

# Lesson 5

Chemistry 0

Fall 2021, L. Tracey Gao



## Key Concepts

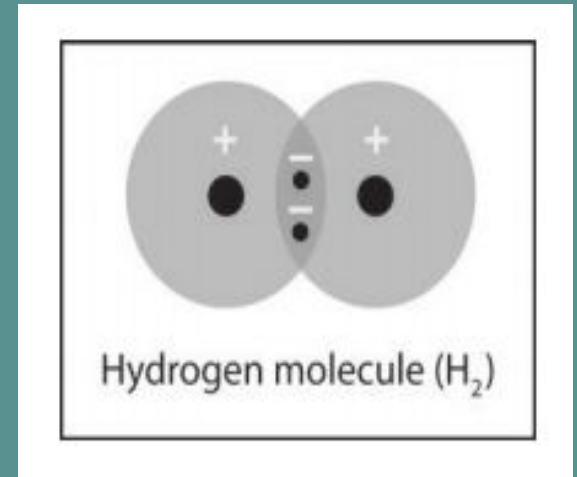
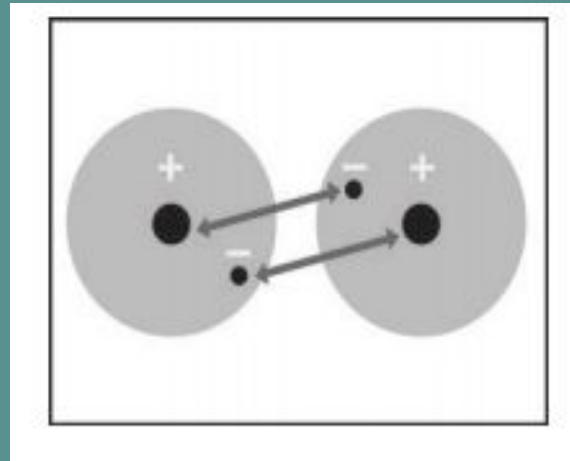
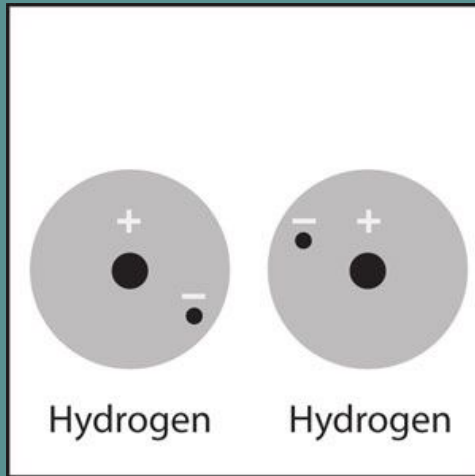
- The electrons on the outermost energy level of the atom are called valence electrons.
- The valence electrons are involved in bonding one atom to another.













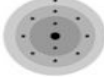
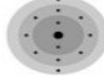

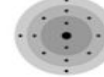

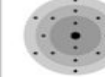




## Question

- If atoms have an equal number of protons and electrons, why do atoms bond to other atoms? Why don't they just stay separate?

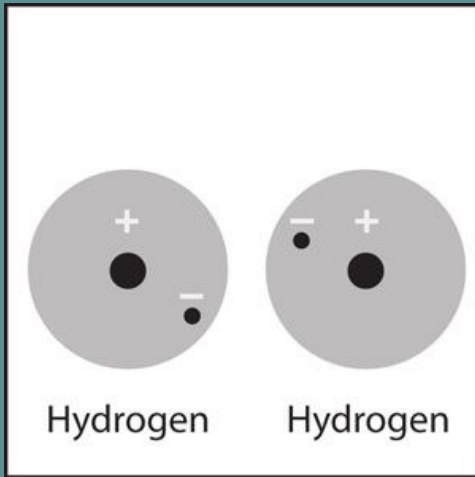
# Use Hydrogen ( $H_2$ ) as an example



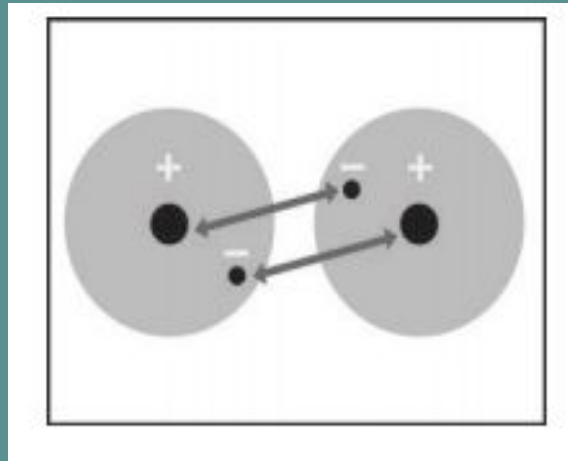
# Energy Levels Model

<b>ENERGY LEVELS ELEMENTS 1-20</b>							
<b>HYDROGEN</b> 1  1.01							<b>HELIUM</b> 2  4.00
<b>LITHIUM</b> 3  6.94	<b>BERYLLIUM</b> 4  9.01	<b>BORON</b> 5  10.81	<b>CARBON</b> 6  12.01	<b>NITROGEN</b> 7  14.01	<b>OXYGEN</b> 8  16.00	<b>FLUORINE</b> 9  19.00	<b>NEON</b> 10  20.18
<b>SODIUM</b> 11  22.99	<b>MAGNESIUM</b> 12  24.31	<b>ALUMINUM</b> 13  26.98	<b>SILICON</b> 14  28.09	<b>PHOSPHORUS</b> 15  30.97	<b>SULFUR</b> 16  32.07	<b>CHLORINE</b> 17  35.45	<b>ARGON</b> 18  39.95
<b>POTASSIUM</b> 19  39.10	<b>CALCIUM</b> 20  40.08						

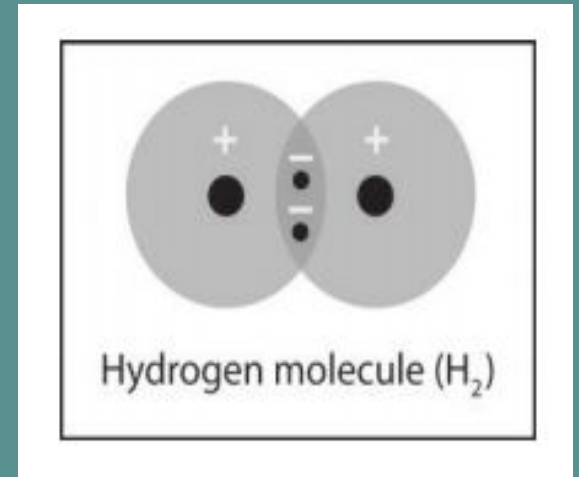
# Use Hydrogen ( $H_2$ ) as an example



Two hydrogen atoms are near each other.



When two hydrogen atoms come close enough to each other, their electrons are attracted to the proton of the other atom.



Because there is both a strong enough attraction between atoms and room for electrons in the outer energy level of both atoms, the atoms share electrons.

This forms a covalent bond.



# Covalent Bonding for Hydrogen Molecule

There are two main reasons why two hydrogen atoms bond together to make one hydrogen molecule:

- There needs to be a strong enough attraction between the electrons of each atom for the protons of the other atom.
- There needs to be room in the outer energy level of both atoms.

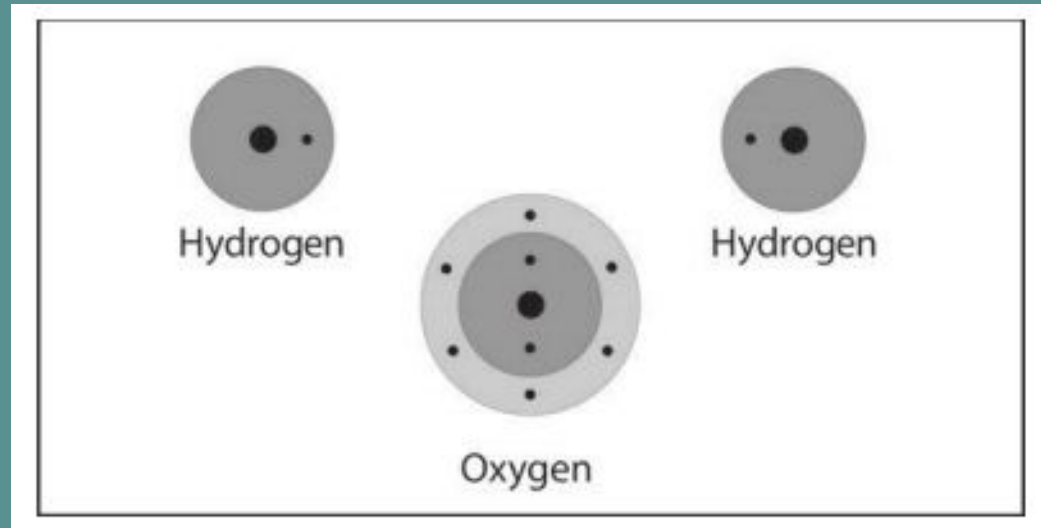


## Key Concepts about Covalent Bond

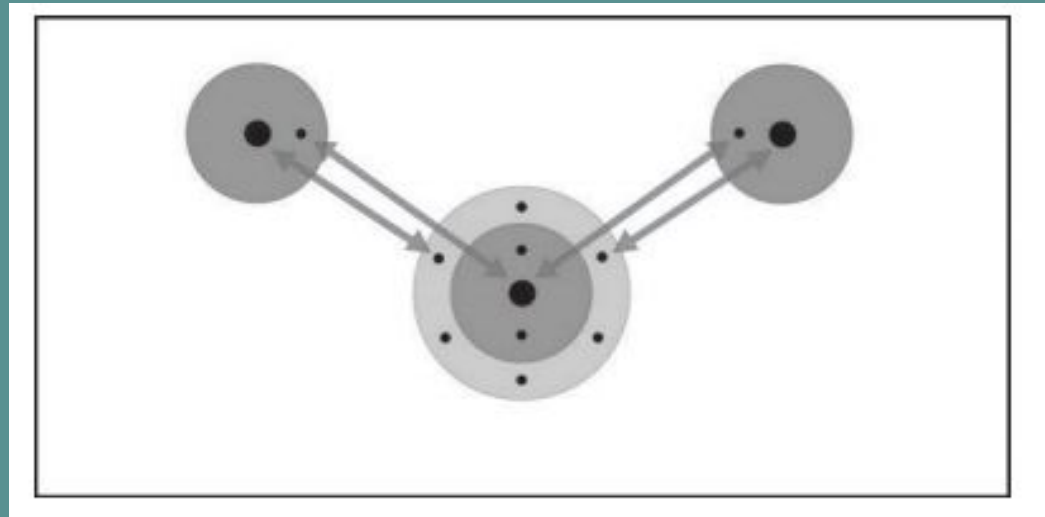
- The sharing of electrons between atoms is called a covalent bond, which holds the atoms together as a molecule.
- A covalent bond happens if the attractions are strong enough in both atoms and if each atom has room for an electron in its outer energy level.
- Atoms will covalently bond until their outer energy level is full.
- Atoms covalently bonded as a molecule are more stable than they were as separate atoms.



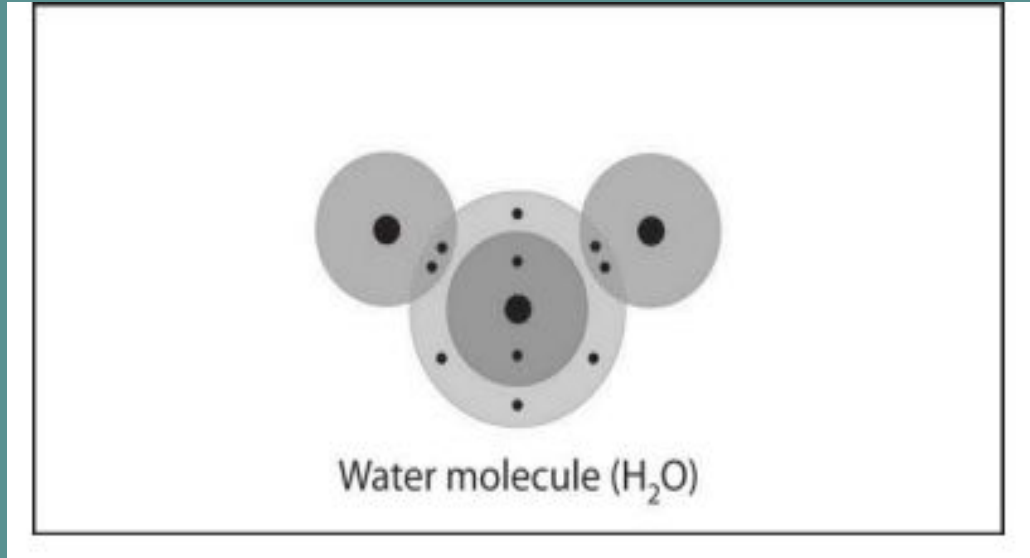
# Water Molecules (H<sub>2</sub>O)



# Water Molecules (H<sub>2</sub>O)

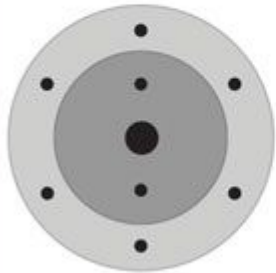


# Water Molecules ( $\text{H}_2\text{O}$ )



Why can't a third hydrogen atom join the water molecule ( $\text{H}_2\text{O}$ ) to make  $\text{H}_3\text{O}$ ?

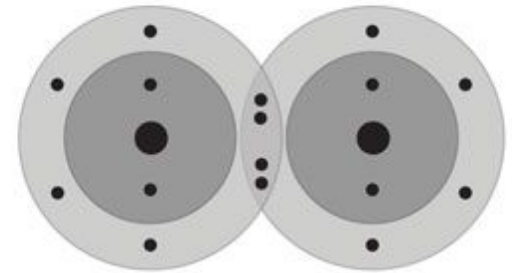
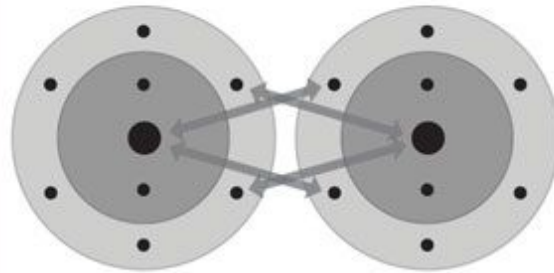
# Oxygen Molecules ( $O_2$ )



Oxygen

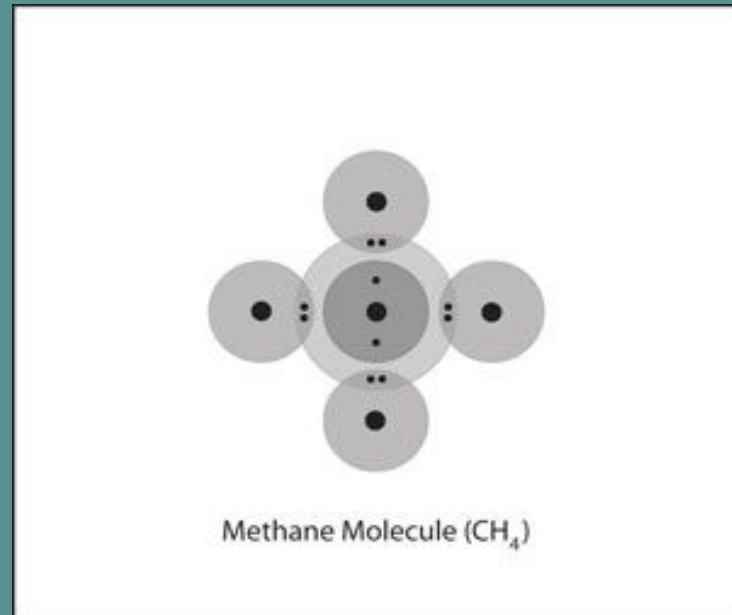
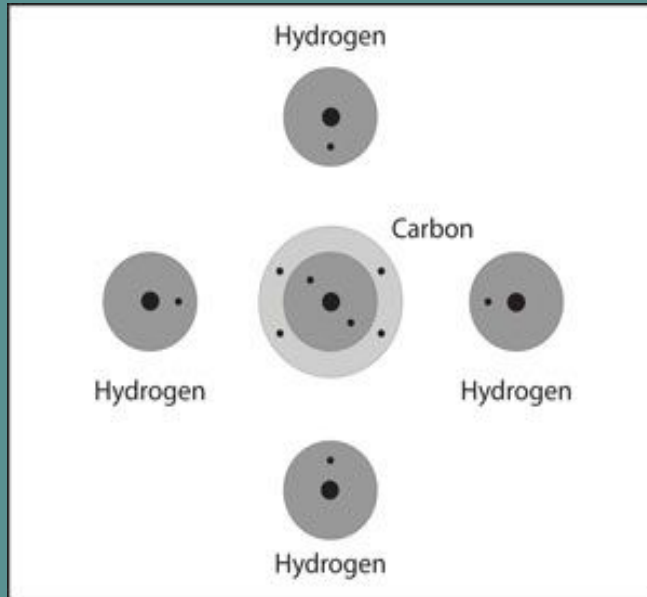


Oxygen



Oxygen Molecule ( $O_2$ )

# Methane (CH<sub>4</sub>)



# Carbon Dioxide (CO<sub>2</sub>)



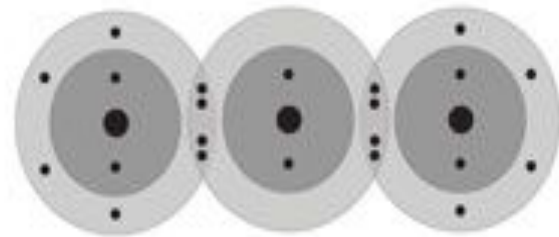
Oxygen



Carbon



Oxygen



Carbon Dioxide Molecule (CO<sub>2</sub>)

## Electrolysis



- Electricity breaks the covalent bond between hydrogen and oxygen in the water molecule.
- Two hydrogen atoms covalently bond to form hydrogen gas.
- Two oxygen atoms covalently bond to form oxygen gas.
- There are twice as many hydrogen atoms as oxygen atoms so more hydrogen gas is formed.



## Key Concepts

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- Atoms will covalently bond until their outer energy level is full.
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