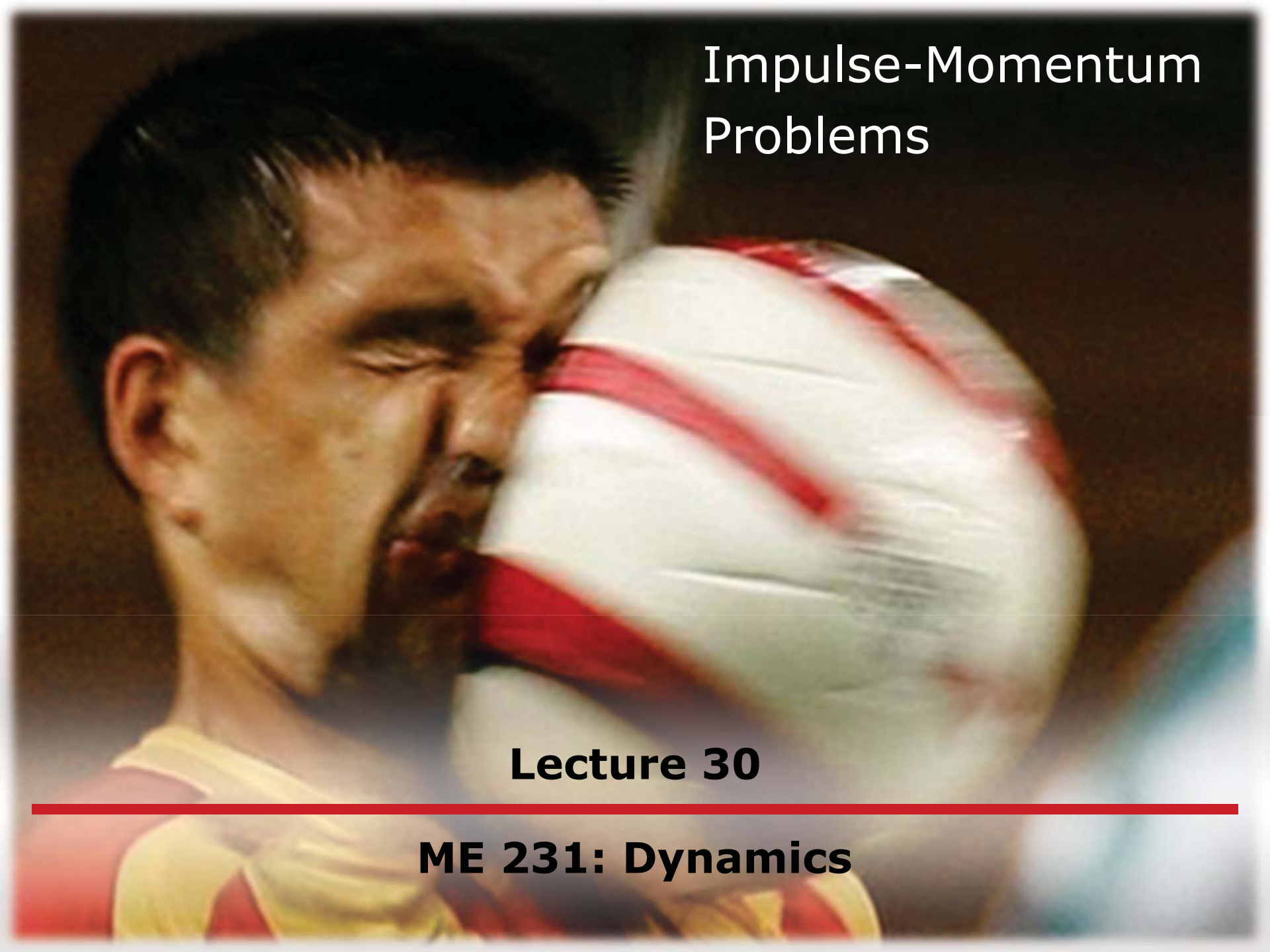
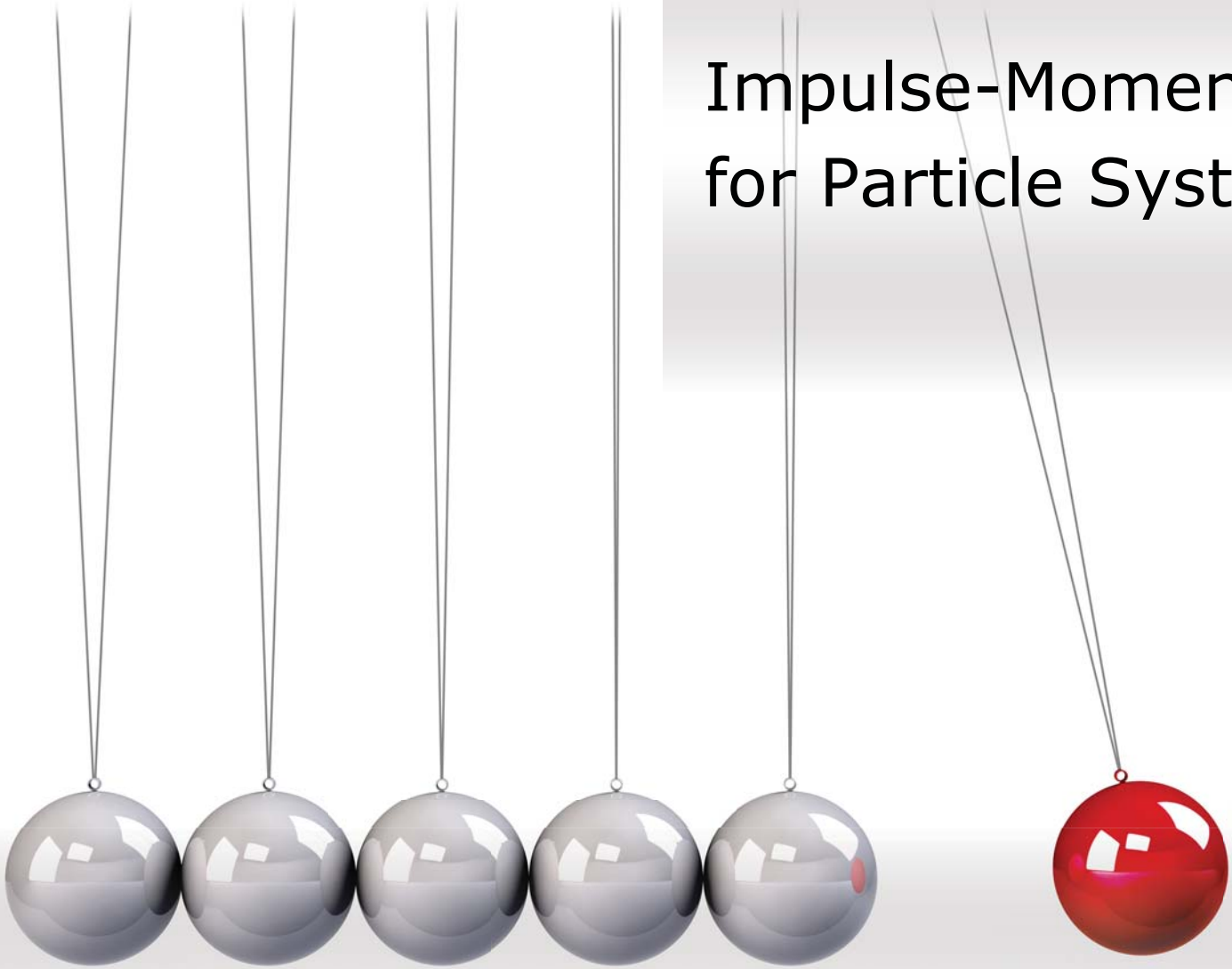


# Impulse-Momentum Problems

**Lecture 30**

**ME 231: Dynamics**

# Impulse-Momentum for Particle Systems

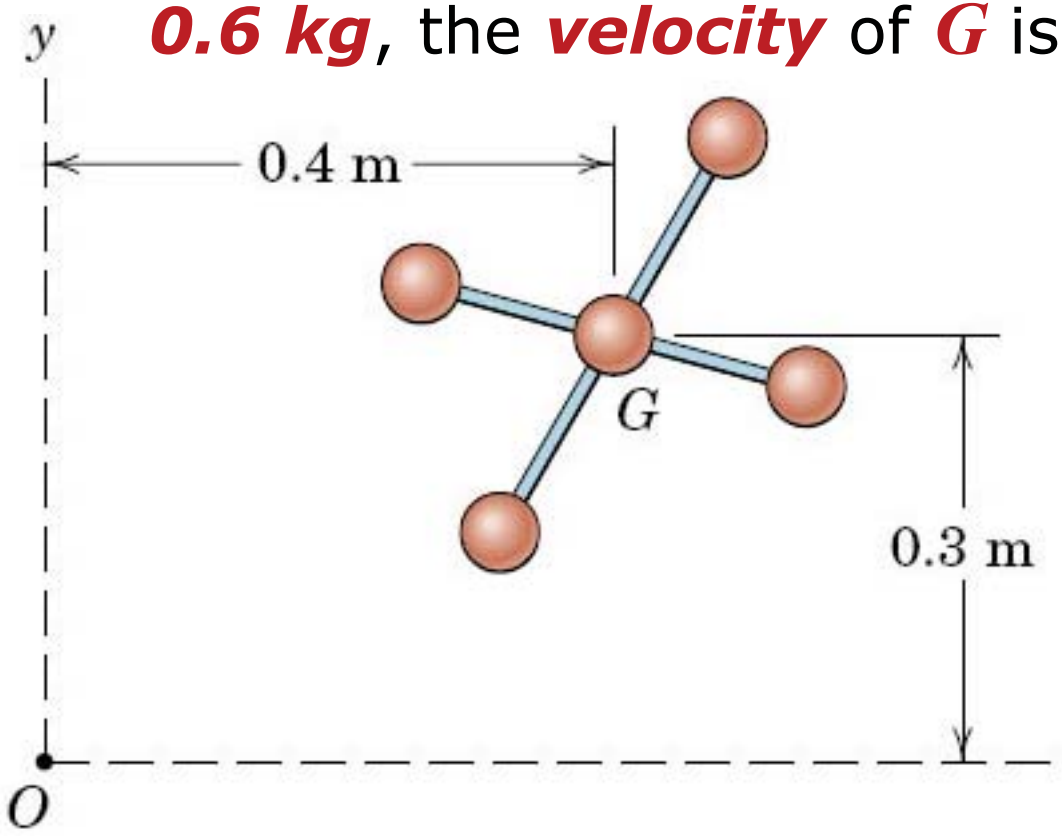


**Lecture 29**

ME 231: Dynamics

# Question of the Day

Each of five connected particles has a ***mass*** of ***0.6 kg***, the ***velocity*** of $G$ is $3\mathbf{i}+4\mathbf{j}$, and the ***angular momentum*** of the system ***about*** $G$ is $1.2\mathbf{k}$ ***kg·m²/s***.



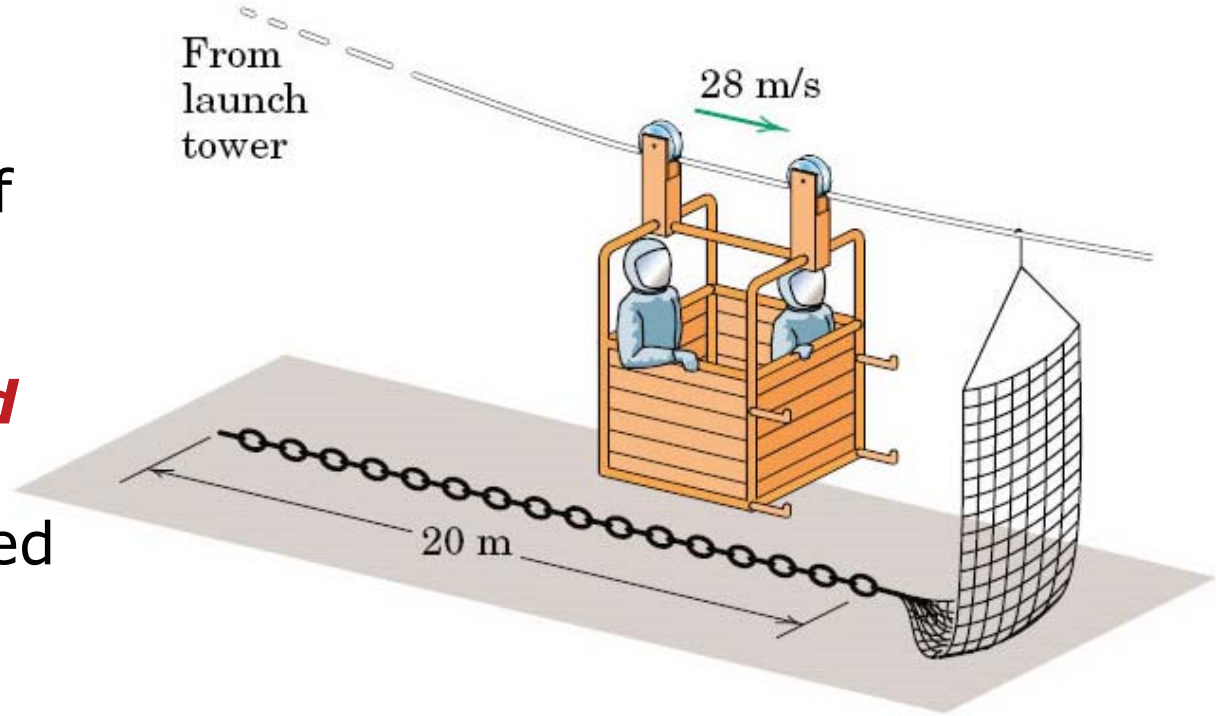

Determine the ***angular momentum*** $H_O$ of the system ***about*** $O$.

# Outline for Today

- Question of the day
- Linear impulse and momentum problems (5.1 & 5.2)
- Angular impulse and momentum problems (5.3)
- System impulse-momentum problems (8.2)
- Answer your questions!

# Linear Impulse and Momentum: Exercise 1

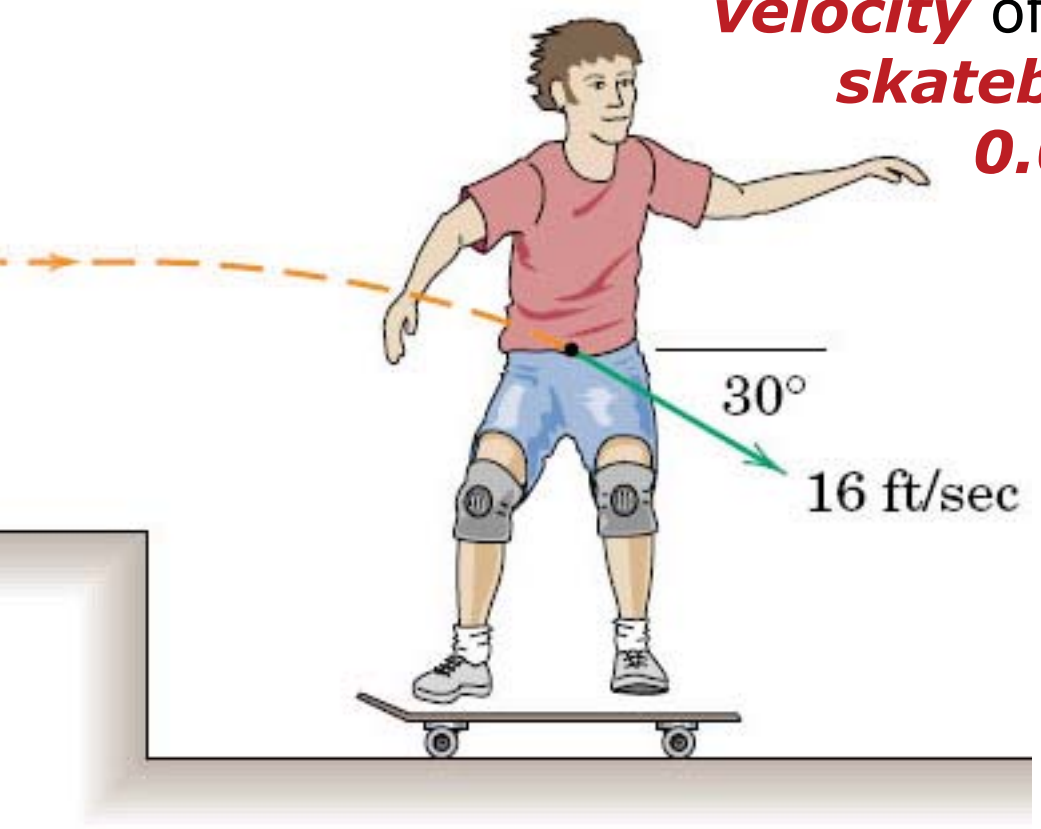
The basket and occupants have a combined ***mass*** of ***320 kg*** and approach the netting at a ***speed*** of ***28 m/s***. The netting is connected to ***20 m*** of chain with a ***mass*** of ***18 kg/m*** and the ***coefficient of kinetic friction*** between the chain and ground is ***0.70***.




Determine the initial ***velocity*** $v$ of the chain when the cage engages the net and find the ***time*** $t$ to bring the cage to a stop.

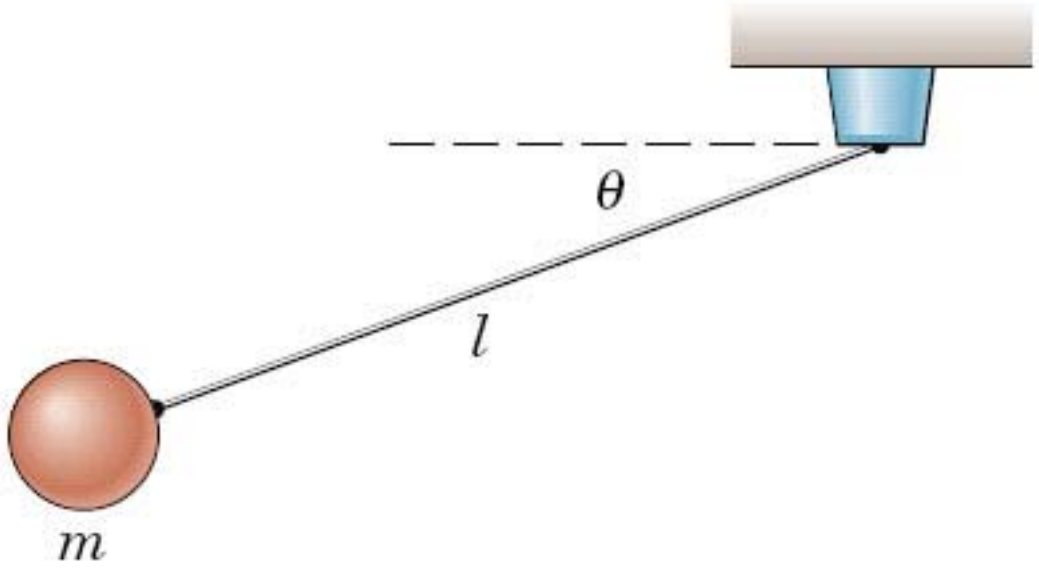
# Linear Impulse and Momentum: Exercise 2

The ***80-lb boy*** takes a running jump with a ***velocity*** of ***16 ft/s*** onto ***10-lb skateboard*** and ***impact*** lasts ***0.05 s***.



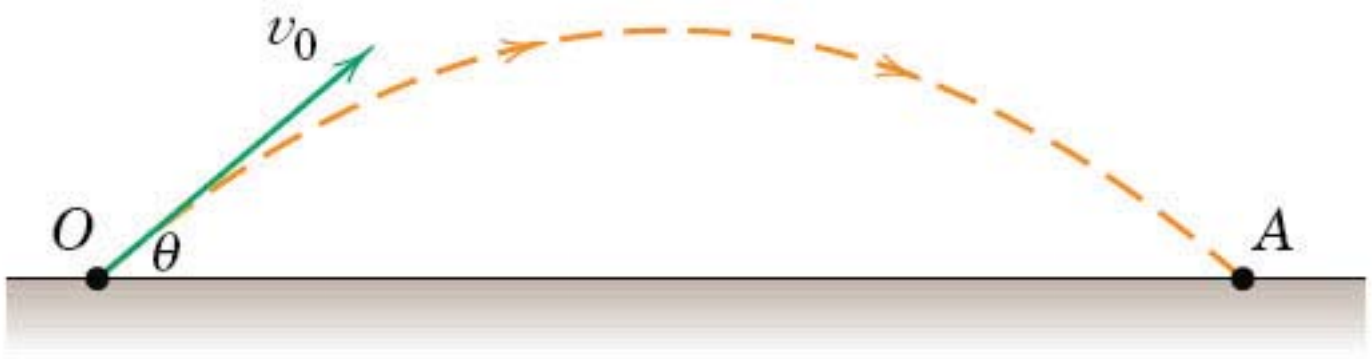

Determine the ***final speed*** $v$ along the horizontal surface and the total ***normal force*** $N$ exerted by the surface on the skateboard during impact.

# Angular Impulse and Momentum: Exercise 1




Using only the angular impulse-momentum principle, determine the expression for $\ddot{\theta}$ in terms of $\theta$ and the ***velocity v*** of the pendulum at $\theta = 90^o$.

# Angular Impulse and Momentum: Exercise 2

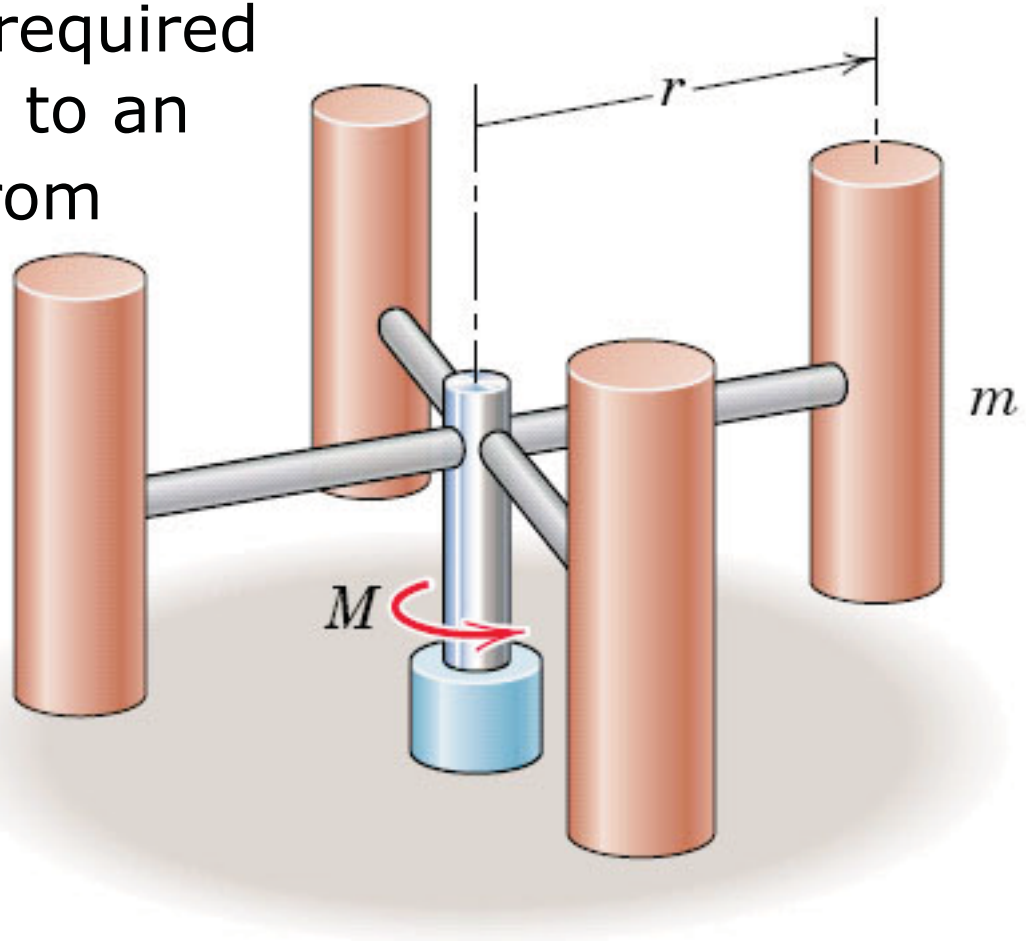



The projectile of ***mass m*** is launched with ***speed*** $v_0$ at the ***angle*** $\theta$.

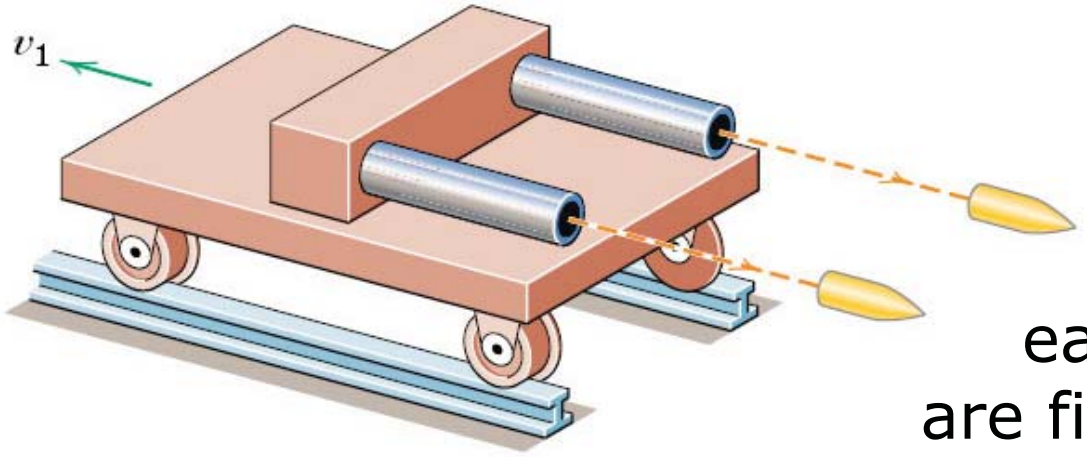
Determine the magnitude $H_O$ of the ***angular momentum*** about the launch ***point O*** at (a) the instant of ***launch*** and (b) the instant of ***impact***.

# System Impulse-Momentum: Exercise 1

Determine the ***time $t$*** required to bring the centrifuge to an ***angular velocity $\omega$*** from rest under a constant ***torque $M$*** applied to the shaft.



# System Impulse-Momentum: Exercise 2




Two ***projectiles***, each ***weighing 20 lb***, are fired simultaneously with identical ***velocities*** $v_r$ ***= 800 ft/s*** relative to the ***cart weighing 2000 lb*** and moving opposite to the firing with an initial ***velocity*** $v_1$ ***= 4 ft/s***.

Determine the ***velocity*** $v_2$ of the cart after the projectiles have been fired.

# Outline for Today

- Question of the day
- Linear impulse and momentum problems (5.1 & 5.2)
- Angular impulse and momentum problems (5.3)
- System impulse-momentum problems (8.2)
- Answer your questions!

# For Next Time…

- Continue Homework #10 due on ***Thursday (11/8)***
- Read Chapter 8, Sections 8.2 & 8.3