

# PHYSICS 151 READING

## ASSIGNMENT FOR NOVEMBER 9

### SECTIONS 7.5-7.6, 9.7, 10.3

Please notice that this file is two pages long.

#### **7.5 - Using Newton's Second Law for Rotation**

- I'm not going to stress this too much in lecture since we already have most of the skills needed to solve these problems.
- Examples 7.11 and 7.12 are the best ones to look over in this section since they will be most like what we'll see on homework.

#### **7.6 - Rolling Motion**

- We'll combine this section and the one from chapter 10 on kinetic energy.
- Figure 7.35 is really good at visually explaining where the "rolling constraint"  $v = \omega r$  comes from.
- A wheel which rolls without slipping has a total velocity of zero at the point where it touches the ground. This is why we have static friction between a wheel and the road.

## 9.7 - Angular Momentum

- We're tying up a few loose ends here.
- Angular momentum,  $L$ , is the rotational counterpart to linear momentum.  $\tau_{av} = \frac{\Delta L}{\Delta t}$  in the same way that  $F_{av} = \frac{\Delta p}{\Delta t}$ .
- Angular momentum for systems and *for single objects* is conserved if we ignore external torques.

## 10.3 - Kinetic Energy

- Here you just need to read the part about the kinetic energy of a rotating and rolling object.
- Rotating object,  $K = \frac{1}{2}I\omega^2$ .
- Rolling object,  $K = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$  - rolling objects have more kinetic energy!
- If an object rolls without slipping, we can write  $K = \frac{1}{2}mv^2 \left(1 + \frac{I}{mR^2}\right)$ .