

$$P_{\text{solution}} = (P_{\text{solvent}}^{\circ}) (\chi_{\text{solvent}}) \quad \Delta T_f = -i k_f m \quad \Delta T_b = i k_b m \quad \Pi = i c RT$$

$$\ln [A]_t = -k t + \ln [A]_0$$

$$\ln N_t = -\lambda t + \ln N_0$$

$$\frac{1}{[A]_t} = kt + \frac{1}{[A]_0}$$

$$k = Ae^{-E_a/RT}$$

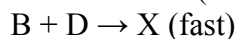
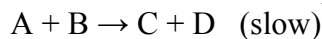
$$\ln \frac{k_2}{k_1} = \frac{E_a}{R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

$$R = 8.314 \text{ J/mol K}$$

1. (10) As I add solute to a solvent, the vapor pressure goes down, but as I increase temperature, the vapor pressure goes up. Explain these two processes on a molecular level.

2. (10) Your 8th grade nephew adores you and looks up to you as a future scientist. He wants to grow up to be just like you and really likes science. He is learning about water pollution. His science teacher at school is sort of an environmental extremist and says that all human activity is ruining the water supply. He rants about something having to do with the oxygen going away. Your nephew asks you to explain how mankind affects the quality of the water. He also needs to know what a 'point source' and a non-point source' is. This is your opportunity to flex your intelligence and inspire the next generation. Remember that you are talking to a 8th grader, so be elementary in your discussion.

3. (12) Consider the reaction mechanism for the formation of the product X:



a. (4) Which species is (are) intermediates in this mechanism (if any).

b. (4) Write the overall reaction.

c. (4) Predict the rate law of the overall reaction.

4. (5) What are the units of a rate constant for a reaction that is third order overall?

5. (5) Consider the decomposition of A. If I make a graph of concentration of A versus time and it is linear, what is the overall order of reaction?

6. (8) Explain why F_2 is a gas at room temp, but I_2 is a solid, yes they are both non-polar.

7. (6) Which would you predict to have a greater boiling point, a 0.75 molal solution of Na_2SO_4 or a 1.6 molal solution of glucose? Explain your answer.

8. (8) In class, we explained why cadmium is bad for you and several facts about its nastiness were explained. Give 4 of them.

9. (10) Explain how we (as scientists) determine chemical toxicity levels (both chronic and acute) and explain why it is erroneous.

On a separate piece of paper, do the following problems. Put a box around your final answers.

10. (12) A typical grade phosphoric acid is 75.0 % by mass H_3PO_4 and has a density of 1.57 g/mL. Calculate the molality AND the molarity.

11. (14) On Jan 22, 2000 two **honors** general chemistry students (at Western Wyoming Community College aka WWCC) decided to open a pressure cooker at work. When they opened it up, a great deal of steam, $H_2O_{(g)}$ came out at 160 °C. If we assume that 50.0 g of steam actually hit each one of them, how much energy was absorbed by each of them as the steam cooled from 160 °C to liquid water at 25°C. Something you might want to know is that the pressure of air at WWCC is about 610.0 torr. Strange, but the vapor pressure of water at 91.5 °C is exactly 610.0 torr. Some data for water: $\Delta H_{vap} = 40.67$ kJ/mol, $\Delta H_{fus} = 6.01$ kJ/mol; specific heats: $H_2O_{(g)} = 1.84$ J/gK, $H_2O_{(l)} = 4.18$ J/gK.