Name: _____

Please show all of your work, no credit will be given if there is no work. Partial credit will be given where warranted, so show me your physics reasoning. Do not forget to give units for numeric answers and use appropriate significant figures.

This quizzam is open notes and open book but not open internet, i.e. do not google the problems for solutions.You have 45 minutes to complete this quizzam. Good luck!

1. (5 points) There are analogies between translational and rotational quantities. What are the rotational equivalents of the following translational quantities?

    a. Velocity, $\vec{v}$

    b. Acceleration, $\vec{a}$

    c. Force, $\vec{F}$

    d. Mass, m

    e. Linear Momentum, $\vec{p}$

2. (4 points) During a very quick stop, a car decelerates at 8.00 m/s^2.

    a. What is the angular acceleration of its tires, with radius 0.250 m, assuming that they roll without slipping?

    b. How long does it take the car to stop, given that the initial angular velocity of the tires is 90.0 rad/s?

    c. What was the initial linear velocity of the car?

    d. What is the distance that the car travels in this time?

3. (2 points) The earth has a mass of 5.974×10^{24} kg and a radius of 6.378×10^{6} m. Calculate both the angular momentum and rotational kinetic energy of the earth. (The moment of inertia of a sphere is $I = 2MR^2/5$.)

4. (3 points) An object rolls without slipping down an incline starting from rest at a height of 3.00 m. What is its moment of inertia if it has a final velocity of 5.00 m/s? (You can leave the mass and radius of the object as variables, your final answer should be some multiple of MR^2).

5. BONUS: (3 points) A 0.50 kg ball thrown with an initial velocity of 10 m/s is caught by an ice skater with an outstretched arm as shown. If the skater has a mass of 70 kg and moment of inertia 2.73 kg·m^2, what are the final linear and angular velocities of the skater. (You can treat the ball as a point mass and neglect its effect on the center of mass of the skater after being caught. The length of the skater's arm is 0.90 m)