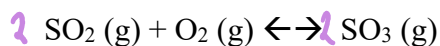
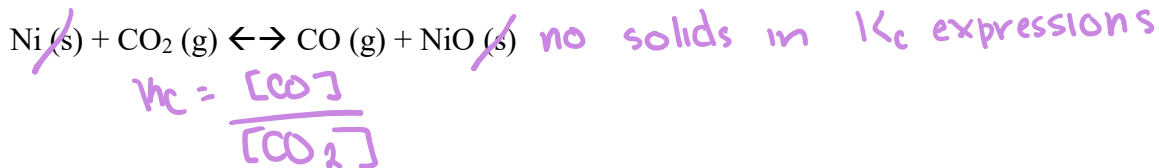
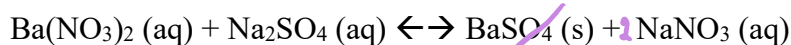


Equilibrium

1. Balance the following reactions if they are not balanced already and then write the equilibrium constant expression for each reaction:



$$K_c = \frac{[SO_3]^2}{[SO_2]^2 [O_2]}$$



$$K_c = \frac{[NaNO_3]^2}{[Ba(NO_3)_2][Na_2SO_4]}$$

2. For the system, if we start with 0.100 mol/L of CO₂ and H₂, what are the concentrations of the reactants and products at equilibrium given that K_{eq} = 0.64 at 900K:

R	CO ₂	H ₂	CO	H ₂ O
I	0.100M	0.100M	0	0
C	-x	-x	+x	+x
E	0.100 - x	0.100 - x	x	x

$$K_{eq} = \frac{[CO][H_2O]}{[CO_2][H_2]} = \frac{(x)(x)}{(0.100-x)^2}$$

$$0.64 = \frac{x^2}{(0.100-x)^2}$$

$$0.80 = \frac{x}{0.100-x}$$

$$0.080 - 0.80x = x$$

$$1.80x = 0.080$$

$$x = 0.0444$$

$$[CO] = [H_2O] = 0.0444 M$$

$$[CO_2] = [H_2] = 0.0556 M$$

3. Calculate the equilibrium constant for the following hypothetical reactions. Assume that all components of the reactions are gaseous:



At equilibrium, the concentration of A is $2.24 \times 10^{-2} \text{ M}$ and the concentrations of both C and D are $6.41 \times 10^{-3} \text{ M}$:

$$K_{\text{eq}} = \frac{[6.41 \times 10^{-3}][6.41 \times 10^{-3}]}{[2.24 \times 10^{-2}]} = \frac{[(6.41 \times 10^{-3})^2]}{(2.24 \times 10^{-2})}$$

$$K_{\text{eq}} = 1.83 \times 10^{-3}$$

b) $A + B \rightleftharpoons C + D$

$$K_{\text{eq}} = \frac{[C][D]}{[A][B]}$$

At equilibrium, the concentrations of both A and B are $3.23 \times 10^{-5} \text{ M}$ and the concentrations of both C and D are $1.27 \times 10^{-2} \text{ M}$:

$$K_{\text{eq}} = \frac{[1.27 \times 10^{-2}][1.27 \times 10^{-2}]}{[3.23 \times 10^{-5}][3.23 \times 10^{-5}]} = \frac{(1.27 \times 10^{-2})^2}{(3.23 \times 10^{-5})^2}$$

$$K_{\text{eq}} = 1.55 \times 10^5$$