CHAPTER 19

Unit Content Map

Unit EQ: How are ionic and covalent bonds different?

Topic: Bonds

What are Chemical bonds?

Vocabulary: isotope, stable, ionic bond, covalent bond

Warm up 10.25.10
Write the standard!

- **SPS1.**
- Compare and contrast ionic and covalent bonds in terms of electron movement.

Unit 4 Vocabulary
Chapter 6

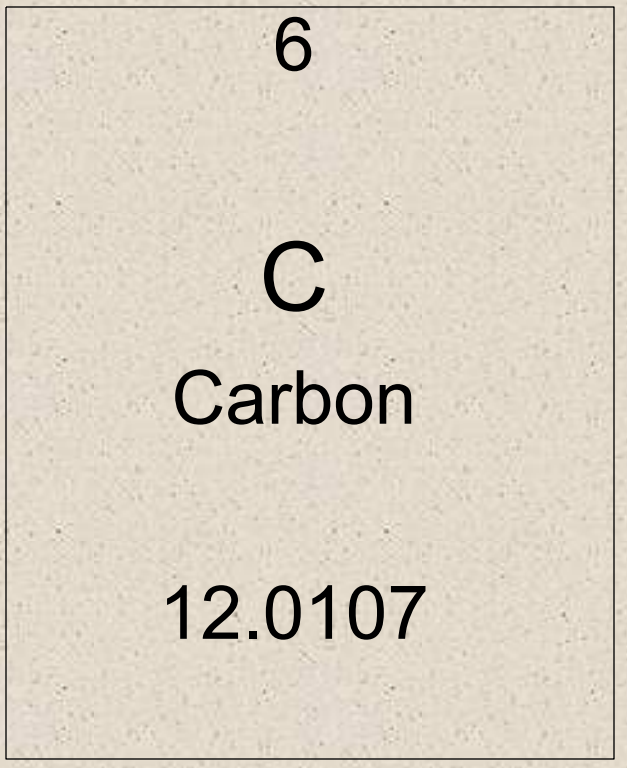
- Chemical bond (page 177)
- Ionic bond (page 184)
- Covalent bond (page 186)
- Metallic bond (page 188)
- Polyatomic ion (page 188)
- Ion (page 120 and 153)
- Cation (page 153)
- Anion (page 153)
- Oxidation number or ion charge
  - A positive or negative number that tell how many electrons must be lost or gained to become stable

Warm up 10.30.14

$2Ca_3(PO_4)_2$

- Tell how many of each atom are in the compound above.

Review

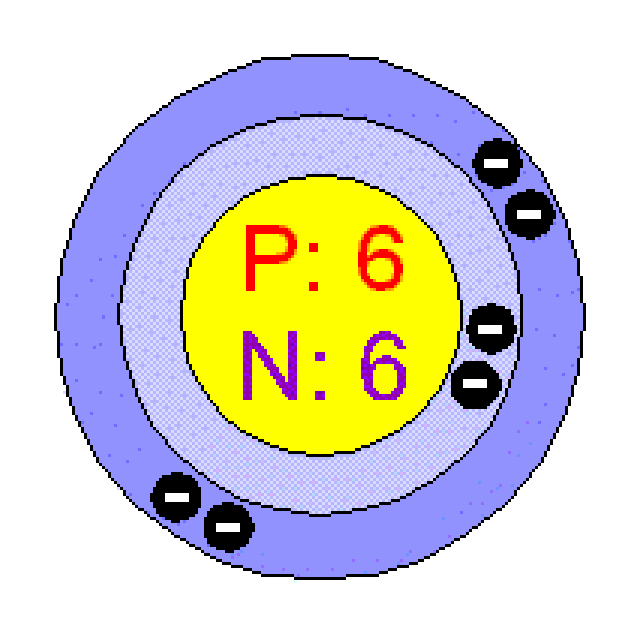


Atomic Number:
Number of protons

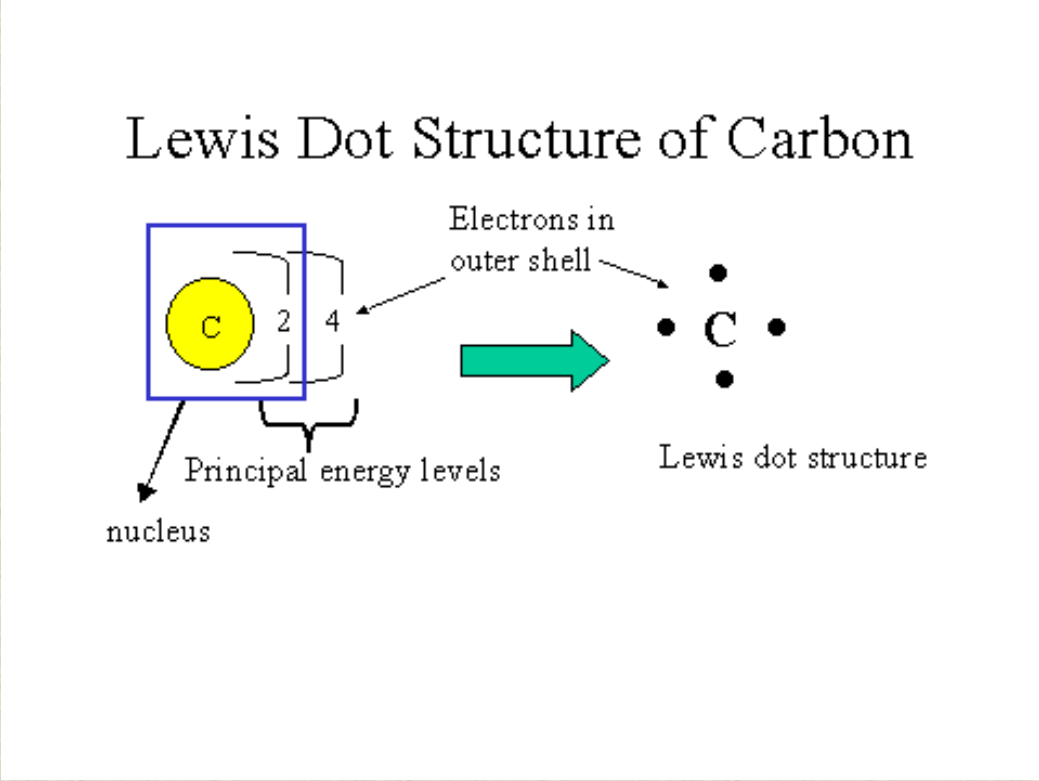
Atomic Mass: Protons + neutrons

Drawing of atoms

- Bohr Model



- Lewis Dot Diagram



Isotopes

- Atoms of the same number of protons and electrons, but with different numbers of neutrons

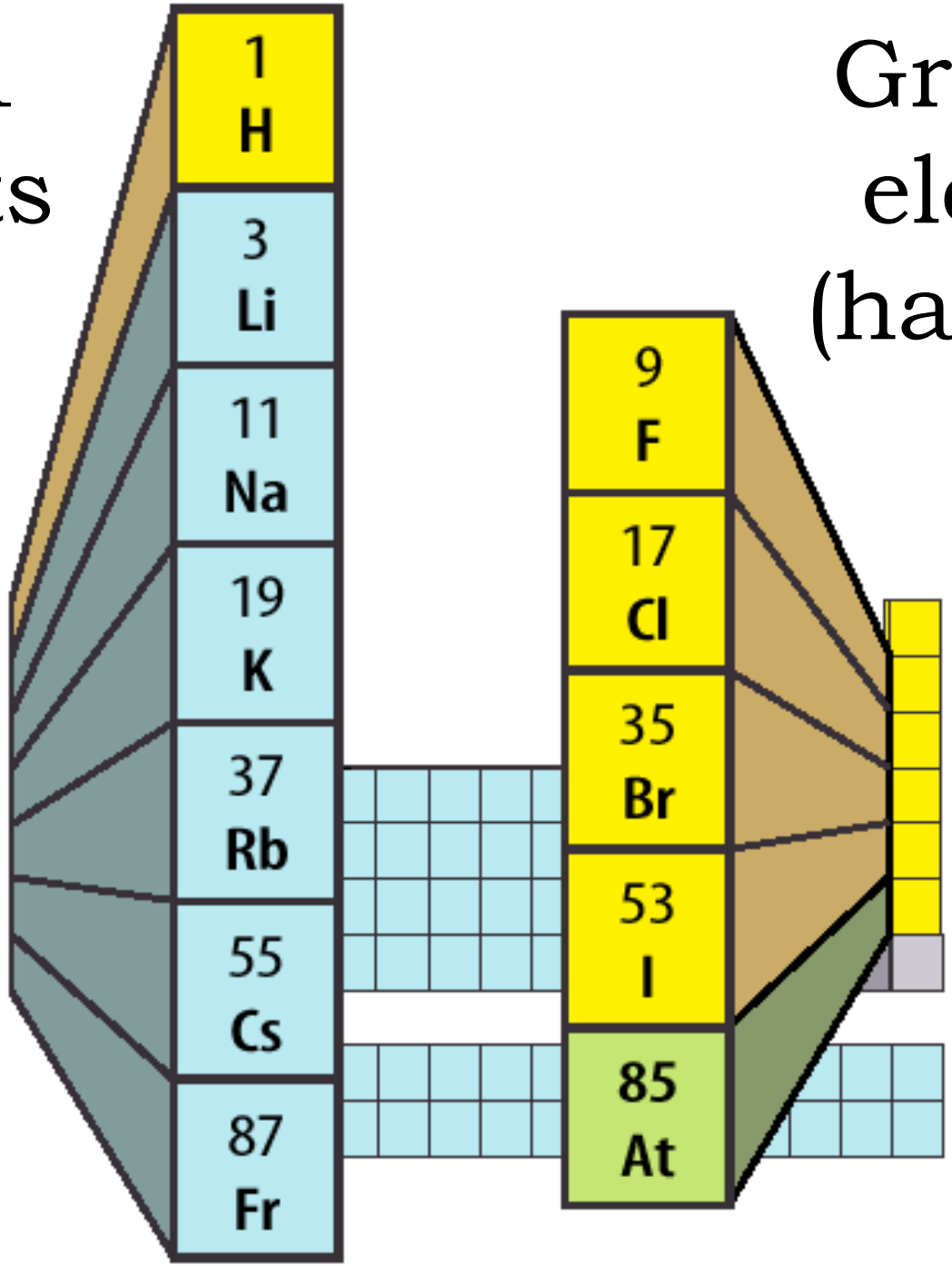
- Carbon-12 (stable)
- Carbon-14 (radioactive dating)

BONDING

- Atoms will form compounds when they’re more stable than atoms that are separate.

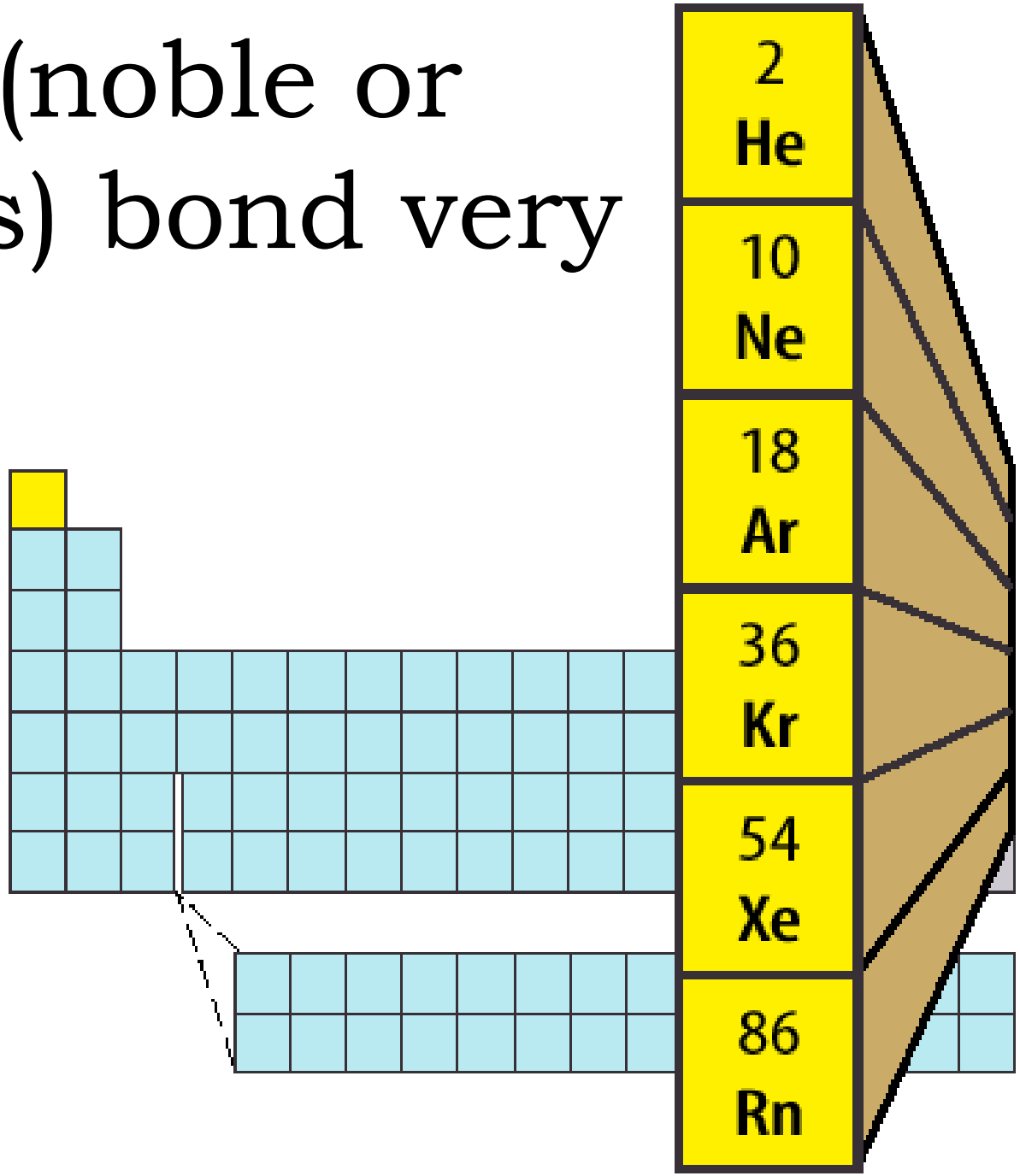
- Stable Atom: Full outer shell of electrons

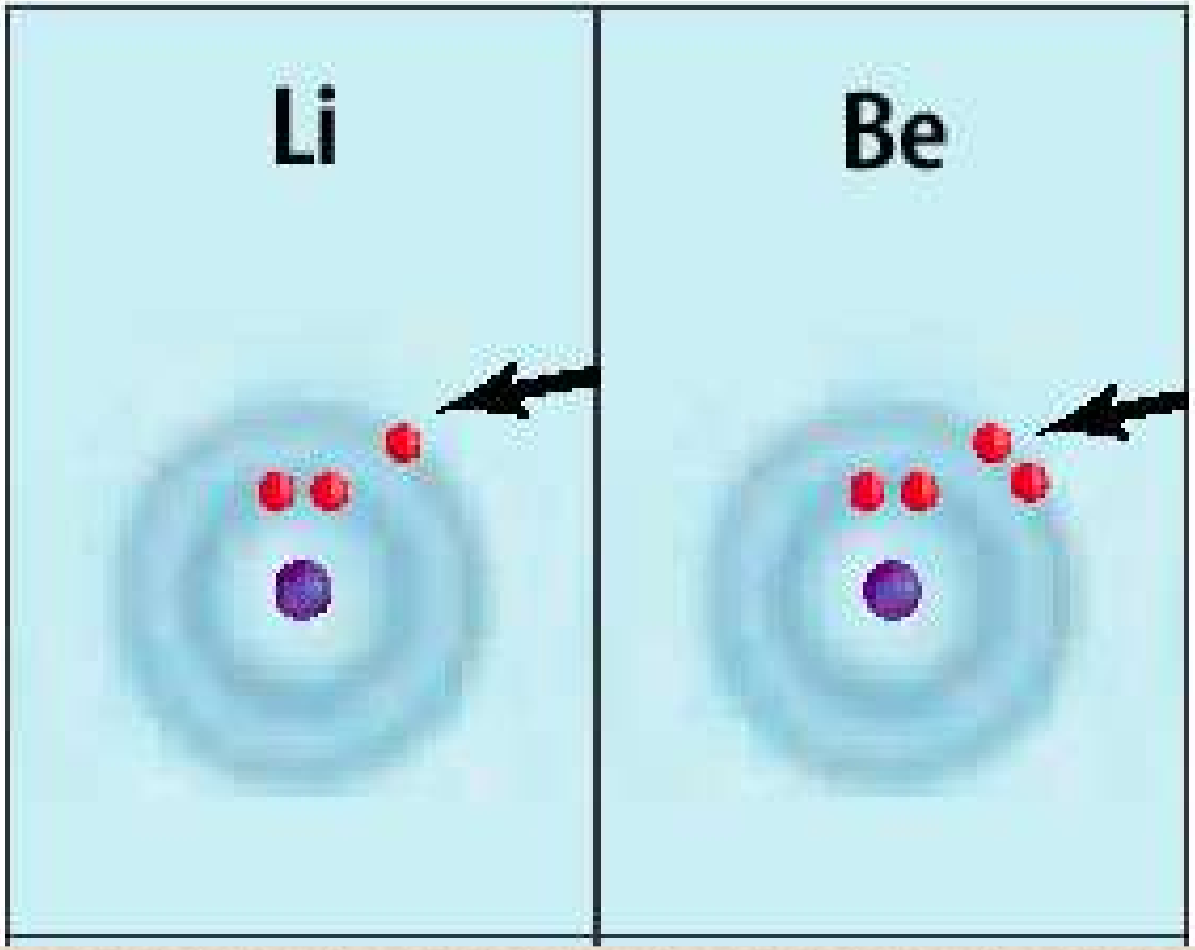
Group 1 elements (alkali metals) bond easily.



Group 17 elements (halogens) bonds easily.

Group 18 (noble or inert gases) bond very rarely.





Why do some atoms bond while others don't?

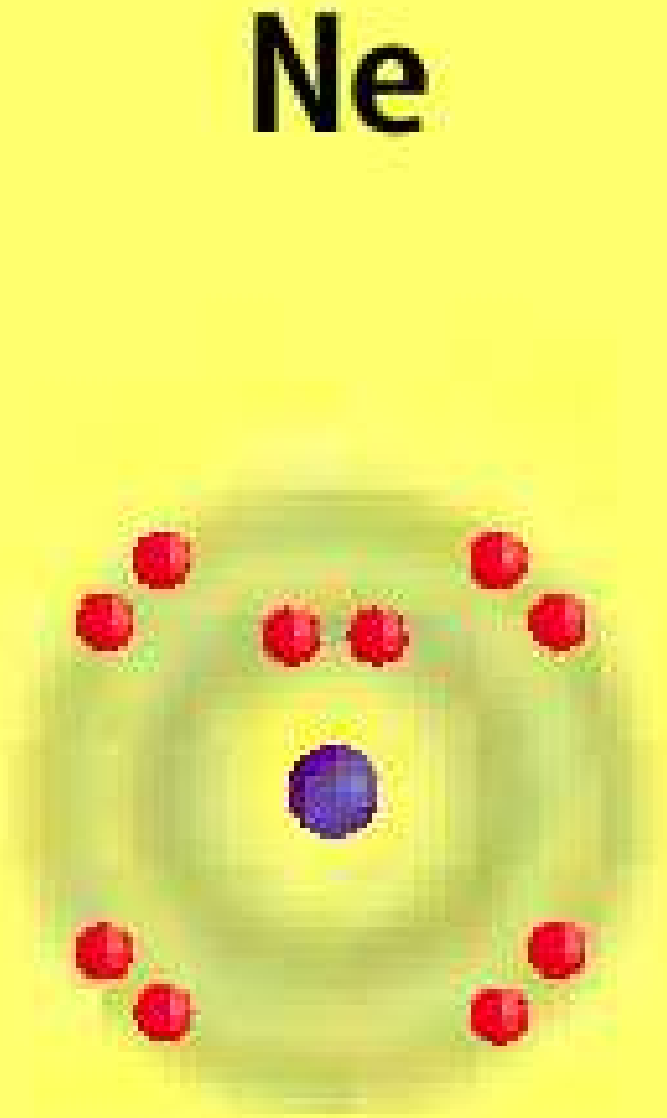
It's because of their VALENCE ELECTRONS (electrons in the outermost energy level).

OCTET RULE

Atoms will form bonds if it causes all atoms involved to have a stable outer energy level of 8 electrons.

(H & He are exceptions. Why?)

An atom already having 8 valence electrons is stable (Group 18, noble gases) and rarely reacts with other elements.



CHEMICAL BONDS

To become stable atoms form bonds

When 2 or more atoms (same or different elements) lose, gain or share electrons.

They are written as a chemical formula).

When elements combine, they no longer have the same properties.

Complete outer energy levels are formed by bonding

- Two types of bonds
- Ionic and covalent bonds

Warm up10.28.09

- Write the family names for the following groups
  - Group 1
  - Group 2
  - Group 3-12
  - Group 17
  - Group 18
- Why are noble gases stable?

UNIT CONTENT MAP

- Topic Ionic Bond
- EQ: What is an ionic bond?
- Vocab: ion, oxidation number, ionic bond

: **IONIC BONDING**

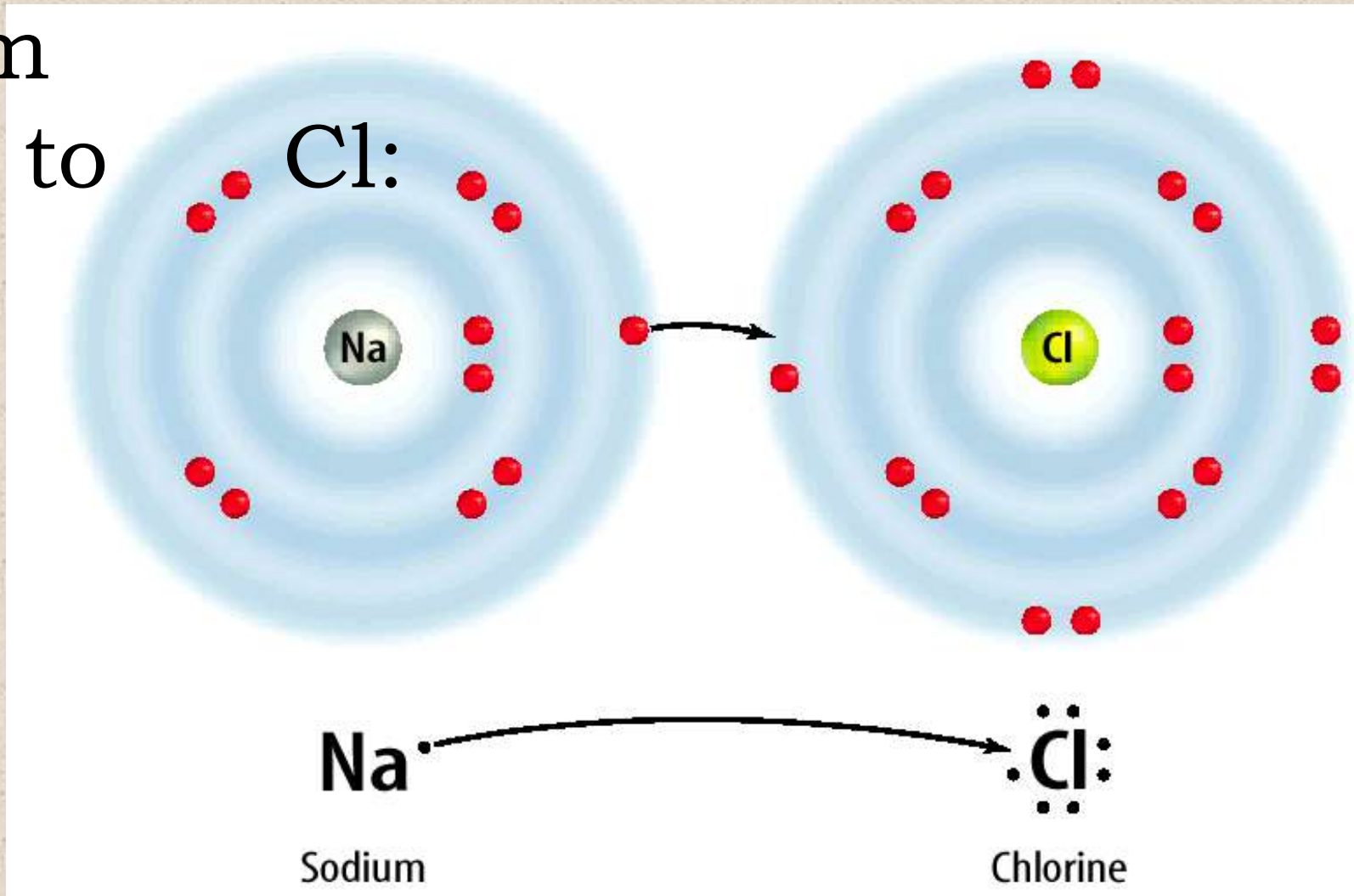
Between a metal and nonmetal

Electrons are lost or gained (transferred)

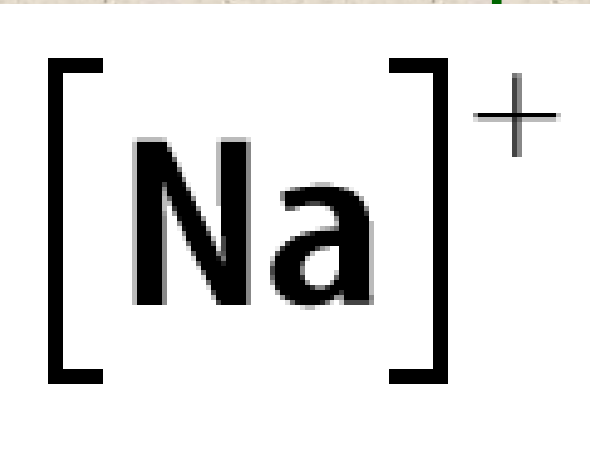
Forming ions (electrically charged particles),

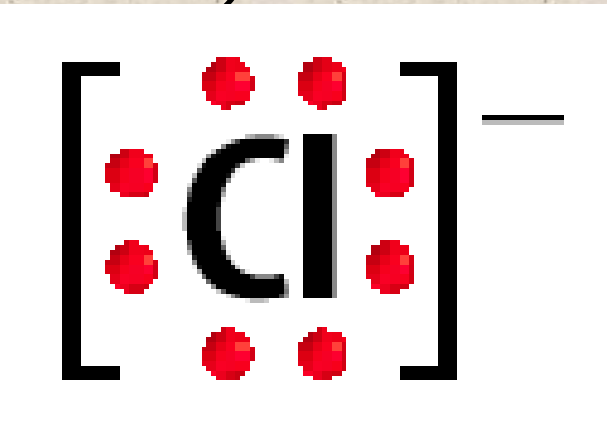
NaCl, sodium chloride (table salt)

Because the electron transfers from Na to Cl:



a) the Na atom now has a positive electric charge, called a positive ion, Na^+; and

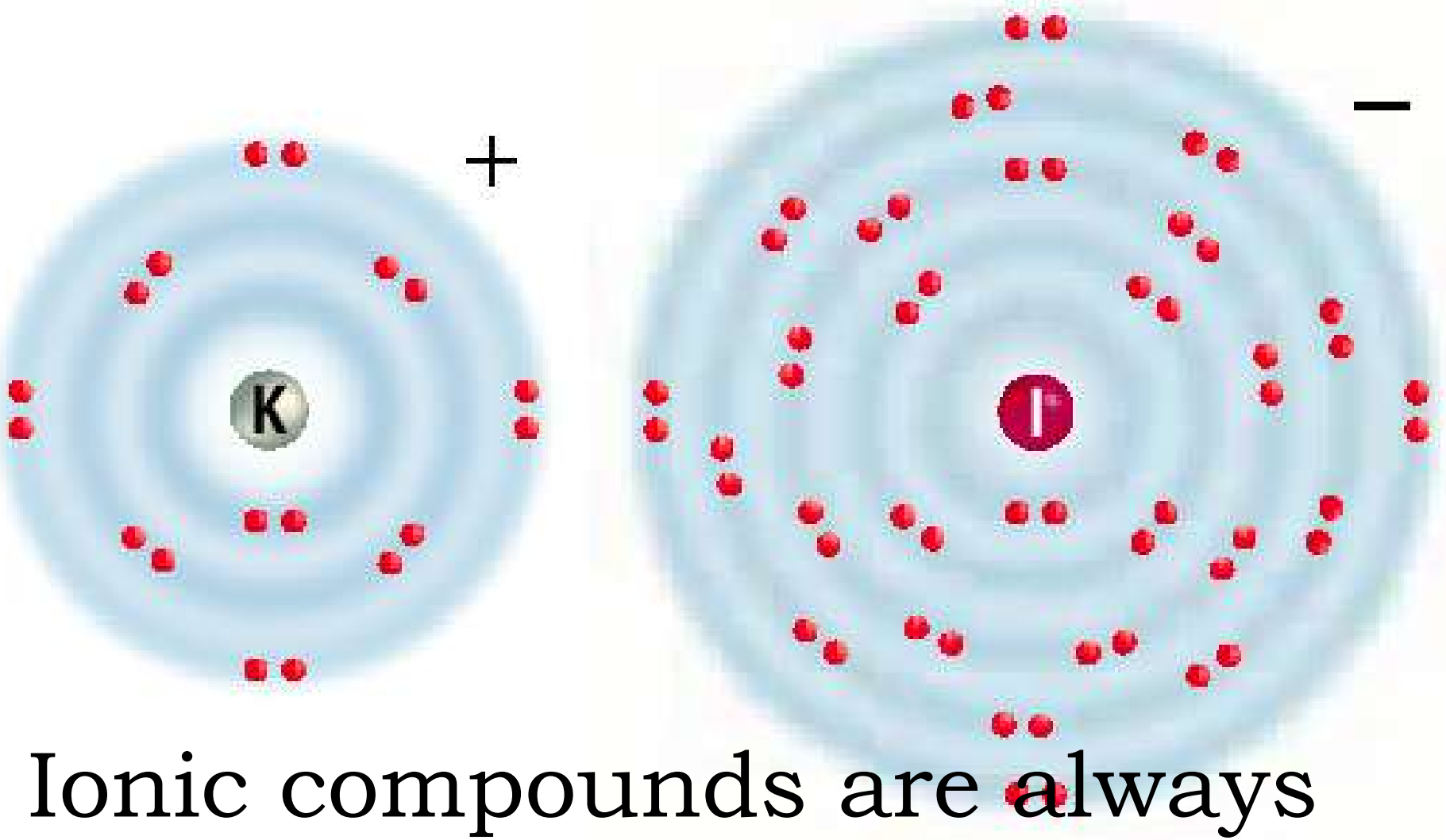




b) the Cl atom now has a negative electric charge, called a negative ion, Cl^-.

Oppositely charged particles (ions) attract and form neutral compounds.

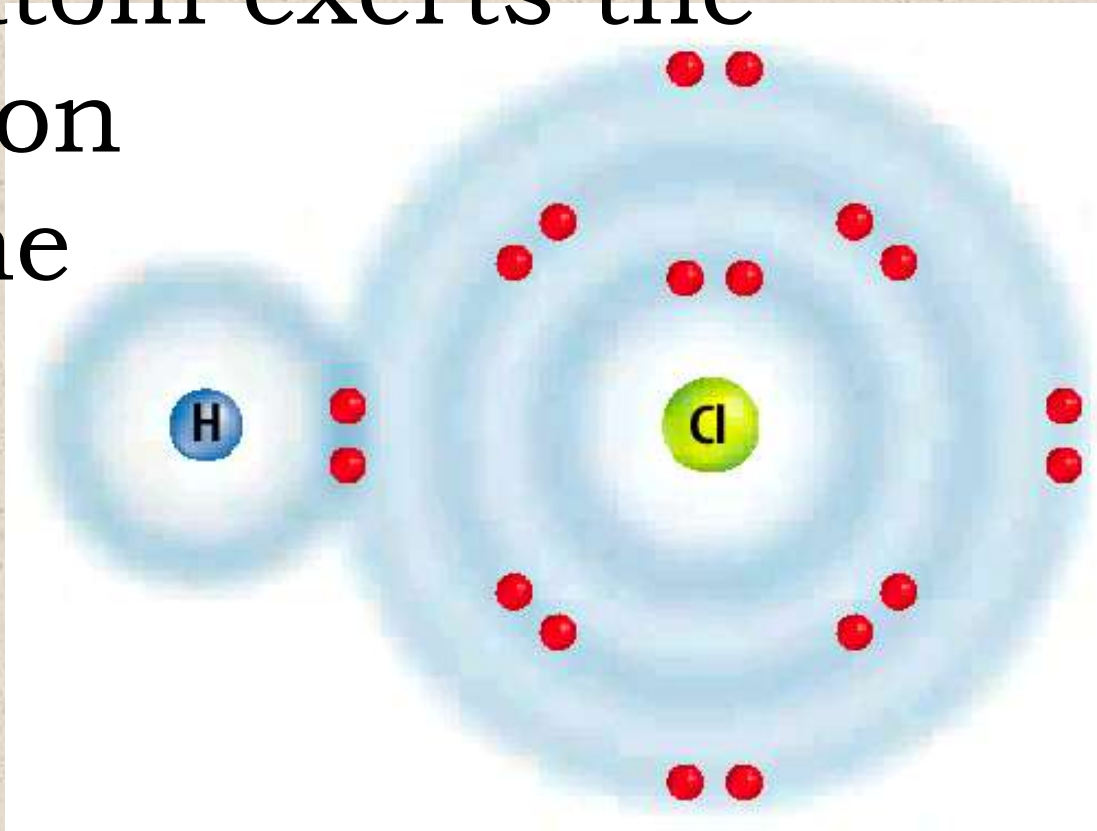
The sum of the charges on the ions together is always zero.



Ionic compounds are always made of a metal (positive ion) and a nonmetal (negative ion).

HCl, hydrogen chloride (hydrochloric acid/stomach acid)

The greater number of protons in the chlorine atom exerts the stronger pull on hydrogen's one electron. This forms hydrochloric acid in water.



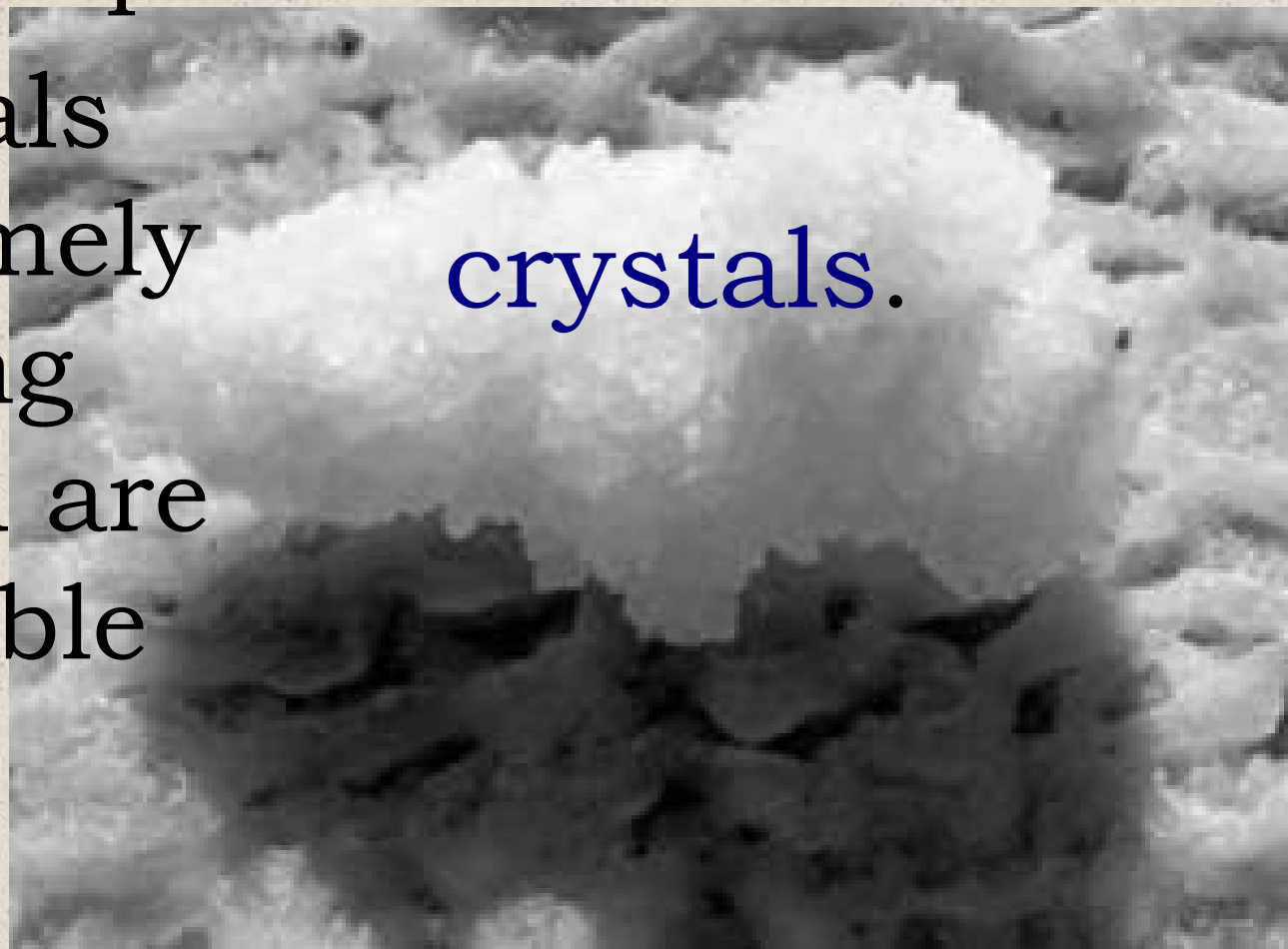
Sometimes single elements are replaced by groups of covalently bonded nonmetals called polyatomic ions.

Table 4 Polyatomic Ions

Charge	Name	Formula
1+	ammonium	NH_4^+
1–	acetate	$C_2H_3O_2^-$
	chlorate	ClO_3^-
	hydroxide	OH^-
	nitrate	NO_3^-
2–	carbonate	CO_3^{2-}
	sulfate	SO_4^{2-}
3–	phosphate	PO_4^{3-}

The strong electrical attraction in ionic bonds causes them to form regularly shaped structures called crystals.

Ionic crystals have extremely high melting points, and are highly soluble in H_2O.



Some crystals absorb moisture from their surroundings. These compounds are called hydrates.

This humidity detector uses cobalt (II) chloride, $CoCl_2 \cdot 6\ H_2O$.

Warm up: Fill in notes on your outline
COVALENT BONDING

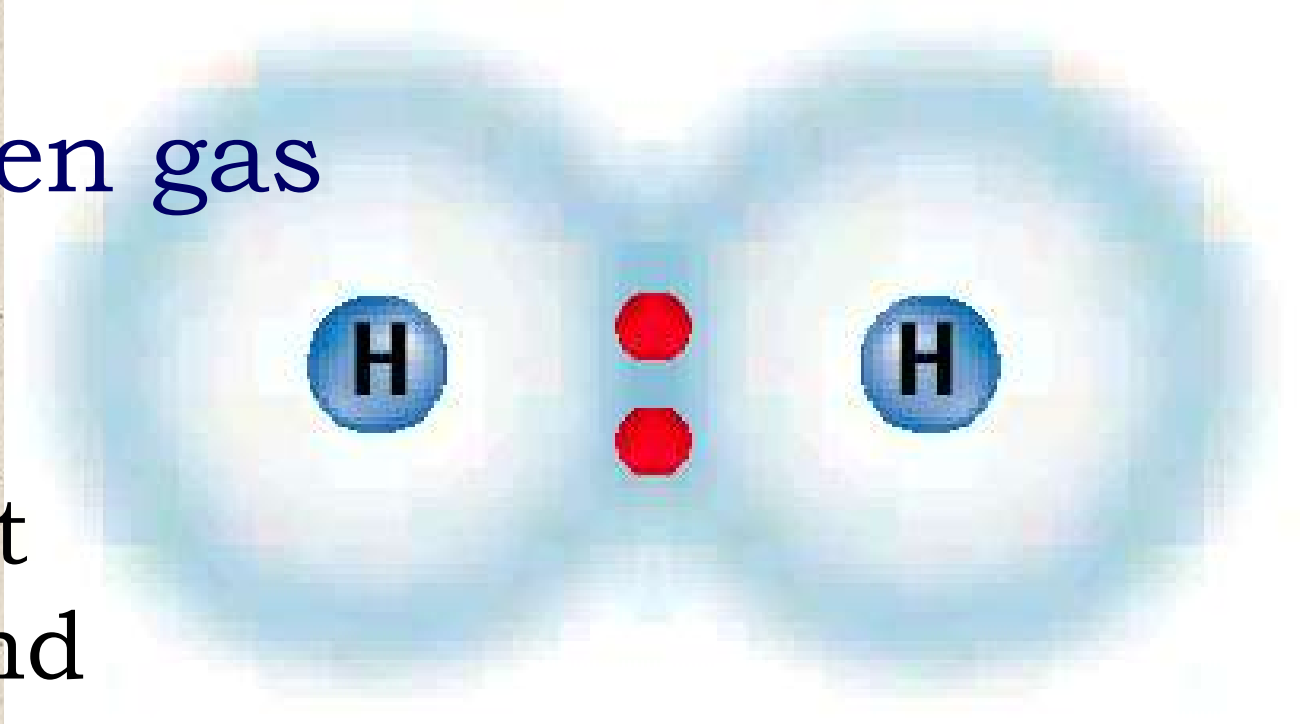
- Between nonmetal and nonmetal
- Electrons are shared!
- Forms a molecule
  - Polar molecule: molecules has a positive and negative ends.
- Can form single, double, or triple bonds

B. COVALENT BONDING

Force of attraction as nonmetallic atoms share electrons to form molecules.

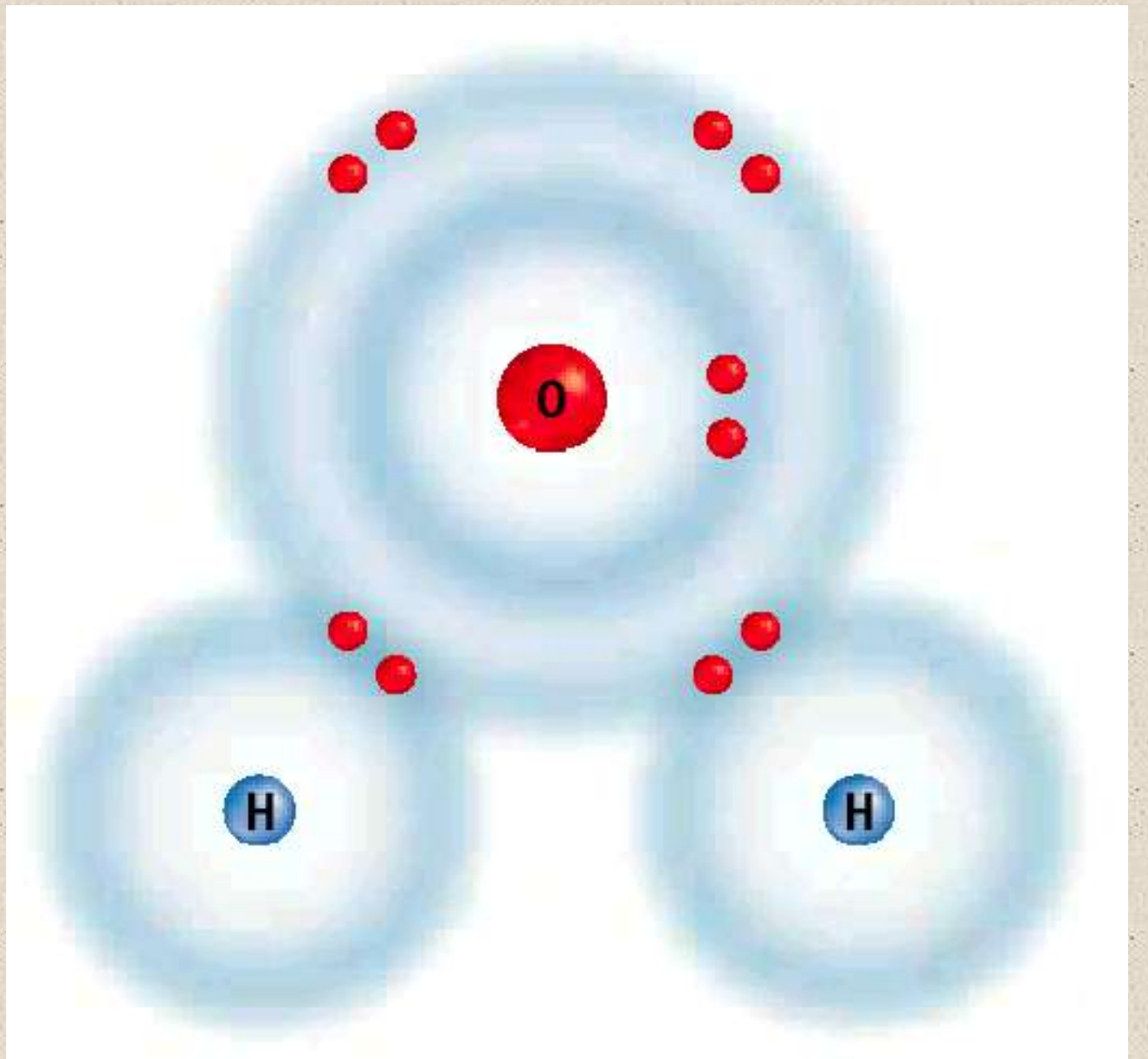
Covalent molecules are not soluble in H_2O, & have low melting pts. & vaporize easily so they have a smell).

H_2, hydrogen gas

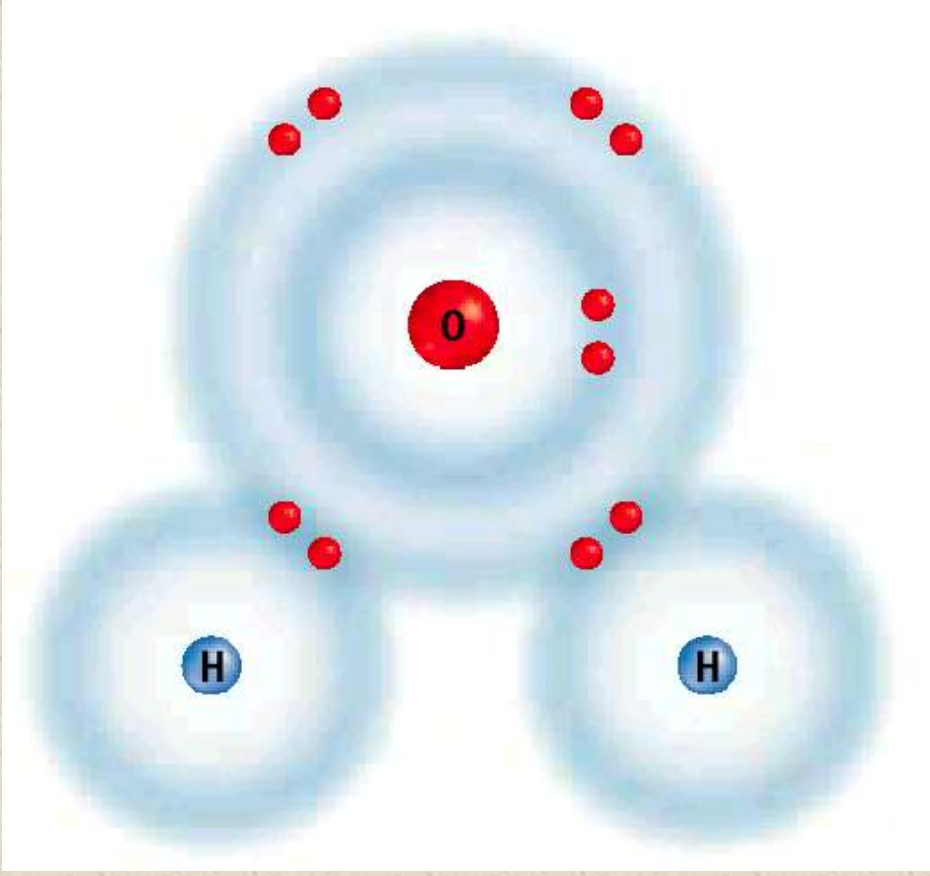


The simplest covalent bond is when two hydrogen atoms share their one electron each to form a diatomic molecule (2 atoms of the same element). The pair of electrons, (one from each atom) merges into one energy level about the two H nuclei.

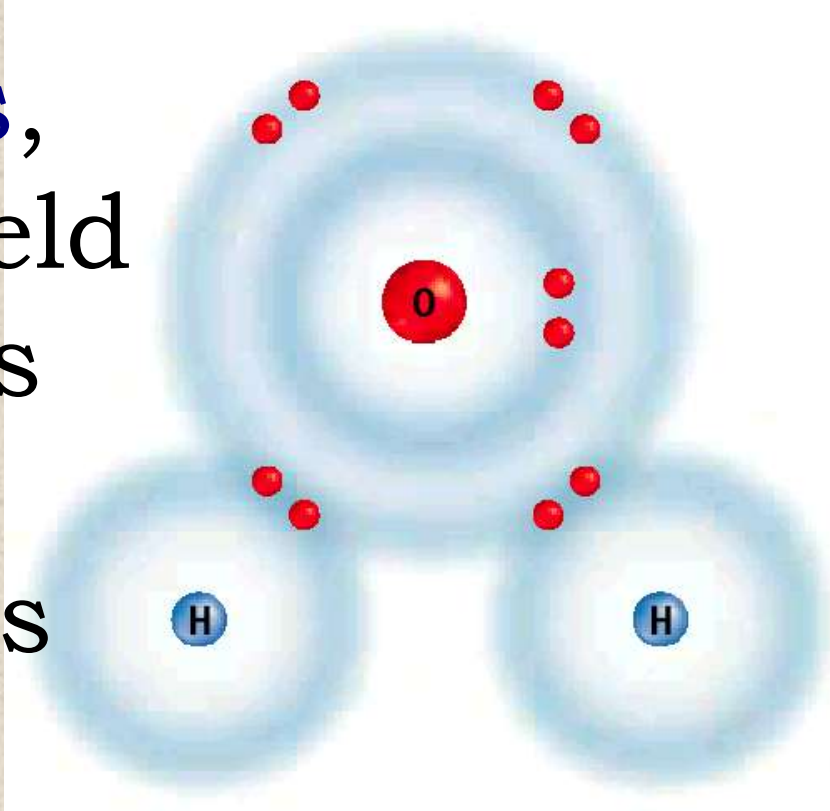
H_2O, dihydrogen monoxide (water)

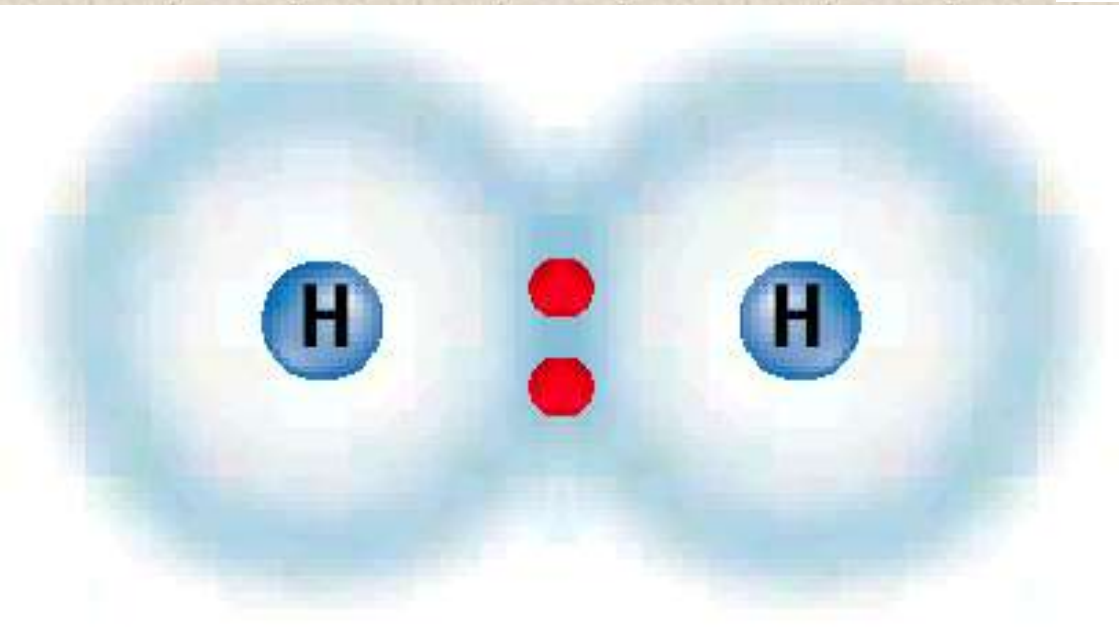


The strength of covalent bonds comes from the attraction of the positively charged nuclei for the negative electrons. Electrons shared in a molecule are held more closely to atoms with the larger nucleus.



In polar molecules, electrons are not held evenly so one end is slightly negative and the other end is slightly positive.

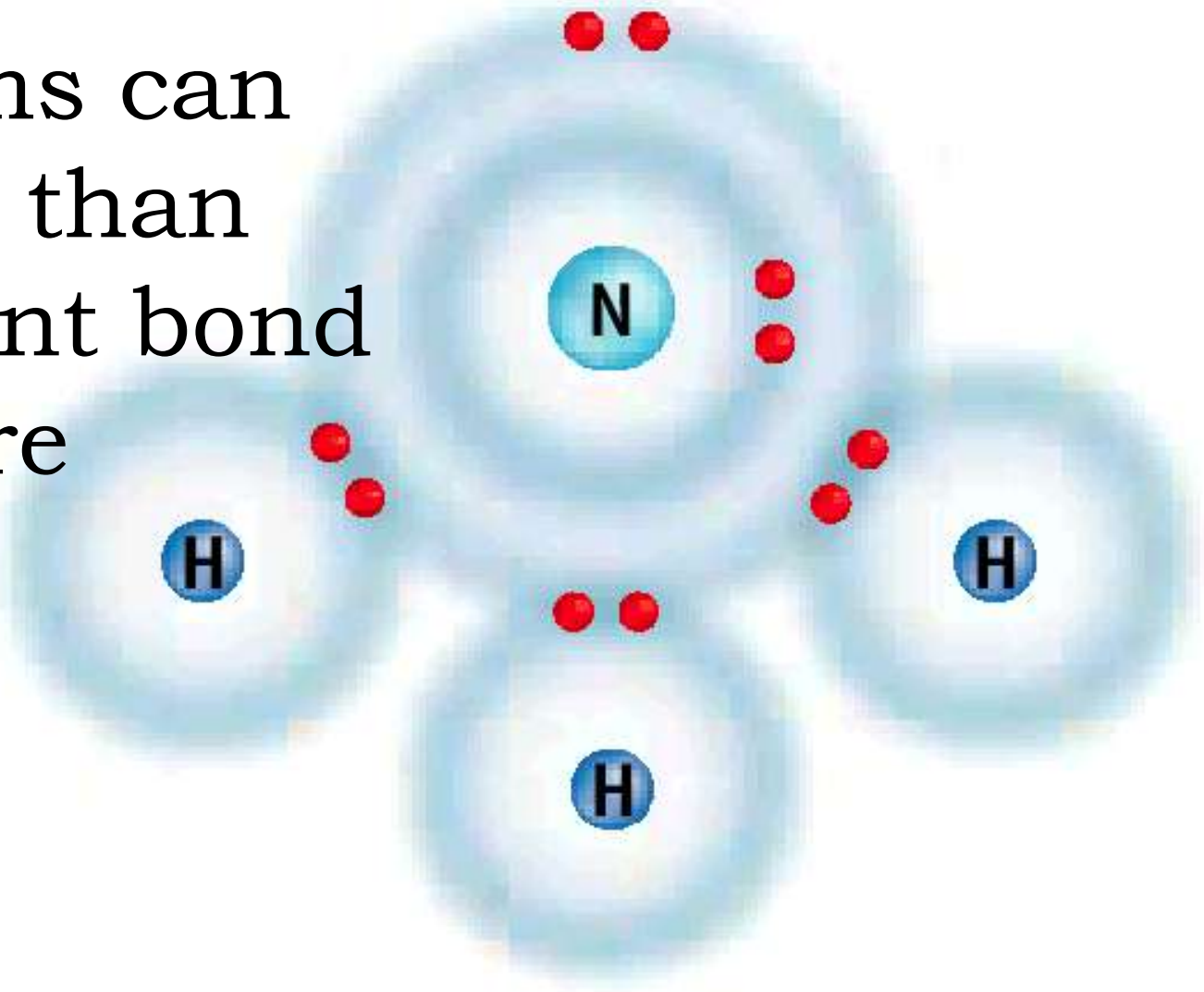




In nonpolar molecules, electrons are shared evenly.

NH_3, nitrogen trihydride (ammonia)

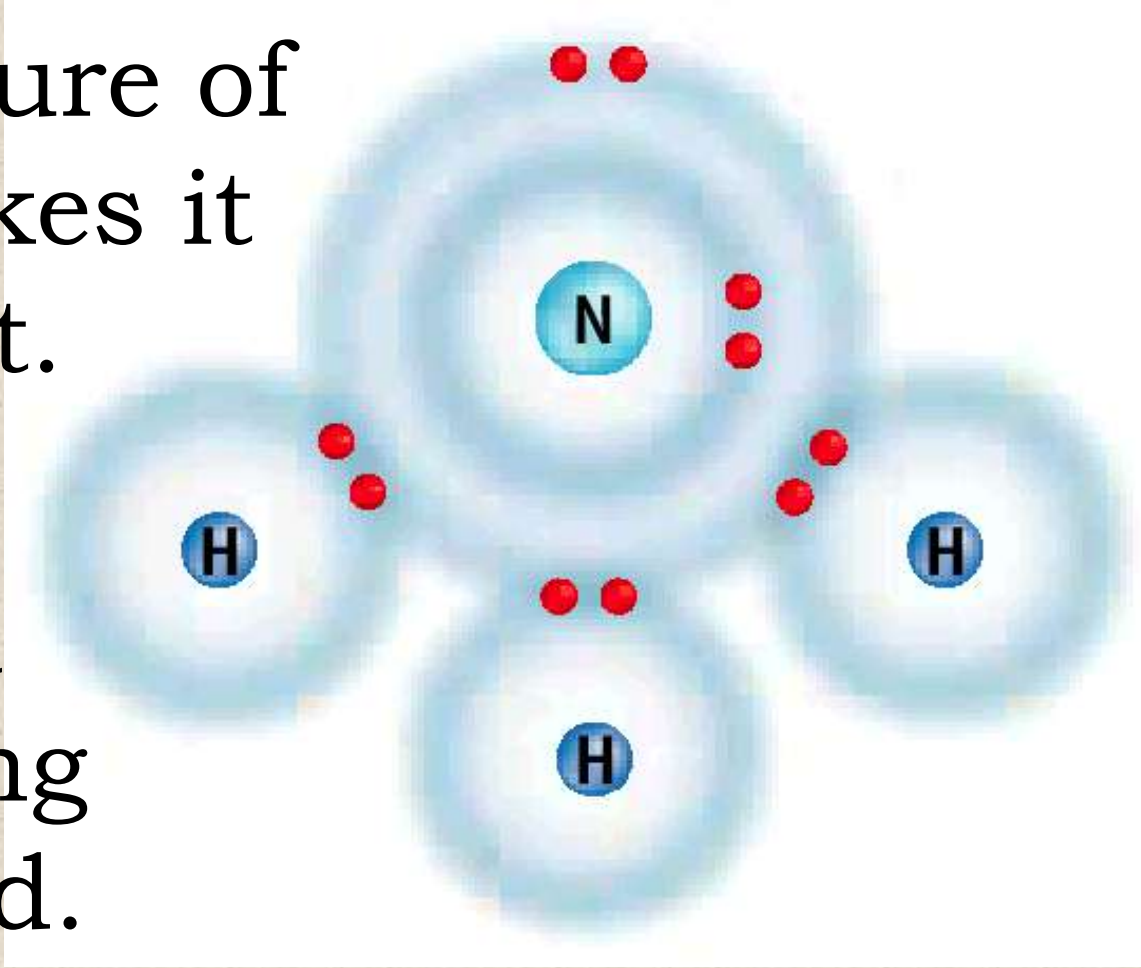
Some atoms can form more than one covalent bond (share more than one pair of electrons).



Nitrogen shares 3 electrons with each of the 3 hydrogen atoms forming 3 double covalent bonds.

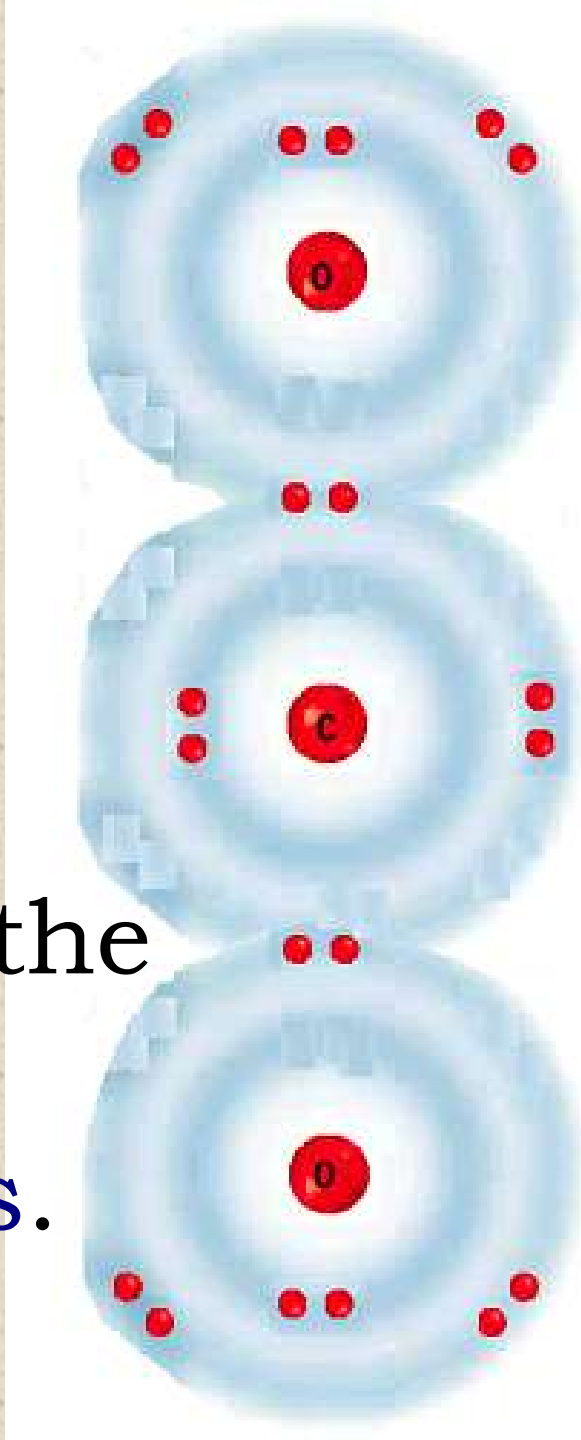
The polar nature of ammonia makes it a good solvent.

Ammonia is a strong smelling cleaning liquid.



CO_2, carbon dioxide

Carbon has 4 valence electrons and oxygen has 6. The C atom shares 2 electrons with one O atom and 2 with the other O atom forming 2 double covalent bonds.



Covalent compounds are named using Greek prefixes before the names of the nonmetals.

Table 5 Prefixes for Covalent Compounds

Number of Atoms	Prefix
1	*mono-*
2	*di-*
3	*tri-*
4	*tetra-*
5	*penta-*
6	*hexa-*
7	*hepta-*
8	*octa-*

Page 39
Ionic vs covalent bonds

- Create a Venn diagram

Warm up 11.2.10

- Write one difference between ionic and covalent bond.

- NOT THE SAME AS YOUR NEIGHBORS