Chem 1515.001 – 1515.006
InClass Exercise #1
Week of September 24, 2001
Fall 2001

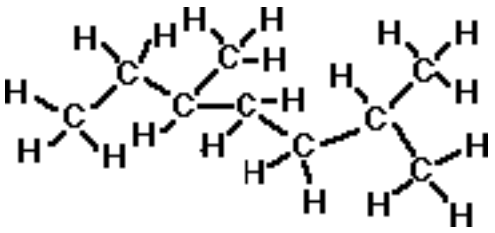
Name_____

TA Name _____

Lab Section #_____

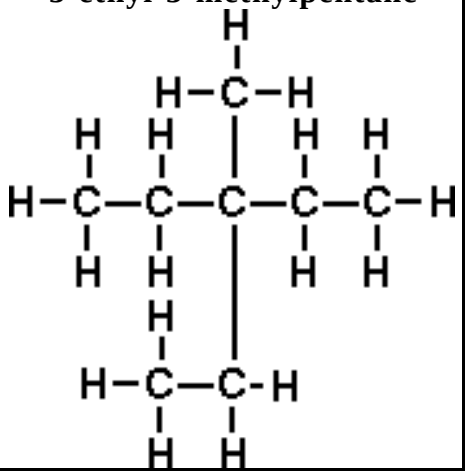
ALL work must be shown to receive full credit. **Due at the end of laboratory.**

ICE1.1. Give the name or draw the Lewis structure for each of the following compounds.

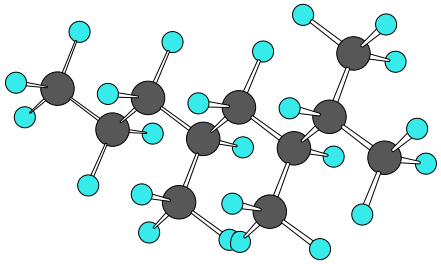


2,5-dimethyheptane

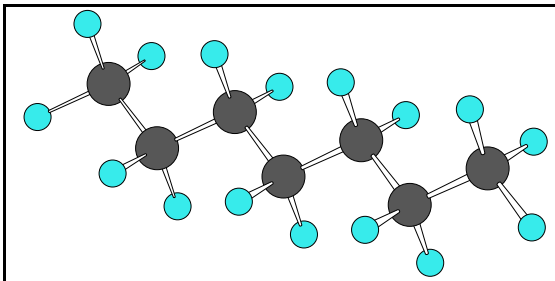
3-ethyl-3-methylpentane



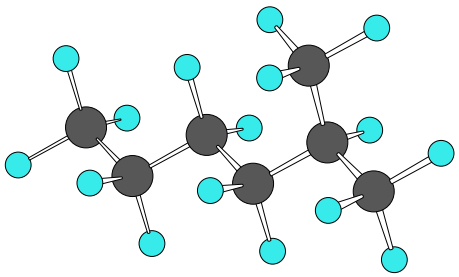
2,3,5-trimethyloctane



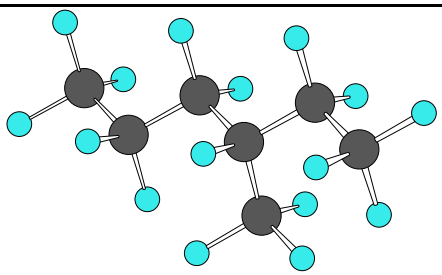
ICE1.2. Draw and name the structural isomers for C_7H_{16}.



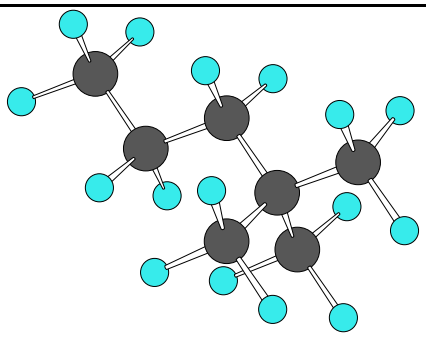
***n*-heptane**



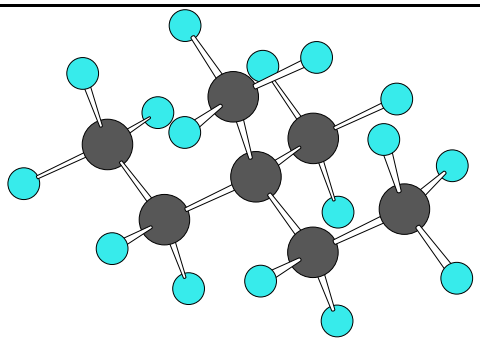
2-methylhexane



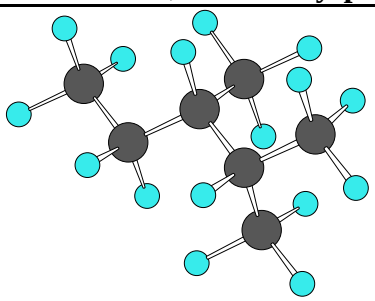
3-methylhexane



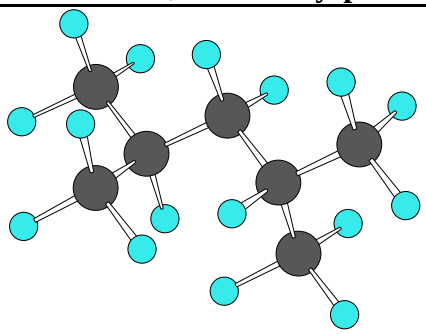
2,2-dimethylpentane



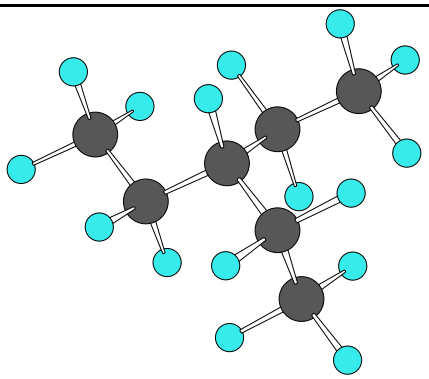
3,3-dimethylpentane



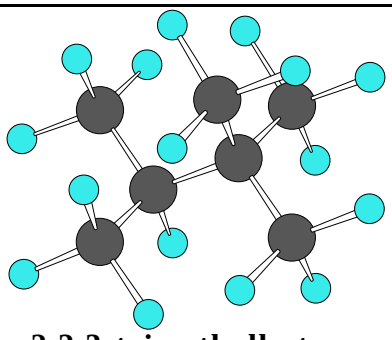
2,3-dimethylpentane



2,4-dimethylpentane



3-ethylpentane



2,2,3-trimethylbutane

ICE1.3. Which member of the following pairs is more soluble in water? Provide a brief explanation supporting your choice. Also provide a brief explanation why you ruled out the other choice.

a) HCl or C_4H_9Cl

HCl is more soluble. HCl is a polar covalent molecule that dissociates completely into ions when added to water. C_4H_9Cl is nonpolar, or very nearly nonpolar, has only London Dispersion forces, and is insoluble in water.

b) CH_3NH_2 or $(CH_3)_3N$

CH_3NH_2 and $(CH_3)_3N$ can hydrogen bond in water. But CH_3NH_2 will form more hydrogen bonds with water compared to $(CH_3)_3N$ and is more soluble.

ICE1.4. A solution of formic acid, HCOOH, is prepared by 54.0 g of formic acid in enough water to make 250 mLs of solution.

a) calculate the molarity of the solution;

$$\mathbf{54.0\ g\left(\frac{1\ mol}{46\ g}\right) = 1.17\ mol}$$

$$\mathbf{\frac{1.17\ mol}{0.250\ L} = 4.70\ M}$$

b) the solution described above is also 20.0 % by weight formic acid. Calculate the mole fraction of formic acid in the solution;

Assume 100 g of solution

$$\mathbf{20\ g\ HCOOH\left(\frac{1\ mol}{46\ g}\right) = 0.435\ mol}$$

$$\mathbf{80\ g\ H_2O\left(\frac{1\ mol}{18\ g}\right) = 4.44\ mol}$$

$$\mathbf{\text{mol fraction HCOOH} = \frac{0.435\ mol}{0.435\ mol + 4.44\ mol} = 0.891}$$

c) assuming formic acid is a nonvolatile, nonelectrolyte calculate the freezing point of this solution;

$$\mathbf{\text{molality} = \frac{\text{mol HCOOH}}{\text{kg solvent}} = \frac{0.435\ mol\ HCOOH}{0.080\ kg} = 5.44\ molal}$$

$$\mathbf{\Delta T_f = iK_f m = 1 \cdot 1.86\ ^\circ C\ m^{-1} \cdot 5.44\ molal = 10.1\ ^\circ C}$$

$$\mathbf{T_f = -10.1\ ^\circ C}$$

ICE1.4. (CONTINUED)

d) formic acid is actually a weak acid. Suggestion a reasonable experimental freezing point (do not calculate) for this solution? Explain your answer.

If formic acid is a weak acid than the number of particles will be slightly more than if formic acid were a nonelectrolyte. So I will be a little larger than 1…say 1.05. So the freezing point will be a little more negative than –10.1 ˚C, like –11 or –12 ˚C.

e) Calculate the density of the solution.

$$\frac{\mathbf{54.0\ g\ HCOOH}}{\mathbf{250\ mLs\ solution}}\left(\frac{\mathbf{100\ g\ solution}}{\mathbf{20.0\ g\ HCOOH}}\right) = \mathbf{1.08}\ \frac{\mathbf{g}}{\mathbf{mLs}}$$

ICE1.5. Write the chemical formula(s) of the product(s) and balance the following reactions. Identify all products phases as either (g)as, (l)iquid, (s)olid or (aq)ueous. Soluble ionic compounds should be written in the form of their component ions.

b) $Na_2CO_{3(s)} + \mathbf{2}HCl_{(aq)} \rightarrow \mathbf{2Na^+_{(aq)} + 2Cl^-_{(aq)} + CO_{2(g)} + H_2O_{(l)}}$

c) $\mathbf{2}Na_3PO_{4(aq)} + \mathbf{3}Ba(NO_3)_{2(aq)} \rightarrow \mathbf{Ba_3(PO_4)_{2(s)} + 6Na^+_{(aq)} + 6NO_3^-{}_{(aq)}}$

ICE1.6. Write the ionic and net ionic chemical equations for 1b).

1b)

Ionic equation:

$$\mathbf{Na_2CO_{3(s)} + 2H^+_{(aq)} + 2Cl^-_{(aq)} \rightarrow 2Na^+_{(aq)} + 2Cl^-_{(aq)} + CO_{2(g)} + H_2O_{(l)}}$$

Net Ionic equation:

$$\mathbf{Na_2CO_{3(s)} + 2H^+_{(aq)} + \cancel{2Cl^-_{(aq)}} \rightarrow 2Na^+_{(aq)} + \cancel{2Cl^-_{(aq)}} + CO_{2(g)} + H_2O_{(l)}}$$

$$\mathbf{Na_2CO_{3(s)} + 2H^+_{(aq)} \rightarrow 2Na^+_{(aq)} + CO_{2(g)} + H_2O_{(l)}}$$