Name:

Partner:

Physics 11
M. Lam

Incline Lab

Block:

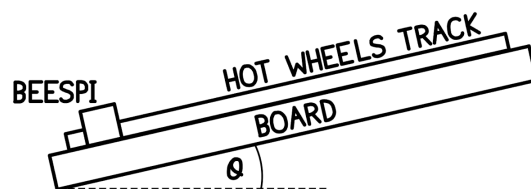**Objective**
Determine the coefficient of friction for a block as it slides down an incline

Equipment   **Apparatus**
BeeSpi photogate timer
ramp
small wooden block
Hot Wheels track
meter stick
phone

Experimental Method
1. Construct the apparatus above.

2. Mark a starting point at the top of the track at which you will place the bottom corner of your block. Determine the distance *d* along the track from the starting point to the middle of the BeeSpi photogate timer. Record the distance below.

    Distance: _____

3. Secure your phone to the wooden board (e.g. with tape) and open an app that can be used to measure the angle of the ramp.

4. Place the block on the track. Starting from an angle of zero, increase the angle <u>very slowly</u> until the block begins to move without stopping. Do this five times and record the minimum angle for each trial in Table 1.

Table 1: Measurements used to determine the coefficient of static friction

Angle θ (º)	Coefficient of static friction μ_s

5. Increase the angle of the ramp. Record the angle in Table 2. *Make sure the angle is large enough that the block begins to accelerate (greater than the angles found in step 4).*

6. Release the block from rest from the marked starting point. Use the BeeSpi photogate timer to determine the final velocity at the bottom of the ramp. Record the final velocity in Table 2.

7. Repeat steps 5 and 6 for a total of five angles.

Table 2: Measurements used to determine the coefficient of kinetic friction

Angle θ (°)	Final velocity v_f (m/s)	Acceleration a (m/s²)	Coefficient of kinetic friction μ_k

Analysis and Discussion
1. Draw and label a free-body diagram for the block. Use dashed lines to show the components of the gravitational force.

2. For Table 1, determine the coefficient of static friction μ_s for each trial. Show an example calculation below.

3. For Table 2, determine the acceleration a for each trial. Show an example calculation below.

4. For Table 2, determine the coefficient of kinetic friction μ_k for each trial. Show an example calculation below.

5. Determine the average values for the coefficients of static and kinetic friction.