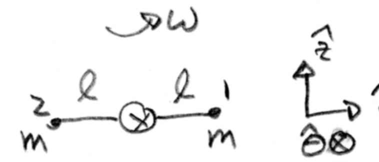
Phys 262 Worksheet



Yes hand this in with the homework.

Consider a baton, consisting of 2 masses (each m) at the ends of a massless rod (Length 2ℓ). The baton twirls with $\vec{\omega} = \omega\hat{z}$ as drawn. Choosing the CM as the origin, the angular momentum of particle 1 is: $\vec{L}_1 = \vec{r}_1 \times m\vec{v}_1$ where...

$\vec{r}_1 =$ [ ] and $\vec{v}_1 = \vec{\omega} \times \vec{r}_1 =$ [ ] $\Rightarrow \vec{L}_1 =$ [ ]

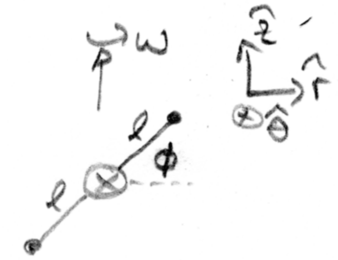
Likewise, for particle 2,

$\vec{r}_2 =$ [ ] $\vec{v}_2 =$ [ ] $\Rightarrow \vec{L}_2 =$ [ ]

So together the total $\vec{L}$ for the system is $\vec{L} = \vec{L}_1 + \vec{L}_2 =$ [ ]

From this we conclude that the net external torque on the system is

$\vec{\tau} = \frac{d}{dt}\vec{L} =$ [ ]



Next, the baton is tilted at an angle ϕ. Perhaps a hand holds it as it twirls with $\vec{\omega} = \omega\hat{z}$. Some questions:

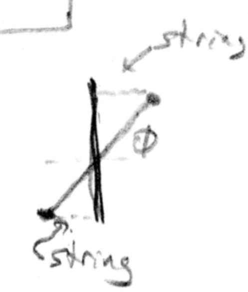
$\vec{r}_1 =$ [ ] $\Rightarrow \vec{v}_1 = \vec{\omega} \times \vec{r}_1 =$ [ ]

$\Rightarrow \vec{L}_1 = \vec{r}_1 \times m\vec{v}_1 =$ [ ]

Likewise $\vec{L}_2 =$ [ ] $\Rightarrow \vec{L} = \vec{L}_1 + \vec{L}_2 =$ [ ]

From which we conclude that $\vec{\tau} = \frac{d}{dt}\vec{L} =$ [ ]

Suppose the torque comes from two strings attached to an axle along the $\hat{z}$ axis. Then $\vec{\tau}_1 = \vec{r}_1 \times (-T\hat{r})$



where it must be that $T =$ [ ]