Phet: Balanced & Unbalanced Torque

Name _____ Partner _____ Mod ____

Objectives:
1. Determine the relationship between the applied force, frictional force (of the brake) and the torque
2. Determine the type of motion that results from balanced and unbalanced torque.

Directions:
1. Google: PHET → choose the site below →Play w/ SIMS → Physics→Motion →Torque
   This should get you to http://phet.colorado.edu
2. Choose "Run Now". Do NOT update JAVA if it asks you to do this.
3. Click on the tab at the top that says Torque.

Part 1: Unbalanced Torque
Set the applied force = 1 N and click "Go". Let it run for about 10 seconds. You may need to replay this several times to answer all the questions.

1. Calculate the torque on the wheel and show work below. Include a positive or negative sign for direction. Verify that your answer is correct by looking at the applied torque.

2. Look at the velocity and acceleration vectors as the lady bug is rotating. What is happening to these vectors (you may need to replay this to watch them).

   a) Velocity is _____ (increasing, decreasing, or constant).
   b) Acceleration is _____ (increasing, decreasing, or constant).

3. What eventually happens to the lady bug? _____

4. Replay this scenario and look at the direction of the acceleration vector. What do you notice about its direction? _____

When an objects angular velocity changes it is said to have angular acceleration.

5. From Newton's 2nd Law, a net force causes _____. In angular motion (or rotational motion), a net or unbalanced _____ causes angular acceleration.
   (Answer is NOT force for the 2nd blank)

6. What is the centripetal force that keeps the lady bug moving in a circle? _____

7. How would the lady bug describe angular acceleration from her point of view?

   _____

Part 2: Balanced Torque

Rest All Set the applied force = 1 N and click "Go". Let it run for about 3 seconds then stop and set the Force of Brake (found under the picture on left side) to 1 N. Hit Go then stop after a few seconds.

8. Look at the velocity and acceleration vectors as the lady bug is rotating. What is happening to these vectors (you may need to replay this to watch them).

   a) Velocity is _____ (increasing, decreasing, or constant).
   b) Acceleration is _____ (increasing, decreasing, or constant).

9. Look at the applied Torque graph and identify the following torques:

   Applied Torque= _____ Brake Torque = _____ Net Torque = _____

10. Replay this scenario and look at the direction of the acceleration vector. How is the acceleration vector in this scenario different from the first scenario? _____
_____

11. There is no angular acceleration in this scenario. The only acceleration the lady bug has is centripetal acceleration. Recall from previous units that this is acceleration due to direction change only. What direction is this centripetal acceleration acting? _____

Rest All Set the applied force = 1 N and click "Go". Let it run for about 3 seconds then stop and set the Force of Brake (found under the picture on left side) to 3 N. Let it go until the lady bug stops moving.

12. Look at the applied Torque graph and identify the following torques:

   Applied Torque= _____ Brake Torque = _____ Net Torque = _____

A braking force only opposed motion. In can cause an object to stop but not reverse directions. Once the object stops the braking force equals the applied force.

Summary Questions: You do not need the website to answer these but you may use it for help.

13. An applied force of 10 N is given to a rotating object with a radius of 0.25 m. There is no braking force. What the net torque? _____ Does this object have angular acceleration? _____

14. An applied force of 10 N is given to a rotating object with a radius of 0.25 m. There is a braking force of 10 N.

   a) What is the magnitude of the applied torque? _____
   b) What is the magnitude of the braking torque? _____
   c) What is the magnitude of the net torque? _____
   d) Does this object have angular acceleration? _____

15. Objects that have angular acceleration have _____ (balanced or unbalanced) torque.

16. Objects that have constant velocity have _____ (balanced or unbalanced) torque.

17. Objects that are at rest have _____ (balanced or unbalanced) torque.