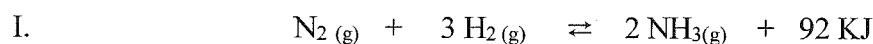


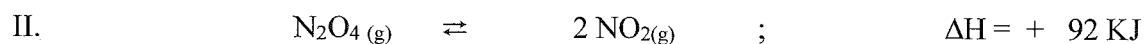
Learning Goal B3: Apply Le Chatelier's principle to the shifting of equilibrium. Key

Problem Set A: Le Châtelier's Principle

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

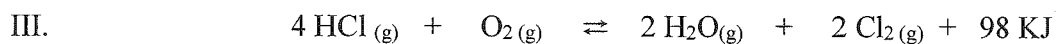


Stress	[N ₂]	[H ₂]	[NH ₃]	Shifts Right or Left	Shifts to the Reactants or Products
1. [N ₂] is increased	↑	↓	↑	R	products
2. [H ₂] is increased	↓	↑	↑	R	products
3. [NH ₃] is increased	↑	↑	↑	L	reactants
4. Temp is increased	↑	↑	↓	L	reactants
5. [N ₂] is decreased	↓	↑	↓	L	reactants
6. [H ₂] is decreased	↑	↓	↓	L	reactants
7. [NH ₃] is decreased	↓	↓	↓	R	products
8. Temp is decreased	↓	↓	↑	R	products
9. A catalyst is added	—	—	—	NO shift	NO shift

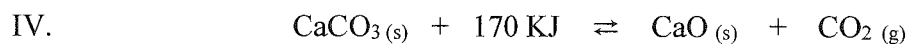


Stress	[N ₂ O ₄]	[NO ₂]	Shifts Right or Left	Shifts to Favour the Reactants or Products
1. [N ₂ O ₄] is increased	↑	↑	R	products
2. [NO ₂] is increased	↑	↑	L	reactants
3. Temp is increased	↓	↑	R	products
4. [N ₂ O ₄] is decreased	↓	↓	L	reactants
5. Ne is added	—	—	no shift	no shift/no change
6. [NO ₂] is decreased	↓	↓	R	products
7. Temp is decreased	↑	↓	L	reactants

Key



Stress	[O ₂]	[H ₂ O]	[HCl]	Shifts Right or Left	Shifts to Favour the Reactants or Products
1. [HCl] is increased	↓	↑	↑	R	products
2. [H ₂ O] is increased	↑	↑	↑	L	reactants
3. [O ₂] is increased	↑	↑	↓	R	products
4. Temp is increased	↑	↓	↑	L	reactants
5. [H ₂ O] is decreased	↓	↓	↓	R	products
6. [HCl] is decreased	↑	↓	↓	L	reactants
7. [O ₂] is decreased	↓	↓	↑	L	reactants
8. Temp is decreased	↓	↑	↓	R	products
9. A catalyst is added	—	—	—	NO change	no shift



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	—	None	no change
2. CaO is added	—	none	no change
3. CO ₂ is added	↑	L	reactants
4. Temp is decreased	↓	L	reactants
5. A catalyst is added	—	none	no change
6. [CO ₂] is decreased	↓	R	products
7. Temp is increased	↑	R	products
8. CaO is removed	—	none	no change