

CHEM 103

R&R 18

26 June 2024

Adapted from a 30 June 2021 document

1. Rationalize the difference in boiling points for each of the following pairs of substances:

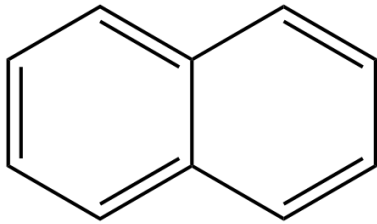
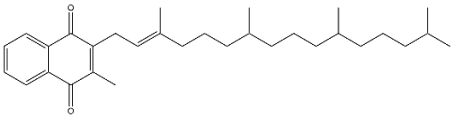
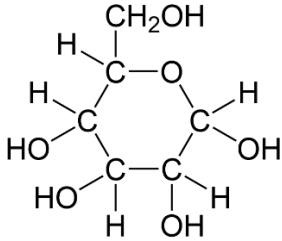
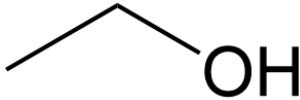
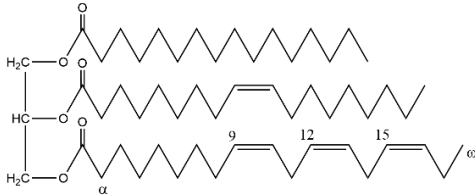
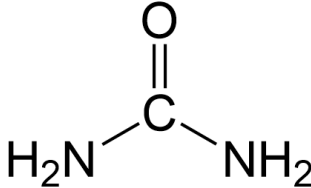
- a. HF (20 °C); HCl (-85 °C)
- b. HCl (-85 °C); LiCl (1360 °C)
- c. Br<sub>2</sub> (59 °C); ICl (97 °C)
- d. CHCl<sub>3</sub> (61 °C); CHBr<sub>3</sub> (150 °C)

2. Based on the principle that like dissolves like (i.e., molecules with similar classes of IMFs will form homogeneous mixtures with each other), predict with pairs of substances you would expect to form homogeneous solutions when combined. What types of IMFs are involved for each pair?

- a. CCl<sub>4</sub> and H<sub>2</sub>O
- b. KCl and H<sub>2</sub>O
- c. Br<sub>2</sub> and CCl<sub>4</sub>
- d. CH<sub>3</sub>CH<sub>2</sub>OH and H<sub>2</sub>O
- e. CH<sub>3</sub>OH and CH<sub>3</sub>(CH<sub>2</sub>)<sub>4</sub>CH<sub>3</sub>

3. The enthalpy of vaporization of acetone is 32.0 kJ mol<sup>-1</sup>. The normal boiling point of acetone is 56.5 °C. What is the vapor pressure of acetone at 25.0 °C?

4. Predict whether the following molecules would be more soluble in water or hexane (C<sub>6</sub>H<sub>14</sub>).

<p>Naphthalene</p> 	<p>Vitamin K</p> 	<p>Glucose</p> 
<p>Ethanol</p> 	<p>Triglyceride</p> 	<p>Urea</p> 

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 atom or ion has the smallest radius?

a. Li, Na, K

b. P, As

c. O<sup>+</sup>, O, O<sup>-</sup>

d. S, Cl, Kr

e. Pd, Ni, Cu

7. A gas consisting of only carbon and hydrogen has an empirical formula of  $\text{CH}_2$ . 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.