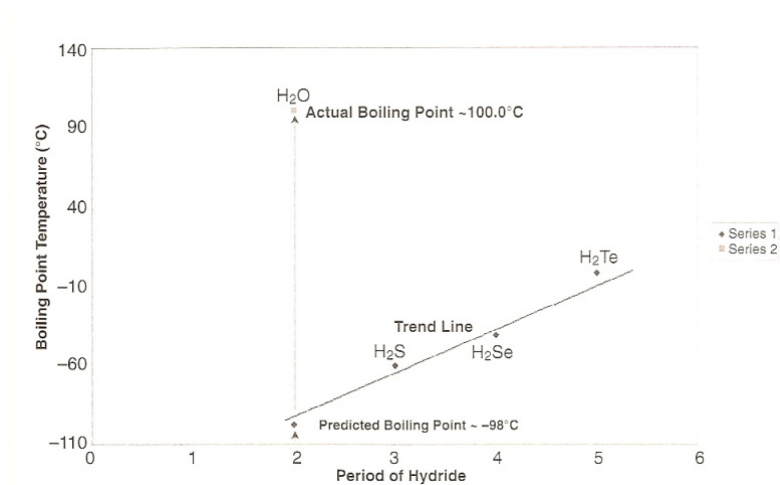




4. (a) What kind of intermolecular forces are present in  $\text{H}_2\text{O}$ ?
- (b) Explain why the actual boiling point of water is 127 degrees higher than the predicted boiling point.



5. Which will evaporate more quickly: 100 mL of water in a beaker or 100 mL of acetone  $[(\text{CH}_3)_2\text{CO}]$  in an identical beaker under identical conditions? Explain your answer.
6. (a) Use Henry's law ( $S_{\text{gas}} = k_{\text{H}}P_{\text{gas}}$ ) to calculate the solubility of oxygen in water at standard atmospheric pressure (1 atm) and temperature (25 °C) ( $k_{\text{H}} = 1.3 \times 10^{-3} \text{ M/atm}$ , Oxygen comprises 21% of atmospheric gases).
- (b) Explain what will happen to  $S$  as temperature increases.
- (c) Explain what will happen to  $S$  if atmospheric pressure were to increase.

7. An aqueous solution of NaCl is made using 133 g of NaCl diluted to a total solution volume of 1.00 L. Molar mass of NaCl = 58.44 g/mol.

Calculate the:

(a) molarity,

(b) mass percent of the solution (Assume a density of 1.08 g/mL).

8. Use Raoult's law:

$$P_{\text{solvent in solution}} = X_{\text{solvent}} \cdot P^{\circ}$$

Where  $P_{\text{solution}}$  = vapor pressure of solvent,  $X_{\text{solvent}}$  = mole fraction, and  $P^{\circ}$  = normal vapor pressure of solvent.

To answer the following question:

Water at 25 °C contains 2.70 mol water and 0.60 mol sucrose, calculate the vapor pressure of the solution.

[At 25 °C  $P^{\circ} = 23.8$  torr]

9. A glucose solution contains 55.8 g of glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ) in 455 g of water. Compute the freezing point of the solution.

$$\Delta T_f = m \cdot K_f$$

Where  $K_f$  = depression constant = 1.86 °C/m,  $m$  = molality (mol/kg), and  $\Delta T_f$  = temperature change. Molar mass of glucose = 180.16 g.

10. Why does magnesium chloride have a Van't Hoff factor of 3 whereas glucose only has a Van't Hoff factor of 1? Write a chemical reaction for magnesium chloride to explain your answer.

## BONUS: (Take Home)

1. Draw Lewis structures for:  
(a) Nitrate ion, (b) carbonate ion, (c) sulfate ion, and (d) ammonium ion
  
2. Draw Lewis structures for  $\text{BrCl}_5$  and  $\text{IF}_5$  and use them to explain why  $\text{BrCl}_5$  is nonpolar and  $\text{IF}_5$  is polar even though both have the same molecular geometry.
  
3. Which compound has the higher boiling point, ammonia or methane. Explain your answer using the concept of intermolecular forces.
  
4. Question 88 from chp 11.
  
5. What is a Van't Hoff factor? Use Van't Hoff factors and Raoult's law to explain why calcium chloride is better at melting ice than sodium chloride.