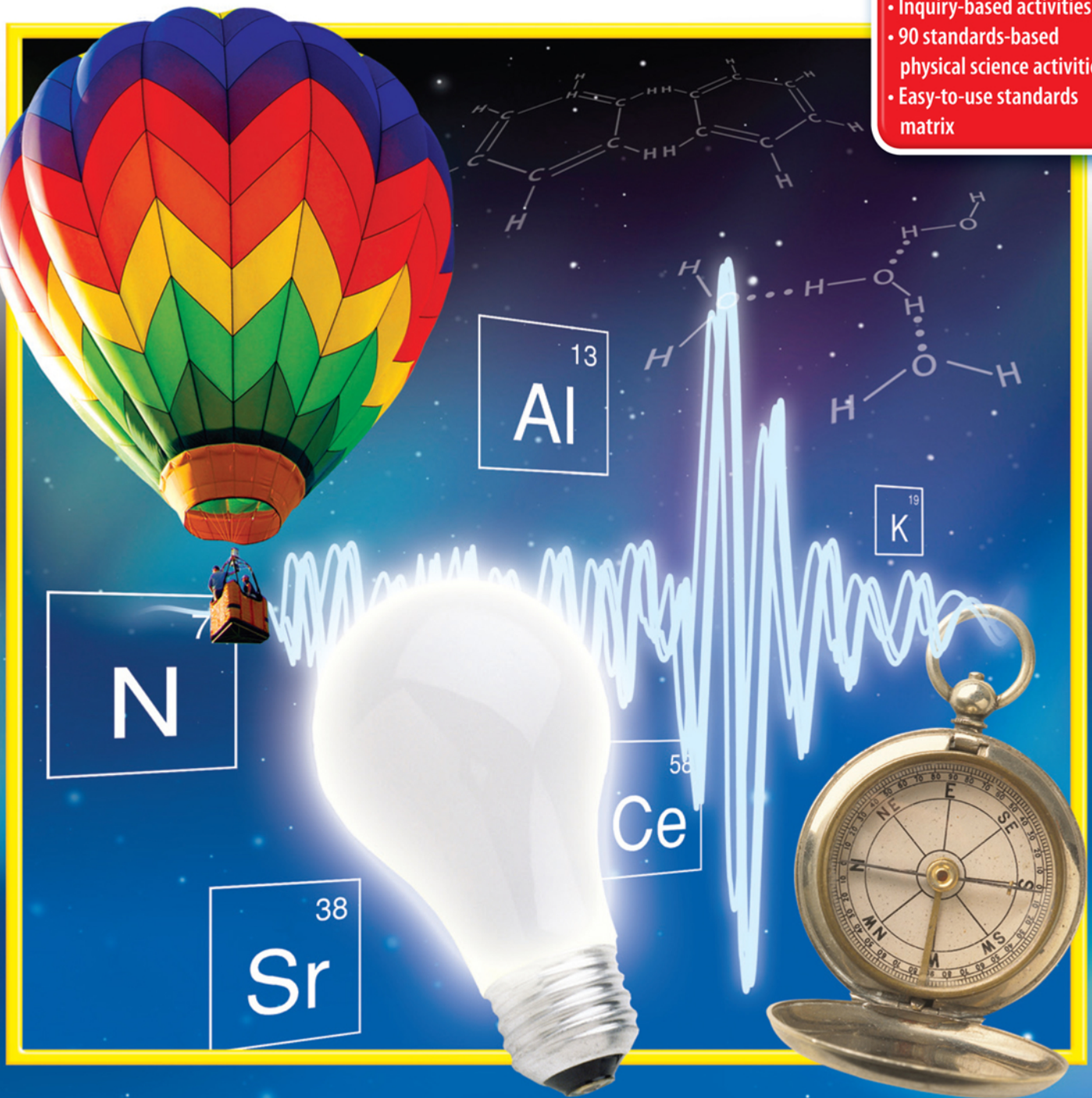
Just the Facts:
Physical Science

Fun activities, puzzles, and investigations!

State, National & Provincial CORRELATED Standards

Features:

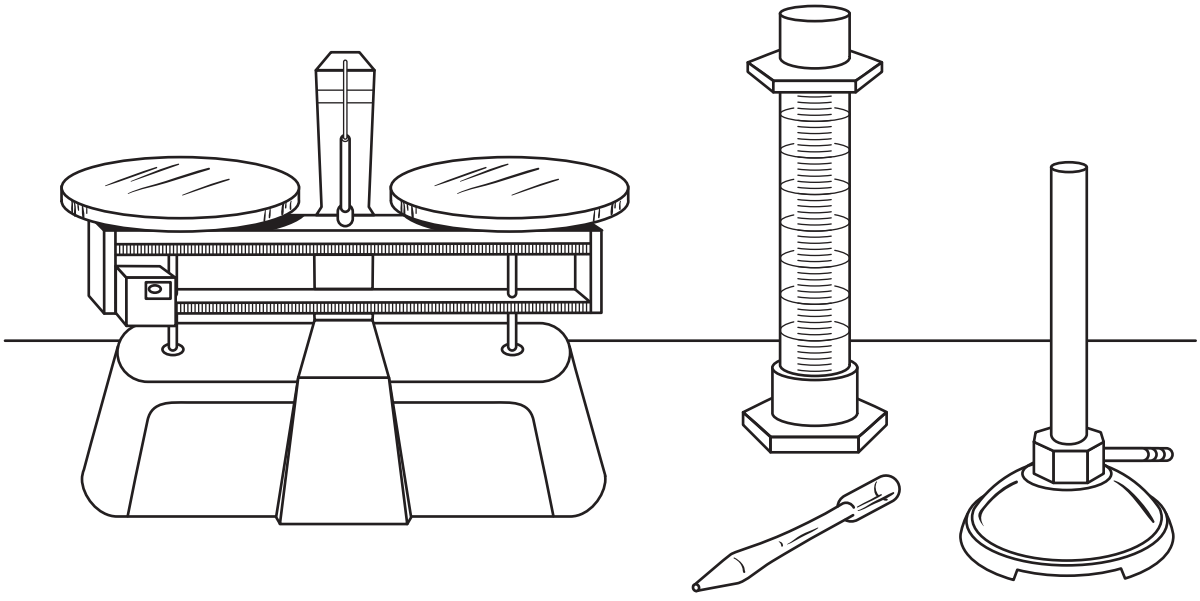
- Data analysis and investigations that build science proficiency
- Inquiry-based activities
- 90 standards-based physical science activities
- Easy-to-use standards matrix



by Matthew Fisher

Carson-Dellosa Publishing Company, Inc.

Just the Facts: Physical Science



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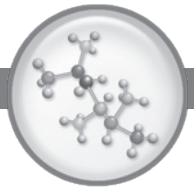

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This book has been correlated to state, national, and Canadian provincial standards. Visit *www.carsondellosa.com* to search for and view its correlations to your standards.

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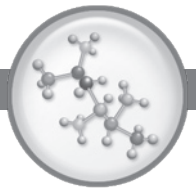
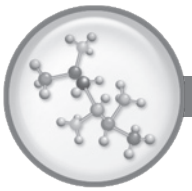
Just the Facts: Physical Science

TABLE OF CONTENTS





LIGHT

HEAT AND ENERGY

MAGNETISM AND ELECTRICITY

Just the Facts: Physical Science

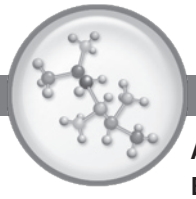
INTRODUCTION

Students are filled with curiosity and wonder about the physical world around them. How far does a magnetic field extend? How fast does sound travel through air? How do different types of materials in a circuit affect the flow of electricity? Students should be provided with opportunities to engage in meaningful inquiry activities that put their questioning and investigating abilities to the test. Before and after these inquiry activities, it is crucial to expose students to the concepts and vocabulary addressed in the activities. *Just the Facts: Physical Science* provides students with an effective means of introducing and reinforcing many of the important concepts, vocabulary terms, and phenomena that they will be observing as they study physical science.

Students begin to realize that energy is an important property of substances and that most changes involve energy transfers. In this book, they will see connections between many of the concepts they have been studying, including phase changes, light, heat, sound, electricity, and magnetism. When studying concepts such as motion and forces, give students concrete experiences on which they will build in their later study of physics. For example, by observing the movement of balls and mechanical objects, students can begin to make quantitative measurements and describe the forces acting on the objects.

In *Just the Facts: Physical Science*, students will be exposed to basic, factual information that will allow them to conduct inquiry investigations, much like the experiments that scientists conduct every day. The worksheets and activities in this book will supplement your daily lessons, and some can be used as stepping-stones to full inquiry experiments that students can develop themselves. The worksheets and activities are aligned with national and state standards. Use the Standards Matrix on pages 6–7 to find which standards each activity covers.

Armed with scientific facts and knowledge, scientists carry on the process of inquiry and discovery to find answers to mysteries such as, why does nature contain only a finite number of elements? Perhaps, one day, it will be one of your students who reveals the truth!



STANDARDS MATRIX

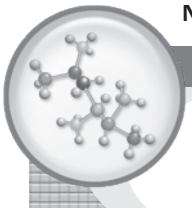
A = Science as Inquiry
B = Physical Science
C = Life Science
D = Earth and Space Science
E = Science and Technology
F = Science in Personal and Social Perspectives
G = History and Nature of Science

ACTIVITY	A	B	C	D	E	F	G
Branches of Physical Science (page 9)		X				X	X
An Introduction to Matter Word Search (page 10)		X					
An Introduction to Matter Crossword Puzzle (page 11)		X					
Tools of the Trade (page 12)		X	X	X	X	X	X
Calculating Mass (page 13)		X					
Calculating Volume (page 14)		X					
Calculating Density (page 15)		X					
Mass, Volume, Density (page 16)		X					
The Density of Water (page 19)	X	X					
Float Your Boat! (page 22)	X	X			X		
Viscosity (page 24)	X	X					
Types of Measurement (page 26)		X					
Ways to Measure (page 27)		X					
Learning about Changes (page 28)		X					X
Changes Word Search (page 29)		X					
Changes Crossword Puzzle (page 30)		X					
Types of Changes (page 31)		X					
Staying Cool (page 32)	X	X	X				
Boiling and Freezing (page 33)		X					
Physical or Chemical? (page 34)		X					
Matter of Fact (page 35)		X					
All About Matter (page 36)		X					
Periodic Table of Elements (page 37)		X					
It's Elemental Word Search (page 38)		X					
It's Elemental Crossword Puzzle (page 39)		X					
Elemental Names Word Search (page 40)		X					
Chemical Symbols Crossword Puzzle (page 41)		X					
Making the Elements (page 42)		X					X
Bohr's Model of the Atom (page 44)		X					
Groups of Nonmetals (page 45)		X					
Heavy Metal Vocabulary (page 46)		X					
Uses of the Elements (page 47)		X				X	X
Element Superheroes (page 48)	X	X				X	
Elemental Organization (page 50)		X					
All About Elements (page 51)		X					
Elemental Discovery (page 52)		X				X	
Learning about Motion and Forces (page 53)		X					
A Lot of Movin' Word Search (page 54)		X					
A Lot of Movin' Crossword Puzzle (page 55)		X					
Moving Along (page 56)		X					
Motion Graphs (page 57)		X					
Travel Graphs (page 58)		X				X	
Newton's First Law (page 59)		X					
Newton's Third Law (page 60)		X					
Newton's Laws (page 61)		X					

STANDARDS MATRIX

ACTIVITY	A	B	C	D	E	F	G
Will, Bill, and Phil (page 62)		X					
Net Forces (page 63)		X					
Gravity's Force (page 64)	X	X	X	X			
Air Pressure Word Search (page 67)		X					
Air Pressure Crossword Puzzle (page 68)		X					
Lifting with Air! (page 69)	X	X					
The Science of Flight (page 70)		X			X		
Airfoils (page 71)		X			X		
Bernoulli's Airplane (page 73)		X					
Sound Off! Word Search (page 74)		X					
Sound Off! Crossword Puzzle (page 75)		X					
Measuring Sound (page 76)	X	X					
The Doppler Effect (page 78)		X					
The Human Ear (page 79)		X	X				
Wave Anatomy (page 80)		X					
Shoe Box Guitar (page 81)		X			X		
String and Cup Communication (page 82)	X	X			X		
Turn It Down! (page 84)		X				X	
Sound Wave Acrostic (page 85)		X				X	
Lights On! Word Search (page 86)		X					
Lights On! Crossword Puzzle (page 87)		X					
Into the Light (page 88)		X					
Bouncing and Bending (page 89)	X	X					
Bending Light (page 90)	X	X					
The Human Eye (page 91)		X	X				
Using Lenses in Science (page 92)		X					X
Can You See the Light? (page 93)		X					
Heat Transfer Word Search (page 94)		X					
Heat Transfer Crossword Puzzle (page 95)		X					
Insulators in Action (page 96)		X			X		
Insulation Data (page 100)		X					
Renewable Power (page 101)		X		X	X		
Renewable Energy (page 102)		X		X	X		
Solar "Still" Works (page 103)	X	X		X	X		
The Greenhouse Effect (page 105)	X	X		X	X		
Heat & Energy Cinquain (page 107)		X				X	
Learning about Magnetism (page 108)		X					
Attracting Forces Word Search (page 109)		X					
Attracting Forces Crossword Puzzle (page 110)		X					
It's Magnetic! (page 111)		X					
Magnetic Strength (page 112)	X	X					
Lights in the Sky (page 114)		X		X			
It's Electric! Word Search (page 115)		X					
It's Electric! Crossword Puzzle (page 116)		X					
Build an Electroscope (page 117)	X	X					
Conductors and Insulators (page 119)	X	X			X		
Transfer of Energy (page 120)		X					
Electricity Rap (page 121)		X				X	

Name: _____ Date: _____



INTRODUCTION

Show What You Know!

KWL CHART

DIRECTIONS: Before you begin learning about this topic, complete the first two sections of the **KWL** chart below. Under **K**, list what you already know about the topic. Under **W**, list what you would like to find out about the topic. Once you have studied the topic, come back to the chart and list what you learned under **L**.

TOPIC: _____

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

Name: _____ Date: _____

INTRODUCTION

Branches of Physical Science

FILL IN THE BLANKS

No one scientist could know everything about the physical side of science—there are too many different topics. Scientists who study the way that the physical world works specialize in one specific area, such as atoms or electricity. These scientists go to school for many years to become experts in their fields. They also write reports that are published in scientific journals. What kind of physical scientist might you like to be?

DIRECTIONS: Write each type of physical science in the correct blank below to match the type with its topic.

WORD BANK

acoustics	aerodynamics	aerostatics	catacoustics
chemistry	electrology	electrostatics	hydrodynamics
kinematics	magnetics	mechanics	metallography
optics	thermodynamics		

1. movement of liquids _____
2. echoes or reflected sounds _____
3. magnetism _____
4. flow of air or gas _____
5. air pressure _____
6. heat _____
7. electricity _____
8. sound _____
9. action of force on bodies _____
10. properties of substances _____
11. light _____
12. static electricity _____
13. motion _____
14. structure of metals _____

Name: _____ Date: _____

PHYSICAL PROPERTIES OF MATTER

An Introduction to Matter

WORD SEARCH

DIRECTIONS: Find the matter vocabulary words in the word search below. Words can be found down, across, and diagonally. Then, on a separate sheet of paper, write sentences for five of the words.

WORD BANK

atom	boiling	chemical	compound
density	element	mass	matter
melting	mixture	molecule	physical
solution	volume	weight	

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

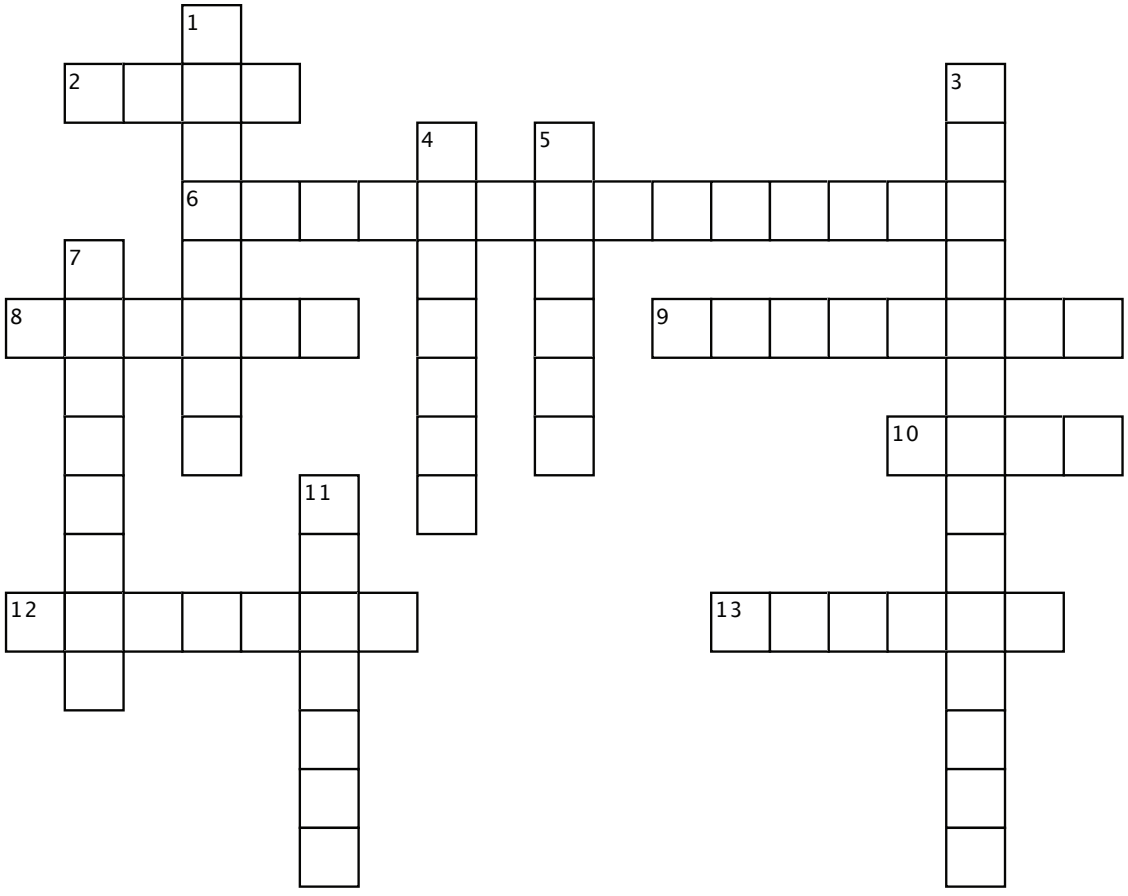
Name: _____ Date: _____

PHYSICAL PROPERTIES OF MATTER

An Introduction to Matter

CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle.



ACROSS

2. the smallest unit of an element

6. a change in a substance that does not change its identity

8. the amount of space that matter occupies

9. a mixture that is mixed very well

10. a measure of how much matter is in an object

12. a substance that cannot be broken down into other substances by chemical or physical means; for example, hydrogen, helium, and carbon

13. a measure of the force of gravity on an object

DOWN

1. a substance that is made of two or more elements that are chemically combined

3. a change in which one or more substances combine or break apart to form new substances

4. two or more substances that are mixed, but not chemically combined

5. anything that has mass and occupies space

7. a combination of two or more atoms

11. the measurement of how much mass is contained in a given volume

Name: _____ Date: _____

PHYSICAL PROPERTIES OF MATTER

Tools of the Trade

MATCHING

DIRECTIONS: Match the name of each type of scientific measuring device below with the situation in which it would be used. Some situations may require more than one type of measuring device.

1. _____ the acidity of an unknown substance

2. _____ the time it takes to heat water to 100°C

3. _____ the volume of a cube

4. _____ the distance between two large trees

5. _____ the angle of incline on a toy car ramp

6. _____ the transfer of a very small amount of water between two test tubes

7. _____ the mass of an unknown substance

8. _____ the density of a small, irregularly shaped object

a. centimeter ruler

b. graduated cylinder

c. digital scale or balance

d. beaker

e. gas burner

f. pipette

g. thermometer

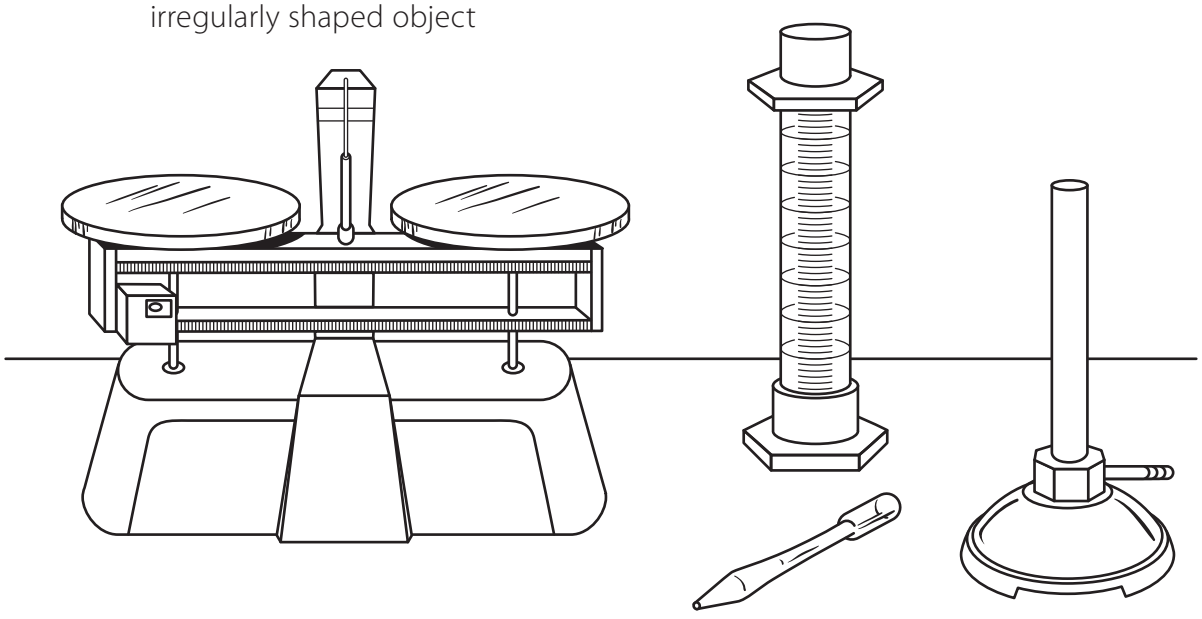
h. meterstick

i. stopwatch

j. protractor

k. pH meter

l. calculator



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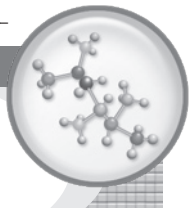


Calculating Mass

SCIENCE ACTIVITY

Mass is the amount of matter in an object. A **balance** is a tool that scientists use to calculate the mass of an object. In this activity, your group will use a triple beam balance to find the mass of different corn food products.

MATERIALS

triple beam balance	corn cereal	popped popcorn	tortilla chips
5 resealable plastic bags	cornmeal	unpopped popcorn	

CAUTION: Before completing any food activity, ask families' permission and inquire about students' food allergies and religious or other food preferences.

PROCEDURE:

1. Your teacher will give your group five bags filled with different corn food products. Carefully examine each plastic bag, but do not open it.
2. Estimate the mass of each bag of food. Record each estimate in the data table below. Then, based on your estimates, arrange the bags in order from least to greatest mass.
3. Use the balance to find the mass of each bag. Record the actual mass in the data table.
4. Find the difference between your estimate and the actual mass. Record the difference in the data table.

DATA TABLE:

Type of Corn Product	Estimated Mass (g)	Actual Mass (g)	Difference in Mass (g)
Corn Cereal			
Cornmeal			
Popped Popcorn			
Unpopped Popcorn			
Tortilla Chips			

Name: _____ Date: _____

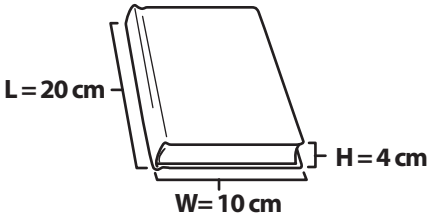
Calculating Volume

MATH SKILLS

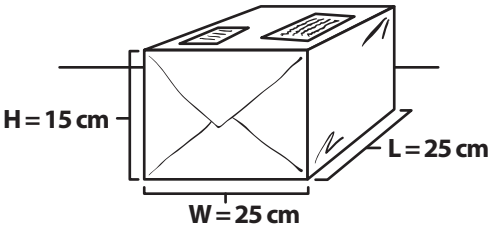
Volume is the amount of space that matter occupies. To find the volume of a regularly shaped object, multiply the length by the width by the height, or L x W x H. To find the volume of an irregularly shaped object, use the displacement method. The units of volume are mL or cm^3. In this activity, you will calculate the volume of regularly and irregularly shaped objects.

DIRECTIONS: Find the volume of each object. Use the space below each problem or a separate sheet of paper to show your work.

1. a. How much space does this book take up?

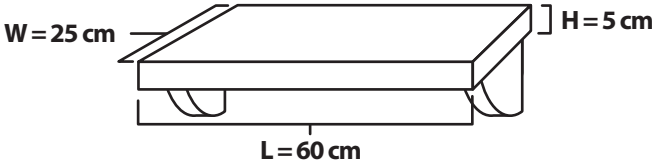


b. What is the volume of this box?

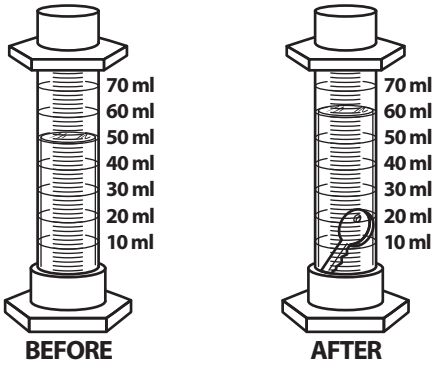


c. If you used the box in question b to ship books identical to the book in question a, how many books would fit in the box?

2. How much space does this bookshelf take up?



3. What is the volume of the key in the graduated cylinder?



Name: _____ Date: _____

Calculating Density

MATH SKILLS

Different objects may have the same mass but not the same volume. For example, one pound of rocks and one pound of grapes may have the same mass, but they probably do not have the same volume. You can compare these objects by finding their densities. The **density** of an object is the ratio of its mass to its volume. To find the density of an object, divide its mass by its volume, or D = M/V. The unit of density is g/cm^3, which is read "grams per cubic centimeter."

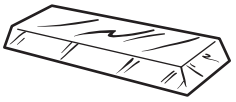
DIRECTIONS: Calculate the density of each object. Use the space below each problem or a separate sheet of paper to show your work. Then, answer each question.

1. small rock  M = 5 g
V = 2 cm^3

2. feather  M = 0.5 g
V = 10 cm^3

3. lead in a pencil  M = 3 g
V = 2 cm^3

4. silver coin  M = 5.25 g
V = 0.5 cm^3

5. gold bar  M = 289.5 g
V = 15 cm^3

6. apple  M = 10 g
V = 15 cm^3

7. Which object is the least dense? _____

8. Which object is the most dense? _____

9. List the objects from least dense to most dense. _____

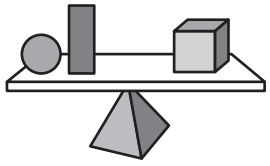
_____

Name: _____ Date: _____

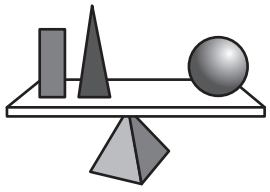
Mass, Volume, Density—Part 1

MATH SKILLS

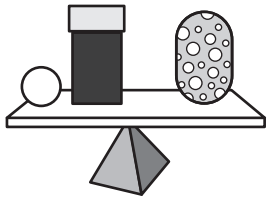
DIRECTIONS: Use the illustrations and the information provided to determine the mass of the object on the right side of the balance. Use the space to the right of each problem or a separate sheet of paper to show your work. Record your answers in the data table on page 18.

1. 

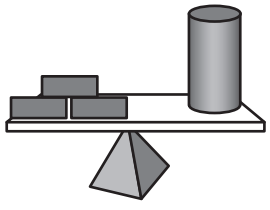
= 5 grams
= 10 grams
=

2. 

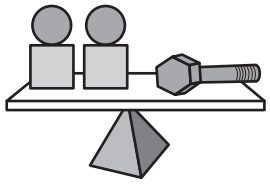
= 10 grams
= 15 grams
=

3. 

= 7 grams
= 10 grams
= 3 grams
=

4. 

= 10 grams
=

5. 

= 20 grams
= 5 grams
=

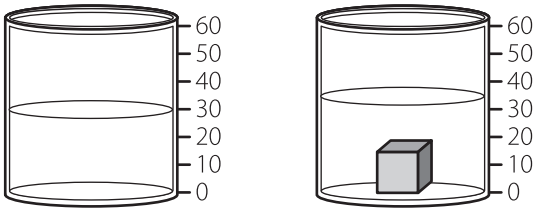
Name: _____ Date: _____

Mass, Volume, Density—Part 2

MATH SKILLS

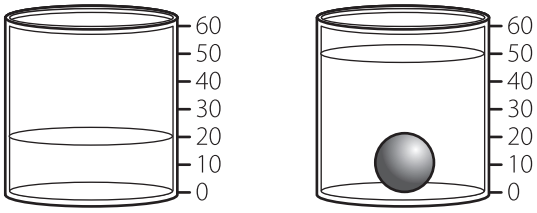
DIRECTIONS: Use the illustrations, the information provided, and the displacement method to determine the volume of each object. Use the available space or a separate sheet of paper to show your work. Record your answers in the data table on page 18.

1.



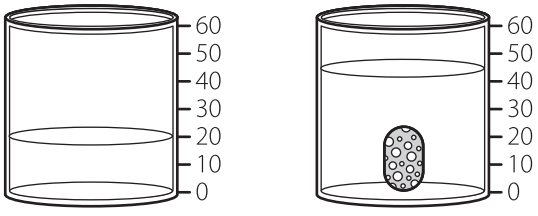
Volume = _____ mL

2.



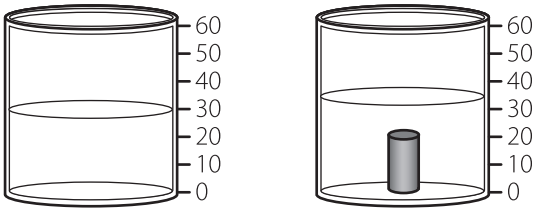
Volume = _____ mL

3.



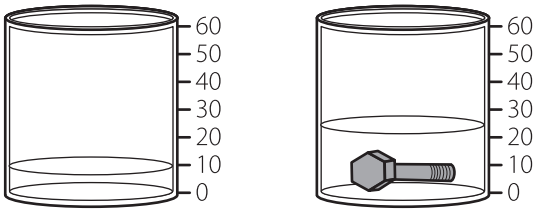
Volume = _____ mL

4.



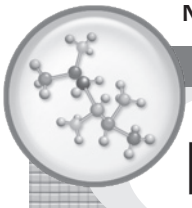
Volume = _____ mL

5.



Volume = _____ mL

Name: _____ Date: _____



PHYSICAL PROPERTIES OF MATTER

Mass, Volume, Density—Part 3

MATH SKILLS

The **density** of an object is the ratio of its mass to its volume. In other words, density is the amount of mass packed into a given amount of space. The formula for calculating density is:

Density (g/mL) = Mass (grams) ÷ Volume (mL)

DIRECTIONS: Use the data collected in parts 1 and 2 (pages 16–17) to calculate the density of each object. Use a separate sheet of paper to show your work. Record the density of each object in the data table below. Pure water has a density of 1 g/mL. Look at the density of each object and record whether the object will sink or float in water.

DATA TABLE: Remember to label your data with the correct units for mass, volume, and density.

Object	Mass (g)	Volume (mL)	Density (g/mL)	Sink or Float?
1. Cube				
2. Sphere				
3. Spotted Oval				
4. Cylinder				
5. Bolt				

CONCLUSIONS:

1. If an object has a density greater than 1 g/mL, will it sink or float in water? Why? _____

_____

_____

2. Which objects have a density greater than 1 g/mL? What do you think they are made of? _____

_____

3. If an object has a density less than 1 g/mL, will it sink or float in water? Why? _____

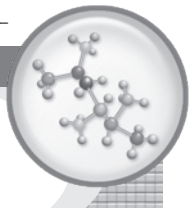
_____

_____

4. Which objects have a density less than 1 g/mL? What do you think they are made of? _____

_____

Name: _____ Date: _____



The Density of Water

SCIENCE ACTIVITY

The **density** of an object is the ratio of its mass to its volume. You can find the density of any object if you know its mass and its volume. In this activity, you will find the density of tap water and salt water to see how the addition of salt to water can determine whether a raw egg sinks or floats.

MATERIALS

500 mL beaker	water	raw egg	stirring spoon
100 mL beaker	salt	balance	

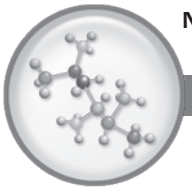
CAUTION: Raw or lightly cooked eggs may be contaminated with salmonella, a bacteria responsible for food poisoning. To prevent illness from bacteria, use only properly refrigerated, clean, sound-shelled, fresh, grade AA or A eggs.

PROCEDURE:

1. Place an empty 500 mL beaker on the balance and find its mass. Record the mass of the empty beaker on page 20.
2. Fill the beaker with 250 mL of tap water. Use the balance to find the mass of the beaker and the tap water. Record the mass of the beaker with tap water in Data Table 1 on page 20.
3. Calculate the density of the tap water by dividing its mass by its volume. Record the density of the tap water in Data Table 1.
4. Fill the 100 mL beaker with 100 mL of salt. Pour the salt into the beaker of tap water and stir until the salt and water have mixed. Record the volume of the salt water in Data Table 1.
5. Use the balance to find the mass of the beaker and the salt water. Record the mass of the beaker with salt water in Data Table 1.
6. Calculate the density of the salt water. Record the density of the salt water in Data Table 1.

Now, you will see how the density of water affects whether an object sinks or floats. Your teacher will give you a raw egg. Be very careful that the egg does not break.

7. Use the balance to find the mass of the raw egg. Record the mass of the egg in Data Table 2 on page 20.
8. Fill the 100 mL beaker with 50 mL of tap water. Gently place the egg in the tap water to determine whether it sinks or floats. Record your observations in Data Table 2.



Name: _____ Date: _____

THE DENSITY OF WATER (CONTINUED)

9. Use the displacement method to find the volume of the egg. Record the volume of the egg in Data Table 2.

10. Calculate the density of the egg. Record the density of the egg in Data Table 2.

11. Compare the density of the egg to the density of the salt water. Based on your data, do you think that the egg will sink or float in salt water? _____

_____

_____

12. Gently place the egg in the beaker of salt water to determine whether it sinks or floats. Record your observations in Data Table 2.

Mass of the Empty Beaker (g): _____

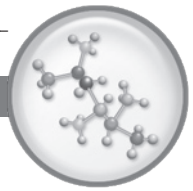
DATA TABLE 1: Remember to label your data with the correct units for mass, volume, and density.

	Tap Water	Salt Water
Mass of Beaker with Water		
Volume of Water	250 mL	
Density of Water		

DATA TABLE 2: Remember to label your data with the correct units for mass, volume, and density.

Mass of Egg	
Volume of Egg	
Density of Egg	
Does the egg sink or float in tap water?	
Does the egg sink or float in salt water?	

Name: _____ Date: _____



THE DENSITY OF WATER (CONTINUED)

RESULTS:

1. How could you find the mass of the tap water without the beaker in step 2 on page 19?

_____

_____

2. How could you find the mass of the water and salt without the beaker in step 5 on page 19?

_____

_____

3. Compare the density of the raw egg to the density of the tap water. Is the egg more or less dense than tap water? _____

_____

4. Did the egg sink or float in the tap water? Why do you think this happened?_____

_____

_____

5. What happened to the density of the tap water when salt was added? _____

_____

6. Did the egg sink or float in the salt water? Why do you think this happened?_____

_____

_____

CONCLUSION:

7. What is the relationship between the density of a liquid and the density of an object that will sink or float in the liquid? _____

_____

_____

_____

_____

Name: _____ Date: _____

PHYSICAL PROPERTIES OF MATTER

Float Your Boat!

INQUIRY INVESTIGATION

Buoyancy is the upward force that keeps objects afloat. When placed in water, an object will float if its buoyancy is greater than its weight. The object will sink if its weight is greater than its buoyancy. The **buoyant force** of an object is equal to the weight of the fluid that it displaces. In this activity, your group will attempt to build a boat with the greatest buoyant force possible. After you create a boat that floats, you will test its buoyancy by adding mass to it.

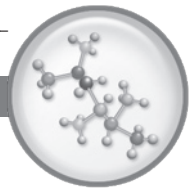
MATERIALS

4 craft sticks	4 toothpicks	plastic tub of water	paper clips
30 cm x 30 cm (11.8 in. x 11.8 in.) square of aluminum foil	2 plastic drinking straws	30 cm (11.8 in.) of transparent tape	balance
	glue		paper towels

PROCEDURE:

1. Use the materials from the Materials list and work with your group to build a boat.
2. Determine if your boat is buoyant by placing it in the plastic tub of water. If your boat does not float, adjust its construction until it floats. Use a paper towel to dry off your boat.
3. After you have completed your boat and tested its buoyancy, draw a diagram of your boat in the space provided on page 23. Below the picture, describe how the shape of your boat will support the added mass of paper clips.
4. Use the balance to find the mass of your boat. Make sure that it is dry. Record the mass of your boat in the data table on page 23.
5. Use the balance to find the mass of one paper clip. Record the mass of one paper clip in the data table.
6. Place your boat back in the tub of water. Carefully add paper clips one by one to your boat. Keep a count of the number of paper clips you add to your boat until the last paper clip that you add sinks it.
7. Record the total number of paper clips added to your boat, minus the one paper clip that sank it, in the data table. Calculate the mass of the paper clips added to your boat before it sank. Record the mass of the paper clips in the data table.
8. Calculate the total mass that your boat supported. Record the mass of your boat and the paper clips in the data table.

Name: _____ Date: _____



FLOAT YOUR BOAT! (CONTINUED)

DIRECTIONS: Draw your boat. Then, describe how it will support the added mass of paper clips.

_____

_____

_____

_____

DATA TABLE:

Object(s)	Mass (g)
Empty Boat	
One Paper Clip	
_____ Paper Clips in Boat before Sinking	
Boat and Paper Clips	

RESULTS:

1. What was the mass of your boat before you added paper clips? _____
2. What was the mass of your boat and the paper clips before it sank? _____

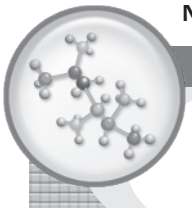
_____

CONCLUSION:

3. When you place an object, such as a block of wood, in a bucket of water, the wood displaces (pushes out of the way) some of the water and the level of the water rises. If you could find the mass of the water that the wood displaces, its mass would equal the mass of the wood. What is the mass of the water that was displaced by your boat loaded with paper clips? _____

_____

Name: _____ Date: _____



PHYSICAL PROPERTIES OF MATTER

Viscosity

INQUIRY INVESTIGATION

The resistance of a liquid to flowing is called **viscosity**. Liquids act in different ways depending on their viscosity. Some flow quickly, while others flow slowly. In this activity, you and a partner will measure the viscosity rates of different types of liquids.

MATERIALS

5 large-mouth beakers	maple syrup	stopwatch	paper towels
honey	water	metric ruler	
vegetable oil	shampoo	5 tablespoons	

CAUTION: Before completing any food activity, ask families' permission and inquire about students' food allergies and religious or other food preferences.

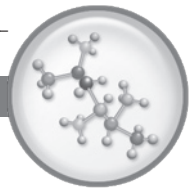
PROCEDURE:

1. Your teacher will give you and your partner five labeled beakers filled with different liquids.
2. Predict the viscosity of each liquid by ranking the liquids from least to greatest viscosity below.
3. Dip a tablespoon into the first beaker of liquid and stir gently. Was it easy or difficult to stir? Observe the liquid for any signs of bubbles. Record your observations in the data table on page 25.
4. Repeat step 3 with a different tablespoon for each of the remaining four liquids.
5. Ask your partner to hold the ruler upright next to the first beaker. Find the 30 cm mark on the ruler.
6. Take a tablespoonful of the first liquid and raise it to the 30 cm mark. When your partner starts the stopwatch, gently turn the spoon downward and allow the liquid to flow back into the beaker. Your partner should stop the stopwatch when all of the liquid is off the spoon and in the beaker. Record your results in the data table.
7. Use a paper towel to clean up any liquid that splashes out of the beaker.
8. Repeat steps 6 and 7 two additional times for the first liquid for a total of three trials. Calculate the average time for the liquid to flow back into the beaker. Record your results in the data table.
9. Repeat steps 6–8 for the remaining four liquids.

PREDICTION:

Least Viscosity (Fastest) ⟶ Greatest Viscosity (Slowest)

Name: _____ Date: _____



DATA TABLE:

		Time for Liquid to Flow into the Beaker (sec.)			
Type of Liquid	**Observations while Stirring**	**Trial 1**	**Trial 2**	**Trial 3**	**Average Time**
Honey					
Vegetable Oil					
Maple Syrup					
Water					
Shampoo					

RESULTS:

1. Reread your prediction on page 24. Was your prediction correct? _____

2. Which liquid has the greatest viscosity? (Remember that viscosity is the resistance of a liquid to flowing.) What evidence did you find that supports your conclusion? _____

_____

_____

_____

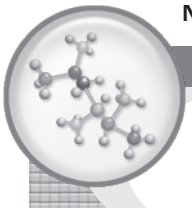
3. Why did you conduct three trials and find an average time for each liquid? _____

_____

_____

_____

Name: _____ Date: _____



PHYSICAL PROPERTIES OF MATTER

Types of Measurement

MYSTERY WORDS

DIRECTIONS: Write the type of measurement or the unit used to label each measurement example in the correct blank below to match the term with its description. Circle the named letter or letters in each answer. Then, unscramble the circled letters to reveal the mystery words.

WORD BANK

centimeter	cubic centimeter	density	gram
kilogram	kilometer	length	mass
meter	milligram	milliliter	volume

1. _____ the mass of a few grains of sand (third and eighth letters)

2. _____ physical property of matter used to determine whether an object fits on a bookshelf (second and fourth letters)

3. _____ the distance between two cities (ninth letter)

4. _____ the volume of a test tube (second and eighth letters)

5. _____ the mass of a coin (third letter)

6. _____ the volume of a desk drawer (fourth and eighth letters)

7. _____ the mass of an automobile (second letter)

8. _____ the length of a pencil (third letter)

9. _____ physical property of matter used to find the distance between two cities (third and fifth letter)

10. _____ physical property of matter used to determine whether an object will float in water (third and sixth letters)

11. _____ physical property of matter used to determine whether you are able to lift and carry an object (fourth letter)

12. _____ the height of a tree (second letter)

MYSTERY WORDS

Scientists measure the properties of matter using the

_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

System of _____ _____ _____ _____ _____, or SI.

Name: _____ Date: _____

PHYSICAL PROPERTIES OF MATTER

Ways to Measure

ORGANIZING INFORMATION

DIRECTIONS: Complete the graphic organizer. Place the number for each fact about the physical properties of matter in the correct location in the organizer.

1. the ratio of mass to volume

2. the amount of matter in an object

3. measured in centimeters, meters, or inches

4. the amount of space an object takes up

5. measured in grams

6. determines which state of matter a substance will be

7. measured in degrees Celsius or Fahrenheit

8. measured in g/mL or g/cm^3

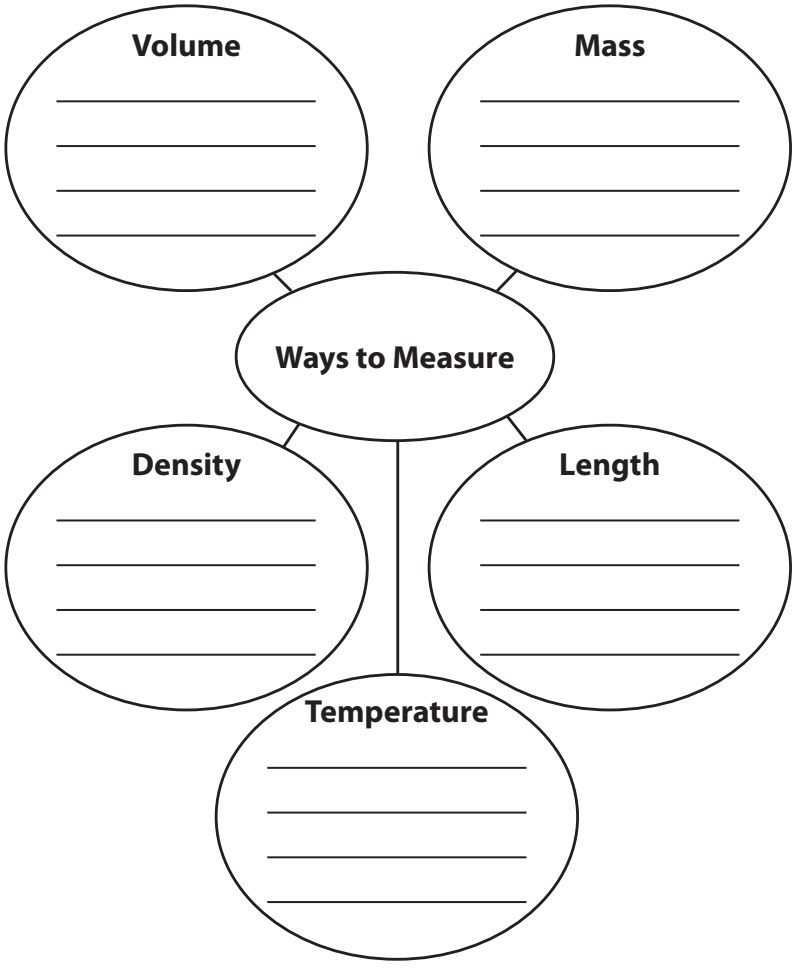
9. found using a balance or scale

10. found using a thermometer

11. measured in mL or cm^3

12. the speed of the molecules within a substance

13. found using a ruler, a beaker, or a graduated cylinder

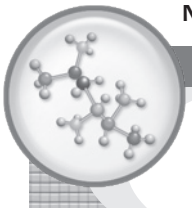


14. tells you how tightly the molecules are packed in a given space

15. found using a meterstick

16. determines the distance between two points

Name: _____ Date: _____



PHASES OF MATTER

Learning about Changes

CONTEXT CLUES

DIRECTIONS: Context clues help us learn new words when we read. Use the words, phrases, and sentences around new words to determine their meanings. Look at the words in the chart and fill in the column "What I Think It Means." Read the passage below and look for context clues to help determine the meanings of the words. Then, fill in the last column, "What It Means in Context." If your answer in the first column was completely correct, use the second column to add something to the word's meaning beyond your original idea.

Word	What I Think It Means	What It Means in Context
temperature		
molecules		
evaporate		
condenses		

The world changes around you every day. You might see ice on a pond melting in the spring or water in a pot changing to steam on a stove. These changes are due to changes in **temperature**.

Matter is found in three common forms: solid, liquid, and gas. A solid has **molecules** that are packed tightly together and stay in fixed positions. It has a shape and volume that do not easily change. When you heat a solid, it can melt and change to a liquid. For example, when you burn a candle, the solid wax melts and becomes liquid. When you blow out the candle, the liquid wax cools and freezes back into solid form.

Liquids do not have fixed shapes. They take the shapes of the containers in which they are held. Even though a liquid's shape can change, its volume does not change as easily. A liquid can change state when its molecules are heated or cooled. For example, after a heavy rainfall, you might find puddles in the street. As the sun heats the water in these puddles, water molecules on the surface **evaporate** and change from liquid to gas. When that water vapor reaches high enough in the atmosphere, it cools and **condenses** and it falls back to the earth as liquid rain.

Gases can change their volume and shape very easily. In fact, gas molecules spread apart or compress to fill a container of any shape. For example, when you blow air into a balloon, the air molecules bounce around as they push on the walls of the balloon. If you tie the balloon's nozzle and squeeze the balloon, the gas molecules cluster into the smaller space.

Name: _____ Date: _____

PHASES OF MATTER

Changes

WORD SEARCH

DIRECTIONS: Find the matter vocabulary words in the word search below. Words can be found down, across, and diagonally. Then, on a separate sheet of paper, write sentences for five of the words.

WORD BANK

boiling	condensation	evaporation	freezing
gas	liquid	melting	solid
sublimation	temperature		

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

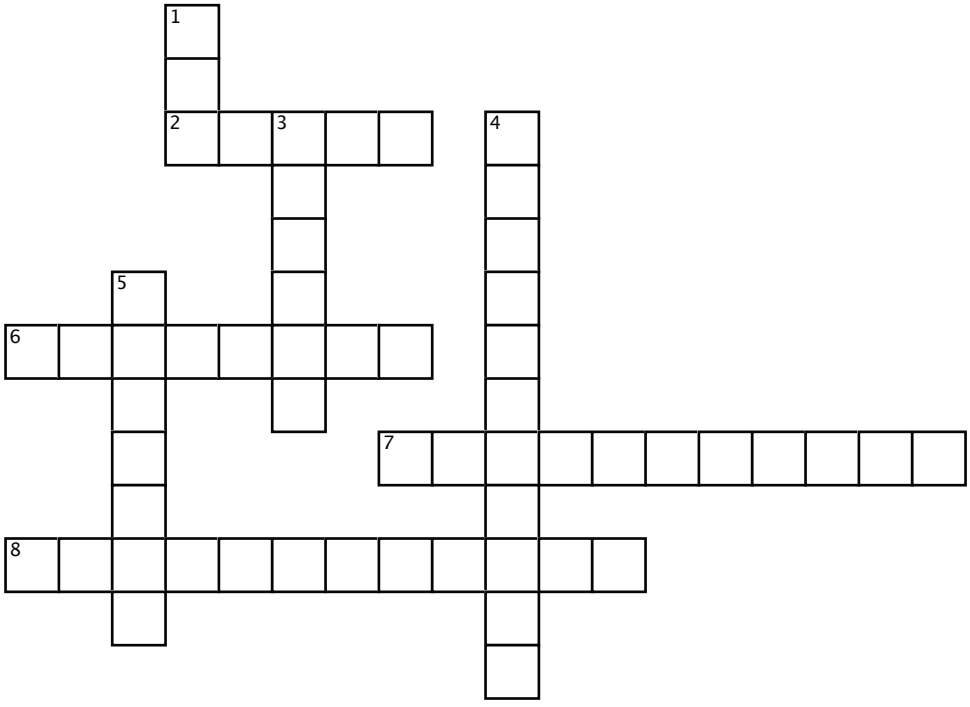
Name: _____ Date: _____

PHASES OF MATTER

Changes

CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle.



ACROSS

2. state in which a substance has a definite shape and a definite volume

6. change of state from liquid to solid

7. change of state from liquid to gas

8. change of state from gas to liquid or solid

DOWN

1. state in which a substance has no definite shape or volume

3. state in which a substance has no definite shape; substance takes the shape of the container in which it is held

4. change of state from solid to gas without passing through the liquid state

5. change of state from solid to liquid

Name: _____ Date: _____

PHASES OF MATTER

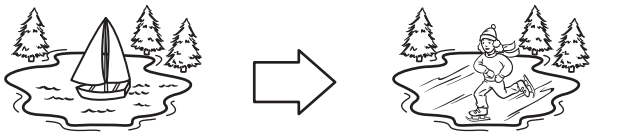
Types of Changes

FILL IN THE BLANKS

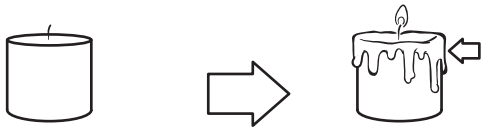
DIRECTIONS: Write each type of phase change in the correct blank below to match the change to its depiction. Some phase changes will be used more than once.

WORD BANK

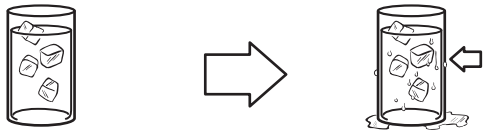
condensation evaporation freezing melting sublimation



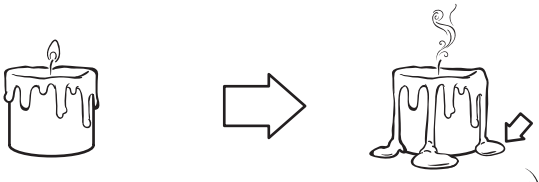
1. _____



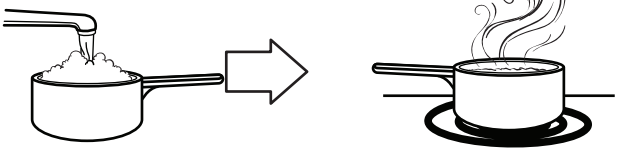
2. _____



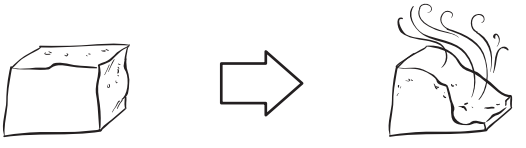
3. _____



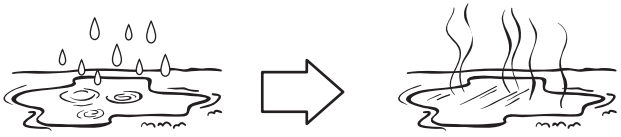
4. _____



5. _____

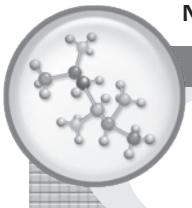


6. _____



7. _____

Name: _____ Date: _____



PHASES OF MATTER

Staying Cool

LIFE SCIENCE CONNECTION

Have you ever wondered how a healthy human body keeps its temperature constant even when exercising on a hot summer day? In this activity, you will see that by releasing water in the form of sweat, your body uses its own method of phase changing to keep you cool.

MATERIALS

cup of water | rubbing alcohol | cooking oil | paper towels

PROCEDURE:

1. Blow on the back of your hand. Describe how it feels. _____

   _____

2. Dip your finger in the cup of water and rub it on the back of your hand. Blow on your hand again. Describe how it feels in comparison to step 1. _____

   _____

3. Dry your hand with a paper towel. Repeat step 2 using rubbing alcohol instead of water. Describe how it feels in comparison to steps 1 and 2. _____

   _____

4. Dry your hand with a paper towel. Repeat step 2 using cooking oil instead of water. Describe how it feels in comparison to steps 1–3. _____

   _____

   _____

CONCLUSION:

1. Which of the three substances most resembles how it feels when you sweat? Think about phase changes. What do you think is happening that makes your skin feel cooler? _____

   _____

   _____

   _____

   _____

   _____

Name: _____ Date: _____

Boiling and Freezing

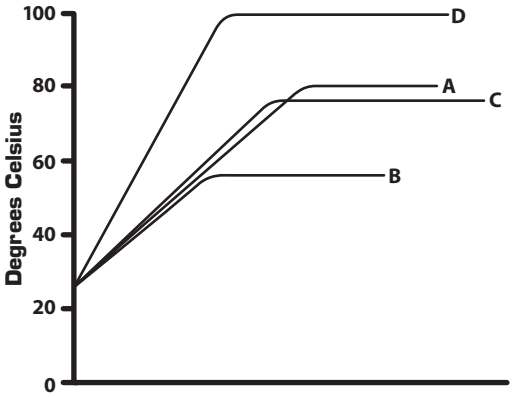
DATA ANALYSIS

DIRECTIONS: Study the data table and the graphs below. The first graph shows the boiling points of the four substances. The second graph shows the freezing points of the same substances. When a substance is boiled or frozen, the temperature **plateaus**, or stays the same, while all of the substance changes to the next phase. Use the data table and the graphs to write the letter that identifies which piece of data represents each substance.

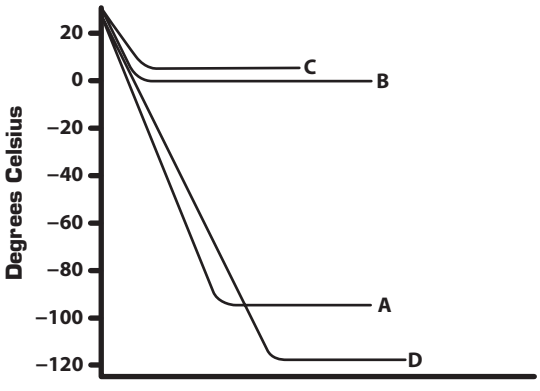
DATA TABLE:

Substance	Uses	Boiling Point (°C)	Freezing Point (°C)
Benzene	plastic, synthetic rubber, and dyes	80.1	5.5
Ethanol	thermometers	78.4	–114.6
Water	essential for all life on Earth	100	0
Acetone	nail polish remover and paint thinner	56.2	–94.8

Boiling Points



Freezing Points



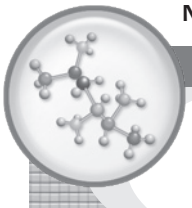
BOILING POINTS:

1. Benzene _____
2. Ethanol _____
3. Water _____
4. Acetone _____

FREEZING POINTS:

5. Benzene _____
6. Ethanol _____
7. Water _____
8. Acetone _____

Name: _____ Date: _____



PHASES OF MATTER

Physical or Chemical?

IDENTIFICATION

Do you know the difference between a physical change and a chemical change? The difference is based on whether there is a change in the state of matter or a chemical reaction.

Physical changes occur with forces, like motion, temperature, and pressure. For example, when energy (heat) is added to ice cream, it melts. This example caused a change in the state of matter, but the chemical composition is still the same.

Chemical changes occur on a much smaller scale. When a chemical change occurs, the object's molecules change and a new type of substance is formed. For example, when a piece of iron rusts, you notice the change only over a long period of time. The molecules of iron have combined with oxygen in the air to become iron oxide.

DIRECTIONS: Identify each change as a physical change or a chemical change. Then, explain why you chose that answer.

1. ice melting _____

_____

2. toast burning _____

_____

3. frying an egg _____

_____

4. fireworks exploding _____

_____

5. metal corroding _____

_____

6. mowing the lawn _____

_____

7. food spoiling _____

_____

8. glass breaking _____

_____

Name: _____ Date: _____

PHASES OF MATTER

Matter of Fact

ORGANIZING INFORMATION

DIRECTIONS: Complete the graphic organizer. Place the number for each fact about the phases of matter in the correct location in the organizer.

1. have molecules that are packed tightly together

2. difficult to compress or force into a smaller space

3. hold their shape

4. have atoms that are made of free electrons and ions

5. have molecules that can spread far apart to fill any shape or container

6. are called a *solution* when a variety of materials are combined

7. can be found in fluorescent lightbulbs and neon signs

8. are called a *mixture* when more than one type of compound is combined

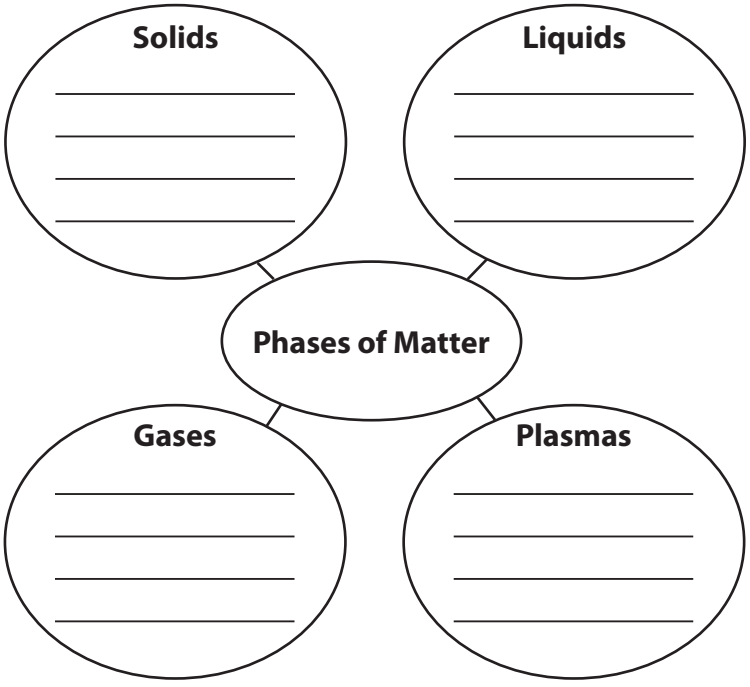
9. have a cohesive force that holds the molecules together

10. another word for *vapors*

11. take the form of any container they are poured into

12. not found often on Earth, but found in stars and the northern lights

13. can be compressed into smaller spaces



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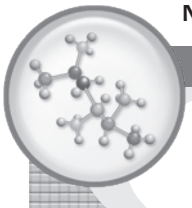


PHASES OF MATTER

All About Matter

TRUE OR FALSE

DIRECTIONS: Determine whether each statement is true or false. Write *T* for true or *F* for false in the blank. If the statement is false, cross out the incorrect word or words and rewrite the sentence to make it true.

1. _____ Volume is the amount of space an object takes up. _____

_____

2. _____ All things are composed of matter. _____

_____

3. _____ The molecules in a solid are loosely packed together. _____

_____

4. _____ A liquid takes the shape of the container in which it is held. _____

_____

5. _____ Gas particles cannot be compressed into a smaller space. _____

_____

6. _____ A substance changing from solid to gas is called melting. _____

_____

7. _____ A substance changing from gas to liquid is called condensation. _____

_____

8. _____ A substance changing from liquid to gas is called evaporation. _____

_____

9. _____ To change a substance from solid to liquid, energy needs to be taken from the system. ___

_____

10. _____ Gases have mass and volume. _____

_____

Name: ____________________ Date: ____________

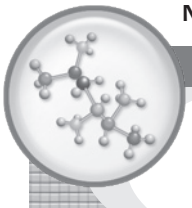
Periodic Table of Elements

REFERENCE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	hydrogen 1 **H** 1																	helium 2 **He** 4
2	lithium 3 **Li** 7	beryllium 4 **Be** 9											boron 5 **B** 11	carbon 6 **C** 12	nitrogen 7 **N** 14	oxygen 8 **O** 16	fluorine 9 **F** 19	neon 10 **Ne** 20
3	sodium 11 **Na** 23	magnesium 12 **Mg** 24											aluminum 13 **Al** 27	silicon 14 **Si** 28	phosphorus 15 **P** 31	sulphur 16 **S** 32	chlorine 17 **Cl** 35	argon 18 **Ar** 40
4	potassium 19 **K** 39	calcium 20 **Ca** 40	scandium 21 **Sc** 45	titanium 22 **Ti** 48	vanadium 23 **V** 51	chromium 24 **Cr** 52	manganese 25 **Mn** 55	iron 26 **Fe** 56	cobalt 27 **Co** 59	nickel 28 **Ni** 59	copper 29 **Cu** 64	zinc 30 **Zn** 65	gallium 31 **Ga** 70	germanium 32 **Ge** 73	arsenic 33 **As** 75	selenium 34 **Se** 79	bromine 35 **Br** 80	krypton 36 **Kr** 84
5	rubidium 37 **Rb** 85	strontium 38 **Sr** 88	yttrium 39 **Y** 89	zirconium 40 **Zr** 91	niobium 41 **Nb** 93	molybdenum 42 **Mo** 96	technetium 43 **Tc** (98)	ruthenium 44 **Ru** 101	rhodium 45 **Rh** 103	palladium 46 **Pd** 106	silver 47 **Ag** 108	cadmium 48 **Cd** 112	indium 49 **In** 115	tin 50 **Sn** 119	antimony 51 **Sb** 122	tellurium 52 **Te** 128	iodine 53 **I** 127	xenon 54 **Xe** 131
6	caesium 55 **Cs** 133	barium 56 **Ba** 137	lanthanum 57 **La*** 139	hafnium 72 **Hf** 178	tantalum 73 **Ta** 181	tungsten 74 **W** 184	rhenium 75 **Re** 186	osmium 76 **Os** 190	iridium 77 **Ir** 192	platinum 78 **Pt** 195	gold 79 **Au** 197	mercury 80 **Hg** 201	thallium 81 **Tl** 204	lead 82 **Pb** 207	bismuth 83 **Bi** 209	polonium 84 **Po** (209)	astatine 85 **At** (210)	radon 86 **Rn** (222)
7	francium 87 **Fr** (223)	radium 88 **Ra** (226)	actinium 89 **Ac**** (227)	rutherfordium 104 **Rf** (267)	dubnium 105 **Db** (268)	seaborgium 106 **Sg** (271)	bohrium 107 **Bh** (272)	hassium 108 **Hs** (277)	meitnerium 109 **Mt** (276)	darmstadtium 110 **Ds** (281)	roentgenium 111 **Rg** (280)							

*Lanthanides	cerium 58 **Ce** 140	praseodymium 59 **Pr** 141	neodymium 60 **Nd** 144	promethium 61 **Pm** (145)	samarium 62 **Sm** 150	europium 63 **Eu** 152	gadolinium 64 **Gd** 157	terbium 65 **Tb** 159	dysprosium 66 **Dy** 163	holmium 67 **Ho** 165	erbium 68 **Er** 167	thulium 69 **Tm** 169	ytterbium 70 **Yb** 173	lutetium 71 **Lu** 175
**Actinides	thorium 90 **Th** 232	protactinium 91 **Pa** 231	uranium 92 **U** 238	neptunium 93 **Np** (237)	plutonium 94 **Pu** (244)	americium 95 **Am** (243)	curium 96 **Cm** (247)	berkelium 97 **Bk** (247)	californium 98 **Cf** (251)	einsteinium 99 **Es** (252)	fermium 100 **Fm** (257)	mendelevium 101 **Md** (258)	nobelium 102 **No** (259)	lawrencium 103 **Lr** (262)

Name: _____ Date: _____



ATOMS AND ELEMENTS

It's Elemental

WORD SEARCH

DIRECTIONS: Find the atoms and elements vocabulary words in the word search below. Words can be found down, across, and diagonally. Then, on a separate sheet of paper, write sentences for five of the words.

WORD BANK

alloy	electron	group	metal
metalloid	neutron	noble gas	nonmetal
nucleus	period	periodic table	proton

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

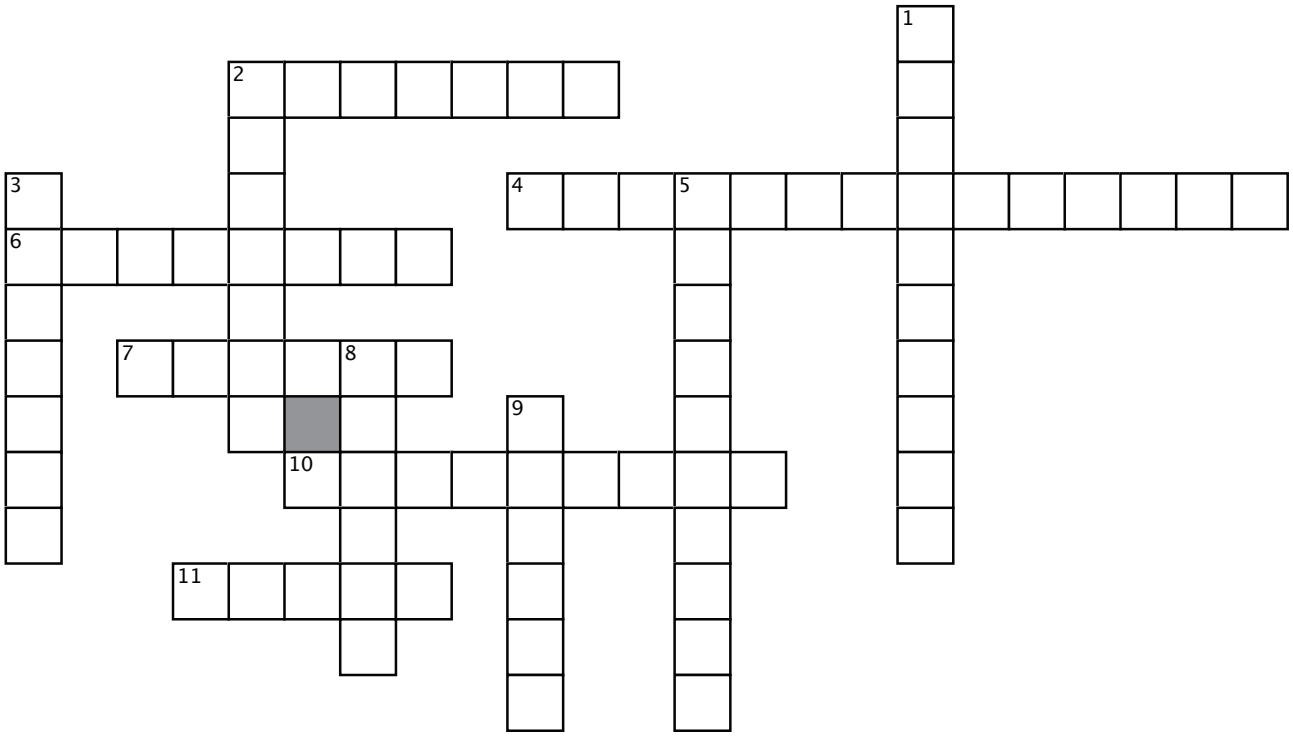
Name: _____ Date: _____

ATOMS AND ELEMENTS

It's Elemental

CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle.



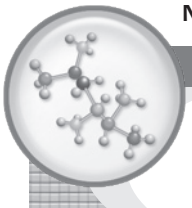
ACROSS

2. the core of an atom
4. name of an element written as one letter or a combination of two letters
6. carries a negative electrical charge
7. columns on the periodic table
10. most of these are in gas form at room temperature
11. a mixture of metals

DOWN

1. gases that do not form compounds with other elements
2. carries no electrical charge
3. rows on the periodic table
5. elements that have some characteristics of metals and some characteristics of nonmetals
8. carries a positive electrical charge
9. elements that can be described by their hardness, shininess, and ductility

Name: _____ Date: _____



ATOMS AND ELEMENTS

Elemental Names

WORD SEARCH

DIRECTIONS: Find the names of the elements in the word search below. Words can be found down, across, and diagonally. Then, on a separate sheet of paper, write sentences for five of the elements.

WORD BANK

calcium	copper	gold	hydrogen
iron	lead	mercury	nitrogen
oxygen	potassium	silver	sodium

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

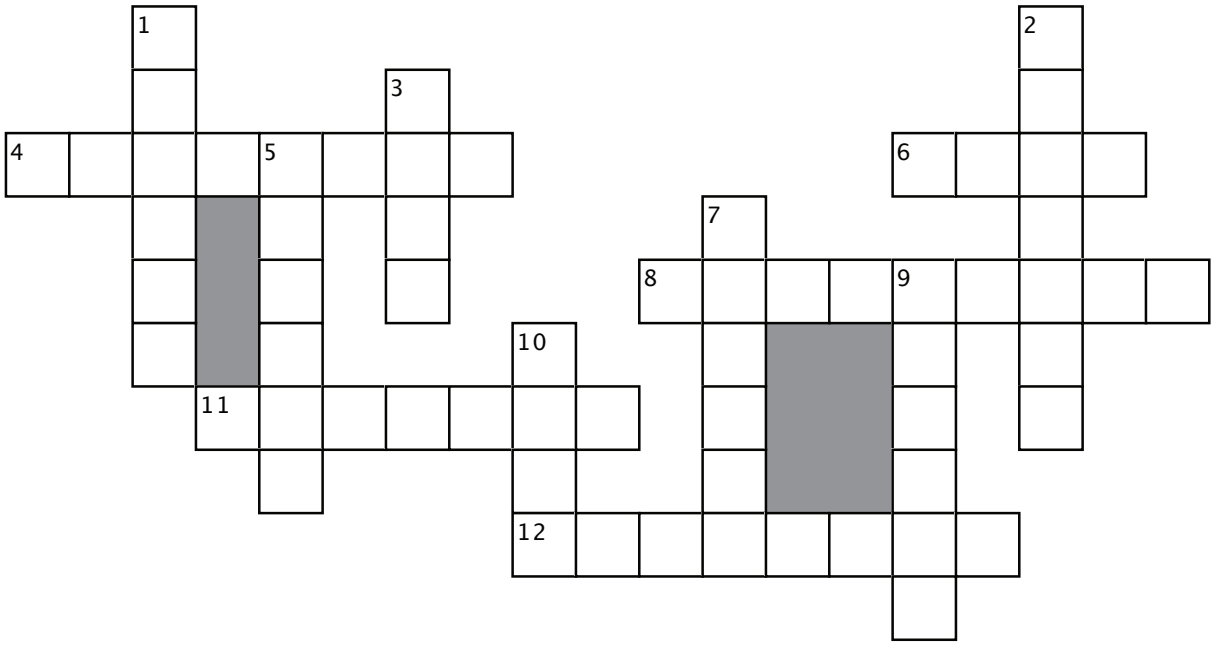
Name: _____ Date: _____

Chemical Symbols

CROSSWORD PUZZLE

In 1801, a Scottish chemist named Thomas Thomson was the first person to use letters to represent the elements. Before that, chemists used drawings to represent the elements. After 1801, when a new element was discovered, the scientist who made the discovery had the honor of naming it. Today, a council of scientists names new elements. New elements are named after places, scientists, mythical characters, or the element's properties.

DIRECTIONS: Use the periodic table on page 37 to help you complete the crossword puzzle. Write the name of the element associated with each chemical symbol.



ACROSS

4. H
6. Au
8. K
11. Hg
12. N

DOWN

1. Na
2. Ca
3. Pb
5. O
7. Cu
9. Ag
10. Fe

Name: _____ Date: _____

Making the Elements

SCIENCE ACTIVITY

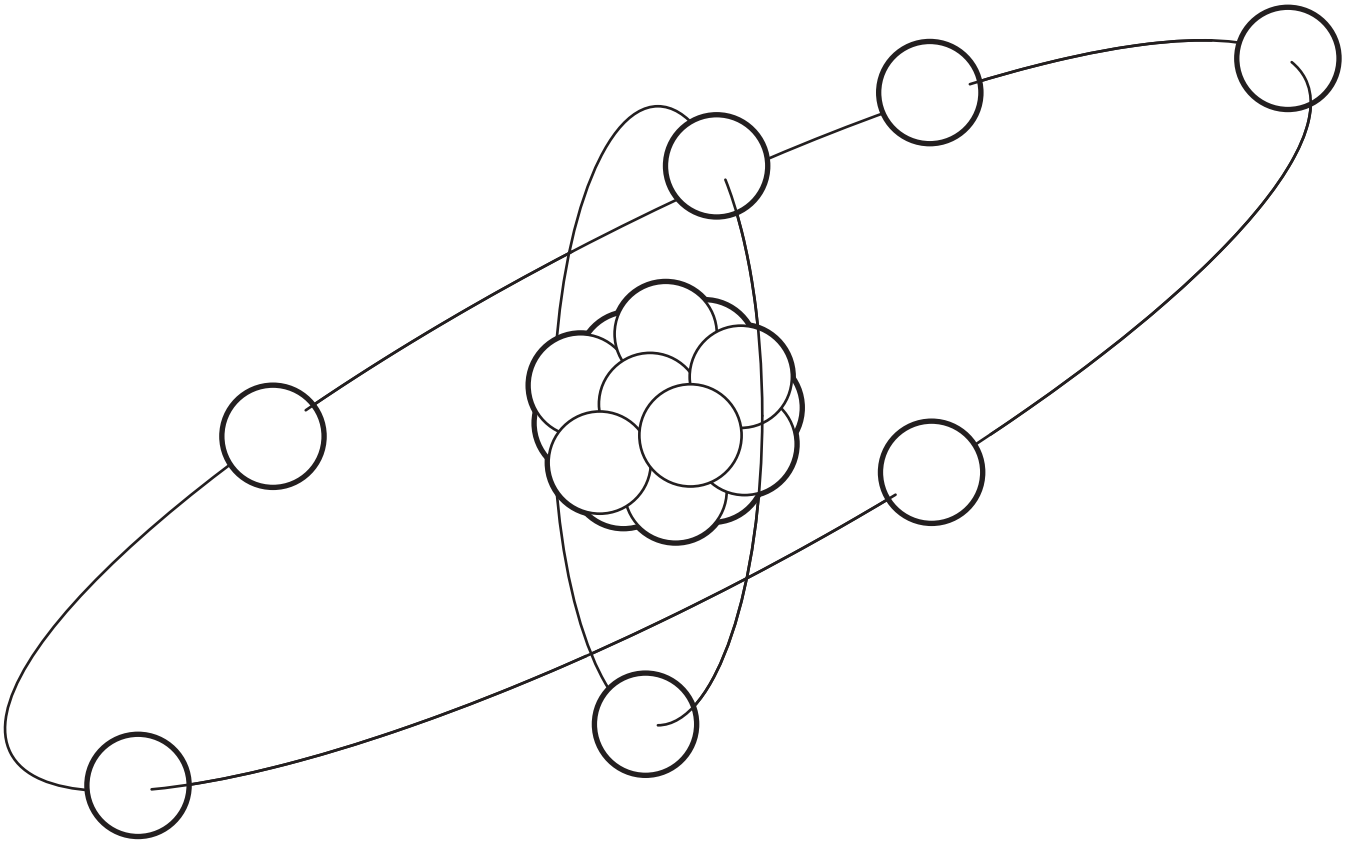
We cannot see atoms, but scientists have made models of what they think atoms look like. Scientists use models to show objects that may be too big to duplicate or too small to be easily seen. In 1913, a scientist named Niels Bohr proposed the model of an atom that is used today. In this activity, you will make Bohr models of several types of atoms.

Atoms are made of three parts: **protons**, **electrons**, and **neutrons**. The protons and neutrons are in the core of the atom, which is called the **nucleus**. Electrons are always found speeding around the nucleus. The electrons on the outermost shell are called **valence electrons**. The number of these electrons determines how reactive an element is.

The **atomic number** is the number of protons in an atom's nucleus. Typically, there are the same number of electrons and protons in an atom.

To find the number of neutrons, subtract the atomic number from the **atomic mass**. For example, nitrogen's atomic mass is 14 and its atomic number is 7.

14 – 7 = 7 (A nitrogen atom has 7 neutrons in its nucleus.)



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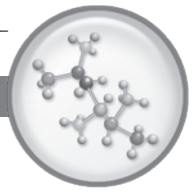


MAKING THE ELEMENTS (CONTINUED)

MATERIALS

candy-coated chocolates	jelly beans	Periodic Table of Elements (page 37)
raisins	Bohr's Model of the Atom (page 44)	

CAUTION: Before completing any food activity, ask families' permission and inquire about students' food allergies and religious or other food preferences.

PROCEDURE:

1. Use the Periodic Table of Elements to find the correct number of protons, neutrons, and electrons for each atom below.
2. Bohr's Model of the Atom shows an atom's nucleus and electron shells. Use this blank diagram of an atom and the candy-coated chocolates, raisins, and jelly beans to create models of the atoms below. Use the candy-coated chocolates to represent protons, the raisins to represent neutrons, and the jelly beans to represent electrons.
3. When you have completed your models, draw pictures of them in the boxes below.

a. hydrogen
protons _____
neutrons _____
electrons _____

b. helium
protons _____
neutrons _____
electrons _____

c. carbon
protons _____
neutrons _____
electrons _____

d. oxygen
protons _____
neutrons _____
electrons _____

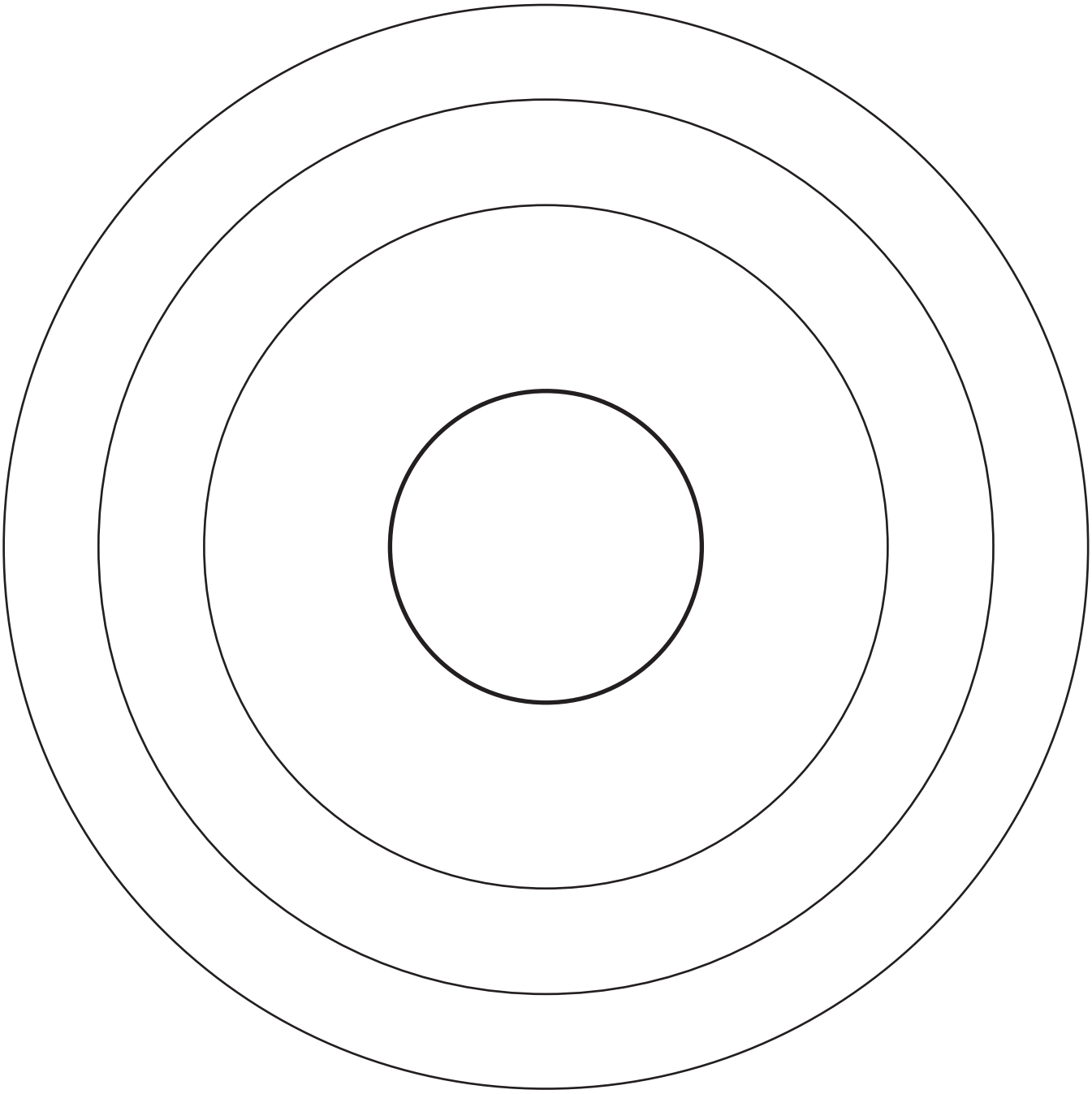
e. neon
protons _____
neutrons _____
electrons _____

f. sodium
protons _____
neutrons _____
electrons _____

Name: _____ Date: _____

Bohr's Model of the Atom

TEMPLATE



Name: _____ Date: _____

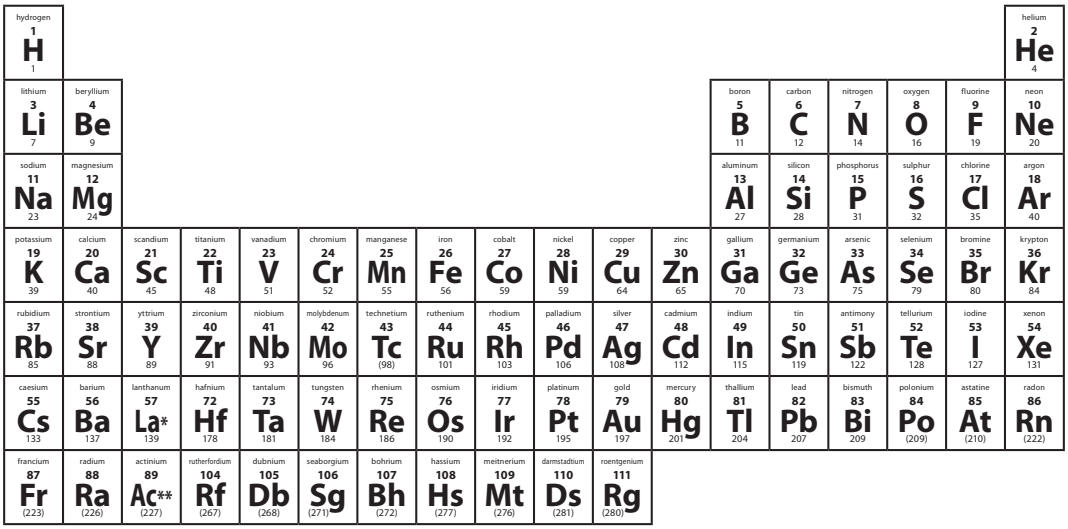
Groups of Nonmetals

FILL IN THE BLANKS / MATCHING

DIRECTIONS: The columns on the periodic table are called **groups**. Use the portion of the periodic table provided to write each group name in the correct blank below to match the group with its description.

WORD BANK

carbon group | halogen group | nitrogen group | noble gases | oxygen group



1. _____ known as group 14; each element has four valence electrons; one element in this group is a nonmetal; includes the element silicon, which is a metalloid

2. _____ known as group 15; each element has five valence electrons; two elements in this group are nonmetals; includes an element with the chemical symbol P

3. _____ known as group 16; each element has six valence electrons; three elements in this group are nonmetals; includes an element with 16 protons

4. _____ known as group 17; each element has seven valence electrons; four elements in this group are nonmetals; includes an element that is part of the compound table salt, or sodium chloride

5. _____ known as group 18; these elements do not combine easily with other elements because each element has eight valence electrons; six elements in this group are nonmetals; includes the element neon

Name: _____ Date: _____

Heavy Metal Vocabulary

MATCHING

DIRECTIONS: Match each term or characteristic below with its description.

1. _____ metals found in groups 3–12; these are fairly stable metals that either react slowly with or do not react with water and air; includes metals such as gold, nickel, and copper

2. _____ capable of being pulled into long wires

3. _____ capable of being pounded and hammered into different shapes

4. _____ a combination of two or more metals; copper is mixed with tin to create bronze

5. _____ the ease and speed with which an element combines with other elements and compounds

6. _____ group 1 of the periodic table; these are very reactive metals that are found only as compounds; never as pure elements in nature

7. _____ a metal that has the ability to transmit heat and electricity

8. _____ soft, shiny metals that are good conductors of electricity; elements numbered 57–71

9. _____ the ability to attract other metallic objects

10. _____ group 2 of the periodic table; these are reactive metals that are never found in pure states in nature

11. _____ a group of metals that includes uranium; most of these metals are created artificially in laboratories and last for only a fraction of a second after they are made; elements numbered 89–103

a. malleable

b. ductile

c. conductor

d. magnetic

e. reactivity

f. alloy

g. alkali metals

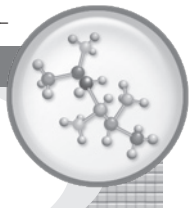
h. alkaline earth metals

i. transition metals

j. lanthanides

k. actinides

Name: _____ Date: _____



Uses of the Elements

MYSTERY WORD

DIRECTIONS: Write each element in the correct blank below to match the element with its uses. Circle the named letter in each answer. Then, unscramble the circled letters to reveal the mystery word.

WORD BANK

aluminum	carbon	copper	gold
helium	hydrogen	neon	oxygen
phosphorus	silver	titanium	uranium

1. _____ production of mirrors (third letter)
2. _____ production of jewelry; can be found as nuggets
3. _____ aiding respiration in hospital patients
4. _____ safety matches and fireworks (ninth letter)
5. _____ glowing advertising signs
6. _____ joint replacement parts, such as a hip ball and socket (first letter)
7. _____ electrical wires (third letter)
8. _____ filling balloons and blimps (fifth letter)
9. _____ nuclear fuel (seventh letter)
10. _____ cans, foil, and kitchen utensils (fifth letter)
11. _____ rocket fuel (fifth letter)
12. _____ fuel, such as coal (sixth letter)

MYSTERY WORD

_____ _____ _____ _____ _____ _____ _____ _____ _____ is used to provide energy for space probes, such as NASA's *Cassini* spacecraft, that travel millions of miles from Earth.

Name: _____ Date: _____

Element Superheroes—Part 1

INDEPENDENT RESEARCH

If you could have superpowers, what would they be? Would you be able to fly or see through walls? Those may be common superpowers in comic books, but how about the ability to attract anything metallic or to turn copper into gold?

DIRECTIONS: Use the periodic table on page 37, encyclopedias, or the Internet to research an element. After completing the Element Fact Sheet below, create an element superhero based on the element's properties.

ELEMENT FACT SHEET:

Element: _____

Symbol	Atomic Number	Atomic Mass
Number of Protons	**Number of Neutrons**	**Number of Electrons**
Melting Point °C	**Boiling Point** °C	**State of Matter at Room Temperature**

CLASSIFICATION: Nonmetal ☐ Metal ☐ Metalloid ☐

My element belongs to the _____ group.

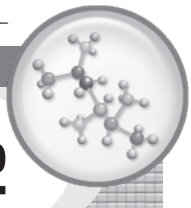
Origin of name of element: _____

Discovered by _____ in _____

Key ideas about the element (important uses, interesting facts, common compounds, etc.):

1. _____
2. _____
3. _____
4. _____
5. _____

Name: _____ Date: _____



Element Superheroes—Part 2

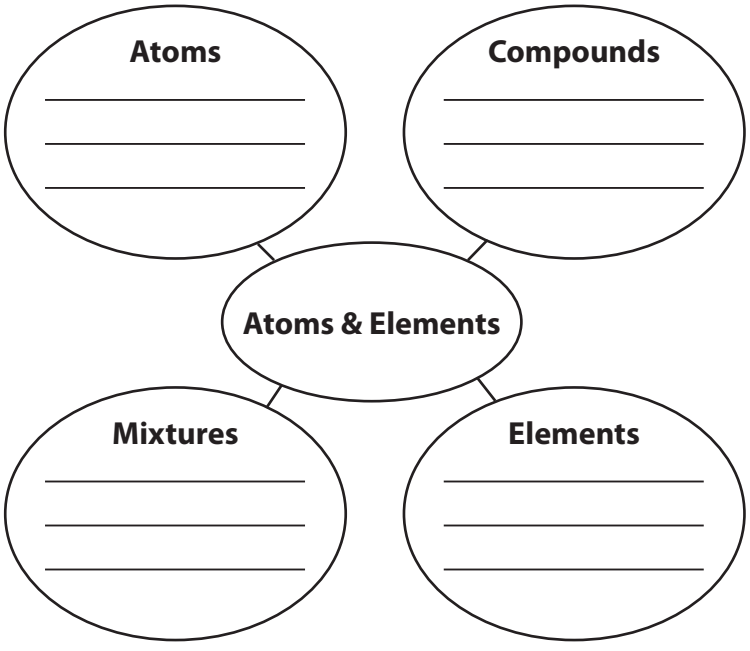
DIRECTIONS: Draw a picture of your element superhero. Include the element's name, atomic number, and atomic mass. Create a superhero slogan that describes one or more of its important superpowers.

Name: _____ Date: _____

Elemental Organization

DIRECTIONS: Complete the graphic organizer. Place the number for each fact in the correct location in the organizer.

1. substances made of two or more different, chemically combined elements
2. pure substances; all of the atoms have the same number of protons and properties
3. have smaller parts called neutrons
4. more than 100 of these are found on the periodic table
5. water, table salt, and chalk
6. positively charged particles are found in their nuclei
7. bag of candy, cereal, or fruit
8. substances made by combining two or more different materials with no chemical reaction
9. negatively charged particles circle in their orbitals
10. can be separated into their original parts



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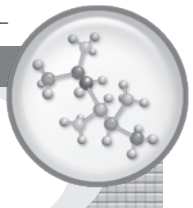


All About Elements

TRUE OR FALSE

DIRECTIONS: Determine whether each statement is true or false. Write *T* for true or *F* for false in the blank. If the statement is false, cross out the incorrect word or words and rewrite the sentence to make it true.

1. _____ Protons and electrons are found in an atom's nucleus. _____

_____

2. _____ The atomic number of carbon is 4. _____

_____

3. _____ The atomic number tells you the number of protons in the nucleus. _____

_____

4. _____ Noble gases do not combine with other elements because their outermost shells are complete with electrons. _____

_____

5. _____ Electrons have a positive charge. _____

_____

6. _____ The chemical abbreviation for helium is He. _____

_____

7. _____ The periodic table is arranged according to each element's atomic mass. _____

_____

8. _____ Being malleable and ductile are properties of nonmetals. _____

_____

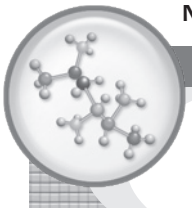
9. _____ An alloy is a mixture of two or more metals. _____

_____

10. _____ Niels Bohr created the periodic table. _____

_____

Name: _____ Date: _____



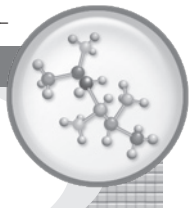
ATOMS AND ELEMENTS

Elemental Discovery

CREATIVE WRITING

DIRECTIONS: Imagine that you are a scientist and you have just discovered a new element. What are the properties of this element? Use what you have learned from your study of atoms and elements to tell your story. Write the element's name, chemical symbol, and where it would be on the periodic table.

Name: _____ Date: _____



Learning about Motion and Forces

CONTEXT CLUES

DIRECTIONS: Context clues help us learn new words when we read. Use the words, phrases, and sentences around new words to determine their meanings. Look at the words in the chart and fill in the column "What I Think It Means." Read the passage below and look for context clues to help determine the meanings of the words. Then, fill in the last column, "What It Means in Context." If your answer in the first column was completely correct, use the second column to add something to the word's meaning beyond your original idea.

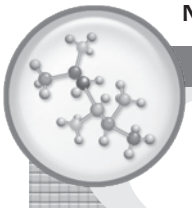
Word	What I Think It Means	What It Means in Context
physicist		
physical		
friction		
inertia		

Sir Isaac Newton was a mathematician, an astronomer, and a **physicist** who lived about 400 years ago. He spent many years studying the laws of the **physical** universe, which led him to create a set of laws that explained how and why things moved.

Newton's first law of motion states that an object at rest will stay at rest and an object in motion will stay in motion, unless acted upon by another force. For example, if there is a ball sitting on the floor, it will not move unless you move it across the room. It will stay in the same spot unless something (like your hand) causes it to move. The other part of this law states that an object will stay in motion unless another force causes it to change direction, speed up, or slow down. If you roll the ball on carpet, it might roll five feet, slow down, and stop. But, if you roll the ball on the kitchen floor, it might roll all of the way across the room to the other wall. The surface of each floor causes this to happen. As the ball rolls on the carpet, the carpet rubs against the ball causing **friction**, which slows the ball.

Newton's first law is also called the law of **inertia**. An example of inertia could be represented by a ball sitting on a table. That ball would stay on the table forever unless something moved it. When you push the ball, it moves in the direction you push it, and it slows down because of the friction from rubbing against the table. But, what if you threw the ball in outer space? If there was no air or other surface to slow down the ball, how far might it travel then?

Name: _____ Date: _____



MOTION AND FORCES

A Lot of Movin'

WORD SEARCH

DIRECTIONS: Find the motion and forces vocabulary words in the word search below. Words can be found down, across, and diagonally. Then, on a separate sheet of paper, write sentences for five of the words.

WORD BANK

acceleration	force	friction	gravity
inertia	mass	meter	momentum
motion	speed	velocity	weight

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

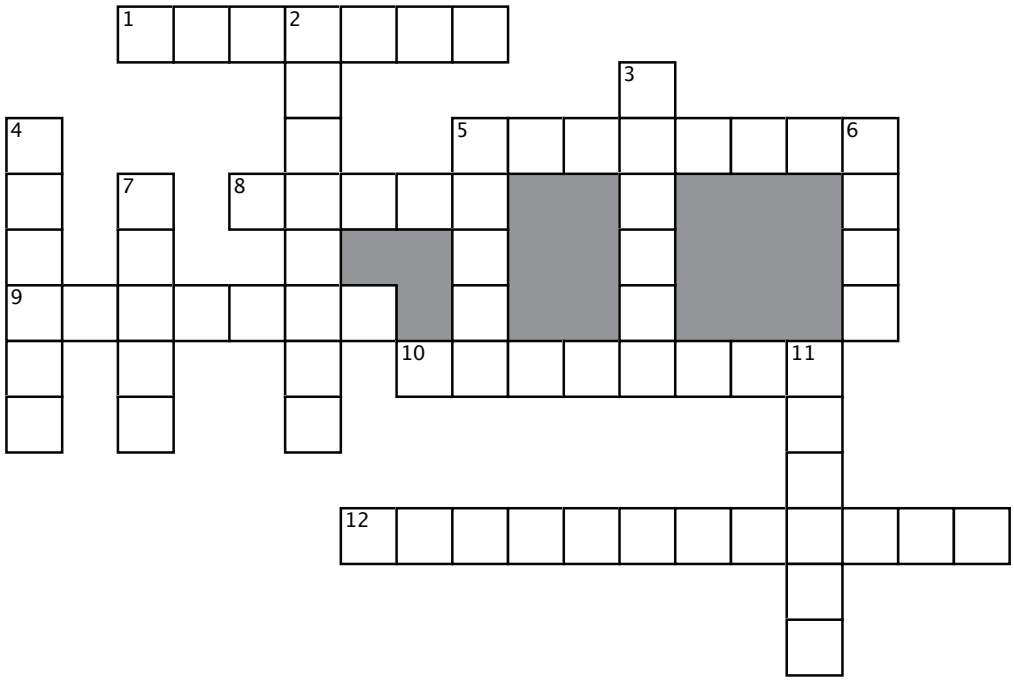
Name: _____ Date: _____

MOTION AND FORCES

A Lot of Movin'

CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle.



ACROSS

1. the force that pulls two objects toward each other

5. the product of an object's mass and its velocity

8. a push or pull exerted on an object

9. how an object resists any change in its motion

10. the force that one surface has on another when they rub together

12. the rate at which velocity changes

DOWN

2. the speed of an object in a given direction

3. the force of gravity on an object at the surface of a planet

4. how an object can be measured by its change in position from one area to another

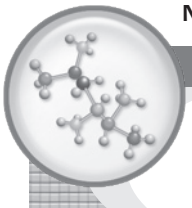
5. the basic metric measurement of length

6. the amount of matter in an object

7. the distance an object travels in a specific amount of time

11. a unit of measurement of force

Name: _____ Date: _____



MOTION AND FORCES

Moving Along

MYSTERY WORDS

DIRECTIONS: Write each motion and forces vocabulary word in the correct blank below to match the term with its description. Circle the named letter or letters in each answer. Then, unscramble the circled letters to reveal the mystery words.

WORD BANK

acceleration	force	friction	gravity
inertia	mass	momentum	newton
speed	velocity	weight	

1. _____ the force that pulls objects toward each other (third letter)

2. _____ the distance an object travels in a given amount of time (first and second letters)

3. _____ speed in a given direction (third letter)

4. _____ the force of gravity on an object at the surface of a planet (fifth letter)

5. _____ the force one object exerts on another when they rub together

6. _____ the pushing or pulling on an object (fourth letter)

7. _____ the product of an object's mass times its velocity (seventh letter)

8. _____ the tendency of an object to resist any change in its motion (third letter)

9. _____ the force required to accelerate 1 kg of mass at 1 m/sec. (fourth letter)

10. _____ the rate that the velocity of an object changes (fourth and ninth letters)

11. _____ the amount of matter in an object; used to calculate forces on an object (third letter)

MYSTERY WORDS

This vehicle can overcome Earth's gravity because it expels a gas with a force equal to the pull of gravity.

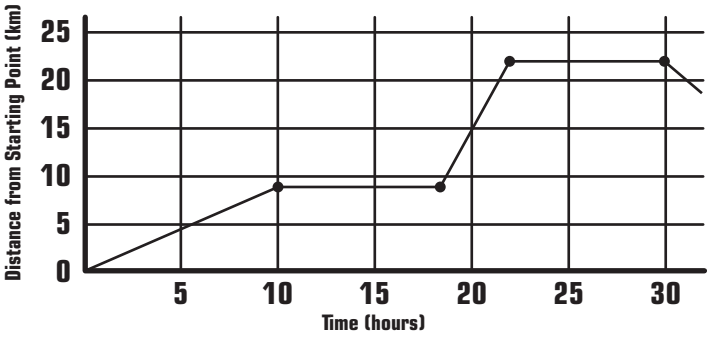
_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

Name: _____ Date: _____

Motion Graphs

DIRECTIONS: Velocity is the speed of an object in a given direction. It can be found by dividing the distance by the time. The graphs below show the data collected by students investigating motion. Use the graphs to answer each question.

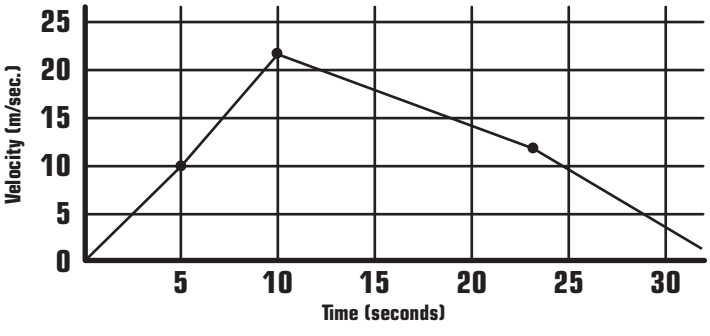
Caleb's Hiking Trip



1. How far did Caleb hike in the first 10 hours of his trip? _____
2. What was Caleb's average velocity for the first 18 hours of his trip? _____
3. How fast did Caleb hike between hours 18 and 22 of his trip? _____
4. What do you think is happening after hour 30 of his trip? _____

_____

A Ball Thrown into a Field



5. Describe what is happening to the ball's velocity. _____

_____

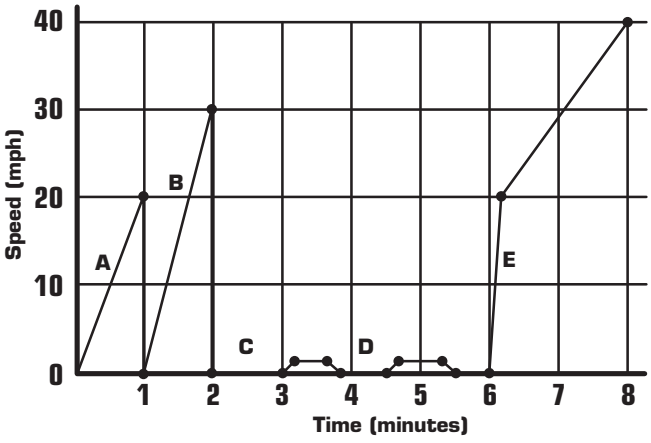
6. How much time did it take the ball to gain a velocity of 10 m/sec.? _____

Name: _____ Date: _____

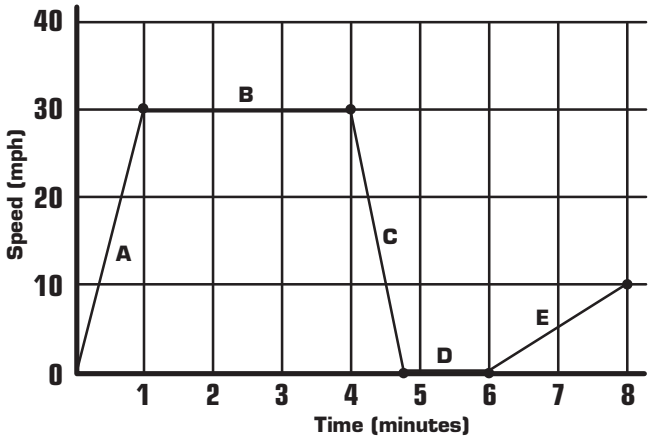
Travel Graphs

DIRECTIONS: The graphs below show the data collected by a student studying motion. Write the letter from each graph next to the sentence that most accurately describes what is occurring at that stage.

Graph 1



Graph 2



GRAPH 1:

1. _____ Bridget left her purse at home. She stops the car, turns around, and drives home 10 mph faster than before.
2. _____ For three minutes, Bridget's car moves slowly and stops several times at traffic lights.
3. _____ Bridget accelerates from 0 to 20 mph in 1 minute.
4. _____ Bridget accelerates quickly to 20 mph as she gets on the highway.
5. _____ Bridget leaves her car running in the driveway for 1 minute while she searches for her purse.

GRAPH 2:

6. _____ Tyler's car is stopped for 1 minute and 15 seconds.
7. _____ Tyler accelerates to 30 mph in 1 minute.
8. _____ Tyler sees a red traffic light ahead. It takes him 45 seconds to come to a complete stop.
9. _____ Tyler drives 30 mph for 3 minutes.
10. _____ Tyler drives through a construction zone and accelerates over 2 minutes to reach 10 mph.

Name: _____ Date: _____

Newton's First Law

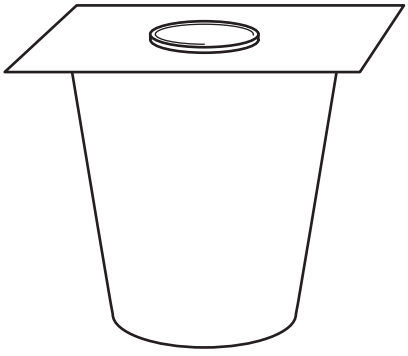
SCIENCE ACTIVITY

Newton's first law of motion states that an object at rest will stay at rest and an object in motion will stay in motion, unless acted upon by another force. In this activity, you will test this law and learn a new trick.

MATERIALS

plastic cup	coin	index card

PROCEDURE:



1. Cover the top of the cup with the index card. Put the coin on top of the card.
2. Think about how you can get the coin inside of the cup without touching the coin or lifting or tilting the index card.
3. Test your ideas and see if you can get the coin into the cup. After you have successfully made the coin fall into the cup, answer the questions below.

RESULTS:

1. How did you get the coin into the cup? _____

_____

2. What happens to the coin if the card is moved away slowly? _____

_____

_____

CONCLUSIONS:

3. Why does the coin drop into the cup? _____

_____

_____

_____

4. Can you think of a place where you have seen something similar happen? _____

_____

_____

Name: _____ Date: _____

MOTION AND FORCES

Newton's Third Law

SCIENCE ACTIVITY

Newton's third law of motion states that for every action there is an equal and opposite reaction. In this activity, you will test this law using an empty milk carton and water.

MATERIALS

empty milk carton	sharpened pencil	cup of water
piece of sturdy string	plastic tub or sink	

PROCEDURE:

1. Use the sharpened pencil to make a small hole in the lower-right corner of each side of the milk carton.
2. Make another hole in the center of the top of the carton. Thread the string through this hole and tie a knot so that the carton hangs from the string.
3. Hold the carton over the plastic tub or sink. Open the spout of the carton and pour the cup of water into the carton. Note which direction the carton turns as you pour the water.

RESULTS:

1. Which direction did the carton turn, clockwise or counterclockwise?

_____

CONCLUSIONS:

2. How could you make the milk carton turn in the opposite direction? _____

_____

_____

_____

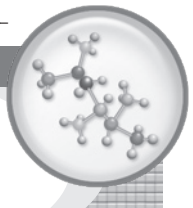
3. What caused the carton to turn? _____

_____

_____

_____

Name: _____ Date: _____



Newton's Laws

MAGIC NUMBER / MATCHING

DIRECTIONS: Match each motion and forces vocabulary term with its definition. Then, copy the number of each answer into the box with the matching letter below. When you add the numbers down, across, and diagonally, the sums should be the same.

1. _____ for every action of force on an object, the object will exert an equal and opposite reaction

2. _____ the product of an object's mass and its velocity

3. _____ the tendency of an object to resist any change in motion

4. _____ a measure of the force of gravity on an object

5. _____ a push or pull exerted on an object

6. _____ an object at rest will remain at rest and an object in motion will remain in motion, unless it is acted upon by an unbalanced force

7. _____ a force that one surface exerts on another when they rub together

8. _____ the net force on an object is the product of its acceleration and its mass

9. _____ the total momentum is the same before and after an event as long as there are no outside forces

a. Newton's second law of motion

b. Newton's third law of motion

c. Newton's first law of motion

d. inertia

e. force

f. friction

g. weight

h. conservation of momentum

i. momentum

a.	**b.**	**c.**
d.	**e.**	**f.**
g.	**h.**	**i.**

MAGIC NUMBER = _____

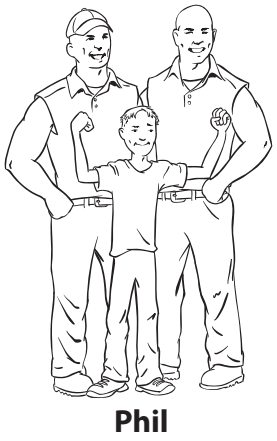
Name: _____ Date: _____

Will, Bill, and Phil

MATCHING

Will, Bill, and Phil are brothers who own a furniture moving company. Sometimes they work well together, and sometimes they do not. When two of the brothers push on the same object, their combined force can either add together or subtract from each other. The **net force** is the total strength of these forces. Sometimes the object will move, and other times it will not. Which direction it moves in depends on how strong of a force the brothers use to push on the object.

DIRECTIONS: Match each description and picture showing the brothers moving the bookcase with the correct type of force.



DESCRIPTION OF FORCE:

a. Will and Bill disagree on which direction to push the bookcase, so they push in opposite directions. The net force is zero because they cancel out each other's force. The bookcase does not move.

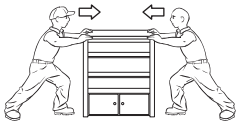
b. Will wants to push the bookcase to the right. Phil wants to push it to the left. The net force is the difference between Will's and Phil's forces. The bookcase moves slightly toward Phil.

c. Will and Phil push the bookcase together down the hall. The net force is the sum of Will's and Phil's forces.

d. Will and Bill move the bookcase together down the hall. The net force is the sum of Will's and Bill's forces.

PICTURES OF FORCE:

e. 

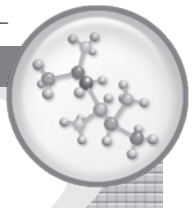
f. 

g. 

h. 

TYPE OF FORCE:	**Description**	**Picture**
1. balanced forces in the same direction	_____	_____
2. balanced forces in opposite directions	_____	_____
3. unbalanced forces in the same direction	_____	_____
4. unbalanced forces in opposite directions	_____	_____

Name: _____ Date: _____



Net Forces

DRAWING

DIRECTIONS: Draw a diagram that shows the directions of the individual forces and net force for each type of force listed below. Remember to label the forces in each diagram as individual or net forces.

1. balanced forces in the same direction

2. balanced forces in opposite directions

3. unbalanced forces in the same direction

4. unbalanced forces in opposite directions

Name: _____ Date: _____

MOTION AND FORCES

Gravity's Force

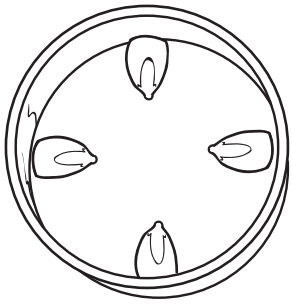
LIFE AND EARTH SCIENCE CONNECTION

Just like how forces that are exerted on an object can change the object's direction, similar forces affect the way plants grow. **Tropisms** are the forces that affect the way plants grow. A tropism causes the roots, the stems, and the leaves to grow in a certain direction. In this activity, you will see what effect gravity has on sprouting corn seeds.

MATERIALS

petri dish	4 corn seeds, soaked overnight	cotton balls	duct tape	scissors
transparent tape		graduated cylinder	filter paper	cabinet

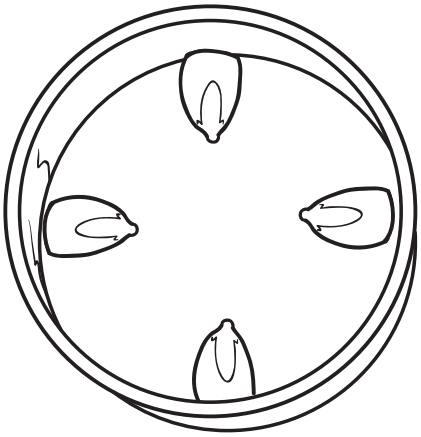
PROCEDURE:



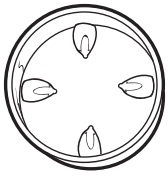
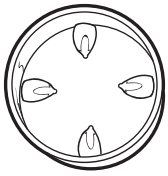
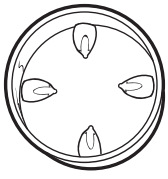
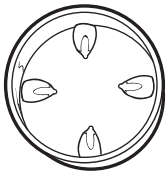
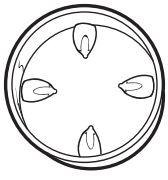
1. Your teacher soaked corn seeds in water overnight. This allowed water to enter the seed coat and start germinating the seeds. Place the four corn seeds flat in the bottom of the petri dish. If you imagine the petri dish as a clock, place the seeds at 12, 3, 6, and 9 o'clock. Make certain that the pointed ends of the seeds face inward as shown.
2. Cut a piece of filter paper so that it fits in the petri dish. Carefully place the filter paper into the petri dish, covering the seeds. Make certain that the seeds do not move.
3. Measure 15 mL of water in the graduated cylinder and pour it on the filter paper. Then, cover the filter paper with enough cotton balls that the paper and seeds are held tightly in place when you place the cover on the petri dish.
4. Use transparent tape to keep the petri dish closed. Turn over the dish to make certain that the seeds have not moved. If they have, open the dish and reposition the seeds.
5. Cut two pieces of duct tape long enough to support the petri dish. Tape the petri dish to the wall of a dark cabinet, or to another dark location, so that you can see the seeds through the bottom of the petri dish. Close the cabinet to keep the seeds in the dark for several days.
6. Sketch what you think will happen to the roots that grow from each seed in the prediction section on page 65.
7. At the same time each day, look at your petri dish. Sketch how the roots from each seed are growing and describe the growth in the data table on page 65.
8. Observe your petri dish for five days.

Name: _____ Date: _____

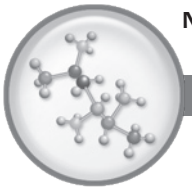
PREDICTION: Sketch what you think will happen to each seed in the petri dish.



DATA TABLE:

Date	Description of Seed Growth	Sketch of Seed Growth
		
		
		
		
		

Name: _____ Date: _____



GRAVITY'S FORCE (CONTINUED)

RESULTS:

1. Review your prediction on page 65. Was your prediction correct? _____

2. In which direction did the seeds' roots grow? _____

_____

CONCLUSIONS:

3. How does gravity help the roots of a plant grow? _____

_____

_____

_____

_____

4. Why did you place the sprouting seeds in a dark cabinet? _____

_____

_____

_____

_____

5. After a plant's roots grow, they produce a stem and leaves that grow upward. What type of tropism, or force that affects the way a plant grows, is causing these parts of the plant to grow upward? (Hint: Think about the process in which plants use sunlight to make food.)

_____

_____

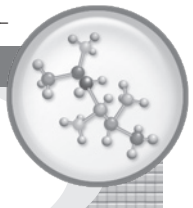
_____

_____

_____

_____

Name: _____ Date: _____



Air Pressure

WORD SEARCH

DIRECTIONS: Find the air pressure vocabulary words in the word search below. Words can be found down, across, and diagonally. Then, on a separate sheet of paper, write sentences for five of the words.

WORD BANK

air pressure	barometer	Bernoulli	drag	high pressure
lift	low pressure	pressure	thrust	weight

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

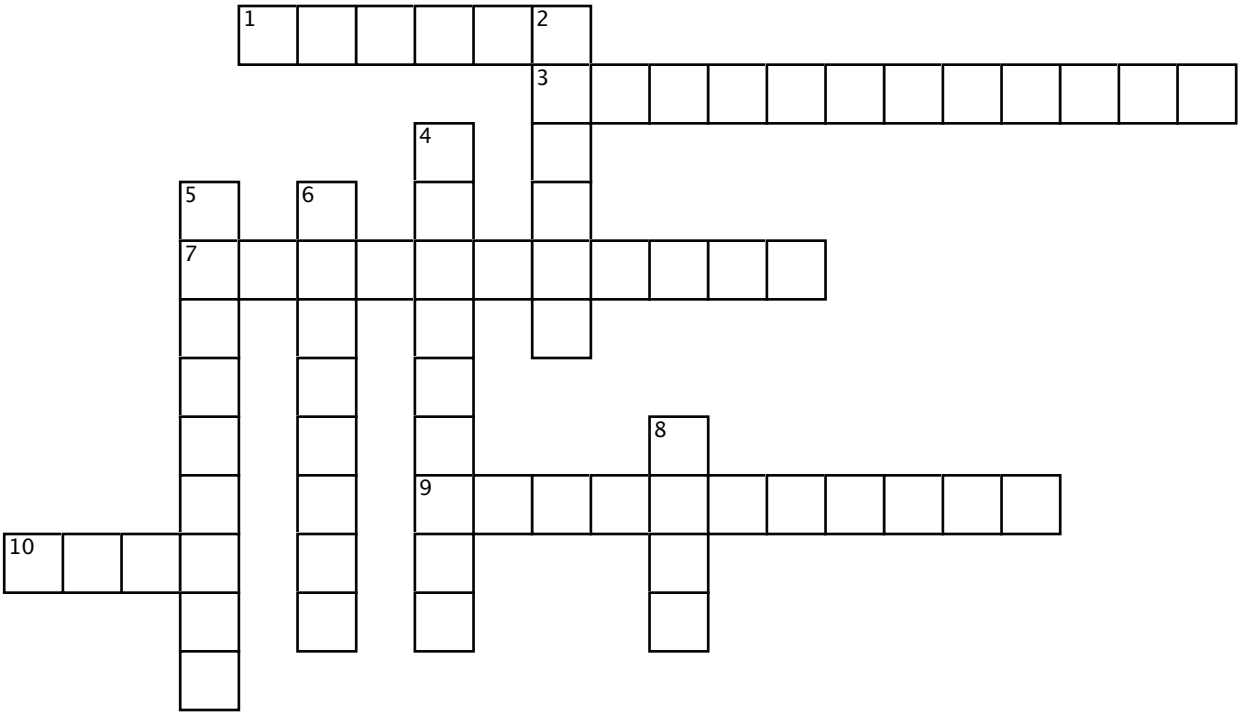
Name: _____ Date: _____

AIR PRESSURE

Air Pressure

CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle.



ACROSS

1. the force that pulls a plane toward the ground

3. area where there is a high density of air molecules

7. the force that results from the weight of a column of air pushing down

9. area where there is a low density of air molecules

10. the force that keeps a plane in the air; it is produced by the shape of the plane's wings

DOWN

2. the force that pushes a plane forward; it is produced by the plane's propeller or jet engine

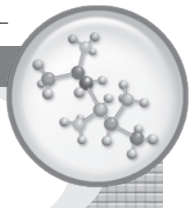
4. scientist who studied the pressure of fluids, such as air

5. instrument used to measure changes in air pressure

6. the force that pushes on an area or surface

8. the force that tries to stop a plane moving through the air

Name: _____ Date: _____



Lifting with Air!

SCIENCE ACTIVITY

Even though gases like oxygen and carbon dioxide are invisible, they still exert pressure on objects around them. Is air pressure strong enough to lift heavy objects? In this activity, you will test the strength of air pressure.

MATERIALS

1-gallon resealable plastic bag	sharpened pencil	duct or packing tape
	plastic drinking straw	3–4 books

PROCEDURE:

1. Seal the plastic bag. Place one book on top of the bag and leave about 2" (5 cm) of the bottom of the bag sticking out from under the book.
2. Use the sharpened pencil to poke a hole in the bag.
3. Place the drinking straw in the hole. Use the duct or packing tape to seal the space around the straw so that no air can escape.
4. Blow into the straw. When you need to take a breath, place your finger over the end of the straw to keep air from leaking out. Blow into the bag until it is partially inflated. What happens to the book when you blow into the bag? _____

   _____
5. Place two or three books on top of the first book. Repeat step 4. What happens to the stack of books when you blow into the bag? Is the air pressure strong enough to lift several books?

   _____

   _____

CONCLUSIONS:

1. Name one of the properties of air that allows it to lift objects. _____

   _____
2. Name other situations in which air pressure is strong enough to lift heavy objects. _____

   _____

   _____

Name: _____ Date: _____

AIR PRESSURE

The Science of Flight

FILL IN THE BLANKS / DIAGRAM LABELING

Flight by heavy planes is made possible by a careful balance of four physical forces: lift, drag, weight, and thrust.

DIRECTIONS: Write each force in the correct blanks below to match the force with its definition and to label the force acting on the plane.

WORD BANK

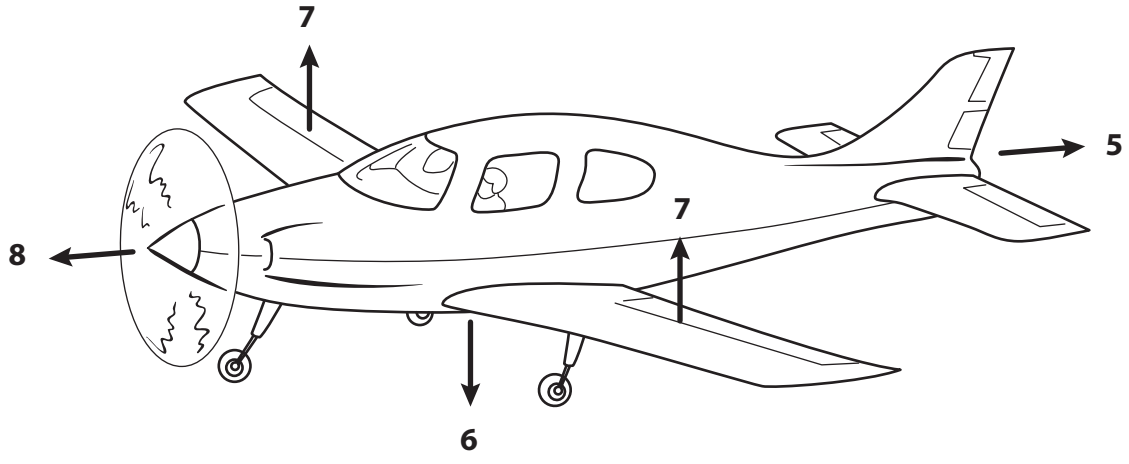
drag	lift	thrust	weight

1. _____ the force that pushes a plane forward; it is produced by the plane's propeller or jet engine

2. _____ the force that pulls a plane toward the ground

3. _____ the force that tries to stop a plane moving through the air

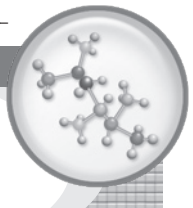
4. _____ the force that keeps a plane in the air; it is produced by the shape of the plane's wings



5. _____ **6.** _____

7. _____ **8.** _____

Name: _____ Date: _____



Airfoils—Part 1

SCIENCE ACTIVITY

An eighteenth-century Swiss scientist named Daniel Bernoulli was interested in the way that fluids, such as air, move. He conducted many experiments and is credited with Bernoulli's Principle, which helps us understand fluids and the pressures they exert. An **airfoil** is a surface, such as a wing, whose shape can control lift. In these activities, you will demonstrate how lift keeps an airplane in the air during flight.

MATERIALS

strip of paper, 10" x 2" (25 cm x 5 cm)	2–3 paper clips	transparent tape	pencil

PROCEDURE:

1. Grasp one of the short ends of the strip of paper and set it against your chin, just below your mouth.
2. Hold the paper in place and blow over the top of the strip. What happens to the paper?

   _____

   _____
3. Attach a paper clip to the end of the paper that is opposite your mouth. Repeat steps 1 and 2. Does the paper lift into the air? Describe what you think is happening. _____

   _____

   _____
4. Remove the paper clip from the paper. Fold the strip of paper in half lengthwise.
5. Push the top half of the paper toward the crease and tape it in place about 1" (2.5 cm) from the end of the paper. Your strip of paper should look like a teardrop when viewed from the side. This is an airfoil.
6. Place a pencil through the middle of the airfoil and let it hang downward from the fold.
7. Hold the airfoil against your chin like in step 1. Blow across the top of the airfoil. What happens to the airfoil? _____

   _____

Name: _____ Date: _____

AIR PRESSURE

Airfoils—Part 2

SCIENCE ACTIVITY

MATERIALS

copy of Bernoulli's Airplane (page 73)	transparent tape	scissors
	1–2 paper clips	protractor

PROCEDURE:

1. Cut out Bernoulli's Airplane along the solid line.
2. Fold line D from the top half so that it meets the bottom half, but do not crease the paper at the fold.
3. Place small pieces of tape at the points marked A, B, and C so that line D stays in place.
4. Fold the plane along line E so that it creates a flattened V shape. The angle of the V should be about 15 degrees.
5. Look at the side of the plane. What does the shape of the wing look like? _____

   _____
6. Test-fly your plane. If it does not fly well, adjust its stability by adding weight to the nose of the plane. Add one or two paper clips to the front of the plane and try to fly it again.
7. Cut small notches in the tail of the plane. Then, bend those notches up or down. How does this affect the flight of your plane? _____

   _____

RESULTS:

1. Describe how your plane flew the best (with or without paper clips, with or without notches, etc.).

   _____

   _____

CONCLUSION:

2. How do you think the shape of the airfoil affected flight? _____

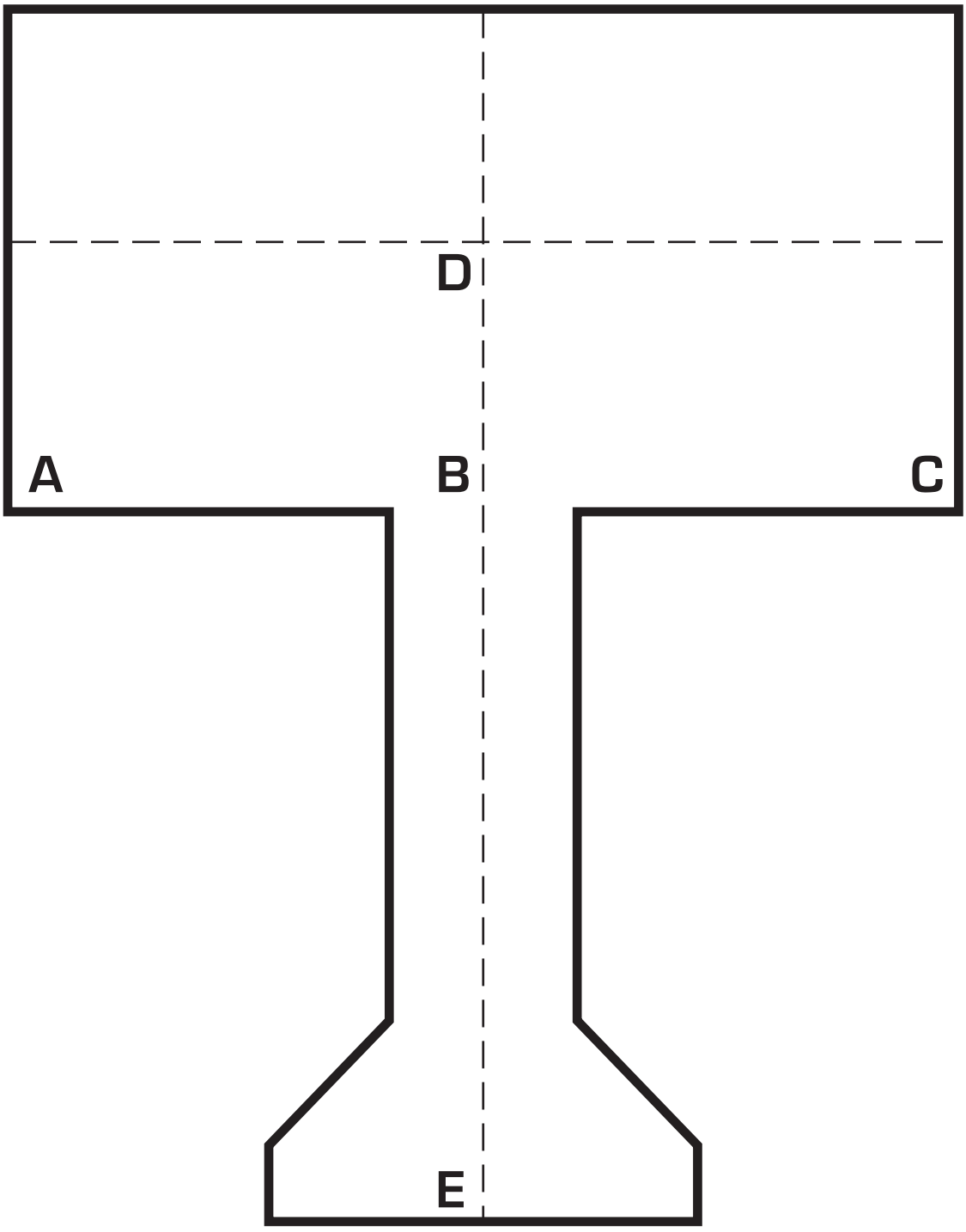
   _____

   _____

Name: _____ Date: _____

Bernoulli's Airplane

TEMPLATE



Name: _____ Date: _____

SOUND

Sound Off!

WORD SEARCH

DIRECTIONS: Find the sound vocabulary words in the word search below. Words can be found down, across, and diagonally. Then, on a separate sheet of paper, write sentences for five of the words.

WORD BANK

cochlea	decibel	Doppler effect	ear canal	eardrum
elasticity	infrasound	loudness	medium	middle ear
pitch	sonar	sound	ultrasound	vibration

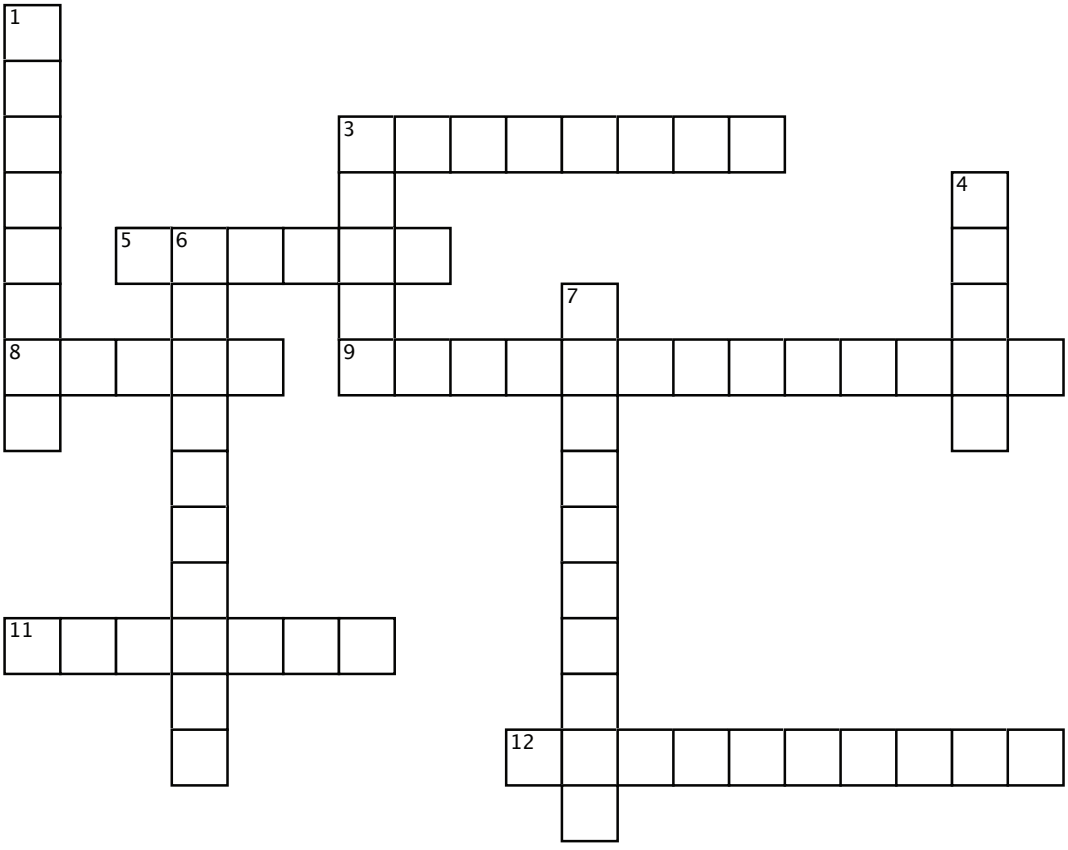
P R C Q X C M R B O R P D S L S H J L G
K E Z Y D B E X E A R D R U M I M V V J
N O T Q T E F X Y W Q N D E T N B F F O
V I B K J T U W K G U A E L W F H W Q J
Q X H A V I B R A T I O N N M R A Y C G
J M C O C H L E A Z K I N D N A T T V G
L B S C I I L M E M U L T R A S O U N D
L O I O B K O C A E W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

Name: _____ Date: _____

Sound Off!

CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle.



ACROSS

3. an image made by an ultrasound machine; often used for seeing internal organs in humans

5. the substance through which sound waves travel

8. a method that uses sound waves to find objects underwater

9. the perception in the change of a sound's frequency as the source moves closer or farther from the listener

11. a unit of measurement of how loud a sound is

12. sound waves with frequencies below 20 Hz

DOWN

1. a human's perception of how intense a sound is

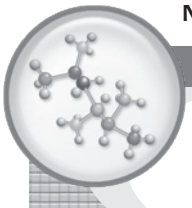
3. a disturbance that travels through a medium as a wave

4. a human's perception of the frequency of a sound

6. the ability of a material to bounce back after being disturbed

7. sound waves with frequencies above 20,000 Hz

Name: _____ Date: _____



SOUND

Measuring Sound

INQUIRY INVESTIGATION

Sound can travel through many different types of materials, including solid, liquid, or gaseous materials. In this activity, your group will measure how fast sound travels through air.

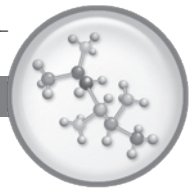
MATERIALS

metric tape measure	empty coffee can	metric thermometer
stopwatch	metal spoon	large outdoor area

PROCEDURE:

1. With the other two members of your group, use the thermometer to record the outdoor air temperature in degrees Celsius. Record the temperature on page 77.
2. Use the tape measure to measure a distance of 100 m in a straight line. How much time do you think it will take sound to travel this distance? Record your prediction on page 77.
3. One student in the group will be the "drummer" and stand at one end of the 100 m with the empty coffee can and spoon.
4. The other students in the group will stand at the opposite end of the 100 m with the stopwatch. One student, the "listener," will face away from the drummer. The other student, the "watcher," will operate the stopwatch and watch the drummer.
5. The drummer should hit the can once with the spoon.
6. When the watcher sees the spoon hit the can, she should start the stopwatch. When the listener hears the sound, she should say, "Stop!" and the watcher should stop the stopwatch. Record this time in the data table on page 77.
7. Reset the stopwatch. Repeat steps 6 and 7 nine more times for a total of 10 trials.
8. Calculate the average of the measured times. To calculate the average time, use this formula: average time (sec.) = the sum of the time from all of the trials (sec.) ÷ the number of trials. Record the average time on page 77.
9. Calculate the speed of sound. Speed can be measured in meters per second (m/sec.). To calculate the speed of sound, use this formula: speed (m/sec.) = distance (m) ÷ time (sec.). Record the speed of sound on page 77.

Name: _____ Date: _____



MEASURING SOUND (CONTINUED)

Air Temperature (°C): _____

Measured Distance (m): 100 m

PREDICTION: How long will it take sound to travel this distance? _____

DATA TABLE:

Trial	Time (sec.)	Trial	Time (sec.)
1		6	
2		7	
3		8	
4		9	
5		10	

Average Time (sec.): _____

Speed of Sound (m/sec.): _____

RESULTS:

1. Reread your prediction above. How close was your prediction? If it was very different, what could have caused the difference? _____

_____

CONCLUSIONS:

2. How do you think the speed of sound would change in cooler air temperatures? How do you think the speed of sound would change in warmer temperatures? Why? _____

_____

3. On a cooler or warmer day, repeat the experiment to test your hypotheses. Describe your results.

_____

_____

Name: _____ Date: _____

SOUND

The Doppler Effect

SCIENCE ACTIVITY

Have you ever noticed that the sound of a car as it approaches you is different from its sound after it passes? Why does the sound change? In this activity, you will demonstrate the Doppler effect.

MATERIALS

small buzzer	plastic tub of water
tape recorder	pebble

PROCEDURE:

1. Hold the buzzer in front of the tape recorder. Turn on the buzzer and record the sound.
2. Play back the recording and make sure that it sounds the same as the original sound the buzzer made.
3. Record the sound of the buzzer a second time. This time, move the buzzer toward and away from the recorder several times.
4. Play back the recording and listen to how the pitch (the highness or lowness of a sound) of the buzzer changes as it moves closer and farther away.
5. Describe the difference between the first recording and the second recording. _____

   _____

   _____
6. Drop the pebble into the plastic tub of water and watch the ripples in the water. Describe the ripples. _____

   _____

These ripples show what happens when something makes a sound and the air vibrates. The sound waves spread in every direction, similar to the water ripples. These ripples look like the sound waves that the buzzer made when you held it still in front of the recorder.

7. Drag your finger across the surface of the water. Describe how these ripples are different from the ripples created by dropping the pebble into the water. _____

   _____

These ripples look like the sound waves when you moved the buzzer toward and away from the recorder. The sound waves near the buzzer are closer, which makes the pitch of the sound higher. When the buzzer is farther from the recorder, the sound waves are farther apart and the pitch is lower.

Name: _____ Date: _____

The Human Ear

FILL IN THE BLANKS / DIAGRAM LABELING

DIRECTIONS: Write each part of the human ear from the first set of words in the correct blank below to match each term with its description. Then, use the second set of words to label the parts of the human ear.

WORD BANK

cochlea	ear canal	eardrum	hammer, anvil, and stirrup	nerve cells

anvil	cochlea	ear canal	eardrum	hammer	inner ear	middle ear	outer ear	stirrup

1. _____ outermost part of the ear that funnels sound waves into the ear

2. _____ small, tightly stretched membrane that vibrates when sound waves strike it

3. _____ the three smallest bones in the body; found in the middle ear

4. _____ liquid-filled cavity with thousands of nerve cells; sound waves travel through this liquid to pass into the inner ear

5. _____ hairlike structures in the cochlea that move with sound vibrations and send messages to the brain

6. _____

7. _____

8. _____

9. _____

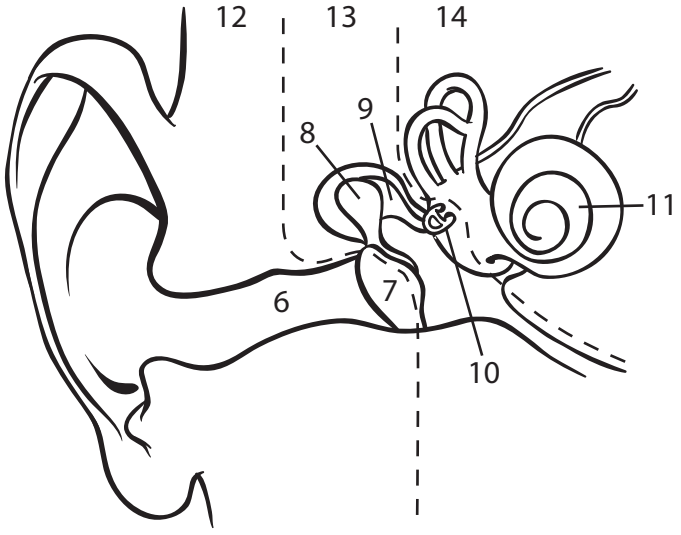
10. _____

11. _____

12. _____

13. _____

14. _____



Name: _____ Date: _____

SOUND

Wave Anatomy

FILL IN THE BLANKS / DIAGRAM LABELING

DIRECTIONS: Write each word in the correct blanks below to match each term with its definition and to label the parts of the sound wave.

WORD BANK

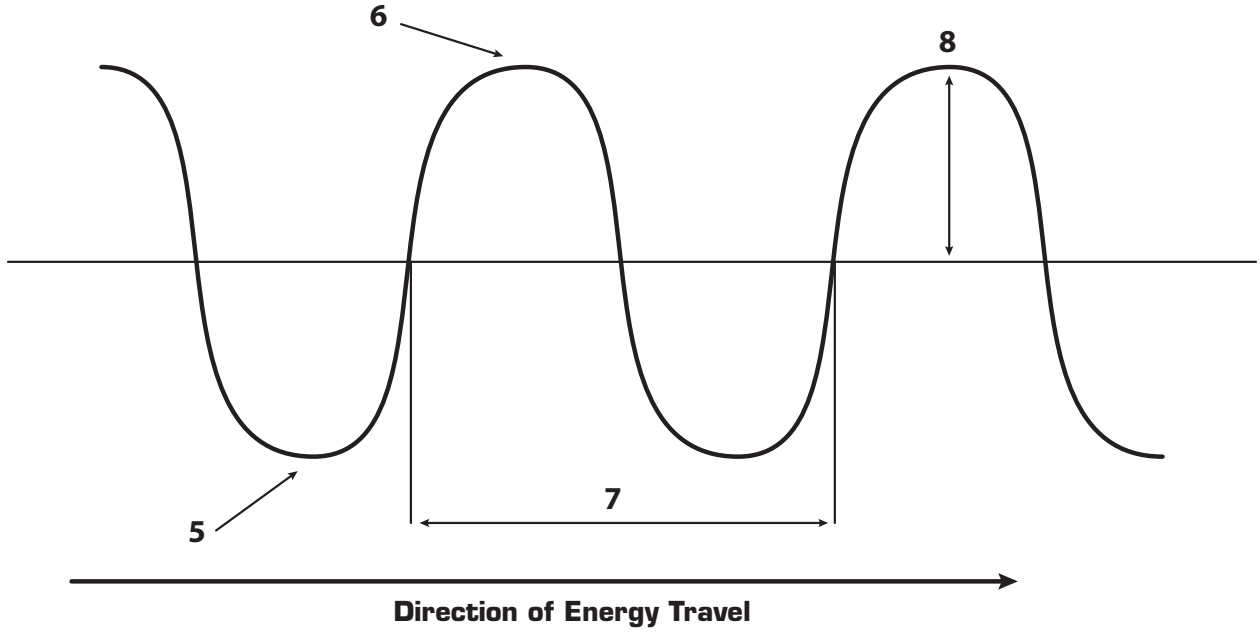
amplitude	crest	trough	wavelength

1. _____ the height of a wave above the median line

2. _____ the distance between two equal points on the wave

3. _____ the section of a wave that rises above the median line

4. _____ the section of a wave that lies below the median line



5. _____ **6.** _____

7. _____ **8.** _____

Name: _____ Date: _____

Shoe Box Guitar

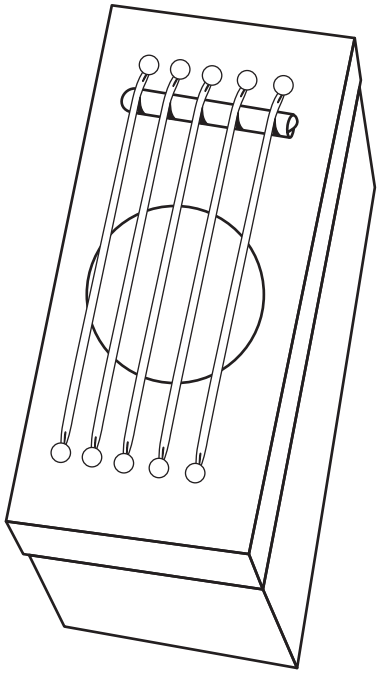
SCIENCE ACTIVITY

Why do the strings of a guitar have different pitches when they are plucked? **Pitch** is how high or low a sound seems to the human ear. Pitch also depends on the frequency of the sound wave. Sound waves with a high frequency have a high pitch, and sound waves with a low frequency have a low pitch. In this activity, you will make a shoe box guitar.

MATERIALS

shoe box	masking tape	5 rubber bands with different lengths and widths	10 brass fasteners
pen	scissors		

PROCEDURE:



1. Draw a large circle on the lid of the shoe box. Cut out the circle from the lid.
2. Roll the cutout circle into a tube from each end so that the edges touch. Tape the edges together. This will be the guitar's bridge.
3. Tape the bridge to the shoe box lid so that it is parallel to the short side of the lid.
4. Mark five evenly spaced holes along both short sides of the shoe box lid about 2" from the circle. Push a brass fastener through each hole.
5. Cut each rubber band once. Starting at one brass fastener, stretch each rubber band lengthwise across the lid, loop it around the opposite brass fastener, and tie it to the brass fastener where you started.
6. Place the lid on the shoe box.
7. Pluck each rubber band. Each one should have a different pitch. If they do not, tighten or loosen the rubber bands with the same pitch.

CONCLUSIONS:

1. How does the shoe box guitar make sounds? _____

   _____

2. Why do you think the sounds from each rubber band are different? _____

   _____

   _____

Name: _____ Date: _____

SOUND

String and Cup Communication

INQUIRY INVESTIGATION

In this activity, you and your partner will observe how sound is transmitted through vibrations.

MATERIALS

2 plastic cups	2 paper clips
string	sharpened pencil

PROCEDURE:

1. Use the sharpened pencil to poke a small hole in the bottom of each plastic cup.
2. Tie a paper clip to one end of the string.
3. Thread the other end of the string through one of the cups from the inside. Pull it all of the way through until the paper clip is at the bottom of the cup.
4. Thread the string through the hole of the second cup from the outside. Tie the second paper clip to the end of the string. Pull the string until the paper clip is at the bottom of the second cup.
5. Pull the string taut and have your partner talk into one cup while you hold the other cup to your ear.
6. With your partner, choose *one* variable to change in your string and cup communicator. Write your plan and a hypothesis of what you think will happen. Then, carry out your plan.

_____

_____

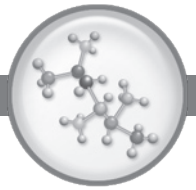
_____

_____

_____

_____

_____



RESULTS:

1. Describe what you heard when your partner spoke into the cup. _____

_____

_____

2. Which variable did you change on your string and cup communicator? Why did you choose to change this variable? _____

_____

_____

_____

3. Describe your results after you changed one variable. _____

_____

_____

_____

4. How did your results compare to your hypothesis on page 82? _____

_____

_____

_____

_____

_____

CONCLUSION:

5. How do you think the string and cup communicator works? _____

_____

_____

_____

_____

Name: _____ Date: _____

SOUND

Turn It Down!

FILL IN THE CHART

How does the sound of paper shuffling compare to the sound of a jackhammer? Of course, one is much louder than the other, but what does that mean? These sounds are different because the amount of energy carried by the sound waves from each one is different. Sound waves from a jackhammer carry a lot more energy than sound waves from shuffling papers. Sound level, or loudness, is measured in decibels (dB).

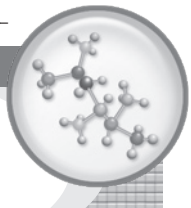
DIRECTIONS: Write each source of sound in the correct blank to match each source with its decibel level.

WORD BANK

breathing	city traffic	concert	jet engine
motorcycle	normal conversation	space shuttle engine	whispering

Source of Sound	Decibel Level
1.	10 dB
2.	30 dB
3.	60 dB
4.	70 dB
Sustained noises above this level may result in hearing loss.	80 dB
5.	100 dB
6.	120 dB
7.	130 dB
8.	190 dB

Name: _____ Date: _____



Sound Wave Acrostic

CREATIVE WRITING

DIRECTIONS: An acrostic poem is a poem in which each letter of a word or phrase is used as the beginning of a word or line that tells something about that word or phrase. Use what you have learned in your study of sound to write an acrostic poem for the phrase **sound wave**.

S _____

_____

O _____

_____

U _____

_____

N _____

_____

D _____

_____

W _____

_____

A _____

_____

V _____

_____

E _____

_____

Name: _____ Date: _____

LIGHT

Lights On!

WORD SEARCH

DIRECTIONS: Find the light vocabulary words in the word search below. Words can be found down, across, and diagonally. Then, on a separate sheet of paper, write sentences for five of the words.

WORD BANK

concave	convex	cornea	focal point
iris	lens	opaque	optic nerve
pupil	ray	reflection	refraction
retina	translucent	transparent	

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

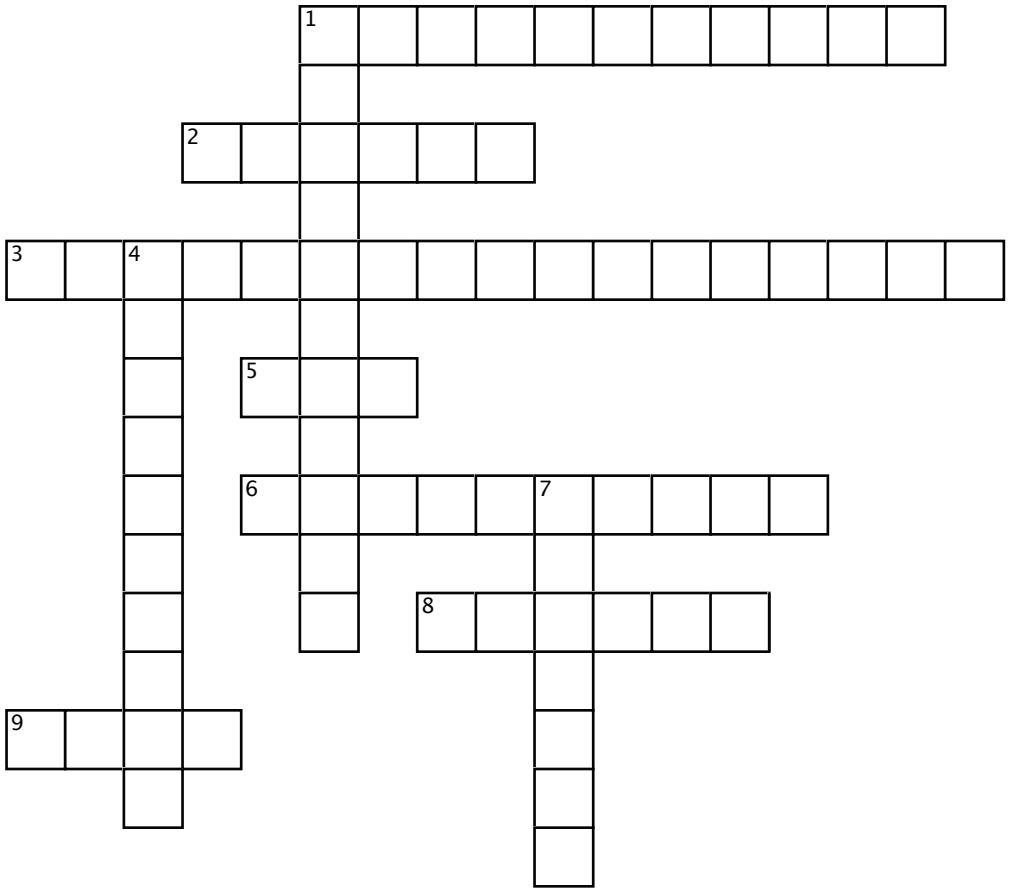
Name: _____ Date: _____

LIGHT

Lights On!

CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle.



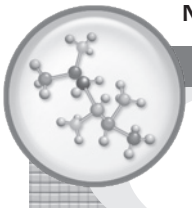
ACROSS

1. a type of material that scatters light as it passes through
2. a type of material that absorbs or reflects light
3. when light rays hit a rough surface and bounce back at different angles
5. a straight line that represents a light wave
6. when light rays hit a smooth surface and bounce back at the same angle
8. curved outward
9. a curved piece of glass used to refract light

DOWN

1. a type of material that allows light to pass through it
4. the point where light waves appear to meet after being reflected by a mirror or lens
7. curved inward

Name: _____ Date: _____



LIGHT

Into the Light

MYSTERY WORD

DIRECTIONS: Write each light vocabulary word in the correct blank below to match the term with its description or example. Circle the named letter in each answer. Then, unscramble the circled letters to reveal the mystery word.

WORD BANK

concave	convex	images	opaque	ray
reflect	refraction	translucent	transparent	

1. _____ objects such as clear glass, water, and air (sixth letter)
2. _____ when light passes through a drinking glass into water (seventh letter)
3. _____ shiny metals and mirrors allow light to do this (sixth letter)
4. _____ objects such as wax paper and frosted glass (fifth letter)
5. _____ objects such as wood, metal, cotton, and wool fabric (fifth letter)
6. _____ a narrow beam of light that travels in a straight line from a light source (first letter)
7. _____ a lens that is thinner in the middle than at the edges (seventh letter)
8. _____ a lens that is thicker in the middle than at the edges
9. _____ these copies are formed by light rays that are reflected or refracted through a lens (second letter)

MYSTERY WORD

When visible light is refracted through a prism, you can see the colors of the rainbow, which is called the light _____ _____ _____ _____ _____ _____ _____ _____.

Name: _____ Date: _____

Bouncing and Bending

FILL IN THE BLANKS

DIRECTIONS: Write each word in the correct blanks below to match the term with its description and to identify each light ray.

WORD BANK

concave mirror | convex mirror | diffuse reflection | reflection | refraction

1. _____ when parallel light rays strike a flat object and are returned at an equal angle

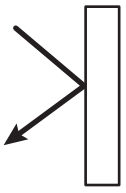
2. _____ when light rays strike a transparent object and are bent at a different angle after passing through it

3. _____ a mirror that curves outward

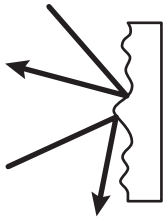
4. _____ a mirror that curves inward

5. _____ when light rays strike an uneven surface and are returned at random angles

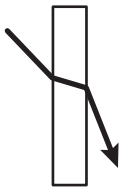
6. _____



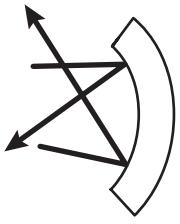
7. _____



8. _____



9. _____



10. _____

Name: _____ Date: _____

LIGHT

Bending Light

SCIENCE ACTIVITY

In this activity, you will observe how light can be **refracted**, or bent, as it passes through transparent objects such as glass and water.

MATERIALS

drinking glass filled with water	flashlight	coins, pebbles, and similar small objects that sink	small aquarium or clear rectangular container
sharpened pencil	masking tape		

PROCEDURE:

1. Place the pencil in the glass of water.
2. Observe the pencil from different angles. Describe what you see. _____

   _____

   _____
3. Fill the aquarium or clear rectangular container with water.
4. Place various objects that sink, such as coins or pebbles, into the water.
5. Look at these objects from the side, from above, and at an angle. Describe what you see.

   _____

   _____
6. Cover the front of the flashlight with several layers of masking tape. Use the sharpened pencil to poke a hole near the center of the tape. When you turn on the flashlight, a thin beam of light should shine through.
7. Turn off the lights in the room. Focus the light into the aquarium at different angles, from the side, and straight down. Describe what you see. _____

   _____

   _____

Name: _____ Date: _____

The Human Eye

FILL IN THE BLANKS / DIAGRAM LABELING

DIRECTIONS: Write each word in the correct blanks below to match each term with its definition and to label the parts of the human eye.

WORD BANK

cornea	iris	lens	optic nerve
pupil	retina	vitreous humor	

1. _____ dark opening at the center of the iris

2. _____ clear liquid that fills the eye

3. _____ clear, dome-shaped tissue that covers the front of the eye

4. _____ sensory tissue at the back of the eye; filled with photoreceptors called rods and cones; changes light into electrical impulses that are transferred to the optical nerve

5. _____ colored part of the eye; controls the amount of light that enters the eye by changing the size of the pupil

6. _____ transmits electrical impulses from the eye to the brain

7. _____ structure that focuses light onto the retina

8. _____

9. _____

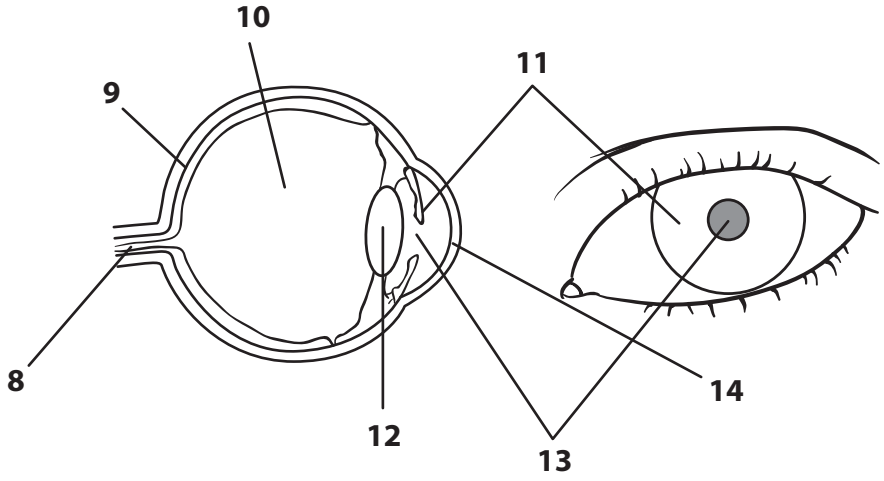
10. _____

11. _____

12. _____

13. _____

14. _____



Name: _____ Date: _____

LIGHT

Using Lenses in Science

INDEPENDENT RESEARCH

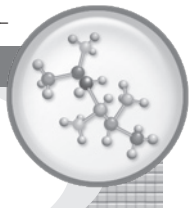
Have you used a telescope to gaze at the moon or distant stars? Telescopes use lenses and mirrors to collect and focus light from faraway objects. Microscopes work in a similar way, except they use a series of lenses to magnify small objects.

DIRECTIONS: Use science books, encyclopedias, or the Internet to research one of the scientific instruments below that uses lenses or mirrors. Write a short paragraph and draw a diagram to explain how the instrument uses lenses or mirrors.

WORD BANK

microscope	reflecting telescope	refracting telescope

Name: _____ Date: _____



LIGHT

Can You See the Light?

TRUE OR FALSE

DIRECTIONS: Determine whether each statement is true or false. Write *T* for true or *F* for false in the blank. If the statement is false, cross out the incorrect word or words and rewrite the sentence to make it true.

1. _____ Light that hits an object can only be reflected. _____

_____

2. _____ A concave mirror has a surface that curves inward. _____

_____

3. _____ A concave mirror has a surface that curves outward. _____

_____

4. _____ Diffuse reflection occurs when parallel light rays hit a smooth surface and reflect at the same angle. _____

_____

5. _____ Regular reflection occurs when parallel light rays hit a rough surface and reflect at different angles. _____

_____

6. _____ Transparent materials reflect or absorb all of the light that strikes them. _____

_____

7. _____ The point where light rays meet after being reflected by a mirror is called the focal point.

_____

_____

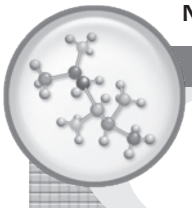
8. _____ Translucent materials scatter light as it passes through them. _____

_____

9. _____ Opaque materials allow light to pass through them. _____

_____

Name: _____ Date: _____



HEAT AND ENERGY

Heat Transfer

WORD SEARCH

DIRECTIONS: Find the heat and energy vocabulary words in the word search below. Words can be found down, across, and diagonally. Then, on a separate sheet of paper, write sentences for five of the words.

WORD BANK

absolute zero	Celsius	conduction	conductor
convection	convection current	Fahrenheit	heat
insulation	Kelvin	radiation	temperature

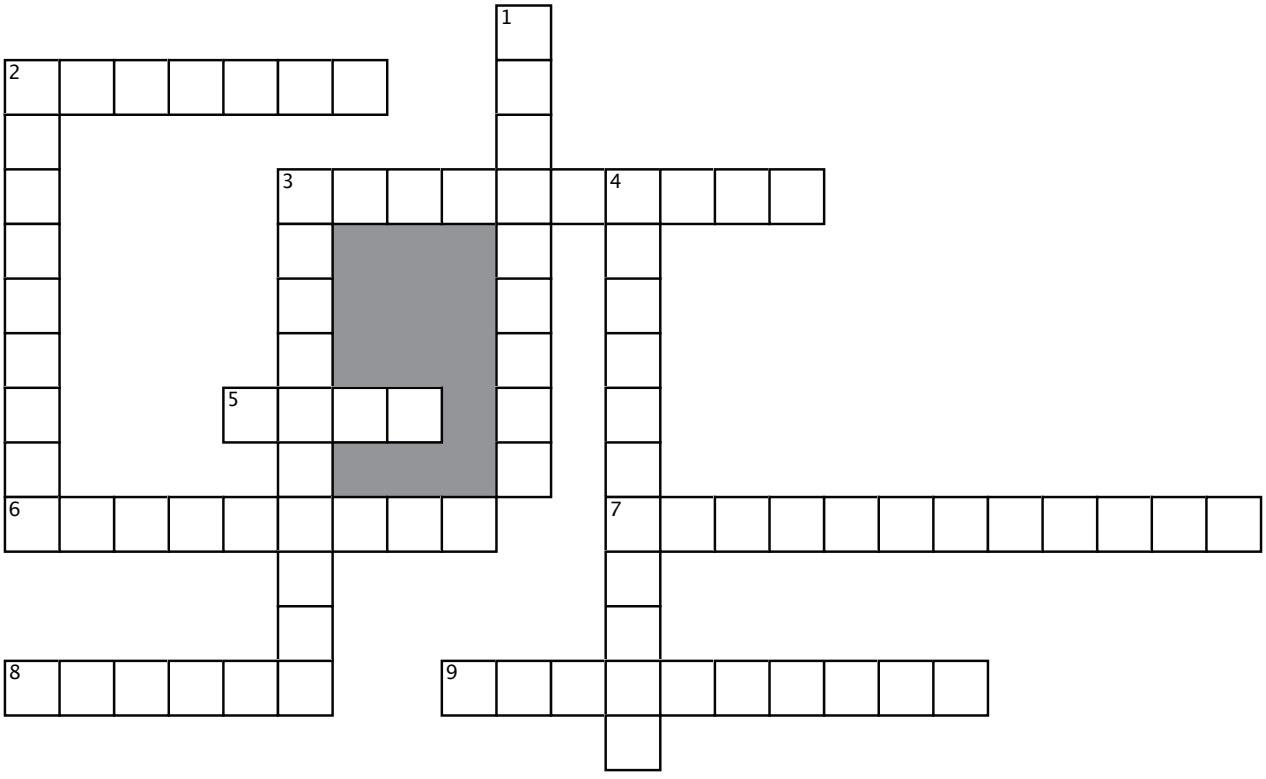
Q B H X F M D N L B R N S R T E K T X Y
A Z X S G L L N O I A V Y Z J N E F A Y
G D U T H F H M G R V N P N Z A L W X W
X F A H R E N H E I T O P C T A V M W D
T W D G M X N J G G P C U U D B I G Y Q
N C O N V E C T I O N C U R R E N T C K
W A C M H Q P M Y B A W D E Q F C N R G
D C C O N V E C T I O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

Name: _____ Date: _____

Heat Transfer

CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle.



ACROSS

2. temperature scale on which water freezes at 0° and boils at 100°

3. a transfer of heat between particles in a substance

5. thermal energy transferred from one substance to another

6. a transfer of energy by electromagnetic waves

7. the temperature at which no more energy can be removed from a substance

8. temperature scale on which no more energy can be removed from matter at 0°

9. temperature scale on which water freezes at 32° and boils at 212°

DOWN

1. a material that restricts the transfer of heat

2. a material that transfers heat easily

3. a transfer of heat by the movement of currents within a fluid

4. the measure of the energy in a substance's molecules

Name: _____ Date: _____

Insulators in Action

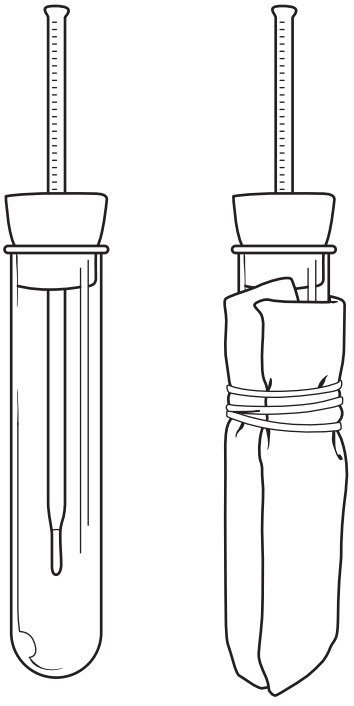
SCIENCE EXPERIMENT / GRAPHING

In some areas of the world, people insulate their homes to keep the heat in during the colder months and the cooler air in during the warmer months. By using materials called **insulators**, the transfer of heat is slowed. In this activity, your group will conduct a controlled experiment to test how effectively different materials act as insulators.

MATERIALS

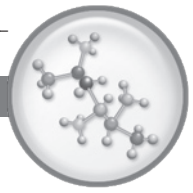
2 test tubes	2 metric thermometers	assorted types of fabric (cotton, wool, felt, polyester)	large beaker
2 one-hole rubber stoppers	rubber band		scissors
	lubricating oil		

PROCEDURE:



1. Choose one type of fabric. Cut it into equal-sized squares big enough to wrap around a test tube twice. Write the type of fabric insulation you use on page 97.
2. Carefully place a thermometer through the hole in each stopper. If necessary, use lubricating oil to insert the thermometers without breaking them.
3. Fill both test tubes with hot water. Make certain that the temperature of the water is the same in both test tubes.
4. Place the stoppers with the thermometers in both test tubes.
5. Wrap one of the test tubes with the fabric. Use the rubber band to hold the fabric in place. Leave the second test tube without material to use as the control.
6. Place both test tubes into the empty beaker.
7. Record the starting temperature in the data table on page 97.
8. Record the temperature of the water in each test tube every minute for 30 minutes in the data table.
9. Graph your results on the blank graph on page 98. Be certain to use two different colors, one for each test tube, on the graph.

Name: _____ Date: _____



INSULATORS IN ACTION (CONTINUED)

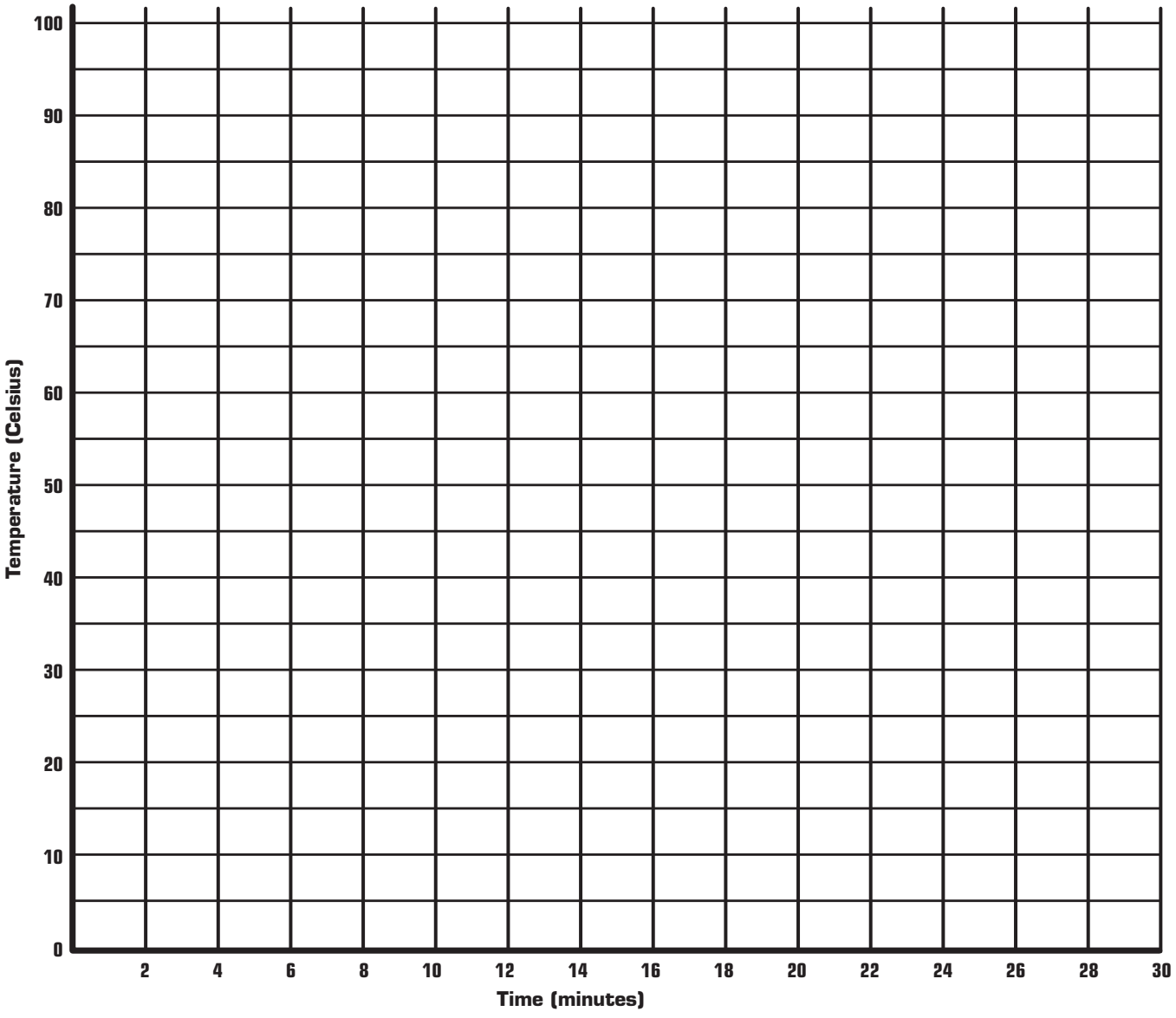
Type of Fabric Insulation Used: _____

DATA TABLE:

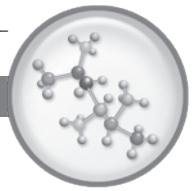
Time (min.)	Control Test Tube (°C)	Insulated Test Tube (°C)
0 (starting temperature)		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		

Name: _____ Date: _____

INSULATORS IN ACTION (CONTINUED)



Name: _____ Date: _____



INSULATORS IN ACTION (CONTINUED)

CONCLUSIONS:

1. Why did the water temperature in both test tubes decrease over time? _____

_____

_____

2. Wrapping the test tube in an insulating material helped decrease which type of heat transfer?

_____

_____

3. Compare your results to your classmates'. Which type of fabric insulators were the most efficient?

_____

_____

4. On the blank graph below, create a bar graph of the data of each group's final temperatures compared to the type of insulation used on the test tubes. Do not include the control test tubes' results in your graph. Remember to label the axes and to give the graph an appropriate title.

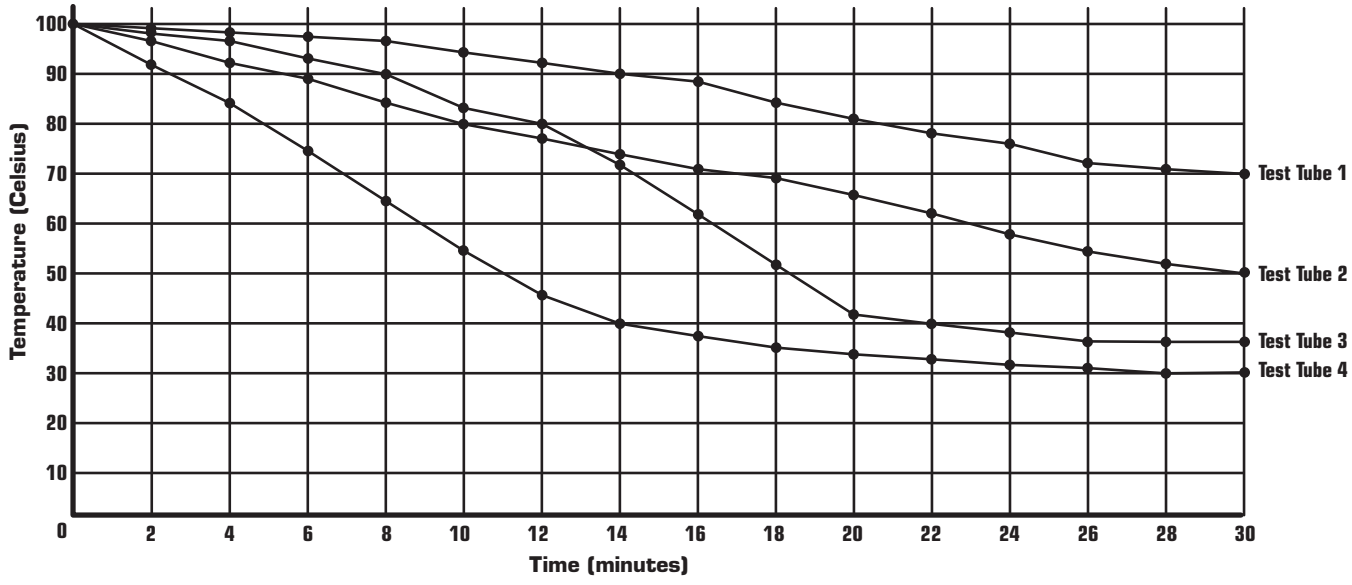
_____

Name: _____ Date: _____

Insulation Data

DATA ANALYSIS

DIRECTIONS: The graph below shows data that scientists collected in an experiment involving heat and insulators. Four test tubes were filled with water that measured the same temperature. Each test tube was then closed with a rubber stopper that held a thermometer to record the temperature of the water. Three test tubes were wrapped in different insulating materials, and one was not wrapped in any insulation material. Use this information and the graph to answer each question.



1. What was the variable tested in this experiment? _____
2. How long was the experiment conducted? _____
3. What temperature scale was used for this experiment? _____
4. Which test tube was wrapped in the most efficient insulator (helped retain the most heat)? How do you know? _____

   _____
5. Which test tube was the control test tube for the experiment? How do you know? _____

   _____
6. What is the temperature range of final water temperatures between the most and least efficient insulators? _____
7. What would be an appropriate title for the graph? _____

Name: _____ Date: _____

Renewable Power

MATCHING

We take for granted that with the flip of a switch or a push of a button the lights come on, music plays, and our computers hum to life. Do you know where this energy comes from? Most of the energy in North America comes from the burning of fossil fuels, such as coal, to turn generators that create electricity. Burning coal and oil creates electricity, but it can be very expensive and can damage our environment. There are other types energy, such as renewable energy, that will become more common in the future. Renewable energy has a limitless supply, and it can be good for the environment.

DIRECTIONS: Match each type of renewable energy source below with its description.

1. _____ wind

2. _____ solar

3. _____ geothermal

4. _____ hydroelectric

5. _____ biomass

6. _____ tidal

a. the use of steam and hot water, which are produced by energy within the earth, to operate power plants and heat homes

b. organic material from plants that can be burned to produce steam for making electricity or heat for homes; can also be used to create fuels for automobiles

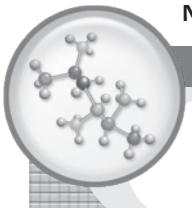
c. the use of the daily rising and falling of the ocean levels to turn turbines; these turbines spin a generator to create electricity

d. created by directing the flow of moving water through a turbine that spins a generator to create electricity

e. the sun's radiation is converted into usable electricity by photovoltaic cells

f. fast-moving air turns turbines that spin a generator to create electricity

Name: _____ Date: _____



Renewable Energy

INDEPENDENT RESEARCH

DIRECTIONS: Although renewable energy seems like it might help save our environment by creating clean electricity, it does have drawbacks. Choose two renewable energy sources from the word bank below and use science books, encyclopedias, or the Internet to research some of the advantages and disadvantages of each one. If you need additional space, continue your research on a separate sheet of paper.

WORD BANK

biomass geothermal hydroelectric solar tidal wind

ENERGY RESOURCE: _____

Advantages: _____

_____

_____

_____

Disadvantages: _____

_____

_____

_____

ENERGY RESOURCE: _____

Advantages: _____

_____

_____

_____

Disadvantages: _____

_____

_____

_____

Name: _____ Date: _____

Solar "Still" Works

SCIENCE ACTIVITY

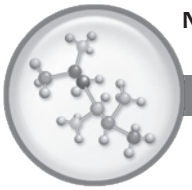
Solar energy is created through a process of harnessing the sun's light and turning it into usable energy. Solar energy is called a **renewable resource** because, unlike energy resources such as oil and coal, we will never run out of it. Renewable energy can help solve many environmental problems, such as drought. In some coastal areas where there are low levels of freshwater for drinking and farming, people have turned to a device called a solar still to create freshwater. In this activity, you and a partner will create a solar still and discover how it works.

MATERIALS

large plastic cup	rubber band	graduated cylinder	salt water
small paper cup	plastic wrap	small rock	250 mL beaker

CAUTION: Before completing any food activity, ask families' permission and inquire about students' food allergies and religious or other food preferences.

1. Your teacher will give you and your partner a small amount of salt water in a beaker. Dip your finger into it and taste it. How does it taste? _____
2. Pour about 50 mL of salt water into the large plastic cup.
3. Place the small paper cup inside the large cup so that it floats.
4. Cover the large cup with plastic wrap and secure it tightly with the rubber band.
5. Place the small rock in the middle of the plastic wrap so that it sags slightly. Do not allow the rock to touch the salt water or rip the plastic wrap.
6. Place the cups in a sunny location. Check on the cups after a few hours. Record your observations on page 104.
7. After a few days, check the cups by removing the plastic wrap. Record your observations on page 104.
8. Dip your finger into the small cup and taste it. How does it taste? _____



Name: _____ Date: _____

SOLAR "STILL" WORKS (CONTINUED)

RESULTS:

1. What did you observe after your solar still had been in the sun for a few hours? _____

_____

_____

2. What did you observe after your solar still had been in the sun for a few days? Describe the difference in the water levels in each cup. _____

_____

_____

CONCLUSIONS:

3. How was solar energy used in this activity? _____

_____

_____

_____

_____

4. How might this method be used on a larger scale? (Think of locations on Earth where supplies of freshwater are low). _____

_____

_____

_____

5. The name of the device you created is a solar still. This comes from the word *distillation*. Look up the definition of *distillation*. How does this word relate to the name of the device?

_____

_____

_____

_____

Name: _____ Date: _____

The Greenhouse Effect

EARTH SCIENCE CONNECTION

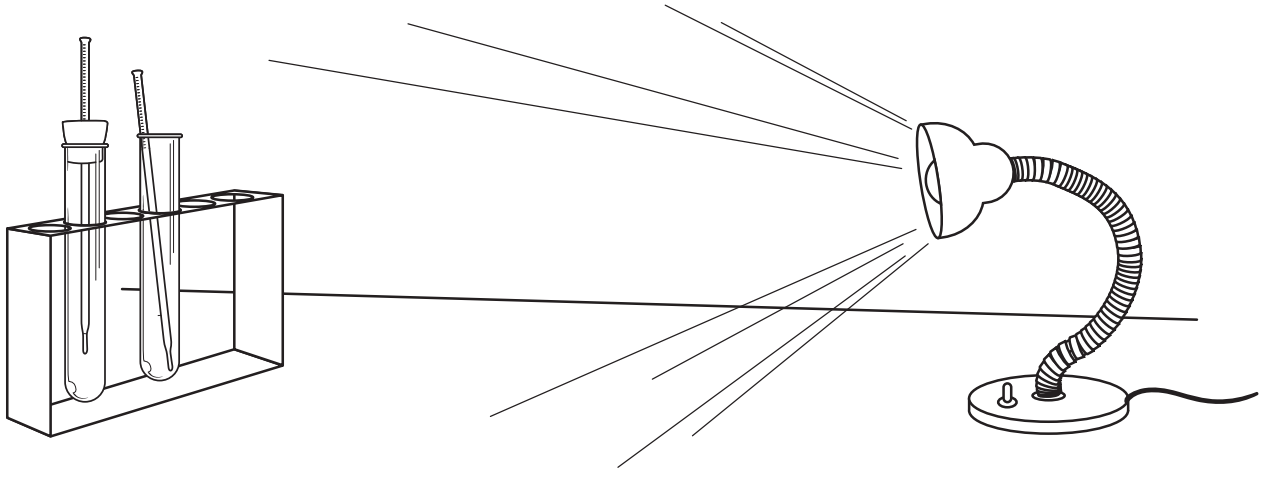
A greenhouse uses the sun's energy to grow plants, even in the middle of the winter. Have you ever wondered how this works? A similar situation, called global warming, is occurring to the planet Earth, and people around the world are concerned about it. Scientists believe that the burning of fossil fuels for energy is one of the causes of global warming. In this activity, you will model the effects of global warming on a much smaller scale.

MATERIALS

2 metric thermometers	test tube rack	ruler	spotlight with white lightbulb
2 test tubes	one-hole rubber stopper	lubrication oil	

PROCEDURE:

1. Insert one of the thermometers into the one-hole stopper. If necessary, use lubricating oil to insert the thermometer without breaking it. Put this stopper and the thermometer into one of the test tubes. Place the test tube in the test tube rack.
2. Carefully place the second thermometer in the second test tube. Leave this test tube open at the top. Place the test tube in the test tube rack.
3. Place the spotlight about 20" (50 cm) from the test tubes.
4. Record the starting temperature in the data table on page 106.
5. Turn on the spotlight. Record the temperature of each thermometer every minute for 15 minutes in the data table.



Name: _____ Date: _____

THE GREENHOUSE EFFECT (CONTINUED)

DATA TABLE:

Time (min.)	Open Test Tube Temperature (°C)	Closed Test Tube Temperature (°C)
0 (starting temperature)		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

RESULTS:

1. Which thermometer showed a higher temperature? _____

2. What are the thermometers recording the temperature of? _____

_____

CONCLUSIONS:

3. What do the results of this experiment tell you about a greenhouse? _____

_____

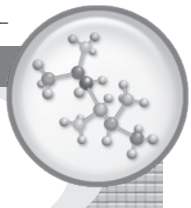
_____

4. How do you think your results relate to the issue of global warming? _____

_____

_____

Name: _____ Date: _____



Heat & Energy Cinquain

CREATIVE WRITING

DIRECTIONS: Use what you have learned in your study of heat and energy to write two cinquain poems about heat, light, or energy. A cinquain poem has five lines.

	Example:
Line 1: Title (noun)—1 word	Light
Line 2: Description (adjectives)—2 words	Hot, white
Line 3: Action (*ing* words)—3 words	Warming, soothing, comforting
Line 4: Feeling (phrase)—4 words	Makes us feel happy
Line 5: Title (synonym for the title)—1 word	Heat

Name: _____ Date: _____

Learning about Magnetism

CONTEXT CLUES

DIRECTIONS: Context clues help us learn new words when we read. Use the words, phrases, and sentences around new words to determine their meanings. Look at the words in the chart and fill in the column "What I Think It Means." Read the passage below and look for context clues to help determine the meanings of the words. Then, fill in the last column, "What It Means in Context." If your answer in the first column was completely correct, use the second column to add something to the word's meaning beyond your original idea.

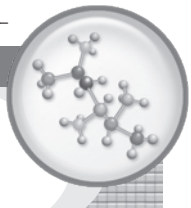
Word	What I Think It Means	What It Means in Context
lodestone		
magnetic		
magnetized		
compass		
generators		

For thousands of years, people have noticed that there are some rocks that pull toward and apart from each other. This type of rock is known as a **lodestone**. Because it contains iron oxide, it is naturally **magnetic**. The word *magnet* comes from the ancient Greek district of Magnesia. At that time, there were many magnetic rocks found in the area. But, people in ancient China discovered magnetism long before that. They knew that a lodestone swinging on a thread would always point north and that a piece of iron could be **magnetized** by heating it and allowing it to cool while lying north to south.

It is thought that the Chinese were also the first people to place a magnetic needle on a pivot so that it could swing freely. This was the first magnetic **compass**. This secret was passed on to Arab traders who passed it on to the continent of Europe.

Magnets still play an important part in modern technology. Without magnets, we would not have electric motors or **generators**. Without these, we would not have television, radios, electric lights, or computers.

Name: _____ Date: _____



Attracting Forces

WORD SEARCH

DIRECTIONS: Find the magnetism vocabulary words in the word search below. Words can be found down, across, and diagonally. Then, on a separate sheet of paper, write sentences for five of the words.

WORD BANK

atom	compass	domain	electron
elements	ferromagnetic	magnetic field	magnetic pole
magnetism	nucleus	permanent	proton

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

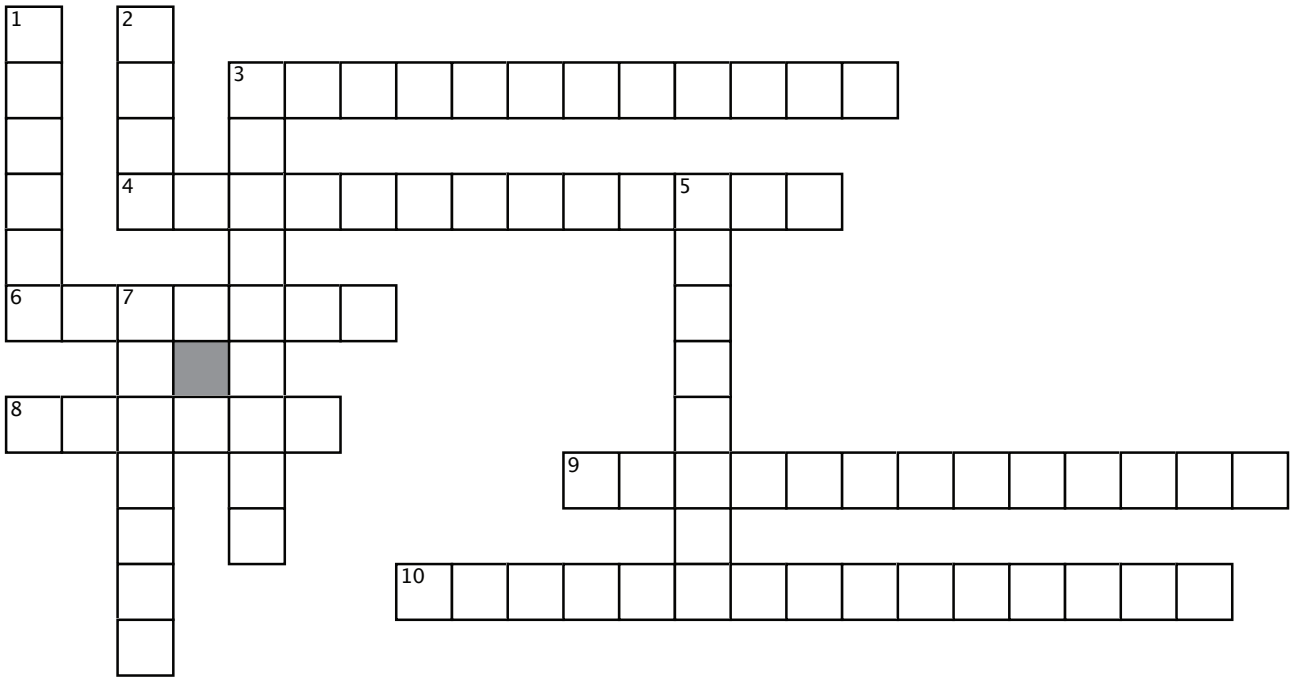
Name: _____ Date: _____

MAGNETISM AND ELECTRICITY

Attracting Forces

CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle.



ACROSS

3. area of a magnet where the magnetic force is the strongest

4. area around a magnet where the magnetic forces can be detected

6. found at the core of an atom

8. area in the magnetic field where all of the atoms are aligned

9. type of material that is attracted to magnets and can be made into a magnet

10. magnet that retains its magnetism

DOWN

1. positively charged particle found in an atom's nucleus

2. the smallest part of an element that still has the properties of that element

3. a force that attracts or repels materials

5. negatively charged particle found orbiting an atom's nucleus

7. uses a magnetized needle to help people navigate; its needle always points north

Name: _____ Date: _____

MAGNETISM AND ELECTRICITY

It's Magnetic!

WORD SCRAMBLE / MYSTERY WORD

DIRECTIONS: Use the clues to help unscramble each magnetism vocabulary word. Then, unscramble the bold letters to reveal the mystery word.

1. magnetic mineral _____ t m e a g **n** t i e
2. forces pulling together _____ n i c r a t **o** t a t
3. forces pushing apart _____ n i l p r o **s** u e
4. area where magnetic forces act _____ **d** e f c t n a l i i e g m
5. metals such as iron, nickel, and cobalt _____ c t n a o r f **i** e g m r e
6. one way to destroy a magnet _____ t h e a
7. magnetic rock _____ **e** o s d l n t e o
8. an iron bar wrapped in wire coils _____ t n a o t e e e g m r c **l**
9. common shape of a magnet _____ e h e r h o s s **o**
10. piece of metal that attracts or repels certain materials _____ t n a e g m

MYSTERY WORD

This object creates a magnetic field by running a current through a coil of wire.

_____ _____ _____ _____ _____ _____ _____ _____

Name: _____ Date: _____

MAGNETISM AND ELECTRICITY

Magnetic Strength

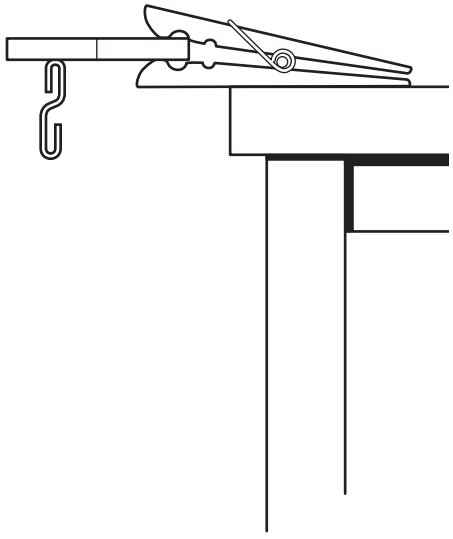
SCIENCE EXPERIMENT / GRAPHING

How does distance affect the strength of a magnet? Will a magnet attract a paper clip from across a desk? Will a magnet attract a paper clip with a barrier between the objects? In this activity, you will test the strength of a magnet.

MATERIALS

small bar magnet | wooden clothespin | masking tape | paper clips

PROCEDURE:



1. Place the magnet inside the clothespin. Tape the clothespin to the edge of the desk so that the magnet hangs over the edge.
2. Open one paper clip so that it creates a small hook.
3. Touch this hook to the magnet. What happens? _____

   _____
4. Add paper clips to this hook one by one. Count the total number of paper clips that you can hang on the hook before the weight is too much and the paper clips fall. Record this data in the data table on page 113.
5. Cut two small 1" x 1" (2.5 cm x 2.5 cm) squares of masking tape. Stick these two pieces of tape to the bottom of the magnet. Then, repeat steps 3 and 4, making sure that the paper clip hook touches the masking tape and not the magnet.
6. Repeat step 5 eight additional times so that you have conducted 10 trials.

CONCLUSIONS:

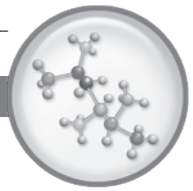
1. What do you think happened to the strength of the magnet as you added layers of masking tape? _____

   _____

   _____
2. Do you think the magnetic attraction is being blocked by the tape, or is there something else that could be having an effect on the magnet's strength? _____

   _____

Name: _____ Date: _____



MAGNETIC STRENGTH (CONTINUED)

DATA TABLE:

Pieces of Tape	Number of Paper Clips Held	Pieces of Tape	Number of Paper Clips Held
0		10	
2		12	
4		14	
6		16	
8		18	

DIRECTIONS: Create a graph of your data. Think about what kind of graph would best represent your data: a bar graph or a line graph. Remember to label the axes and to give the graph an appropriate title.

Name: _____ Date: _____

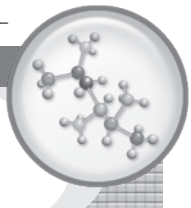
Lights in the Sky

EARTH SCIENCE CONNECTION

Have you heard of the northern lights, also called the aurora borealis? Different cultures have told stories about these mysterious lights of the north for many years. Some thought that they were the dancing spirits of their ancestors, while others thought that they were caused by the quick movements of foxtails made of fire. The name *aurora borealis* comes from the Roman goddess of dawn, Aurora, and the Latin word for north, boreal. In the Antarctic, the lights are called aurora australialis, or the southern lights.

DIRECTIONS: Use science books, encyclopedias, or the Internet to research how the aurora borealis and the aurora australialis are created. Hint: It has something to do with the sun and Earth's magnetic field.

Name: _____ Date: _____



It's Electric!

WORD SEARCH

DIRECTIONS: Find the electricity vocabulary words in the word search below. Words can be found down, across, and diagonally. Then, on a separate sheet of paper, write sentences for five of the words.

WORD BANK

conduction	discharge	electric field	electroscope
friction	induction	potential	potential difference
static	voltage	voltmeter	

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

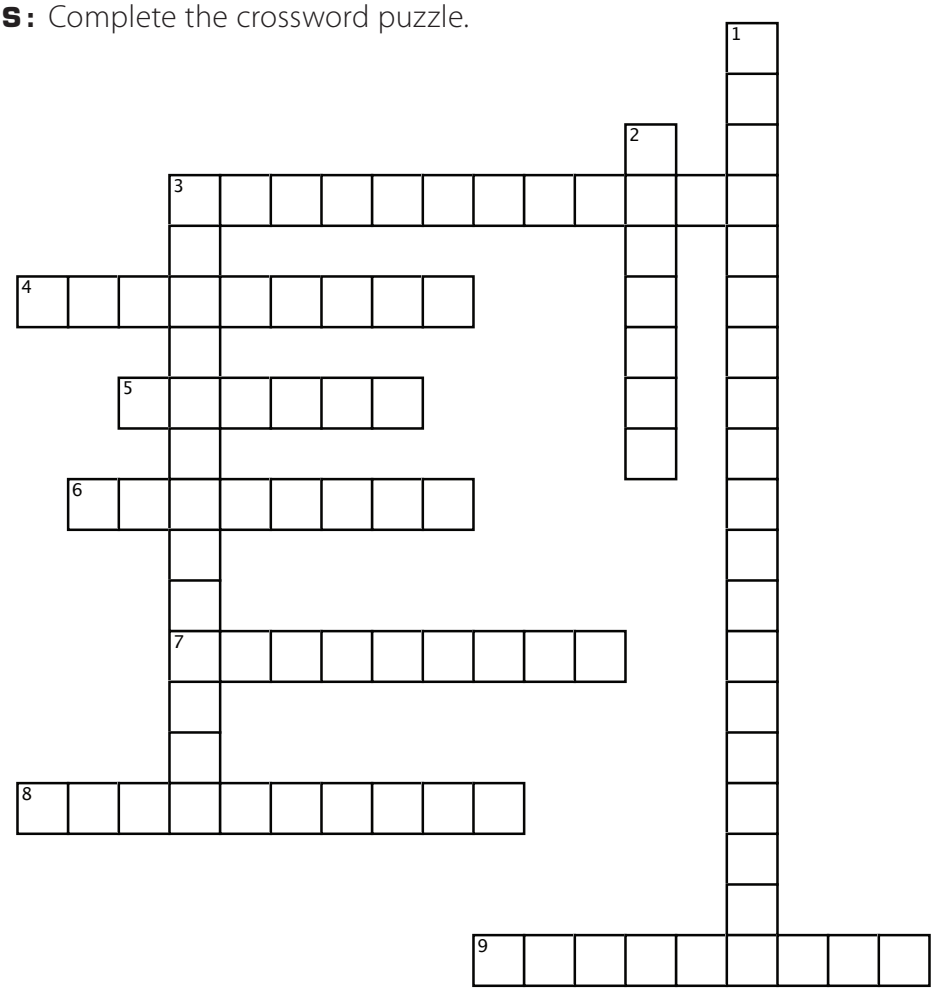
Name: _____ Date: _____

MAGNETISM AND ELECTRICITY

It's Electric!

CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle.



ACROSS

3. a device used to detect electrical charges

4. the amount of energy in an electrical charge

5. the accumulation of excess electric charge on an object

6. a force that opposes the sliding motion between two touching surfaces

7. a method in which the electrical field of another object changes an object

8. a transfer of energy that occurs when molecules bump into each other

9. a device used to measure the potential difference between two points in a circuit

DOWN

1. measured in volts

2. a measurement of the potential difference

3. area around charged particles that exerts forces on other charged particles

Name: _____ Date: _____

Build an Electroscope

INQUIRY INVESTIGATION

Have you ever opened a drier and found your clothes sticking together? As your clothes tumbled around, they rubbed against each other, leaving your sock with a negative charge and your sweater with a positive charge. This is called **static electricity**.

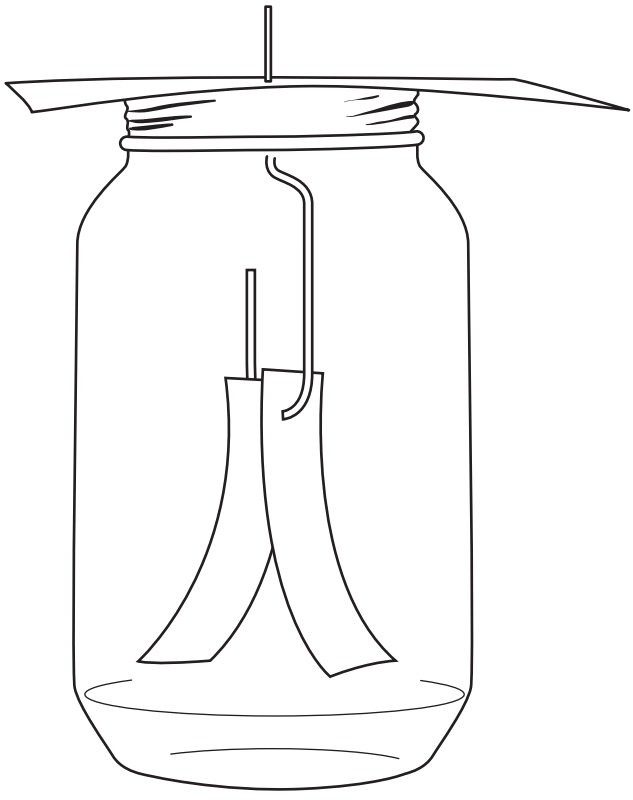
Static electricity is different from electrical currents because it does not flow like currents. Static electricity is a buildup of charges on an object. In this activity, you will make a device that detects static electrical charges called an **electroscope**.

MATERIALS

aluminum foil	index card	transparent tape	piece of wool
paper clip	mason jar or drinking glass	metric ruler	objects to test as conductors and insulators
sharpened pencil		inflated balloon	

PROCEDURE:

1. Cut two 1 cm x 4 cm (0.4" x 1.6") strips of aluminum foil.
2. Open the paper clip so that it creates a small hook.
3. Use the sharpened pencil to make a small hole in the middle of the index card. Push the paper clip hook through the hole and tape it to the card.
4. Place the two aluminum foil strips together and push the hook through them so that they hang from the hook.
5. Put the hook inside the jar or glass and let the index card rest on top. This is your electroscope.
6. Rub the piece of wool cloth on the inflated balloon to give it a charge. Place the balloon near the top of the electroscope. Then, move away the balloon.



Name: _____ Date: _____

BUILD AN ELECTROSCOPE (CONTINUED)

RESULTS:

1. What happened to the strips of aluminum foil when the balloon was placed near the top of the electroscope? _____

_____

_____

2. What happened to the strips of aluminum foil when the balloon was moved away? _____

_____

_____

3. Touch the balloon to the paper clip hook. What happens? _____

_____

CONCLUSION:

4. Describe how you think an electroscope works. _____

_____

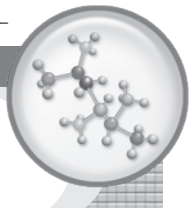
_____

_____

DATA TABLE: Find five other objects to rub with the piece of wool fabric, one at a time. Place each object near the paper clip hook. Write your observations in the data table below.

Charged Object	Observation of Electroscope

Name: _____ Date: _____



Conductors and Insulators

INQUIRY INVESTIGATION

A **conductor** is a type of material that allows heat, electricity, or sound to flow easily through it. An **insulator** is a type of material that restricts the flow of heat, electricity, or sound. A **circuit** is a circular route that provides a path for electricity to flow through. A closed electrical circuit allows electricity to flow uninterrupted through each object in the circuit. When a circuit is open, the flow of electricity stops. In this activity, you will create a closed electrical circuit that lights a lightbulb. Then, you will test different objects to determine whether they are conductors or insulators of electricity.

MATERIALS

aluminum foil	electrical tape	plastic clothespin
D-cell battery	flashlight bulb	objects to test as conductors and insulators

PROCEDURE:

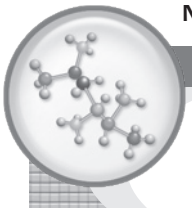
1. Use the materials above to create a closed electrical circuit. When the circuit is closed, the lightbulb should light.
2. On a separate sheet of paper, describe how you created the circuit and draw a picture of it.
3. After you create the closed circuit, add steps to your procedure that will allow you to insert different objects into the circuit to test if they are conductors or insulators. Record your results in the data table below.
4. How do you know whether an object is a conductor or an insulator? _____

_____

DATA TABLE:

Object	Conductor or Insulator?

Name: _____ Date: _____



MAGNETISM AND ELECTRICITY

Transfer of Energy

FILL IN THE BLANKS / MYSTERY WORDS

DIRECTIONS: Write each electricity vocabulary word in the correct blank below to complete each sentence. Circle the named letter or letters in each answer. Then, unscramble the circled letters to reveal the mystery words.

WORD BANK

attract	conductor	discharge	electrons
insulator	negative	protons	repel

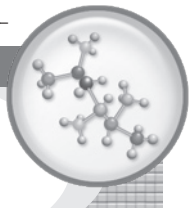
1. An object that stops the flow of electricity is called an _____. (first letter)
2. An atom with more _____ than protons has a negative charge. (sixth and eighth letters)
3. When an object is rubbed with a wool cloth, it usually picks up a _____ charge. (third and sixth letters)
4. When two objects have different charges, they _____ each other.
5. When two objects have similar charges, they _____ each other. (fifth letter)
6. An atom with more _____ than electrons has a positive charge. (third and fourth letters)
7. An object that allows electricity to pass through it is called a _____. (third and fourth letters)
8. The movement of static electricity from one object to another is called _____. (fifth and eighth letters)

MYSTERY WORDS

This prevents damage to buildings during storms by transferring the energy from a lightning strike safely to the ground.

_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

Name: _____ Date: _____



Electricity Rap

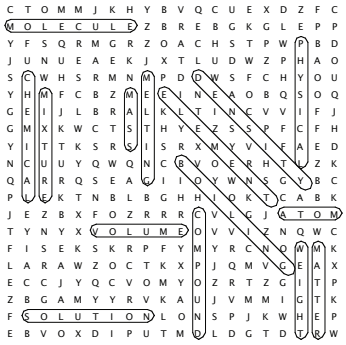
CREATIVE WRITING

DIRECTIONS: Rap is a spoken-word or music form that means "to talk." Rap's power and beauty comes from the sound and movement of words working with or against a rhythmic background. Raps do not have to rhyme, but they should tell a story or send a message. Create a rap about electricity. Use what you have learned in your study of electricity to write your rap. Then, perform it for your classmates.

Branches of Physical Science (page 9)

1. hydrodynamics; 2. catacoustics; 3. magnetics; 4. aerodynamics; 5. aerostatics; 6. thermodynamics; 7. electrology; 8. acoustics; 9. mechanics; 10. chemistry; 11. optics; 12. electrostatics; 13. kinematics; 14. metallography

An Introduction to Matter (page 10)



An Introduction to Matter (page 11)

ACROSS
2. atom; 6. physical change; 8. volume; 9. solution; 10. mass; 12. element; 13. weight
DOWN
1. compound; 3. chemical change; 4. mixture; 5. matter; 7. molecule; 11. density

Tools of the Trade (page 12)

1. k; 2. d, e, g, i; 3. a, d; 4. h; 5. j; 6. f; 7. c; 8. b, l

Calculating Mass (page 13)

Answers will vary.

Calculating Volume (page 14)

1. a. 800 cm^3; b. 9,375 cm^3; c. 11 books; 2. 7,500 cm^3; 3. 10 mL

Calculating Density (page 15)

1. 2.5 g/cm^3; 2. 0.05 g/cm^3; 3. 1.5 g/cm^3; 4. 10.5 g/cm^3; 5. 19.3 g/cm^3; 6. 0.667 g/cm^3; 7. The feather is the least dense.; 8. Gold is the most dense.; 9. feather, apple, lead in a pencil, small rock, silver coin, gold bar

Mass, Volume, Density (pages 16–18)

Data table: 1. Mass = 15 g; Volume = 5 mL; Density = 3 g/mL; Sink; 2. Mass = 25 g; Volume = 30 mL; Density = 0.833 g/mL; Float; 3. Mass = 20 g; Volume = 25 mL; Density = 0.8 g/mL; Float; 4. Mass = 30 g; Volume = 5 mL; Density = 6 g/mL; Sink; 5. Mass = 50 g; Volume = 15 mL; Density = 3.333 g/mL; Sink; Conclusions: 1. An object with a density greater than 1 g/mL will sink in water because it is denser than water.; 2. Objects 1, 4, and 5 are denser than water. Answers will vary but may include: These objects could be made of a metal or stone.; 3. An object with a density less than 1 g/mL will float in water because it is less dense than water.; 4. Objects 2 and 3 are less dense than water. Answers will vary but may include: These objects could be made of plastic or wood.

The Density of Water (pages 19–21)

Procedure: 11. Correct predictions will say that the egg will float in salt water.; The mass of empty beaker will vary.; Data tables will vary.; Results/Conclusion: 1. Subtract the mass of the empty beaker from the mass of the beaker and water.; 2. Subtract the mass of the empty beaker from the mass of the beaker, water, and salt.; 3. The egg is more dense than tap water.; 4. The egg sank in the tap water. The density of the egg was greater than the density of the tap water.; 5. The density of the tap water increased when salt was added.; 6. The egg floated in the salt water. The density of the raw egg is less than the density of the salt water.; 7. An object will float if its density is less than that of the liquid. The object will sink if its density is greater than that of the liquid.

Float Your Boat! (pages 22–23)

Data tables will vary.; Results/Conclusion: 1.–2. Answers will vary.; 3. Answers will vary, but the water displaced equals the mass of the boat loaded with paper clips.

Viscosity (pages 24–25)

Procedure: Predictions will vary.; Data tables will vary.; Results: 1.–2. Answers will vary based on student observations; 3. Answers will vary but may include: Three trials were conducted and the average was found to get a more accurate reading. This way, any potential mistakes that occurred could be averaged out.

Types of Measurement (page 26)

1. milligram, L, A; 2. volume, O, U; 3. kilometer, R; 4. milliliter, I, T; 5. gram, A; 6. cubic centimeter, I, N; 7. kilogram, I; 8. centimeter, N; 9. length, N, T; 10. density, N, T; 11. mass, S; 12. meter, E
Mystery Words: International System of Units

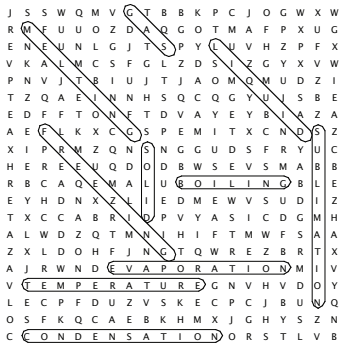
Ways to Measure (page 27)

Volume: 4, 11, 13; Mass: 2, 5, 9; Density: 1, 8, 14; Length: 3, 15, 16; Temperature: 6, 7, 10, 12

Learning about Changes (page 28)

temperature: physical property of matter that affects which state substances will be;
molecules: groups of atoms that are held together by chemical bonds;
evaporate: when liquid molecules heat up and change to a gaseous state of matter; condenses: when gaseous molecules cool and change to a liquid state of matter

Changes (page 29)



Changes (page 30)

ACROSS
2. solid; 6. freezing; 7. evaporation; 8. condensation
DOWN
1. gas; 3. liquid; 4. sublimation; 5. melting

Types of Changes (page 31)

1. freezing; 2. melting; 3. condensation; 4. freezing; 5. evaporation; 6. sublimation; 7. evaporation

Staying Cool (page 32)

Procedure: 1.–4. Answers will vary but may include: 1. It feels like warm air on your hand.; 2. The breath feels cooler with water on the back of your hand than dry skin.; 3. The rubbing alcohol feels much cooler than water or dry skin.; 4. The breath on the back of the hand with cooking oil feels similar to blowing on dry skin.; Conclusion: 1. Answers will vary but may include: The rubbing alcohol most resembles how it feels when you sweat. When your skin feels warmer, the liquid on your skin (sweat) evaporates and absorbs heat from its surroundings. This cools your skin because it evaporates quickly. This is similar to the rubbing alcohol, which evaporated quickly and pulled heat away from the skin.

Boiling and Freezing (page 33)

1. Benzene = a; 2. Ethanol = c; 3. Water = d; 4. Acetone = b; 5. Benzene = c; 6. Ethanol = d; 7. Water = b; 8. Acetone = a

Physical or Chemical? (page 34)

1.–8. Explanations will vary.; 1. physical change: The ice changed state from solid to liquid.; 2. chemical change: The burnt toast changed from one substance to a new one.; 3. chemical change: The raw egg is cooked and changed to a new substance.; 4. chemical change: The chemicals in the fireworks ignite and create sound and bright lights.; 5. chemical change: a new substance is produced on the surface of the metal; 6. physical change: The grass is cut shorter, but it is the same substance; 7. chemical change: The food changes to a new substance such as mold.; 8. physical change: The glass does not change form or composition. It is only broken into smaller pieces.

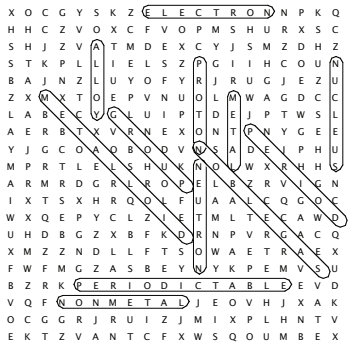
Matter of Fact (page 35)

Solids: 1, 3, 8; Liquids: 2, 6, 9, 11; Gases: 5, 10, 13; Plasmas: 4, 7, 12

All About Matter (page 36)

1. T; 2. T; 3. F, The molecules in a solid are tightly packed together. Or, The molecules in a liquid (or gas) are loosely packed together.; 4. T; 5. F, Gas particles can be compressed into a smaller space.; 6. F, A substance changing from solid to gas is called sublimation. Or, A substance changing from solid to liquid is called melting.; 7. T; 8. T; 9. F, To change a substance from solid to liquid, energy needs to be added to the system. Or, To change a substance from liquid to solid, energy needs to be taken from the system.; 10. T

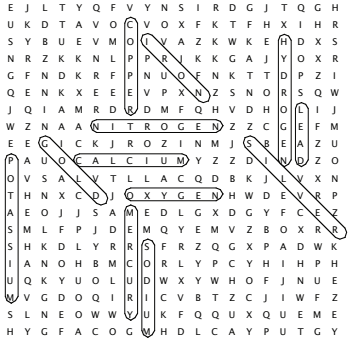
It's Elemental (page 38)



It's Elemental (page 39)

ACROSS
2. nucleus; 4. chemical symbol; 6. electron; 7. groups; 10. nonmetals; 11. alloy
DOWN
1. noble gases; 2. neutron; 3. periods; 5. metalloids; 8. proton; 9. metals

Elemental Names (page 40)



Chemical Symbols (page 41)

ACROSS
4. hydrogen; 6. gold; 8. potassium; 11. mercury; 12. nitrogen
DOWN
1. sodium; 2. calcium; 3. lead; 5. oxygen; 7. copper; 9. silver; 10. iron

Making the Elements (pages 42–43)

a. hydrogen: 1; 0; 1; b. helium: 2; 2; 2; c. carbon: 6; 6; 6; d. oxygen: 8; 8; 8; e. neon: 10; 10; 10; f. sodium: 11; 12; 11; Check students' drawings for the appropriate number of protons, neutrons, and electrons.

Groups of Nonmetals (page 45)

1. carbon group; 2. nitrogen group; 3. oxygen group; 4. halogen group; 5. noble gases

Heavy Metal Vocabulary (page 46)

1. i; 2. b; 3. a; 4. f; 5. e; 6. g; 7. c; 8. j; 9. d; 10. h; 11. k

Uses of the Elements (page 47)

1. silver, L; 2. gold; 3. oxygen; 4. phosphorus, U; 5. neon; 6. titanium, T; 7. copper, P; 8. helium, U; 9. uranium, M; 10. aluminum, I; 11. hydrogen, O; 12. carbon, N
Mystery Word: plutonium

Element Superheroes (pages 48–49)

Information for each element should be accurate. Superheroes will vary but should be based on the information for students' selected elements.

Elemental Organization (page 50)

Atoms: 3, 6, 9; Compounds: 1, 5; Mixtures: 7, 8, 10; Elements: 2, 4

All About Elements (page 51)

1. F, Protons and neutrons are found in an atom's nucleus.; 2. F, The atomic number of carbon is 6. Or, The atomic number of beryllium is 4.; 3. T; 4. T; 5. F, Electrons have a negative charge. Or, Protons have a positive charge.; 6. F, The chemical symbol for helium is He.; 7. T; 8. F, Being malleable and ductile are properties of metals.; 9. T; 10. F, Niels Bohr created the model of the atom.

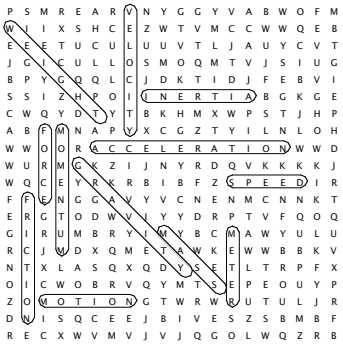
Elemental Discovery (page 52)

Stories will vary.

Learning about Motion and Forces (page 53)

physicist: a scientist who studies physics, such as motion and forces; physical: a type of characteristic that can be seen; friction: the force caused by two objects rubbing against each other; inertia: an object's resistance to any change in its movement

A Lot of Movin' (page 54)



A Lot of Movin' (page 55)

ACROSS
1. gravity; 5. momentum; 8. force; 9. inertia; 10. friction; 12. acceleration
DOWN
2. velocity; 3. weight; 4. motion; 5. meter; 6. mass; 7. speed; 11. newton

Moving Along (page 56)

1. gravity, A; 2. speed, S, P; 3. velocity, L; 4. weight, H; 5. friction; 6. force, C; 7. momentum, U; 8. inertia, E; 9. newton, T; 10. acceleration, E, T; 11. mass, S
Mystery Words: space shuttle

Motion Graphs (page 57)

1. 9 km; 2. 0.5 km/hr.; 3. 3.25 km/hr.; 4. He started hiking back toward his starting point.; 5. The ball moves very fast after it is thrown but slows down.; 6. 5 seconds

Travel Graphs (page 58)

1. b; 2. d; 3. a; 4. e; 5. c; 6. d; 7. a; 8. c; 9. b; 10. e

Newton's First Law (page 59)

Results/Conclusions: 1. Answers will vary but may include: Flick the card forward or pull it backward quickly.; 2. The coin moves with the index card and does not fall into the cup.; 3. As the card moves away quickly, the coin slides over the card. There is little friction between the card and the coin, so it is not affected by the movement of the card. Gravity pulls the coin into the cup; 4. Answers will vary but may include: This happens when you are sitting in a car and the car moves forward suddenly.

Newton's Third Law (page 60)

Results/Conclusions: 1. The milk carton turned counterclockwise.; 2. Place the holes in the lower-left corners of the carton.; 3. As the water left the carton through the holes, the carton reacted by turning in the opposite direction.

Newton's Laws (page 61)

1. b; 2. i; 3. d; 4. g; 5. e; 6. c; 7. f; 8. a; 9. h; Magic Number: 15

Will, Bill, and Phil (page 62)

1. d, h; 2. a, f; 3. c, e; 4. b, g

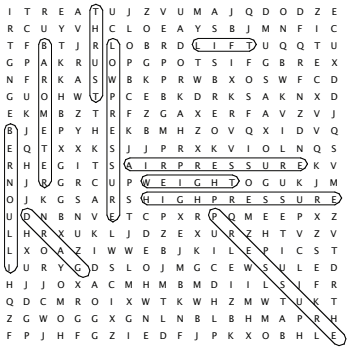
Net Forces (page 63)

Drawings will vary but should show the specified forces.

Gravity's Force (pages 64–66)

Predictions, observations, and data tables will vary.; Results/Conclusions: 1. Answers will vary.; 2. The roots grew downward.; 3. Gravity pulls the roots of the plants downward.; 4. The seeds were grown in a dark cabinet so that they would not be affected by light, which could have changed the results of the experiment by altering the growth direction of the roots.; 5. Phototropism helps the stems and leaves of plants grow upward toward the light source so that photosynthesis can occur.

Air Pressure (page 67)



Air Pressure (page 68)

ACROSS
1. weight; 3. high pressure; 7. air pressure; 9. low pressure; 10. lift
DOWN
2. thrust; 4. Bernoulli; 5. barometer; 6. pressure; 8. drag

Lifting with Air! (page 69)

Procedure: 4. When air is blown into the bag, the air is compressed, pushes on the bag, and lifts the book.; 5. The stack of books lifts into the air. The air pressure is strong enough to lift several books.; Conclusions: 1. Answers will vary but may include: density and mass; 2. Answers will vary but may include: bike and car tires

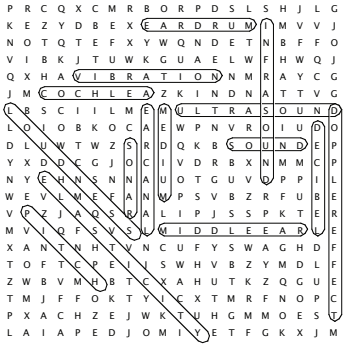
The Science of Flight (page 70)

1. thrust; 2. weight; 3. drag; 4. lift; 5. drag; 6. weight; 7. lift; 8. thrust

Airfoils (pages 71–72)

Part 1—Procedure: 2. The paper lifts into the air.; 3. The paper does not lift into the air because the weight of the paper clip holds it down.; 7. The airfoil lifts into the air and spins.;
Part 2—Procedure: 5. The wing looks like a teardrop; 7. The notches allow the plane to rise and fall depending on their positions.; Results/Conclusion: 1. Answers will vary but may include: The plane flew best with one paper clip at the nose and notches folded down.; 2. Answers will vary but may include: The shape of an airfoil causes air to flow faster on top than on bottom. The air pressure is greater below the airfoil than above, which creates lift.

Sound Off! (page 74)



Sound Off! (page 75)

ACROSS
3. sonogram; 5. medium; 8. sonar; 9. Doppler effect; 11. decibel; 12. infrasound
DOWN
1. loudness; 3. sound; 4. pitch; 6. elasticity; 7. ultrasound

Measuring Sound (pages 76–77)

Air temperatures, predictions, and data tables will vary.; Results/Conclusions: 1. Answers will vary.; 2. The speed of sound travels faster in warm air than in cold air. The compressional sound wave travels faster in warm air when the molecules are moving more quickly.; 3. Answers will vary.

The Doppler Effect (page 78)

Procedure: 5. The first recording was a constant and consistent sound. The second recording got louder as the buzzer approached the recorder and softer as it moved farther away.; 6. The ripples spread out from the pebble in a circular pattern.; 7. The ripples spread out from the finger. The ripples in front of the finger are closer together, and the ones behind it are farther apart.

The Human Ear (page 79)

1. ear canal; 2. eardrum; 3. hammer, anvil, and stirrup; 4. cochlea; 5. nerve cells; 6. ear canal; 7. eardrum; 8. hammer; 9. anvil; 10. stirrup; 11. cochlea; 12. outer ear; 13. middle ear; 14. inner ear

Wave Anatomy (page 80)

1. amplitude; 2. wavelength; 3. crest; 4. trough; 5. trough; 6. crest; 7. wavelength; 8. amplitude

Shoe Box Guitar (page 81)

Conclusions: 1. Plucking the rubber bands causes them to vibrate. This vibration produces sounds by causing the air inside the box to vibrate as well.; 2. The thicker and longer the rubber band, the lower the pitch. The thinner and shorter the rubber band, the higher the pitch. This difference in pitch is due to the thicker and longer rubber band having more mass and vibrating slower.

String and Cup Communication (pages 82–83)

Procedure: 6. Plans will vary but may include: changing the length of the string, using empty soup cans, using two different sized cups, or using a different type of string;
Results/Conclusion: 1. Students should hear their partners' voices. Depending on the length and tautness of the string, it may be clear or muffled.; 2–4. Answers will vary depending on the variable changed.; 5. When one student talks into a cup, she sends air vibrations into the cup, which causes the back end of the cup to vibrate. This vibration is passed along the string and into the other cup. When the other cup vibrates, it creates vibrations in the air again and you can hear the other student's voice.

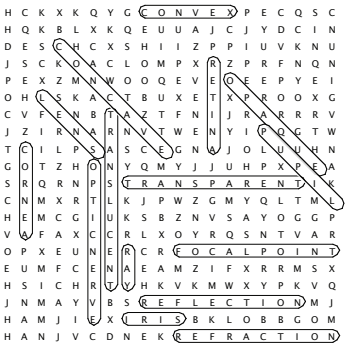
Turn It Down! (page 84)

1. breathing; 2. whispering; 3. normal conversation; 4. city traffic;
5. motorcycle; 6. concert; 7. jet engine;
8. space shuttle engine

Sound Wave Acrostic (page 85)

Poems will vary. Each letter should describe a fact learned about sound waves.

Lights On! (page 86)



Lights On! (page 87)

ACROSS
1. translucent; 2. opaque; 3. diffuse reflection; 5. ray; 6. reflection; 8. convex; 9. lens
DOWN
1. transparent; 4. focal point; 7. concave

Into the Light (page 88)

1. transparent, P; 2. refraction, T; 3. reflect, C; 4. translucent, S; 5. opaque, U; 6. ray, R; 7. concave, E; 8. convex; 9. images, M
Mystery Word: spectrum

Bouncing and Bending (page 89)

1. reflection; 2. refraction; 3. convex mirror; 4. concave mirror; 5. diffuse reflection; 6. reflection; 7. diffuse reflection; 8. refraction; 9. concave mirror; 10. convex mirror

Bending Light (page 90)

Procedure: 2. The pencil appears to be in two pieces, broken or bent at the point it enters the water.; 5. The objects appear to be in different locations, depending on which angle they are viewed from. They may also appear to be larger and distorted.; 7. The beam of light appears to bend as it enters the water and it scatters into a larger beam.

The Human Eye (page 91)

1. pupil; 2. vitreous humor; 3. cornea; 4. retina; 5. iris; 6. optic nerve; 7. lens; 8. optic nerve; 9. retina; 10. vitreous humor; 11. iris; 12. lens; 13. pupil; 14. cornea

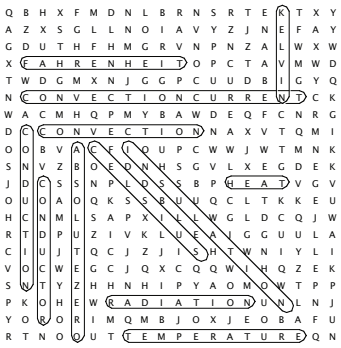
Using Lenses in Science (page 92)

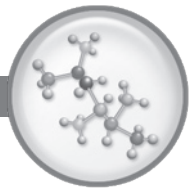
Answers will vary but may include: Reflecting telescopes use concave mirrors to focus light. The concave mirrors reflect light to form an image.; Refracting telescopes use two convex lenses to focus light and make it look like the object is closer than it really is. The convex lenses bend light inward, which makes the image look smaller.; Microscopes use a small spherical lens that brings the image into focus within the microscope's tube. A second lens magnifies the image as it is brought to the eye.; Check students' drawings.

Can You See the Light? (page 93)

1. F, Light that hits an object can be absorbed, reflected, refracted, scattered, or transmitted.; 2. T; 3. F, A convex mirror has a surface that curves outward. Or, A concave mirror has a surface that curves inward.; 4. F, Diffuse reflection occurs when parallel light rays hit a rough surface and reflect at different angles. Or, Regular reflection occurs when parallel light rays hit a smooth surface and reflect at the same angle.; 5. F, Regular reflection occurs when parallel light rays hit a smooth surface and reflect at the same angle. Or, Diffuse reflection occurs when parallel light rays hit a rough surface and reflect at different angles.; 6. F, Opaque materials reflect or absorb all of the light that strikes them. Or, Transparent materials allow most of the light to pass through them.; 7. T;
8. T; 9. F, Transparent materials allow light to pass through them. Or, Opaque materials absorb all of the light that strikes them.

Heat Transfer (page 94)





Heat Transfer (page 95)

ACROSS
2. Celsius; 3. conduction; 5. heat; 6. radiation; 7. absolute zero; 8. Kelvin; 9. Fahrenheit
DOWN
1. insulator; 2. conductor; 3. convection; 4. temperature

Insulators in Action (pages 96–99)

Types of fabric insulation used and data tables will vary.; Graphs will vary.; Conclusions: 1. Conduction and convection of the heat contained by the water molecules caused the temperature to decrease. Also, none of the materials are perfect insulators, so the temperature will eventually decrease.; 2. Wrapping the test tube helped decrease conduction of heat out of the test tube.; 3. Answers will vary.; 4. Graphs will vary.

Insulation Data (page 100)

1. The insulating material used was the variable.; 2. 30 minutes; 3. Celsius.; 4. Test tube 1; This is known because it retained the heat of the water for the longest period of time.; 5. The control was test tube 4, which was uninsulated. This is known because its temperature dropped the quickest of all four tubes.; 6. 40°C; 7. Answers will vary.

Renewable Power (page 101)

1. f; 2. e; 3. a; 4. d; 5. b; 6. c

Renewable Energy (page 102)

Answers will vary but may include: Wind—Advantages: clean, abundant in some areas; Disadvantages: possible noise pollution, possible interference with migratory bird routes; Solar—Advantages: renewable, noiseless, creates no pollution; Disadvantages: cannot be used during storms or at night, high initial cost; Geothermal—Advantages: requires little maintenance after construction, unaffected by changes in weather; Disadvantages: limited places to establish geothermal power stations, may produce hazardous gases and minerals that are hard to dispose of; Hydroelectric—Advantages: clean, abundant; Disadvantages: changes in ecosystem upstream and downstream from dam;
Biomass—Advantages: fuel is inexpensive, does not contribute to global warming, reduces the problem of waste disposal; Disadvantages: all waste materials not available year-round, transporting and handling are costly;
Tidal—Advantages: inexpensive to maintain, produces no greenhouse gases or other waste, abundant fuel source; Disadvantages: provides only about 10 hours of power each day, may affect tidal level, which may affect navigation and recreation and cause flooding of the shoreline and affect local marine life

Solar "Still" Works (pages 103–104)

Procedure: 1. The water tastes salty.; 8. The water tastes like freshwater.; Results/Conclusions: 1. Water is condensing on the plastic wrap, especially around the rock.; 2. There is water in the small cup where there wasn't any before. The level of the water in the big cup decreased slightly.; 3. Solar energy converted the salt water into freshwater through the process of evaporation. As the sun heated the salt water, the water in the salt water evaporated, leaving the salt behind. As the water vapor rose, it hit the plastic wrap and then condensed back into liquid water. The rock on the plastic wrap funneled the fresh water into the small paper cup.; 4. This process could be used on a larger scale in areas on Earth where there are low supplies of freshwater. The salt water could be converted into fresh drinking water.; 5. Distillation is the process of evaporating a liquid and condensing it. It is often used to purify a liquid (by condensation and evaporation) that is contaminated with bacteria or wastes. The solar still performed the same task by separating the salt and water.

The Greenhouse Effect (pages 105–106)

Data tables will vary.; Results/Conclusions: 1. The thermometer in the test tube with a stopper showed the higher temperature.; 2. The air temperature inside the test tubes.; 3. A greenhouse traps the sun's energy after it passes through the glass. The trapped heat keeps the greenhouse at a constantly warmer temperature.;
4. The burning of fossil fuels produces gases. Energy from the sun enters our atmosphere and is absorbed by the land and oceans of Earth. When the heat is radiated back up, it cannot pass through the greenhouse gases and is trapped in our atmosphere. This trapped heat raises the global temperature and causes global warming.

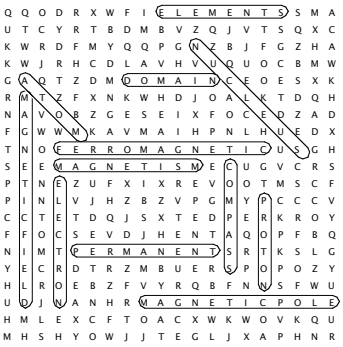
Heat & Energy Cinquain (page 107)

Poems will vary but should contain concepts and vocabulary about heat, light, and energy.

Learning about Magnetism (page 108)

lodestone: a rock that is naturally magnetic; magnetic: physical property that causes objects to attract certain materials; magnetized: property of a material that attracts or repels certain materials; compass: a device used for navigation; magnetic needle on a pivot; generators: machines that use magnets to create electricity

Attracting Forces (page 109)



Attracting Forces (page 110)

ACROSS
3. magnetic pole; 4. magnetic field; 6. nucleus; 8. domain; 9. ferromagnetic; 10. permanent magnet
DOWN
1. proton; 2. atom; 3. magnetism; 5. electron; 7. compass

It's Magnetic! (page 111)

1. magnetite; 2. attraction; 3. repulsion; 4. magnetic field; 5. ferromagnetic; 6. heat; 7. lodestone; 8. electromagnet; 9. horseshoe; 10. magnet
Unscrambled Word: solenoid

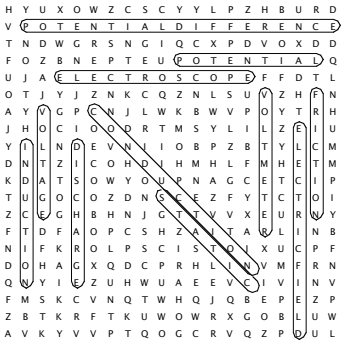
Magnetic Strength (pages 112–113)

Procedure: 3. The hook is drawn to the magnet.; Conclusions: 1. The strength of the magnet did not decrease, but the barrier of masking tape added additional distance between the paper clips and magnet and placed the paper clips farther away from the magnetic field. Therefore, it seems like the strength of the magnet decreased.; 2. The distance is affecting the magnet's strength.; Data tables and graphs will vary.

Lights in the Sky (page 114)

Answers will vary but may include: The real cause of the auroras is the sun. The sun gives off high-energy charged particles called plasma. The traveling plasma moves in a cloud called the solar wind. When the solar wind passes by Earth, some of the particles get trapped in Earth's magnetic field. When the particles meet with gases in our atmosphere, they begin to glow.

It's Electric! (page 115)



It's Electric! (page 116)

ACROSS
3. electroscope; 4. potential; 5. static; 6. friction; 7. induction; 8. conduction; 9. voltmeter
DOWN
1. potential difference; 2. voltage; 3. electric field

Build an Electroscope (pages 117–118)

Results/Conclusions: 1. The strips of aluminum foil move apart.; 2. When the balloon is moved away, the strips move close together and back to their original positions.; 3. The strips stick together.; 4. An electroscope detects the presence of static electricity. When you rub the balloon with the wool cloth, electrons move from the cloth onto the balloon and give the balloon a negative charge. When you bring the balloon close to the hook, the electrons in the hook are pushed to the foil strips and they separate. The strips are charged the same way so that they repel each other.; Data tables will vary.

Conductors and Insulators (page 119)

Sample procedure: 1. Use the aluminum foil to make three, 1 cm wide, 10 cm long aluminum foil "wires" by folding the strips of foil three or four times.; 2. Use electrical tape to attach one end of two foil wires to opposite ends of the battery.; 3. Use the clothespin to attach the other ends of both aluminum foil wires to the lightbulb. The circuit should be closed and light the lightbulb.; 4. To create a circuit tester for different objects, add the third aluminum foil wire between the battery and lightbulb. Attach different objects to the ends of the two open wires with a clothespin.; Drawings will vary.; 4. If the object is a conductor, the lightbulb will light. If it is an insulator, it will not light.; Data tables will vary.

Transfer of Energy (page 120)

1. insulator, I; 2. electrons, R, N; 3. negative, G, I; 4. attract; 5. repel, L; 6. protons, O, T; 7. conductor, N, D; 8. discharge, H, G
Mystery Words: lightning rod

Electricity Rap (page 121)

Raps will vary but should contain concepts and vocabulary about electricity.