W14D2 Concept Questions

Concept Question: The angular momentum about the point $O$ of the “reduced body”

1. is constant.
2. changes throughout the motion because the speed changes.
3. changes throughout the motion because the distance from $O$ changes.
4. changes throughout the motion because the angle $\theta$ changes.
5. Not enough information to decide.
6. We had the angular momentum quiz last Friday so I don’t need to think about it anymore.

Answer: 1. The torque about the point $O$ due to the central force is zero,

$$\vec{\tau}_O = \vec{r}_O \times \vec{F}_{1,2} = \vec{0},$$

since the vector $\vec{r}_O$ and the vector $\vec{F}_{1,2}$ are anti-parallel. Therefore the change in angular momentum is zero

$$\vec{\tau}_O = \frac{d\vec{L}_O}{dt} = \vec{0}. $$

For motion confined to the plane, the angular momentum must be constant.
**Concept Question:** The mechanical energy of the “reduced body”

1. is constant.
2. changes throughout the motion because the speed changes.
3. changes throughout the motion because the distance from $O$ changes.
4. is not constant because the orbit is not zero hence the central force does work.
5. Not enough information to decide.

**Answer:** 1. There are no non-conservative forces so the mechanical energy is constant.