**Chemical Bonding Notes**

Elements and the atoms that make them up are most often found in nature as **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Ecology of Atoms describes:

REVIEW

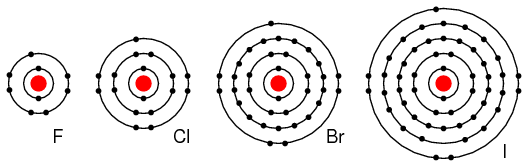
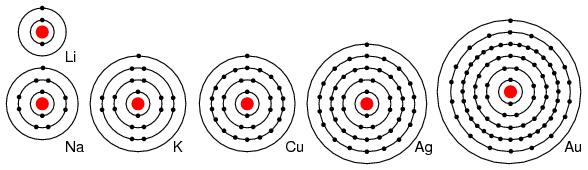
How would you draw an atom?

What is the shell model of the atom?

|  |  |  |
| --- | --- | --- |
| * Helium | * Oxygen | * Chlorine |

Valence Electrons - Electrons in the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** that are responsible for **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Electron Dot Structure - map out only the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Electron Dot Structure Tells You 2 Important Things:

1. How many **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
2. How many **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Paired Valence Electrons

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Unpaired Valence Electrons

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Ultimate Goal - To Be **\_\_\_\_\_\_\_\_\_\_\_\_**! Have the entire outer shell **\_\_\_\_\_\_\_\_\_\_** and **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Filling the Valence Shell **- \_\_\_\_\_\_\_\_** or **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** with other atoms through **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Noble Gases **- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,** almost neverbond with other atoms

**Why?**

Octet Rule- Atoms tend to **\_\_\_\_\_\_\_\_\_\_\_**, **\_\_\_\_\_\_\_\_\_**, or **\_\_\_\_\_\_\_\_\_\_\_** electrons to have a **\_\_\_\_\_\_\_\_\_\_\_\_\_** outer valence shell

* Groups 1-3 will **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* Groups 5-7 will **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* Group 4 will **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**3 Types of Chemical Bonds**

**IONIC BONDS**

Atoms are **\_\_\_\_\_\_\_\_\_\_\_\_\_** -They have the same number of **\_\_\_\_\_\_\_\_\_\_\_\_** and **\_\_\_\_\_\_\_\_\_\_\_\_\_**

However…

* To gain **\_\_\_\_\_\_\_\_\_\_\_\_\_**, an atom may give up or gain electrons to have a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Ion - An atom with a **\_\_\_\_\_\_\_\_\_\_\_\_** or **\_\_\_\_\_\_\_\_\_\_\_\_\_** charge

* + Cation –
  + Anion –

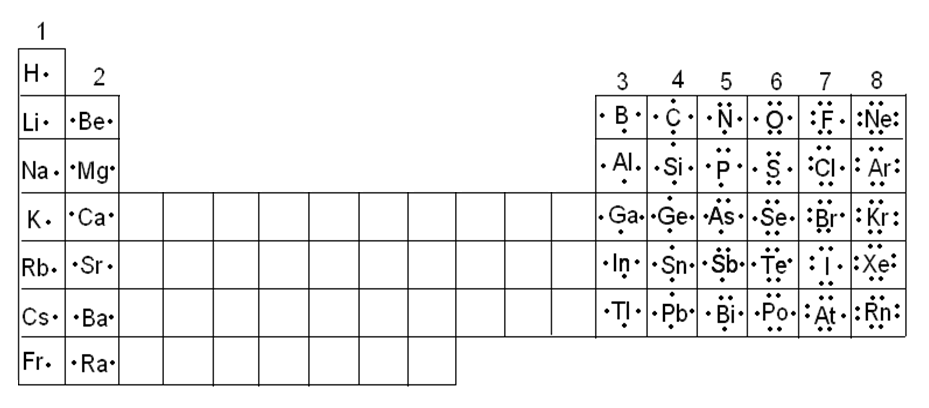
**Examples:**

Writing Ions - **\_\_\_\_\_\_\_\_\_\_\_\_\_\_** to the **\_\_\_\_\_\_\_\_\_** of the atomic symbol tells the ion’s **\_\_\_\_\_\_\_\_\_\_\_\_**

**Other examples:**

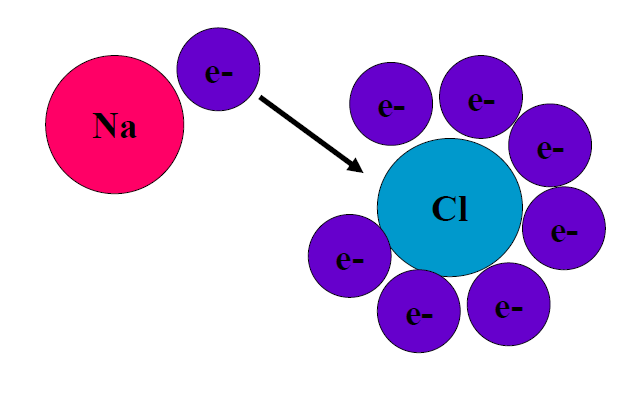
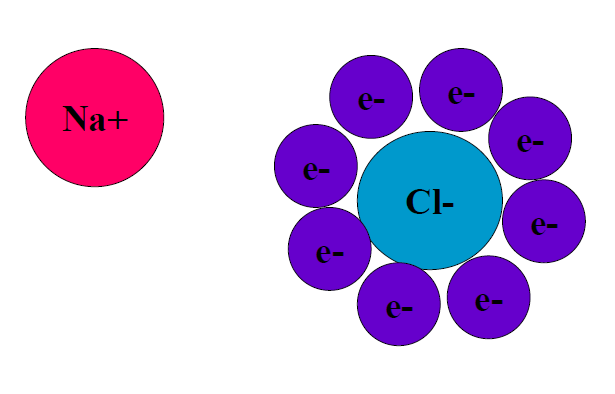
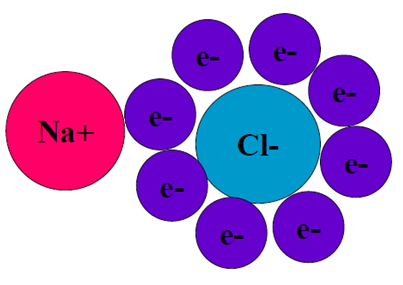
* Calcium atom that loses 2 electrons =
* Oxygen atom that gains 2 electrons =

Easy way to know the charge of atoms

****

When atoms that tend to lose electrons come in contact with atoms that tend to gain them, the result is an **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and the formation of two **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

ATTRACTION!!! - These two atoms with **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** are now **\_\_\_\_\_\_\_\_\_\_\_\_\_\_** to each other by the electrical **\_\_\_\_\_\_\_\_\_\_\_\_**

**  **

Ionic Bond - The force of attraction between two **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

* Electrons are **\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and **\_\_\_\_\_\_\_\_\_\_\_**, **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Ionic Compounds - Compounds containing **\_\_\_\_\_\_\_\_\_\_\_**

Elements that form ionic compounds - Those found on **\_\_\_\_\_\_\_\_\_\_\_\_\_** sides of the periodic table

Rules for Naming Simple Ions

1. CATIONS
   * Borrow names from the **\_\_\_\_\_\_\_\_\_\_\_\_**
     + EX: K+ =
     + EX: Zn2+=
   * When an ELEMENT forms two or more ions, **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** indicate the **\_\_\_\_\_\_\_\_\_**
     + EX: Cu+ =
     + EX: Cu2+ =
2. ANIONS
   * Name of Anion is also formed form the name of the elements name, but it ends with **“\_\_\_\_\_”!!**
     + EX: Cl-
     + EX: O2-
     + EX: P3-

Binary (two) Compounds

* RULE: Place the name of the **\_\_\_\_\_\_\_\_\_\_** followed by the name of the **\_\_\_\_\_\_\_\_\_\_\_**
  + EX: NaCl 🡪
  + EX: ZnS 🡪
  + EX: CuO🡪

For all Ionic Compounds, Positive and Negative Charges **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_!**

* Sodium Chloride:

* Calcium Oxide:

What if the charges differ??

* Calcium²⁺
* Fluoride¹⁻

Ionic Crystals - **\_\_\_\_\_\_\_\_\_\_\_\_\_** of ions grouped together in a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, three-dimensional array

**Metallic Bonds**

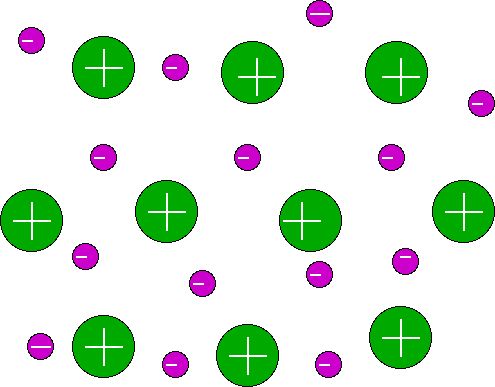
Metals are more willing to **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** their valence electrons and the bond is **\_\_\_\_\_\_\_\_\_\_\_**

Weak Electrons

* Each metal atom gives up its outer electrons to a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* The electrons are **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** throughout the metal

Metallic Bond - A lattice of **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** immersed in a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

* Occurs only between **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**



How does this metallic bond explain the properties of metals?

* Conduct electricity and heat?
* Shiny?
* Malleable?

Metallic Bonds can hold together two or more of the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** or **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Alloys – **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** with one or more **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

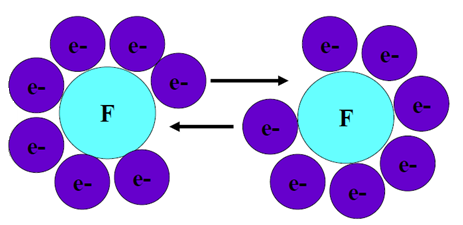
Examples:



**COVALENT BONDS**

Two atoms can be held together by their **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** for the electrons they **\_\_\_\_\_\_\_\_\_\_\_**

Covalent Bond - Mutual attraction for **\_\_\_\_\_\_\_\_\_\_\_** electrons



Molecule - Two or more atoms that **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Writing Electron Dot Structures for Covalent Compounds

* A **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** is used to represent the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** (1 from each atom)

Elements that form Ionic Compounds

* Those found **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** on the periodic table, mostly between **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

A covalent bond is made up of **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

* The **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** an atom can form is equal to the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** needed to **\_\_\_\_\_\_** its valence shell

Hydrogen – needs only **\_\_\_\_\_** additional electron so it forms only **\_\_\_\_\_** covalent bond

Oxygen – needs **\_\_\_\_\_** additional electrons. Forms **\_\_\_\_\_** covalent bonds with Hydrogen to make the molecule H₂O or water

Nitrogen – needs **\_\_\_\_\_** additional electrons. Forms **\_\_\_\_\_** covalent bonds with Hydrogen to make NH₃ or ammonia

Carbon – needs **\_\_\_\_\_** additional electrons. Forms **\_\_\_\_\_** covalent bonds with Hydrogen to make CH₄ or methane

It is possible to share **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** electrons in a covalent bond

Double bond – shares **\_\_\_\_\_** electrons

Example –

Triple bond – shares **\_\_\_\_\_** electrons

Example -

Bond Strength - Single bonds are **\_\_\_\_\_\_\_\_\_\_** and **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, while triple bonds are **\_\_\_\_\_\_\_\_\_\_\_** and **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Draw the Dot Structure for each molecule

**PH₃ H₂S CCl₄**

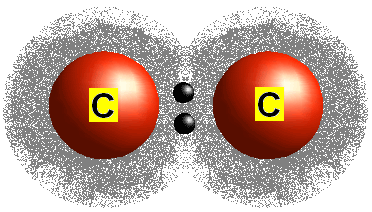
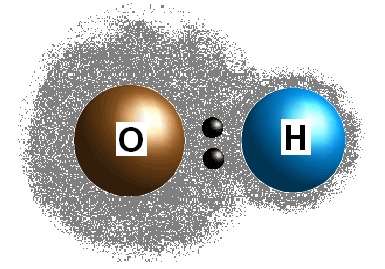
Rules for Naming Covalent Compounds

* The **\_\_\_\_\_\_\_\_** element in the formula is **\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and keeps its **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* The **\_\_\_\_\_\_\_\_** element changes its suffix to **“\_\_\_\_\_\_”**
* **\_\_\_\_\_\_\_\_\_\_** are used to tell **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** of each atom is used in the compound

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| # of atoms | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Prefix |  |  |  |  |  |  |  |  |  |  |

* The first element **\_\_\_\_\_\_\_\_\_\_\_\_\_\_** the mono- suffix

If the two atoms in a covalent bond are **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, the electrons are shared **\_\_\_\_\_\_\_\_\_\_\_**

** **

If the two atoms in a covalent bond are **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, the electrons are shared **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Dipole – **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** of charge

Since the Oxygen has the electrons around it for most of the time, it has a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and Hydrogen has a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Electronegativity – atoms ability to **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** in a chemical bond

The **\_\_\_\_\_\_\_\_\_\_** the electronegativity, the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** to pull in electrons

**\_\_\_\_\_\_\_\_\_\_\_** in elements on the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** of the periodic table, and **\_\_\_\_\_\_\_\_\_\_\_** for elements on the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** are excluded.

Nonpolar bond–

* Dipoles **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** when atoms have the **\_\_\_\_\_\_\_\_\_\_\_** electronegativity

Polar bond–

* Dipoles **\_\_\_\_\_\_\_\_** when atoms have **\_\_\_\_\_\_\_\_\_\_\_\_** electronegativity

How polar a bond is depends on the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** between atoms

* The **\_\_\_\_\_\_\_\_\_\_\_\_\_** the difference, the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** the bond

**Intermolecular Forces**

Bonds between atoms are **\_\_\_\_\_\_\_\_\_\_**, but attractive forces between molecules are **\_\_\_\_\_\_\_\_**

Intermolecular forces **–**

**Types of Intermolecular Forces**

1. **Ion-Dipole Attraction**
   * Between **\_\_\_\_\_\_\_\_\_\_\_** and the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Example: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_\_\_ salts in \_\_\_\_\_\_\_\_\_\_\_ solution

1. **Dipole-Dipole Attraction**
   * Between **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Hydrogen Bond** – between molecules that have **\_\_\_\_\_** bonded to a highly electronegative atom (**\_\_\_\_\_\_\_\_**)

Example: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**because water molecules are so **\_\_\_\_\_\_\_\_\_\_\_\_\_** to themselves

1. **Induced Dipole-Dipole Attraction**

* Between a **\_\_\_\_\_\_\_\_\_\_** and **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** molecule

Induced dipole - **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** uneven distribution of electrons

Example: **\_\_\_\_\_\_\_\_\_\_\_\_** binding to **\_\_\_\_\_\_\_\_\_** in Hemoglobin

Example:

**Adhesive and Cohesive Forces**

Cohesive forces - Forces of attraction between **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Water - Pull water into **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** drops

Adhesive forces - Forces of attraction between **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Water - **\_\_\_\_\_\_\_\_\_** water to surfaces

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** is determined by **\_\_\_\_\_\_\_\_\_\_\_\_** of cohesive and adhesive forces

* If **\_\_\_\_\_\_\_\_\_\_\_\_** force is stronger…Water drop will be **\_\_\_\_\_\_\_\_\_\_\_\_**
* If **\_\_\_\_\_\_\_\_\_\_\_\_** force is stronger…Water drop will be **\_\_\_\_\_\_\_\_\_\_\_\_**

Meniscus - **\_\_\_\_\_\_\_\_\_\_\_\_** of a liquid's **\_\_\_\_\_\_\_\_\_\_\_\_** within a container

* Concaves Up the Sides - When the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** force of the liquid to the wall is **\_\_\_\_\_\_\_\_\_\_\_\_\_** than the cohesive force of the liquid, the liquid is more **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** than its neighbors
* Concaves Down the Sides - When the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** force of the liquid is **\_\_\_\_\_\_\_\_\_\_\_\_\_\_** than the adhesive force of the liquid to the wall, the liquid concaves down in order to **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**with the surface of the wall