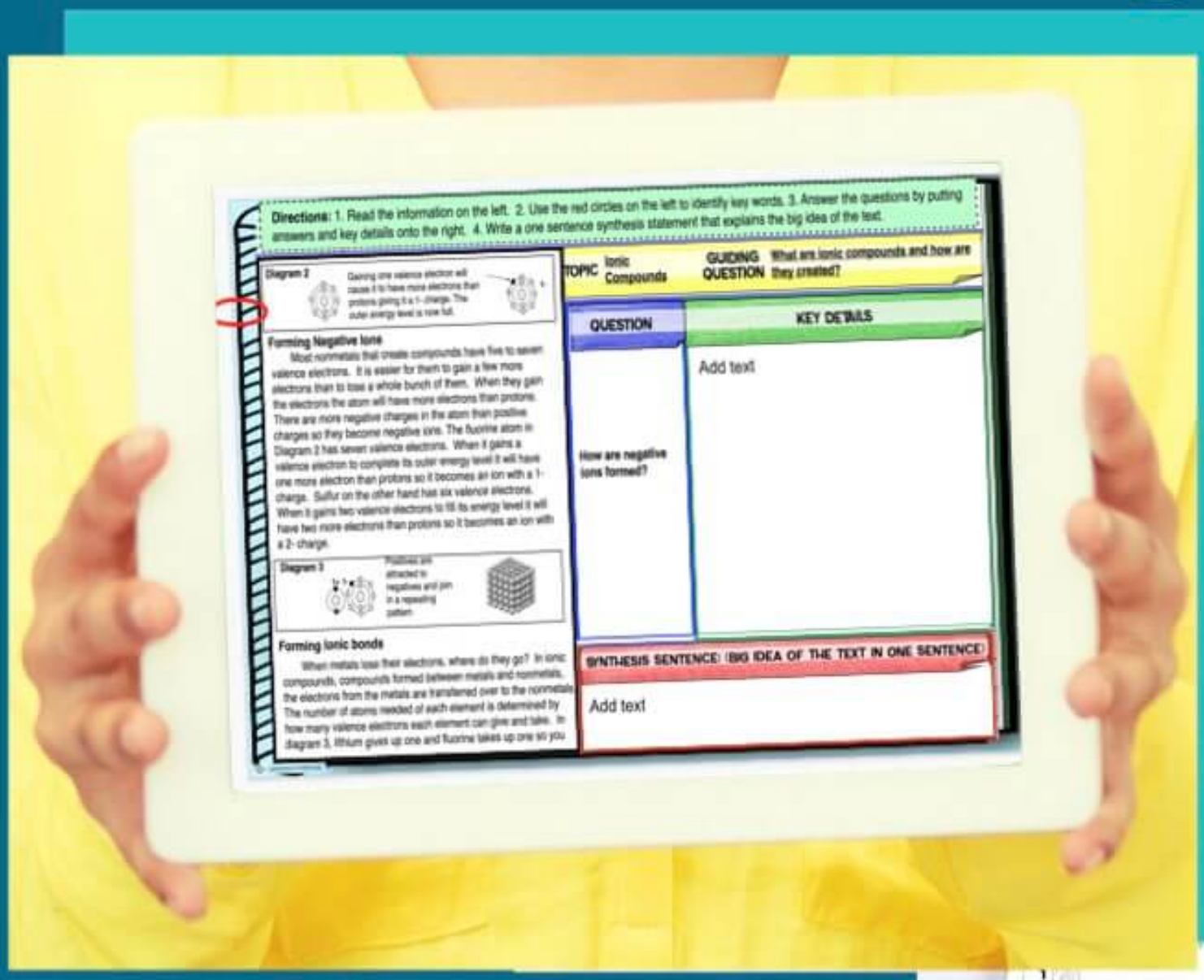
# Compounds and Chemical Bonding Reading

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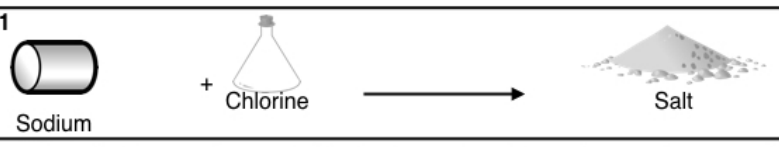
Adventures in ISTEM

## 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. is a highly poisonous green gas that can kill you if you inhale it. When these two e are mixed together they create a compound that is so safe we eat it in most of the consume (diagram 1). Together they make sodium chloride, otherwise known as t How is this possible? How are two extremely dangerous elements able to make s we can eat?

### Creating Chemical Bonds

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

### Electrons and Bonding

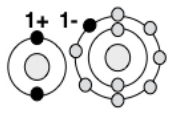
In a neutral atom the number of electrons is the same as the number of pro These electrons are organized into different energy levels. The first energy level hold two electrons and is the first to be filled. The other energy levels can hold u electrons and need to be filled before you move onto the next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

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

## Ionic Compounds

**Big Idea Question: What are ionic compounds and how are they cr**

**Diagram 3**




Positives are attracted to negatives and in a repeatin

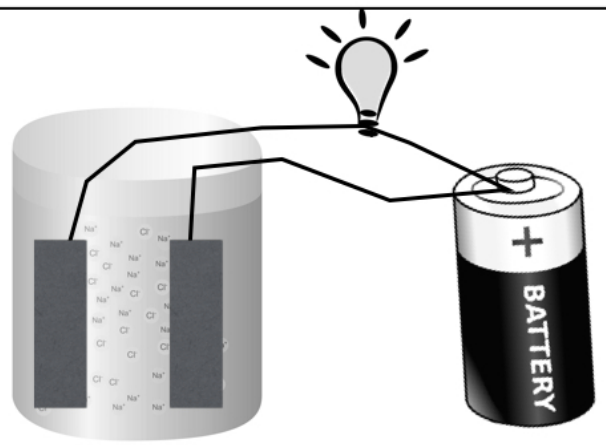
### Forming Ionic bonds

When metals lo compounds forme transferred over to determined by how 3, lithium gives up on However, if you were t accomplish this. This is oxygen needs two valenc occurs it creates positive io positive and negative ions be

### Properties of Ionic Compounds

These ionic bonds give ionic Due to the strong attraction of the ions, ionic compoun s. This gives them high melting and boiling points. It also give ttice structure since only opposite ions are attracted to each other so they tween 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**



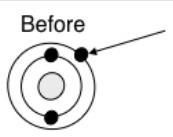

 

## Ionic Compounds

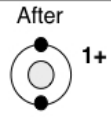
**Big Idea Question: What are ionic compounds and how are they created?**

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**




Losing its one valence electron will cause it to have more protons than electrons giving it a 1+ charge. The energy level below, which is already full, becomes the outer level




### 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+ charg n the other hand has two valence electrons. When it loses its two v has two more protons than electrons so it becomes an ion with a

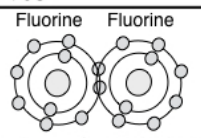
**Diagram 2**


ns. It is . When are more ve ions. The s a valence electron

## Ionic Compounds

**nd how are they formed?**

ove the sugar will melt and turn into nt compound and is held together by weak med give it certain properties.




nds formed when electrons are nsferred and ions are formed

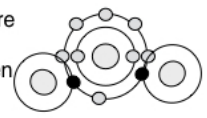
Covalent bonds are formed when the electrons are shared between the atoms

### 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.

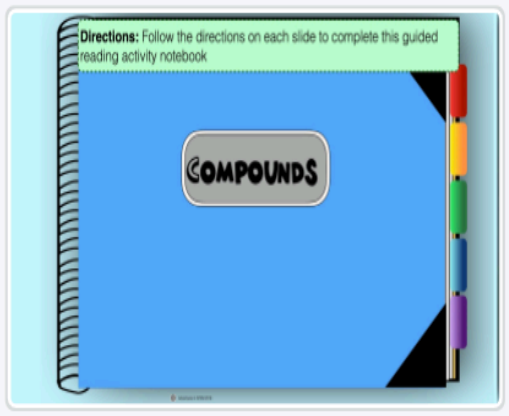
### Sharing Electrons

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.

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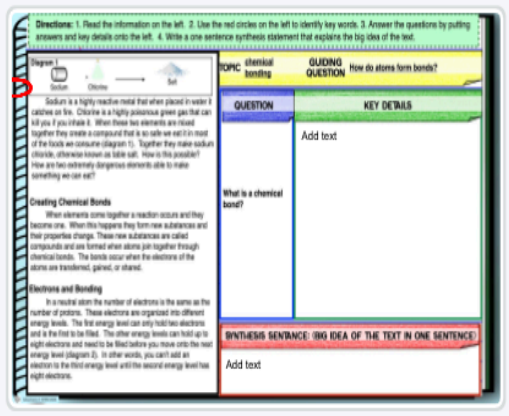


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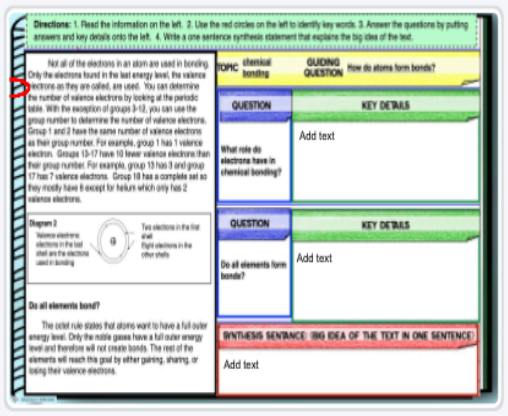


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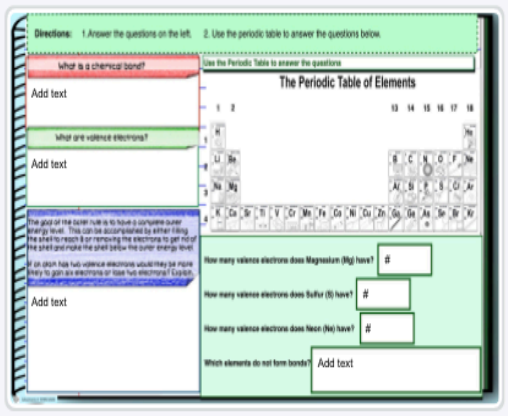


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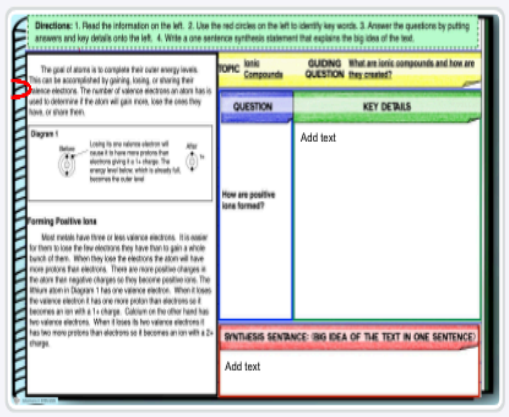


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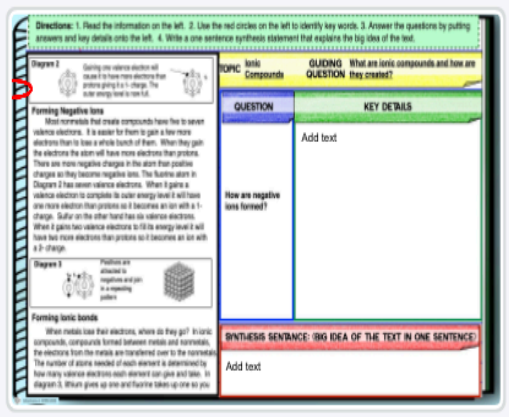


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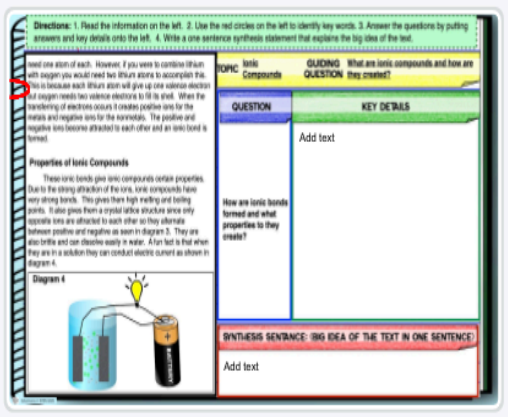


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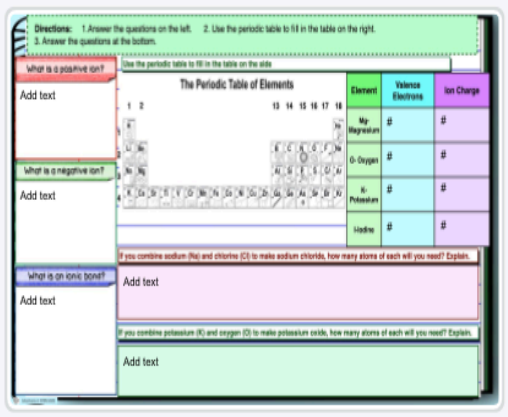


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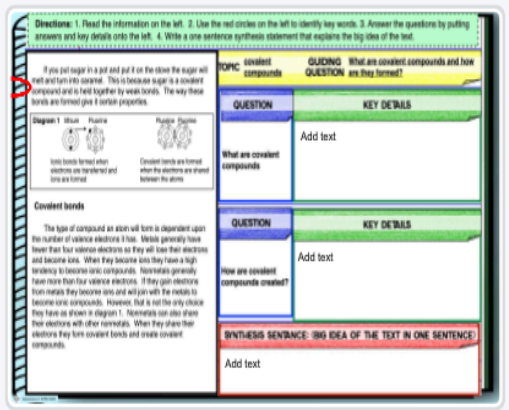


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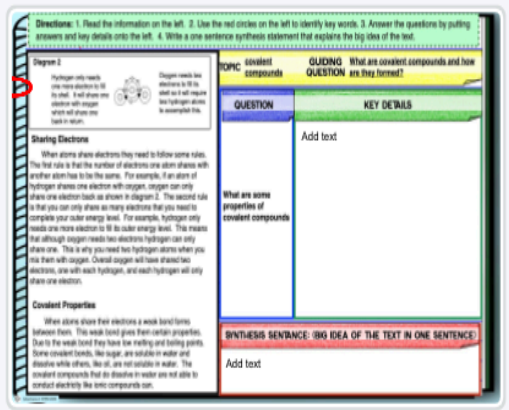


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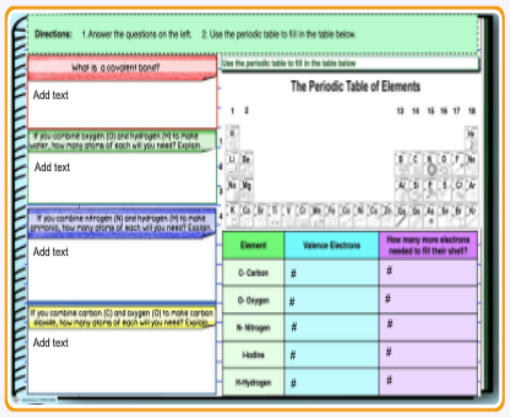


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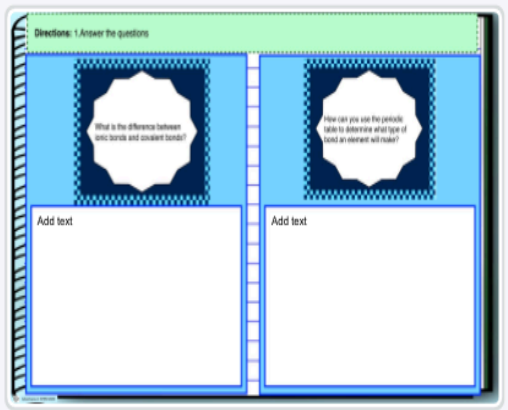


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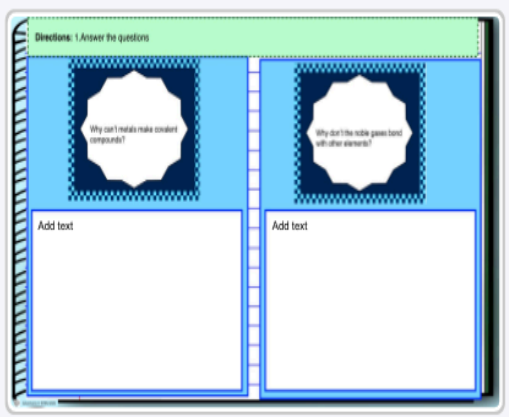


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Digital or Print

**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 th periodic table? | |
| What are some properties of the nonmetal families of the periodic table? | |

**Summary:**

## Chemical Bonding

**Identify and Define:**

1. What is a chemical bond? _____

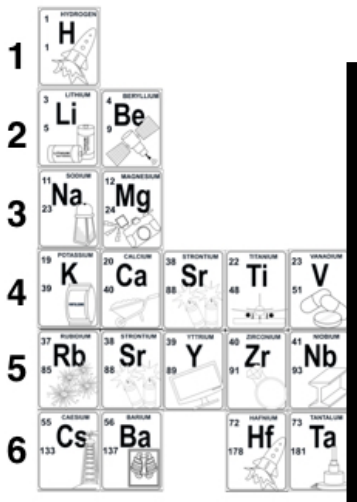
_____

_____

2. What are valence electrons? _____

_____

### The Periodic Table of Elements



**Apply**

3. How many valence elect

4. How many valence elect

5. How many valence elect

6. Which elements do not f

**Extend**

The goal of the octet rule is
accomplished by either fillir
the shell and
7. If an atom
lose two el

_____

explain

_____

_____

## Ionic Compounds

**Define:**

1. What is a positive ion? _____

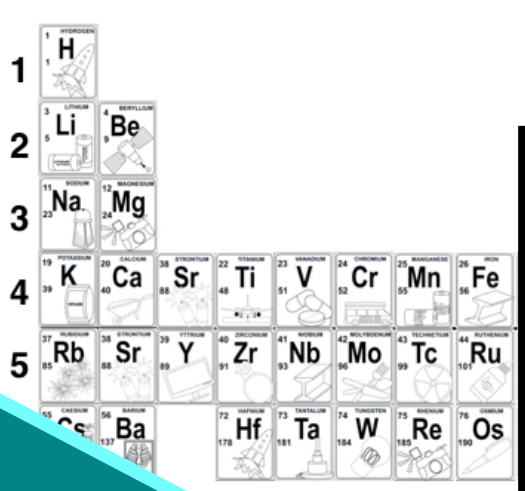
_____

2. What is a negative ion? _____

_____

3. What is an ionic bond? _____

### The Periodic Table of Elements



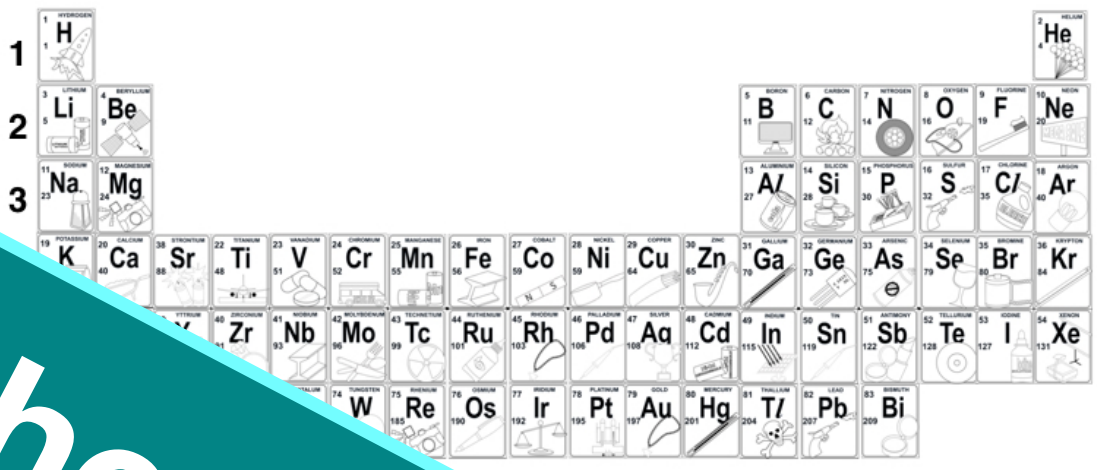
## Covalent Compounds

**Define:**

1. What is a covalent bond? _____

_____

### The Periodic Table of Elements



| | How many more electrons needed to fill their shell? |
|---|---|
| | |
| | |
| | |
| | |
| | |

ny atoms of each will you

_____

_____

a, how many atoms of each will

_____

_____

9. If yo dioxide, how many atoms of each will you need? _____

_____

_____





# Comprehension Worksheets with answer key

# Extension Task Cards

How can you use t
table to determine
bond an element v

Why can't m
compo
covalent

What is the difference
ionic bonds and coval

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

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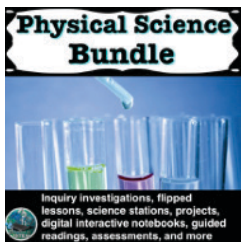



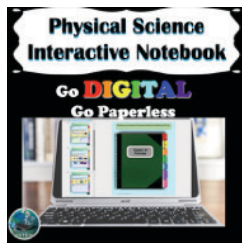


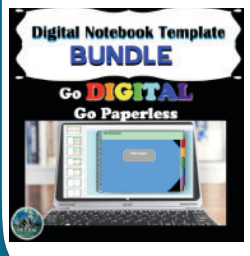




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