Experimental Design C Test

November 15-23, 2025

Instructions:

- ➔ You will have **50 minutes** to complete your exam. At the end of this time period, you must stop working. Partial credit will be awarded, so attempt as many questions as you can!
- ➔ Each team is allowed to use writing utensils, a timepiece, a linear measuring device, and a Class III calculator.
- ➔ Illegible responses will receive a score of zero.
- ➔ Failure to adhere to the prompt and topic provided may result in score penalties, including a **0.95x** multiplier for experiments that fail to use at least two provided materials, up to a **0.75x** multiplier for off-topic experiments, and a **0.25x** multiplier if no experiment is conducted.
- ➔ **Ties will be broken in accordance with the national Science Olympiad rules in this order:**
  - ♦ Analysis of Claim/Evidence/Reasoning (CERs)
  - ♦ Procedure and Set-up Diagrams
  - ♦ Variables
  - ♦ Data Table
  - ♦ Graph

School/Team Name: _____

Team Number: ____

Written by Tiffany Phan (Temple City '25/Brown University '29), Ethan Chen (Novi '25/UMich '29)
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Topic: Torque and Friction

Torque is the measure of a rotational or "twisting" force, dependant on a translational force applied perpendicularly from a pivot point at a distance r.

Kinetic Friction is the frictional force exerted on an object's direction of movement as it is moving along a surface. The coefficient of kinetic friction is μ_k.

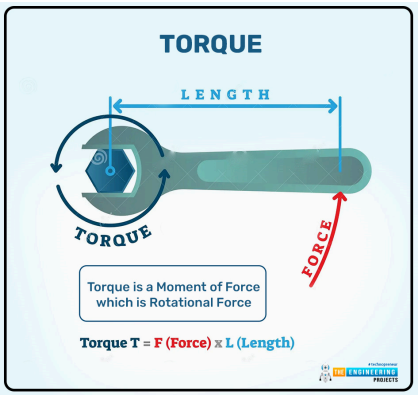
Static Friction is the frictional force exerted on an object that prevents it from moving and keeps the object remaining at rest. The coefficient of static friction is μ_s.

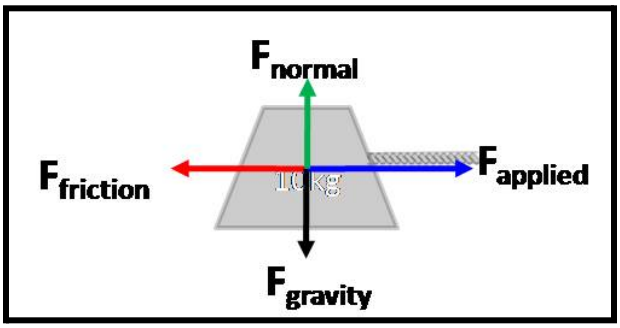
Torque: $\tau = r \times Force$

Kinetic Friction: $f_k = \mu_k mg$ (level surface) $f_k = \mu_k mgcos(\theta)$ (sloped surface)

Static Friction: $f_s = \mu_s mg$ (level surface) $f_s = \mu_s mgcos(\theta)$ (sloped surface)

Your objective is to design and conduct an experiment related to torque or friction using at least 2 of the provided materials listed below:





Allowed Materials:

- Paper Plate
- 1x1' Cardboard Square
- Textbook
- Wooden Dowel
- 5 Cotton Balls
- Stapler (Unlimited Staples)
- 1' strip of blue tape,
- Tennis Ball
- 3 Quarters
- 3 Pennies
- 3 Dimes
- 3 Washers
- 3 Screw Nuts
- A Scale
- 1 Marble

You may use any of the above materials in any way to conduct your experiment. In addition to the above materials, each team is allowed to have a timepiece, a linear measuring device, as well as a Class III calculator. No other materials are allowed.

A: Statement of Problem

B: Hypothesis

C: Variables

Independent Variable (IV)	Dependent Variable (DV)	Controlled Variables (CV)
		1. **2.** **3. .**
		Constant
		1.

D: Experimental Control (Standard of Comparison)

E: Materials

F: Procedure and Set-up Diagrams

G: Qualitative Observations

Qualitative Observations Related to Procedure

Before	During	After

Qualitative Observations Related to Results

During	After

H: Quantitative Data - Raw and Condensed Data Tables

Experimental Design Report - Part 2

Data, Analysis, and Conclusions

Time: 30 Minutes

School: _____

Team #: _____

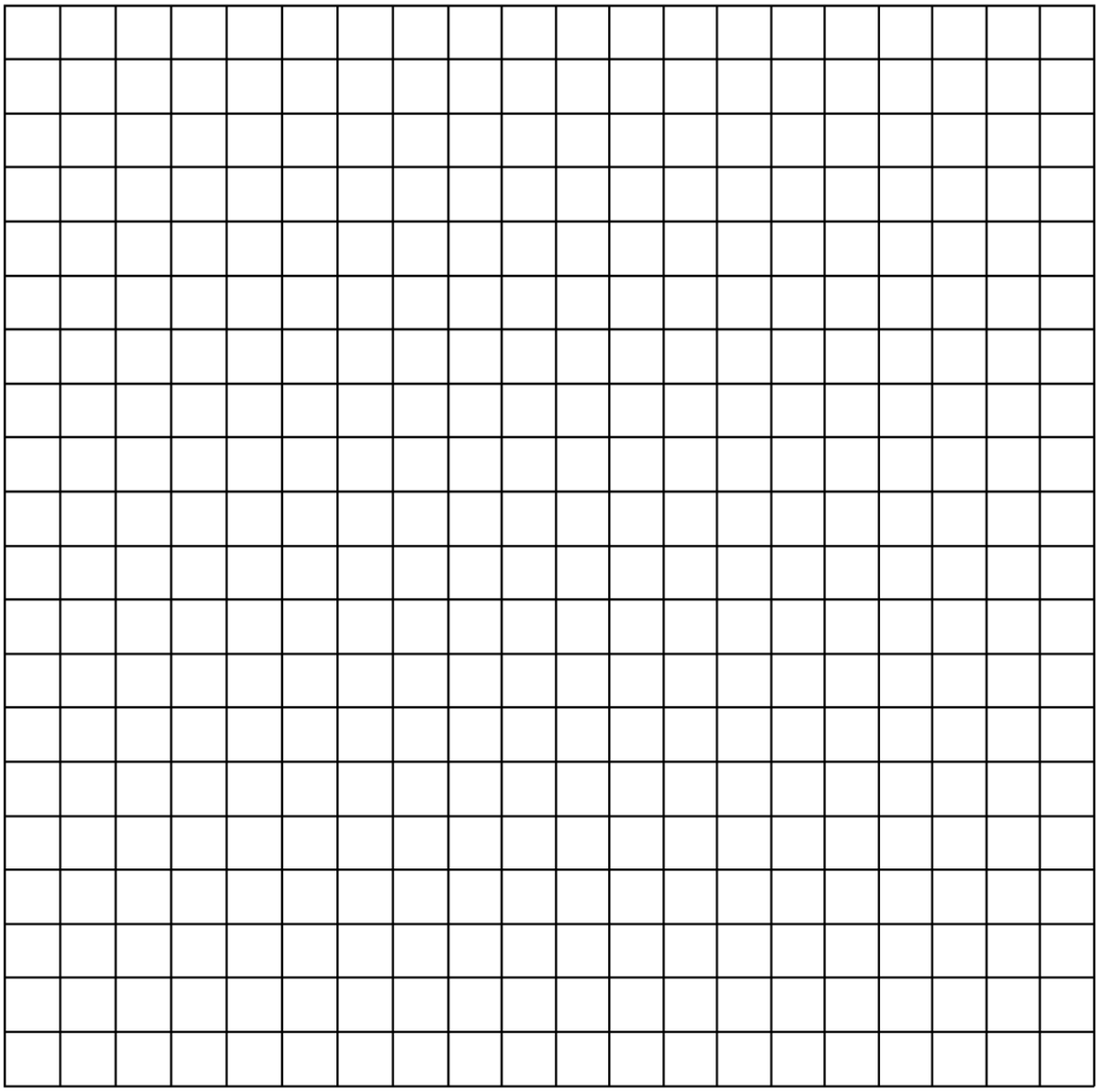
Student: _____

Student: _____

Student: _____

Students may continue experimenting and working on Part 1 during this time.

I: Graph



J: Statistics

L: Analysis of Claim/Evidence/Reason

Variation	
Claim	
Evidence	
Reasoning	

Outliers	
Claim	
Evidence	
Reasoning	

Data Trend	
Claim	
Evidence	
Reasoning	

M: Possible Experimental Errors

	Specific Error Identified	Specific Error Effect on Results
Error 1		
Error 2		

N: Conclusion

Hypothesis Restated:	
Hypothesis is evaluated	
Claim (Accept or Reject the Hypothesis)	
Evidence	
Reasoning	

O: Applications and Recommendations for Future Use

P: Abstract

insert post-test comments if you have any

This test was written by Tiffany Phan (Temple City '25/Brown University '29) and Ethan Chen (Novi '25/UMich '29).

Feel free to reach out to us here:

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