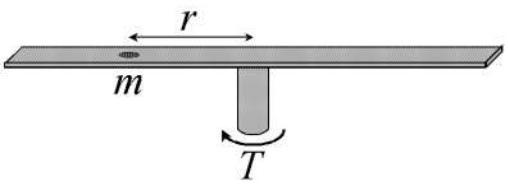
NAME _____ DATE _____

Scenario

A student is attempting to determine the coefficient of static friction μ_s between a coin and a steel plate. The student attaches the center of the plate to a freely rotating axis. For each trial, the student sets the coin on different positions on the steel plate and measures the distance r from the center of the coin to the center of the axis of rotation. The student also has a stopwatch to measure the period T of the plate's rotation.



Experimental Design

PART A: Explain how the student can use this setup to take measurements that would allow the coefficient of static friction to be calculated. Be sure to explain clearly what rotational period must be measured and how experimental error can be reduced.

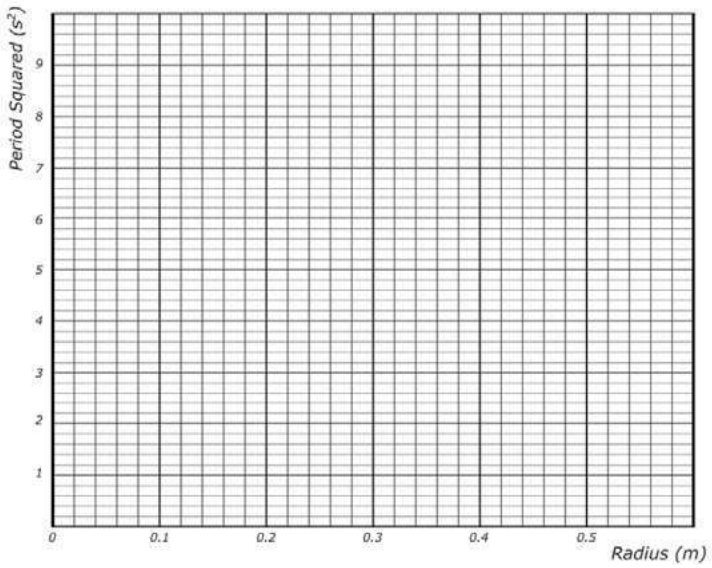
Quantitative Analysis

PART B: Starting with Newton's laws and basic equations for circular motion, derive an equation that relates μ, r, T, and fundamental constants.

The student collects the data shown in the table above.

r (m)	T (s)	T^2 (s^2)
0.1	1.4	1.96
0.2	2.0	4.00
0.3	2.3	5.29
0.4	2.7	7.29
0.5	2.9	8.41

PART C: Plot the data on the T^2 vs. r graph shown below. Draw a best-fit line to the data and calculate the slope of the best-fit line.



PART D: Use your equation from Part B along with the slope of your best-fit line from Part C to calculate the value of μ.