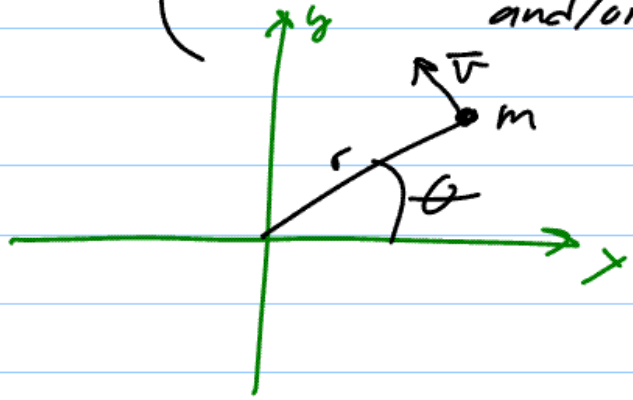
PHY138 Mechanics - Class 10 - Oct 16/06

§9.7 Angular Momentum

recall: $v = \omega r$

(increase v, increase ω and/or r)



angular momentum

$L \equiv mvr$

Chapter 13: if $F_t = 0$

L is conserved

Not following text:

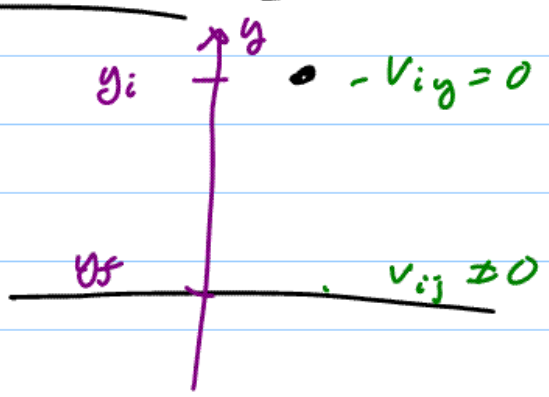
$L = mv_t r = mr^2\omega$

mr^2 - same role in rotations as m does for linear motion

CHAPTER 10 ENERGY

§10.1 - NTA

§10.2 Free Fall



Eqn 2.22

$$v_{fy}^2 = v_{iy}^2 + 2 a_y s$$

$$v_{fy}^2 = v_{iy}^2 - 2g(y_f - y_i)$$

$$v_{fy}^2 + 2gy_f = v_{iy}^2 + 2gy_i$$

multiply by $\frac{1}{2}m$

$$\Rightarrow \boxed{\frac{1}{2}mv_f^2 + mgy_f = \frac{1}{2}mv_i^2 + mgy_i}$$

Eqn 10.10

Kinetic Energy $= K \equiv \frac{1}{2}mv^2 = \frac{1}{2}$ vis viva

Grav. Potential Energy $U_g \equiv mgy$

Free Fall $K + U_g$ conserved

UNIT: $kg\ m^2/s^2 \equiv$ joule J

$$\Delta K = -\Delta U_g$$

ΔU_g depends only on $(y_f - y_i)$

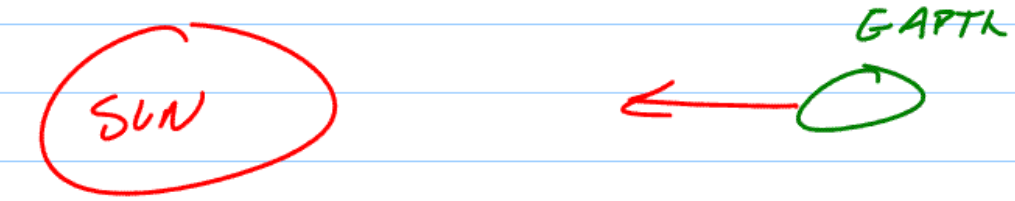
↳ vertical distance

Zero of U_g

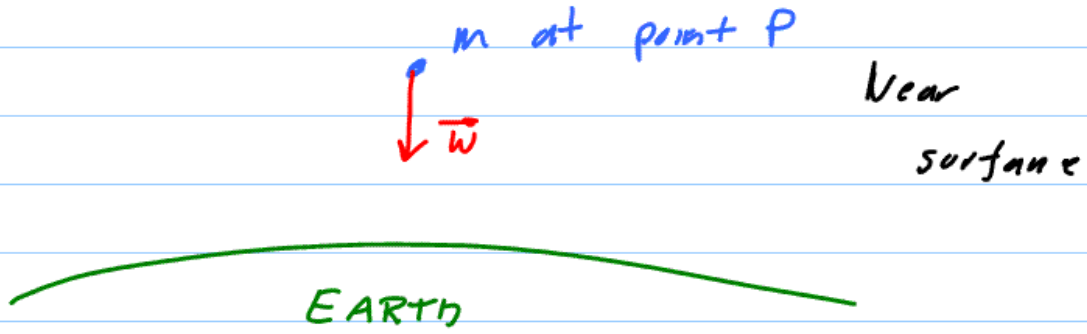
Choice of where $U_g = 0$ is arbitrary

Gravitational Fields (not in text)

setup for 3rd quarter



"Action At a Distance"



2 steps!

(1) Earth creates a gravitational field everywhere around it. $\vec{E}_g$

(2) Field $\vec{E}_g$ at point P exerts force on mass at that point

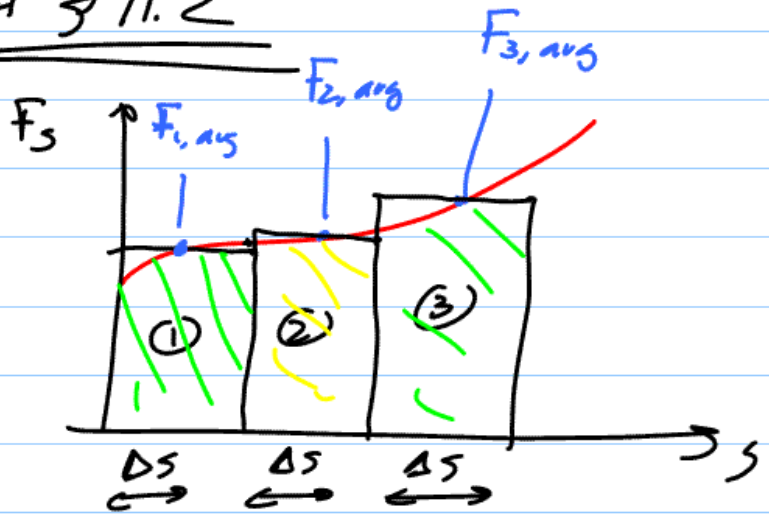
$\vec{E}_g$? Simplest is best.

$$\vec{E}_g = \vec{g} = -g\hat{s}$$

$$\vec{F}_{on\ m} = m\vec{E}_g$$

U_g is real energy, stored in $\vec{E}_g$

Almost § 11.2



If Δs small: $a_{1,avg} = \dfrac{v_{f1} - v_{i1}}{\Delta t_1}$ ←

$$\Delta s = v_{1,avg}\,\Delta t_1 = \frac{v_{1,f} + v_{1,i}}{2}\,\Delta t$$

Area ① $\quad F_{1,avg}\,\Delta s$

$(m\,a_{1,avg})$

$$\frac{1}{2}mv_{f1}^2 - \frac{1}{2}mv_{i1}^2$$

Total Area: $\quad \Delta K = \sum F \Delta s$

$$\Delta K = \int F\,ds$$