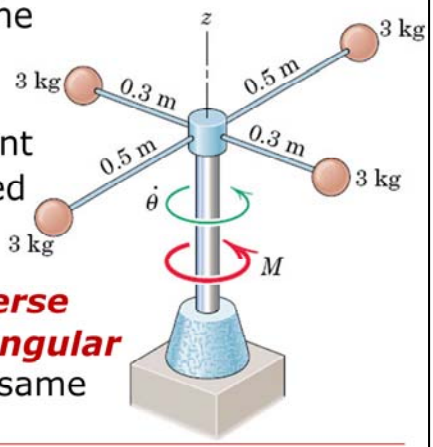
Impulse-Momentum: Another Exercise

Four ***3-kg*** balls are mounted to a frame freely rotating about the vertical ***z-axis*** at a rate of ***20 rad/s*** clockwise when viewed from above. A constant ***torque M = 30 Nm*** is applied to reverse the rotation.



Determine the ***time t*** to ***reverse the rotation*** and reach an ***angular velocity*** of ***20 rad/s*** in the same sense as ***M***.

4/116 $\int_0^t M_z\,dt = H_{z_2} - H_{z_1}$, $H_z = \sum m_i r_i (r_i \dot{\theta})$

$H_z = 2(3)(0.3)^2\dot{\theta} + 2(3)(0.5)^2\dot{\theta} = 2.04\dot{\theta}$

So $30t = 2.04\,(20 - [-20]) = 81.6$

$t = 2.72$ s