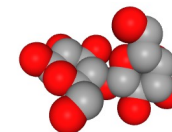


What are small molecules?

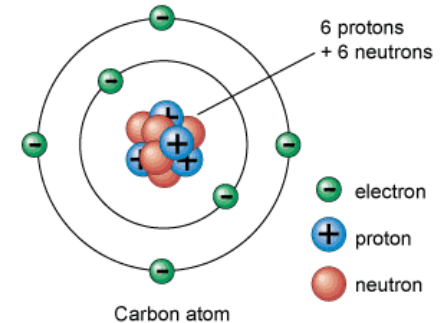
Micromolecules (Small Molecules)

- Small molecules consist of atoms that are bound to each other
 - Atoms are the foundational building blocks of all matter in the universe
 - The most common atoms in biomolecules are
 - Hydrogen (white)
 - Carbon (grey)
 - Oxygen (red)
 - Nitrogen (blue)
 - Phosphorus (orange)
 - Sulfur (yellow)



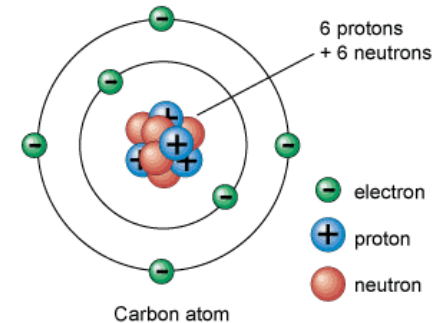
What are atoms?

- All atoms consist of protons, neutrons, and electrons:
 - **Protons:** Positively charged particles found in the nucleus of an atom
 - **Neutrons:** Neutral particles, carrying no charge, that also reside in the nucleus.
 - **Electrons:** Negatively charged particles that orbit the nucleus in electron shells.
- **Nucleus:**
 - Is the dense core of an atom; contains almost all the mass
 - Contains Protons and Neutrons
 - Number of protons defines the element
- **Electron shells:**
 - Electrons surround the nucleus in layers of electron shells



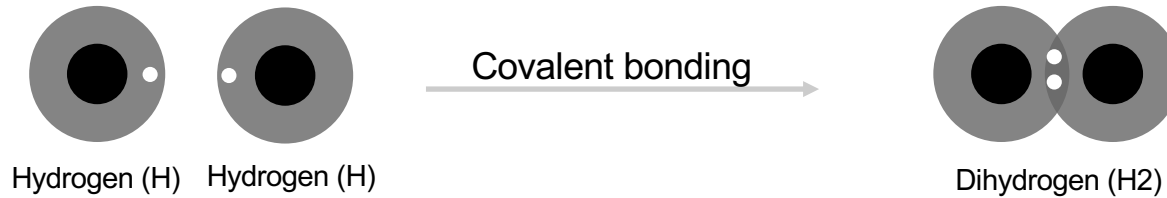
Electron shells

- Electron shells are layers or regions around an atom's nucleus where electrons are most likely to be found.
- Each shell can hold only a certain number of electrons:
 - The first shell can hold up to 2 electrons
 - The second shell can hold up to 8 electrons
 - The third shell typically holds up to 8 atoms
- Filling Order:
Electrons fill the innermost shell first before moving to higher energy shells.
- Atoms typically aim to fill their outermost electron shell. Options:
 - Ionic Bonding: Gaining or losing electrons
 - Covalent Bonding: Sharing electrons with other atoms

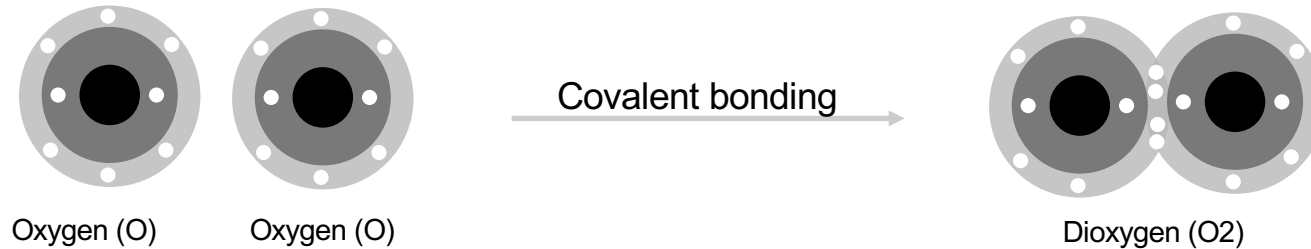


Covalent bonding

- Covalent bonding between two hydrogen atoms (single bond):

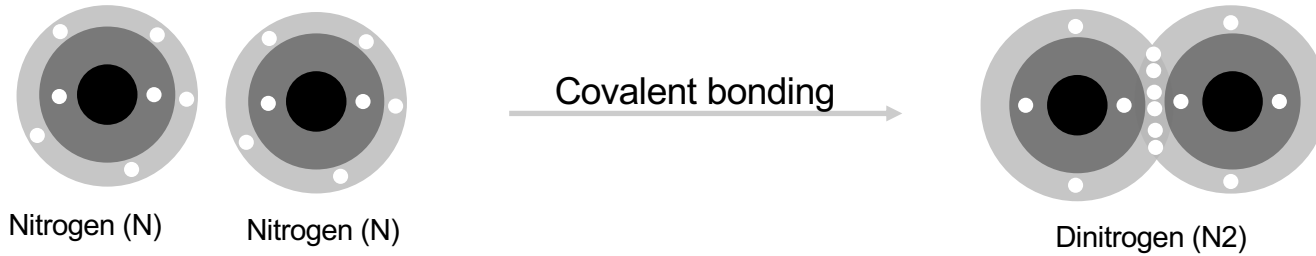


- Covalent bonding between two oxygen atoms (double bond):

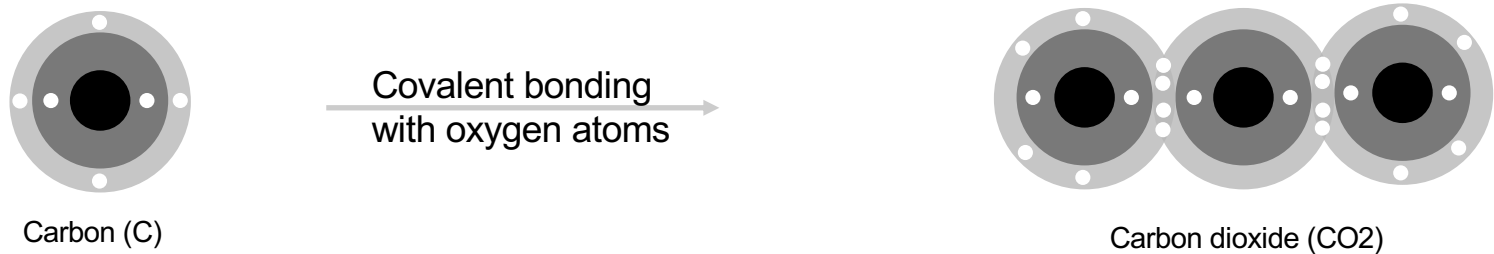


Covalent bonding

- Covalent bonding between two nitrogen atoms (triple bond):



- Covalent bonding between two different atoms:



Representing small molecules

- Small molecules can consist of many atoms that are bound to each other
 - We need a way to represent such molecules
 - Which atoms are bound to each other and by which type of bond?
 - How are the atoms spatially arranged?

