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1. Use Bohr model diagrams to illustrate the compounds formed from the following ion.

    a. Li^{1+} and Cl^{1-}

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b. Ca^{2+} and O^{2-}

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c. Na^{1+} and S^{2-}

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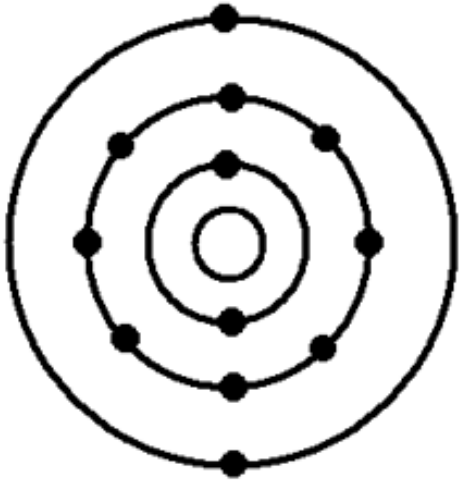
2. Use the diagram below to answer the following questions.



a. Use the periodic table to name this element. Magnesium
b. To which family does this element belong? Alkaline earth metal IIA
c. Would you classify this element as a metal or non-metal? metal
d. How many electrons would you expect this element to lose or gain when it becomes an ion? Lose 2
e. What is the charge of this element when it becomes an ion? 2+
f. Would this element be more likely to combine with chlorine or lithium? Explain.
Chlorine: (+) attracts (-)
g. Draw the ion that is normally formed from the atom in the space beside it.

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3. Use the periodic table to complete the table.

Element	Number of Electrons Lost or Gained	Positive or Negative Ion	Charge on Ion	Inert gas with the same number of electrons as the ion
Sulphur	2 gained	(-)	2-	Argon
Boron	3 lost	(+)	3+	Helium
Calcium	2 lost	(+)	2+	Argon
Chlorine	1 gained	(-)	1-	Argon

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Three-Point Approach for Words and Concepts

Definition	Word or Concept	Diagram
• The tendency of elements to lose or gain electrons to obtain the same number of valence electrons as the nearest inert gas	octet rule Synonym or Example Boron loses 3 electrons to become "happy"	

8 valence e-

Definition	Word or Concept	Diagram
• The force of attraction between oppositely charged ions that transfer electrons • A bond between a metal and a non-metal	ionic bond Synonym or Example Lithium and oxygen transfer electrons	

Definition	Word or Concept	Diagram
• The force of attraction between atoms that share electrons • A bond between a non-metal and a non-metal	covalent bond Synonym or Example Carbon and oxygen share electrons	

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Lesson Four: Covalent Bonds

Covalent Bonds

When two atoms form *ionic bonds*, they *transfer* one or more electrons from a **metal** atom to a **non-metal** atom. As a result of the electron transfer, one ion has a **positive** charge (loses electrons) and one has a **negative** charge (gains electrons). An attraction exists between these ions, forming an ionic bond, holding them together as an ionic **compound**.

A covalent bond is formed when:

two or more non-metal atoms share valence electrons

Non-metallic atom + Non-metallic atom = **covalent bond**

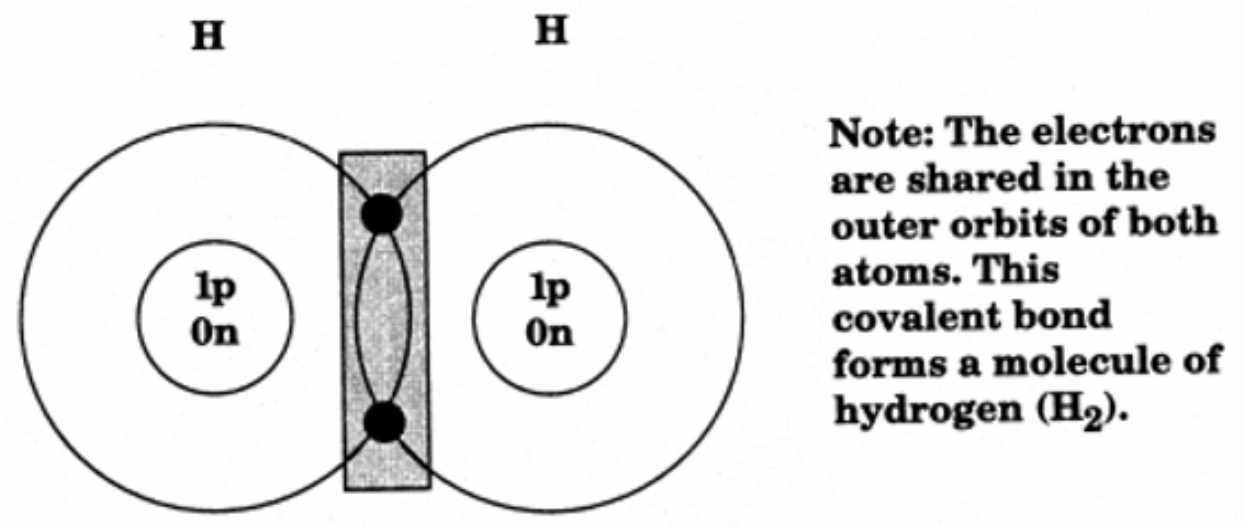
Compounds contain at least *two* different types of atoms.

- A ___molecule___ is the smallest unit of a covalent compound.
- A molecule of a compound has ___different___ characteristic properties than the atoms which form it.

Covalent Bonding in the Hydrogen Molecule

Two hydrogen atoms form a covalent bond by ___sharing___ electrons to produce a hydrogen molecule. A hydrogen molecule still possesses the properties of hydrogen. No new ___substance___ is formed since only one type of atom, H, is present.

The Bohr model for hydrogen shown below illustrates a covalent bond.



When two atoms of hydrogen come close to each other, the **protons** attract each other's **electrons**. The force is not strong enough to cause an electron transfer (ionic bond), but it is strong enough to force the **electrons** to travel in both of the atoms' orbits, spending most of the time in the position shown in the diagram, between the two nuclei. As a result, the two electrons are **shared** by both atoms. The hydrogen atom at the left "looks" at its orbit and "sees" two electrons, so does the one at the right. By **sharing** their electrons, both atoms are satisfied they have filled outer orbits (the outer orbits are the same as for helium) and are stable.

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Diatomic Elements

The two hydrogen atoms form a __diatomic__ molecule (i.e., two atoms of hydrogen share electrons to make a single __molecule__ of hydrogen gas).

A list of diatomic molecules is shown below. Many of these molecules, which you recognize as __gases__, are important to life. The elements forming diatomic gases are __unstable__ as single atoms and combine almost instantaneously to form __stable__ molecules.

Name of Element	Symbol for one atom of the element	Formula or one molecule of the element
Hydrogen	H	H_2
Nitrogen	N	N_2
Oxygen	O	O_2
Fluorine	F	F_2
Chlorine	Cl	Cl_2
Bromine	Br	Br_2
Iodine	I	I_2

If the diatomic elements are placed in a different order the symbols spell out a word that can help you remember these diatomic elements.

Remember "Count HOFBrNICl", pronounced as "Count Hoffbrinkle". or I Have No Bright Or Clever Friends

Why do chemicals react differently? – The Octet Rule

In each of the cases above, the outer energy levels of the atoms are "filled" with electrons. What does it mean for an energy level to be filled? An energy level is filled when it contains all the electrons it can hold in that particular energy level. When an energy level is filled, it has the same number of electrons as an inert gas and becomes itself inert or unreactive.

The fact that atoms will lose, gain, or share electrons in order to obtain a complete octet of electrons like the nearest inert gas is called the Octet rule.

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Covalent bonds are formed when electrons are **Shared** between two non-metal atoms. (Keep in mind that outer orbit electrons are called valence electrons and "co" means share.)

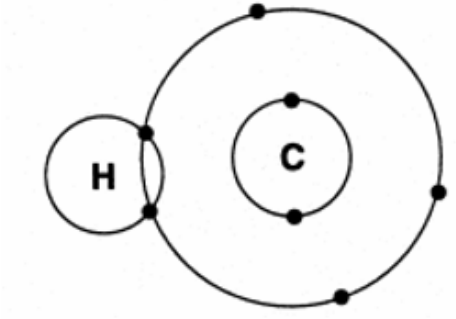
The shared electrons are attracted at the same time to each nucleus in each atom. This is the "glue" that holds the atoms together.

A covalent bond is: **formed when two atoms share one or more pairs of electrons to obtain a complete octet (eight) of electrons**

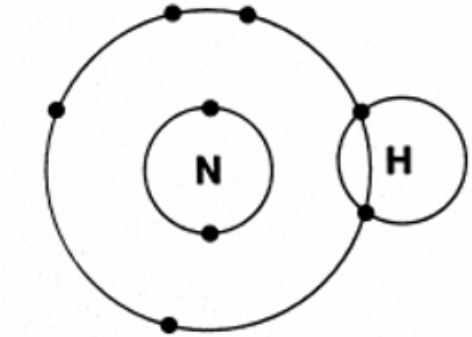
Covalent Bonds in Bohr Diagrams

Use the Bohr model to show how the following molecules are formed. Part of the molecule is included in each drawing. Your task is to complete the molecule.

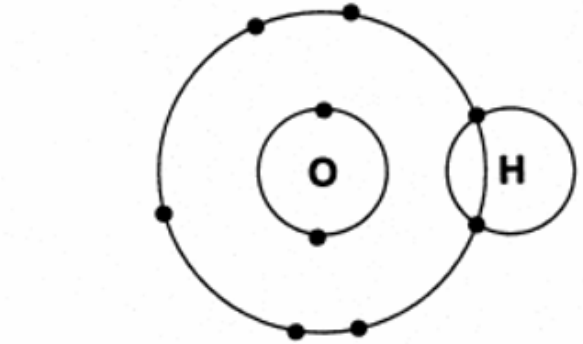
a. Methane CH_4



b. Ammonia NH_3



c. Water H_20



d. Hydrogen fluoride HF