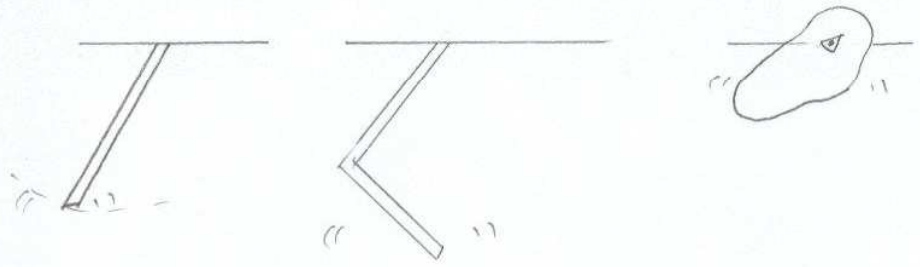
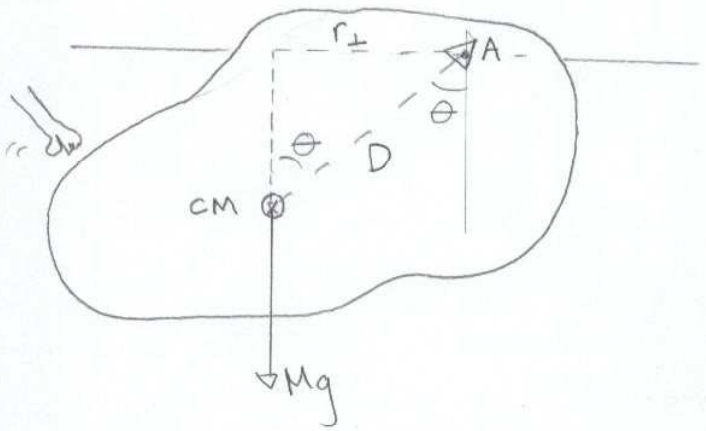
* Most Pendulums are NOT Simple



These are called "compound" or "physical" Pendulums.

Physical Pendulum: Find the Period of oscillation. Is the motion Simple Harmonic?



$$\Sigma \tau_A = I_A \alpha$$

$$r_\perp = D\sin\theta$$

$$\Sigma \tau_A = -MgD\sin\theta$$

$MgD\sin\theta$ is a Restoring Torque!

$$-MgD\sin\theta = I_A \alpha$$

$$\alpha = -\frac{MgD}{I_A}\sin\theta \quad , \text{ but } \quad \alpha = \frac{d^2\theta}{dt^2}$$

so $$\frac{d^2\theta}{dt^2} = -\frac{MgD}{I_A}\sin\theta$$

Units of $\frac{MgD}{I}$:

$$\frac{kg\ \frac{m}{s^2}\ m}{kg\ m^2} \Rightarrow \left(\frac{1}{s}\right)^2 = \left(\frac{rad}{s}\right)^2$$

$\therefore$ Let $\omega^2 = \frac{MgD}{I_A}$

so $$\frac{d^2\theta}{dt^2} = -\omega^2 \sin\theta \quad \therefore \text{SHM?}$$

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