ANGULAR MOMENTUM CONSERVATION Unit 16

Dr. John P. Cise, Professor of Physics, Austin Com. College, 1212 Rio Grande St., Austin Tx. 78701 jpcise@austincc.edu

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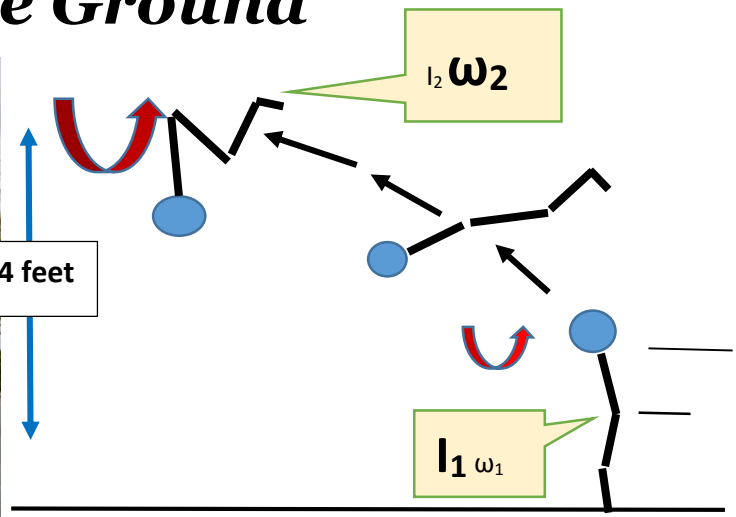
Instead of Arrests, Subway Dancers Are Getting a Stage Above Ground



Alfonso Stewart, 30, performing last week in Battery Park at a street-dancing showcase organized by It's Showtime NYC.

For years, it was the sight that stopped "showtime": a plainclothes officer, rising to identify himself aboard a New York City subway car and greeting tip-seeking break dancers with handcuffs. Arrests for performers onboard trains more than doubled last year. The "acrobats," as Police Commissioner William J. Bratton called them, were held up as a signpost of disorder underground; enforcement against them, the commissioner said last year, was "soaring." But in recent months, police officers underground have quietly begun delivering a sharply different message on small palm cards handed to the scofflaw showmen they encounter. **"Make money," the cards read. "Avoid arrest. Dance!"** As part of a pilot program aimed at curbing illicit performances on the rails, the de Blasio administration is urging dancers to **(((take their act above ground)))**, **setting aside outdoor space for performances that can allow dancers to earn tips legally.** Though officers may still pursue arrests or issue summonses for soliciting on trains, they have been urged to consider the alternative approach: handing out the cards with information about the dance initiative. Every transit officer now carries the small, brightly colored square cards. Roughly 200 have been handed out to dance groups since officers began the effort in May.

INTRODUCTION: If no external torques(T) exist on a rotating system the angular momentum is conserved.

$$I_1 \omega_1 = I_2 \omega_2. \qquad \text{Equation 1}$$

The dancer above leaps up 4 ft., makes one rotation (1/2 rotation to top of arc, $\Theta = \pi$ rad.), prior to landing on the ground. On the way up he reduces his moment of inertia I_2 by ½ ($I_2 = I_1/2$) from an initial moment of inertia of I_1.

QUESTIONS: (a) Find time to leap up 4 ft.? (same as time to fall 4 ft.), (b) Assume final angular velocity (ω_2) at top of leap is $\Theta/t = \omega_2 = \pi /\{1/2\} = 2\pi$ rad./s. Find ω_1 from momentum conservation concepts (equation 1) ? (c) Find dancer's initial rotational kinetic energy (K_1) and kinetic energy at top (K_2)? (d) Find ΔK?, (e) ΔK came from where?

HINTS: $x = V_o t + \frac{1}{2} a t^2$, $T \Delta t + I_1 \omega_1 = I_2 \omega_2$, $K_{ROTATIONAL} = \frac{1}{2} I \omega^2$,

ANSWERS: (a) ½ second, (b) $\omega_1 = \pi$ rad./s., (c) $K_1 = \frac{1}{2} I_1 \pi^2$, $K_2 = I_1 \pi^2$, (d) $\Delta K = + \frac{1}{2} I_1 \pi^2$, (e) $+\Delta K$ came from WORK done by dancer in pulling his arms and legs into a ball shape (making moment of inertia smaller).