2.9 Polarity
-molecular dipole: vector sum of bond and lone-pair dipoles

A simple molecule is totally nonpolar only if:
1. Central atom has no lone pairs
2. All attached atoms are the same

Practical:
- Lone pairs and O-H or N-H bonds usually dominate
- C-C, C-H, and C-halogen bonds are practically nonpolar or at best only weakly polar

Problems: Classify as totally nonpolar or polar.

a. CO_2 b. CCl_4 c. CH_4 d. C_4H_{10}

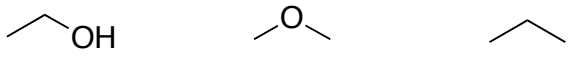
e. H_2O f. NH_3 g. CH_3CH_2OH h. $CHCl_3$

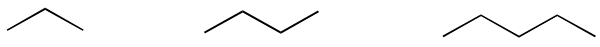
2.10 Intermolecular Forces and Boiling Points
1. Hydrogen bonds (O-H or N-H)
2. Dipole-Dipole
   - Much weaker than hydrogen bonds
3. London Forces
   - Increases with increasing molecular weight

Intermolecular Forces impact:
1. Boiling points and melting points
2. Solubility

For Boiling Points:
1. If weight is about equal → H-bonder > polar > nonpolar
2. If H-bonding/polarity is comparable: high mw > lower mw

Problem: Rank the boiling points, 1 being highest

a. 

b. 

c. 

2.11 Polarity and Solubility

2 Practical Rules:

1. The more N's or O's in a molecular, the greater it's water solubility
2. The more C's, the lower it's water solubility

Facts/Theory

1. "Like dissolves like"
   - enthalpy and entropy factors

Good solubility	Bad solubility
a. Polar solvent-polar solute	a. Polar solvent-nonpolar solute
b. Nonpolar solvent-nonpolar solute	b. Nonpolar solvent-polar solute

2. Water is very polar

3. Any molecules with N or O can H-bond with water (even if it can't necessarily H-bond itself) (Rule 1)

4. Adding C's adds C-C, C-H nonpolar bonds → reduces water solubility (Rule 2)

5. Hydrocarbons and halocarbons are insoluble in water
   - Many other organics have low solubility in water
   - Depends on the ratio of nonpolar/polar, N or O to C

Problems: Circle the more water soluble of the following pairs:

1. 

2. 

3. 

Problem: Box the higher boiling in each pair. Does water solubility and boiling point always correspond? Why or why not?