Student name: _____

5-minute Quiz #11

Answer these two questions:

1. A race car with mass 500.0 kg enters a circular turn at 360.0 km/h in the counterclockwise direction about the origin of the circle. The radius of curvature of the turn is 100.0 m. Compute the angular momentum of the car. *[5 points]*

2. A disk of mass 2.0 kg and radius 50 cm with a small mass of 0.1 kg attached at the edge is rotating at 2.0 rev/s. The small mass suddenly separates from the disk. What is the disk's final rotation rate in rev/s? *[5 points]* NOTE: The moment of inertia of a disk of radius R and mass M about its axis is $I = MR^2/2$. The moment of inertia of a mass M at a distance R from the origin is MR^2.

Key Equations

Velocity of center of mass of rolling object	$v_{\text{CM}} = R\omega$
Acceleration of center of mass of rolling object	$a_{\text{CM}} = R\alpha$
Displacement of center of mass of rolling object	$d_{\text{CM}} = R\theta$
Acceleration of an object rolling without slipping	$a_{\text{CM}} = \frac{mg\sin\theta}{m+(I_{\text{CM}}/r^2)}$
Angular momentum	$\vec{\mathbf{l}} = \vec{\mathbf{r}} \times \vec{\mathbf{p}}$
Derivative of angular momentum equals torque	$\frac{d\vec{\mathbf{l}}}{dt} = \sum \vec{\boldsymbol{\tau}}$
Angular momentum of a system of particles	$\vec{\mathbf{L}} = \vec{\mathbf{l}}_1 + \vec{\mathbf{l}}_2 + \cdots + \vec{\mathbf{l}}_N$
For a system of particles, derivative of angular momentum equals torque	$\frac{d\vec{\mathbf{L}}}{dt} = \sum \vec{\boldsymbol{\tau}}$
Angular momentum of a rotating rigid body	$L = I\omega$
Conservation of angular momentum	$\frac{d\vec{\mathbf{L}}}{dt} = 0$
Conservation of angular momentum	$\vec{\mathbf{L}} = \vec{\mathbf{l}}_1 + \vec{\mathbf{l}}_2 + \cdots + \vec{\mathbf{l}}_N = \text{constant}$