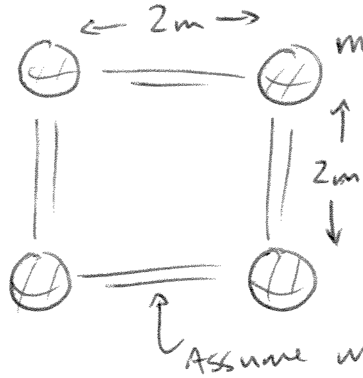


$m = 3kg$ [all identical]

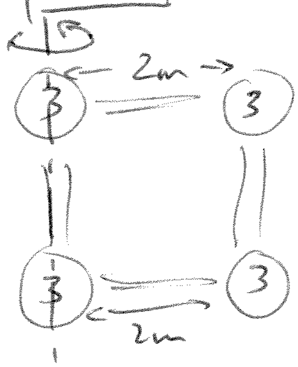
Assume same rotational speed (angular frequency)

$$KE_{rot} = \frac{1}{2} I \omega^2 \qquad \omega = \text{constant}$$

$$I = \sum_i r_i^2 m_i$$

Determine KE_{rot} for different spin axis...

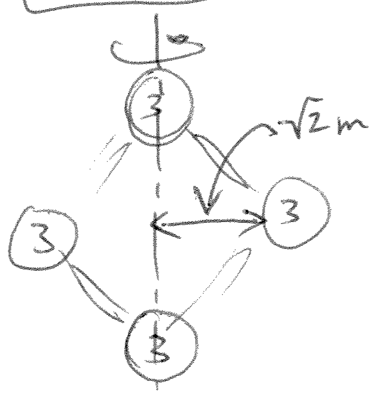
A EDGE



$$I_A = (0m)^2(3kg) + (0m)^2(3kg) + (2m)^2 3kg + (2m)^2 3kg$$
$$= 24\, m^2 kg$$

$$KE_A = \frac{1}{2} I \omega^2 = (12\, m^2 kg)\omega^2$$

B DIAGONAL



$$I_B = (0m)^2 3kg + (0m)^2 3kg + (\sqrt{2}m)^2 3kg + (\sqrt{2}m)^2 3kg$$
$$= 12\, m^2 kg$$

$$KE_B = \frac{1}{2} I \omega^2 = 6\, m^2 kg\, \omega^2$$

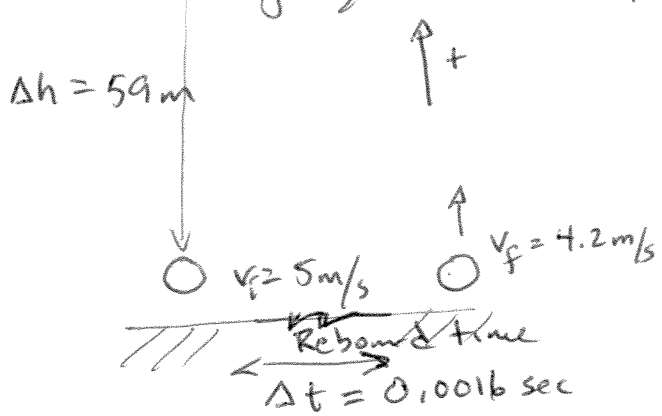
units ✓

Reasonable ✓ units plus $I_B < I_A$ (mass is closer!)

The Ratio: $\frac{\text{Edge Energy}}{\text{Diagonal Energy}} = \frac{KE_A}{KE_B} = \frac{(12\, m^2 kg)\omega^2}{(6\, m^2 kg)\omega^2} = 2$

Twice the energy is stored when rotating about edge

$mgh = \frac{1}{2}mv^2$ If no frictional loss...



$m = 0.15$ kg

$\vec{p} = m\vec{v}$

F_N (electrostatic in nature)

Normal force from floor

$\Delta p = F_{net}\Delta t$ Impulse equals the change in momentum

Freefall m $F_g = mg = 1.47\,N$

Rebounding m $F_g = mg$

$F_{net} = F_N - F_g$

$\frac{\Delta p}{\Delta t} = F_{net}$

$\Delta p = p_f - p_i$

$= mv_f - (-mv_i) = m(v_f + v_i)$

$F_{net} = F_N - F_g$

solve for "floor" force

$\frac{m(v_f + v_i)}{\Delta t} + mg = F_N$

$(0.15kg)\left(\frac{(5m/s + 4.2m/s)}{0.0016s} + 9.8\frac{m}{s^2}\right) = 864\,N$

units ✓ $\frac{kg\frac{m}{s}}{s} = N$

$v_f \uparrow$ $F_N \uparrow$

$v_i \uparrow$ $F_N \uparrow$

$F_g \uparrow$ $F_N \uparrow$

$\Delta t \uparrow$ $F_N \downarrow$ "cushioned"

Reasonable since units and limiting cases make sense

$F_N = 864\,N$

$F_g = 1.47\,N$

Gravitational force is 0.2% of normal force... basically negligible -