

Thermodynamics of Materials 5th edition by David R Gaskell
Chapter 11 Homework Solution Tips

11.1

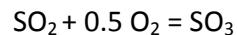
This is a reaction extent problem.

Note: for gases: volume percent = mole percent = pressure percent

Get K from ΔG°

11.2

This is a reaction extent problem for the reaction



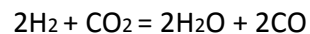
Note: for gases: volume percent = mole percent = pressure percent

Get K from ΔG°

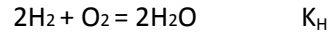
Once the moles of SO_3 formed is determined from the reaction extent calculation, multiply by the $\Delta H^\circ_{\text{R}}$.

11.3

This problem consists of four unknowns (the pressures of H_2 , CO_2 , H_2O , and CO) for which four equations will be needed to solve for them. The overall reaction (which should be considered to be redundant) is



is composed of the two independent reactions



Since the pressure of O_2 is specified and the same in both reactions, the K's for the two reactions give two equations relating the four unknowns (the moles of each gas). Since all the H_2O and CO come from the overall reaction (the amount of O_2 formed is negligible), the moles of H_2O and CO are equal. This is a third equation relating the four unknowns. There are infinite combinations of H_2 and CO_2 that give the same equilibrium ratios. We need only one combination of initial H_2 or CO_2 so simply assume a basis of calculation, say 100 moles of either H_2 or CO_2 . This assumed amount is the fourth equation.

Note an important engineering problem solving tip:

Any problem involving ratios, rates, fractions, proportions, or percentages always requires your setting a **BASIS OF CALCULATION**. The assumed basis value makes no difference in the outcome.

11.4

The pressure of Br_2 is half that of Li (stoichiometry) and the pressure of LiBr is still essentially unity. So substitute pressures into K and find K. Then find $\Delta G^\circ = -RT \ln K$ and solve for T using $\Delta G^\circ = A + BT$.