Types of Bonding

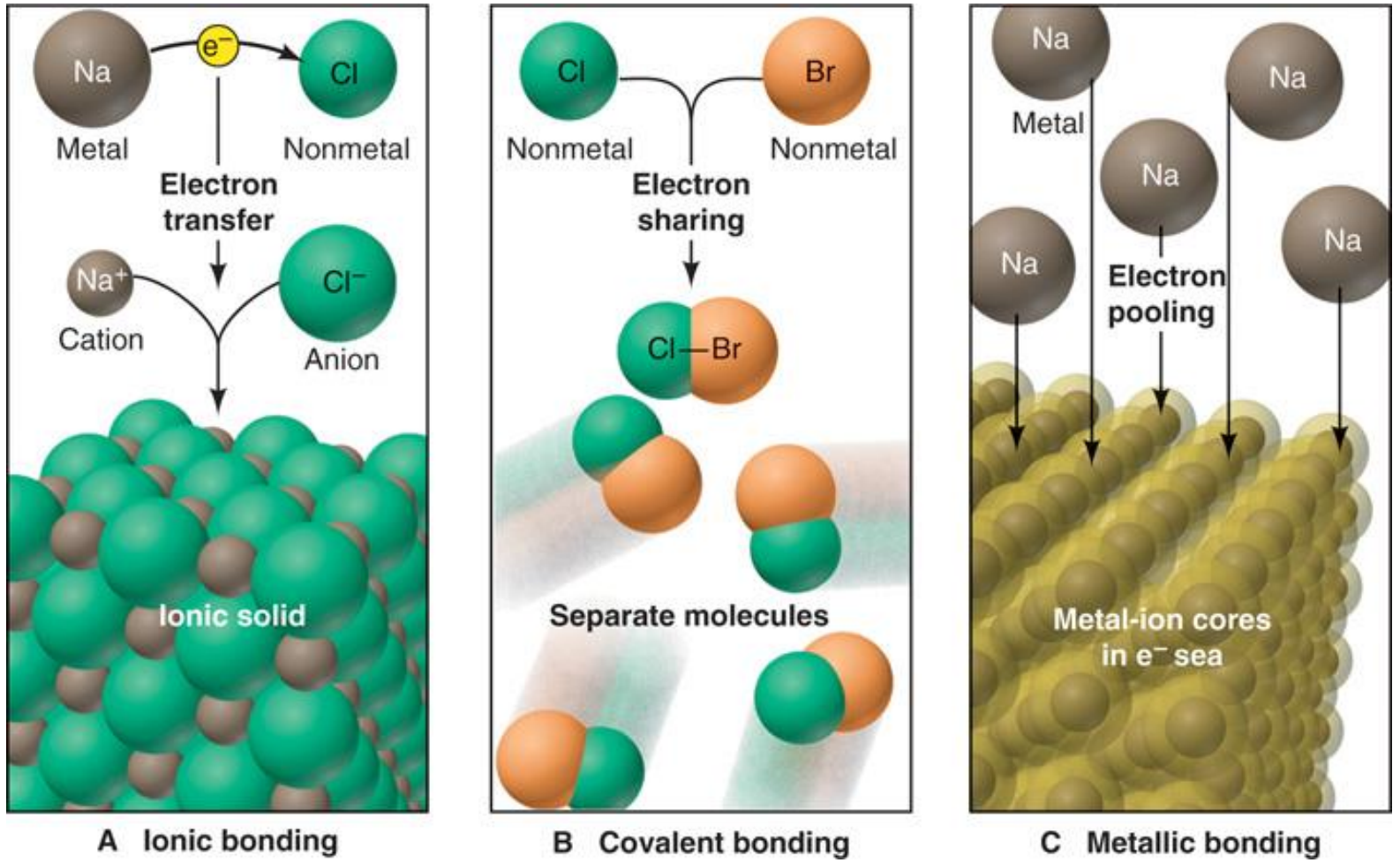


Fig. 8.3

Ionic Bonding: Lewis Structures

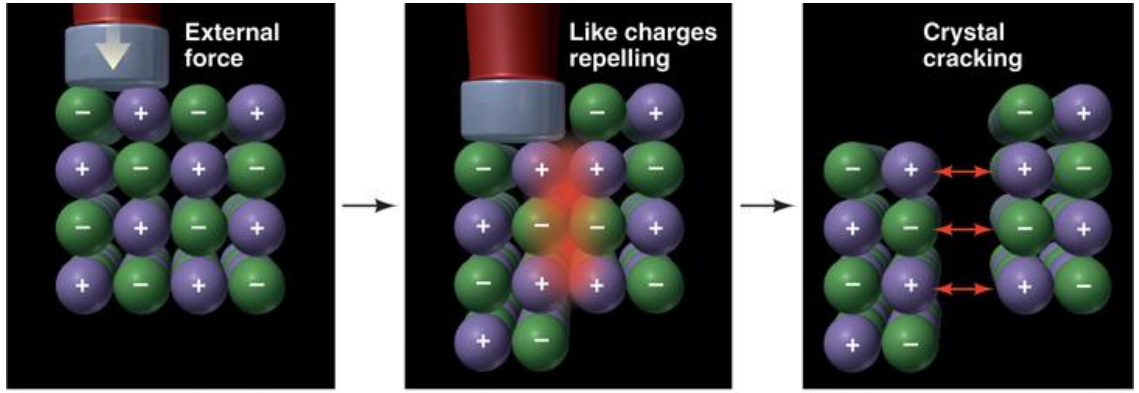
No electrons are shared in an ionic bond. The ions are held together only through electrostatic attractions.

To show ionic bonding in a Lewis structure, simply show the structures of the ions (and their formation)

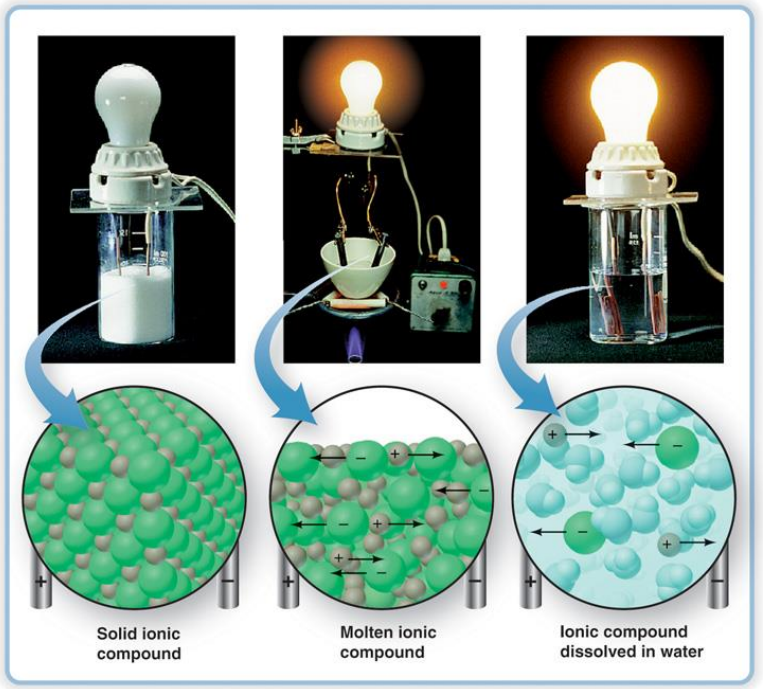
e.g. $MgCl_2$

Ionic Bonding

- Ionic compounds (which we describe in *formula units*, not molecules!) generally exist in crystals. The nature of the attraction explains some physical properties, such as brittleness:



and conductivity:



Metallic Bonding

Metallic bonding is based on a “sea” of delocalized electrons moving around the (very localized) nuclei:

Since the nuclei are freely sharing electrons, this bonding explains the conductivity and ductility of metals.

Covalent Bonding

In covalent bonds, electrons (two per bond) are shared between two atoms:

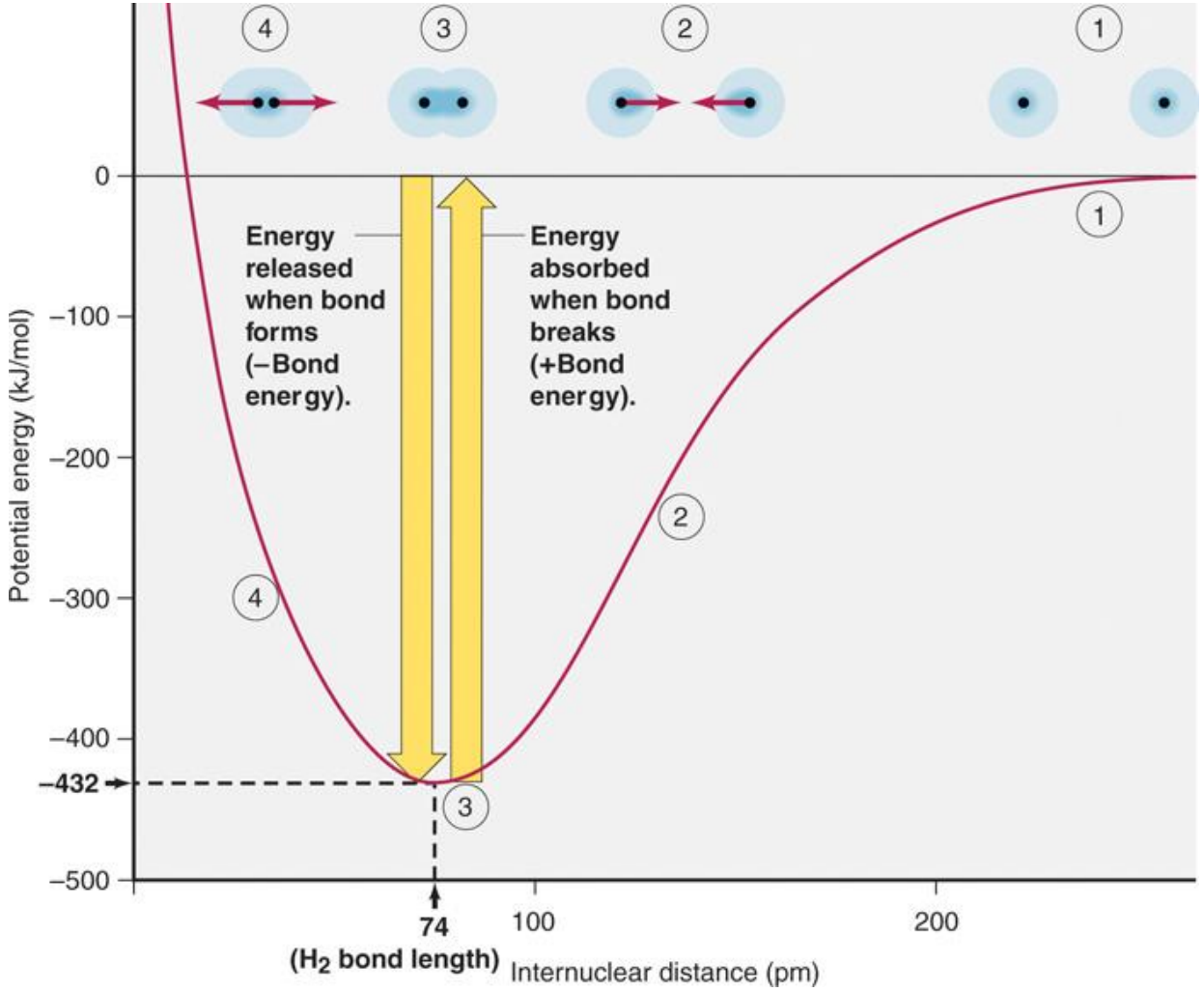


Figure 8.13

The continuum of bonding

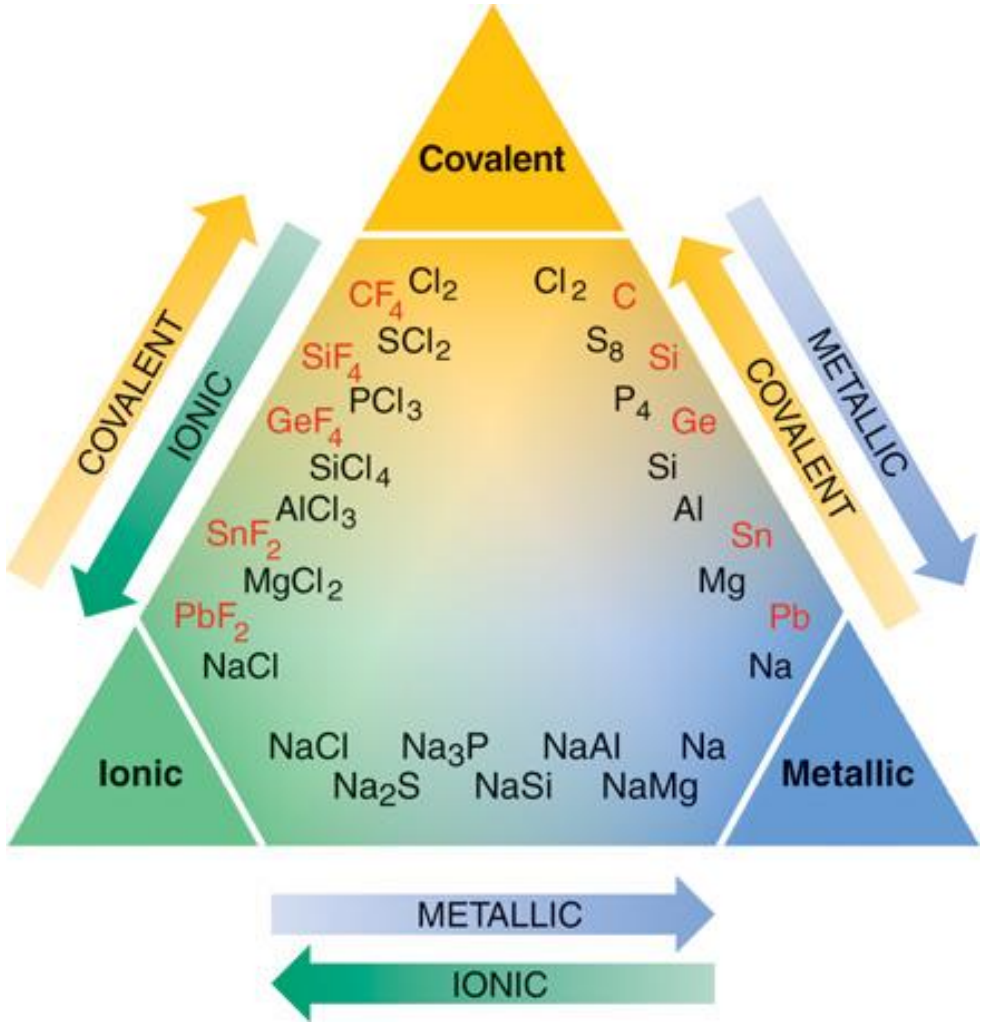


Figure 8.4

Describing Covalent Bonds

Lewis structures:

F_2:

Bond order:

Bond length:

Bond energy:

Draw the Lewis structure for N_2.

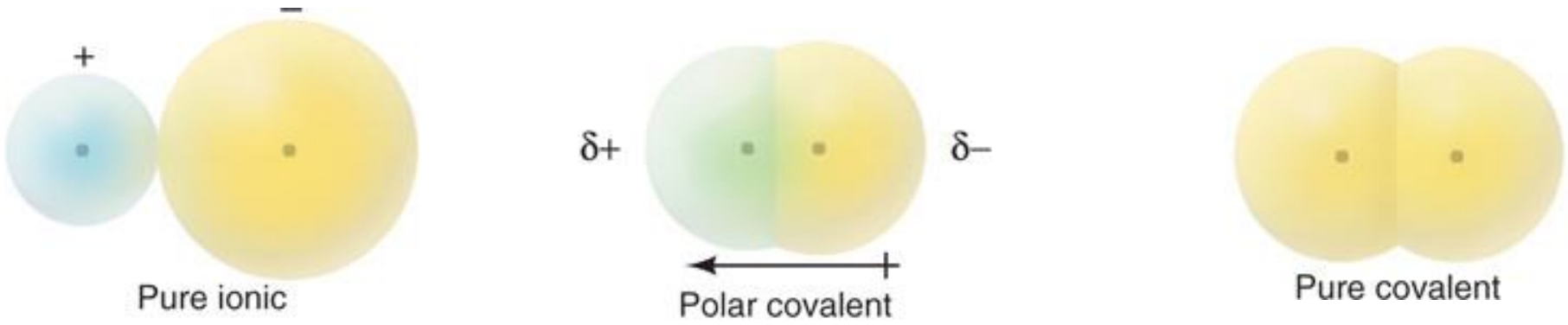
What is the bond order of this molecule?

Electronegativity & Bond Polarity

Covalent bonds where the electrons are not perfectly evenly shared are called **polar bonds** and have a **dipole**.

We can show this with arrows, or with a small delta +/-, meaning ‘partial charge’:

The ability of an atom to draw electrons towards itself in a covalent bond is **electronegativity**.



Electronegativties on the Pauling scale

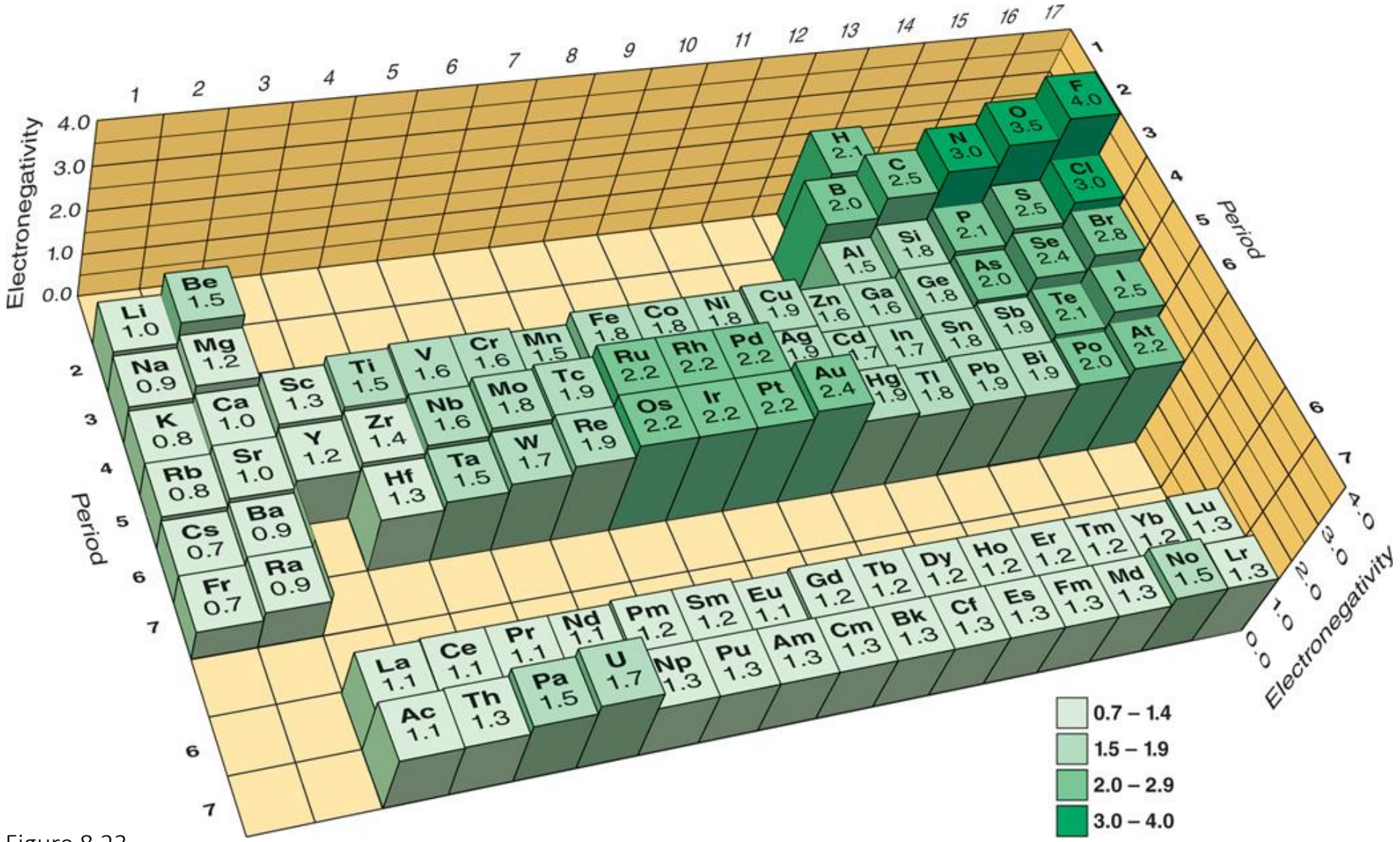
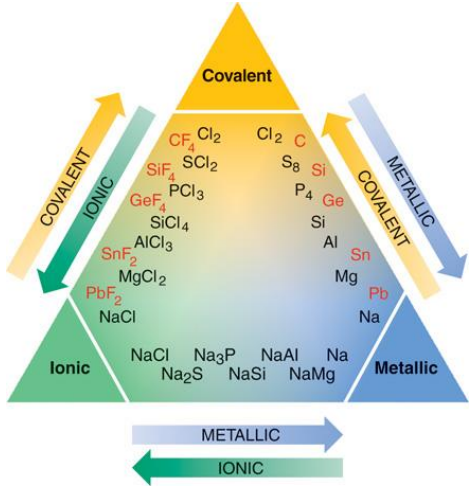


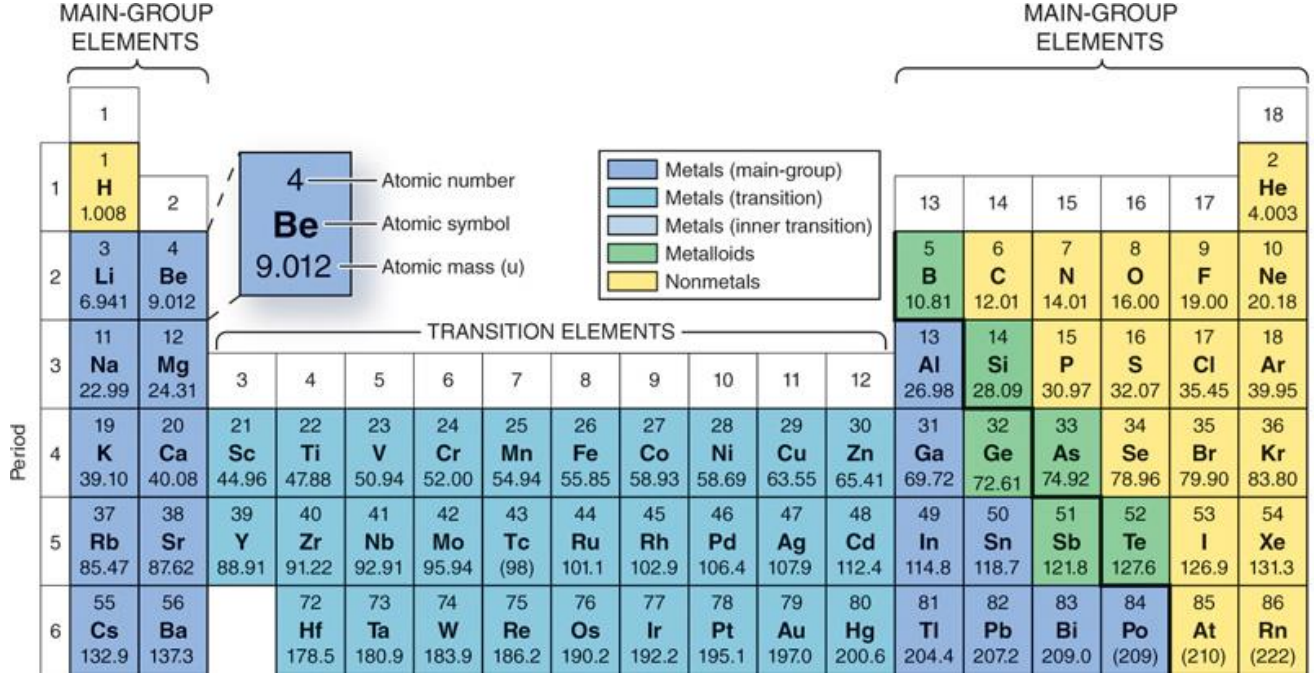
Figure 8.23

What kind of bond will it be?



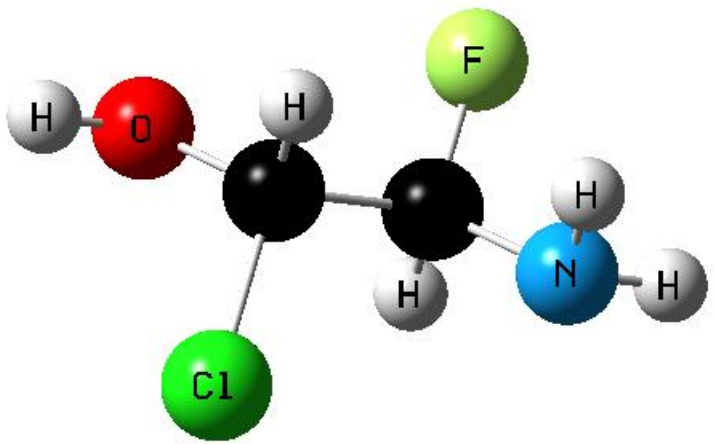
Though the actual bonding behaviour is a continuum, we have some helpful cutoffs:

- A difference in electronegativity > 1.7 is (usually) ionic.
- A difference < 0.4 is (usually) nonpolar.
- In between are polar covalent bonds.



PROPERTY	METAL ATOM	NONMETAL ATOM
Atomic size	Larger	Smaller
Z_{eff}	Lower	Higher
IE	Lower	Higher
EA	Less negative	More negative

Which bond is most polar?



1. C-O
2. C-Cl
3. C-F
4. C-H
5. C-N