1. Give a short answer to each of the following.
(a) Below is the structural formula for glucose. Any unlabeled intersection is a carbon atom.

Glucose is very soluble in water. Suggest a reason why?

(b)-(e) refer to Butane, C₄H₁₀, and octane, C₈H₁₈ which are two hydrocarbons, that is molecules that contain only carbon and hydrogen atoms.

(b) What are the intermolecular forces in these to substances. 

(c) Which has the higher boiling point? octane (same forces, higher molecular weight) 

(d) which has the higher vapor pressure at 25 °C? butane (weaker forces, easier to vaporize)

The following molecule, trimethylpentane, has the same formula as octane, C₈H₁₈. 

(e) would you expect the boiling point of trimethylpentane to be higher or lower than octane? Lower, less tangling smaller interactions

(f) Urea forms hydrogen bonds in water. Draw two hydrogen bonds between the urea molecule and water molecules.
2. A solution is made by dissolving 120.5 g of NaOH in enough water to make 200.0 mL of solution. I will call this solution the stock solution.

(a) What is the molarity of this stock solution.

\[ 120.5 \text{ g NaOH} \times \frac{1 \text{ mol}}{40.01 \text{ g NaOH}} = 3.01 \text{ mol NaOH} \]

\[ M = \frac{\text{mol solute}}{\text{L solution}} = \frac{3.01 \text{ mol}}{1200 \text{ L}} = 15.1 \text{ M NaOH} \]

(b) If you measure out 25.0 mL of the stock solution how many mol of NaOH will this sample contain?

\[ M \times V = \text{mol NaOH} \]

\[ 15.1 \text{ mol NaOH} \times 0.250 \text{ L solution} = 3.78 \text{ mol NaOH} \]

(c) How many mL of the stock solution are required to provide 1.00 mol of NaOH?

\[ 1.00 \text{ mol NaOH} \times \frac{1.0 \text{ L solution}}{15.1 \text{ mol NaOH}} = 6.62 \times 10^{-2} \text{ L solution} \]

\[ 66.2 \text{ mL of solution} \]

3. What is the (w/v) % of a solution that is made by mixing 10.6 g of glycine in enough water to make 150.0 mL of solution?

\[ \frac{\text{w/v} \%}{\text{v}} = \frac{\text{g solute}}{\text{mL solution}} \times 100 \]

\[ \frac{10.6 \text{ g}}{150.0 \text{ mL}} = 7.07 \text{ (w/v)\% of glycine} \]
4. (a) Define a saturated solution.

A saturated solution contains the maximum amount of solute dissolved at a given temperature.

(b) Why is it better to dissolve sugar in ice tea while it is still warm?

The sugar, as are most solids, is more soluble with increasing temperature.

(c) A chemical plant dumps clean but hot water into a nearby stream. What will the effect be on the oxygen content of the water in the stream?

Gases like O₂ are less soluble as the temperature increases. O₂ content will decrease.

A phase diagram is below.

(d) Label the solid, liquid and gas regions.

(e) What is the state of the substance if P = 1 atm (careful) and T = 60 K, liquid(A)

760 mm Hg

(f) What phase transition occurs if at the start the P = 50 mmHg and the T = 20 K and the pressure is increased to 600 mm Hg and the temperature remains 20 K?

\[ T, P = 60 K, 760 \text{ atm} \]

\[ \text{Solid} \rightarrow \text{Gas} \]

Pressure

\( (\text{mm Hg}) \)

Solid

Liquid

Gas

Temperature (K)