South Pasadena • AP Chemistry

Name _____
Period ___ Date ___/___/___

16 • Chemical Equilibrium

AP Problem -- 1995

CLEARLY SHOW THE METHOD USED AND THE STEPS INVOLVED IN ARRIVING AT YOUR ANSWERS. It is to your advantage to do this, since you may obtain partial credit if you do and you will receive little or no credit if you do not. Attention should be paid to significant figures.

$$H_2(g) + CO_2(g) \rightleftarrows H_2O(g) + CO(g)$$

When $H_2(g)$ is mixed with $CO_2(g)$ at 2,000 K, equilibrium is achieved according to the equation above. In one experiment, the following equilibrium concentrations were measured.

$$[H_2] = 0.20 \text{ mol/L}$$

$$[CO_2] = 0.30 \text{ mol/L}$$

$$[H_2O] = [CO] = 0.55 \text{ mol/L}$$

(a) What is the mole fraction of CO(g) in the equilibrium mixture?

(b) Using the equilibrium concentrations given above, calculate the value of K_c, the equilibrium constant for the reaction.

(c) Determine K_p, in terms of K_c for this system.

(d) When the system is cooled from 2,000 K to a lower temperature, 30.0 percent of the CO(g) is converted back to $CO_2(g)$. Calculate the value of K_c at this lower temperature.

(e) In a different experiment, 0.50 mole of $H_2(g)$ is mixed with 0.50 mole of $CO_2(g)$ in a 3.0-liter reaction vessel at 2,000 K. Calculate the equilibrium concentration, in moles per liter, of CO(g) at this temperature.