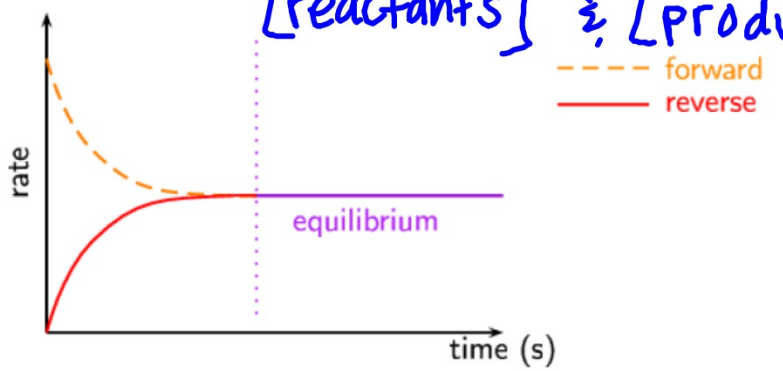
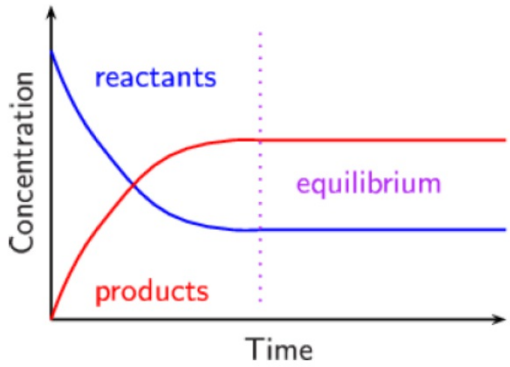
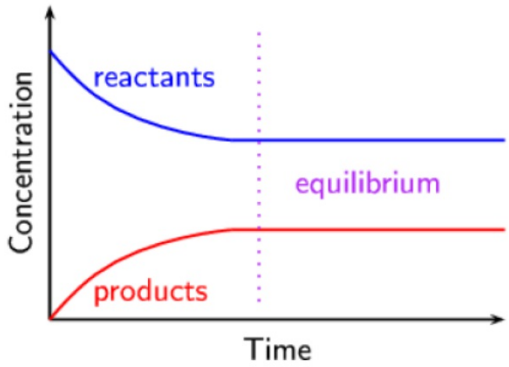
Non-Reversible Reaction – single arrow $\longrightarrow$

Reversible Reaction – double arrow $\longleftrightarrow$, $\rightleftharpoons$, $\rightleftarrows$

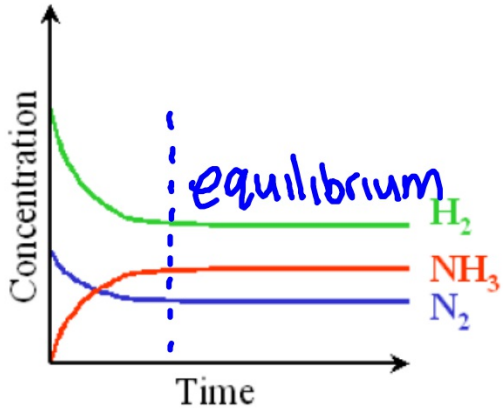
Equilibrium – forward rxn rate = reverse rxn rate
[reactants] & [products] remain constant

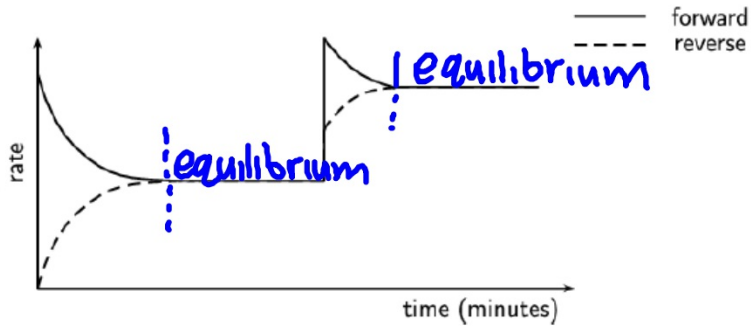






Label on the graphs below the point(s) at which equilibrium is established.





Le Chatelier's Principle

When a system at equilibrium is subjected to a stress, the system will shift its equilibrium point in order to relieve the stress.

	Equilibrium Reaction	Stress Applied	Shift
1.	Gas ↔ heat + liquid	Add more gas	→
2.	Heat + solid ↔ liquid	Lower the temperature	←
3.	Heat + liquid ↔ gas	Add liquid	→
4.	Liquid ↔ heat + solid	Raise the temperature	←
5.	heat + solid ↔ liquid	Remove liquid	→
6.	Gas ↔ liquid + heat	Remove gas	←

Le Chatelier's Principle Rules

1. **Increase** the **Temperature or Heat** causes the reaction to **shift** to

   the side w/ No Heat

2. **Increase** the **concentration of reactant or product** causes the reaction to **shift** to

   away from the addition

3. **Increase** the **pressure** causes the reaction with **gases** to **shift** to

   the side w/ less gas

N_2 (g) + 3 H_2 (g) ↔ 2 NH_3 (g) + 92.1 kJ					
	Stress	**Equilibrium Shift**	**[N_2]**	**[H_2]**	**[NH_3]**
1.	Add N_2	→	-------	↓	↑
2.	Add NH_3	←	↑	↑	-------
3.	Remove NH_3	→	↓	↓	-------
4.	Increase temperature	←	↑	↑	↓
5.	Decrease temperature	→	↓	↓	↑
~~7.~~ 6.	Increase Pressure	→	↓	↓	↑