Name: ______________________ Date: __________

CONTENT 14.1

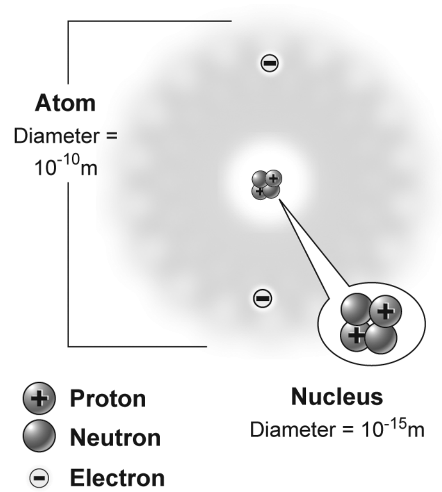
14.1 Structure of the Atom

READ

Atoms are made of three tiny subatomic particles: protons, neutrons, and electrons. The protons and neutrons are grouped together in the nucleus, which is at the center of the atom. The chart below compares electrons, protons, and neutrons in terms of charge and mass.

	Occurrence	Charge	Mass (g)
Electron	found outside of nucleus	-1	9.109×10^{-28}
Proton	found in all nuclei	+1	1.673×10^{-24}
Neutron	found in almost all nuclei (exception: most H nuclei)	0	1.675×10^{-24}

Size and Structure of the Atom



The **atomic number** of an element is the number of protons in the nucleus of every atom of that element.

Isotopes are atoms of the same element that have different numbers of neutrons. The number of protons in isotopes of an element is the same.

The **mass number** of an isotope tells you the number of protons plus the number of neutrons.

Mass number = number of protons + number of neutrons

EXAMPLE

- Carbon has three isotopes: carbon-12, carbon-13, and carbon-14. The atomic number of carbon is 6.

  a. How many protons are in the nucleus of a carbon atom?
  Solution:
  6 protons
  The atomic number indicates how many protons are in the nucleus of an atom. All atoms of carbon have 6 protons, no matter which isotope they are.

  b. How many neutrons are in the nucleus of a carbon-12 atom?
  Solution:
  the mass number - the atomic number = the number of neutrons.
  12 – 6 = 6
  6 neutrons

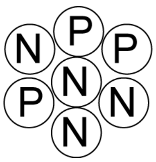
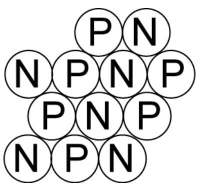
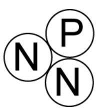
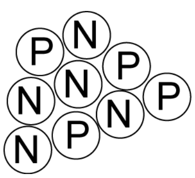
  c. How many electrons are in a neutral atom of carbon-13?
  Solution:
  6 electrons. All neutral carbon atoms have 6 protons and 6 electrons.

  d. How many neutrons are in the nucleus of a carbon-14 atom?
  Solution:
  the mass number - the atomic number = the number of neutrons
  14 – 6 = 8
  8 neutrons

PRACTICE

Use a periodic table of the elements to answer these questions.

1. The following graphics represent the nuclei of atoms. Using a periodic table of elements, fill in the table.

What the nucleus looks like	What is this element?	How many electrons does the neutral atom have?	What is the mass number?
			
			
			
			
			

2. How many protons and neutrons are in the nucleus of each isotope?
   a. hydrogen-2 (atomic number = 1)
   b. scandium-45 (atomic number = 21)
   c. aluminum-27 (atomic number = 13)
   d. uranium-235 (atomic number = 92)
   e. carbon-12 (atomic number = 6)

3. Although electrons have mass, they are not considered in determining the mass number of an atom. Why?

4. A hydrogen atom has one proton, two neutrons, and no electrons. Is this atom an ion? Explain your answer.

5. An atom of sodium-23 (atomic number = 11) has a positive charge of +1. Given this information, how many electrons does it have? How many protons and neutrons does this atom have?

Name: ______________________________ Date: __________

14.1 Atoms and Isotopes

READ

You have learned that atoms contain three smaller particles called protons, neutrons, and electrons, and that the number of protons determines the type of atom. How can you figure out how many neutrons an atom contains, and whether it is neutral or has a charge? Once you know how many protons and neutrons are in an atom, you can also figure out its mass.

In this skill sheet, you will learn about **isotopes**, which are atoms that have the same number of protons but different numbers of neutrons.

What are isotopes?

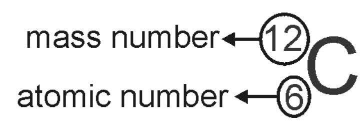
In addition to its atomic number, every atom can also be described by its mass number:

mass number = **number of protons** + **number of neutrons**

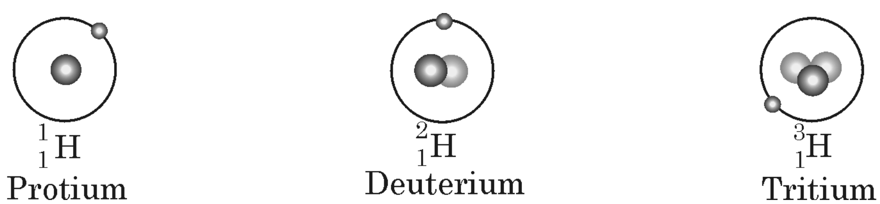
Atoms of the same element always have the same number of protons, but can have different numbers of neutrons. These different forms of the same element are called **isotopes**.

EXAMPLE

Sometimes the mass number for an element is included in its symbol. When the symbol is written in this way, we call it isotope notation. The isotope notation for carbon-12 is shown to the right. How many neutrons does an atom of carbon-12 have? To find out, simply take the mass number and subtract the atomic number: 12 – 6 = 6 neutrons.

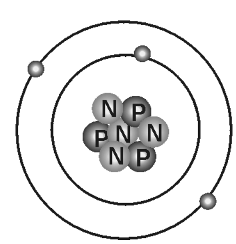


Hydrogen has three isotopes as shown below.



PRACTICE

1. How many neutrons does protium have? What about deuterium and tritium?
2. Use the diagram of an atom to answer the questions:
   a. What is the atomic number of the element?
   b. What is the name of the element?
   c. What is the mass number of the element?
   d. Write the isotope notation for this isotope.



READ

What is the atomic mass?

If you look at a periodic table, you will notice that the atomic number increases by one whole number at a time. This is because you add one proton at a time for each element. The atomic mass however, increases by amounts greater than one. This difference is due to the neutrons in the nucleus. The value of the atomic mass reflects the abundance of the stable isotopes for an element that exist in the universe.

Since silver has an atomic mass of 107.87, this means that most of the stable isotopes that exist have a mass number of 108. In other words, the most common silver isotope is "silver-108." To figure out the most common isotope for an element, round the atomic mass to the nearest whole number.

PRACTICE

1. Look up bromine on the periodic table. What is the most common isotope of bromine?
2. Look up potassium. How many neutrons does the most common isotope of potassium have?
3. Look up lithium. What is its most common isotope?
4. How many neutrons does the most common isotope of neon have?

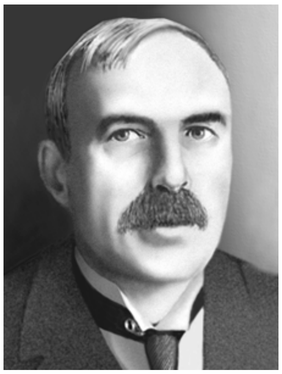
Name: ________________________________ Date: __________

BIOGRAPHY 14.1

14.1 Ernest Rutherford

Ernest Rutherford initiated a new and radical view of the atom. He explained the mysterious phenomenon of radiation as the spontaneous disintegration of atoms. He was the first to describe the atom's internal structure and performed the first successful nuclear reaction.

Ambitious immigrants



Ernest Rutherford was born in rural New Zealand on August 31, 1871. His father was a Scottish immigrant, his mother English. Both valued education and instilled a strong work ethic in their 12 children. Ernest enjoyed the family farm, but was encouraged by his parents and teachers to pursue scholarships. He first received a scholarship to a secondary school, Nelson College. Then, in 1890, after twice taking the qualifying exam, he received a scholarship to Canterbury College of the University of New Zealand.

Investigating radioactivity

After earning three degrees in his homeland, Rutherford traveled to Cambridge, England, to pursue graduate research under the guidance of the man who discovered the electron, J. J. Thomson. Through his research with Thomson, Rutherford became interested in studying radioactivity. In 1898 he described two kinds of particles emitted from radioactive atoms, calling them *alpha* and *beta* particles. He also coined the term *half-life* to describe the amount of time taken for radioactivity to decrease to half its original level.

An observer of transformations

Rutherford accepted a professorship at McGill University in Montreal, Canada, in 1898. It was there that he proved that atoms of a radioactive element could spontaneously decay into another element by expelling a piece of the atom. This was surprising to the scientific community—the idea that atoms could change into other atoms had been scorned as alchemy.

In 1908 Rutherford received the Nobel Prize in chemistry for "his investigations into the disintegration of the elements and the chemistry of radioactive substances." He considered himself a physicist and joked that, "of all the transformations I have seen in my lifetime, the fastest was my own transformation from physicist to chemist."

Exploring atomic space

Rutherford had returned to England in 1907, to Manchester University. There, he and two students bombarded gold foil with alpha particles. Most of the particles passed through the foil, but a few bounced back. They reasoned these particles must have hit denser areas of foil.

Rutherford hypothesized that the atom must be mostly empty space, through which the alpha particles passed, with a tiny dense core he called the nucleus, which some of the particles hit and bounced off. From this experiment he developed a new "planetary model" of the atom. The inside of the atom, Rutherford suggested, contained electrons orbiting a small nucleus the way the planets of our solar system orbit the sun.

'Playing with marbles'

In 1917, Rutherford made another discovery. He bombarded nitrogen gas with alpha particles and found that occasionally an oxygen atom was produced. He concluded that the alpha particles must have knocked a positively charged particle (which he named the *proton*) from the nucleus. He called this "playing with marbles" but word quickly spread that he had become the first person to split an atom. Rutherford, who was knighted in 1914 (and later elevated to the peerage, in 1931) returned to Cambridge in 1919 to head the Cavendish Laboratory where he had begun his research in radioactivity. He remained there until his death at 66 in 1937.

Reading reflection

1. What are alpha and beta particles? Use your textbook to find the definitions of these terms. Make a diagram of each particle; include labels in your diagram.
2. The term “alchemy” refers to early pseudoscientific attempts to transform common elements into more valuable elements (such as lead into gold). For one kind of atom to become another kind of atom, which particles of the atom need to be expelled or gained?
3. Make a diagram of the “planetary model” of the atom. Include the nucleus and electrons in your diagram.
4. Compare and contrast Rutherford’s “planetary model” of the atom with our current understanding of an atom’s internal structure.
5. Why did Rutherford say that bombarding atoms with particles was like “playing with marbles”? What subatomic particle did Rutherford discover during this phase of his work?
6. Choose one of Rutherford’s discoveries and explain why it intrigues you.

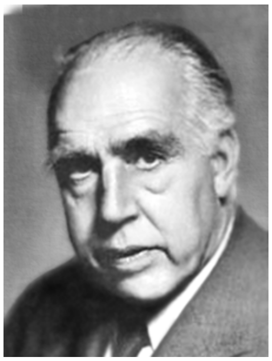
Name: ________________________ Date: __________

BIOGRAPHY 14.2

14.2 Niels Bohr

Danish physicist Niels Bohr first proposed the idea that electrons exist in specific orbits around the atom's nucleus. He showed that when an electron falls from a higher orbital to a lower one, it releases energy in the form of visible light.

At home among ideas



Niels Bohr was born October 7, 1885, in Copenhagen, Denmark. His father was a physiology professor at the University of Copenhagen, his mother the daughter of a prominent Jewish politician and businessman. His parents often invited professors to the house for dinners and discussions.

Niels and his sister and brother were invited to join this friendly exchange of ideas. (Niels and his brother also shared a passion for soccer, which they both played, and for which Harald, later a world-famous mathematician, was to win an Olympic silver medal.)

Bohr entered the University of Copenhagen in 1903 to study physics. Because the university had no physics laboratory, Bohr conducted experiments in his father's physiology lab. He graduated with a doctorate in 1911.

Meeting of great minds

In 1912, Bohr went to Manchester, England, to study under Ernest Rutherford, who became a lifelong friend. Rutherford had recently published his new planetary model of the atom, which explained that an atom contains a tiny dense core surrounded by orbiting electrons.

Bohr began researching the orbiting electrons, hoping to describe their behavior in greater detail.

Electrons and the atom's chemistry

Bohr studied the quantum ideas of Max Planck and Albert Einstein as he attempted to describe the electrons' orbits. In 1913 he published his results. He proposed that electrons traveled only in specific orbits. The orbits were like rungs on a ladder— electrons could move up and down orbits, but did not exist in between the orbital paths.

He explained that outer orbits could hold more electrons than inner orbits, and that many chemical properties of the atom were determined by the number of electrons in the outer orbit.

Bohr also described how atoms emit light. He explained that an electron needs to absorb energy to jump from an inner orbit to an outer one. When the electron falls back to the inner orbit, it releases that energy in the form of visible light.

An institute, then a Nobel Prize

In 1916, Bohr accepted a position as professor of physics at the University of Copenhagen. The University created the Institute of Theoretical Physics that Bohr directed for the rest of his life. In 1922, he was awarded the Nobel Prize in physics for his work in atomic structure and radiation.

In 1940, World War II spread across Europe and Germany occupied Denmark. Though he had been baptized a Christian, Bohr's family history and his own anti-Nazi sentiments made life difficult.

In 1943, he escaped in a fishing boat to Sweden, where he convinced the king to offer sanctuary to all Jewish refugees from Denmark. The British offered him a position in England to work with researchers on the atomic bomb. A few months later, the team went to Los Alamos, New Mexico, to continue their work.

A warrior for peace

Although Bohr believed the creation of the atomic bomb was necessary in the face of the Nazi threat, he was deeply concerned about its future implications.

Bohr promoted disarmament efforts through the United Nations and won the first U.S. Atoms for Peace Award in 1957, the same year his son Aage. shared the Nobel Prize in physics. He died in 1962 in Copenhagen.

Reading reflection

1. How did Niels Bohr's model of the atom compare with Ernest Rutherford's?
2. Name two specific contributions Bohr made to our understanding of atomic structure.
3. Make a drawing of Bohr's model of the atom.
4. In your own words describe how atoms emit light.
5. Why do you think Bohr was concerned with the future implications of his work on atomic bombs?

Name: ______________________________ Date: __________

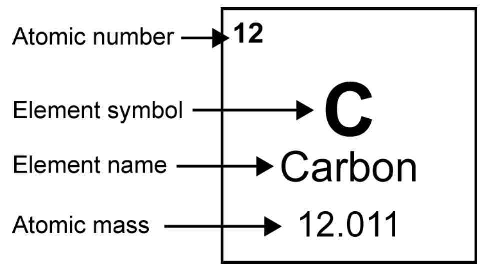
15.1 The Periodic Table

Many science laboratories have a copy of the periodic table of the elements on display. This important chart holds an amazing amount of information. In this skill sheet, you will use a periodic table to identify information about specific elements, make calculations, and make predictions

READ

Periodic table primer

To work through this skill sheet, you will use the periodic table of the elements. The periodic table shows five basic pieces of information. Four are labeled on the graphic at right; the fifth piece of information is the location of the element in the table itself. The location shows the element group, chemical behavior, approximate atomic mass and size, and other characteristic properties.



PRACTICE

Review: Atomic number, Symbol, and Atomic Mass

Use the periodic table to find the answers to the following questions. As you become more familiar with the layout of the periodic table, you'll be able to find this information quickly.

Atomic Number: Write the name of the element that corresponds to each of the following atomic numbers.

1. 9	2. 18	3. 25	4. 15	5. 43

6. What does the atomic number tell you about an element?

Symbol and atomic mass: For each of the following, write the element name that corresponds to the symbol. In addition, write the atomic mass for each element.

7. Fe	8. Cs	9. Si	10. Na	11. Bi

12. What does the atomic mass tell you about an element?

13. Why isn't the atomic mass always a whole number?

14. Why don't we include the mass of an atom's electrons in the atomic mass?

PRACTICE

Periodic Table Groups

The periodic table's vertical columns are called groups. Groups of elements have similar properties. Use the periodic table and the information found in Chapter 15 of your text to answer the following questions:

15. The first group of the periodic table is known by what name?

16. Name two characteristics of the elements in the first group.

17. Name three members of the halogen group.

18. Describe two characteristics of halogens.

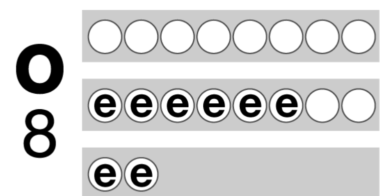
19. Where are the noble gases found on the periodic table?

20. Why are the noble gases sometimes called the *inert gases*?

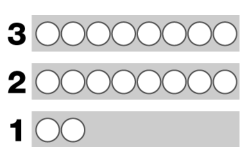
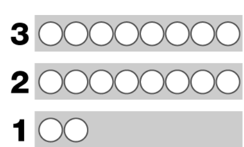
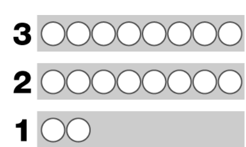
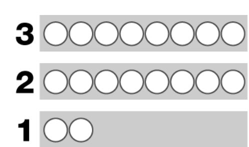
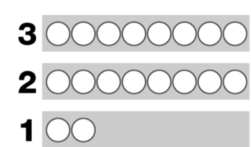
PRACTICE

Periodic Table Rows

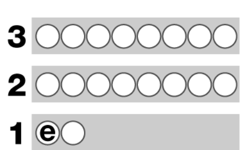
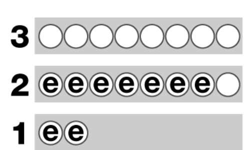
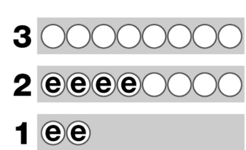
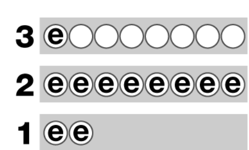
The rows of the periodic table correspond to the energy levels in the atom. The first energy level can accept up to two electrons. The second and third energy levels can accept up to eight electrons each. The example to the right shows how the electrons of an oxygen atom fill the energy level.



Show how the electrons are arranged in energy levels in the following atoms:.

21. He	22. N	23. Ne	24. Al	25. Ar
				

Identify each of the following elements:.

26.	27.	28.	29.	30.
				

Name: ______________________ Date: __________

CONTENT 16.1

16.1 Dot Diagrams

READ

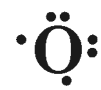
You have learned that atoms are composed of protons, neutrons, and electrons. The electrons occupy energy levels that surround the nucleus in the form of an "electron cloud." The electrons that are involved in forming chemical bonds are called **valence electrons**. Atoms can have up to eight valence electrons. These electrons exist in the outermost region of the electron cloud, often called the "valence shell."

The most stable atoms have eight valence electrons. When an atom has eight valence electrons, it is said to have a complete *octet*. Atoms will gain or lose electrons in order to complete their octet. In the process of gaining or losing electrons, atoms will form chemical bonds with other atoms. One method we use to show an atom's valence state is called a *dot diagram,* and you will be able to practice drawing these in the following exercise.

What is a dot diagram?

Dot diagrams are composed of two parts—the chemical symbol for the element and the dots surrounding the chemical symbol. Each dot represents one valence electron.

- If an element, such as oxygen (O), has six valence electrons, then six dots will surround the chemical symbol as shown to the right.



- Boron (B) has three valence electrons, so three dots surround the chemical symbol for boron as shown to the right.

There can be up to eight dots around a symbol, depending on the number of valence electrons the atom has. The first four dots are single, and then as more dots are added, they fill in as pairs.

PRACTICE

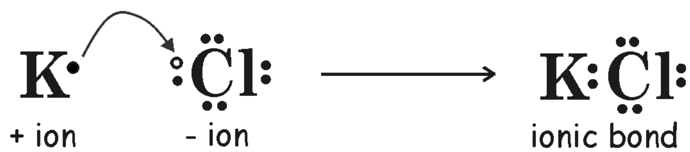
Using a periodic table, complete the following chart. With this information, draw a dot diagram for each element in the chart. Remember, only the valence electrons are represented in the diagram, not the total number of electrons.

Element	Chemical symbol	Total number of electrons	Number of valence electrons	Dot diagram
Potassium	K			
Nitrogen	N			
Carbon	C			
Beryllium	Be			
Neon	Ne			
Sulfur	S			

READ

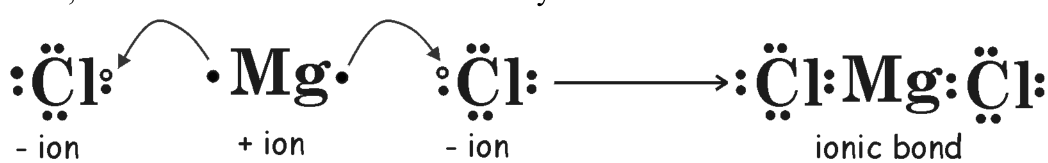
Using dot diagrams to represent chemical reactivity

Once you have a dot diagram for an element, you can predict how an atom will achieve a full valence shell. For instance, it is easy to see that chlorine has one empty space in its valence shell. It is likely that chlorine will try to gain one electron to fill this empty space rather than lose the remaining seven. However, potassium has a single dot or electron in its dot diagram. This diagram shows how much easier it is to lose this lone electron than to find seven to fill the seven empty spaces. When the potassium loses its electron, it becomes *positively* charged. When chlorine gains the electron, it becomes *negatively* charged. Opposite charges attract, and this attraction draws the atoms together to form what is termed an **ionic bond**, a bond between two charged atoms or ions.



Because chlorine needs one electron, and potassium needs to lose one electron, these two elements can achieve a complete set of eight valence electrons by forming a chemical bond. We can use dot diagrams to represent the chemical bond between chlorine and potassium as shown above.

For magnesium and chlorine, however, the situation is a bit different. By examining the electron or Lewis dot diagrams for these atoms, we see why magnesium requires two atoms of chlorine to produce the compound, magnesium chloride, when these two elements chemically combine.



Magnesium can easily donate one of its valence electrons to the chlorine to fill chlorine's valence shell, but this still leaves magnesium unstable; it still has one lone electron in its valence shell. However, if it donates that electron to another chlorine atom, the second chlorine atom has a full shell, and now so does the magnesium.

The chemical formula for potassium chloride is KCl. This means that one unit of the compound is made of one potassium atom and one chlorine atom.

The formula for magnesium chloride is $MgCl_2$. This means that one unit of the compound is made of one magnesium atom and two chlorine atoms.

PRACTICE

Now try using dot diagrams to predict chemical formulas. Fill in the table below:

Elements	Dot diagram for each element	Dot diagram for compound formed	Chemical formula
Na and F			
Br and Br			
Mg and O			

Name: ______________________________ Date: __________

16.2 Finding the Least Common Multiple

READ

Knowing how to find the least common multiple of two or more numbers is helpful in physical science classes. You need to find the least common multiple in order to add fractions with different denominators, or to predict the chemical formula of many common compounds.

EXAMPLE

The least common multiple is the smallest multiple of two or more whole numbers. To find the least common multiple of 3 and 4, simply list the multiples of each number:

multiples of 3: 3, 6, 9, 12, 15...
multiples of 4: 4, 8, 12, 16, 20...

Then, look for the smallest multiple that occurs in both lists. In this case, the least common multiple is 12.

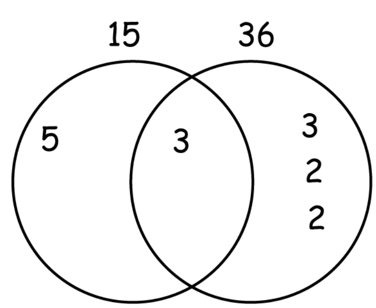
EXAMPLE

Sometimes it's a little trickier to find the least common multiple. Suppose you are asked to find the least common multiple of 15 and 36. Rather than making a long list of multiples, you can use the prime factorization method.

First, factor each number into primes (remember that prime numbers are numbers that can't be divided evenly by any whole number except one).

Prime factorization of 15: 3×5
Prime factorization of 36: $3 \times 3 \times 2 \times 2$

Next, create a Venn diagram. Show the factors unique to each number in the separate parts of the circles and the factors common to both in the overlapping circles. Since 15 and 36 each have one 3, put one 3 in the middle.



Finally, multiply all the factors in your diagram from left to right:

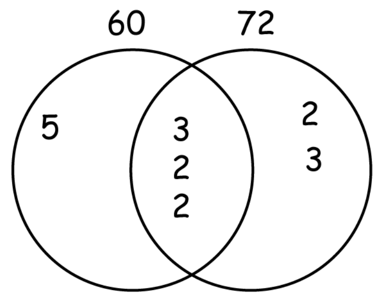
$5 \times 3 \times 3 \times 2 \times 2 = 180$. The least common multiple of 15 and 36 is 180.

MATH 16.2

EXAMPLE

Important note: If the two numbers each have more than one copy of a certain prime factor, place the factor in the overlapping circles as many times as necessary. To find the least common multiple of 60 and 72:

Prime factorization of 60: $2 \times 2 \times 3 \times 5$
Prime factorization of 72: $2 \times 2 \times 3 \times 2 \times 3$



Notice that 2 appears twice in the overlapping circles because 60 and 72 have two 2's apiece.

$5 \times 3 \times 2 \times 2 \times 2 \times 3 = 360$. The least common multiple of 60 and 72 is 360.

PRACTICE

Find the least common multiple of each of the following pairs of numbers:

1. 3 and 7
2. 6 and 8
3. 9 and 15
4. 10 and 25
5. 16 and 40
6. 21 and 49
7. 36 and 54
8. 45 and 63
9. 55 and 80
10. 64 and 96

Name: ______________________ Date: __________

16.2 Chemical Formulas

READ

Compounds have unique names that we use to identify them when we study chemical properties and changes. Chemists have devised a shorthand way of representing chemical names that provides important information about the substance. This shorthand representation for a compound's name is called a chemical formula. You will practice writing chemical formulas in the following activity.

What is a chemical formula?

Chemical formulas have two important parts: chemical symbols for the elements in the compound and subscripts that tell how many atoms of each element are needed to form the compound. The chemical formula for water, H_2O, tells us that a water molecule is made of the elements hydrogen (H) and oxygen (O) and that it takes two atoms of hydrogen and one atom of oxygen to build the molecule. For sodium nitrate, $NaNO_3$, the chemical formula tells us there are three elements in the compound: sodium (Na), nitrogen (N), and oxygen (O). To make a molecule of this compound, you need one atom of sodium, one atom of nitrogen, and three atoms of oxygen.

EXAMPLES

How to write chemical formulas

How do chemists know how many atoms of each element are needed to build a molecule? For ionic compounds, oxidation numbers are the key. An element's oxidation number is the number of electrons it will gain or lose in a chemical reaction. We can use the periodic table to find the oxidation number for an element. When we add up the oxidation numbers of the elements in an ionic compound, the sum must be zero. Therefore, we need to find a balance of negative and positive ions in the compound for the molecule to form.

Example 1:

A compound is formed by the reaction between magnesium and chlorine. What is the chemical formula for this compound?

From the periodic table, we find that the oxidation number of magnesium is 2+. Magnesium loses 2 electrons in chemical reactions. The oxidation number for chlorine is 1-. Chlorine tends to gain one electron in a chemical reaction.

Remember that the sum of the oxidation numbers of the elements in a molecule will equal zero. This compound requires one atom of magnesium with an oxidation number of 2+ to combine with two atoms of chlorine, each with an oxidation number of 1–, for the sum of the oxidation numbers to be zero.

$$(2+) + 2(1-) = 0$$

To write the chemical formula for this compound, first write the chemical symbol for the positive ion (Mg) and then the chemical symbol for the negative ion (Cl). Next, use subscripts to show how many atoms of each element are required to form the molecule. When one atom of an element is required, no subscript is used. Therefore, the correct chemical formula for magnesium chloride is $MgCl_2$.

Example 2:

Aluminum and bromine combine to form a compound. What is the chemical formula for the compound they form?

From the periodic table, we find that the oxidation number for aluminum (Al) is 3+. The oxidation number for bromine (Br) is 1–. In order for the oxidation numbers of this compound to add up to zero, one atom of aluminum must combine with three atoms of bromine:

$$(3+) + 3(1-) = 0$$

The correct chemical formula for this compound, aluminum bromide, is $AlBr_3$.

PRACTICE

Practice writing chemical formulas for ionic compounds

Use the periodic table to find the oxidation numbers of each element. Then write the correct chemical formula for the compound formed by the following elements:

Element	Oxidation Number	Element	Oxidation Number	Chemical Formula for Compound
Potassium (K)		Chlorine (Cl)		
Calcium (Ca)		Chlorine (Cl)		
Sodium (Na)		Oxygen (O)		
Boron (B)		Phosphorus (P)		
Lithium (Li)		Sulfur (S)		
Aluminum (Al)		Oxygen (O)		
Beryllium (Be)		Iodine (I)		
Calcium (Ca)		Nitrogen (N)		
Sodium (Na)		Bromine (Br)		

Name: ______________________________ Date: __________

CONTENT 16.2

16.2 Naming Compounds

READ

Compounds have unique names that identify them for us when we study chemical properties and changes. Predicting the name of a compound is fairly easy provided certain rules are kept in mind. In this skill sheet, you will practice naming a variety of chemical compounds.

Chemical Formulas and Compound Names

Chemical formulas tell a great deal of information about a compound—the types of elements forming the compound, the numbers of atoms of each element in one molecule, and even some indication, perhaps, of the arrangement of the atoms when they form the molecule.

In addition to having a unique chemical formula, each compound has a unique name. These names provide scientists with valuable information. Just like chemical formulas, chemical names tell which elements form the compound. However, the names may also identify a "family" or group to which the compound belongs. It is useful for scientists, therefore, to recognize and understand both a compound's formula and its name.

Naming Ionic Compounds

Naming ionic compounds is relatively simple, especially if the compound is formed only from monoatomic ions. Follow these steps:

1. Write the name of the first element or the positive ion of the compound.
2. Write the root of the second element or negative ion of the compound.
3. For example, write *fluor*- to represent fluorine, *chlor*- to represent chlorine.
4. Replace the ending of the negative ion's name with the suffix -*ide*.
5. Fluorine → Fluoride; Chlorine → Chloride

EXAMPLES

A compound containing potassium (K^{1+}) and iodine (I^{1-}) would be named potassium iodide.

Lithium (Li^{1+}) combined with sulfur (S^{2-}) would be named lithium sulfide.

Naming Compounds with Polyatomic Ions

Naming compounds that contain polyatomic ions is even easier. Just follow these two steps:

1. Write the name of the positive ion first. Use the periodic table or an ion chart to find the name.
2. Write the name of the negative ion second. Again, use the periodic table or an ion chart to find the name.

EXAMPLES

A compound containing aluminum (Al^{1+}) and sulfate (SO_4^{2-}) would be called aluminum sulfate.

A compound containing magnesium (Mg^{2+}) and carbonate (CO_3^{2-}) would be called magnesium carbonate.

CONTENT 16.2

PRACTICE

Predict the name of the compound formed from the reaction between the following elements and/or polyatomic ions. Use the periodic table and the polyatomic ion chart in section 16.2 of your student text to help you name the ions.

Combination	Compound Name
Al + Br	
Be + O	
K + N	
Ba + CrO_4^{2-}	
Cs + F	
NH_3^{1+} + S	
Mg + Cl	
B + I	
Na + SO_4^{2-}	
Si + $C_2H_3O_2^{1-}$	

Name: ______________________________ Date: __________

CHALLENGE! 16.2

16.2 Families of Compounds

READ

Certain compounds have common characteristics, so we place them into groups or families. The group called "enzymes" contains thousands of representative chemicals, but all share certain critical features that allow them to be placed into this group.

The name of a compound often identifies the family of chemical to which it belongs. The clue is usually found in the suffix for the compound's name. The table below lists suffixes for some common chemical families.

Chemical Family	Suffix
Sugars	*-ose*
Alcohols	*-ol*
Enzymes	*-ase*
Ketones	*-one*
Organic acids	*-oic* or *-ic* acid
Alkanes	*-ane*

Glucose, the compound used by your brain as its primary fuel, is a sugar. The suffix *-ose* indicates its membership in the sugar family. Propane, the compound used to operate your gas barbecue grill, is an alkane, a compound formed from carbon and hydrogen atoms that are covalently bonded with single pairs of electrons. We know this from the suffix *-ane*.

Knowing such information about a compound can be very useful when you are reading the labels of consumer products. Compound names can be found in the ingredients list on the label. If you are purchasing a hand lotion to alleviate dry skin, you should avoid one that lists a compound with an *-ol* suffix early in the ingredients list.

The ingredients are listed from largest amount to smallest amount. The earlier a compound is listed, the greater the amount of that compound in the product. A compound with an *-ol* suffix is an alcohol. Hand lotions with high percentages of alcohols are less effective since alcohols tend to dry out rather than moisturize the skin!

In later chemistry courses, you will learn more about the names and characteristics of "families" of compounds. This knowledge will provide you with a powerful tool for making informed consumer decisions.

CHALLENGE! 16.2

PRACTICE

Using the information in the table on the previous page to predict the chemical family to which the following compounds are members:

Compound Name	Chemical Family
Lipase	
Methanol	
Formic Acid	
Butane	
Sucrose	
Acetone	
Acetic Acid	