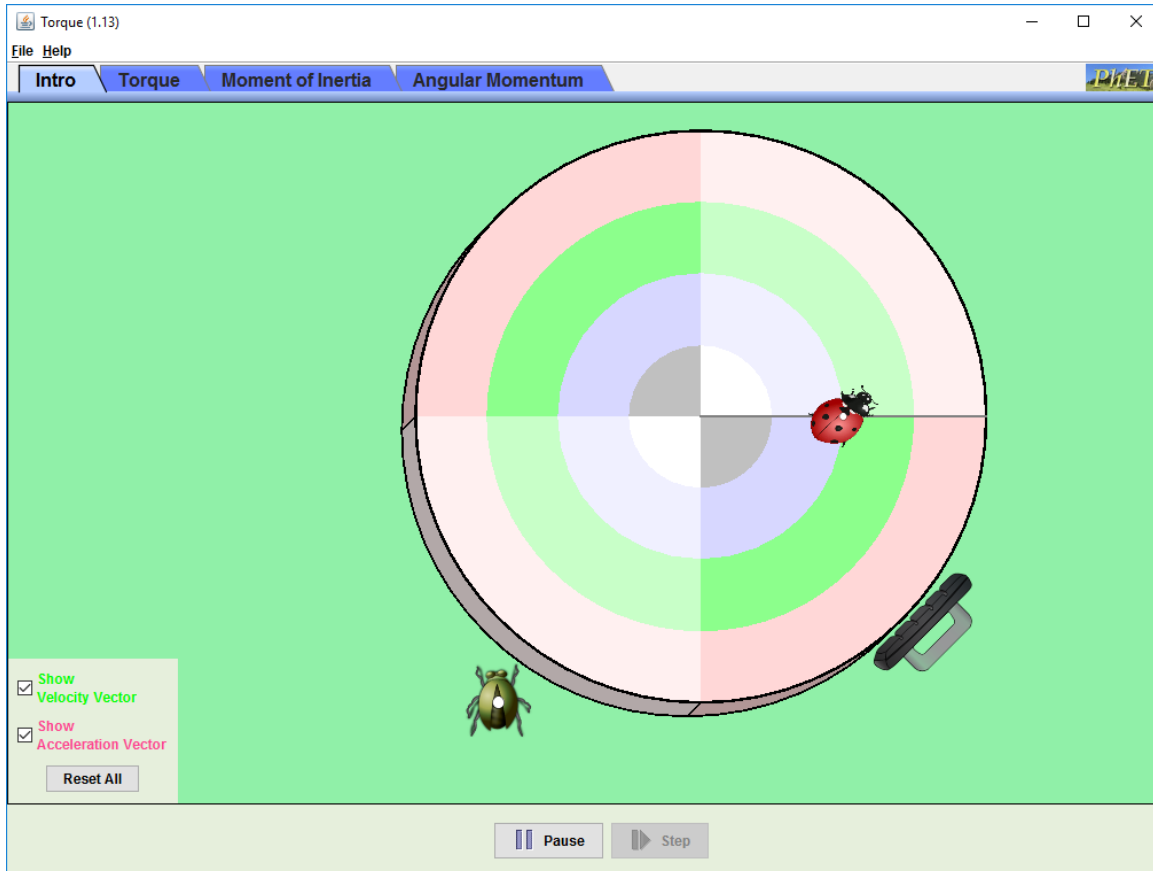# Torque and Angular Momentum

Lab Procedure – Answer questions in red.

Download and run the Java application "torque.en". The screen should appear as shown below.

1. Click the tab at the top that says torque. Make sure that "force of brake" is set to zero. Set the applied force equal to 1 N. The radius of force should be 4m.

a) Click Go let this run for at least 20 seconds. What is the torque on the wheel (include direction)?

b) What eventually happens to the lady bug?

c) What must be the centripetal force that keeps the lady bug moving in a circle?

d) Why does this force eventually fail?

2. Reset all, and set the force back to 1 N if needed.

    a) Observe the acceleration vector (red) as you start. Describe how it changes.

    b) Will the acceleration vector ever point directly to the center? Why / Why not?

3. Click the Moment of Inertia Tab at the top.
   Disregard any millimeter units. They should all be meters.
   To best see the graphs, set the scale of the torque graph to show a range of 20 to
   -20 using the + and – buttons to the right of the charts.
   Set the Moment of Inertia Graph to show a range of 2 kg m^2 to – 2 kg m^2
   Set the angular acceleration graph to show 1,000 degrees / s^2 to –1000 degrees / s^2

   a) Calculate the moment of Inertia for the disk with the given information on the
      screen.
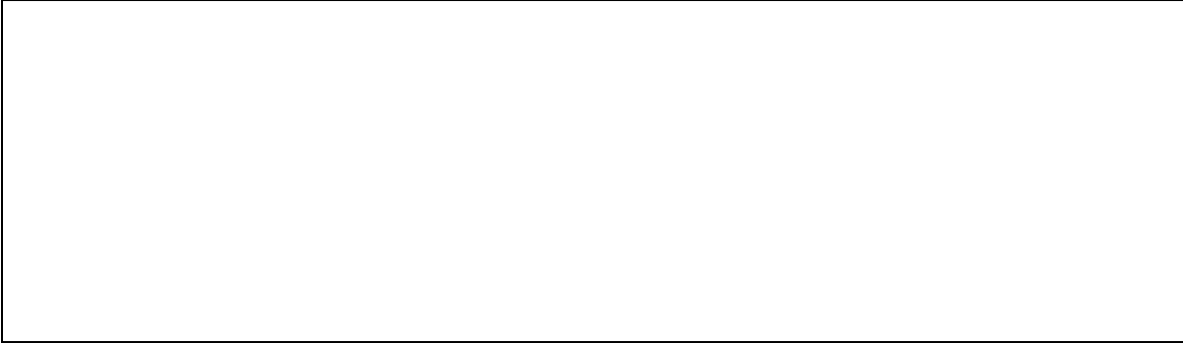
Hold the mouse over the disk so the mouse finger is pointing anywhere between the
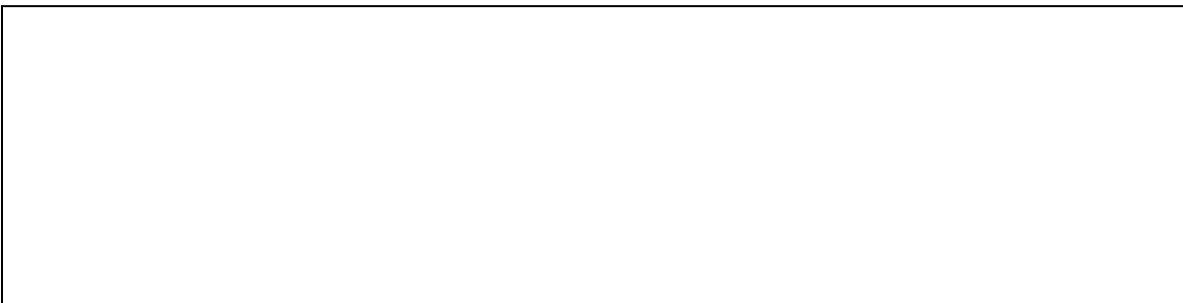green and pink circles.

Hold down the left mouse button. Move your mouse to apply a force.

Look at the graph and try to apply a force that creates a torque of 10.

   b) Use the ruler (click ruler button) to determine the radius at any point between the
      green and pink circles. What do you measure in meters?

   c) Calculate what the applied force must have been.

d) Calculate the angular acceleration of the disk. Work in SI units, and then convert to degrees / s^2. What is your result? Compare to the graph to check your answer.

4. Click the Angular Momentum tab at the top.

Set the scale of the moment of inertia and angular momentum graphs to show a range of 2 to -2.

Set the angular velocity to be 45 degrees / s. Just type this value into the Angular Velocity box.

a) What is the SI unit for angular momentum?

b) Calculate the angular momentum in SI units (you should have already calculated the moment of inertia in part 3).

While the disk is moving, change the inner radius to 2. This creates a hole in the disk.

c) Changing the inner radius automatically changes the angular velocity to 36 degrees / s. Why? (mention moment of inertia and angular momentum in your answer).