Chapter 9- Reminder

1- The definition of the position of the centre of the mass (com) of n particles:

i- Along the X axis: $x_{com} = \frac{1}{M}\sum_{i=1}^{n} m_i\, x_i$

ii- Along the Y axis: $y_{com} = \frac{1}{M}\sum_{i=1}^{n} m_i y_i$

iii- Along the Z axis: $z_{com} = \frac{1}{M}\sum_{i=1}^{n} m_i z_i$

iv- Along the three axes: $\vec{r}_{com} = \frac{1}{M}\sum_{i=1}^{n} m_i\, \vec{r}_i$

2- For the solid body, the position of the centre of mass (com) depending on the mass:

i- Along the X axis: $x_{com} = \frac{1}{M}\int_{x=a}^{b} x\, dm$

ii- Along Y axis: $y_{com} = \frac{1}{M}\int_{y=a}^{b} y\, dm$

iii- Along Z axis: $z_{com} = \frac{1}{M}\int_{z=a}^{b} z\, dm$

3- For the solid bodies, the position of the centre of mass (com) depending on the volume:

i- Along the X axis: $x_{com} = \frac{1}{V}\int_{x=a}^{b} x\, dV$

ii- Along the Y axis: $y_{com} = \frac{1}{V}\int_{y=a}^{b} y\, dV$

iii- Along the Z axis: $z_{com} = \frac{1}{V}\int_{z=a}^{b} z\, dV$

4- For the partial body, the position of the centre of mass of remain body: $x_{remain}\, m_{remain} = x_{total}\, m_{total} - x_{parts}\, m_{parts}$

5- Newton's second law for system particles: $\vec{F}_{net} = M\, \vec{a}_{com}$

6- The linear momentum is defined as: $\vec{p} = m\, \vec{v}$

7- Second Newton's law of motion in terms of momentum: $\vec{F}_{net} = \frac{d\vec{P}}{dt} = m\, \vec{a}$

8- The linear momentum of a system of particles: $\vec{P} = M\, \vec{v}_{com} = \sum_{i=1}^{n} m_i\, \vec{v}_i$

9- Second Newton's law of motion for a system of particles in terms of momentum: $\vec{F}_{net} = \frac{d\vec{P}}{dt}$

10- If the net external force acting on a system of particles is zero (the system is isolated), and no particles leave or enter the system (the system is closed), then $\vec{F}_{net} = 0$, which means $\frac{d\vec{P}}{dt} = 0$, $\vec{P} =$ constant, $\Delta\vec{P} = 0$, $\vec{P}_i = \vec{P}_f$ (Law of conservation of linear momentum).