Physics Web Quest: Torque

Name_____
Period _____

Open the Physics Animations Folder

Open **torque** (http://phet.colorado.edu/simulations/sims.php?sim=Torque)

Part I: Torque

1. Click the tab at the top that says torque
2. Set the force equal to 1 N.
3. Click Go let this run for at least 10 seconds
4. What is the torque on the wheel (include direction).

5. What eventually happens to the lady bug? _____
6. From Newton's second law, a force will cause an _____
7. When considering angular motion, a torque will cause an _____ _____ (consider both torque equations)
8. What must be the centripetal force that keeps the lady bug moving in a circle? _____
9. Why does this force eventually fail? _____ _____
10. Reset all, and set the force back to 1 N.
11. Observe the acceleration vector as you start. Describe how it changes. _____ _____
12. Will the acceleration vector ever point directly to the center? _____ Why / Why not? (the next steps might help you answer this question) _____ _____
13. Reset all. Set the force back to 1 N.
14. Hit start, wait about 2 seconds, and set the brake force to 1 N. Hit enter and observe.
15. Describe the motion of the wheel: _____
16. What happened to the acceleration vector? _____ Why? _____ _____
17. What is the net torque? _____
18. Reset all. Set the Force back to 1 N. Hit Start.
19. After a few seconds, set the brake force equal to 3N and hit enter.
20. Right after you set the break force, calculate the net torque (check with the graph):

21. Eventually the disc stops and the net torque is zero. This is because the breaking torque changed as you can see in the graph. Why did it change?

Part II: Moment of Inertia

1. Click the Moment of Inertia Tab at the top.
2. Disregard any millimeter units. They should all be meters.
3. To best see the graphs, set the scale of the torque graph to show a range of 20 to -20.
4. Set the Moment of Inertia Graph to show a range of 2 kg m^2 to – 2 kg m^2
5. Set the angular acceleration graph to show 1,000 degrees / s^2 to –1000 degrees / s^2
6. Calculate the moment of Inertia for the disk with the given information.

7. Hold the mouse over the disk so the mouse finger is pointing anywhere between the green and pink circles.
8. Hold down the left mouse button. Move your mouse to apply a force.
9. Look at the graph and try to apply a force that creates a torque of 10.
10. Use the ruler to determine the radius at any point between the green and pink circles. r = _____m
11. Calculate what the applied force must have been.

12. Calculate the angular acceleration of the disk. Work in SI units, and then convert to degrees / s^2. Compare to the graph to check your answer.

13. Predict what will happen to the moment of inertia if you keep the mass of the platform the same, but you create a hole in the middle (increase inner radius).
    _____
14. Set the inner radius equal to 2. Calculate the moment of inertia for this shape. Set the disk in motion and check your answer by looking at the moment of inertia graph.

15. Even when the force on the platform changes, the moment of inertia graph remains constant. Why? _____
    _____
16. Fill in the blanks: When the mass of an object increases, the moment of inertia _____. When the distance of the mass from the axis of rotation increases, the moment of inertia _____.

Part III

1. Click the Angular Momentum tab at the top.
2. Set the scale of the moment of inertia and angular momentum graphs to show a range of 2 to -2.
3. Set the angular speed to be 45 degrees / s.
4. What is the SI unit for angular momentum? _____
5. Calculate the angular momentum in SI units (you should have already calculated the moment of inertia in part II).

6. While the disk is moving, change the inner radius to 2.
7. Observe the graphs.
8. Changing the inner radius automatically changes the angular velocity to 36 degrees / s. Why? (mention moment of inertia and angular momentum in your answer).