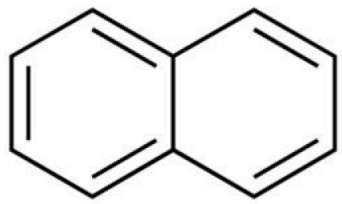
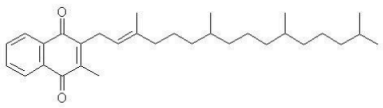
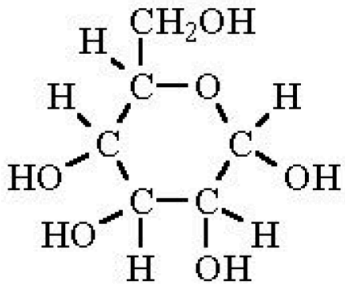
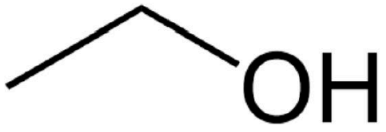
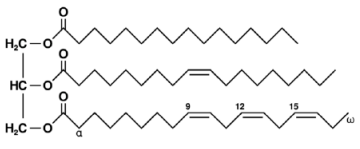
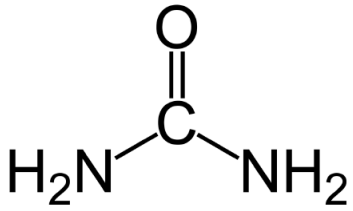
General Chemistry I

June 30, 2021

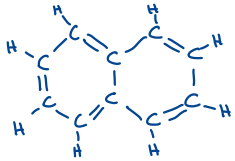
1. **Rationalize the difference in boiling points for each of the following pairs of substances:**
   a. **HF (20°C); HCl (-85°C):**
   b. **HCl (-85°C); LiCl (1360°C):**
   c. **Br_2 (59°C); ICl (97°C):**
   d. **$CHCl_3$ (61°C); $CHBr_3$ (150°C):**

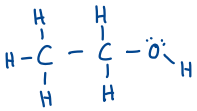
2. **Based on the principle that like dissolves like (i.e. molecules with similar IMFs will form homogeneous mixtures with each other), predict which pairs of substances you would expect to form homogenous solutions when combined. What types of IMFs are involved?**
   a. **CCl_4 and H_2O:**
   b. **KCl and H_2O:**
   c. **Br_2 and CCl_4:**
   d. **CH_3CH_2OH and H_2O:**
   e. **CH_3OH and $CH_3(CH_2)_4CH_3$:**

3. **Predict whether the following molecules would be more soluble in water or hexane (C_6H_{14}).**

Napthalene 	Vitamin K 	Glucose 
Ethanol 	Triglyceride 	Urea 

Note: above notation uses implicit hydrogens and carbons. Carbons are unlabeled at junctures and contain implied hydrogens necessary to complete octet. This notation will become very common as you start classes in the fall. Below are corresponding Lewis structures for naphthalene and ethanol.





4. **The enthalpy of vaporization of acetone is 32.0 kJ/mol. The normal boiling point of acetone is 56.5°C. What is the vapor pressure of acetone at 25.0°C?**

5. **In the ground state of antimony, Sb,**
    a. **How many electrons have $l \geq 1$ as one of their quantum numbers?**

    b. **How many electrons have $m_l = 0$?**

    c. **How many electrons have $m_l = 1$?**

6. **In each of the following sets, which atms or ion has the smallest radius?**
    a. **Li, Na, K**
    b. **P, As**
    c. **O^+, O, O^-**
    d. **S, Cl, Kr**
    e. **Pd, Ni, Cu**

7. **A gas consisting of only carbon and hydrogen has an empirical formula of CH_2. The gas has a density of 1.65 g/L at 27°C and 734 torr. Determine the molar mass and molecular formula of the gas.**