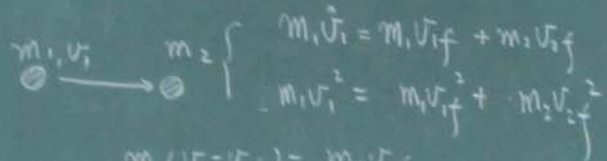




1-dim

$$m_1 v_i = m_1 v_{if} + m_2 v_i + m_2 v_{if}$$

$$\Rightarrow \begin{cases} v_{if} = \frac{m_1 - m_2}{m_1 + m_2} v_i \\ v_{2f} = \frac{2m_1}{m_1 + m_2} v_i \end{cases}$$



$$\begin{aligned} m_1 v_i &= m_1 v_{1f} + m_2 v_{2f} \\ m_1 v_i^2 &= m_1 v_{1f}^2 + m_2 v_{2f}^2 \end{aligned}$$

① $m_1 = m_2$
② $m_1 \gg m_2$
③ $m_1 \ll m_2$

$$v_i + v_{1f} = v_{2f}$$

$$\sum_{i \neq j} \vec{f}_{ij} + \vec{f}_{i,ext} = \vec{f}_{ij} = -\vec{f}_{ji} = \sum_{i=1}^N \vec{f}_i = \sum_{i=1}^N \vec{f}_{i,int} + \vec{f}_{i,ext}$$

$$\frac{d\vec{P}}{dt} = \vec{F}_{ext}$$



$$\begin{aligned} h &= \frac{1}{2} g t^2 \\ v &= g t \\ h &= \frac{v^2}{2g} \quad \underline{mgh = \frac{1}{2} m v^2} \end{aligned}$$
$$K = \frac{1}{2} m v^2$$



$$f_s = -k v$$

$$m \frac{dv}{dt} + k v = 0$$

$$m a + k v = 0$$

$$m \frac{dv}{dt} = -k v$$

$$\int \frac{dv}{v} = -\frac{k}{m} \int dt$$

$$\ln v \Big|_{v_0}^{\frac{1}{2}v_0} = -\frac{k}{m} t$$

$$\vec{F} = m \vec{a}$$

$$\ln \frac{1}{2} v_0 - \ln v_0 = -\frac{k}{m} t \Rightarrow \ln \frac{1}{2} = -\frac{k}{m} t$$

$$t = \left(\frac{m}{k} \right) \ln 2$$



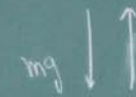
$$F = -k x$$

$$-b v$$

$$m a = -k x$$

$$m \frac{d^2 x}{dt^2} + k x = 0$$

$$\lambda(t)$$



$$mg = \frac{1}{2} C_p A v_t^2$$

$$v_t = \sqrt{\frac{2mg}{C_p A_{air}}}$$



$$N \quad \vec{r}_i, m_i \quad \vec{r}_{CM} \equiv \frac{\sum_{i=1}^N m_i \vec{r}_i}{\sum_{i=1}^N m_i}$$

$$f_s = -k v$$

$$m \frac{dv}{dt} + k v = 0$$

$$m a + k v = 0$$

$$m \left(\frac{dv}{dt} \right) = -k v$$

$$\ln \left(\frac{v}{v_0} \right)^{\frac{1}{k}} = -\frac{k}{m} t$$

$$\int \frac{dv}{v} = -\frac{k}{m} \int dt$$

$$\sum_{i \neq j} \vec{f}_{ij} + \vec{f}_{i,ext} \quad \vec{f}_{ij} = -\vec{f}_{ji}$$

$$= \sum_{i=1}^N \vec{f}_{i,ext} \quad = \sum_{i=1}^N \vec{f}_i$$

$$\frac{d\vec{P}}{dt} = \vec{F}_{ext}$$

$$M \vec{r}_{CM} = \sum_{i=1}^N m_i \vec{r}_i$$

$$\vec{P}_{CM} \leftarrow M \vec{v}_{CM} = \sum_{i=1}^N m_i \vec{v}_i = \sum_{i=1}^N \vec{p}_i$$

linear momentum

