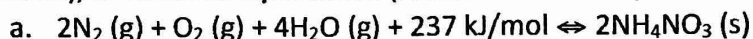


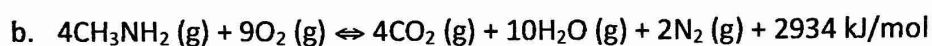
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Unit 12 Review
Equilibrium
Prep

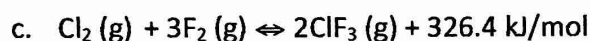
1. A chemical system tends towards minimum enthalpy and maximum entropy.
2. For each of the following reactions, give the direction of the enthalpy drive and the entropy drive. Predict if the reaction will favor the products (spontaneous reaction), the reactants (non-spontaneous reaction), or result in equilibrium (reversible reaction)



$\text{H} \leftarrow \quad \text{S} \leftarrow$ favors reactants, non-spontaneous



$\text{H} \rightarrow \quad \text{S} \rightarrow$ favors products, spontaneous



$\text{H} \rightarrow \quad \text{S} \leftarrow$ reversible, equilibrium

3. Le Châtelier's principle states. If a system in equilibrium is subjected to a change, then processes occur that then to counteract that change, and the system reaches a new state of equilibrium.

4. Explain what would happen to concentration of each substance after each of the following stresses.



- a. Increase [NOBr]

EQ \rightarrow [NO] \uparrow [Br₂] \uparrow

- b. Increase volume

EQ \rightarrow [NO] \uparrow [Br₂] \uparrow [NOBr] \downarrow

- c. Decrease temperature

EQ \leftarrow [NO] \downarrow [Br₂] \downarrow [NOBr] \uparrow

- d. Increase pressure

EQ \leftarrow [NO] \downarrow [Br₂] \downarrow [NOBr] \uparrow

5. Explain what would happen to concentration of each substance, state the color observed, and draw a graph that sketches the concentrations after each of the following stresses.



- a. Decrease temperature

EQ \leftarrow [O₂] \uparrow [O₃] \downarrow

- b. Increase [O₂]

EQ \rightarrow [O₃] \uparrow

Name: _____ Per _____

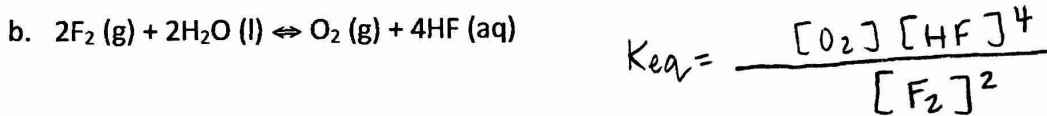
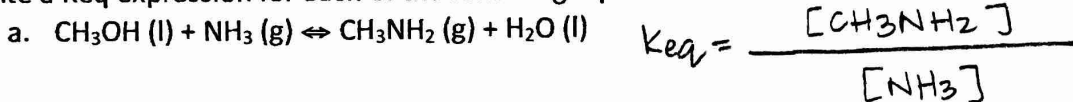
c. Increase volume



d. Increase pressure



6. Write a K_{eq} expression for each of the following equilibria.

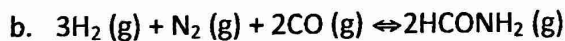


7. Write a K_{eq} expression for each of the following equilibria. Determine the value of K_{eq} . Does the reaction favor the reactants or the products?



At equilibrium, $[\text{PH}_3\text{BCl}_3] = 0.080 \text{ M}$, $[\text{PH}_3] = 0.010 \text{ M}$, and $[\text{BCl}_3] = 0.015 \text{ M}$

$$K_{eq} = \frac{[\text{PH}_3][\text{BCl}_3]}{[\text{PH}_3\text{BCl}_3]} = \frac{(0.010)(0.015)}{(0.080)} = 0.0019, \text{ favors reactants}$$



At equilibrium there are 2.00 mol of H_2 , 1.40 mol of N_2 , 1.50 mol of CO , and 3.20 mol of HCONH_2 in a 2.00 L container.

$$K_{eq} = \frac{[\text{HCONH}_2]^2}{[\text{H}_2]^3[\text{N}_2]} = \frac{(1.60)^2}{(1.00)^3(0.75)} = 3.41, \text{ favors products}$$

8. Consider the following equilibrium



Write a K_{eq} expression for the equilibrium. At equilibrium $[\text{I}_2] = 0.0250 \text{ M}$ and $[\text{Br}_2] = 0.0250 \text{ M}$.

Determine the equilibrium concentration of IBr

$$K_{eq} = \frac{[\text{IBr}]^2}{[\text{I}_2][\text{Br}_2]} \quad 120 = \frac{[\text{IBr}]^2}{(0.0250)(0.0250)} \quad \boxed{[\text{IBr}] = 0.274 \text{ M}}$$