

Atoms Interact

- **Molecules** are made of two or more atoms bonded together through electron interactions
- A substance made of atoms of different elements is a **compound**
- Attractive forces (**chemical bonds**) hold atoms together in molecules

Table 2-2 Common Types of Bonds in Biological Molecules

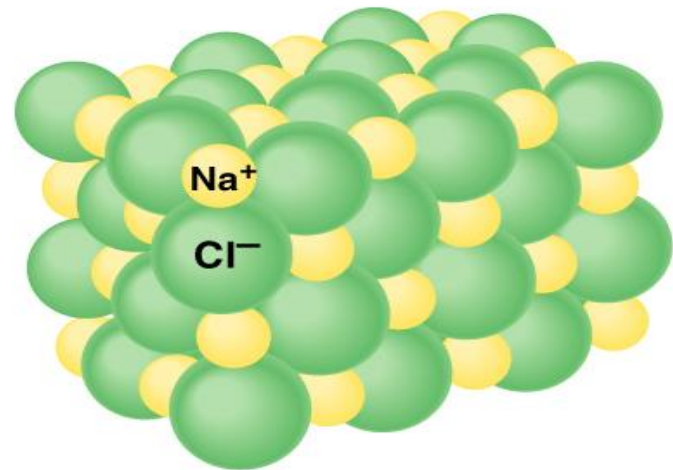
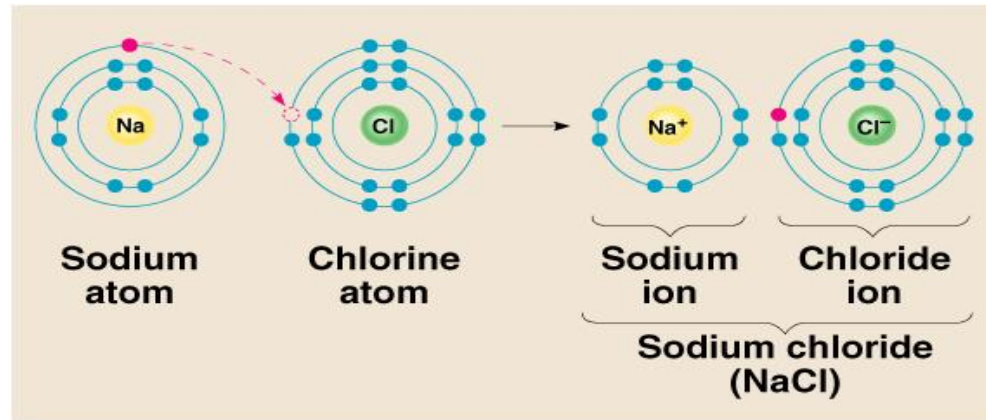
Type	Interaction	Example
Ionic bond	An electron is transferred, creating positive and negative ions that attract one another.	Occurs between sodium (Na^+) and chloride (Cl^-) ions of table salt (NaCl)
Covalent bond	Electron pairs are shared.	
<i>Nonpolar</i>	Equal sharing	Occurs between the two oxygen atoms in oxygen gas (O_2)
<i>Polar</i>	Unequal sharing	Occurs between the hydrogen and oxygen atoms of a water molecule (H_2O)
Hydrogen bond	The slightly positive charge on a hydrogen atom involved in a polar covalent bond attracts the slightly negative charge on an oxygen or nitrogen atom involved in a polar covalent bond.	Occurs between water molecules; slightly positive charges on hydrogens attract slightly negative charges on oxygens in adjacent molecules

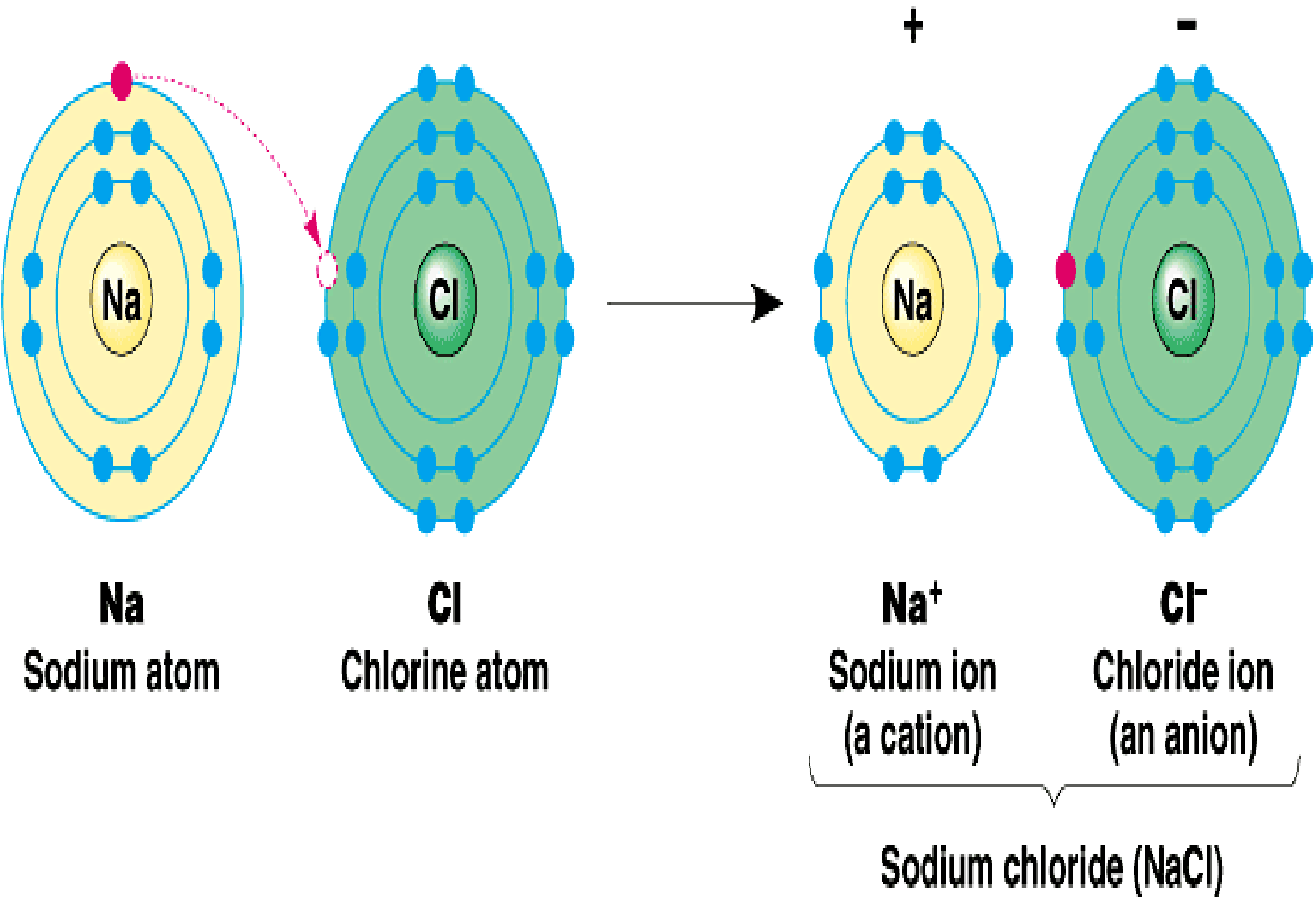
Important bonds in biological molecules:

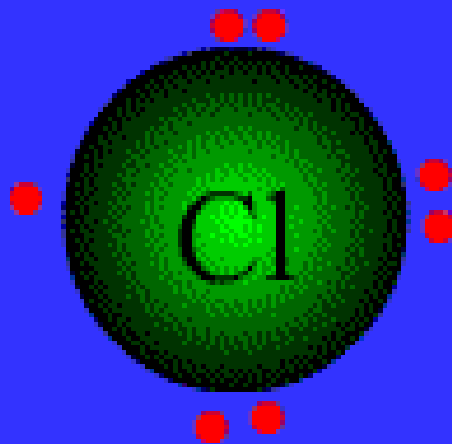
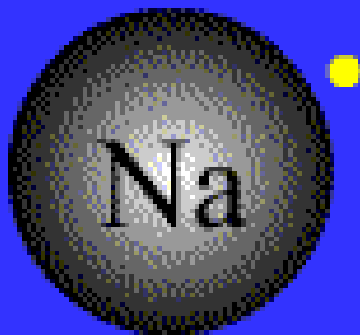
IONIC

- When atom loses or gains an electron, it becomes an positively or negatively charged **ION**
 - **Cations** are positively charged (because they have fewer electrons than protons)
 - **Anions** are negatively charged (because they have more electrons than protons)

- In an ionic bond, cations and anions are linked by attraction of opposite charges.







An ionic compound: NaCl

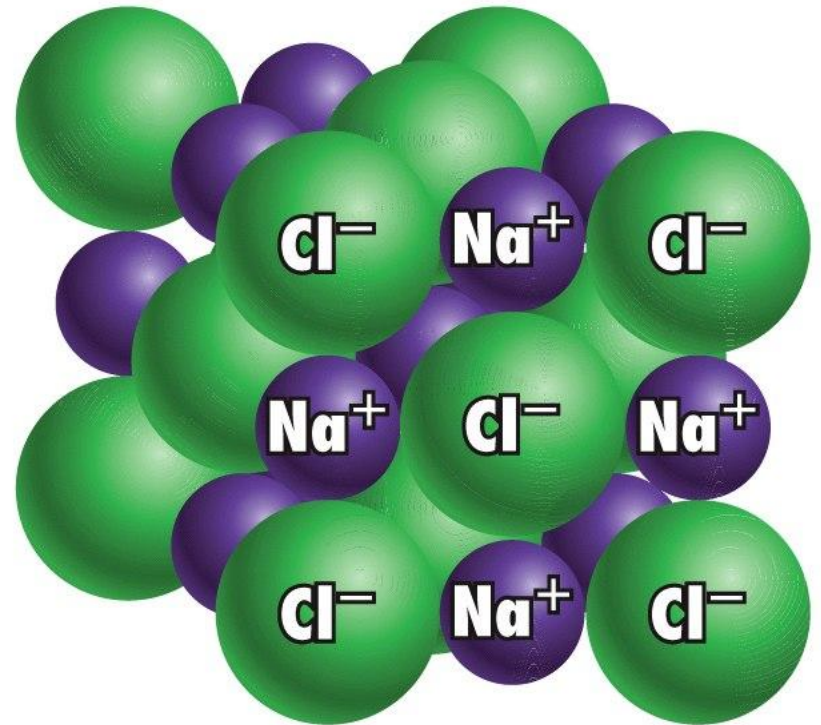
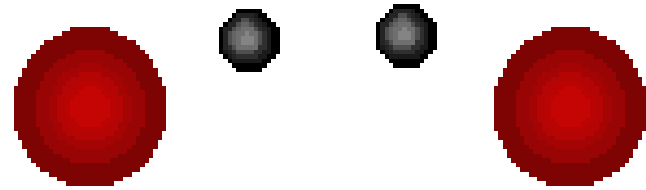


Figure 2-4c Biology: Life on Earth, 8/e
© 2008 Pearson Prentice Hall, Inc.

Important bonds in biological molecules: **COVALENT**

- A covalent bond hold together two atoms that share one or more pair of electrons

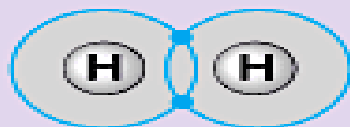


Double bonds: two pairs of shared electrons

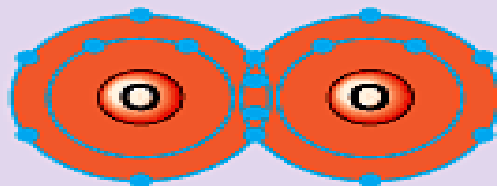
Triple bonds: three pairs of shared electrons

Covalent Bonds

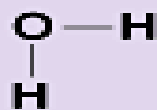
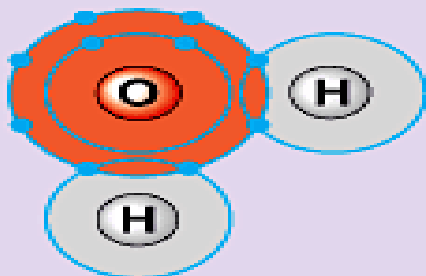
- Most biological molecules contain covalent bonds
- Covalent bonds are stronger than ionic bonds but vary in their stability



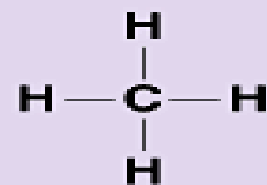
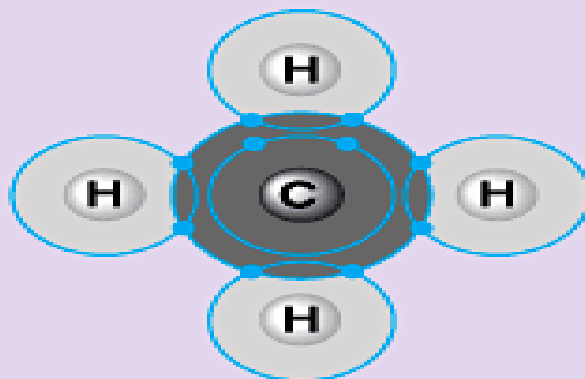
(a) Hydrogen



(b) Oxygen



(c) Water



(d) Methane

Do atoms always have an equal number of protons, neutrons and electrons?

1. Yes.
2. No.

Do atoms always have an equal number of protons, neutrons and electrons?

1. Yes.

2. No.

A chemical bond is formed through:

1. The gaining, losing, or sharing of protons.
2. The gaining, losing, or sharing of neutrons.
3. The gaining, losing, or sharing of electrons.
4. The gaining, losing, or sharing of isotopes.
5. The gaining, losing, or sharing of ions.

A chemical bond is formed through:

1. The gaining, losing, or sharing of protons.
2. The gaining, losing, or sharing of neutrons.
3. The gaining, losing, or sharing of electrons.
4. The gaining, losing, or sharing of isotopes.
5. The gaining, losing, or sharing of ions.

After sodium loses an electron, it is:

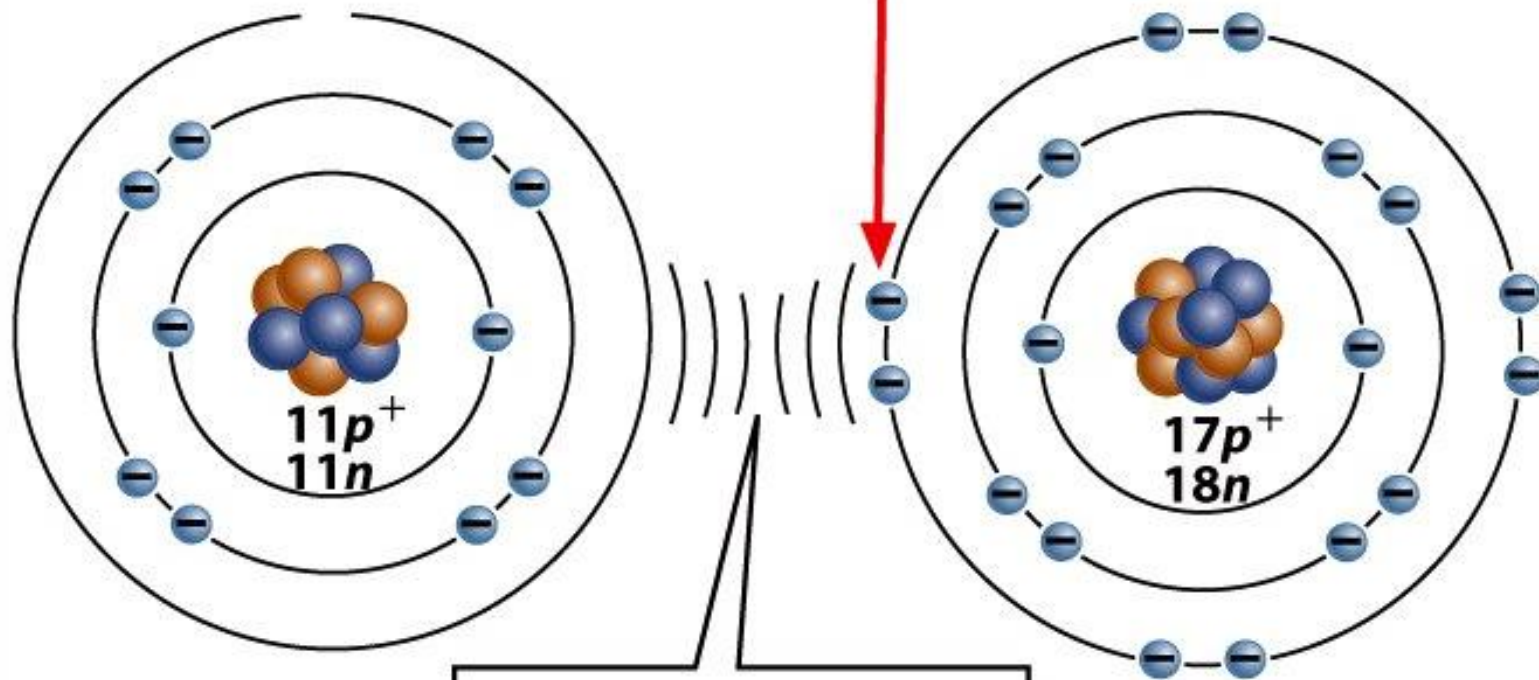
1. A positive ion.
2. A negative ion.
3. A neutral ion.
4. An isotope.
5. A compound.

After sodium loses an electron, it is:

1. A positive ion.
2. A negative ion.
3. A neutral ion.
4. An isotope.
5. A compound.

(b) Sodium ion (+)

Chloride ion (-)



**Attraction between
opposite charges**

After chlorine gains an electron, it is:

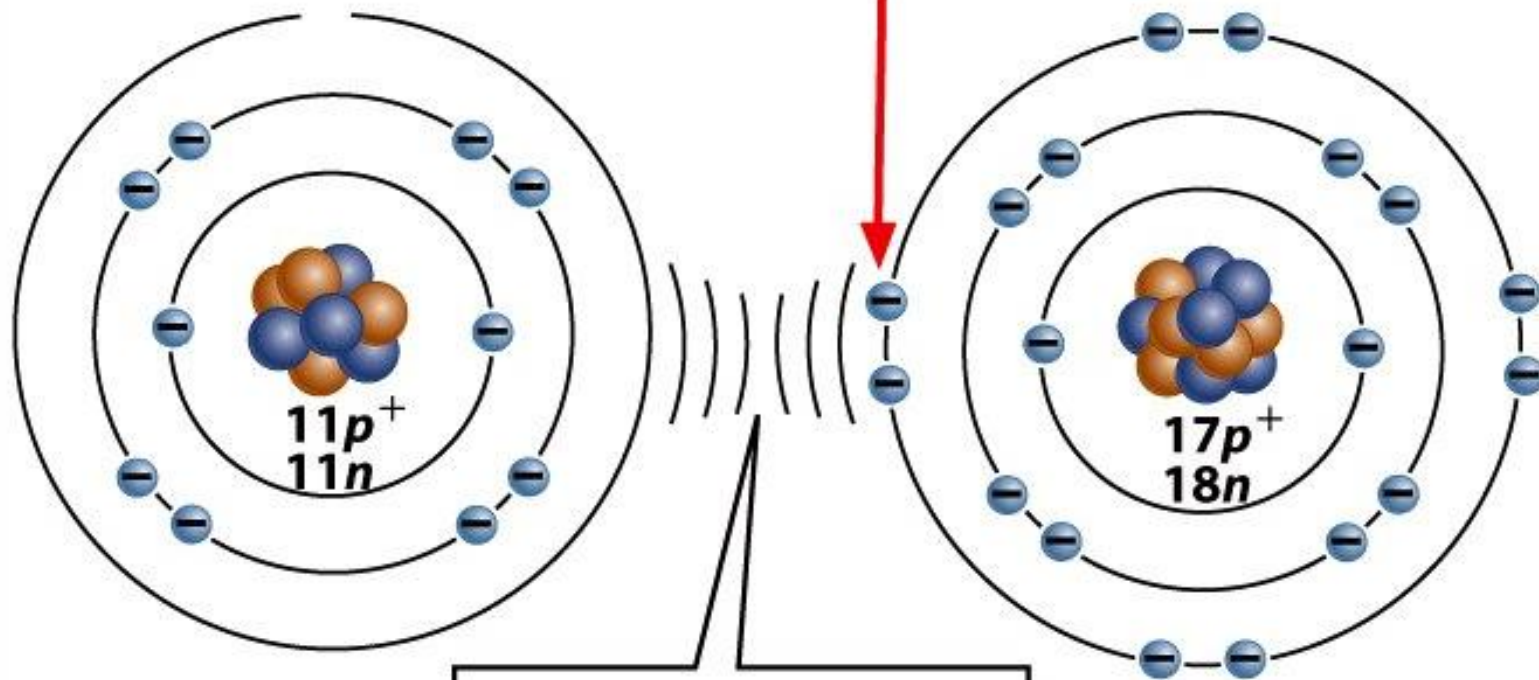
1. A positive ion.
2. A negative ion.
3. A neutral ion.
4. An isotope.
5. A compound.

After chlorine gains an electron, it is:

1. A positive ion.
2. A negative ion.
3. A neutral ion.
4. An isotope.
5. A compound.

(b) Sodium ion (+)

Chloride ion (-)



**Attraction between
opposite charges**

How many electrons does sodium lose to chlorine to form an ionic bond?

1. 1

2. 2

3. 3

4. 4

5. 5

6. 6

7. 7

8. 8

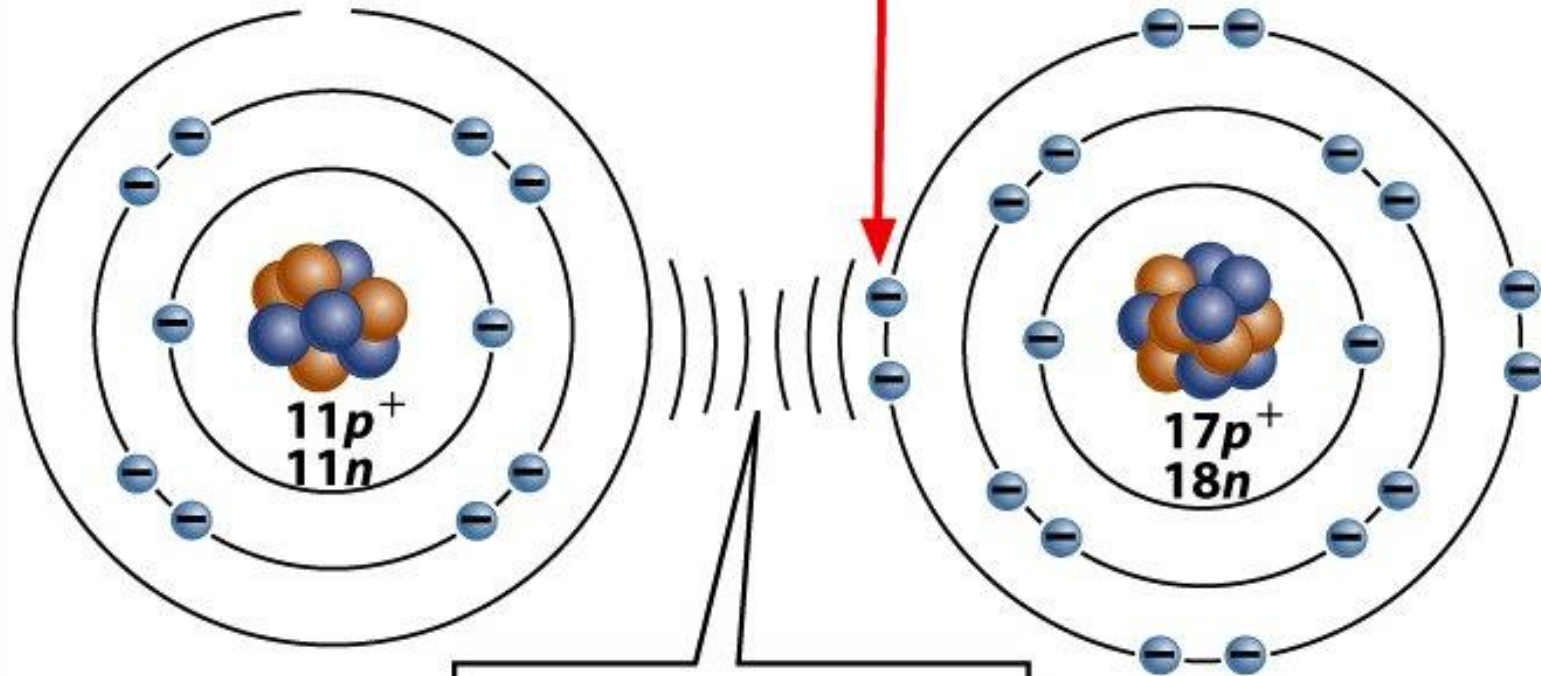
How many electrons does sodium lose to chlorine to form an ionic bond?

- 1. 1
- 2. 2
- 3. 3
- 4. 4

- 5. 5
- 6. 6
- 7. 7
- 8. 8

(b) Sodium ion (+)

Chloride ion (-)



**Attraction between
opposite charges**