The noble gases are a unique type of element. Table 1 below lists the formulas for how noble gases are found in nature versus how other elements are found in nature. After reviewing figure 1, record your observations before reading further.

Table 1: Formulas for noble gases and other elements as they are found in nature.

Noble Gases	Other Elements
He	H_2O
Ne	CO_2
Ar	O_2
Kr	CH_4
Xe	H_2SO_4
Rn	$CaCO_3$

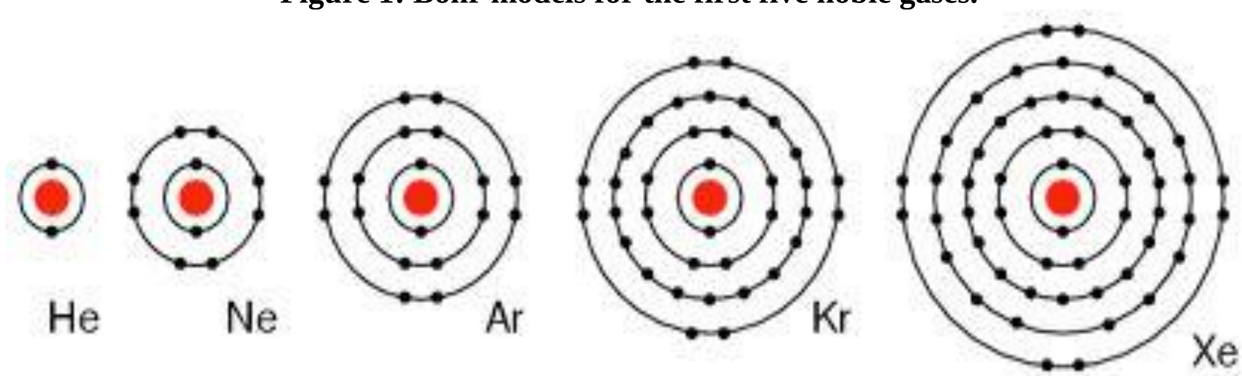
Observations: ____

____

____

The noble gases are unique because of how their valence shells are filled. What do you notice about the number of valence electrons in each noble gases' last shell? How many electrons can fit in their last shell?

Figure 1: Bohr models for the first five noble gases.



Observations: ____

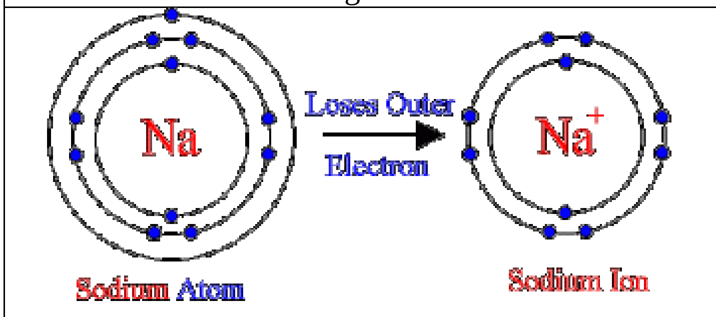
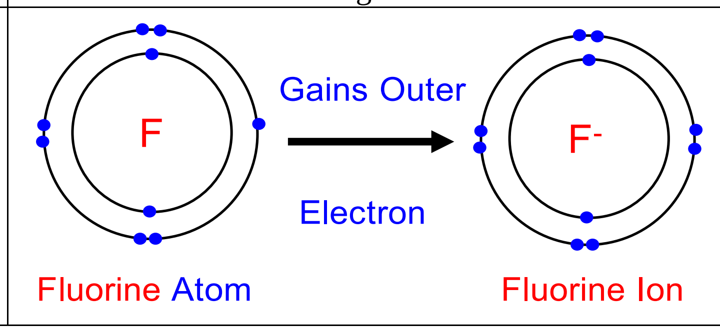
____

____

Every atom is most stable when it has a full valence shell. The noble gases already have a full electron shell and so they are very stable. The noble gases don't make chemical bonds with any other elements. They do not need to gain or lose any electrons, because they already have a full electron shell. Since a full valence shell usually requires 8 electrons, this phenomenon is called the octet rule.

Atoms can gain or lose electrons to get to a full valence shell (octet). Metals have a low electronegativity and will lose electrons. Because metals are losing electrons, which are negatively charged, they will become positively charged ions (cations), with charge equal to however many electrons they have lost. Nonmetals have a high electronegativity and will gain electrons. Since electrons are negative, nonmetals will become negatively charged ions (anions), with charge equal to however many electrons they have gained.

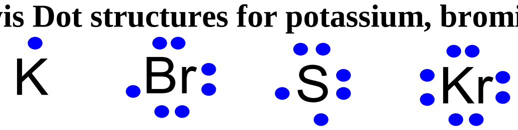
Figure 2: Examples of a metal and a nonmetal forming ions to fill their valence shell.

Metals lose electrons to get a full outer shell, forming cations.	Nonmetals gain electrons to get a full outer shell, forming anions.
	

Lewis Dot structures are shorthand for Bohr models that only show the valence shell of each atom. To draw Lewis Dot structures for atoms:

1. Determine how many valence electrons the atom has.
2. Add one electron to each side of the element symbol (top, right, bottom, and left) until you run out of valence electrons.

Figure 3: Example Lewis Dot structures for potassium, bromine, sulfur, and krypton.

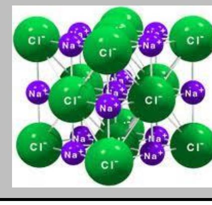
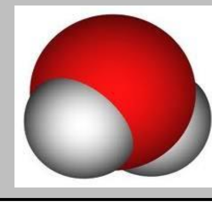


Practice:

Element	#V.E.	Metal or Nonmetal	High or Low E.N.	Gain or lose e-	Ion formed	Cation or Anion
Sodium (Na)						
Magnesium (Mg)						
Iodine (I)						
Nitrogen (N)						
Potassium (K)						
Fluorine (F)						
Francium (Fr)						
Radium (Ra)						
Indium (In)						
Thallium (Tl)						
Phosphorus (P)						

It is all about the learning

Types of Bonds Graphic Organizer

	METALLIC 	IONIC 	COVALENT 
Made of metals or nonmetals?	________ + _________	________ + _________	________ + _________
High or low electronegativity?			
What are the electrons doing?			
Strength of bond (how much energy or heat has to be added to break it?)			
Structure			
Does it conduct electricity?			

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Types of Bonds Practice Worksheet

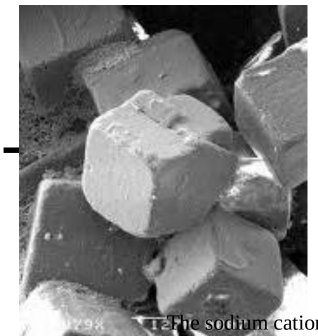
Compound	Made of metals or nonmetals?	Type of Bond	What are the electrons doing?	Structure	Does it conduct electricity?	Strong or Weak Bond?
Ex) $CaCl_2$	*Metal + Nonmetal*	*Ionic*	*Transferred*	*Crystal Lattice*	*Only when dissolved in water*	*Strong*
Oxygen gas O_2						
Mg metal						
$FePO_4$						
CH_3OH						
$CuCl_2$						
Brass Cu & Zn						
Carbon Dioxide						
Sugar $C_6H_{12}O_6$						
Nitrogen gas N_2						
Sand SiO_2						
Water H_2O						
Alcohol C_2H_5OH						
Ammonia NH_3						
Lye (soap) NaOH						
Gold nugget Au						
Human Bone $Ca_3(PO_4)_2$						
Cocaine $C_{17}H_{21}NO_4$						
14 K Gold Au & Cu						
Pool chemical NaOCl						
Candle Wax $C_{20}H_{42}$						
Table Salt NaCl						

Ionic Crystals

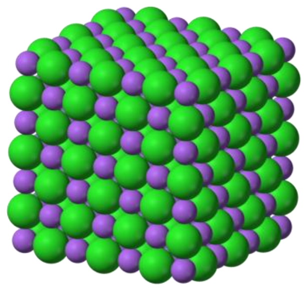
Part I: Ionic Crystals

Chemists have studied reactions of unstable atoms on the periodic table for hundreds of years. One of the first types of reactions to be observed was the reaction between metals and nonmetals. When a metal is brought into contact with a nonmetal, there is often a flaming or explosive reaction that is exciting and sometimes dangerous! When a metal reacts with a nonmetal, an *ionic crystal* is always produced. The most well-known example is ordinary table salt, or sodium chloride, which is produced when sodium metal is exposed to chlorine gas.

Solid sodium chloride crystals



Highly magnified image of sodium chloride salt crystals.



The sodium cation (Na^+) is held in place next to the chloride anion (Cl^-) by electrostatic attraction. This does not conduct electricity because the cations and anions cannot move.

Dissolved sodium chloride

When dissolved in water, the crystal dissociates into the cation and anion. This conducts electricity because the charged cations and anions freely move around.

While each reaction produces a different crystal made up of different elements, all ionic crystals have several similarities. First, each crystal is highly stable and non-reactive, indicating that all of the atoms in the crystal have a full outer shell of valence electrons. Second, each crystal is made up of two parts: a cation and an anion. Since the crystals are made of two types of ions, they are called ionic crystals. Cations and anions are held firmly in place inside the ionic crystal by *electrostatic attraction* between positive and negative charges. Since positive cations are always next to negative anions, the crystal forms a regular, patterned structure known as a *crystalline lattice*. Third, each crystal conducts electricity only when it is dissolved in water. A compound will conduct electricity if a charged particle, such as an electron, cation, or anion, is free to move and carry an electric current. When an ionic crystal is dissolved in water, the cation and anion *dissociate*, or break apart, which allows them to move freely and therefore conduct electricity. Solid ionic crystals do not conduct electricity because the cations and anions are locked in place in the crystal lattice structure.

Naming ionic compounds is very simple. The cation (metal) always comes first and the name is unchanged. Then the anion (nonmetal) follows with an –ide replacing the last few letters of the element name.

Examples: Sodium + Chlorine --→ Sodium Chloride (NaCl)
Magnesium + Oxygen → Magnesium Oxide (MgO)

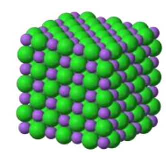
Name K_2S: ___________________________

TEST YOUR UNDERSTANDING

An ionic crystal is produced when a metal reacts with a nonmetal. The crystal is made up of a ________________ and an _________________ that are held together by _______________________________. When the ionic crystal is dissolved in water, it _______________________ into cations and anions, which causes it to ________________ _______________________. The crystal is formed when electrons are ______________________ from the metal to the nonmetal. The metal has a _____ ionization energy, so it _____________ its electrons, creating a ______________________-charged cation. The nonmetal has a _________ electronegativity, so it __________ electrons, creating a _________________-charged anion. This occurs so that both the metal cation and the nonmetal anion have ____________________________.

Part II: Reactions that Produce Ionic Crystals: Based on your knowledge of ions, name each ionic compound and construct a drawing and description that accounts for the formation of each crystal below. Your model should clearly show the behavior of electrons and show how each atom gets a full shell.

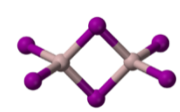
1. Sodium (Na) reacts with Chlorine (Cl) → ____
Diagram:
Before bonding:



During bonding:

After bonding:

2. Aluminum (Al) reacts with Iodine (I) → ____
Diagram:
Before bonding:



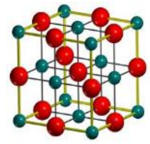
During bonding:

After bonding:

3. Magnesium (Mg) reacts with Oxygen (O) → ____

Diagram:

Before bonding:



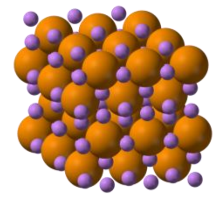
During bonding:

After bonding:

4. Lithium (Li) reacts with Phosphorous (P) → ____

Diagram:

Before bonding:



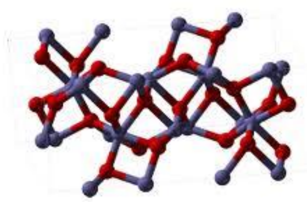
During bonding:

After bonding:

5. CHALLENGE: Aluminum (Al) reacts with Oxygen (O) → ____________________________________

Diagram:

Before bonding:



During bonding:

After bonding:

Part III: PRACTICE

1. For the following ionic crystals, write the name of the crystal and identify the cation and anion in the crystal (*Hint: Use your periodic table*):

Formula	**Name**	**Cation**	**Anion**
NaCl	Ex) Sodium Chloride	Na^+	Cl^-
LiBr			
Cs_2O			
$MgCl_2$			
Na_3P			
BeO			
AlN			
$CaBr_2$			

2. **Draw and describe** what is happening with the electrons in the following reactions (just as we did on p 2.6-2.7):

a) Potassium (K) reacts with Chlorine (Cl)

b) Aluminum (Al) reacts with Bromine (Br)

c) Beryllium (Be) reacts with Sulfur (S)

3. Which correctly describes what happens when zinc (Zn) bonds with chlorine (Cl) to form zinc chloride ($ZnCl_2$)? Explain in the margins.

a) Zinc shares one electron with each chlorine atom.
b) Zinc donates two electrons, one to each chlorine atom.
c) Each chlorine atom donates one electron to the zinc atom.
d) Electrons are move randomly between zinc and chlorine atoms.

Read the scenario and answer the remaining questions in complete sentences, using academic language.

In the 1950s', Corning Inc. first invented glasses that would darken when exposed to sunlight. More recently, Transitions Sunglasses has improved and popularized the technology. The glasses allow people to wear their prescription glasses (for poor eyesight) indoors, and have their glasses automatically adjusted to protect their eyes from the intense sunlight outside. The original process worked by incorporating silver chloride (AgCl) and other silver halides into the glasses. When exposed to ultraviolet light, as shown in the reaction below, silver chloride will break up into chlorine and silver metal. The silver metal causes the glasses to turn grey and darken.

Transitions lenses darken when exposed to UV rays and lighten up again as UV exposure decreases.

Formation of silver from silver chloride and UV light
Reactants (chemicals you start with) Products (chemicals you end with)
$2AgCl(s) \xrightarrow{uv} Cl_2(g) + 2Ag(s)$

A) Fill in the table below, identifying the type of bonding in each chemical, the behavior of the electrons, and at least one property of that type of bond.

	Silver Chloride (AgCl)	Chlorine gas (Cl_2)	Silver Metal (Ag)
Type of bond			
Behavior of electrons			
One likely property			

B) Diagram and describe what is happening in the bond in silver chloride.

	Diagram	Description (Discuss EN, electrons, any ions present, and the structure)
Before bonding		
During bonding		
After bonding		

C) Transitions glasses do not change color while driving in the car. Why do you think this is?

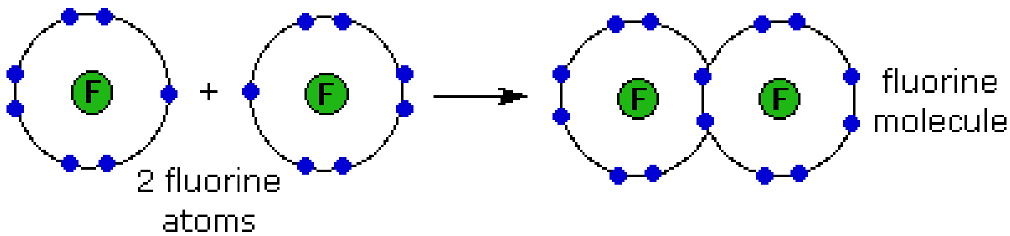
It is all about the learning

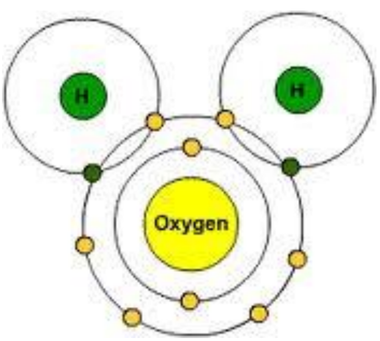
Covalent Molecules

Nonmetal + Nonmetal → Covalent Molecule

When a non-metal reacts with another non-metal, both atoms have a high electronegativity. Since they both strongly attract electrons, neither element loses electrons; instead, the electrons are *shared* in a ***covalent bond***. Covalent bonds do not cause crystals. Rather, they create small groups of atoms called ***molecules***. The molecule is held together because the positive nucleus in each atom is attracted to the negative electrons shared between them.

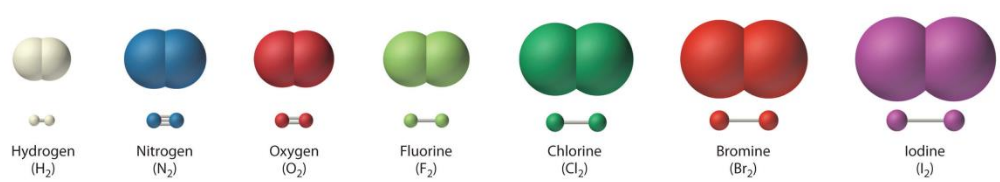
For example, fluorine is a highly electronegative atom with 7 valence electrons. When two fluorine atoms react, each fluorine atom shares 1 electron with the other so that both atoms achieve a full shell. Together, they create a fluorine molecule (F_2). It is important to note that neither fluorine atom has a charge, since neither gained or lost an electron. The positive nucleus of each fluorine atom is attracted to the two electrons shared between them. The unshared pairs of electrons are called lone pairs. The fluorine molecule contains a total of 6 lone pairs.





Another example is a water molecule (H_2O). Both hydrogen atoms have 1 valence electron, while the oxygen atom has 6 valence electrons. When they share electrons, hydrogen achieves a full shell of 2 electrons, while oxygen achieves a full shell of 8 electrons. Since both hydrogen and oxygen atoms share electrons, the atoms are tightly bound together in a covalent bond but the atoms do not become ions with charges.

The elements hydrogen, nitrogen, oxygen, fluorine, chlorine, bromine, and iodine form covalent bonds with themselves because they have such high electronegativities that they cannot exist as single atoms in nature.



Naming covalent compounds is a little more complicated than ionic compounds because there are no charges to use to determine the formulas. Prefixes are used to indicate how many of each atom there is. A prefix is always used except for the first atom if there is only one in the molecule.

Prefixes for naming covalent compounds

Mono	1	**Tri**	3	**Penta**	5	**Hepta**	7	**Nona**	9
Di	2	**Tetra**	4	**Hexa**	6	**Octa**	8	**Deca**	10

Examples:

H_2O : Dihydrogen monoxide

OF_2 : Oxygen difluoride

P_2O_4 : ____

Lewis Structures for Atoms: Instead of showing every electron in every shell (the Bohr model), you can save time by only showing the valence electrons. These are called Lewis Structures.

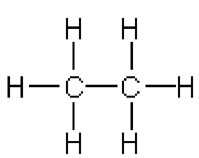
Hydrogen	***Carbon***	***Oxygen***	***Sulfur***	***Nitrogen***	***Fluorine***	***Chlorine***
Can make 1 covalent bond	Can make 4 covalent bonds	Can make _____ covalent bonds	Can make _____ covalent bonds	Can make _____ covalent bonds	Can make _____ covalent bonds	Can make _____ covalent bonds

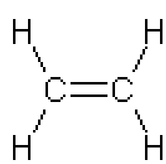
Lewis Structures for Molecules:

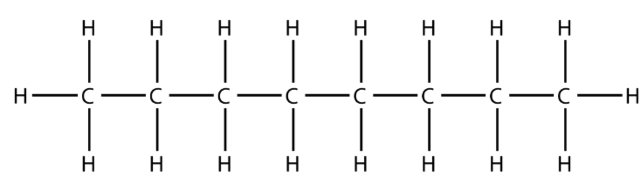
Compound (count v. e^-s)	**Before bonding**	**During bonding (show e^- moving)**	**After bonding**
1. F_2 *Name:*			
2. H_2O *Name:*			
3. C_3H_8 *Name:* *Propane*			

Note: Carbon makes 4 covalent bonds—more than any other nonmetal! Carbon is therefore very versatile and is found in long chains, or sometimes rings, in the center of many molecules.

Examples:







Simple Lewis Dot Structure Practice

Based on your knowledge of nonmetals, name each covalent compound and construct a drawing and description that accounts for the formation of each molecule below. Your model should clearly show the behavior of electrons and show how each atom gets a full shell.

1) Diagram and describe what is happening in the bond in Br_2.

	Diagram	Description (Discuss EN, electrons, any ions present, and the structure)
Before bonding		
During bonding		
After bonding		

2) Diagram and describe what is happening in the bond in CF_4.

	Diagram	Description (Discuss EN, electrons, any ions present, and the structure)
Before bonding		
During bonding		
After bonding		

3) Diagram and describe what is happening in the bond in OBr_2.

	Diagram	Description (Discuss EN, electrons, any ions present, and the structure)
Before bonding		
During bonding		
After bonding		

Lewis Structures with Multiple Bonds

In certain molecules, some atoms must share more than 1 pair of electron. If an atom shares more than one pair of electron, it forms either a double or a triple bond. The types of bonds are summarized in the table below:

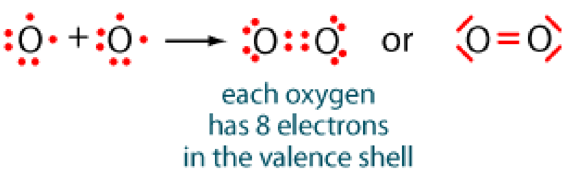
Bond	Symbol	Bond Order	Example	
Single	—	1	F_2	F–F
Double	=	2	O_2	O=O
Triple	≡	3	N_2	N≡N

2 e⁻ are shared (1 pair)

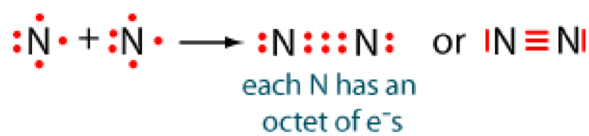
4 e⁻ are shared (2 pairs)

6 e⁻ are shared (3 pairs)

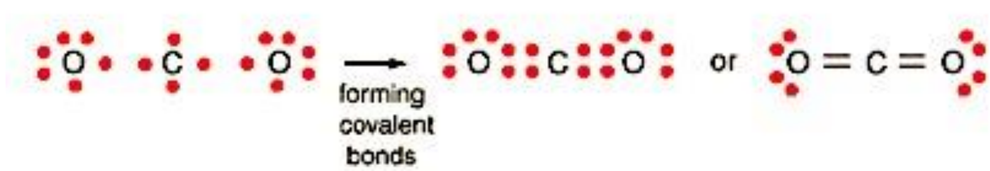
For example, the oxygen atoms in an oxygen molecule (O_2) must share 2 pairs, or 4 total, electrons. Therefore, the oxygen molecule contains a **double bond.**

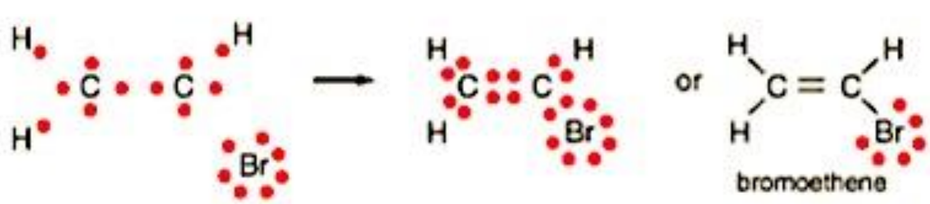


The nitrogen atoms in a nitrogen molecule (N_2) must share 3 pairs, or 6 total, electrons. Therefore, the nitrogen molecule contains a **triple bond**.



Below you will find several more Lewis structures illustrating double and triple bonds. Examine each structure carefully. **Circle the electrons shared by each atom** to verify that every atom has a full shell. **Label each double and triple bond.**





Read the scenario and answer the remaining questions in complete sentences, using academic language.

Ethanol is the alcohol responsible for making alcoholic drinks intoxicating. The higher the concentration of ethanol in the drink, the more of an effect it tends to have on the drinker. Ethanol is composed of carbon, hydrogen, and oxygen and is usually written with the formula C_2H_5OH. Besides being consumed in alcoholic drinks, ethanol has also been used as an alternative fuel to gasoline, since it can be made from plants, commonly corn. It can be burnt according to the equation below:

$$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O + \text{heat}$$

A) What type of bond holds ethanol together? Explain how you know.

B) Diagram and describe what is happening in the bond in ethanol.

	Diagram	Description (Discuss EN, electrons, any ions present, and the structure)
Before bonding		
During bonding		
After bonding		

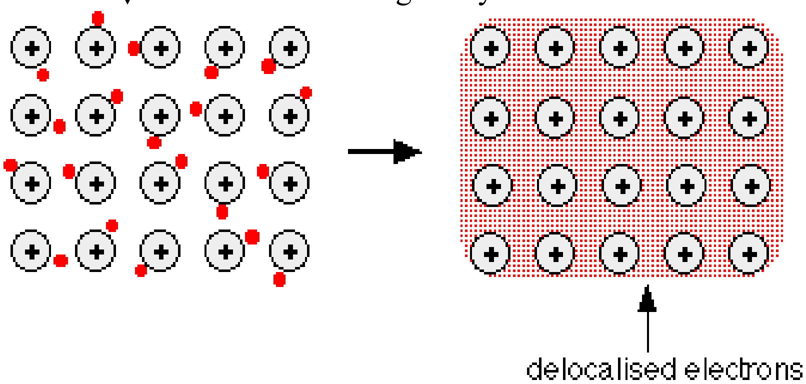
C) Will ethanol conduct electricity? Why/why not?

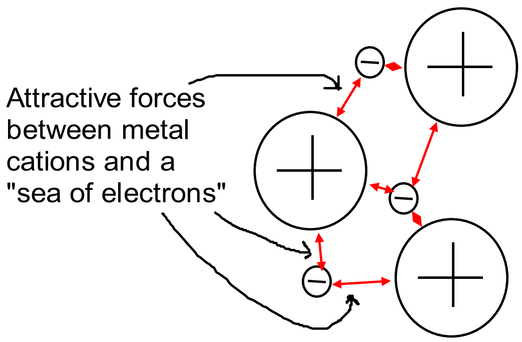
D) Which will produce more heat, vodka with 40% ethanol or beer with 5% ethanol? Explain.

Metallic Bonds

Metals behave very differently than ionic and covalent compounds. They conduct electricity in the solid state, meaning electrons can flow through metallic bonds without disrupting the compound's structure. If the compound's structure is changed by bending or twisting a metal, the metallic bonds rearrange and the metal stays together. Metals are essential to modern life and have found uses in electronics, structural engineering, transportation, cooking, and many other areas.

Electrons are not very tightly bound to metals due to metals' low electronegativity and ionization energy. In a metallic bond, the valence electrons leave the metal and wander around through the metal. Because electrons are not locked into one specific area, they are sometimes called delocalized electrons or a "sea of electrons". When the metal atoms lose their valence electrons, the metal atoms become positively charged. These metal cations are attracted to the delocalized electrons through electromagnetic forces, forming a metallic bond.





The mobility of the valence electrons leads to metal compound's characteristic properties. Electricity is simply electrons in motion, and metals always have delocalized electrons which can move around. When a metallic compound is bent, the metal cations are still always in the sea of electrons and remain bound together. This is why metals are malleable and not brittle.

<u>Test your understanding:</u>

1. Where are the valence electrons in a metallic bond? Why?

In a metallic bond, the valence electrons …

2. Explain what holds metal atoms together.

Metal atoms are held together because …

3. Why can metals conduct electricity?

Metals can conduct electricity because …

Practice

1) Circle the compounds below which would exhibit metallic bonding.
    a. H_2O
    b. Au
    c. NaCl
    d. $MgCl_2$
    e. Ag
    f. FeCr
    g. Cl_2

Explain how you know which compounds exhibit metallic bonding:

2) In metallic bonds, the valence electrons wander between metal cations in a sea of electrons. Why don't nonmetals form similar types of bonds?

3) What is different about the bonding between salt and iron that makes iron conductive?

4) What would happen to a sample of metal if you took away all the valence electrons? Include a diagram in your explanation.

Read the scenario and answer the remaining questions in complete sentences, using academic language.

Brass is an example of an alloy made of zinc and copper. An alloy is a combination of metals. Unlike ionic or covalent compounds, the amount of each metal in an alloy can be almost anything. $ZnCl_2$, an ionic compound, always has one zinc for every two chlorine atoms. Brass on the other hand, can have different ratios of zinc and copper. Alloys are used because they often have more appealing properties than the pure metals themselves.

A) Draw a representation of the metallic bonding in brass. Use Zn^{2+} and Cu^{2+} to represent the zinc and copper ions in the alloy.

B) Why is brass able to conduct electricity?

C) Why doesn't an alloy need to have a constant ratio of the metals in the compound like ionic or covalent compounds would?

D) Diagram and describe the bonding that takes place in $ZnCl_2$. Assume zinc has two valence electrons.

Title:	Metallic, Covalent, and Ionic Bond Properties
Standard:	*2.a Students know* atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging electrons to form ionic bonds.

1) What type of bonding will each set of atoms exhibit?
   a. Na and Br
   b. Cl and I
   c. Ba and Cl
   d. Ba and Sr
   e. P and O

2) What do the electrons do in each type of bonding?
   a. Ionic
   b. Covalent
   c. Metallic

3) What is an example of two elements which would bond and form a compound with a high melting point that will conduct electricity only if dissolved in water?

4) Diagram the bonding that occurs in solid iron.

5) Why do metals always form positive ions and why do metals conduct electricity so well?

6) What are some likely properties of carbon tetrachloride: CCl_4?

Title:	Explaining and Naming Ionic Compounds
Standard:	*2.c Students know* salt crystals, such as NaCl, are repeating patterns of positive and negative ions held together by electrostatic attraction. *2.g Students know* how electronegativity and ionization energy relate to bond formation.

1) Define the terms ‘cation’ and ‘anion’.

2) Draw a diagram of an ionic crystal (show at least 8 cations and 8 anions) and explain why the structure stays together.

3) Diagram and describe what is happening in the bond in lithium nitride (Li_3N).

	Diagram	Description (Discuss EN, electrons, any ions present, and the structure)
Before bonding		
During bonding		
After bonding		

4) Diagram and describe what is happening in the bond in calcium iodide (CaI_2).

	Diagram	Description (Discuss EN, electrons, any ions present, and the structure)
Before bonding		
During bonding		
After bonding		

Title:	Explaining and Naming Covalent Compounds
Standard:	*2.b Students know* chemical bonds between atoms in molecules such as H_2, CH_4, NH_3, H_2CCH_2, N_2, Cl_2, and many large biological molecules are covalent. *2.g Students know* how electronegativity and ionization energy relate to bond formation.

1) Proteins are made of amino acids, which contain mostly carbon, hydrogen, oxygen, and nitrogen. What type of bond holds proteins together? Explain how you know.

2) Which one of the three pairs of electronegativites will most likely form a covalent bond? Why? (0 is low, 4.0 is high).
   a) 0.5 and 4.0
   b) 0.5 and 0.5
   c) 4.0 and 4.0

3) Diagram and describe what is happening in the bond in fluorine gas (F_2).

	Diagram	Description (Discuss EN, electrons, any ions present, and the structure)
Before bonding		
During bonding		
After bonding		

4) Diagram and describe what is happening in the bond in methane (CH_4).

	Diagram	Description (Discuss EN, electrons, any ions present, and the structure)
Before bonding		
During bonding		
After bonding		

Title:	Drawing Lewis Dot Structures
Standard:	*2.b Students know* chemical bonds between atoms in molecules such as H_2, CH_4, NH_3, H_2CCH_2, N_2, Cl_2, and many large biological molecules are covalent. *2.e Students know* how to draw Lewis dot structures.

1) What is the octet rule?

2) Draw Lewis Dot structures for the following compounds:
   a) Br_2
   b) H_2O
   c) SO
   d) NH_3
   e) PI_3
   f) HCN
   g) HF

Read the scenario and answer the remaining questions in complete sentences, using academic language.

Ions are often made from a metal or nonmetal atom that has lost or gained electrons. However, sometimes ions can be formed from molecules. In these cases, where molecules gain a positive or negative charge, the ions are called polyatomic ions. Poly means "many" and atomic comes from "atom": thus a polyatomic ion is an ion made from many atoms. One example of a polyatomic ion is ammonium, NH_4^+, which is a cation with a positive one charge. Ammonium forms many compounds, but one of them is ammonium chloride, NH_4Cl.

A) If ammonium is a positive ion, has it gained or lost an electron when compared to a neutral NH_4 molecule? Explain.

B) Draw the lewis dot structure of ammonium in the brackets below, taking your answer in question A into account (you can't just use all the valence electrons from N and H).

$$[\qquad\qquad]^+$$

C) Neutral NH_4 isn't stable, but NH_4^+ is. Explain.

D) What type of compound is ammonium chloride and what are some of its properties?

E) Ammonia, NH_3, is a related compound to ammonium. Diagram and describe how NH_3 forms.

	Diagram	Description (Discuss EN, electrons, any ions present, and the structure)
Before bonding		
During bonding		
After bonding		

Read the scenario and answer the remaining questions in complete sentences, using academic language.

Table salt, NaCl, is one of the most commonly used ionic compounds on the planet. The table salt produced in the world comes from evaporating seawater or mining ancient seabeds. Historically, it has been used for preserving and seasoning food since ancient times. It was even used as pay for roman soldiers, which is where the term salary comes from. Salt is an important electrolyte needed for nerve function in the body. The compound also helps to regulate blood volume and pressure.

Mined from ancient seabeds	Evaporated seawater
	

A) Describe what happens between sodium and chlorine atoms to produce NaCl in terms of electrons, electronegativity, octet, etc.

B) Sodium chloride forms a crystal lattice. Explain why with a diagram of a crystal and a couple sentences.

C) Sodium chloride is almost never found in the molten state. Why is it so hard to melt?

D) One reason that sodium chloride is important to the body is that it is an electrolyte. However, solid sodium chloride does not conduct electricity. Explain.

Read the scenario and answer the remaining questions in complete sentences, using academic language.

In the 1950s', Corning Inc. first invented glasses that would darken when exposed to sunlight. More recently, Transitions Sunglasses has improved and popularized the technology. The glasses allow people to wear their prescription glasses (for poor eyesight) indoors, and have their glasses automatically adjusted to protect their eyes from the intense sunlight outside. The original process worked by incorporating silver chloride (AgCl) and other silver halides into the glasses. When exposed to ultraviolet light, as shown in the reaction below, silver chloride will break up into chlorine and silver metal. The silver metal causes the glasses to turn grey and darken.

Transitions lenses darken when exposed to UV rays and lighten up again as UV exposure decreases.

Formation of silver from silver chloride and UV light
Reactants (chemicals you start with) Products (chemicals you end with)
$2AgCl(s) \xrightarrow{uv} Cl_2(g) + 2Ag(s)$

D) Fill in the table below, identifying the type of bonding in each chemical, the behavior of the electrons, and at least one property of that type of bond.

	Silver Chloride (AgCl)	Chlorine gas (Cl_2)	Silver Metal (Ag)
Type of bond			
Behavior of electrons			
One likely property			

E) Diagram and describe what is happening in the bond in silver chloride.

	Diagram	Description (Discuss EN, electrons, any ions present, and the structure)
Before bonding		
During bonding		
After bonding		

F) Transitions glasses do not change color while driving in the car. Why do you think this is?