Kinetics of a Particle

#12

Newton's Second Law of Motion

$$\boxed{F = \frac{d(mv)}{dt}} = m\frac{dv}{dt} = ma$$

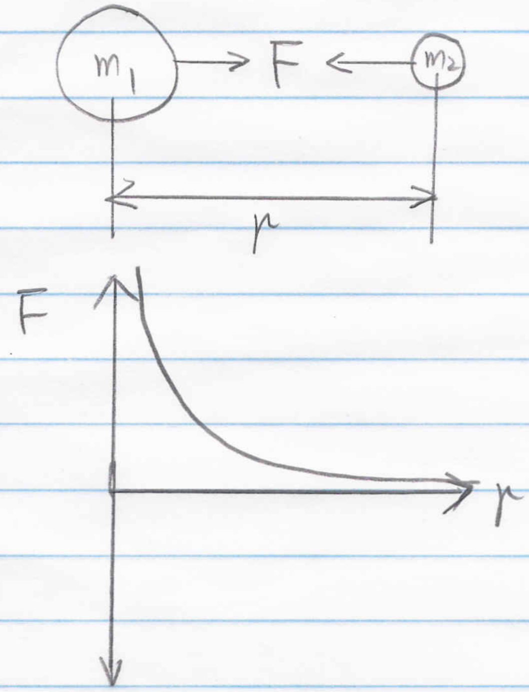
where mv = linear momentum

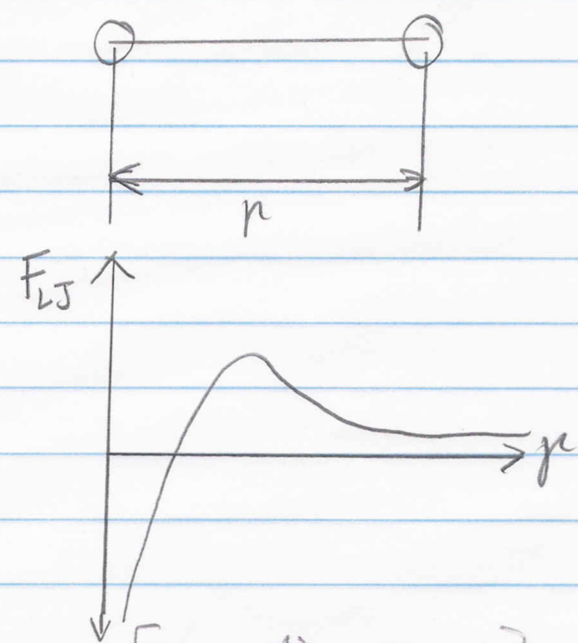
Also, $\boxed{F = \frac{-dU}{dr}}$, where $U = U(r)$ = potential energy

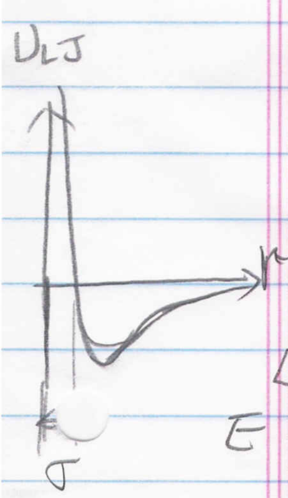
* Newton's Law of Gravitational Attraction

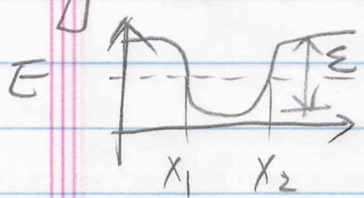
$$F = G\frac{m_1 m_2}{r^2}$$

$$F_{LJ} = -24\varepsilon\left[2\left(\frac{\sigma^{12}}{r^{13}}\right) - \left(\frac{\sigma^6}{r^7}\right)\right]$$









$$U_{LJ}(r) = 4\varepsilon\left[\left(\frac{\sigma}{r}\right)^{12} - \left(\frac{\sigma}{r}\right)^6\right]$$

(*) Lennard-Jones Potential

Pauli repulsion

* Determination of g

$$\because F = ma = mg = G\frac{m_e \cdot m}{r^2} = \left(\frac{G \cdot m_e}{r^2}\right) \times m$$

$\Rightarrow g = \frac{G \cdot m_e}{r}$, r = distance btwn the center of the earth & the particle.

G = universal constant of gravitation.

$= 66.73 \times 10^{-12} \cdot \frac{m^3}{kg \cdot s^2}$

$\Rightarrow$ acceleration due to gravity.

SI system: $W = m \times g \Rightarrow N = (kg) \cdot \left(\frac{m}{s^2}\right) \Rightarrow g = 9.81\ m/s^2$ #

(N → Derived!)

Foot Pound Second (FPS) system:

$$m = \frac{W}{g} \Rightarrow slug = \frac{lb}{ft/s^2} \Rightarrow g = 32.2\ ft/s^2$$ #

$$\text{Or} \Rightarrow (lb) = (slug) \times \left(\frac{ft}{s^2}\right)$$

(slug → Derived!)