Answer to Question #51829, Chemistry, Physical Chemistry

The value of K_c=4.24 at 800 K for the reaction
CO(g)+ H_2O(g) = CO_2(g)+H_2(g)
Calculate the equilibrium concentration of CO_2,H_2,CO,H_2O at 800K, if only CO and H2O are present initially at concentration of 0.10M each?
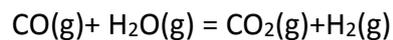
Solution:
CO(g)+ H_2O(g) = CO_2(g)+H_2(g)
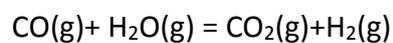
$$K_c = \frac{[CO_2][H_2]}{[CO][H_2O]} = \frac{x \times x}{(0.1 - x)(0.1 - x)} = 4.24$$
$$x^2 = 4.24 \times (0.1 - x)^2$$
$$x^2 = 4.24 \times (0.01 - 0.2x + x^2)$$
$$x^2 = 0.0424 - 0.848x + 4.24x^2$$
$$3.24x^2 + 0.0424 - 0.848x = 0$$
$$x = 0.194$$

$$x = 0.067$$

Answer:
[CO_2] = 0.067 M
[H_2] = 0.067 M
[H_2O] = 0.033 M
[CO] = 0.033 M