



Module 6

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BIOC 141



Electron Sharing

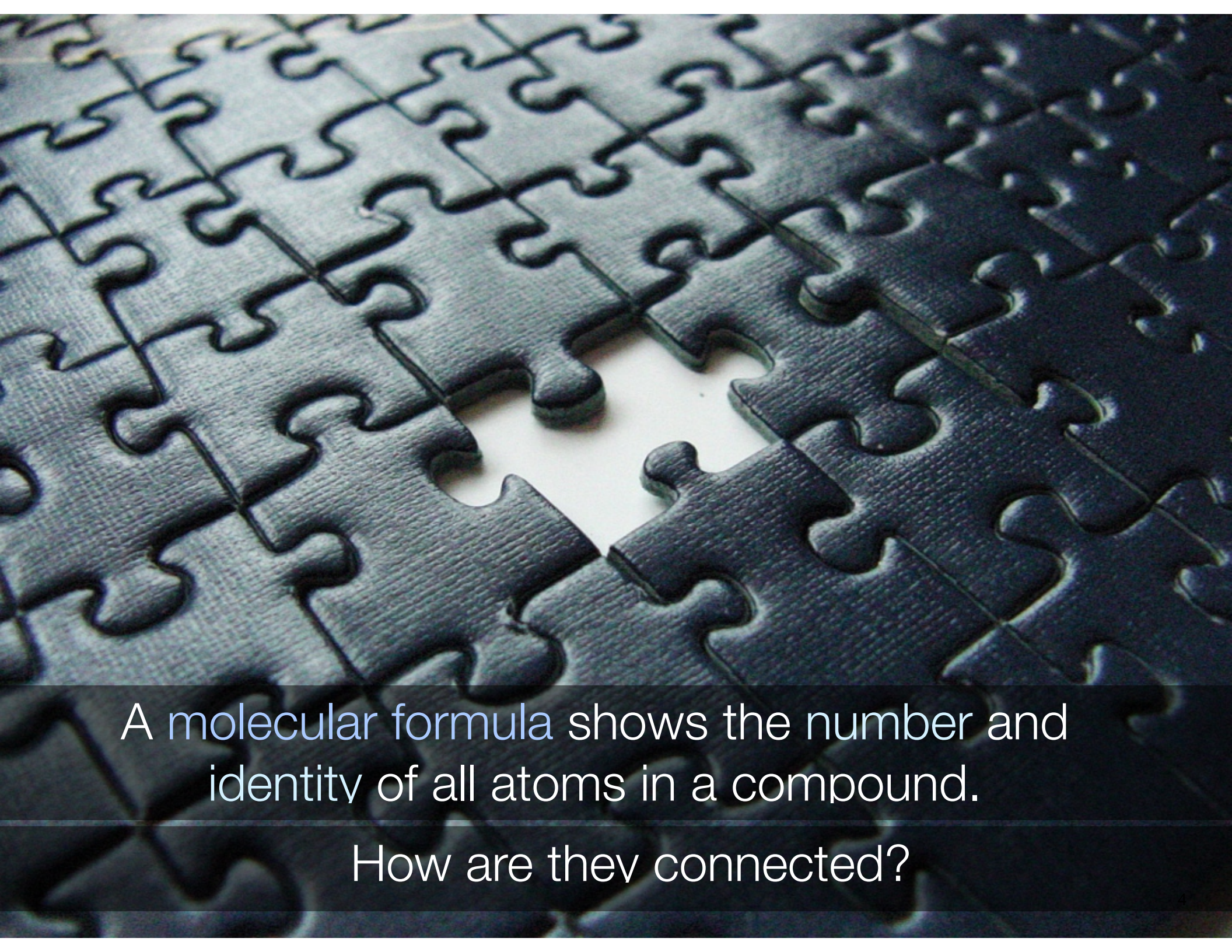
Key Bonding Patterns

1A 2A 3A 4A 5A 6A 7A

dot structure:

of bonds:

of lone pairs:

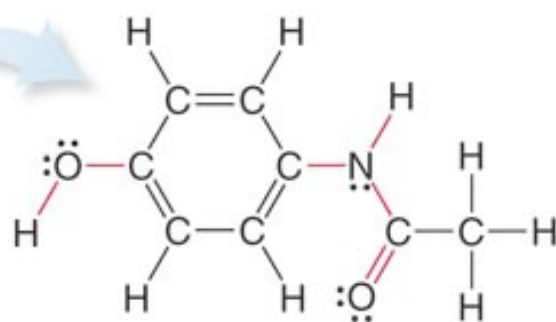


A molecular formula shows the number and identity of all atoms in a compound.

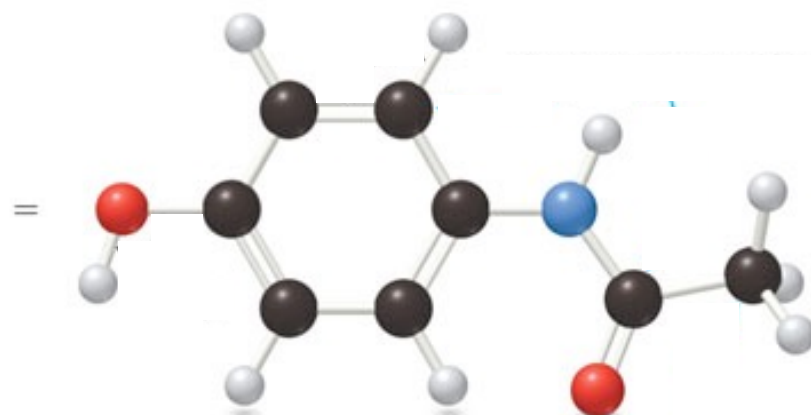
How are they connected?

Lewis Structures

Lewis structures show the **connectivity** of all atoms and valence electrons in a molecule.



$C_8H_9NO_2$
acetaminophen



Drawing Lewis Structures

1. **Arrange** atoms.
2. **Connect** atoms.
3. **Add** lone pairs.

Use Key Bonding Patterns



Household Cleaner

Draw the
Lewis structure
of NH_3

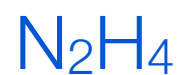




Draw the Lewis structure
of $\text{C}_2\text{H}_6\text{O}$

Concept Check

Draw the Lewis structure of:



Concept Review (Section 4.1)

CONCEPT REVIEW EXERCISES

1. How is a covalent bond formed between two atoms?
2. How does covalent bonding allow atoms in group 6A to satisfy the octet rule?

Practice Problems: 1-16

Lewis Structures - Multiple Bonds

What about the
Lewis structures
for O_2 and N_2 ?

Connect atoms with multiple covalent bonds to
form a **double or triple bond**.

Fruit Ripening Hormone

Draw the Lewis structure of C_2H_4



Outliers to Octet Rule

Hydrogen - only has two electrons.

Elements in group 2A/3A can have less than 8 electrons.

Phosphorus (P) and sulfur (S) can have more than 8 electrons.

Atoms that have charges.

Naming Covalent Compounds

Step 1: Name the first non-metal with its
element name

Step 2: Name the second non-metal using
the suffix “-ide”



Naming Covalent Compounds

Step 3: Add prefixes to show the **number of atoms** of each element

Don't put two vowels together except with di- and tri-



TABLE 4.1 Common Prefixes in Nomenclature

Number of Atoms	Prefix
1	Mono
2	Di
3	Tri
4	Tetra
5	Penta
6	Hexa
7	Hepta
8	Octa
9	Nona
10	Deca

Concept Check

Name the following compounds



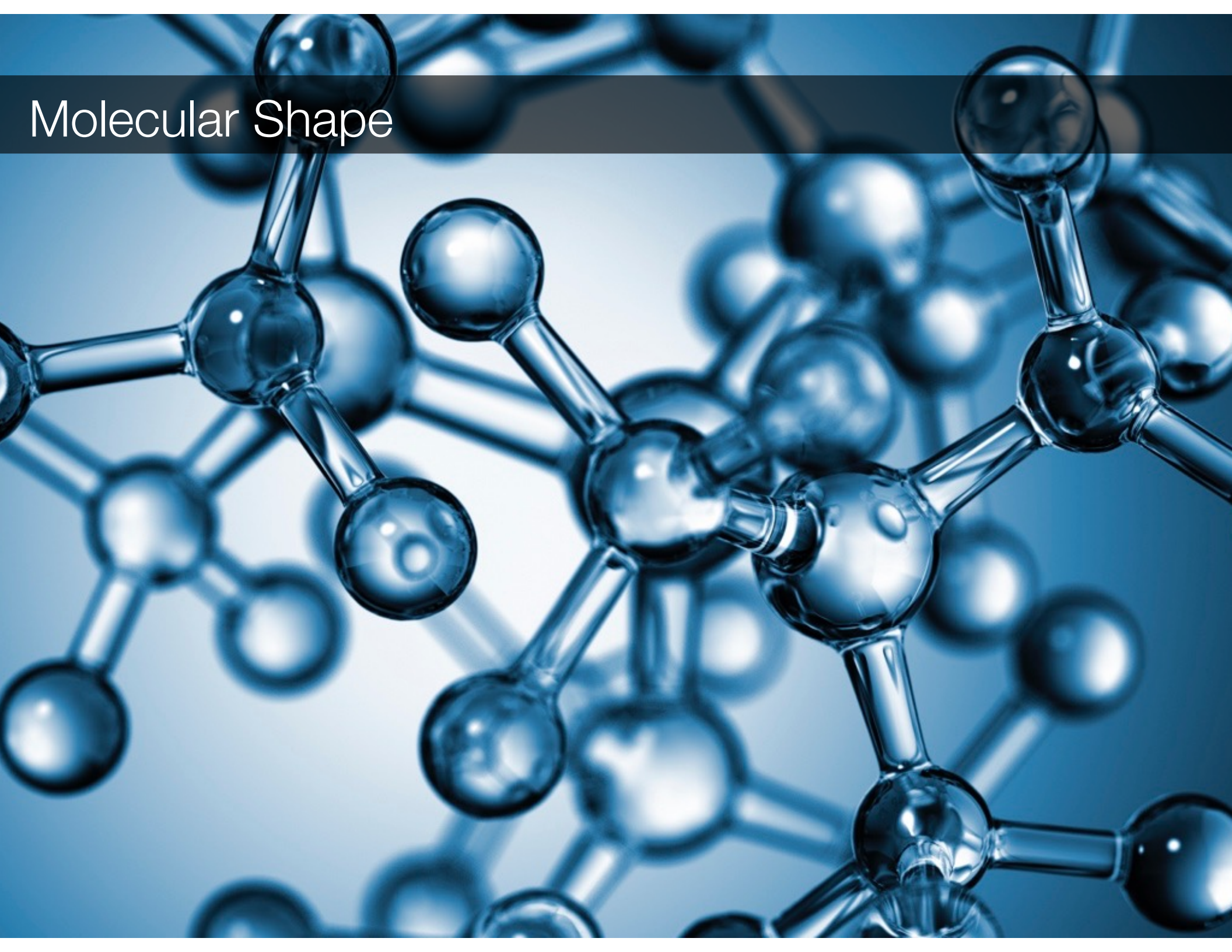
Concept Review (Section 4.2 + 4.3)

CONCEPT REVIEW EXERCISES

1. How do you recognize a covalent compound?
2. What are the rules for writing the molecular formula of a simple covalent compound?
3. What are the rules for naming a simple covalent compound?

Practice Problems: 1-10 in 4.2
1-4 in 4.3

Molecular Shape



Molecular Shape

Determine how many **groups** surround the **central atom**.

A **group** is either an **atom** or a **lone pair** of electrons

Five Key Molecular Shapes

Molecular Shape - Two Groups

carbon dioxide

Any atom surrounded by two groups is **linear**.

Molecular Shape - Three Groups

boron trifluoride

Any atom surrounded by three groups is trigonal planar.

Molecular Shape - Four Groups

silicon tetrachloride

Any atom surrounded by four groups is **tetrahedral**.

Molecular Shape - Four Groups

phosphorus tribromide

Any atom surrounded by four groups (one lone pair)
is trigonal pyramidal.

Molecular Shape - Four Groups

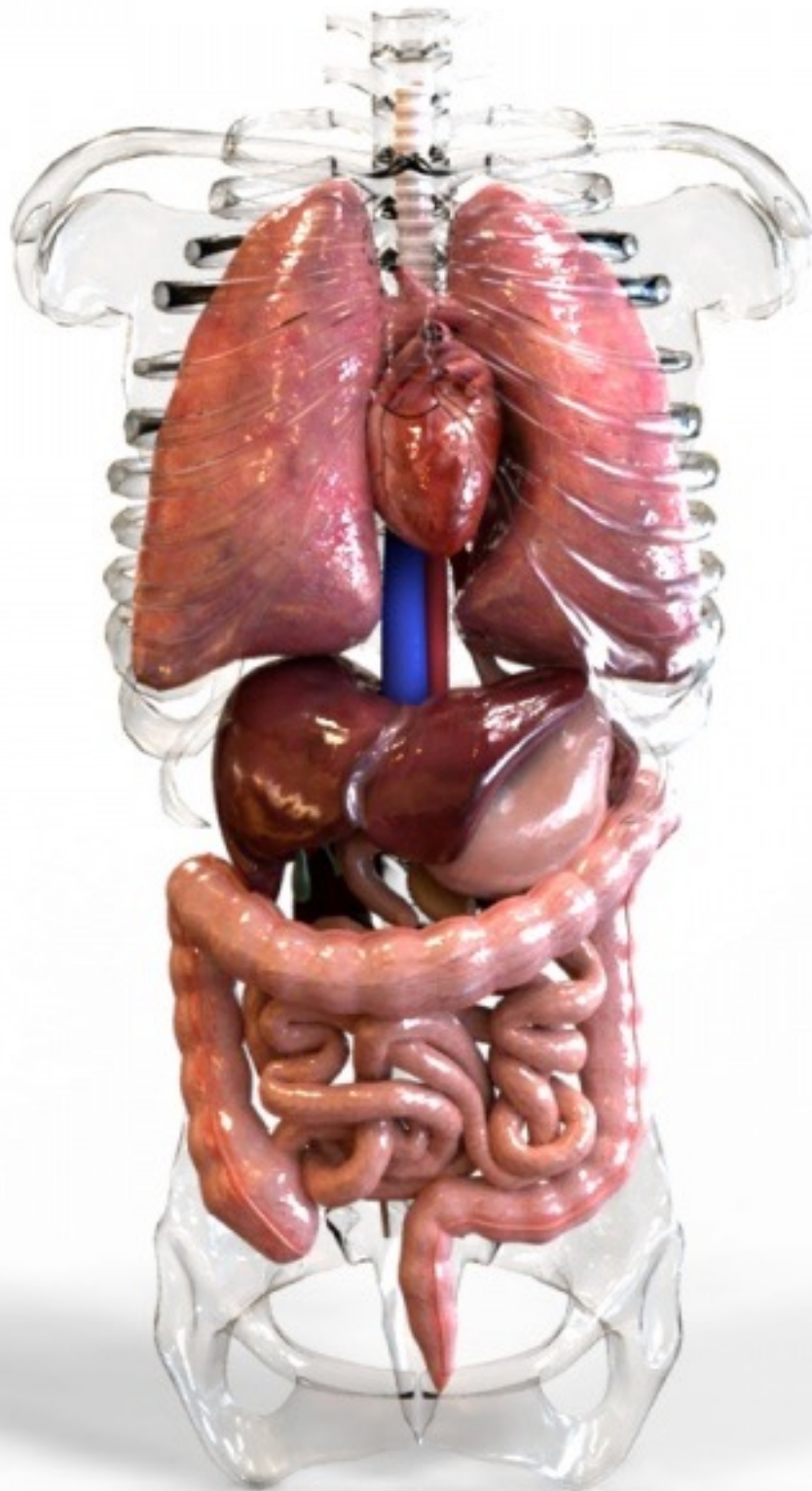
water

Any atom surrounded by four groups (two lone pairs)
is bent.

Household Cleaner

What is the
molecular shape
of NH_3





Embalming Fluid

What is the
molecular shape
of CH_2O ?

Bond Polarity



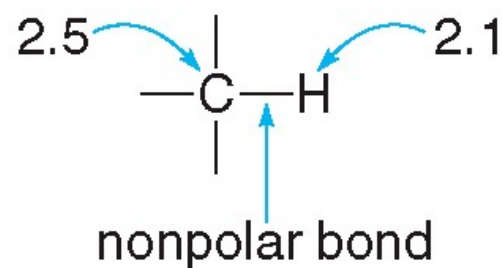
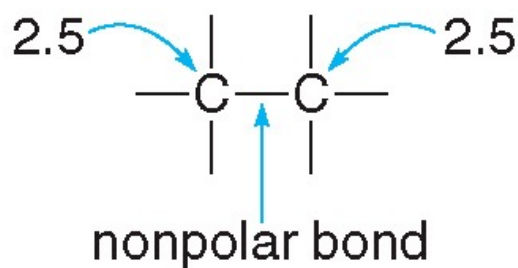
Bond Polarity

Electronegativity is a measure of how much an atom “wants” electrons.

1A							8A
H 2.1	2A						
Li 1.0	Be 1.5						
Na 0.9	Mg 1.2						
K 0.8	Ca 1.0						
Rb 0.8	Sr 1.0						
		3A	4A	5A	6A	7A	
		B 2.0	C 2.5	N 3.0	O 3.5	F 4.0	
		Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0	
		Ga 1.6	Ge 1.8	As 2.0	Se 2.4	Br 2.8	
		In 1.7	Sn 1.8	Sb 1.9	Te 2.1	I 2.5	

Bond Polarity

If the difference in electronegativities of two atoms are < 0.5 units, the bond is non-polar.



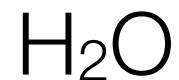
If the difference in electronegativities of two atoms are $> \text{ or } = 0.5$ units, the bond is polar.

Overall Polarity of a Molecule

Step 1:

Step 2:

Step 3:



Concept Review (Section 4.4 + 4.5)

CONCEPT REVIEW EXERCISES

1. What is the name for the distance between two atoms in a covalent bond?
2. What does the electronegativity of an atom indicate?
3. What type of bond is formed between two atoms if the difference in electronegativities is small?
Medium? Large?

2. How do you determine the shape of a molecule?

Practice Problems: 7-10 in 4.4
5-8 in 4.5