Key for Take-Home Assignment 04

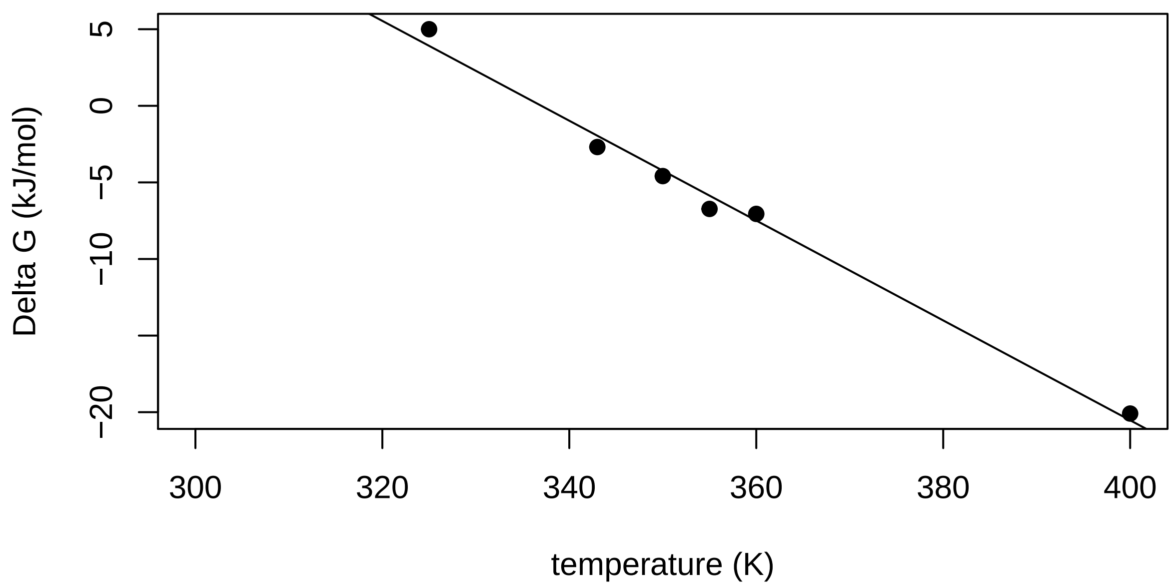
A thermodynamic study of the reaction 2A + 3B → C gives the following results for ΔG^{o} at six temperatures in the range 300 K to 400 K. Use Excel or LoggerPro to create a plot of ΔG^{o} vs. temperature and then use a linear regression analysis to determine values for ΔH^{o} and for ΔS^{o}. If the reaction has a critical temperature, what is its value?

Attach a copy of your plot to this sheet and place additional work in the space below the table. This assignment is due in one week. Your sample number is 62r.

temperature (K)	ΔG^{o} (kJ/mol$_{\text{rxn}}$)
325	5.00
343	-2.69
350	-4.59
355	-6.73
360	-7.06
400	-20.09

Solution

A plot of ΔG^{o} vs. temperature is shown here along with the line of best fit determined by linear regression.



The equation of the regression line is

$$\Delta G^{o} = -0.33 \times T + 109.83$$

The slope of the line gives ΔS^{o} as 0.33 kJ/Kmol$_{\text{rxn}}$, and the intercept gives ΔH^{o} as 109.83 kJ/mol$_{\text{rxn}}$. Using these two values, the critical temperature is

$$T_{\text{crit}} = \frac{109.83\text{kJ/mol}_{\text{rxn}}}{0.33\text{kJ/Kmol}_{\text{rxn}}} = 337\text{K}$$