These questions are from a previous exam. They serve only to give you an idea of the sort of questions you might expect on Exam 3 in Chemistry 126. Please note, however, that each year different sorts of problems are introduced, and I make no guarantee that any problems of any particular sort will be included on this year's exam.

(10 pts) Draw a graph of G vs. T for a reaction for which ΔH^o and ΔS^o are those indicated on the board. Clearly indicate the temperature where $\Delta G = 0$ for standard conditions, if such a temperature exists. If reactants and products are at their standard concentrations and pressures, which will be favored at room temperature, the forward or the reverse reaction?

(20 pts) Briefly explain the following statements, illustrating your argument using graphs of G vs. T.

a.) If a system involving gaseous reactants and products is at equilibrium at a certain temperature, and some of the reactant is removed, then the reverse reaction will always occur.

b.) If a system involving reactants and products is at equilibrium at a certain temperature and the temperature is lowered, an exothermic reaction will always ensue. (Show that this is true regardless of the sign of ΔH^o for the reaction.)

(20 pts) Calculate the temperatures at which a reaction with ΔH^o and ΔS^o indicated on the board will be in equilibrium under standard conditions of pressure and concentration and have (a) $K = 0.001$, (b) $K = 1$, and (c) $K = 1000$. Does the trend in K vs. T agree with what you expect for the values of ΔH^o and ΔS^o in this case? What is the limit of the value of K as the temperature approaches infinity?

(10 pts) Explain in your own words (and graphic illustrations) how one can determine experimentally (that is, in the lab) the values of ΔH^o and ΔS^o for a chemical reaction.

(20 points; up to 30 points if you want extra credit)

Pick any the following phenomena and, on the next pages, explain them. Note that some are worth 5 points and some are worth 10 points. Take your pick. If you feel you want to write about something that is in Chapter 12 or was presented in class but is not on the list, raise your hand and ask what it is worth prior to working on it. Up to 30 points will be awarded on a "first-read-first-graded" basis. (So, clearly cross out any that you start and then decide to abandon.)

(a) (5 pts) All pure substances have melting point that are relatively insensitive to pressure and boiling points that are very sensitive to pressure.
(b) (5 pts) The principle behind "frost-free" refrigerators is sublimation.
(c) (10 pts) Relative humidity and dew points are related to the amount of water vapor in the atmosphere.
(d) (5 pts) Evaporation of a liquid can occur below its boiling point, leading to cooling of the liquid.
(e) (5 pts) With a rotary evaporator, you can remove a solvent by boiling below its "normal" boiling point.
(f) (5 pts) Triple points and critical points are characteristic of all substances.
(g) (10 pts) Phase diagrams can be derived from graphs of G vs. T and depict what phase is favored at specific points of pressure and temperature.
(h) (5 pts) The solubilities of solids and gases in water both change with temperature, but not necessarily in the same direction.
(i) (5 pts) Liquids can be "degassed" by heating to the boiling point.
(j) (5 pts) It is possible to "supersaturate" a solution.
(k) (5 pts) Recrystallization can be used to purify a substance.
(l) (10 pts) Boiling points are elevated and freezing points are lowered when substances are dissolved in a pure liquid.
(m) (5 pts) The vapor pressure over an impure liquid is lower than the vapor pressure over a pure liquid.
(n) (5 pts) The pH of neutral water is less than 7.0 in water at its normal boiling point and more than 7.0 in ice-cold water.
(o) (10 pts) If the concentration of CO_2 in the atmosphere continues to increase, coral reefs will be increasingly threatened.
(p) (__ pts) OTHER: _____ (call me over for specific approval)
(q) (__ pts) OTHER: _____ (call me over for specific approval)