








# Chapter 5 Lesson 1 Notes

# 5.1 How Atoms Form Compounds

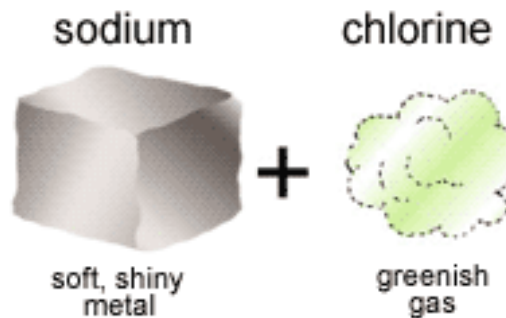
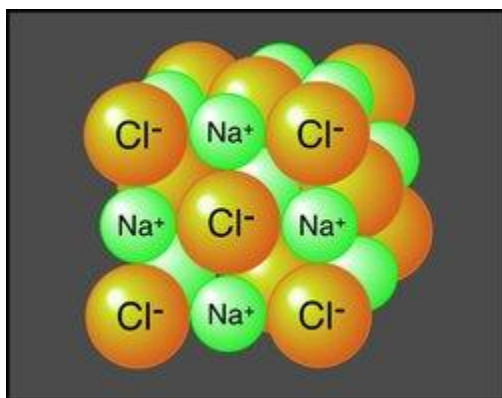
## LESSON Vocabulary

-  compound
-  chemical formula
-  molecule
-  chemical bond
-  ionic bond
-  valence
-  covalent bond



## What is a compound?

- ◀ A **compound** is a pure substance that contains two or more elements.
- Compounds are chemical combinations of elements with properties that are different from the elements that formed them.



# Chemical Formulas for Compounds

- ◀ A **chemical formula** contains atomic symbols and subscripts to show the elements and the number of atoms of each element in the compound.

**NaCl** sodium chloride (salt)

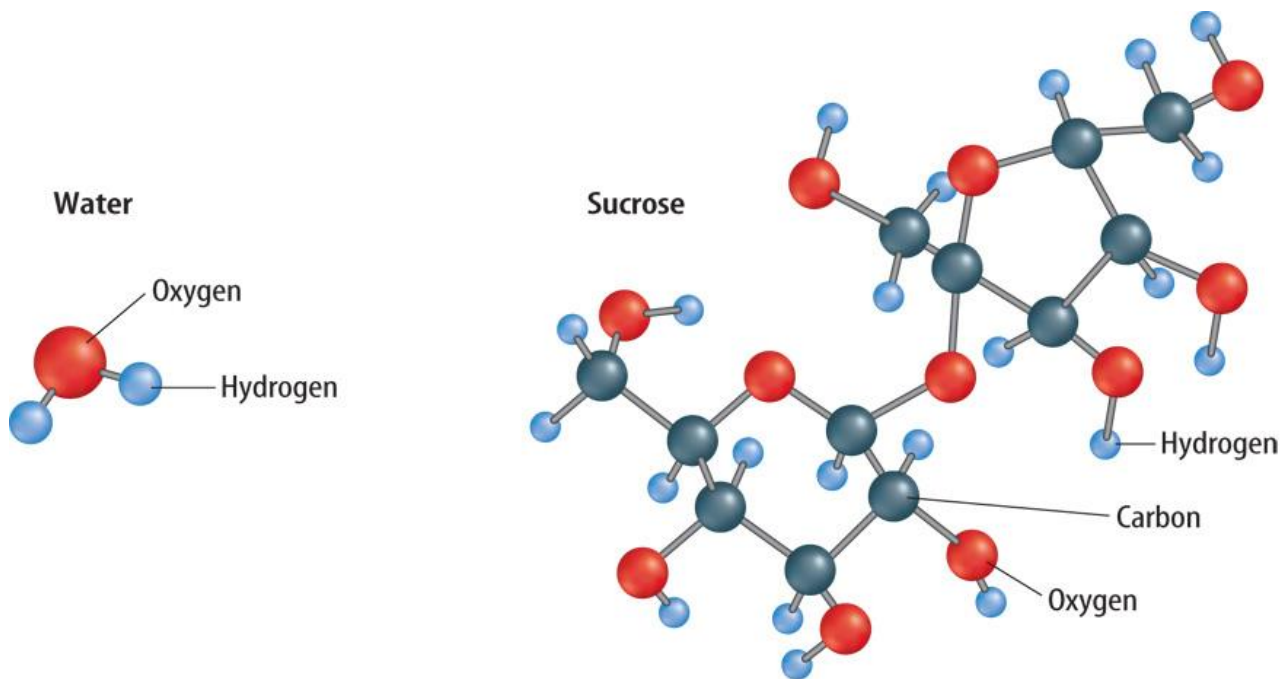
**H<sub>2</sub>O** dihydrogen oxide (water)

**CO<sub>2</sub>** carbon dioxide



## Describing Compounds (cont.)

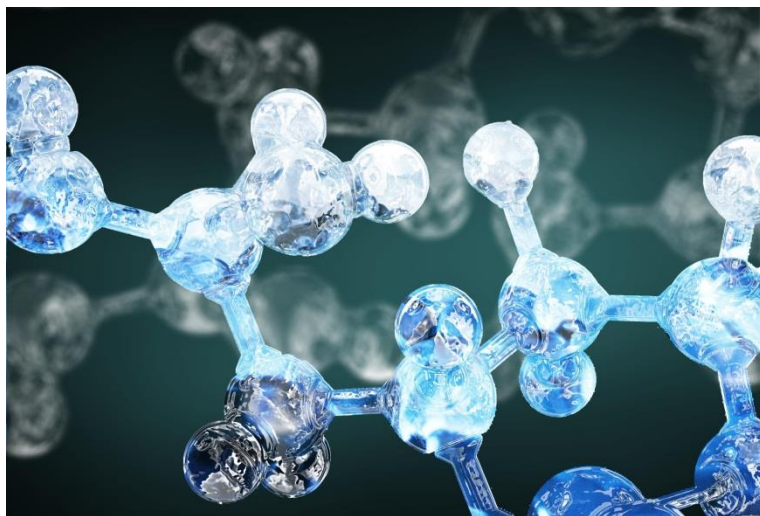
- The chemical formula for sucrose,  $C_{12}H_{22}O_{11}$ , includes all the atoms in one molecule.





## Describing Compounds

- ◀ A **molecule** is a neutral particle that forms as a result of electron sharing.



Virtual  
Lab



How can a molecule  
model be built?

[http://www.glencoe.com/sites/common\\_assets/science/virtual\\_labs/E02/E02.swf](http://www.glencoe.com/sites/common_assets/science/virtual_labs/E02/E02.swf)



Resources



## Formulas and the Law of Definite Proportion

- A pure compound will always contain the same elements in the same proportion by mass.
- Extra credit Whiteboard point:
  - Give an example of this law!!!!

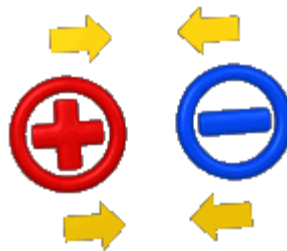


# Ionic Bonds and Ionic Compounds

- ◀ A **chemical bond** is a force that holds atoms together in a compound.



- ◀ An **ionic bond** is an electrical attraction between positively and negatively charged ions in an ionic compound.





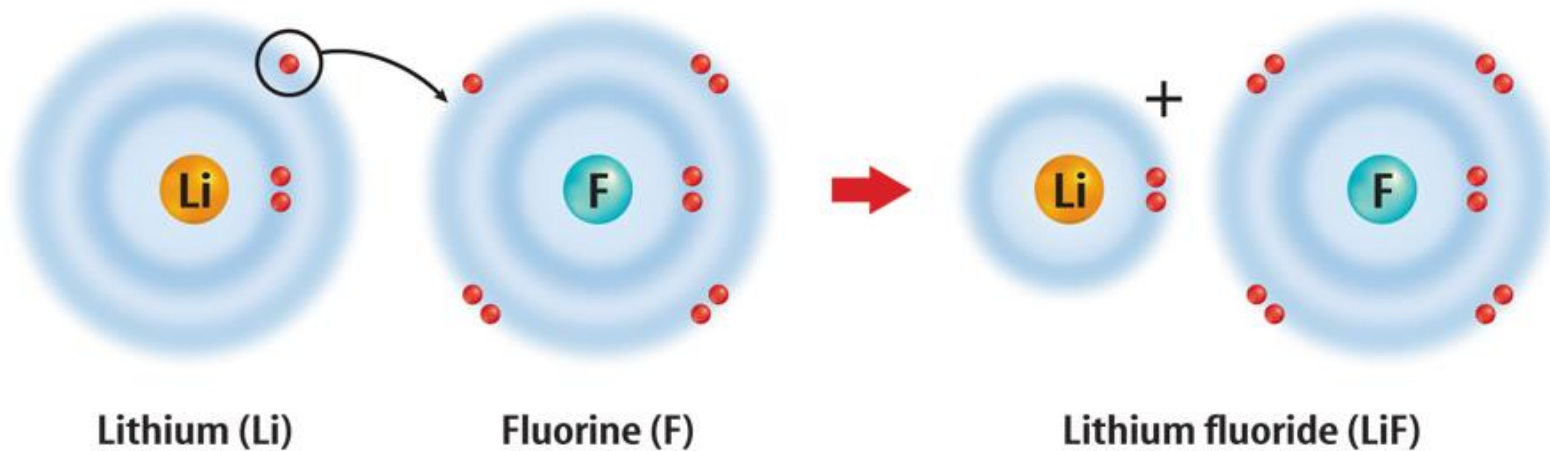
## Ionic Bonds—Transferring Electrons

- An atom can become charged by transferring one or more electrons to another atom.
- Both atoms become charged particles, or ions.



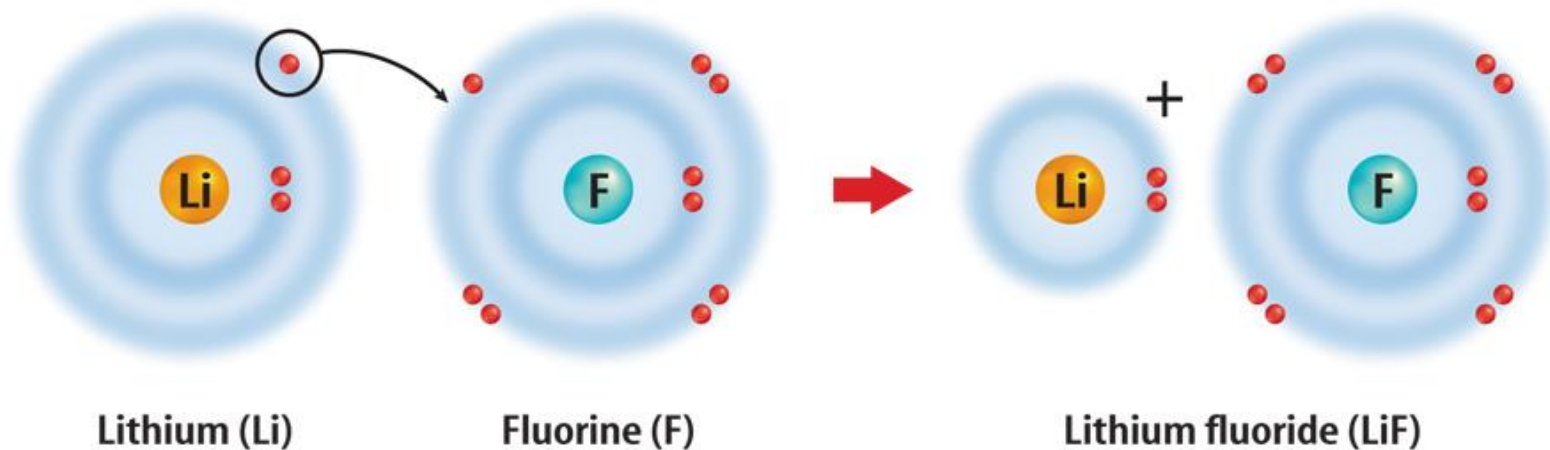
# Ionic Bonds—Transferring Electrons (cont.)

- A lithium atom gives up an electron to a fluorine atom.
- The result is a positively charged lithium ion and a negatively charged fluoride ion.



# Ionic Bonds—Transferring Electrons (cont.)

- The two ions have opposite charges and are attracted to each other.
- Lithium fluoride is the simplest type of compound, made only of two elements and known as a binary compound.



# Ionic Bonds—Transferring Electrons (cont.)

**con**cepts In **MO**tion

<http://www.youtube.com/watch?v=NgD9yHSJ29I>



Resources









# Other Binary Ionic Compounds

- Group 2 elements are also metals and can lose 2 electrons and form ions with a +2 charge.
- Elements in Group 16 can gain 2 electrons and form ions with a -2 charge.

hydrogen 1 H 1.0079	helium 2 He 4.0026																		
lithium 3 Li 6.941	beryllium 4 Be 9.0122											boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180		
sodium 11 Na 22.990	magnesium 12 Mg 24.305											aluminum 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948		
potassium 19 K 39.098	calcium 20 Ca 40.078	scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80		
rubidium 37 Rb 85.469	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc (98)	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	silver 46 Ag 107.87	cadmium 47 Cd 112.41	indium 48 In 114.82	tin 49 Sn 118.71	antimony 50 Sb 121.76	tellurium 51 Te 127.60	iodine 52 I 126.90	xenon 53 Xe 131.29	radon 54 Rn (222)		
cesium 55 Cs 132.91	barium 56 Ba 137.33	* 57-70		lanthanum 57 La 174.97	hafnium 71 Hf 178.49	tantalum 72 Ta 180.95	tungsten 74 W 183.84	mercury 75 Hg 196.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po (209)	astatine 85 At (210)	radon 86 Rn (222)
francium 87 Fr (223)	radium 88 Ra (226)	** 89-102		actinium 89 Ac (227)	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np (237)	plutonium 94 Pu (244)	americium 95 Am (243)	curium 96 Cm (247)	berkelium 97 Bk (247)	californium 98 Cf (251)	esboium 99 Es (252)	fermium 100 Fm (257)	mendelevium 101 Md (258)	nobelium 102 No (259)		

\* Lanthanide series

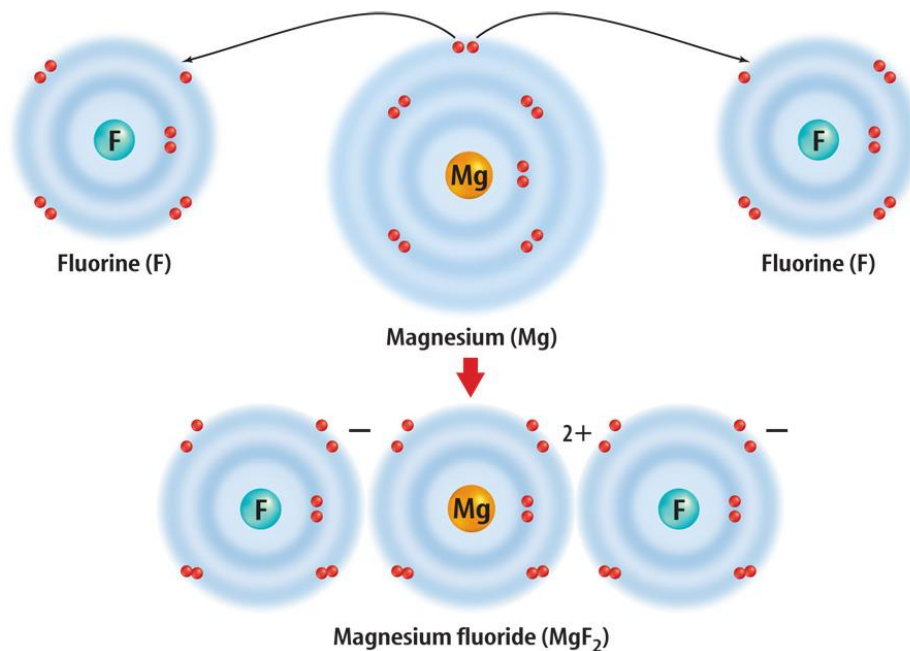
\*\* Actinide series

lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm (145)	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dyprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
actinium 89 Ac	thorium 90 Th	protactinium 91 Pa	uranium 92 U	neptunium 93 Np	plutonium 94 Pu	americium 95 Am	curium 96 Cm	berkelium 97 Bk	californium 98 Cf	esboium 99 Es	fermium 100 Fm	mendelevium 101 Md	nobelium 102 No
(227)	232.04	231.04	238.03	(237)	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)



## Other Binary Ionic Compounds (cont.)

- Magnesium can ***transfer*** one electron to each of 2 Fluorine atoms to form magnesium fluoride ( $\text{MgF}_2$ ).

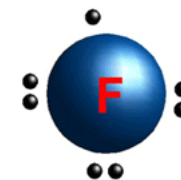
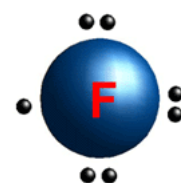
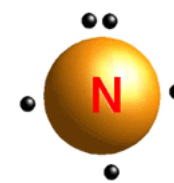
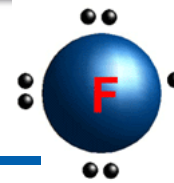


## Properties of Ionic Compounds

- Usually solids at room temperature
- Brittle and break apart easily
- Have high melting and boiling points
- Many dissolve in water



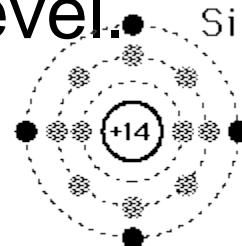
# Diagramming Electrons— Lewis Dot Diagrams



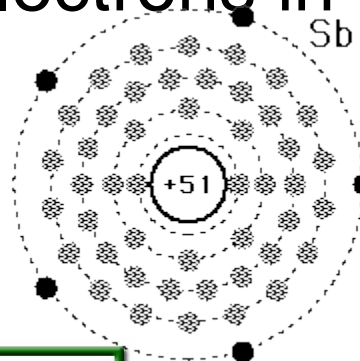
- A Lewis dot diagram is a system to represent atoms and their valence electrons.
- **Valence** electrons are the electrons in the outermost energy level.



Boron  
3 Valence  
Electrons



Silicon  
4 Valence  
Electrons



Antimony (5 Valence)

Interactive  
Table



Valence and Lewis  
Dot Diagrams



Resources



# 8th grade Physical Science! Hot Sync

Mrs. Winters

Wednesday 1/28/15

Copy table and Show all work on your hot sync. Answer in a complete sentence.

## Materials Needed Today

Please take these materials out of your backpack.

- Pencil & notes Lesson 1

3 A spring scale is pulled downward and readings are recorded.

Data Table

Distance Pulled	Spring Scale Reading
1.0 cm	4 N
1.5 cm	6 N
2.0 cm	8 N
2.5 cm	10 N

If the spring is pulled 3.5 cm, the spring scale should read

- A 12 N.
- B 13 N.
- C 14 N.
- D 15 N.



# Riddle of the Day!!!

What is.....

Free, but it's priceless.

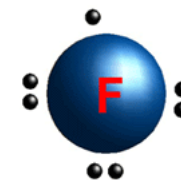
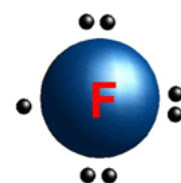
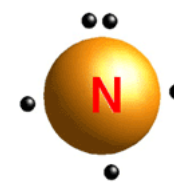
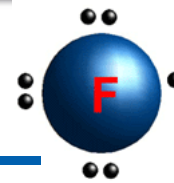
You can't own it, but you can use it.

You can't keep it, but you can spend it.

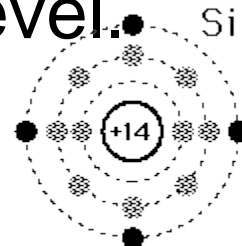
Once you've lost it you can never get it back

# Diagramming Electrons— Lewis Dot Diagrams

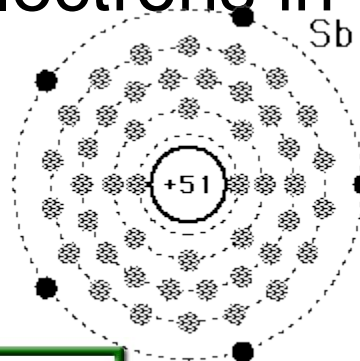
- A Lewis dot diagram is a system to represent atoms and their valence electrons.
- **Valence** electrons are the electrons in the outermost energy level.



Boron  
3 Valence  
Electrons



Silicon  
4 Valence  
Electrons



Antimony (5 Valence)

Interactive  
Table



Valence and Lewis  
Dot Diagrams



Resources



## Your turn

- Draw a Lewis Dot diagram for Lithium...



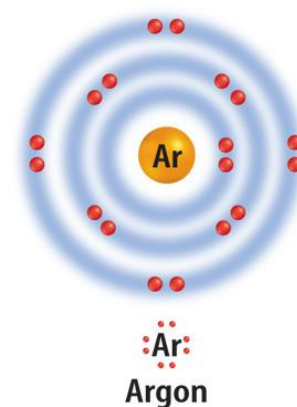
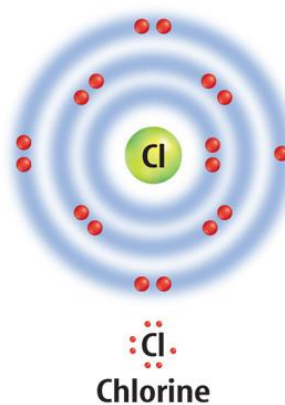
## Ions and Noble Gases

- Groups 3–12 of the periodic table are metals and the valence number can vary.
- Elements in Group 18 are the noble gases.
- The noble gases are stable because their outer energy levels are filled.
- Elements that are stable rarely react to form compounds.



## Noble Gas Structure by Gaining Electrons

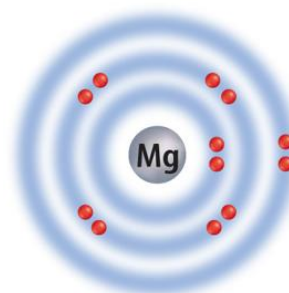
- Chlorine can achieve noble gas structure by filling its outer energy levels.
- Argon is the nearest noble gas to chlorine.
- Chlorine can become more stable by gaining one electron and forming the chloride ion  $\text{Cl}^-$ .



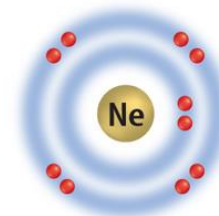


## Noble Gas Structure by Losing Electrons

- Magnesium can achieve the electron structure of neon, the nearest noble gas on the periodic table.
- Magnesium can lose two electrons to form the stable ion  $\text{Mg}^{2+}$ .



Mg:  
Chlorine

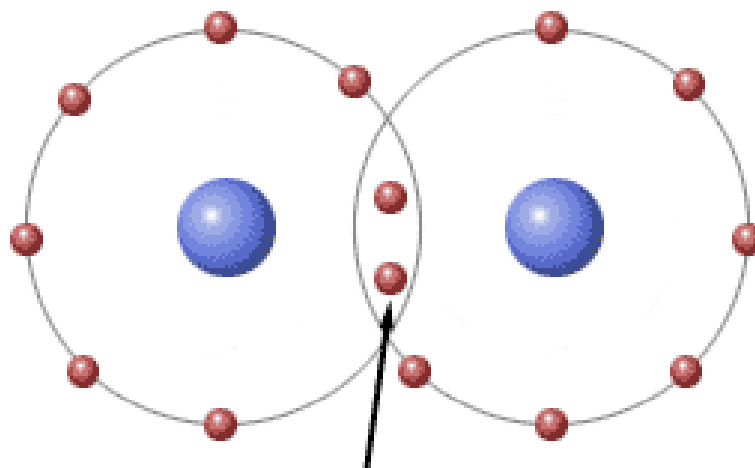


Ne:  
Neon



# Covalent Bonds—Sharing Electrons

- Ionic bonds form when electrons are transferred.
- Some elements need to gain or lose too many electrons.
- A **covalent bond** is a chemical bond formed when atoms share electrons.  
(potluck)

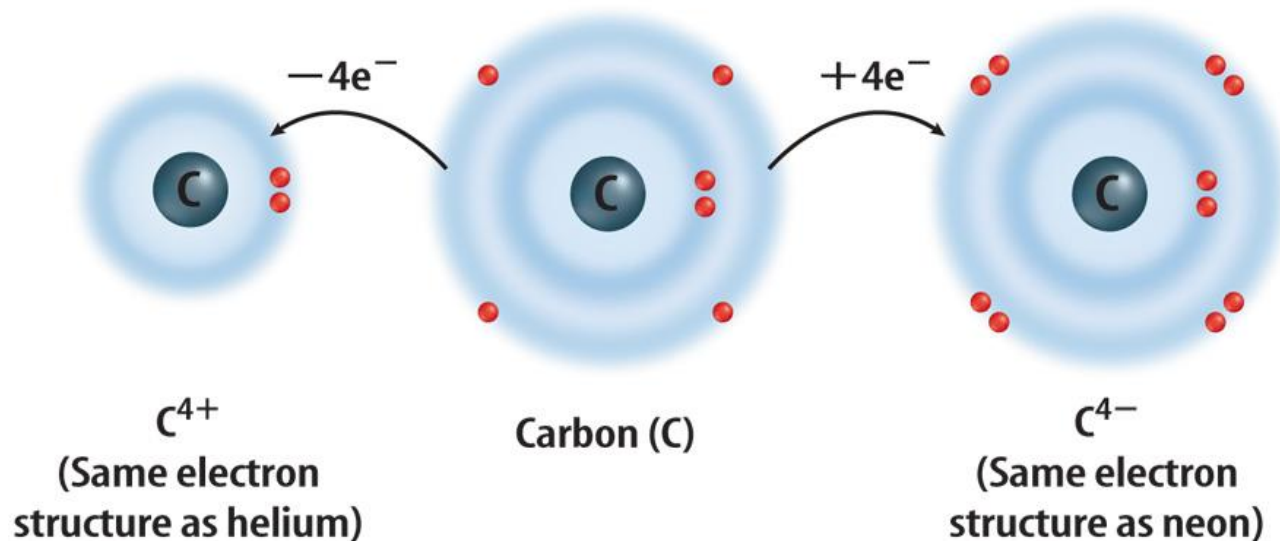


Shared Electrons



# Covalent Bonds—Sharing Electrons (cont.)

- Carbon has 4 valence electrons.
- Too much energy is needed for carbon to easily gain or lose 4 electrons.



## Covalent Bonds—Sharing Electrons (cont.)

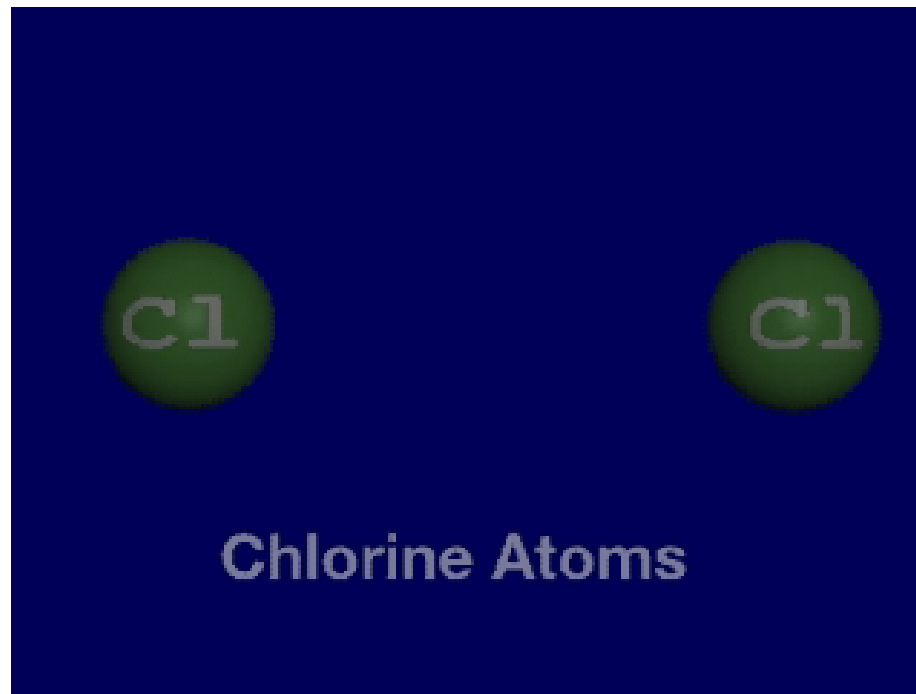
- Covalent bonds form by sharing electrons.
- Elements that are close together on the periodic table are more likely to share electrons in a covalent bond than to transfer electrons.
- *Organic compounds are covalent compounds containing carbon atoms and are important for living organisms.*



# Covalent Bonds—Sharing Electrons

(cont.)

Concepts In Motion



Resources





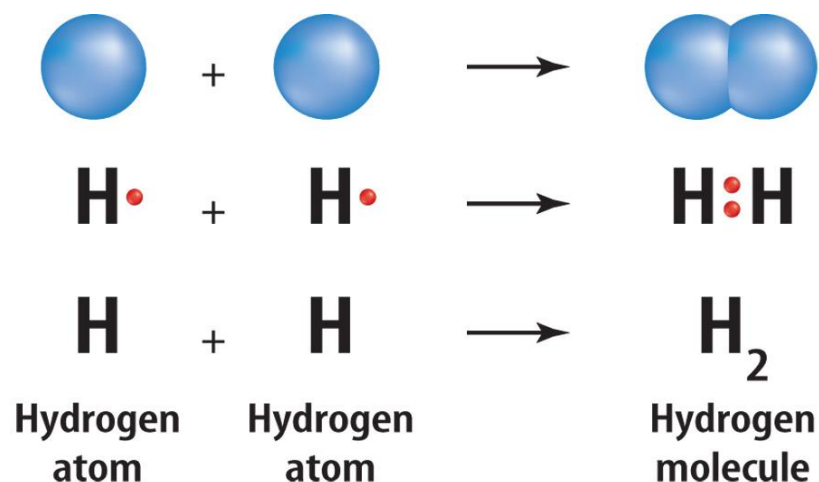
## Properties of Covalent Compounds

- Can be solids, liquids, or gases at room temperature
- Usually have lower melting and boiling points than ionic compounds
- Do not usually separate in water
- Most do not conduct electricity



## Single Covalent Bonds

- Hydrogen has one unpaired electron.
- Two hydrogen atoms share their single electrons to form a pair.



- The shared pair of electrons is a single covalent bond, which holds the hydrogen molecule  $\text{H}_2$  together.



## Double and Triple Bonds

- Some atoms may form stronger bonds by sharing more than one pair of electrons.
- A double bond has two pairs of shared electrons and is stronger than a single bond.
- A triple bond has three pairs of shared electrons and is stronger than a double bond.

