Exercise A The reaction A → B with ΔG_r° = -2000. J/mole at 298 K.
i) Compute Q and ΔG_r when P_A = 0.1 bar and P_B = 1.5 bar.
ii) Is the reaction spontaneous when P_A = 0.1 bar and P_B = 1.5 bar?
iii) If the reaction starts with P_A = 1.00 bar and P_B = 0, and P_{Total} is constant, what is the value of P_B at equilibrium?

Problem 1 For the system in Exercise A starting at P_A = 1.00 bar, n_A= 1.00 moles and P_B = 0, sketch a quantitative plot of G versus ξ. Assume $G_{A,molar}$ = +3000. J/mole

Problem 2 The reaction C → D with ΔG_f°(C) = +5000. J/mole and ΔG_r° = +3000. J/mole.
a) Compute ΔG_f°(D)
b) At P_C = P_D = 1 bar, does the reaction need to shift to reactants or to products to reach equilibrium?
c) At P_C = 25 bar and P_D = 15 bar, does the reaction need to shift to reactants or products to reach equilibrium?
d) ΔG_r = -2447 J/mole in a system where P_C + P_D always equals 1.000 bar. What are the values of P_C and P_D?

Exercise B For the reaction 2 NH_3 → 2 N_2 + 3 H_2, $K_p = 1.6 \times 10^{-4}$ at 673 K.
i) Compute ΔG_r° at 673 K.
ii) Compute Q and ΔG_r if the pressure of each compound is 1.00 bar
iii) Compute Q and ΔG_r if the pressure of each compound is 0.01 bar
iv) Compute Q and ΔG_r if the pressure of each compound is 1 Torr
v) Is the reaction spontaneous under either condition (ii) or (iii)?

Exercise C For the reaction A → B + 2C, $K_p = 5.0 \times 10^5$ at 298 K. The reaction starts with P(A) = 3.0 bar and P(B)=P(C) = 0 bar.

a) compute the pressure of all three gases at equilibrium if the system is at constant volume

b) compute the pressure of all three gases at equilibrium if the system is at constant pressure at an initial volume of 0.200 m^3.

Problem 3 From the data given in Exercise B, for the reaction starting with P(NH_3) = 2.0 bar and P(N_2)=P(H_2) = 0 bar (at 673 K):

a) compute the pressure of all three gases at equilibrium if the system is a constant volume

b) compute the pressure of all three gases at equilibrium if the system is a constant pressure at an initial volume of 0.015 m^3.

Problem 4
From the data given in Exercise B, compute the value of K_p and ΔG_r° for the reaction:

$$NH_3 \rightarrow \frac{1}{2} N_2 + 3/2\ H_2$$

Exercise D. The dissociation of I_2(g) into atomic iodine has been studied at various temperatures. Given the data below, f ind ΔH° and ΔS° for the dissociation of I_2.

T(K)	K
872	1.81×10^{-4}
973	1.80×10^{-3}

Problem 5. From the data in Exercise E, estimate K at 1000 K.

Exercise E Consider the reaction A (g) → 2B (g) + C(s), for which ΔH_r° = +50 kJ/mole. If the reaction starts at equilibrium, which way will the reaction shift (if it shifts at all) if:

a) The temperature is increased

b) The volume of the reaction container is doubled.

c) some B is selectively removed

d) a little C is selectively removed while maintaining the total volume of gases constant

Problem 6 Consider the gas-phase reaction Cl + O_2 → ClOO, for which $\Delta H_r^\circ < 0$. If the reaction starts at equilibrium, which way will the reaction shift (if it shifts at all) if:

a) The temperature is increased

b) The volume of the reaction container is doubled.

c) Cl is selectively removed.