

Compounds and Chemical Bonding

Reading

Directions: 1. Read the information on the left. 2. Use the red circles on the left to identify key words. 3. Answer the questions by putting answers and key details onto the right. 4. Write a one sentence synthesis statement that explains the big idea of the text.

Diagram 2 Giving one valence electron will cause it to have more electrons than protons giving it a 1- charge. The outer energy level is now full.

Forming Negative Ions
Most nonmetals that create compounds have five to seven valence electrons. It is easier for them to gain a few more electrons than to lose a whole bunch of them. When they gain the electrons the atom will have more electrons than protons. There are more negative charges in the atom than positive charges so they become negative ions. The fluorine atom in Diagram 2 has seven valence electrons. When it gains a valence electron to complete its outer energy level it will have one more electron than protons so it becomes an ion with a 1- charge. Sulfur on the other hand has six valence electrons. When it gains two valence electrons to fill its energy level it will have two more electrons than protons so it becomes an ion with a 2- charge.

Diagram 3 Positives are attracted to negatives and join in a repeating pattern.

Forming Ionic Bonds
When metals lose their electrons, where do they go? In ionic compounds, compounds formed between metals and nonmetals, the electrons from the metals are transferred over to the nonmetals. The number of atoms needed of each element is determined by how many valence electrons each element can give and take. In Diagram 3, lithium gives up one and fluorine takes up one so you

TOPIC Ionic Compounds

GUIDING QUESTION What are ionic compounds and how are they created?

QUESTION	KEY DETAILS
How are negative ions formed?	Add text

SYNTHESIS SENTENCE (BIG IDEA OF THE TEXT IN ONE SENTENCE)
Add text



comprehension passages
3 Guided Note templates
worksheets

Ionic Compounds

Periodic Table of Elements

13 14 15 16 17 18

1	Li	Be							B	C	N	O	F	Ne				
2	Na	Mg							Al	Si	P	S	Cl	Ar				
3	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
4	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
5	Cs	Ba		Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	

Identify:

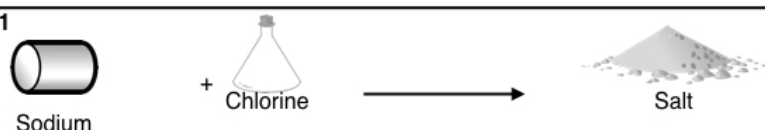
	Element	Valence Electrons	Ion Charge
4	Mg- Magnesium		
5	O- Oxygen		



Chemical Bonding

Big Idea Question: How do atoms form bonds?

Diagram 1



Sodium is a highly reactive metal that when placed in water it catches on fire. Chlorine is a highly poisonous green gas that can kill you if you inhale it. When these two elements are mixed together they create a compound that is so safe we eat it in most of the food we consume (diagram 1). Together they make sodium chloride, otherwise known as table salt. How is this possible? How are two extremely dangerous elements able to make something we can eat?

Creating Chemical Bonds

When elements come together a reaction occurs and they become one. When this happens they form new substances and their properties change. These new substances are called compounds and are formed when atoms join together through chemical bonds. The bonds occur when the electrons of the atoms are transferred, gained, or shared.

Electrons and Bonding

In a neutral atom the number of electrons is the same as the number of protons. These electrons are organized into different energy levels. The first energy level can hold two electrons and is the first to be filled. The other energy levels can hold up to eight electrons and need to be filled before you move onto the next energy level (diagram 2). In other words, you can't add an electron to the third energy level until the second energy level has eight electrons.

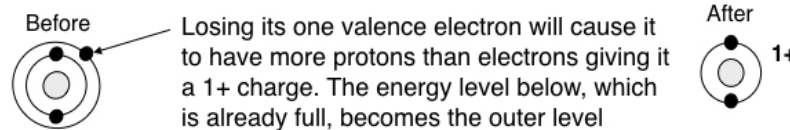
Not all of the electrons in an atom are used in bonding. Only the electrons in the last energy level, the valence electrons as they are called, are used. You can determine the number of valence electrons by looking at the periodic table. With the exception of groups 3-12, you can use the group number to determine the number of valence electrons. Group 1 and 2 have the same number of valence electrons as their group number. For example, group 1 has 1 valence electron. Groups 13-17 have one more valence electron than their group number. For example, group 13 has 3 and group 17 has 7 valence electrons. Group 18 has a complete set so they mostly have 8 except for helium which only has 2 valence electrons.

Ionic Compounds

Big Idea Question: What are ionic compounds and how are they created?

The goal of atoms is to complete their outer energy levels. This can be accomplished by gaining, losing, or sharing their valence electrons. The number of valence electrons an atom has is used to determine if the atom will gain more, lose the ones they have, or share them.

Diagram 1



Forming Positive Ions

Most metals have three or less valence electrons. It is easier for them to lose the few electrons they have than to gain a whole bunch of them. When they lose the electrons the atom will have more protons than electrons. There are more positive charges in the atom than negative charges so they become positive ions. The lithium atom in Diagram 1 has one valence electron. When it loses the valence electron it has one more proton than electrons so it becomes an ion with a 1+ charge. Fluorine on the other hand has two valence electrons. When it loses its two valence electrons it has two more protons than electrons so it becomes an ion with a 2+ charge.

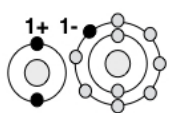
Diagram 2



Ionic Compounds

Big Idea Question: What are ionic compounds and how are they created?

Diagram 3



Positives are attracted to negatives and form a repeating crystal lattice structure.

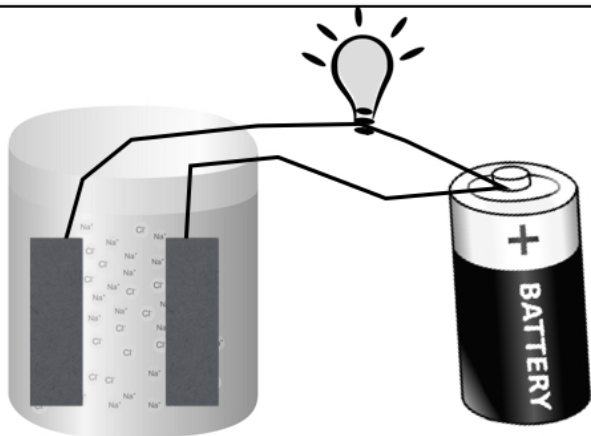
Forming Ionic bonds

When metals lose electrons and nonmetals gain electrons, ionic compounds form. The number of electrons transferred over to the nonmetal is determined by how many valence electrons the metal has. For example, lithium gives up one electron. However, if you were to mix lithium with fluorine, you could accomplish this. This is because fluorine needs one more electron to complete its outer shell. When this occurs it creates positive and negative ions that are attracted to each other.

Properties of Ionic Compounds

These ionic bonds give ionic compounds certain properties. Due to the strong attraction of the ions, ionic compounds have high melting and boiling points. It also gives them a crystal structure since only opposite ions are attracted to each other so they form a repeating pattern of positive and negative as seen in diagram 3. They are also brittle and can dissolve easily in water. A fun fact is that when they are in a solution they can conduct electric current as shown in diagram 4.

Diagram 4



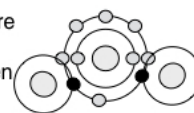
Short passages with Guided Notes

Covalent bonds

The type of compound an atom will form is dependent upon the number of valence electrons it has. Metals generally have fewer than four valence electrons so they will lose their electrons and become ions. When they become ions they have a high tendency to become ionic compounds. Nonmetals generally have more than four valence electrons. If they gain electrons from metals they become ions and will join with the metals to become ionic compounds. However, that is not the only choice they have as shown in diagram 1. Nonmetals can also share their electrons with other nonmetals. When they share their electrons they form covalent bonds and create covalent compounds.

Diagram 1

Hydrogen only needs one more electron to fill its shell. It will share one electron with oxygen which will share one back in return.



Oxygen needs two electrons to fill its shell so it will require two hydrogen atoms to accomplish this.

Sharing Electrons

When atoms share electrons they need to follow some rules. The first rule is that the number of electrons one atom shares with another atom has to be the same. For example, if an atom of hydrogen shares one electron with oxygen, oxygen can only share one electron back as shown in diagram 2. The second rule is that you can only share as many electrons that you need to complete your outer energy level. For example, hydrogen only needs one more electron to fill its outer energy level. This means that although oxygen needs two electrons hydrogen can only share one. This is why you need two hydrogen atoms when you mix them with oxygen. Overall oxygen will have shared two electrons, one with each hydrogen, and each hydrogen will only share one electron.

Covalent Properties

When atoms share their electrons a weak bond forms between them. This weak bond gives them certain properties. Due to the weak bond they have low melting and boiling points. Some covalent bonds, like sugar, are soluble in water and dissolve while others, like oil, are not soluble in water. The covalent compounds that do dissolve in water are not able to conduct electricity like ionic compounds can.

Directions: Follow the directions on each slide to complete this guided reading activity notebook

COMPOUNDS

Directions: 1. Read the information on the left. 2. Use the red circles on the left to identify key words. 3. Answer the questions by putting answers and key details onto the left. 4. Write a one sentence synthesis statement that explains the big idea of the text.

Figure 1

Sodium + Chlorine → Salt

Sodium is a highly reactive metal that when placed in water it catches on fire. Chlorine is a highly poisonous gas that can kill you if you inhale it. When these two elements are mixed together they create a compound that is as safe as water and one of the foods we consume (sodium Cl). Together they make sodium chloride, otherwise known as table salt. How is this possible? How are two extremely dangerous elements able to make something we can eat?

Creating Chemical Bonds

When elements come together a reaction occurs and they release energy. When this happens they form new substances and their properties change. These new substances are called compounds and are formed when atoms join together through chemical bonds. The bonds occur when the electrons of the atoms are transferred, gained, or shared.

Electrons and Bonding

In a neutral atom the number of electrons is the same as the number of protons. These electrons are organized into different energy levels. The first energy level can only hold two electrons and the first is filled. The first energy level can hold up to eight electrons and need to be filled before you move into the next level (energy level 2). In other words, you can't start until the electrons in the first energy level until the second energy level has eight electrons.

IONIC
chemical
bonding

GUIDING QUESTION
How do atoms form bonds?

QUESTION

KEY DETAILS

Add text

What is a chemical bond?

SYNTHESIS SENTENCE: BIG IDEA OF THE TEXT IN ONE SENTENCE

Add text

Directions: 1. Read the information on the left. 2. Use the red circles on the left to identify key words. 3. Answer the questions by putting answers and key details on the left. 4. Write a one-sentence synthesis statement that explains the big idea of the text.

Not all of the electrons in an atom are used to bonding. Only the electrons found in the last energy level, the valence electrons, are used, are used. You can determine the number of valence electrons by looking at the periodic table. With the exception of groups 8-10, you can use the group number to determine the number of valence electrons. Group 1 and 2 have the same number of valence electrons as their group number. For example, group 1 has 1 valence electron. Groups 13-17 have 10 less valence electrons than their group number. For example, group 13 has 3 and group 17 has 7 valence electrons. Group 18 has a complete set as they already have 8 except for helium which only has 2 valence electrons.

Question
How do atoms form bonds?

Key Details
Add text

Synthesis Sentence: (BIG IDEA OF THE TEXT IN ONE SENTENCE)
Add text

Question
Do all elements form bonds?

Key Details
Add text

Synthesis Sentence: (BIG IDEA OF THE TEXT IN ONE SENTENCE)
Add text

Directions: 1. Answer the questions on the left. 2. Use the periodic table to answer the questions below.

What is a chemical bond?

What are valence electrons?

What is the goal of the outer rule? Is it about a complete outer energy level? This rule is discovered by either rising or falling a column or period. To check for the electrons, go right or left and count the grid below the same energy level.

Is it OK that two valence electrons would be right next to each other? Is it OK that two valence electrons would be right next to each other? Is it OK that two valence electrons would be right next to each other?

How many valence electrons does Magnesium (Mg) have?

How many valence electrons does Sulfur (S) have?

How many valence electrons does Neon (Ne) have?

Which elements do not form bonds?

The Periodic Table of Elements

1

2

3

4

Directions: 1. Read the information on the left. 2. Use the red circles on the left to identify key words. 3. Answer the questions by putting answers and key details into the left. 4. Write a sentence/thesis statement that explains the big idea of the text.

The goal of atoms is to complete their outer energy levels. This can be accomplished by gaining, losing, or sharing their valence electrons. The number of valence electrons an atom has is used to determine if the number of valence electrons is the same (it is stable) or if it is different (it is unstable).

Diagram 1:

Looking to fill valence electron shell
can't do it because more protons than
electrons giving it a + charge.
The energy level below, which is empty, still
becomes the outer shell.

Learning Objective:

Most metals have three or less valence electrons. It is easier for them to lose the few electrons they have than to gain a whole bunch of them. When they lose the electrons the atom will have become positive (few electrons). There are more positive electrons in the atom than negative charges so they become positive ions. The periodic table shows 1-2 valence electrons. When it loses the valence electron it has, one more proton than and becomes a +1 ion because an ion with a +1 charge. Cations on the other hand have valence electrons. When it loses the valence electrons it has, two more protons than electrons and it becomes an ion with a +2 charge.

TOPIC	GUIDING QUESTION	What are ionic compounds and how are they created?
QUESTION	KEY DETAILS	<p>Add text</p> <p>How are positive ions formed?</p>
<p>SYNTHESIS SENTENCE: BIG IDEA OF THE TEXT IN ONE SENTENCE</p> <p>Add text</p>		

Directions: 1. Read the information on the left. 2. Use the red circles on the left to identify key words. 3. Answer the questions by putting answers you find inside your red circle. 4. Write a simple synthesis statement that explains the key ideas of the text.

Diagram 1

Forming Negative Ions
 When compounds that make compounds have to gain or lose electrons then it has to lose a whole bunch of them. When they gain the electrons the atom will have more electrons than protons. When there are more negative charges in the atom then the positive charges so they become negative ions. The further down Diagram 1 that you see the elements. When I gain a valence electron it's complete to extra energy level it will have one more electron than protons so it becomes an ion with a 1- charge. Salt is on the other hand but it's valence electrons. When I gain two extra electrons to fill it's energy level it will have two more electrons than protons so it becomes an ion with a 2- charge.

Diagram 2

Forming Ionic bonds
 When metals lose their electrons, where do they go? In ionic compounds, compounds form when metals and nonmetals, the electrons from the metals are transferred over to the nonmetals. The number of atoms needed of each element is determined by how many valence electrons each element can give and take. In Diagram 3, lithium gives up one and fluorine takes one to give the

TYPE Ionic Compounds

GUIDING QUESTION What are ionic compounds and how are they created?

QUESTION	KEY DETAILS
Add text	Add text
How are negative ions formed?	

SYNTHESIS SENTENCE: BIG IDEA OF THE TEXT IN ONE SENTENCE

Add text


Directions: 1. Read the information on the left. 2. Use the red circles on the left to identify key words. 3. Answer the questions by writing answers and key details on the left. 4. Write a one-sentence synthesis statement that explains the big idea of the text.

Read one at a time. However, if you were to write an answer you would need to use **three** ideas to accomplish this. You calculate each. Then you will give up or release electric and copper needs two valence electrons to fill its shell. When the transferring of electrons occurs it creates positive ions for the metals and negative ions for the nonmetals. The positive and negative ions become attracted to each other and an ionic bond is formed.

Properties of Ionic Compounds

These ionic bonds give ionic compounds certain properties. One of the strong attractions of the ionic bonds compounds have is their strong crystals. This gives them high melting and boiling points. It also gives them an opposite ionic structure since only opposite ions are attracted to each other. They alternate between positive and negative as seen in diagrams 3. They are also brittle and can dissolve easily in water. A fun fact is that when they are in a solution they can conduct electric current as well as in a solid.

Diagram 4



TOPIC	Ionic Compounds	GUIDING QUESTION	What are ionic compounds and how are they created?
QUESTION		KEY DETAILS	
	Add text		
		How are ionic bonds formed and what properties do they create?	
		SYNTHESIS SENTENCE: BIG IDEA OF THE TEXT IN ONE SENTENCE	
	Add text		

Directions:

- Answer the questions on the left.
- Use the periodic table to fill in the table on the right.
- Answer the questions at the bottom.

What is a positive ion?

Add text

What is a negative ion?

Add text

What is an ionic bond?

Add text

Use the periodic table to fill in the table on the side

The Periodic Table of Elements																	
												Element	Valence Electrons	Ion Charge			
1	2											Np	§	§			
												Oxygen	§	§			
												Potassium	§	§			
												Iodine	§	§			

If you combine sodium (Na) and chlorine (Cl) to make sodium chloride, how many atoms of each will you need? Explain.

Add text

If you combine potassium (K) and oxygen (O) to make potassium oxide, how many atoms of each will you need? Explain.

Add text

5

6

7

8

Directions: 1. Read the information on the left. 2. Use the red circles on the left to identify key words. 3. Answer the questions by putting answers and key details onto the left. 4. Write a sentence synthesis statement that explains the big idea of the text.

If you put sugar in a pot and put it on the stove the sugar will melt and turn into liquid. This is because sugar is a covalent compound and is held together by weak bonds. The way these bonds are formed give it certain properties.

QUESTION	KEY DETAILS
What are covalent compounds?	Add text
QUESTION	KEY DETAILS
What are covalent compounds created?	Add text
QUESTION	KEY DETAILS
What are covalent compounds created?	Add text


SYNTHESIS SENTENCE: BIG IDEA OF THE TEXT IN ONE SENTENCE:

Add text


Directions: 1. Read the information on the left. 2. Use the red circles on the left to identify key words. 3. Answer the questions by pulling answers and key details onto the left. 4. Write a one sentence synthesis statement that explains the big idea of the text.

Step 1

Hydrogen only needs one electron to fill its shell. It has three other electrons with which it can share.



Oxygen needs two electrons to fill its shell. It has six other electrons with which it can share.



TOPIC	CONCEPT	GUIDING QUESTION	What are compounds and how are they formed?
QUESTION	KEY DETAILS	ADD TEXT	
	What are some properties of covalent compounds		

Sharing Electrons

When atoms share electrons they need to follow some rules. The first rule is that the number of electrons one atom shares with another atom has to be the same. For example, if an atom of hydrogen shares one electron with oxygen, oxygen can only share one electron back as shown in diagram 2. The second rule is that you can't only share as many electrons that you need to complete your outer shell level. For example, hydrogen only needs one more electron to fill its outer energy level. The number of electrons oxygen needs is two electrons (hydrogen can only share one). This is why you need two hydrogen atoms to give one oxygen two electrons. Overall oxygen will have shared two electrons, one with each hydrogen, and each hydrogen will only share one electron.

Covalent Compounds

When atoms share free electrons a weak bond forms between them. The weak bond gives them their covalent properties. Over time the bond will have low solubility and boiling points. Some covalent liquids, like sugar, are solid in water and dissolve while others, like oil, are not soluble in water. The covalent compounds that do dissolve in water are not able to conduct electricity. The ionic compounds can.

SYNTHESIS SENTENCE: BIG IDEA OF THE TEXT IN ONE SENTENCE:

Add text

Directions: 1. Answer the questions on the left. 2. Use the periodic table to fill in the table below.

What is a covalent bond?

Add text

If you combine oxygen (O) and hydrogen (H) to make water, how many atoms of each will you need? Explain.

Add text

If you combine nitrogen (N) and hydrogen (H) to make ammonia, how many atoms of each will you need? Explain.

Add text

If you combine carbon (C) and oxygen (O) to make carbon dioxide, how many atoms of each will you need? Explain.

Add text

The Periodic Table of Elements

Element	Valence Electrons	How many more electrons needed to fill their shell?
D-Carbon	#	#
O-Oxygen	#	#
N-Nitrogen	#	#
I-Iodine	#	#
H-Hydrogen	#	#

Directions: Answer the questions

<p>What is the difference between zero, zeroth and countable kinds?</p> <p>Add text</p>	<p>How can you use the periodic table to determine what type of bond an element will make?</p> <p>Add text</p>
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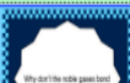
9

10

11

12

Directions: Answer the questions

 <p>Why don't metals make complex compounds?</p>	 <p>Why don't the noble gases bond with other elements?</p>
<p>Add text</p>	<p>Add text</p>



13



Digital or Print

Name: _____ Class: _____
Topic: covalent compounds Date: _____
Big Idea Question: What are covalent compounds and how are they formed?

Questions	Notes
What are the families and where are they located?	
What are some properties of the metal families of the periodic table?	
What are some properties of the nonmetal families of the periodic table?	

Summary:

Chemical Bonding


















1. What is a chemical bond? _____

2. What are valence electrons?

The Periodic Table of Elements

1 2

13 14 15 16 17 18

1	1 H HYDROGEN 	3 Li LITHIUM 	4 Be BERYLLIUM 
2	10 Ne NEON 	9 F FLUORINE 	12 Mg MAGNESIUM 
3	11 Na SODIUM 	24 Cr CHROMIUM 	
4	19 K POTASSIUM 	39 Ca CALCIUM 	38 Sr STRONTIUM 
5	37 Rb RUBIDIUM 	88 Sr STRONTIUM 	40 Y YTTRIUM 
6	55 Cs CAESIUM 	56 Ba BARIUM 	72 Hf HAFNIUM 

3. How many valence electrons

4. How many valence elect

5. How many valence elect

6. Which elements do not f

The goal of the octet rule is accomplished by either filling the shell and

7. If an atom lose two e⁻

explain

Ionic Compounds

1. What is a positive ion? _____

2. What is a negative ion? _____

3. What is an ionic bond?

The Periodic Table of Elements

1 2

13 14 15 16 17 18

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Covalent Compounds

1. What is a covalent bond? _____

The Periodic Table of Elements

1 2

13 14 15 16 17 18

trons

How many more electrons needed to fill their shell?

any atoms of each will you

a, how many atoms of each will

9. If you need 100 atoms of carbon dioxide, how many atoms of each will you need?

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How can you use the periodic table to determine the type of bond an element will form?

Why can't most metals form covalent compounds?

Extension Task Cards

What is the difference between ionic bonds and covalent bonds?

Why don't the noble gases bond with other elements?



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