# PHYS121 Notes

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## 5.1 Friction

There are three kinds of friction:

- Static friction: $\vec{f_s} \leq \mu_s n$. Applies when object is not moving. It adjusts itself so that the net force is 0, but it can only increase to $\mu_s n$ at most.
- Kinetic friction: $\vec{f_k} = \mu_k n$. Applies when object is moving.
- Rolling friction: $\vec{f_r} = \mu_r n$. Applies when object is rolling.

### Interacting Objects

According to Newton's Third Law:

- Every force occurs as one member of an action/reaction pair of forces.
- The two forces act on **different** objects.
- The two forces point in opposite directions and have the same magnitude.

## 5.2 Ropes and Pulleys

### Ropes

**Massless string approximation:** Mass of rope is 0.

Generally, **the tension in a massless string/rope equals the magnitude of the force pulling on the end of the string/rope**. As a result:

- A massless string/rope "transmits" a force undiminished from one end to the other, i.e., if you pull on one end of a rope with force $F$, the other end pulls on whatever it's attached to with the same force.
- The tension in a massless string/rope is the same from one end to the other.

### Pulleys

The tension in a massless string is unchanged by passing over a massless, frictionless pulley (assume such a pulley for problems in Chapter 5).

# 6 Chapter 6

## 6.1 Uniform Circular Motion

Speed is constant but not velocity, because direction is constantly changing.

Centripetal acceleration for uniform circular motion: $a = \dfrac{v^2}{r} = \left(\dfrac{2\pi}{T}\right)^2 r$

**Period:** Time taken to go around circle one time.

**Frequency:** Number of revolutions per second: $f = \frac{1}{T}$ (unit is $\mathrm{s}^{-1}$)

**Angular velocity:** $\omega = 2\pi f$

**Speed:** Time taken to make one revolution: $v = \frac{2\pi r}{T} = 2\pi f r = r\omega$

## 6.2 Dynamics of Uniform Circular Motion

Net force producing the centripetal acceleration of uniform circular motion: $\vec{F}_{net} = m\vec{a}$