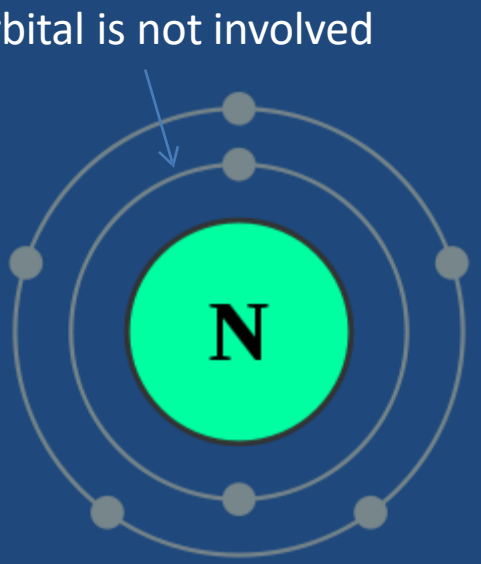
Bioorganic Chemistry
Chemical Bonding _ Ionic Bond
Lecture-1

Rifat Bin Amin
National Institute of Science & Technology

Ionic Bonding

Valence Electrons

- Valence electrons are the electrons in the outermost **s-** and **p-orbitals** that can be involved in chemical reactions.



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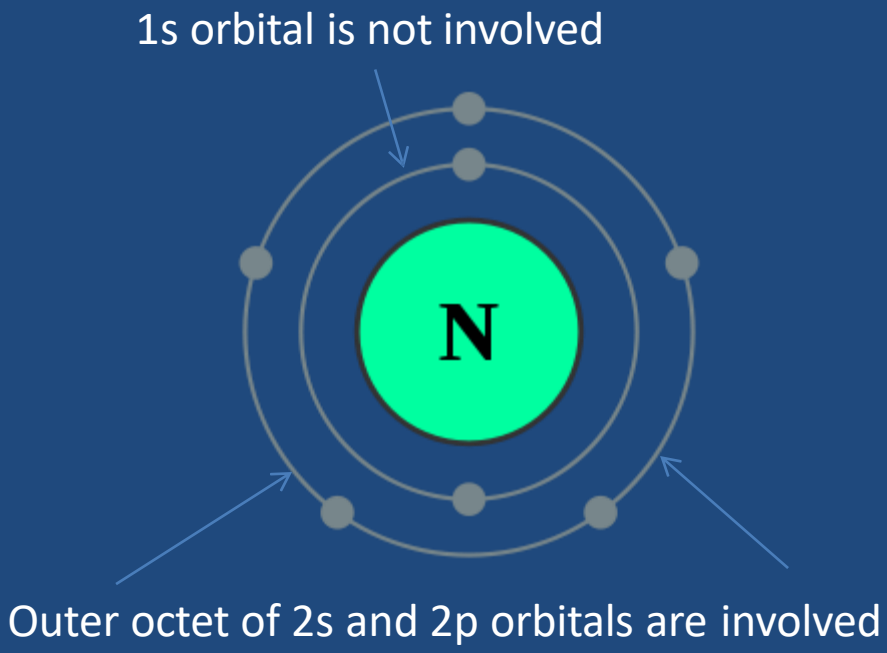

Ions

Cation	Positively Charged Atom (loses electrons)	K^{+1}
Anion	Negatively Charged Atom (gains electrons)	Cl^{-1}

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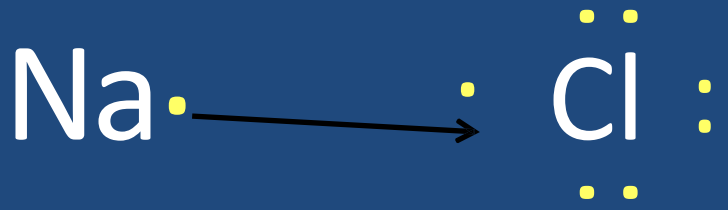
Ionic Bonding occurs when a **cation** gives electrons to an **anion** and the atoms become attracted to each other due to the opposite charges.

Ionic Bonds

- Sodium has one valence electron it wants to lose
- Chlorine has 7 valence electrons, so it wants to gain one more to make it to eight.

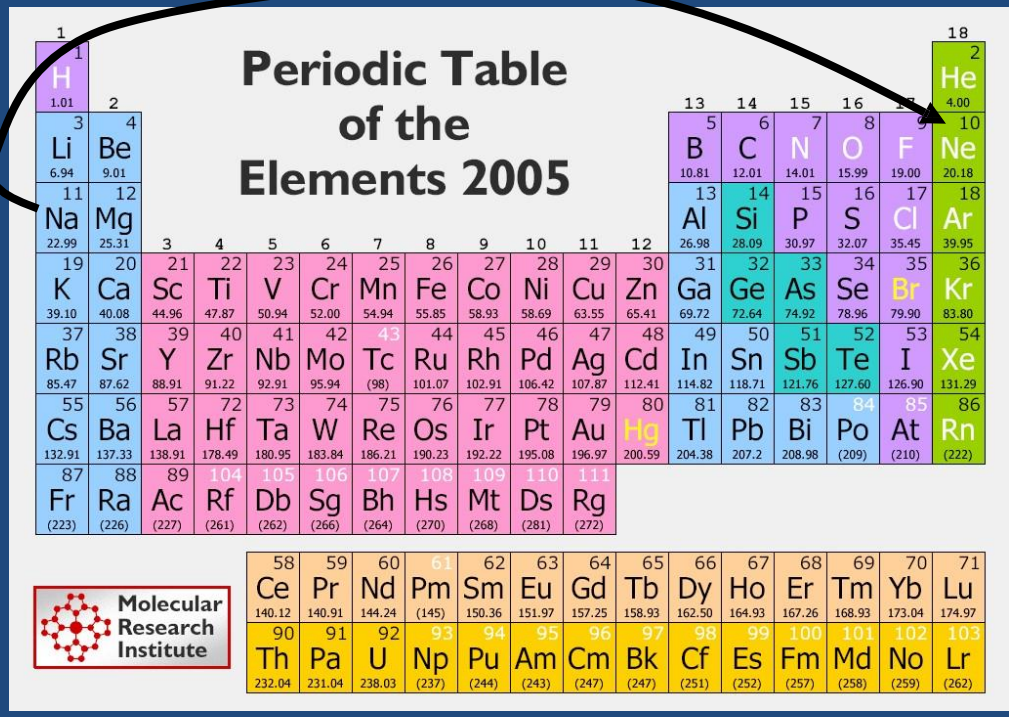
Ionic Bonds



- The Sodium atom donates its one valence electron to Chlorine.

Ionic Bonds

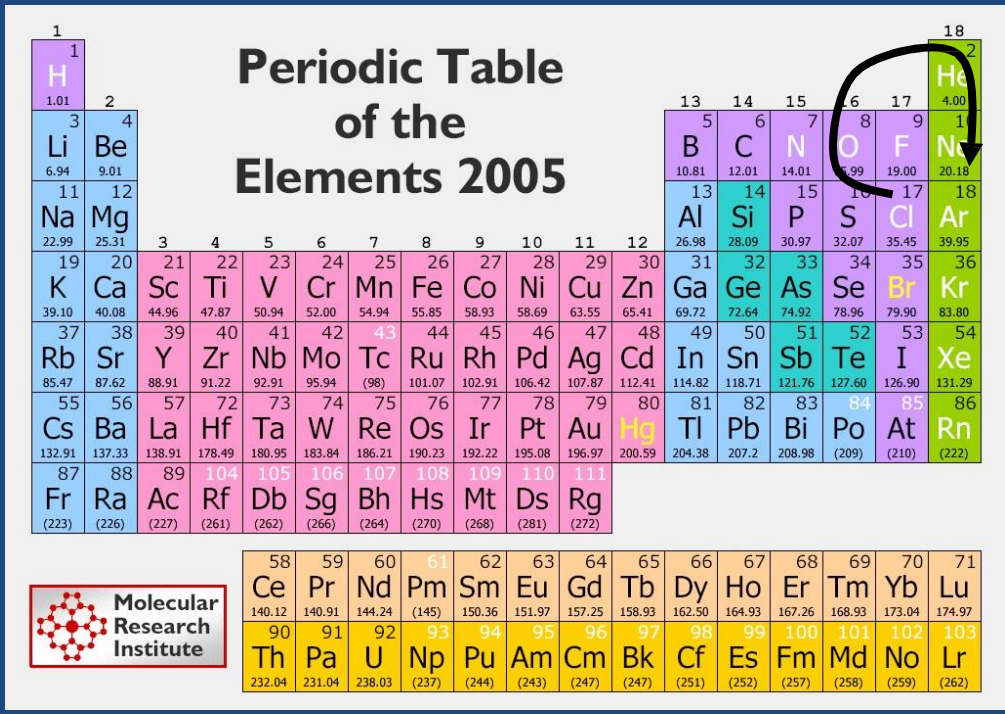
Na^{+1} ⟶ $:\ddot{Cl}^{-1}:$



- This means Na has the electron configuration of the noble gas before it, which is **Neon**
- Sodium's electron configuration is now written as **[Ne]**$^{+}$

Ionic Bonds

Na^{+1} ⟶ $:\ddot{Cl}:^{-1}$

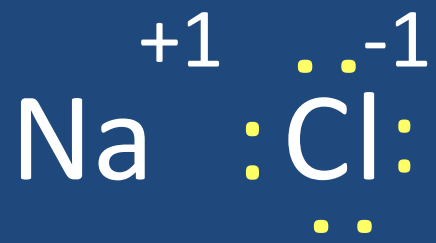


- Chlorine now has the electron configuration of the noble gas after it, which is **Argon.**
- Chlorine's electron configuration is now written as **[Ar]**$^{-}$

Ionic Bonds

- Sodium and Chloride are now **ionically** bonded to form a new compound known as sodium chloride (NaCl).
- This is known to most of us as Table Salt.

Ionic Bonds



- Now each sodium is positively charged and each chlorine is negatively charged.
- They are attached because opposite charges attract electrostatically.
- However, together they balance each other out.

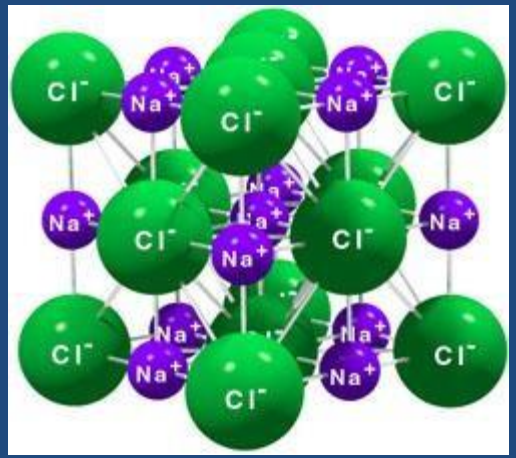
Ionic Bonds

- Bonding that involves a transfer of electrons.
- Positively and negatively charged atoms (ions) result from this transfer
- The resulting positive and negative charged atoms are "attracted" to each because of their opposite charges.

Solvents and Solutions

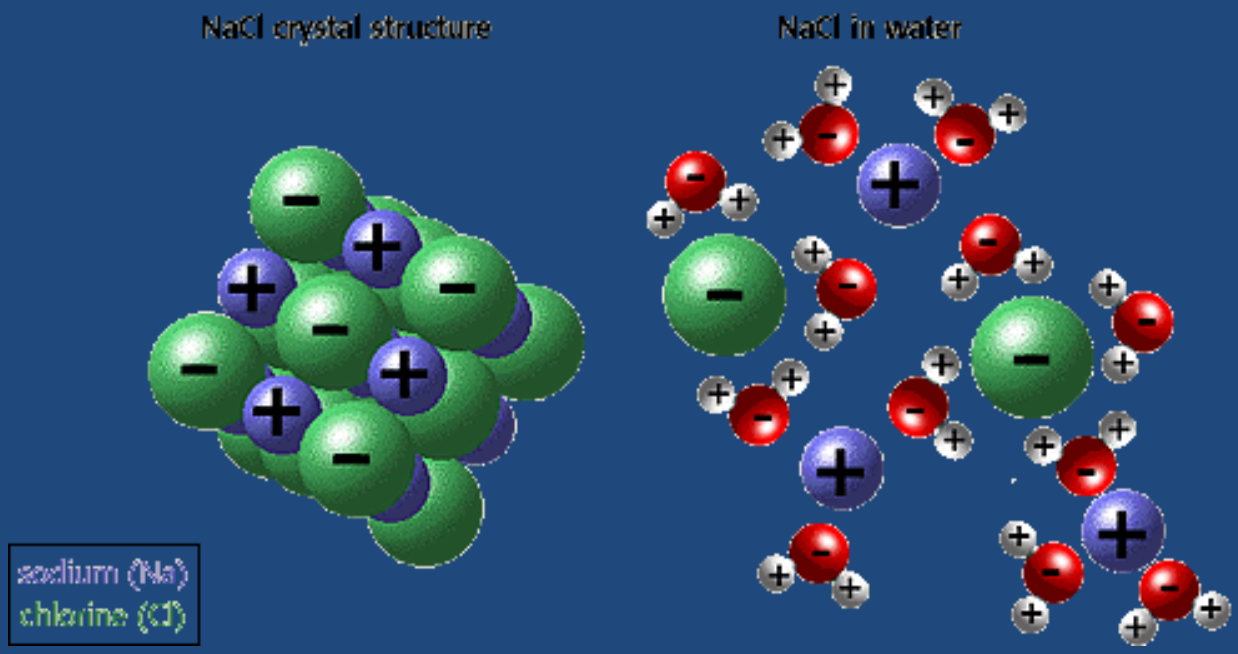
- Because ionic molecules have positive and negative atoms, they can be pulled apart by other substance with positive and negative charges.

$$NaCl_{(s)} \leftrightarrow Na^{+}_{(aq)} + Cl^{-}_{(aq)}$$



Solvents and Solutions

- One example is dissolving salt into water
- Water molecules have positive ends near the hydrogens and negative ends near the oxygen.



Solutions

- Since all of the ions are evenly dispersed and dissolved in the water, it makes a solution of salt water.

- This solution is transparent.

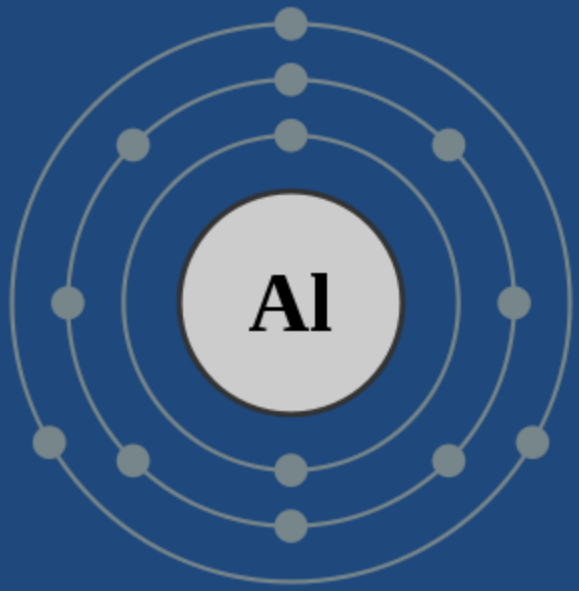
Reforming Crystals

- When the water evaporates, the positive Na ions and the negative Cl ions come back together again!

So, Who Makes Ions Anyways?

- It all depends on how many valence electrons they have and what they need to get to noble gas configuration.

Question #1: How many valence electrons does Aluminum have?



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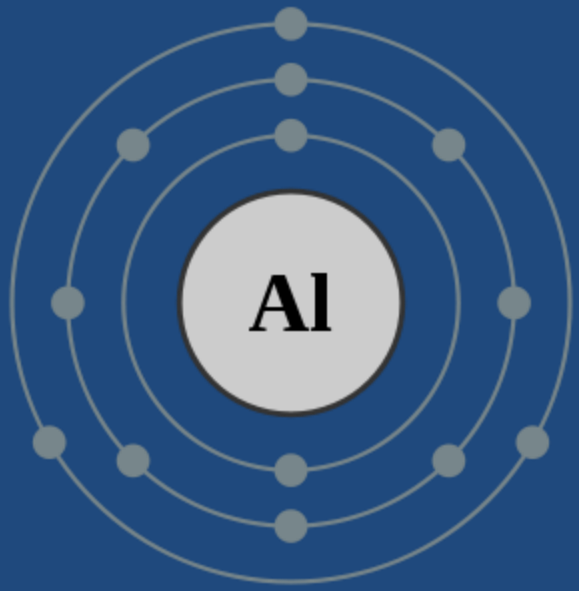
Question #1: How many valence electrons does Aluminum have?

Answer: 3

Question #2: What ionic charge will it have to become noble gas configuration?



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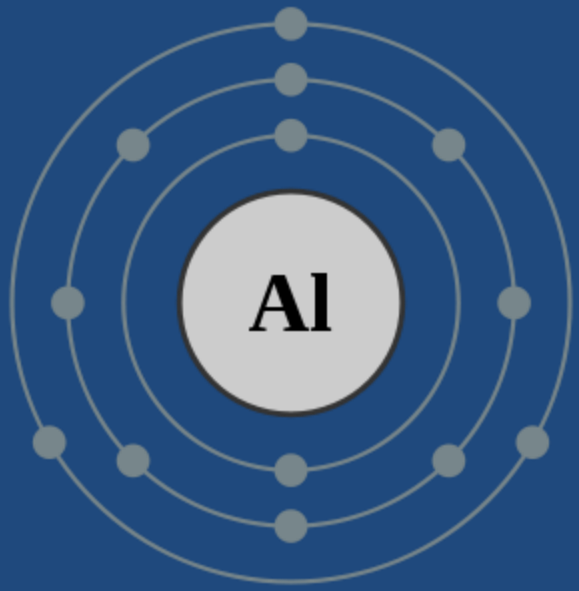
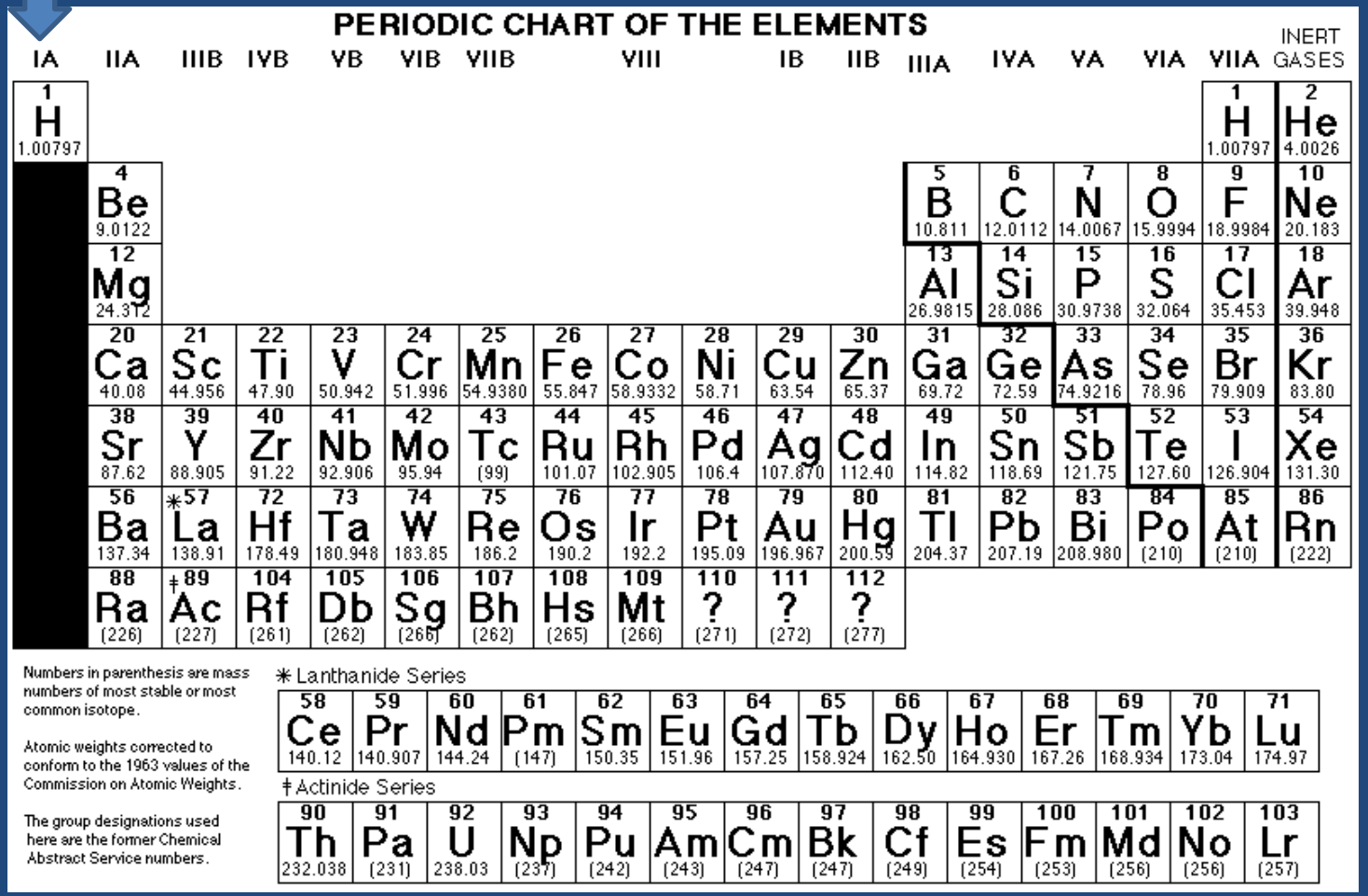
Question #2: What ionic charge will it have to become noble gas configuration?

Answer: Al^{+3}

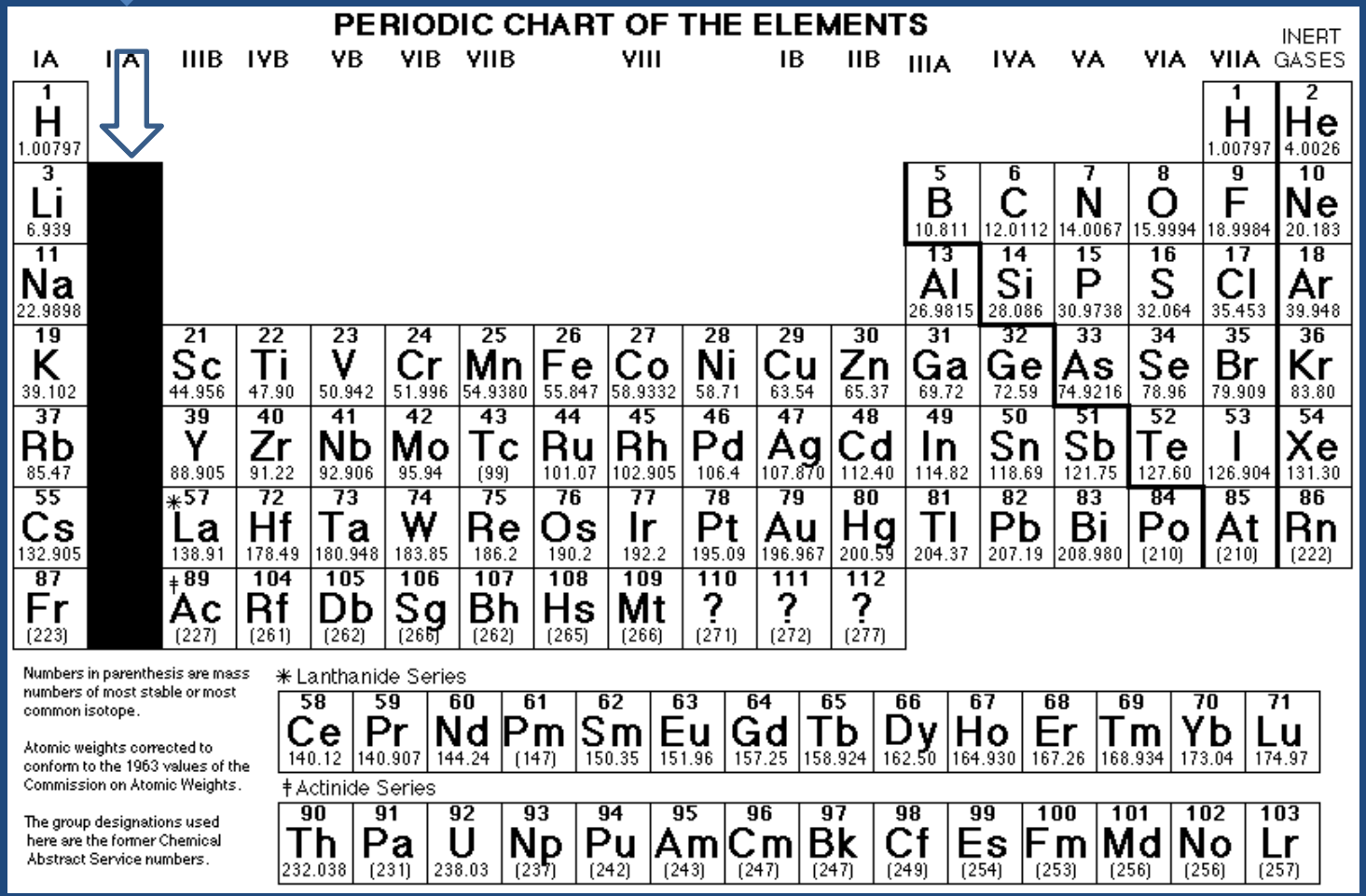


Alkali Metals



Charge: +1

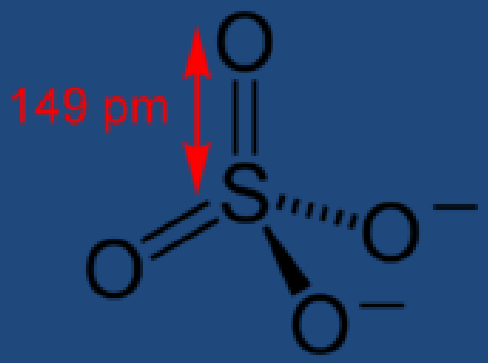
Alkaline Earth Metals



Charge: +2

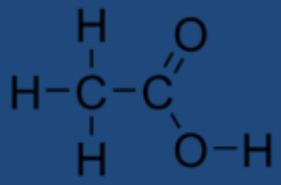
Polyatomic Ion

- Polyatomic ions are ions that have multiple atoms attached to each other, but as a unit have a net charge.
- Sulfate (SO_4 $^{-2}$) is an example.



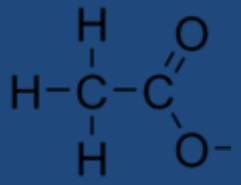
Acetic Acid Dissolving in Water

Acetic Acid

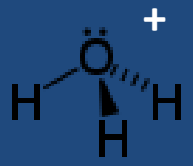


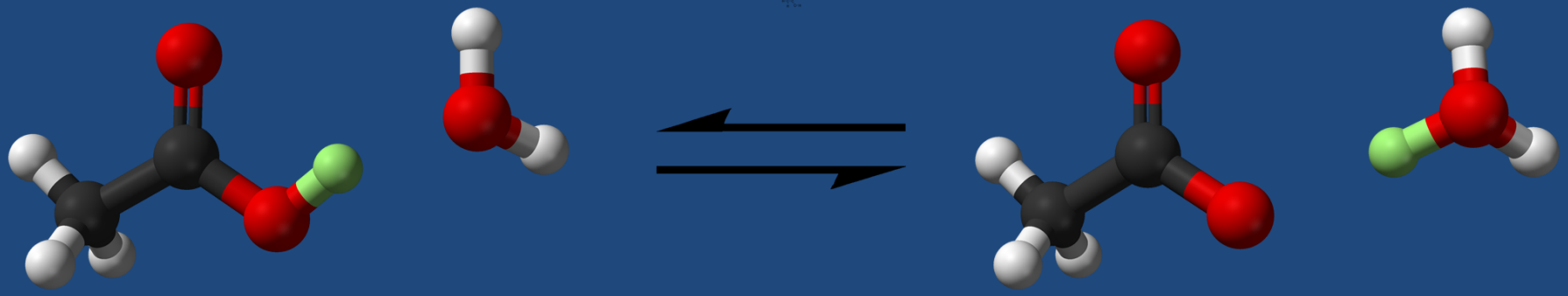
Water

Acetate ion



Hydronium ion





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