**Answers for 1st Test Review for chapter 13 – “Solutions”**

**1. What is the molarity of a solution containing 5.035 grams of FeCl3 in enough water to make 500 mL of solution?** **0.062 M**

**2a. The solubility of lithium chloride is 86.2 g per 100 mL water at 20°C. What does this mean? No more than 86.2 g of LiCl can dissolve in 100 mL at that temp.**

**2b. If you increase the temp from 20 to 30°C, how will that affect the solubility of LiCl? Solubility goes up for most substances with increasing temp.**

**3. Which gases are more soluble in water, polar or non-polar gases? polar**

**List some of each.**

**Polar: HCl NH3 CO2 Non-polar: H2 O2 N2 Cl2 CH4**

**4. What is Henry’s Law? Molarity of a gas in solvent = constant x pressure of gas**

**5. A sugar solution is prepared by dissolving 25.0g of sugar into 100.0g of water. What is the % sugar by mass? 20.0%**

**6. What are colligative properties of solutions?**

**Properties of solutions that depend upon the concentration of solute molecules or ions, but not upon the identity of the solute.**

**List some.**

**vapor pressure lowering, boiling point elevation, freezing point depression, and osmotic pressure.**

**7. How do boiling point and freezing point compare for solutions and a pure solvent?**

**The BP increases and the FP decreases when comparing solutions to the pure solvent**

**8. What makes something a solution? Give examples.** **How is a colloid different?**

**A mixture (can be s, l or g) in which the minor component (the solute) is uniformly distributed within the major component (the solvent) so everything is the same phase (state). So salt or sugar (or any soluble substance) dissolved in water would be a solution.**

**Colloids include gels, sols, and emulsions - the particles do not settle and cannot be separated out by ordinary filtering or centrifuging like those in a suspension. Examples would be whipped cream, mayonnaise, milk, butter, gelatin, jelly, muddy water.**

**9. If 31.65 g of NaCl is dissolved in 220.0 mL of water, what will be the bp of the solution? Assume the NaCl completely dissolves in the water; that the density of water = 0.994 g/mL; and that Kb of water = 0.51 °C kg/mol**

To find the temperature change elevation of a solvent by a solute, use the equation:

ΔT = iKbm where
ΔT = Change in temperature in °C
i = van 't Hoff factor
Kb = [boiling point elevation](https://www.thoughtco.com/understanding-boiling-point-elevation-609180) constant in °C kg/mol
m = molality of the solute in mol solute/kg solvent.

**Step 1** Calculate the molality of the NaCl

molality (m) of NaCl = moles of NaCl/kg water

[atomic mass](https://www.thoughtco.com/atomic-mass-and-atomic-mass-number-606079) Na = 22.99
atomic mass Cl = 35.45
moles of NaCl = 31.65 g x 1 mol/(22.99 + 35.45)
moles of NaCl = 31.65 g x 1 mol/58.44 g
moles of NaCl = 0.542 mol

kg water = density x volume
kg water = 0.994 g/mL x 220 mL x 1 kg/1000 g
kg water = 0.219 kg

mNaCl = moles of NaCl/kg water
mNaCl = 0.542 mol/0.219 kg
mNaCl = 2.477 mol/kg

**Step 2** Determine the van 't Hoff factor

The van 't Hoff factor, i, is a constant associated with the amount of dissociation of the solute in the solvent.

For substances which do not dissociate in water, such as sugar, i = 1. For solutes that completely dissociate [into two ions](https://www.thoughtco.com/definition-of-monatomic-ion-605372), i = 2. For this example, NaCl completely dissociates into the two ions, Na+ and Cl-. Therefore, i = 2 for this example.

**Step 3** Find ΔT

ΔT = iKbm

ΔT = 2 x 0.51 °C kg/mol x 2.477 mol/kg
ΔT = 2.53 °C

**Answer:** Adding 31.65 g of NaCl to 220.0 mL of water will raise the boiling point 2.53 °C, so it’s bp will be 102.53°C.