Work Sheet

Student Name: ______________________________

Team members:

1.- ______________________ 2.- ______________________

3.- ______________________ 4.- ______________________

Instructor: ______________________________

Introduction[1]

Analysis

Orbiting Puck

1. Calculate the velocities at r_{max} and r_{min}, using the distance between the two dots and the spark frequency. This is the perpendicular component of the velocity at those points.

2. Calculate the angular momentum using $|L| = mrv_{\perp}$ at both r_{max} and r_{min}.

3. Calculate the percent error of the angular momentum above. If the angular momentum is conserved, they should be equal, so make one of them the theoretical and the other the experimental.

4. What is the direction of the angular momentum of the puck?

5. If the air table had no friction, then energy would be conserved. Assume this is true. Yet the puck clearly has greater kinetic energy at r_{min} than at r_{max}. So how is energy conserved? Explain.

Changing of Moment of Inertia

1. Suppose your initial moment of inertia and angular velocity are I_i and ω_i, respectively. If extending your arms doubles your moment of inertia so that $I_f = 2I_i$, then what is ω_f in terms of ω_i? Show your work!

2. For the same condition as above, calculate and compare the initial and final rotation energies using $K_{\text{rotation}} = \frac{1}{2}I\omega^2$. Why are they different? Explain.

Spinning Bicycle Wheel

1. Sketch and explain what happened in steps 4 and 6.

2. For the steps 9 and 10, sketch and explain why re-orienting the wheel left to right, and front to back produces the same effect.

3. Sketch and explain what happened in step 11.

4. If the initial spin rate of the wheel were same for the steps 9, 10, and 11, would your rotation rate be the same in each? Explain why.

5. We stated in the background that the angular speed of the wheel does not change when reoriented even though it induces rotation in you; kinetic energy is clearly not conserved. If the initial kinetic energy of the system was the rotational energy of the wheel - which remains constant - where did your rotational evergy come from?

Conclusions

[1] This is an adaption from S. Sugaya's original version