

Friction Surface Investigation

Difficulty Beginner	Time 60-90 minutes	Type Practice & Review
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Background

A payload tray slides during rover motion. The team needs evidence about which surface pairing provides the most resistance to sliding.

Engineering Problem

Compare friction for three surface materials and recommend the best tray liner.

Learning Objectives

- Design a controlled friction test
- Measure force or critical angle
- Collect repeated data
- Use averages to make a recommendation

Materials

- Small test block
- Wood, plastic, foam, or other approved surfaces
- Spring scale or adjustable ramp
- Protractor
- Ruler
- Data sheet

Procedure

1. Choose either a pull-force method or incline-angle method.
2. Define the independent, dependent, and controlled variables.
3. Prepare three surfaces with equal test area.
4. Run at least five trials per surface using the same block and load.
5. Record force or critical angle for every trial.
6. Calculate mean and range for each surface.
7. Create a graph and identify any outlier.
8. Recommend a liner and explain one limitation of the test.

Engineering Requirements

- Test at least three surfaces
- Complete five trials per surface
- Keep block mass and contact area constant
- Calculate mean and range
- Create one labeled graph

Constraints & Safety

- Use only approved surfaces
- Do not exceed spring-scale capacity
- Keep hands clear of a moving block
- Recommendation is based on dry classroom conditions

Deliverables

- Test plan and variables
- Raw data table
- Mean/range calculations
- Graph
- Material recommendation
- Test limitation

Reflection Questions

1. Which surface had the most consistent data?
2. What variable was hardest to control?
3. How could dust or moisture affect the result?
4. Would the best high-friction material always be best for a moving mechanism?

Engineering Tip

Mark a consistent starting position and pull direction for every trial.

Common Mistake

Do not base a conclusion on the single highest measurement; use repeated data.

Stretch Goal

Repeat the chosen surface with two different loads and compare the effect.

Career Connection

Tribology and mechanical engineers study friction, wear, and lubrication in vehicles, machines, and aerospace mechanisms.