

# Molecular Polarity

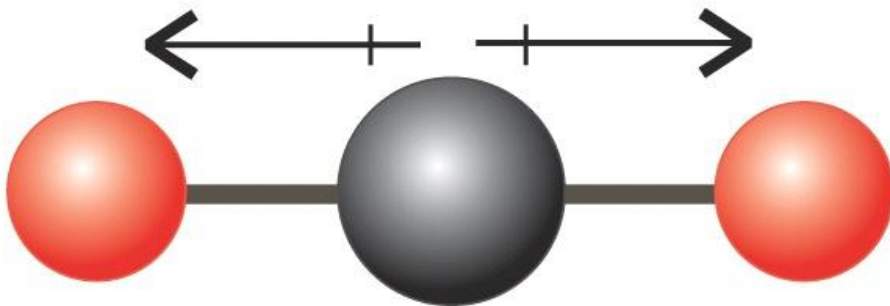
Chapter 4.5

# Molecular Polarity

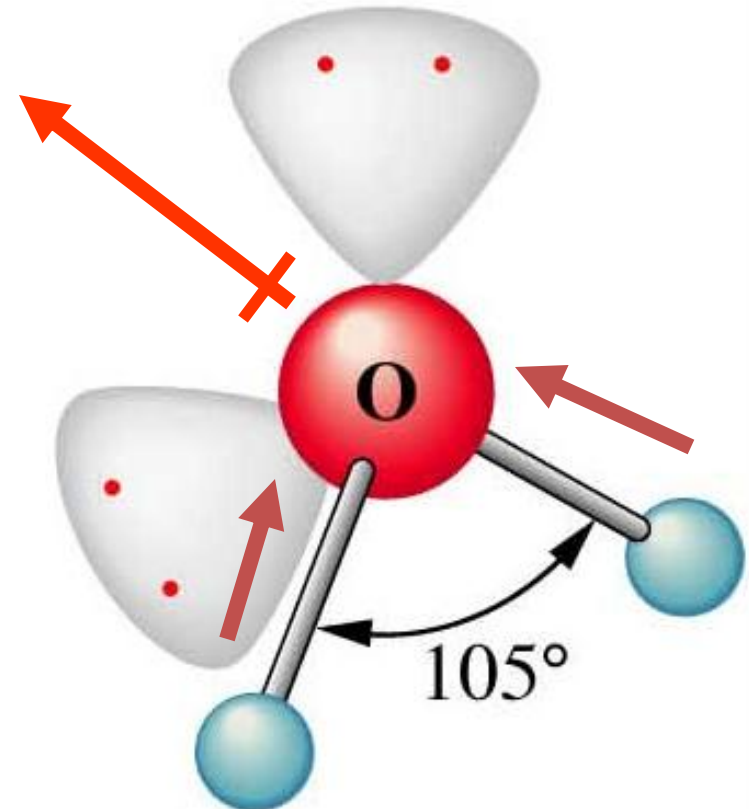
- To predict whether a specific **molecule** is polar or non-polar, you must consider *two* characteristics:
  1. The **types of bonds** in the molecule (polar or non-polar)
  2. The **geometric shape** of the molecule (VSEPR)

# Carbon Dioxide vs. Water

- In Carbon Dioxide the bond dipoles cancel resulting in no overall molecular dipole

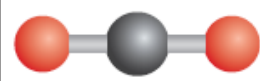
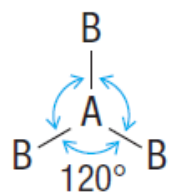
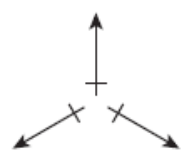
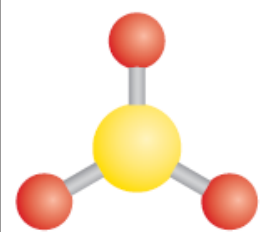
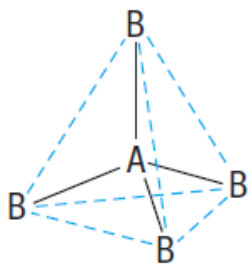
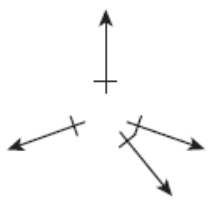
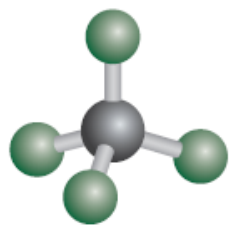


- In Water the bond dipoles add up resulting in an overall molecular dipole



# Symmetrical Shapes Result in Cancellation of Bond Dipoles

**Table 1** Types of Molecular Structures with Polar Bonds but No Net Dipole

Type	General example	Cancellation of polar bonds	Specific example	Ball-and-stick model
linear molecules with 2 identical bonds	$B-A-B$	$\leftarrow + \quad + \rightarrow$	$CO_2$	
planar molecules with 3 identical bonds			$SO_3$	
tetrahedral molecules with 4 identical bonds (109.5° apart)			$CCl_4$	

**TABLE 3.1** Dipole Moments of Selected Molecules

Molecule	Dipole moment, D	Molecule	Dipole moment, D
HF	1.91	PH <sub>3</sub>	0.58
HCl	1.08	AsH <sub>3</sub>	0.20
HBr	0.80	SbH <sub>3</sub>	0.12
HI	0.42	O <sub>3</sub>	0.53
CO	0.12	CO <sub>2</sub>	0
ClF	0.88	BF <sub>3</sub>	0
NaCl*	9.00	CH <sub>4</sub>	0
CsCl*	10.42	<i>cis</i> -CHCl=CHCl	1.90
H <sub>2</sub> O	1.85	<i>trans</i> -CHCl=CHCl	0
NH <sub>3</sub>	1.47		

\* The species consists of pairs of ions in the gas phase.

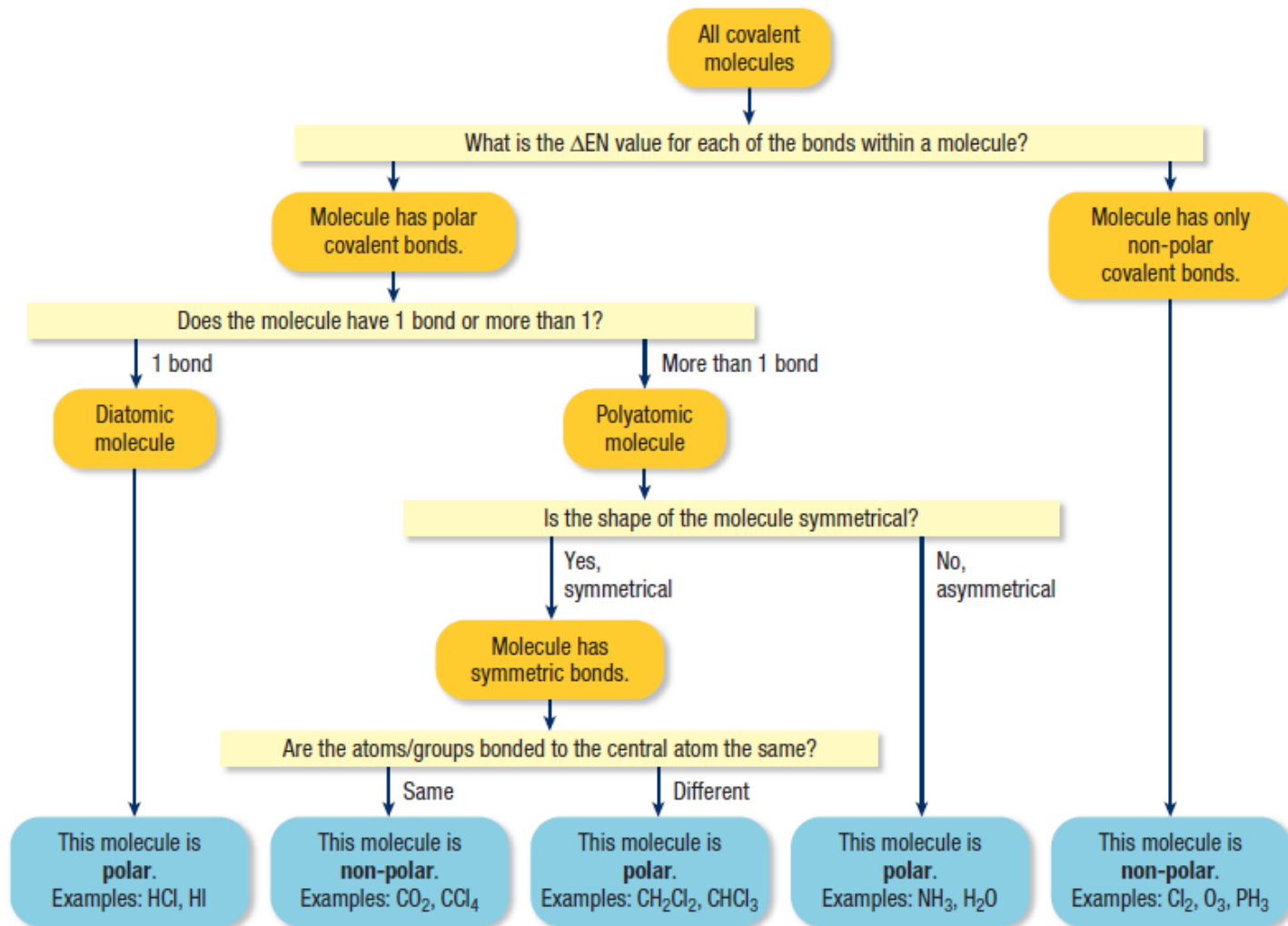


Figure 6 Flow chart to determine whether a molecule is polar or non-polar

# Practice

- Are the following molecules polar or non-polar?



# HOMWORK

## Required Reading:

p. 224-229

(remember to supplement your notes!)

## Questions:

p. 227 #1-2

p. 221 #1-9

