Chapter 12- Reminder

1- **Rolling motion** of object is a combinational of purely **Translational** and **Rotational** Motion.

2- The **Kinetic energy of rolling** motion is: $K_T + K_R = \frac{1}{2} m v_{com}{}^2 + \frac{1}{2} I_{com} w^2$

3- The general formula of the **System Energy** is: $E_{Sys.} = K_T + K_R + U_g + U_s + E_{Th.} + E_{Itn.}$

4- The definition of the angular moment of a **single particle** is: $\vec{\ell} = \vec{r} \times \vec{p} = m(\vec{r} \times \vec{v})$ (The SI unit of it is Kg.m^2/sec)

5- Newton's Second Law for a **single particle** in Angular form is: $\vec{\tau}_{net} = \frac{d\vec{\ell}}{dt}$

6- The Angular Momentum of a **system of n particles** is: $\vec{L} = \sum_{i=1}^{n} \vec{\ell}$

7- Newton's Second Law for a **system of n particles** in Angular form is: $\vec{\tau}_{net} = \frac{d\vec{L}}{dt}$

8- The Angular Momentum of a **rigid body** rotating about a fixed axis is: $\vec{L} = I\vec{w}$

9- If the angular momentum is conserved, which means $\vec{\tau}_{net} = \frac{d\vec{L}}{dt} = 0$, then $\vec{L} =$ constant

That means $\Rightarrow \Delta\vec{L} = 0 \Rightarrow \vec{L}_i = \vec{L}_f$ (**The system is isolated and closed**)

Comparison between variables and relations for Translational and Rotational Motion

Translational	Rotational
Force $\vec{F}$	Torque $\vec{\tau} = \vec{r} \times \vec{F}$
Linear momentum for single particle $\vec{p}$	Angular momentum for single particle $\vec{\ell} = \vec{r} \times \vec{p}$
Linear momentum for particles system $\vec{P} = \sum_{i=1}^{n} \vec{p}_i$	Linear momentum for particles system $\vec{L} = \sum_{i=1}^{n} \vec{\ell}_i$
Newton's Second Law for the system $\vec{F}_{net} = \frac{d\vec{P}}{dt}$	Newton's Second Law for the system $\vec{\tau}_{net} = \frac{d\vec{L}}{dt}$
Conservation of linear momentum $\Delta\vec{P} = 0$	Conservation of angular momentum $\Delta\vec{L} = 0$