Learning Goal B3: Apply Le Chatelier's principle to the shifting of equilibrium.

Problem Set A: Le Châtelier's Principle

Describe the changes that occur after each stress is applied to the equilibrium.

I. $N_{2\,(g)} + 3\,H_{2\,(g)} \rightleftarrows 2\,NH_{3(g)} + 92\ KJ$

Stress	$[N_2]$	$[H_2]$	$[NH_3]$	Shifts Right or Left	Shifts to the Reactants or Products
1. $[N_2]$ is increased					
2. $[H_2]$ is increased					
3. $[NH_3]$ is increased					
4. Temp is increased					
5. $[N_2]$ is decreased					
6. $[H_2]$ is decreased					
7. $[NH_3]$ is decreased					
8. Temp is decreased					
9. A catalyst is added					

II. $N_2O_{4\,(g)} \rightleftarrows 2\,NO_{2(g)}$; $\Delta H = +\ 92\ KJ$

Stress	$[N_2O_4]$	$[NO_2]$	Shifts Right or Left	Shifts to Favour the Reactants or Products
1. $[N_2O_4]$ is increased				
2. $[NO_2]$ is increased				
3. Temp is increased				
4. $[N_2O_4]$ is decreased				
5. Ne is added				
6. $[NO_2]$ is decreased				
7. Temp is decreased				

III. $4\ HCl_{(g)} + O_{2\,(g)} \rightleftarrows 2\ H_2O_{(g)} + 2\ Cl_{2\,(g)} + 98\ KJ$

Stress	$[O_2]$	$[H_2O]$	[HCl]	Shifts Right or Left	Shifts to Favour the Reactants or Products
1. [HCl] is increased					
2. $[H_2O]$ is increased					
3. $[O_2]$ is increased					
4. Temp is increased					
5. $[H_2O]$ is decreased					
6. [HCl] is decreased					
7. $[O_2]$ is decreased					
8. Temp is decreased					
9. A catalyst is added					

IV. $CaCO_{3\,(s)} + 170\ KJ \rightleftarrows CaO_{(s)} + CO_{2\,(g)}$

Note: Adding solids or liquids and removing solids or liquids does not shift the equilibrium. This is because you cannot change the concentration of a pure liquid or solid as they are 100% pure. It is only a concentration change that will change the # of collisions and hence shift the equilibrium.

Stress	$[CO_2]$	Shifts Right or Left	Shifts to Favor the Reactants or Products
1. $CaCO_3$ is added			
2. CaO is added			
3. CO_2 is added			
4. Temp is decreased			
5. A catalyst is added			
6. $[CO_2]$ is decreased			
7. Temp is increased			
8. CaO is removed			