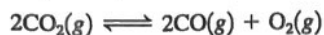


53. At a particular temperature, $K = 2.0 \times 10^{-6}$ for the reaction



If 2.0 mol CO_2 is initially placed into a 5.0-L vessel, calculate the equilibrium concentrations of all species.

55. At 25°C , $K_p = 2.9 \times 10^{-3}$ for the reaction



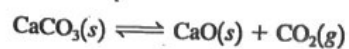
In an experiment carried out at 25°C , a certain amount of NH_4OCNH_2 is placed in an evacuated rigid container and allowed to come to equilibrium. Calculate the total pressure in the container at equilibrium.

75. Suppose $K = 4.5 \times 10^{-3}$ at a certain temperature for the reaction



If it is found that the concentration of PCl_5 is twice the concentration of PCl_3 , what must be the concentration of Cl_2 under these conditions?

76. For the reaction below, $K_p = 1.16$ at $800.^\circ\text{C}$.



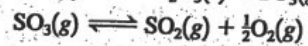
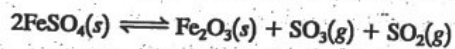
If a 20.0-g sample of CaCO_3 is put into a 10.0-L container and heated to $800.^\circ\text{C}$, what percentage by mass of the CaCO_3 will react to reach equilibrium?

77. A 2.4156-g sample of PCl_5 was placed in an empty 2.000-L flask and allowed to decompose to PCl_3 and Cl_2 at 250.0°C :



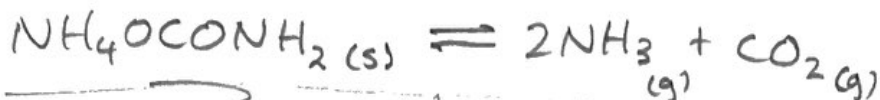
At equilibrium the total pressure inside the flask was observed to be 358.7 torr. Calculate the partial pressure of each gas at equilibrium and the value of K_p at 250.0°C .

86. A sample of iron(II) sulfate was heated in an evacuated container to 920 K, where the following reactions occurred:



After equilibrium was reached, the total pressure was 0.836 atm and the partial pressure of oxygen was 0.0275 atm. Calculate K_p for each of these reactions.

55.



I		0	0
C		+2x	+x
E		2x	x

$$K_p = (P_{\text{NH}_3})^2 (P_{\text{CO}_2})$$

$$2.9 \times 10^{-3} = (2x)^2 (x)$$

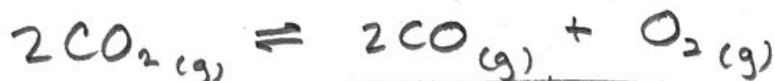
$$2.9 \times 10^{-3} = 4x^3$$

$$x = .090 \text{ atm}$$

$$P_T = 2(.090) + (.090)$$

$$= .27 \text{ atm}$$

53.



I	.40	0	0
C	-2x	+2x	+x
E	.40 - 2x	2x	x

$$2.0 \times 10^{-6} = \frac{(2x)^2 (x)}{(.40 - 2x)^2}$$

used 5% Rule

$$x = .0043$$

$$[\text{CO}_2] = .39 \text{ M}$$

$$[\text{CO}] = .0086 \text{ M}$$

$$[\text{O}_2] = .0043 \text{ M}$$

75.



E	2x	x	x
---	----	---	---

$$4.5 \times 10^{-3} = \frac{x^2}{2x}$$

$$2(4.5 \times 10^{-3}) = \frac{x^2}{x} = x$$

$$9.0 \times 10^{-3} = [\text{Cl}_2]$$

76



$$K_p = P_{\text{CO}_2} = 1.16 \text{ atm}$$

$$PV = nRT$$

$$n = \frac{PV}{RT} = \frac{(1.16)(10.0)}{(.08206)(1073)} = .132 \text{ mol CO}_2$$

$$\frac{.132 \text{ mol CO}_2}{1} \times \frac{1 \text{ mol CaCO}_3}{1 \text{ mol CO}_2} \times \frac{100.09 \text{ g}}{1 \text{ mol CaCO}_3} = 13.2 \text{ g CaCO}_3$$

$$\frac{13.2}{20.0} \times 100 = \boxed{66.0\%}$$

77



I	.2489	0	0
C	-x	+x	+x
E	.2489-x	x	x

$$\frac{2.4156 \text{ g PCl}_5}{1} \times \frac{1 \text{ mol PCl}_5}{208.22 \text{ g PCl}_5} = .011691 \text{ mol PCl}_5$$

$$P = \frac{nRT}{V} = \frac{(.011691)(.08206)(523)}{2.000} = .2489 \text{ atm}$$

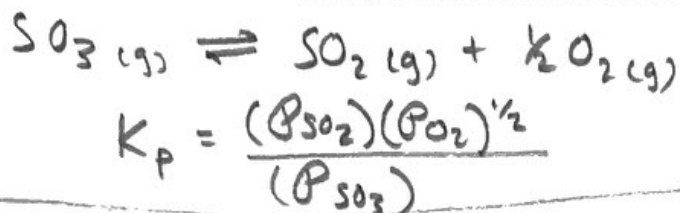
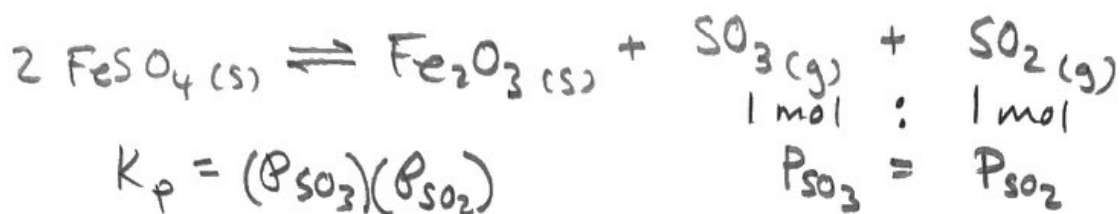
$$P_T = 358.7 \text{ torr} = .4720 \text{ atm}$$

$$.4720 = .2489 - x + x + x$$

$$.4720 = .2489 + x$$

$$x = .2231 \text{ atm}$$

$$\begin{aligned} P_{\text{PCl}_3} &= .2231 \text{ atm} \\ P_{\text{Cl}_2} &= .2231 \text{ atm} \\ P_{\text{PCl}_5} &= .0258 \text{ atm} \end{aligned}$$



$$P_T = .836 \text{ atm} = P_0 - x + P_0 + x + \frac{x}{2} = 2P_0 + \frac{x}{2}$$

$$.836 = 2P_0 + \frac{x}{2}$$

$$.836 - .0275 = 2P_0$$

$$P_0 = .404 \text{ atm}$$

	$\text{SO}_3 \rightleftharpoons \text{SO}_2 + \frac{1}{2} \text{O}_2$		
I	P_0	P_0	0
C	$P_0 - x$	$P_0 + x$	$+\frac{x}{2}$
E	$P_0 - x$	$P_0 + x$	$\frac{x}{2}$

$$.0275 = \frac{x}{2}$$

$$x = .0550 \text{ atm}$$

$$\text{Rxn 1: } K_p = (.404)(.404)$$

$$K_p = .163$$

$$\text{Rxn 2: } K_p = \frac{(.459)(.0275)^{1/2}}{.349}$$

$$K_p = .218$$