

Write something you know about angular momentum.

Solution Many different answers are possible. For each answer, you should be able to say whether it is always true, sometimes true, (or never true). If it is sometimes true, you should be able to say what conditions are necessary for it to be true.

For the answers below, I will always be assuming that we are working in the context of Newtonian (classical) mechanics, not quantum mechanics and not special or general relativity.

Always True

$$\vec{L} = \sum_i \vec{r}_i \times \vec{p}_i \quad (1)$$

$$\frac{d\vec{L}}{dt} = \sum_i \vec{\tau}_{i,\text{ext}} \quad (2)$$

Sometimes True

$$\vec{L} = \sum_i \vec{r}_i \times \vec{p}_i \quad \text{single particles} \quad (3)$$

$$\frac{d\vec{L}}{dt} = 0 \quad \text{no external torques} \quad (4)$$

$$\vec{L} = I\vec{\omega} \quad \text{rigid bodies} \quad (5)$$