

## Question #60984 – Chemistry – General Chemistry

### Question:

Carbon dioxide reacts with hot carbon in the form of graphite. The equilibrium constant,  $K_p$ , for the reaction is 10.0 at 850.°C.

$$\text{CO}_2 \text{ (g)} + \text{C(graphite)} \rightleftharpoons 2\text{CO (g)}$$

If 13.5 g of carbon monoxide is placed in a 2.50-L graphite container and heated to 850.°C, what is the mass of carbon dioxide at equilibrium?

### Solution:

$$K_p = (P_{\text{CO}})^2 / P_{\text{CO}_2}$$

$$n(\text{CO}) = 13.5 \text{ g} / 28 \text{ g/mol} = 0.482 \text{ mol}$$

In equilibrium  $n(\text{CO}) = 0.482 - x$ ,  $n(\text{CO}_2) = x$ .

Ideal gas law:

$$PV = nRT$$

$$P(\text{CO}) = n(\text{CO}) * RT / V$$

$$K_p = (RT/V) * (0.482 - x)^2 / x = (0.082 * (850 + 273) / 2.5) * (0.482 - x)^2 / x = 10 \text{ barr}$$

$$x = 0.231 \text{ mol}$$

$$m(\text{CO}_2) = 0.231 \text{ mol} * 44 \text{ g/mol} = 10.2 \text{ g}$$

**Answer:**  $m(\text{CO}_2) = 10.2 \text{ g}$