

# Comparing Friction on Three Surfaces

Name \_\_\_\_\_

Date \_\_\_\_\_

## Research Question

How does surface material affect the steady horizontal pulling force needed to slide the same block slowly at constant speed in a straight line?

1. Identify the Independent Variable (IV) – the factor you change:

2. Identify the Dependent Variable (DV) – the factor you measure:

3. List three Controlled Variables – factors you must keep constant to ensure a fair test:

4. State your prediction: Which surface will require the most force to slide the block, and which will require the least? Explain your reasoning using what you know about surface textures and friction.

## Equipment & Safety Setup

- Equipment: Low wooden block with secure attachment, suitable spring scale (range selected by teacher), three secured surfaces (bare wood, sandpaper, wax paper), tape, ruler.
- Teacher Check: Ensure the teacher checks your scale range and attachments before pulling.
- Zeroing the Scale: Zero your spring scale horizontally without any load before starting.
- Safety & Technique: Keep the block flat on the table, pull horizontally away from the table edge, pull with no jerks, and never overload the scale.

## Procedure

1. Secure bare wood, sandpaper and wax paper with tape.
2. Use the same block face and mass for every trial.
3. Attach the zeroed spring scale horizontally.
4. Pull slowly at approximately constant speed in a straight line.
5. Read the scale during steady sliding; ignore the starting peak.
6. Record the pulling force in newtons (N). Repeat jerky trials.
7. Take three readings per surface. Add them and divide by three to find the mean. Round to the precision of your scale readings.

# Comparing Friction on Three Surfaces

Name \_\_\_\_\_ Date \_\_\_\_\_

Friction Investigation Data Table

| Surface Material | Trial 1 (N) | Trial 2 (N) | Trial 3 (N) | Mean Force (N) |
|------------------|-------------|-------------|-------------|----------------|
| Bare Wood        |             |             |             |                |
| Sandpaper        |             |             |             |                |
| Wax Paper        |             |             |             |                |

# Comparing Friction on Three Surfaces

Name \_\_\_\_\_

Date \_\_\_\_\_

5. Draw a labelled force diagram of the block sliding to the right on a level table with a horizontal pull at a constant speed in a straight line. Show and label the four forces acting on the block: pull (right), friction (left), normal force (up), and gravity/weight (down). Ensure the relative sizes of your arrows show whether the forces are balanced or unbalanced.



Force Diagram of a Sliding Block

6. Explain why a steady scale reading alone does not prove that the forces acting on the block are balanced. What else must you observe about the block's motion?

---

---

7. Conclusion 1: Based on your experimental data, how does the surface material affect the steady horizontal pulling force (kinetic friction) needed to slide the block? Use specific numbers from your data table to support your answer.

---

---

---

8. Conclusion 2: Based on your evidence, compare the friction on the three surfaces. Why is it incorrect to say that visual roughness is the only factor that determines friction?

---

---

---

# Comparing Friction on Three Surfaces

Name \_\_\_\_\_

Date \_\_\_\_\_

**9. Exit Question 1: A block is resting on a table. You pull it with a force of 0.5 N, but it does not move. Then, you pull it with 1.0 N and it slides at a constant speed. Which statement is true?**

- ☐ **A** At rest, the static friction force was 0.5 N, balancing your pull. In motion, the kinetic friction force is 1.0 N, balancing your pull.
- ☐ **B** At rest, there was no friction acting on the block because it was not moving.
- ☐ **C** In motion, the pulling force must be greater than the friction force to keep it moving.
- ☐ **D** Static friction is always smaller than kinetic friction.

**10. Exit Question 2: A ball is thrown straight up into the air. At the very top of its flight, when its speed is momentarily zero, what forces act on it? (Neglect air resistance.)**

- ☐ **A** No forces act on it because its speed is zero and it is momentarily at rest.
- ☐ **B** Only the downward force of gravity acts on it.
- ☐ **C** Both gravity pulling down and an upward throwing force act on it, balancing each other.
- ☐ **D** Only an upward force acts on it because it is still high in the air.