Linear and Angular Velocity (Pasco)

Initial Thoughts:

This seems to be more of an exercise in graphing and interpreting a graph than one on angular velocity and linear velocity. I think it could be vastly improved if a variable speed motor could be attached to the PASCO device. Better yet, if a pulley system could be created to move a wheel so students could see something that is rotating and translating that into a linear velocity that could be independently measured by something such as a motion sensor. That I feel would be much more interesting than what is done here. At the end I provide an array of questions that could be used either as something like our "pre-test" or just follow-up questions. I also struggle with the wording of some of them…well all of them…but some more than others.

To Set up the PASCO device:

Press the home button
Choose Sensors
Change the Linear Position Scale to Lg. Pulley (O-ring)
Press home button
Choose Digits
Press ✔ to highlight "Angular Position"
Change it to "Angular Velocity"
Press ✔ again
Then press the "down arrow" to highlight the bottom display title
Then press ✔
In the menu select "More" then "Linear Velocity"

To Collect Data:

Press the ► or "play button"
Spin the wheel
    You should see the numbers changing
Press the "play button" again
    This will freeze one particular reading
Record the angular velocity and the linear velocity below
    If you would like to collect more data, please do. The more the merrier.

Trial	Linear Velocity	Angular Velocity
1		
2		
3		
4		
5		

Thinking Time:

On graph paper, graph linear velocity vs. Angular velocity

What is the shape of the graph?

What is the slope of the line?

Describe the relationship between linear velocity and angular velocity?

What is the radius of the O-ring on the Pasco device (perhaps there will be a fun Physics' coincidence)?

Return to the Sensors menu like in the initial set-up but instead of Lg. Pulley (O-ring) change it to Med. Pulley (groove). Then follow the same data collection procedure to graph Linear Velocity vs. Angular Velocity again.

How do the two graphs compare?

What is the slope of the second graph's function?

What is the radius of the medium ring on the Pasco device (perhaps another fun Physics' coincidence)?

Using information from the two experiments can you write an equation to show the relationship between linear velocity and angular velocity?

Other Things to Ponder:

If we had a ring 20 cm in radii, spinning at 15 rad/sec, what would the linear velocity of a point on the edge of the ring be?

Looking up the radius of the Earth, what is your linear velocity due to the Earth's rotation?

Looking up the distance of the Earth from the sun, what is your linear velocity due to the Earth's orbit?

A track coach stands in the center of a circular track (an attempt to save space at the school) and watches two diligent runners doing laps. They are running side by side in lanes 1 and 2. What can the track coach say about their respective linear velocities?

A man was in court for a speeding ticket. He claims that the car dealership must have accidentally put larger tires on the car than what the car should have because his speedometer said that he wasn't speeding. Knowing that a car measures its speed solely by measuring how many times the tire rotates and calculating the linear speed of the car, evaluate the validity of the man's argument.

A standard 12" record spins at a constant angular velocity of approximately 33 rotations per minute. A needle starts at the outside of the record and as the record plays moves towards the middle of the record.

What happens to the linear velocity of the needle as the record plays?

What effect on the sound should this have?

CD's do not have this issue. Explain what at CD player does differently than a record player. (If you don't know, look it up!)