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

$$SO_2 + 0.5\ O_2 = SO_3$$

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 ΔH°_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

$$2H_2 + CO_2 = 2H_2O + 2CO$$

is composed of the two independent reactions

$$2H_2 + O_2 = 2H_2O \qquad K_H$$
$$2CO + O_2 = 2CO_2 \qquad K_C$$

Since the pressure of O_2 is specified and the same in both reactions, the K's for the two reactions give <u>two</u> 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 <u>third</u> 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 <u>fourth</u> 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 $\Delta G^\circ = A + BT$.