Worksheet #2 LeChatelier's Principle

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

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

Stress	$[N_2]$	$[H_2]$	$[NH_3]$	Shifts Right or Left	Shifts to the Reac /Prod
1. $[N_2]$ is increased	**increases**	**decreases**	**increases**	**right**	**products**
2. $[H_2]$ is increased	**decreases**	**increases**	**increases**	**right**	**products**
3. $[NH_3]$ is increased	**increases**	**increases**	**increases**	**left**	**reactants**
4. Temp is increase	**increases**	**increases**	**decreases**	**left**	**reactants**
5. $[N_2]$ is decreased	**decreases**	**increases**	**decreases**	**left**	**reactants**
6. $[H_2]$ is decreased	**increases**	**decreases**	**decreases**	**left**	**reactants**
7. $[NH_3]$ is decreased	**decreases**	**decreases**	**decreases**	**right**	**products**
8. Temp is decreased	**decreases**	**decreases**	**increases**	**right**	**products**
9. A catalyst is added	**nochange**	**nochange**	**nochange**	**nochange**	**nochange**

$N_2O_{4\,(g)} \rightleftharpoons 2NO_{2(g)} \quad \Delta H = +\ 92\ KJ$

Favor the Stress	[N_2O_4]	[NO_2]	Shifts Right or Left	Shifts to Reactants or Products
1. [N_2O_4] is increased	**increases**	**increases**	**right**	**products**
2. [NO_2] is increased	**increases**	**increases**	**left**	**reactants**
3. Temp is increased	**decreases**	**increases**	**right**	**products**
4. [N_2O_4] is decreased	**decreases**	**decreases**	**left**	**reactants**
5. [H_2] is decreased	**nochange**	**nochange**	**nochange**	**nochange**
6. [NO_2] is decreased	**decreases**	**decreases**	**right**	**products**
7. Temp is decreased	**increases**	**decreases**	**left**	**reactants**

$4HCl_{(g)} + O_{2(g)} \rightleftharpoons 2H_2O_{(g)} + 2Cl_{2(g)} + 98\ KJ$

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

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

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	**nochanges**	**nochanges**	**nochanges**
2. CaO is added	**nochanges**	**nochanges**	**nochanges**
3. CO_2 is added	**increases**	**left**	**reactants**
4. Temp is decreased	**decreases**	**left**	**reactants**
5. A catalyst is added	**nochanges**	**nochanges**	**nochanges**
6. $[CO_2]$ is decreased	**decreases**	**right**	**products**
7. Temp is increased	**increases**	**right**	**products**
8. CaO is removed	**nochanges**	**nochanges**	**nochanges**