

**AP Physics B**  
**LAB EXPERIMENT 2: Friction as a Centripetal Force**

**Purpose:** To experimentally determine the coefficient of static friction between a metal washer and a wooden plank by analyzing the circular motion of the washer as it rests on the rotating plank.

**Background:**

- weight:  $F_g = mg$
- friction force:  $F_f = \mu F_N$
- centripetal acceleration:  $a_c = \frac{v^2}{r}$
- linear speed for circular motion:  $v = \frac{2\pi r}{T}$  (where  $T$  is the period of the motion)
- Newton's 2<sup>nd</sup> Law:  $F_{net} = ma$
- coefficient of static friction:  $\mu_s = \tan \theta_c$  (where  $\theta_c$  = critical angle for sliding)
- assumptions:
  - surface characteristics for the washer and the wooden plank remain constant over the entire surface
  - wooden plank remains perfectly horizontal as it rotates

**Materials:** ring stand, wood plank rotator device, metal washer, angle indicator, stopwatch, meter stick, electronic balance, etc.

**Targeted Questions:** (write your answers in self-inclusive sentences at the end of your conclusion)

- 1) How would increasing the mass of the washer affect the amount of force needed to keep it traveling in a circular path?
- 2) How would increasing the mass of the washer affect the value of the coefficient of static friction between the washer and the wood?

Additional requirements:

- You must do some sort of error analysis for this lab (% difference will be most appropriate)

$$\% \text{ difference} = \frac{|\text{value1} - \text{value2}|}{\text{avg. value}} \times 100$$

- You must include a graph of  $v^2$  (y-axis) vs.  $gr$  (x-axis) in your analysis of the data. (Note: this means you will need to run trials with different radius values)