

- (1.) We have an aqueous solution which is 52.0%  $\text{H}_2\text{SO}_4$  by weight, and has density 1.415 g/mL. Please calculate:
- (a) molality (10 points)
  - (b) molarity (10 points)
  - (c) the mass (in grams) of  $\text{H}_2\text{SO}_4$  per liter of solution (5 points)
- (2.) Please calculate the osmotic pressure of an aqueous solution containing 5.80 g per liter of insulin ( $M_m = 5660$  g/mole) at 37 °C. (25 points)
- (3.)
- (a) Please write the expression for Raoult's Law (5 points)
  - (b) A solution contains 14.00 g of glucose,  $\text{C}_6\text{H}_{12}\text{O}_6$ , in 0.120 kg of water. If the vapor pressure of pure water is 41.2 torr at 35 °C, what is the vapor pressure of the solution at this temperature? (20 points)
- (4.) Please assign oxidation numbers for each atom in the following molecules and ions:
- (a)  $\text{MnO}_4^-$
  - (b)  $\text{VO}_2^+$
  - (c)  $\text{NH}_4^+$
  - (d)  $\text{H}_3\text{PO}_3$
  - (e)  $\text{PF}_6^-$  (10 points)

Please derive the balanced equation for the redox reaction below, in acidic solution:

