## Overview

This laboratory involves calculating relevant physical paramters and using graphics to visualize natural phenomena or scientific concepts.

## Tasks

***Regular Solution Model***

The molar free energy of mixing is often approximated by the regular solution model for $\Delta G^{\text{mix}}$

$$\Delta G^{\text{mix}}(X, T; \alpha) = \alpha X(1 - X) + RT[X \log X + (1 - X) \log(1 - X)]$$

where $X$ is the molar composition ($0 < X < 1$) of a binary solution, $R$ is the gas constant, $T$ is temperature $\alpha$ is a parameter that indicates the molar heat of mixing: when $\alpha > 0$ heat is expelled upon mixing at constant $T$ and when $\alpha < 0$ heat is absorbed upon mixing at constant $T$.

1. Calculate the temperature, $T_{crit}$, in terms of $\alpha$ and $R$ at which $\Delta G^{\text{mix}}$ forms an inflection point at $X = 1/2$.
2. Use $T_{crit}$ to normalize the expression for $\Delta G^{\text{mix}}$ so that its right-hand-side is only a function of $T/T_{crit}$.
3. Plot your normalized $\Delta G^{\text{mix}}$ for $T/T_{crit} = 0.5$, 0.7, 0.9, and 1.1. Make your plot as illustrative as possible.
4. Find another graphical representation that illustrates the behavior of the regular solution free energy of mixing for "interesting temperatures."

***Save your Work*** Save your work as a Mathematica notebook: `3016_Lastname_Lab06.nb`.

## Report

This homework will be graded. Your report on the work above should be ordered as it is above. Your report should include comments that would help one of your classmates understand what your work demonstrates. Send your report as a saved Mathematica notebook with name `3016_Lastname_Lab06.nb` to 3.016-labreports@pruffle.mit.edu. As the subject use "3.016 Lab 06 LASTNAME".