Chemical bonds hold molecules together

- **A chemical bond is a union between atoms formed when they give up, gain, or share electrons**

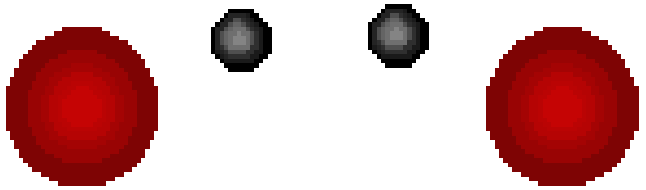
- **Chemical formulas indicate the numbers of atoms of each element that are bonded together in a molecule**

Common Types of Bonds in Biological Molecules

- **Covalent**
  - ***Non-polar***
  - ***Polar***
- **Hydrogen**
- **Ionic**

COVALENT

- A covalent bond holds together two atoms that share one or more pair of electrons
- **Electrons in a covalent bond may be equally or unequally shared between the atoms**



Double bonds: two pairs of shared electrons

Triple bonds: three pairs of shared electrons

Non-Polar Covalent

- Non-polar covalent bond: atoms share electrons evenly

Nonpolar covalent bonding

Hydrogen (H_2 or H—H)

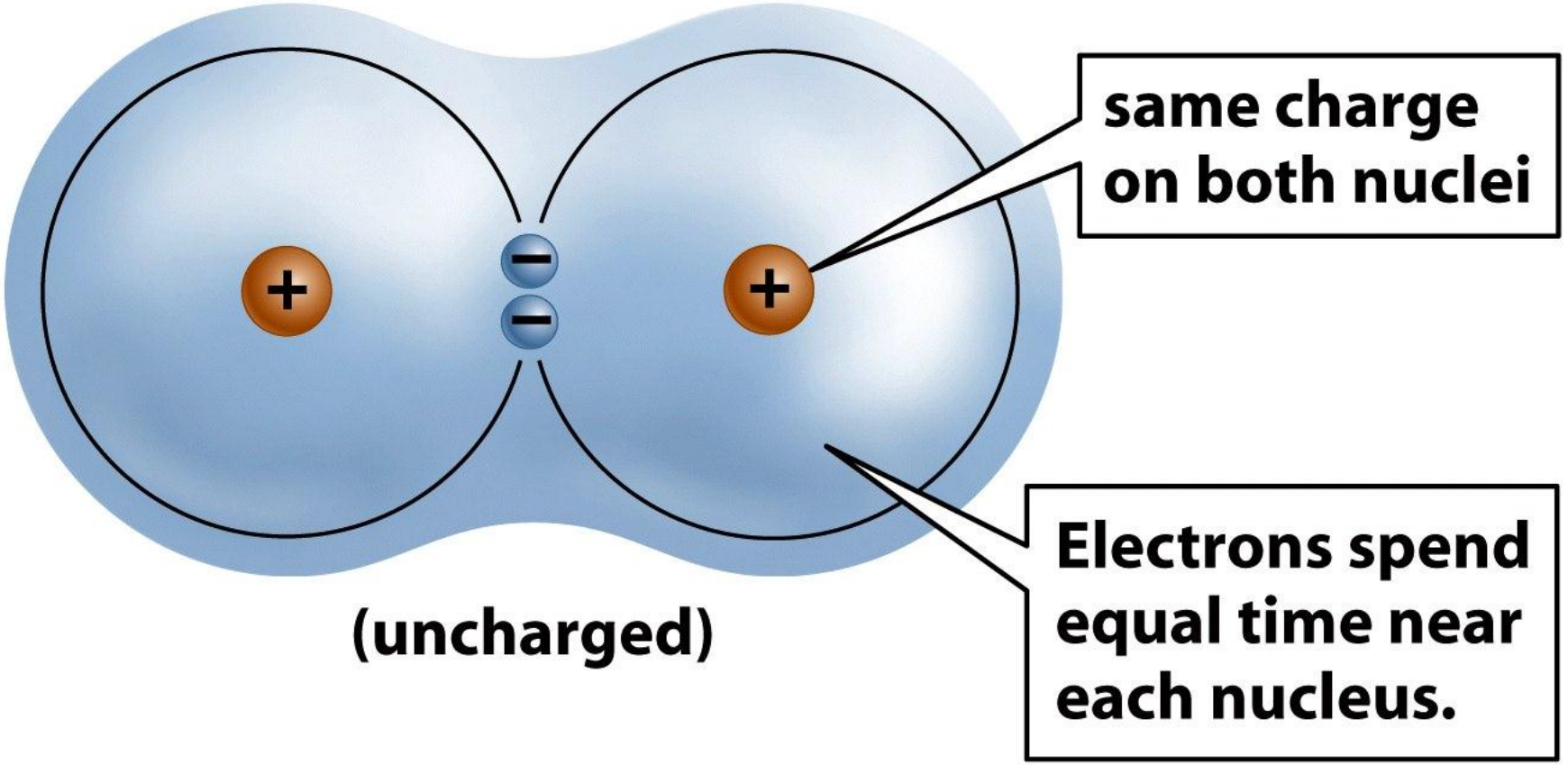
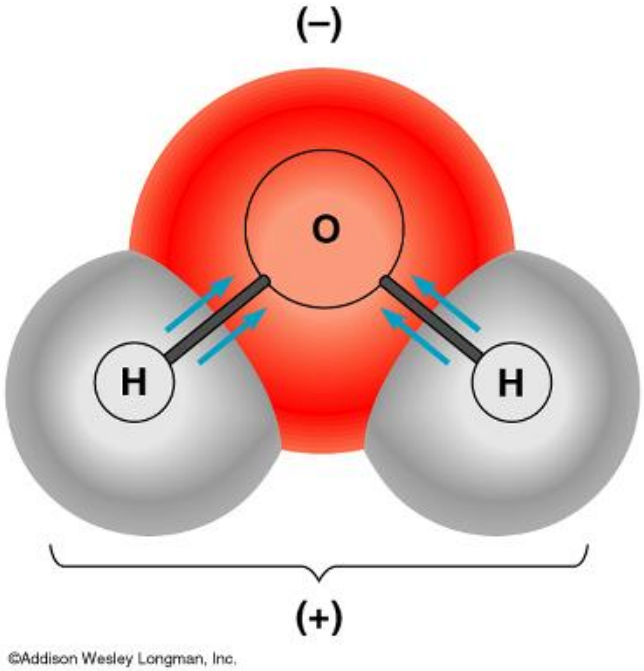


Figure 2-6a Biology: Life on Earth, 8/e

Polar Covalent



Polar covalent bond:

atoms share electrons <u>unequally</u>

Those atoms with greater positive nuclear charge pull more strongly on electrons in a covalent bond

Polar Covalent Bonds

- H_2O is a polar molecule
  - The (slightly) positively charged pole is around each hydrogen
  - The (slightly) negatively charged pole is around the oxygen

Polar covalent bonding

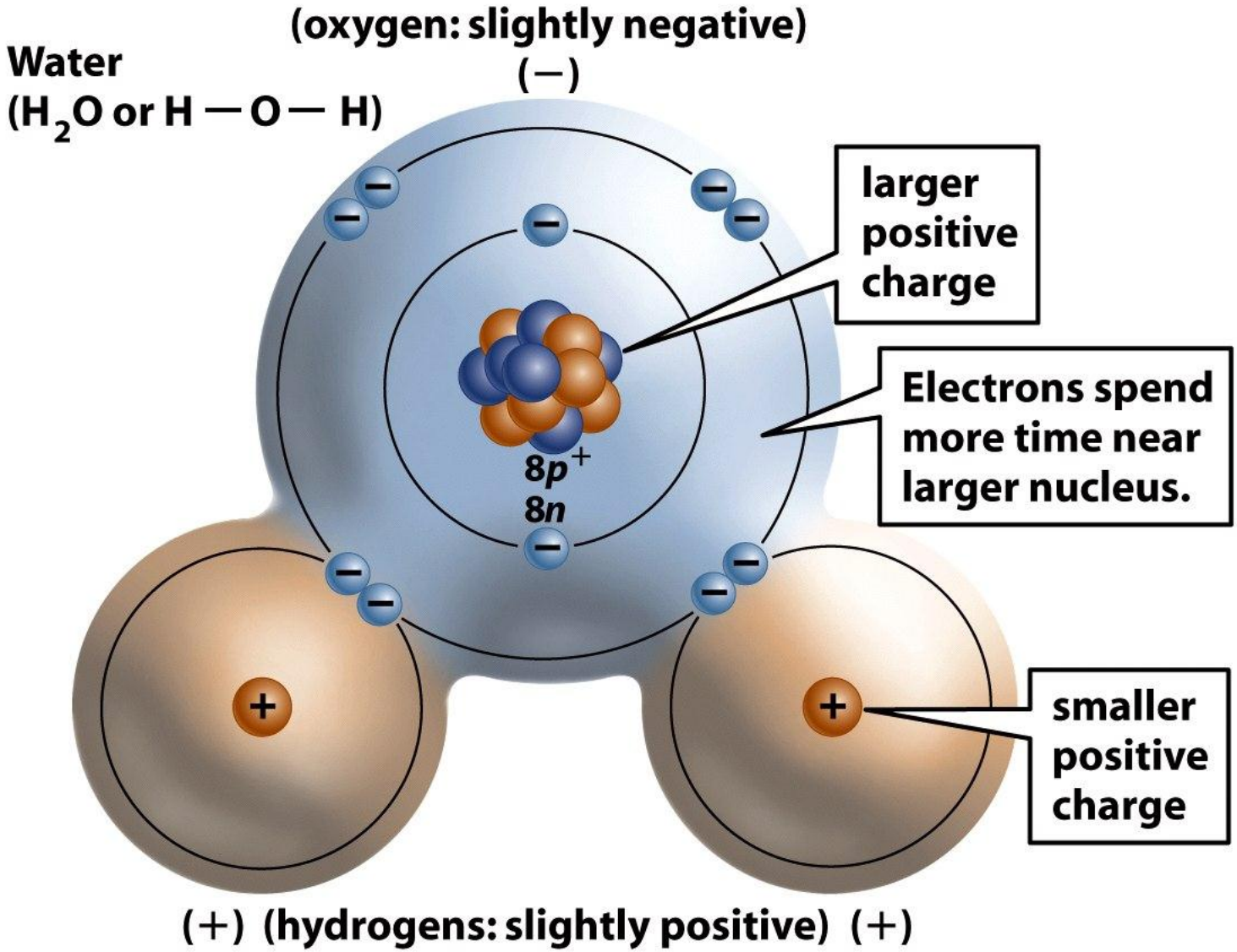
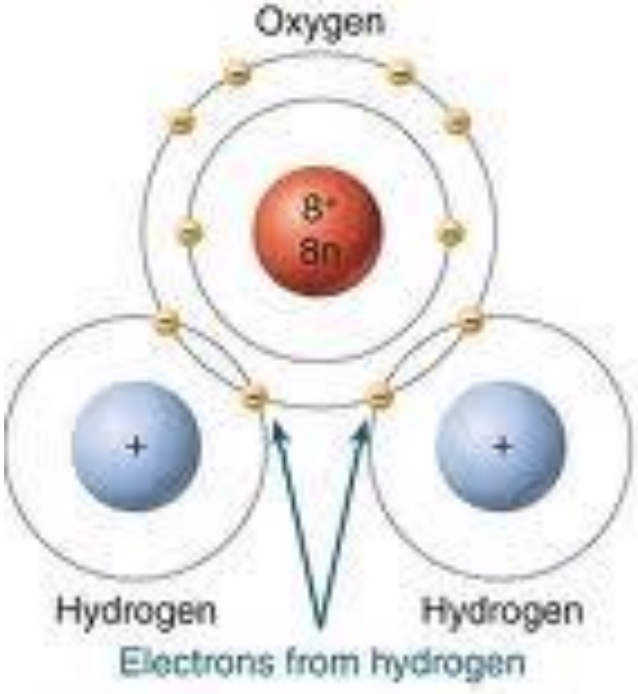


Figure 2-6b Biology: Life on Earth, 8/e

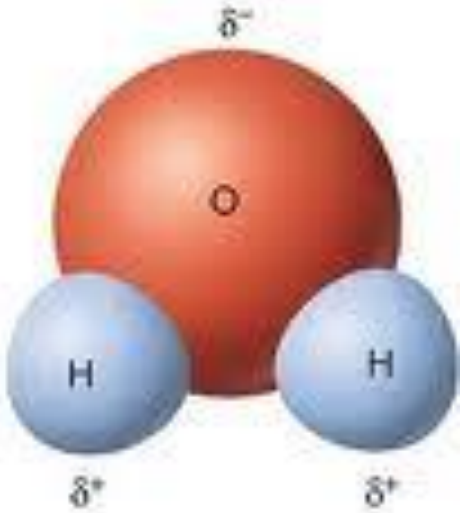
Intermolecular Forces: Hydrogen “bonds”

Hydrogen Bonds

- Polar molecules have partially charged atoms at their ends



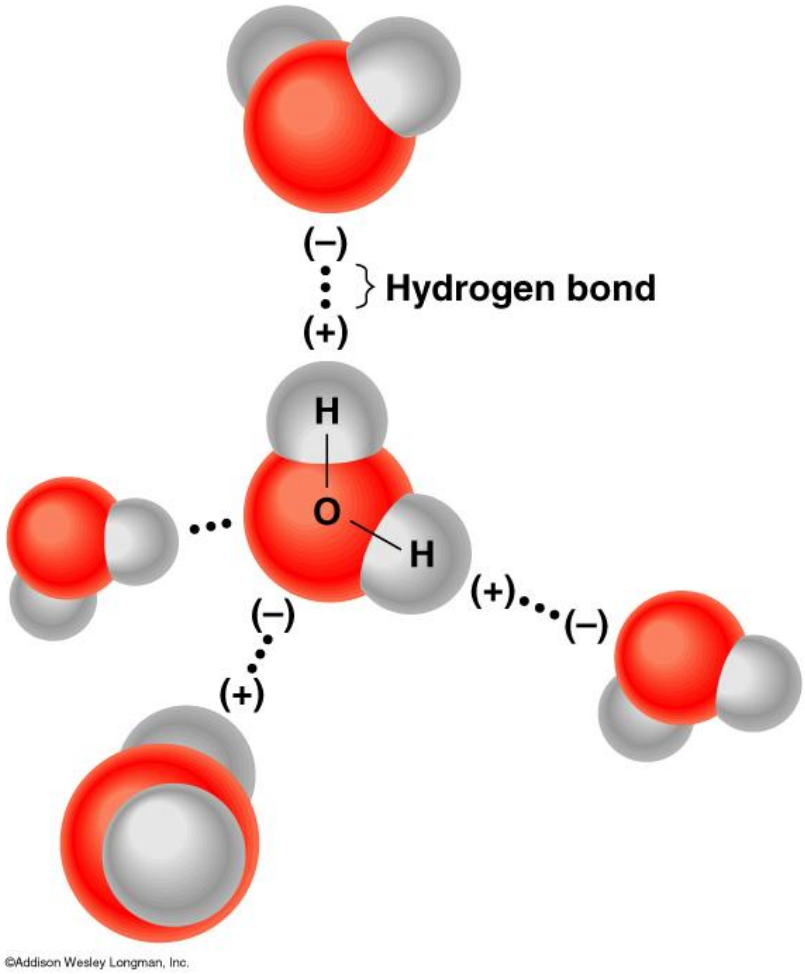
(a) Electron shells in a water molecule

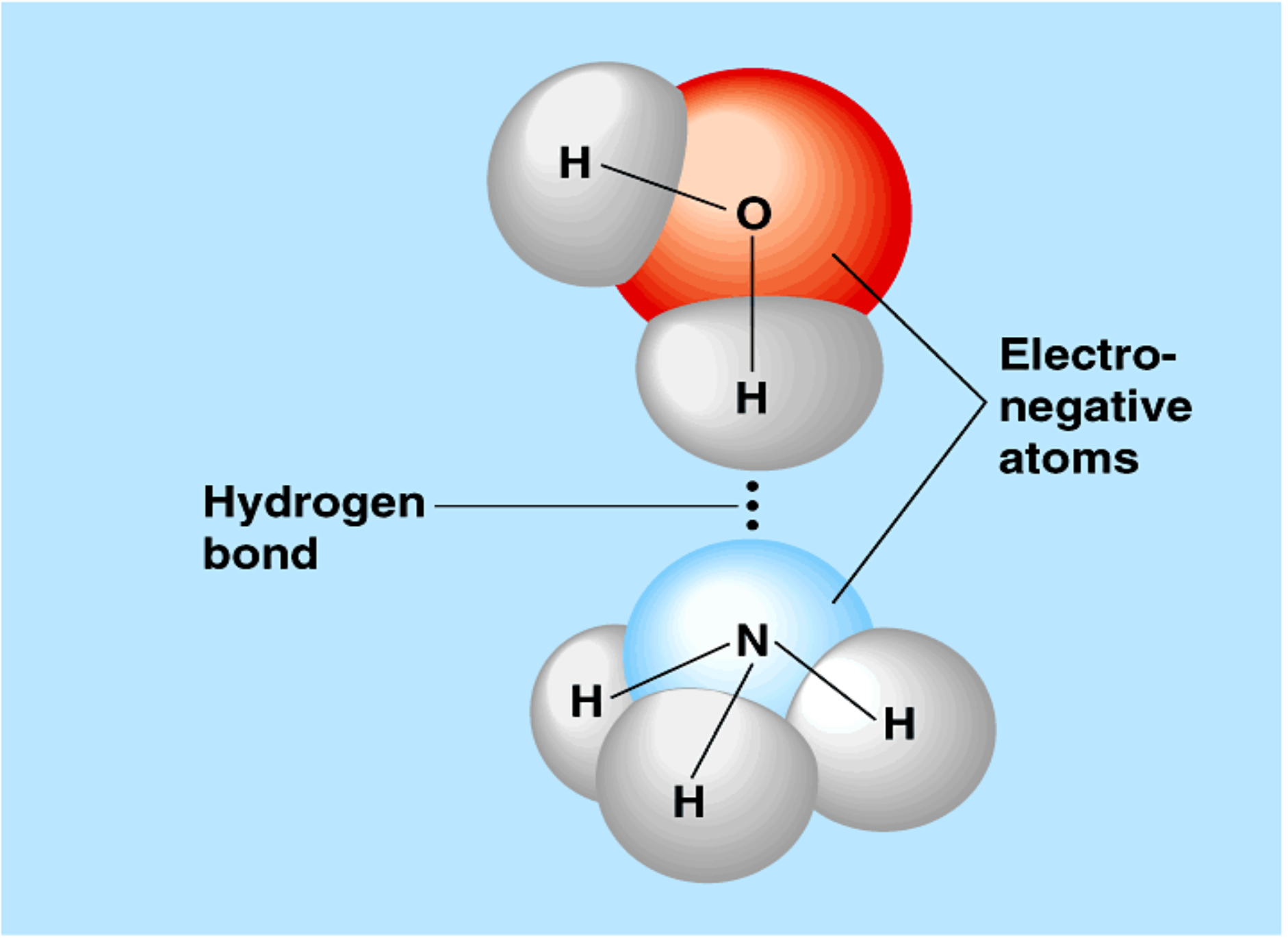


(b) Distribution of partial charges in a water molecule

Hydrogen Bonds

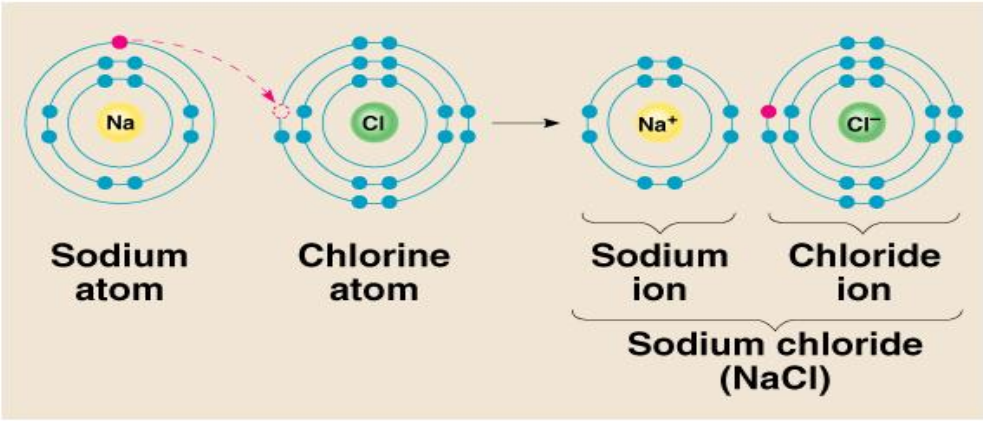
- **Hydrogen bonds** form when partial opposite charges in different polar molecules attract each other
- Individual hydrogen bonds are rather weak, but collectively they are quite strong

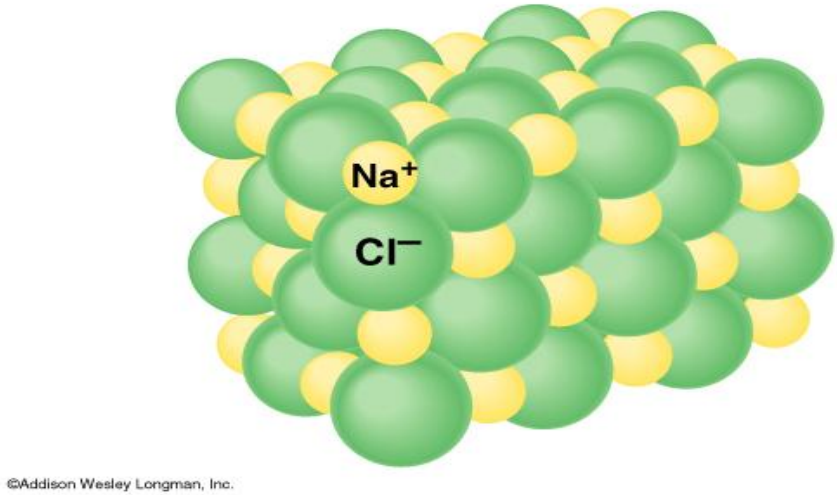




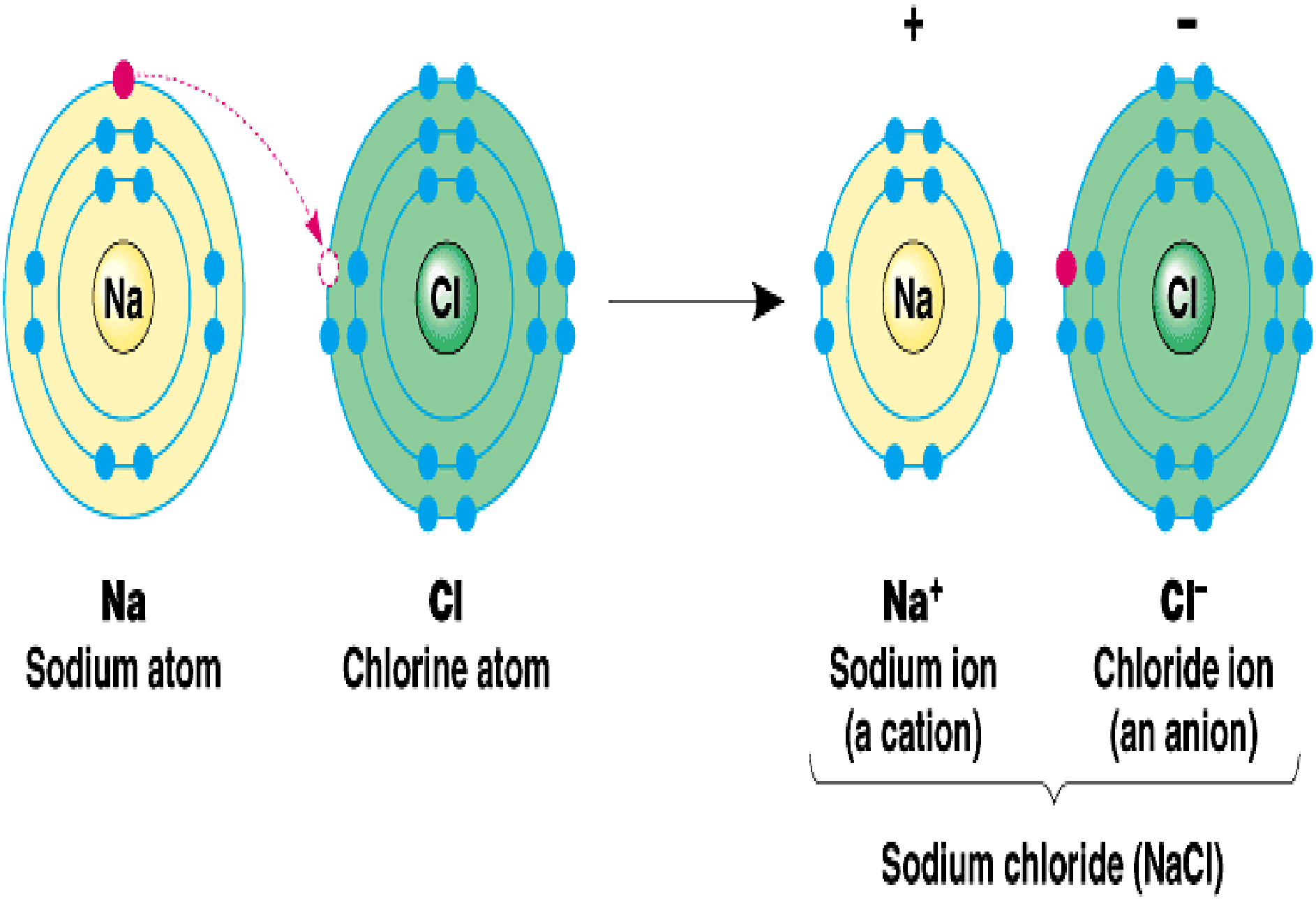
IONIC

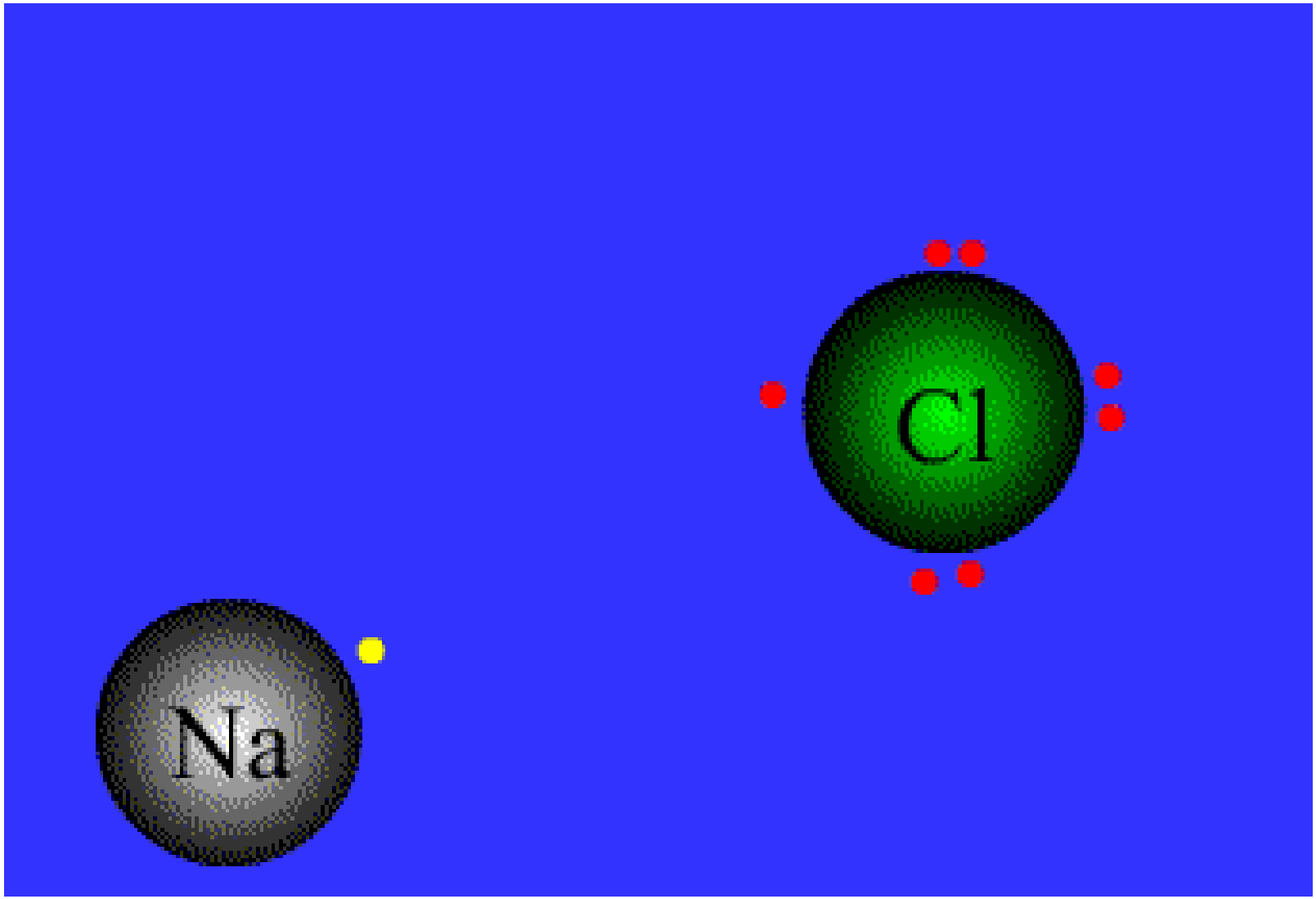
- **An atoms gives up 1 or more of its electrons to another.***
- **The resulting oppositely charged ions attract one another, forming an ionic bond.**

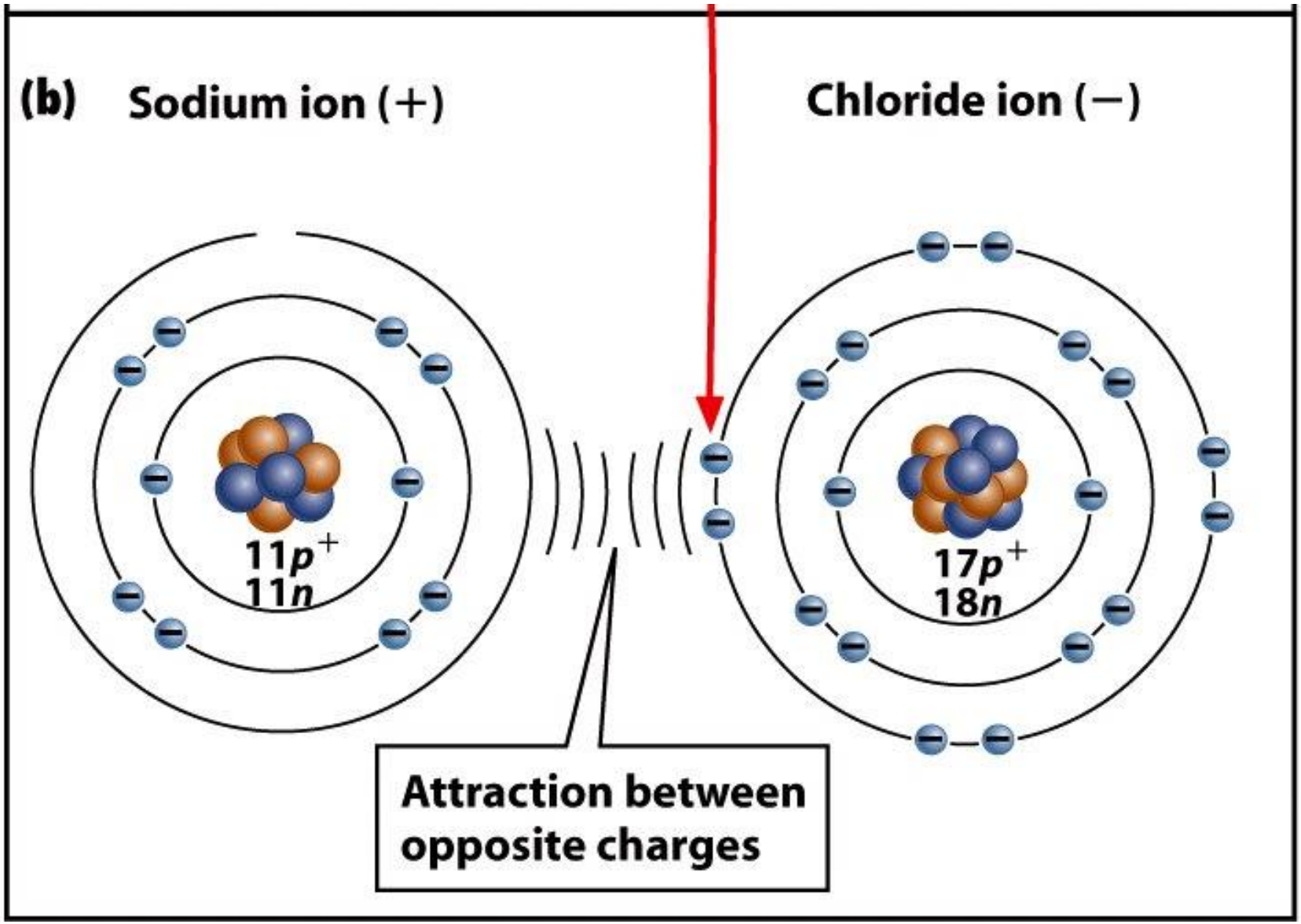




** You do not need to know the details of how this occurs*




Cl
Na


(b) Sodium ion (+)
Chloride ion (−)
11p+
11n
17p+
18n
Attraction between opposite charges

Question 2-9

An ionic compound: NaCl

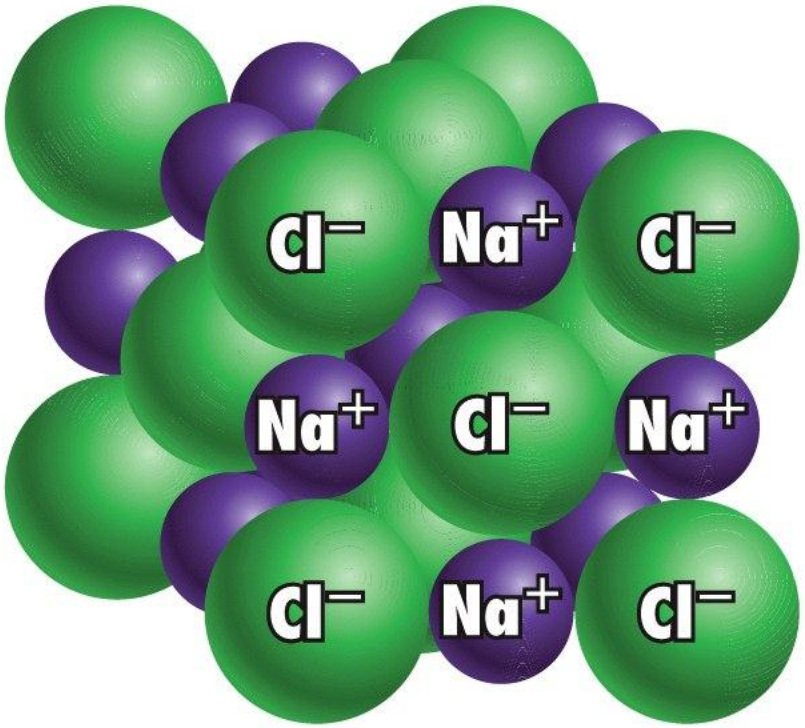


Figure 2-4c Biology: Life on Earth, 8/e

For example, in table salt (sodium chloride) the negative chlorine ion attracts the positive sodium ion, forming an ionic bond.