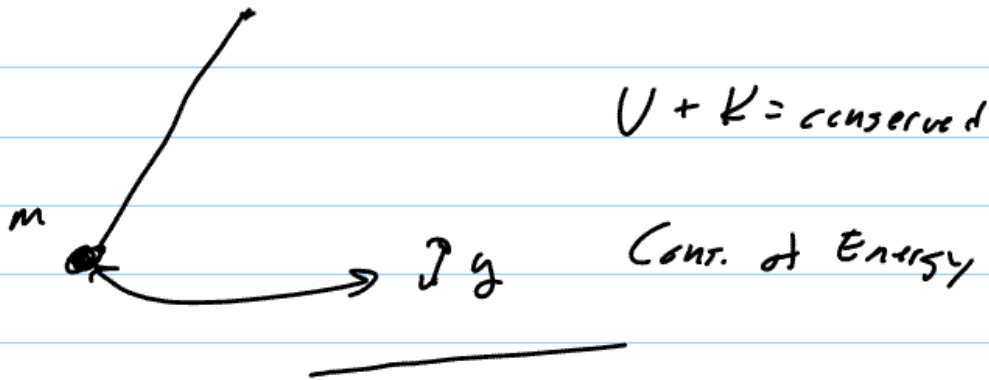


PHY138 Mechanics - Class 12 - Oct. 23/06



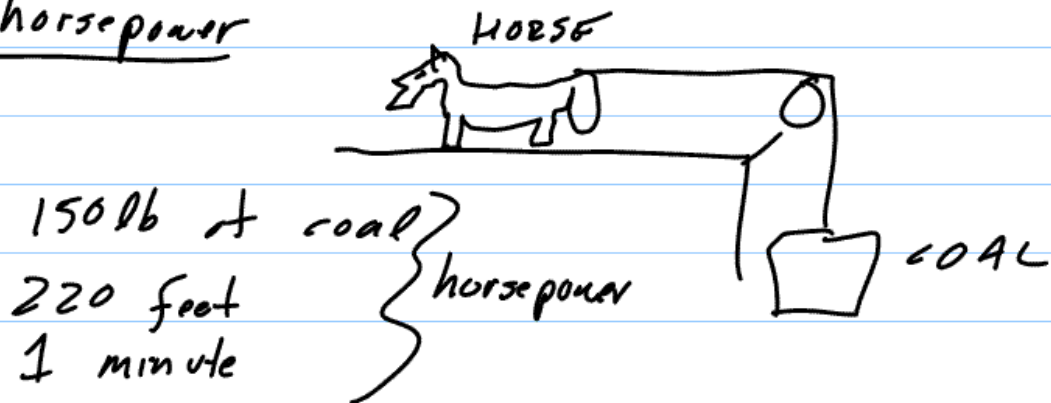
§11.9 - Power

rate of transfer of energy:

$$P = \frac{dE_{\text{sys}}}{dt}$$

UNIT! $J/s = \text{watt } W$

horsepower



$$1 \text{ hp} = \frac{150 \text{ pound} \times 220 \text{ feet}}{1 \text{ minute}}$$

$$\times \frac{4.45 \text{ N}}{\text{lb}} \times \frac{0.305 \text{ m}}{\text{feet}} \times \frac{1 \text{ minute}}{60 \text{ sec}}$$

$$746 \text{ W}$$

Metabolic Rate

Bodies! consume food
produce energy

Metabolic Rate (MR) - rate of
energy production

Basal MR (BMR) - resting.

Radiate away energy!

$$P \propto \left(\frac{\text{surface}}{\text{area}} \right) (T_{\text{surface}} - T_{\text{air}})$$

Equilibrium (Thermal)

$$P = \dot{m} R$$

Cold room: P increases
we get cold

Shower: raises $\dot{m} R$
 $\sim 200W$

$$P \propto A$$

at thermal equilibrium

$$b_{mr} \propto A -$$

$b_{mr} = f(m) ?$

$$b_{mr} \propto L^2$$

$$m = \rho \text{Volume} \propto L^3$$

↓

$$L \propto m^{1/3}$$

$$\boxed{bmr \propto m^{2/3}}$$

"allometry"

Exptly: $\boxed{bmr \propto m^{3/4}}$

Kleiber's Law (1932)

true over 27 orders of magnitude

Why? nobody knows, but ...

1997 West, Brown & Enquist

physicist

biologists

circulatory system: fractal
non-integer dimension

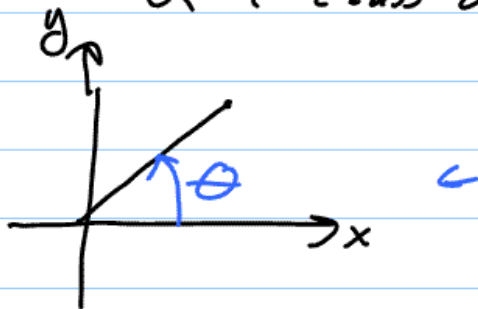
Duplicate! $\boxed{bmr \propto m^{3/4}}$

CHAPTER 13

§ 13.1 Kinematics

ω (class 7)

α (class 8)

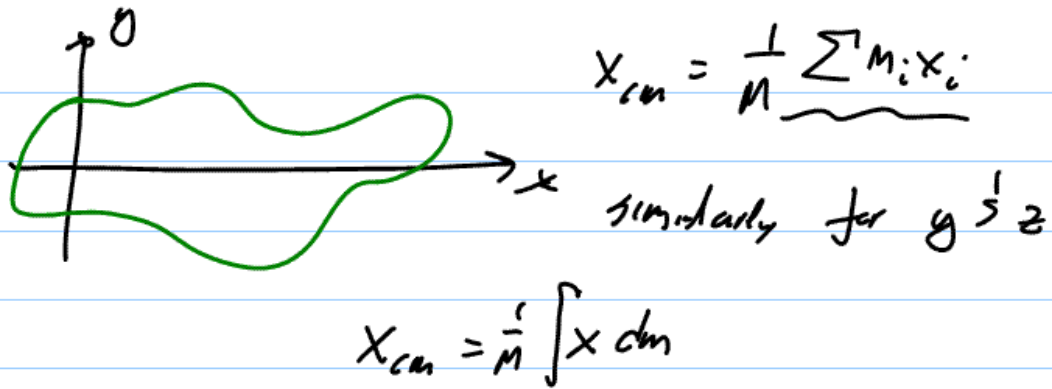


Rigid Body $\left. \begin{array}{l} \omega \\ \alpha \end{array} \right\} \begin{array}{l} \text{same for} \\ \text{all points} \end{array}$

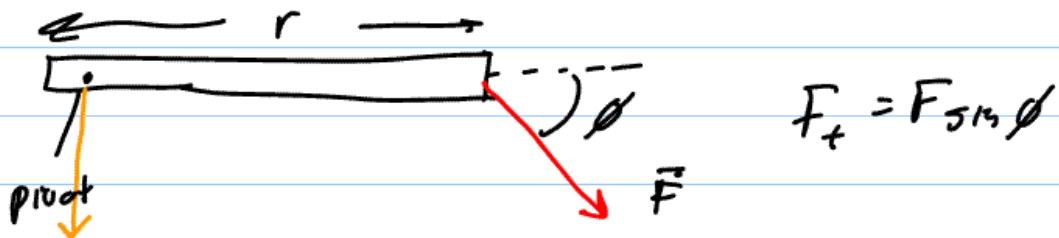
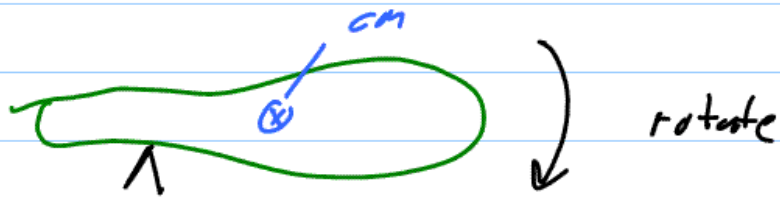
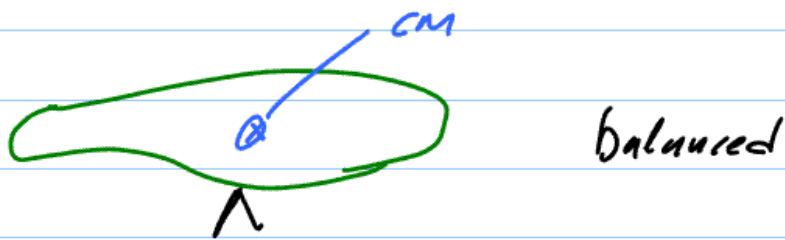
§ B.2 Center of Mass (CM)

Symmetric: physical center

Any object! unconstrained (no axels)
rotates about CM



§ 13.3- Torque

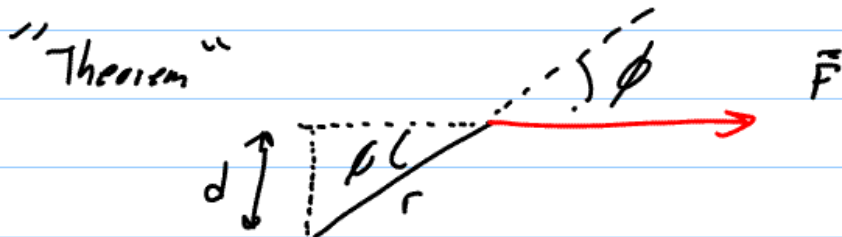


$$d = \frac{a_t}{r}$$

$d \neq 0$ then $F_t \neq 0$

$$\text{Torque } \tau = r F_t = r F \sin \phi$$

"tau"



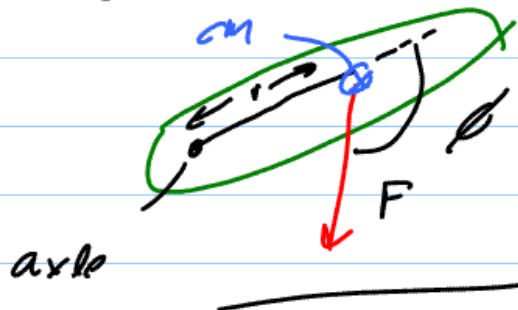
$$\tau = r F \sin \phi$$

$$r \sin \phi = d$$

$$\tau = r F_t$$

$$\tau = F d$$

Slight text extension:



$$\begin{aligned} \tau_{\text{net}} &= r F \sin \phi \\ &= r M g \sin \phi \end{aligned}$$