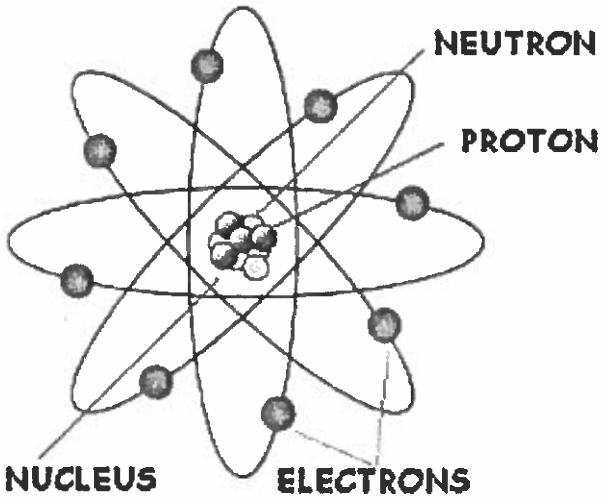
NAME: _____DATE:_____PER:___

ATOMIC STRUCTURE AND THE PERIODIC TABLE

HOMEWORK PACKET



Name: _____

An Atom Apart

by Leslie Cargile

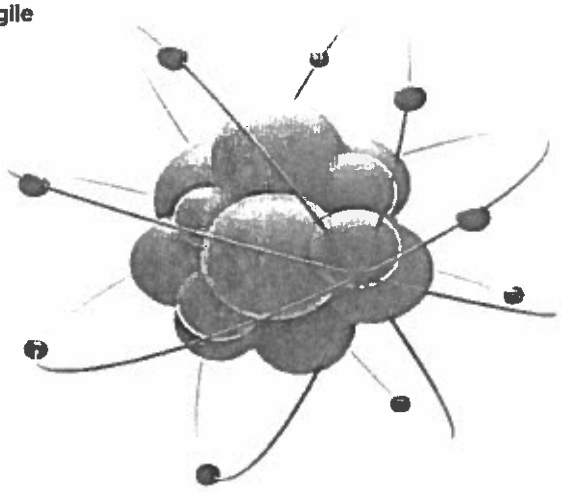
Have you ever walked through a cloud of gnats on a hot summer, only to have them follow you? No matter how you swat at them, or even if you run, they won't leave you alone. If so, then you have something in common with an atom.

Atoms are the building blocks of molecules, which when combined, make up everything. From the smallest one-celled amoeba, to every person who has ever lived, to the largest and brightest stars in the sky, atoms are everywhere.

Even way back in the time of ancient Greece, they wondered about atoms. That's where the word comes from, ancient Greece. The word *A'tomos,* when translated into English, means: *something that cannot be divided any further*. So what's an atom look like? Up until very recently no one could say one way or another.

Technically we can't see individual atoms, since there are no microscopes powerful enough. Since technology improves all the time, it may not be long before we can actually see a whole atom through a special microscope. Even though scientists cannot see atoms with microscopes, they have developed ways to detect them and learn about them.

Atoms are made up of three basic parts; protons, neutrons, and electrons. There is a core, or *nucleus,* and an electron cloud. The nucleus is made up of positively charged protons and neutral neutrons. The nucleus is held closely together by *electromagnetic force.*



Protons and neutrons make up the nucleus of the atom.
A cloud of electrons orbits the nucleus.

The negatively charged electrons are bound to the nucleus, and zap around it in a cloud. Do you remember the cloud of gnats? The gnats would be the electrons zipping around you, the nucleus.

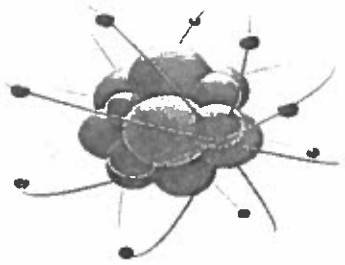
There are different ways atoms are classified. They can be classified into elements, like oxygen, carbon, or hydrogen. All of the elements known to man so far can be found on the periodic table. The number of protons an atom has decides the chemical element. The number of electrons defines the atom's chemical properties, like its melting temperature and boiling point.

The study of atoms and tiny particles that are even smaller is called quantum mechanics. Scientists still have much to learn about atoms. Maybe you will enter the study of quantum mechanics and find a brand new element. Maybe they'll even name it after you!

Name: _____

An Atom Apart

by Leslie Cargile



1. What are atoms?

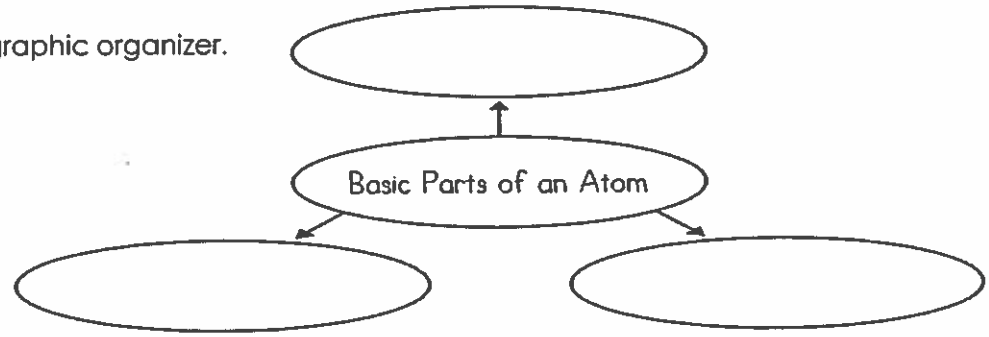
   a. tiny particles that make up all matter
   b. tiny particles that can only be seen with a microscope
   c. tiny particles that look like gnats
   d. particles that are so large they cannot be seen

2. What does the word *A'tomos* mean in ancient Greece?

   _____

   _____

3. Complete the graphic organizer.



4. What is quantum mechanics?

   _____

   _____

5. If you wanted to find the chemical element of an atom, you would need to...

   a. know how many electrons it has
   b. know how many protons it has
   c. know its melting temperature
   d. see it with a microscope

6. The author begins this article by comparing a cloud of gnats to an atom. In this scenario, what do the gnats represent? What does the person walking through the gnats represent?

   _____

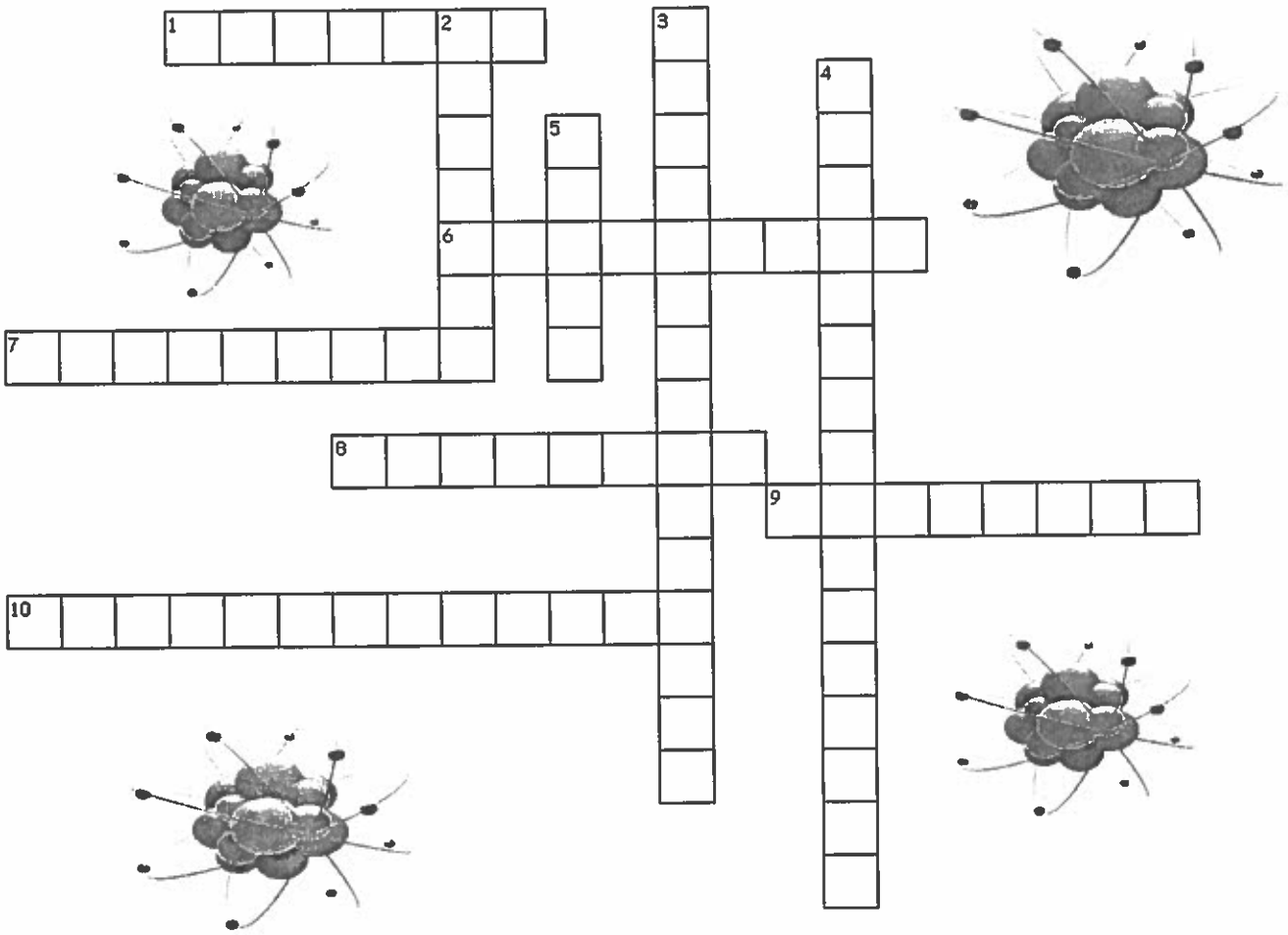
   _____

Something to Think About: If you discovered a new element that was added to the periodic table, what would you name it?

Name: _____

An Atom Apart

Vocabulary Crossword



Across

1. positively charged parts of an atom

6. negatively charged parts of an atom

7. atoms are the building blocks for...

8. the number of electrons in atoms determine an element's ___ properties

9. neutrally charged parts of an atom

10. a chart which lists all of the known elements

Down

2. protons and neutrons are found in this part of an atom

3. type of force that holds the nucleus of an atom together

4. area of science that studies tiny particles like atoms

5. the word a'tomos comes from this language

Name _____ Period _____ Date _____

CHAPTER 1 | ATOMIC STRUCTURE AND THE PERIODIC TABLE

Vocabulary

Proton	Metals	Periodic table	Atomic mass number
Isotope	Nucleus	Metalloids	Period
Reactive	Atomic mass	Atomic number	Half-life
Neutron	Nonmetal	Group	
Ion	Electron	Radioactivity	

A. DEFINITIONS

On the line, write the vocabulary word that matches the definition.

1. An atomic particle that is positively charged.

_____

2. An atomic particle that has no charge.

_____

3. The part of an atom that contains protons and neutrons.

_____

4. The atomic particle that is negatively charged and moves around the outside of the nucleus.

_____

5. The number of protons in an atom's nucleus, which serves to identify an atom.

_____

6. The sum of an atom's protons and neutrons.

_____

7. An element that has the same number of protons but different number of neutrons in the nucleus.

_____

8. Formed when an atom loses or gains one or more electrons.

_____

9. It's the average mass of the isotopes of atoms of an element.

_____

10. A table showing a repeating pattern of properties of the elements.

_____

11. The elements in a column in the periodic table.

_____

12. Each horizontal row in the periodic table.

_____

13. Term used indicates how likely the element is to undergo a chemical change.

_____

14. Elements that conduct electricity and heat well, and have a shiny appearance.

_____

15. The elements on the right side of the periodic table that have properties opposite of those of metals.

_____

16. Elements that have properties of both metals and nonmetals.

_____

17. The process by which atoms produce energy and produce particles.

_____

18. The amount of time it takes for one-half of the atoms in a particular sample to decay.

_____

B. WHICH ONE?

Choose the vocabulary word that matches each description and write it on the line.
Use the bolded words in the sentences as clues.

19. Sometimes this is called a family of elements because these **elements seem to be related.**

period periodic table group

_____

20. Every atom of each element has a unique **number of this particle.**

electrons protons neutrons

_____

Name _____ Period _____ Date _____

CHAPTER 1 | ATOMIC STRUCTURE AND THE PERIODIC TABLE

Math Support

Using Scientific Notation

Scientific notation allows you to express a very large number, like 1,567,000,000, as a decimal and a power of 10.

$$1,567,000,000 = 1.567 \times 10^{9}$$

Scientific notation also allows you to express very small numbers, like 0.0000000000736 as a decimal and a power of 10.

$$0.0000000000736 = 7.36 \times 10^{-11}$$

SAMPLE PROBLEM

Express 45,270,000,000,000 using scientific notation.

Set up: Figure out where you must place a decimal to make a number between 1 and 10. In this case, you would place the decimal between the 4 and the 5 to make the number 4.527.

Count: Count the number of digits between the new decimal and the old decimal. Here, there are 13 digits between the decimals. This is the power of 10 you will use. Now you have

$$4.527 \times 10^{13}$$

Check: Check the sign on the power of 10. If the number you are expressing is a decimal less than one, the power should be negative. If the number you are expressing is greater than one, as this one is, the power is positive.

Answer:

$$4.527 \times 10^{13}$$

EXERCISES

Solve each problem. Remember to show all your work.

1. Express 234,000,000 using scientific notation.

   Set up: _____

   Count: _____

   Check: _____

   Answer: _____

2. Express 0.000000258 using scientific notation.

   Set up: _____

   Count: _____

   Check: _____

   Answer: _____

B7

Name _____ Period _____ Date _____

1 Math Practice

Using Scientific Notation

Answer each question. Remember to show all your work.

1. Write 0.00000000394 using scientific notation.

2. Write 4,580,000 using scientific notation.

3. Write 2.378×10^7 using normal decimal format.

4. Write 1.25×10^{-11} using normal decimal format.

5. Write 30,002,000,000 using scientific notation.

6. Write 0.0000004001 using scientific notation.

7. What is the sum of 3.45×10^{11} and 2.35×10^{11}?

8. Write 12,293,442,101 using scientific notation. Round to the nearest million.

9. Round 1.546×10^7 to the nearest hundred thousand. Write your answer using scientific notation.

Use your knowledge of scientific notation to answer the questions below. Remember to show all your work.

10. Tom took four measurements and wrote them using scientific notation.

    2.32×10^{13}, 1.11×10^{-7}, 9.04×10^5, 4.45×10^8

    Write these in order from least to greatest.

11. Last year, Company A made a profit of $12.7 million. Write the amount Company A made using scientific notation.

12. There are 292,087,000 people living in the United States. Write this number to the nearest million using scientific notation.

88

Name _____ Period _____ Date _____

SECTION 1.1 | ATOMS ARE THE SMALLEST FORM OF ELEMENTS.

Reading Study Guide A

BIG IDEA A substance's atomic structure determines its physical and chemical properties.

KEY CONCEPT Atoms are the smallest form of elements.

Vocabulary

proton a positively charged particle within an atom
neutron an uncharged particle within an atom
nucleus protons and neutrons together at an atom's center
electron a negatively charged particle moving around the outside of the nucleus
atomic number the number of protons in the nucleus in an atom
atomic mass number combined number of protons and neutrons in a nucleus
isotope element that has the same number of protons, but a different number of neutrons from another atom of the same element
ion an atom that has gained or lost electrons

Review

If the statement is true, write *true*. If it is false, replace the underlined word to make it true.

1. Atoms are made of protons, neutrons, and <u>isotopes</u>. _____ .
2. Each element has a unique <u>atomic number</u>. _____ .

Take Notes

I. All matter is made of atoms. (p. 9)

3. About how many different elements make up everything on Earth?

_____

A–B. Types of Atoms, Names and Symbols of Elements (p. 10)

4. All living things contain some common elements. Their symbols are given below. Write the name of each element next to its symbol.

O _____ C _____ N _____ H _____

Which one of these is the most common element in the universe?

_____

Name _____ Period _____ Date _____

II. Each element is made of a different atom (p. 11)

A–B. The Structure of an Atom, Atomic and Atomic Mass Numbers (pp. 11–12)

5. What are the three particles that make up an atom?

_____

6. What is the atomic number of an atom?

_____

7. Atomic mass number is the sum of _____ and _____.
What is an isotope?

_____

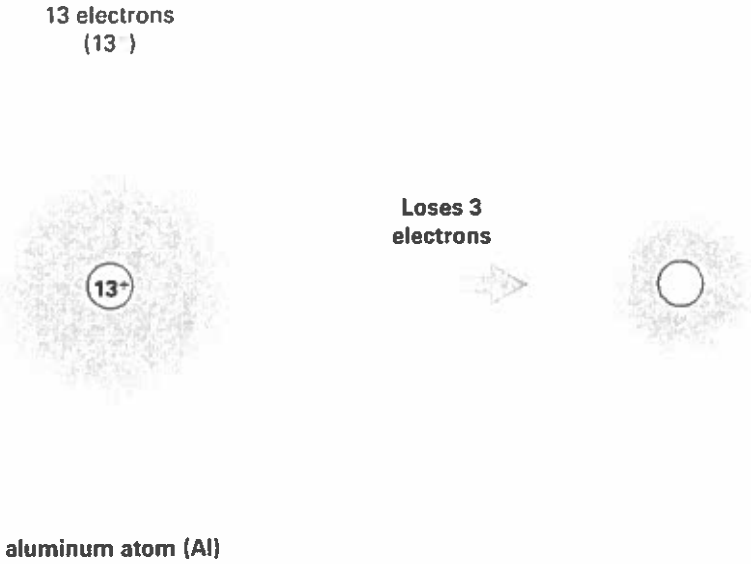
III. Atoms form ions. (p. 14)

8. An ion is an atom that has a positive or negative charge. What happens when an atom becomes an ion?

_____

A–B. Formation of Positive Ions and Formation of Negative Ions (pp. 14–15)

9. All aluminum atoms have 13 protons. Aluminum atoms often lose 3 electrons to form ions. Label the ion on the right side by noting the protons and electrons that remain.



10

Name Period Date

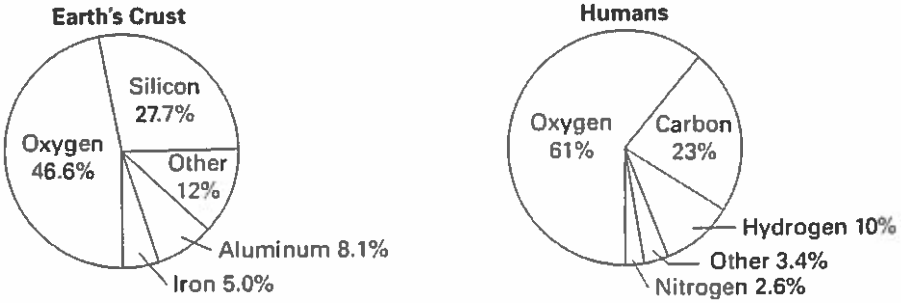
SECTION 1.1 ATOMS ARE THE SMALLEST FORM OF ELEMENTS.

Reinforcing Key Concepts

BIG IDEA A substance's atomic structure determines its physical and chemical properties.

KEY CONCEPT Atoms are the smallest form of elements.

1. **All matter is made of atoms.** Look at the two pie graphs below. One shows the distribution of the types of atoms in approximately the top 100 kilometers of Earth's crust. The other shows the distribution of the types of atoms in the human body.



a. What is the most common element found in Earth's crust and in the human body?

b. What is the second most common element in Earth's crust and in the human body?

2. **Different elements are composed of different atoms.** The identity of an atom is determined by the number of protons in its nucleus, called the atomic number. The atomic mass number of an atom is the sum of its protons and neutrons.

Element	Atomic Number	Atomic Mass Number
gold	79	158
chlorine-37	17	37

a. How many protons are found in the nucleus of one atom of gold?

b. How many neutrons are found in the nucleus of one atom of chlorine-37?

3. **Atoms form ions.** An ion is formed when an atom loses or gains one or more electrons. An atom has 9 protons and 10 neutrons in its nucleus. The electron cloud surrounding the nucleus has 10 electrons. What is the overall charge of the atom? Is the ion smaller or larger than the neutral atom?

NAME _____DATE: _____Period_____

Chemical Interactions – Atoms – 1.1 Quiz Review

1. Carbon-14 and Carbon-16 are 2 elements with the same number of protons but different numbers of _____. Therefore they have different _____ making them _____.
2. Ca and Ca^{+2}, are 2 elements with the same number of protons but a different number of _____. Therefore Ca^{+2} has a positive _____, because it _____ 2 _____ while Ca is neutral. These two atoms are called _____.
3. F and F^{-1}, are 2 elements with the same number of protons but a different number of _____. Therefore F^{-1} has a negative _____, because it _____ 1 _____ while Ca is neutral. These two atoms are called _____.
4. Electrons have a _____charge and are located in energy levels, orbital's and shells inside the _____ _____.
5. Protons have a _____ charge and are located in the _____ ,small dense center, of an atom.
6. Neutrons have a _____ charge and are located in the _____ ,small dense center, of an atom.
7. The protons and neutrons make up an atom's _____.
8. The most common element in the universe is _____.
9. The most common element in the Earth's crust is _____.
10. Draw a Bohr model Diagram of ^{4}He.
    a. Mass #: _____
    b. # of protons: _____
    c. # of neutrons: _____
    d. # of electron: _____
    e. # of valence e-: _____

123

Name _____ Period _____ Date _____

SECTION 1.2 | ATOMS OF ELEMENTS MAKE UP THE PERIODIC TABLE.

Reading Study Guide A

BIG IDEA A substance's atomic structure determines its physical and chemical properties.

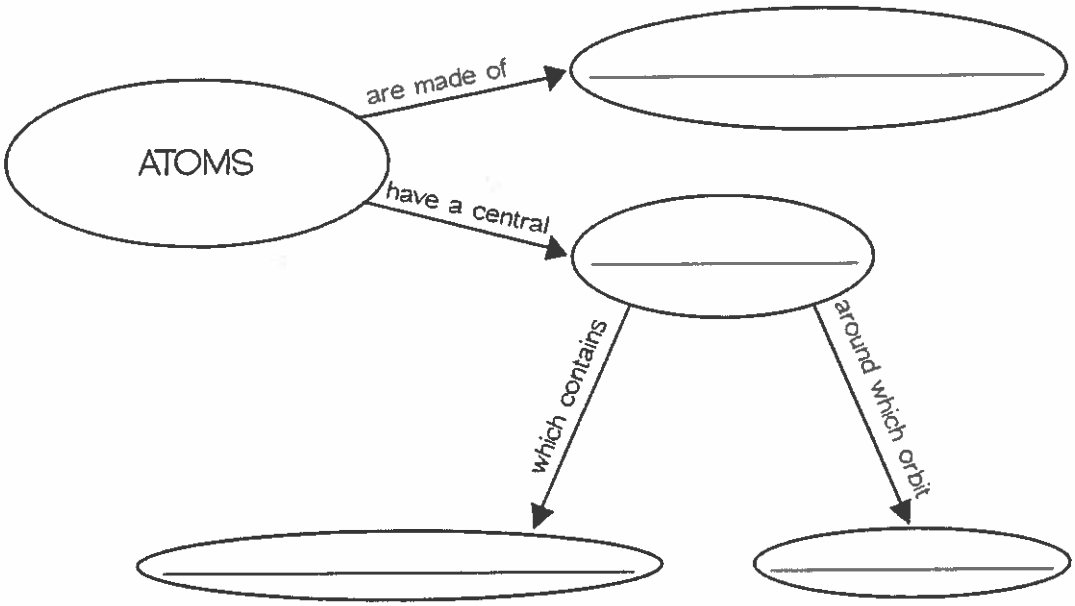
KEY CONCEPT Atoms of elements make up the periodic table.

Vocabulary

atomic mass average mass of all the element's isotopes
periodic table the table that shows the repeating pattern of properties of the elements
group the elements in a column of the periodic table
period a horizontal row in the periodic table

Review

1. Fill in the concept map for *atoms*.



Take Notes

I. Elements can be organized by similarities. (p. 17)

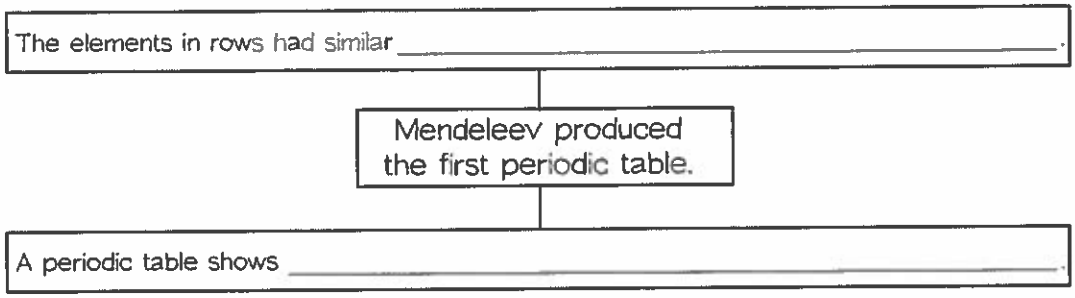
2. The average mass of all an element's isotopes is its _____.

13

Name _____ Period _____ Date _____

A. Mendeleev's Periodic Table and Predicting New Elements (pp. 18–19)

3. Fill in the main-idea web for the main idea shown.



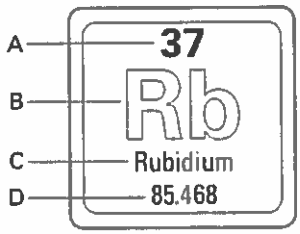
II. The periodic table organizes the atoms of the elements by properties and atomic number. (p. 19)

4. How is the modern periodic table organized?

_____

A. Reading the Periodic Table (p. 19)

5. One square from the periodic table is shown below. Label each of the parts of this element's square.



A _____

B _____

C _____

D _____

6. How many protons does the element shown above have?

_____

B. Groups and Periods (p. 22)

7. What are the vertical columns of the periodic table called?

_____

8. What is the horizontal row called?

_____

C. Trends in the Periodic Table (pp. 22–23)

9. How does atomic size change as you move down the periodic table?

_____

Name _____ Period _____ Date _____

SECTION 1.2 | ATOMS OF ELEMENTS MAKE UP THE PERIODIC TABLE.

Challenge and Extension

BIG IDEA A substance's atomic structure determines its physical and chemical properties.

KEY CONCEPT Atoms of elements make up the periodic table.

Using the Periodic Table Elements that are in the same column, or group, in the periodic table show similarities in their properties. Elements in the same horizontal row, or period, show a gradual change in their properties across the period.

Use the periodic table on pages 21–22 of your textbook to answer the following questions about the properties of elements.

1. What other information would you add to a square of the periodic table?

_____

_____

2. Would you expect aluminum (Al) to be more like thallium (Tl) or sulfur (S)? Explain.

_____

_____

3. If each statement below is true, write true on the line. If the statement is false, rewrite it to make it true.

   a. The number of protons in the nucleus of dysprosium is 162.50.

   _____

   b. All the elements in Period 2 are metals.

   _____

   c. Silicon is best described as having both metallic and nonmetallic properties.

   _____

4. Indicate with a plus sign (+) or a minus sign (−) whether atoms of the element form positive ions or negative ions.

   a. _____ platinum (Pt)

   b. _____ uranium (U)

   c. _____ radium (Ra)

   d. _____ magnesium (Mg)

5. Rank the following elements from least dense to most dense: chromium (Cr), rhenium (Re), beryllium (Be), scandium (Sc)

   _____

NAME _____DATE: _____Period_____

Chemical Interactions – Periodic Table – 1.2 Quiz Review

1. Atomic size generally _____ from the top of the group to the bottom of the group.
2. Atomic size generally _____ from the left to the right side of a row.
3. A row on the periodic table is called a _____.
4. A column on the periodic table is called a _____ or _____.
5. The periodic table is arranged in order of increasing _____ _____ of the elements.
6. As you move from left to right in the periodic table, the atomic number of the elements _____.
7. The metals are located on the _____ side of the periodic table.
8. The non-metals are located on the _____ side of the periodic table.
9. The metals surround the _____.
10. What can an elements position on the periodic table tell you about its relationship to other elements in the periodic table? Be sure to use the terms: groups, periods, properties.

Name _____ Period _____ Date _____

CHAPTER 1 Atomic Structure and the Periodic Table

SECTION 1.3 | THE PERIODIC TABLE IS A MAP OF THE ELEMENTS.

Reading Study Guide A

BIG IDEA A substance's atomic structure determines its physical and chemical properties.

KEY CONCEPT The periodic table is a map of the elements.

Vocabulary

reactive how likely an element is to undergo a chemical change
metals elements that conduct electricity, are shiny, and heat well
nonmetals elements with properties the opposite of metals
metalloids elements with properties between metals and nonmetals
radioactivity the process where atoms release particles and produce energy
half-life the amount of time it takes for half of the atoms in a set amount of a substance to decay

Review

1. Look at this column from the periodic table below. What properties are most likely similar among these elements? Explain why.

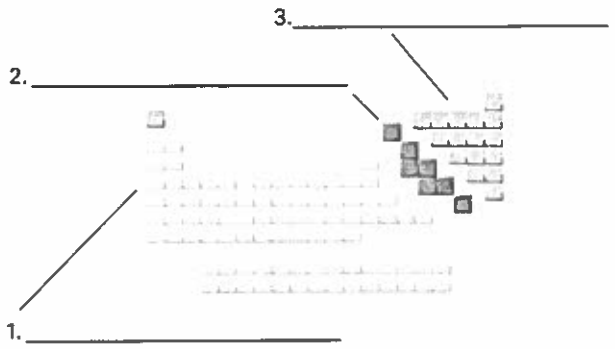
_____

_____

Take Notes

I. The periodic table has distinct regions. (p. 26)

2. The periodic table is divided into three regions—nonmetals, metals, and metalloids. Label these regions on the diagram below.



3. Some elements are more reactive than others. Which groups on the periodic contains the elements that are most reactive?

_____

II. Most elements are metals. (p. 27)

4. Name four characteristics of metals.

_____

A–B. Reactive Metals, Transition Metals, and Rare Earth Elements (pp. 27–28)

5. Why are sodium and potassium often stored in oil?

_____

6. Name two uses for transition metals.

_____

III. Nonmetals and metalloids have a wide range of properties. (p. 29)

7. List three examples of nonmetals.

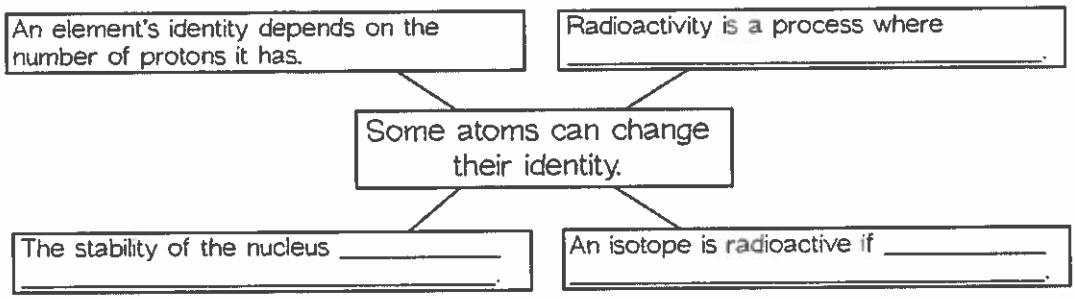
_____

8. What is a common use for metalloids?

_____

IV. Some atoms can change their identity. (p. 30)

9. Fill in the main-idea web for the main idea shown.



A–B. Uses of Radioactivity in Medicine and Radioactive Decay (pp. 31–32)

10. What is one way radioactivity is used in medicine?

_____

Name Period Date

SECTION 1.3 | THE PERIODIC TABLE IS A MAP OF THE ELEMENTS.

Reinforcing Key Concepts

BIG IDEA A substance's atomic structure determines its physical and chemical properties.

KEY CONCEPT The periodic table is a map of the elements.

1. **The periodic table has distinct regions.** The periodic table is a map of the elements. Where an element is on the periodic table will give you an indication of its properties. What are the three main regions of the periodic table? What does *reactive* mean?

_____

_____

2. **Most elements are metals.** Most of the elements on the periodic table are metals. These metals are divided into groups according to their properties. Complete the chart below by describing the difference between the alkali, alkaline, and transition metals.

	Alkali Metals	Alkaline Metals	Transition Metals
Reactivity			
Examples			

3. **Nonmetals and metalloids have a wide range of properties.** Use a periodic table to identify each of the elements below as a nonmetal, halogen, noble gas, or metalloid. Some elements can have more than one answer.

   a. Silicon _____

   b. Chlorine _____

   c. Nitrogen _____

   d. Argon _____

4. **Some atoms can change their identity.** Sometimes, an atom's nucleus may have too many or too few neutrons to be stable. When this occurs, the atom will produce particles and energy until it is again stable. If the number of protons in the nucleus changes, the identity of the atom changes. Atoms that change identity are said to be radioactive. Scientists measure radioactivity by the time it takes for one-half of a sample of atoms to change identity. For example, lead-214 has a half-life of 27 minutes. If you started with 500 grams of this isotope, how many grams would you have after 54 minutes?

_____

19

Name Period Date

SECTION 1.3 | THE PERIODIC TABLE IS A MAP OF THE ELEMENTS.

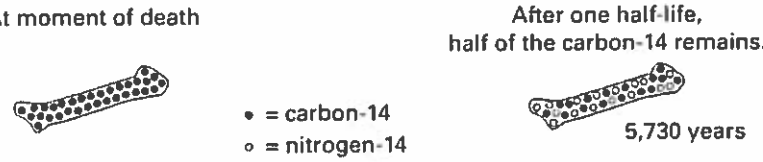
Challenge and Extension

BIG IDEA A substance's atomic structure determines its physical and chemical properties.

KEY CONCEPT The periodic table is a map of the elements.

Radiometric Dating Radioactive decay occurs as the atoms of a radioactive isotope change into atoms of another element. The amount of time that it takes for one-half of the atoms in a particular sample to decay is called the half-life of the isotope. Scientists use this fact to determine the ages of rocks and fossils. In a process called radiometric dating, scientists measure the ratio of certain isotopes remaining in the sample. This ratio shows how much time has passed since the rock formed or since the organism that created the fossil died.

Carbon-14 is an isotope used to determine the ages of certain fossils. Carbon-14 decays to the stable isotope nitrogen-14. While an organism is alive, the ratio of carbon-14 to other isotopes of carbon stays the same. But after death, carbon-14 starts decaying, and its percentage goes down. The diagram below shows how long it takes half of the carbon-14 in a fossil bone to decay to nitrogen-14. Answer the questions that follow.



1. What is the half-life of carbon-14?

2. Suppose scientists find fossilized bones of three mammals. The bones of one animal contain 1/4 of its original carbon-14. The bones of the other two mammals contain 1/8 and 1/32 of their original carbon-14. Determine how long ago each mammal died.

   a. 1/4 of carbon-14

   b. 1/8 of carbon-14

   c. 1/32 of carbon-14

3. What other items, besides fossils, might carbon-14 be used to date?

4. Carbon-14 cannot be used to date items older than about 70,000 years. Why do you think this is so?

20

NAME _____DATE: _____Period_____

Chemical Interactions – Periodic Table – 1.3 Quiz Review

1. The most **reactive** non-metal elements are located in group _____ and are called the _____. This group is often used to kill _____ and they bond with metals to form _____.
2. The most **reactive** metal elements are located in group _____ and are called the _____.
3. The most **non-reactive** elements on the periodic table are located in group _____ they are called the _____ _____, they are non-reactive because they have a full shell of _____ _____.
4. Diatomic molecules are called diatomic molecules because they are always _____.
5. The metals in the middle of the periodic table like silver and gold are called _____ metals.
6. If an element has the same properties as both metals and non-metals it is referred to as a _____.
7. Most elements on the periodic table are _____.
8. Complete the chart on the back of this page.

Properties of Metals	Properties of Metalloids	Properties of Non-Metals