

Worksheet — Friction Block Simulation

Use with *Simulation - Friction block.html* • goes with the Block 2 friction lab

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Name: _____ Class: _____ Date: _____

How to use this worksheet

Scan the QR code or open school.taneski.com/physics/dp/01-friction-block in a browser (laptop, Chromebook or tablet). The **Tasks** tab in the simulation has the same three parts as this sheet. The simulation checks your numbers; write your **explanations** here.

Part 1 before the lab (≈ 15 min) • **Part 2** during the lab (≈ 10 min) • **Part 3** homework (≈ 30 min).

Use $g = 9.81 \text{ N kg}^{-1}$. Give every value with its unit.



Scan to open

Part 1 — Pre-lab: predict, then test

For each question, write your prediction **before** you test it. Lock it in on the sim, test it, then explain.

Question	My prediction (before)	What the simulation showed	Physics explanation
1. Set the pull rate to 0.5 N s^{-1} . Hold the pull at about 0.5 N ; the block does not move. What is the friction force?			
2. What happens to the newton-meter reading at the moment the block starts to slide?			
3. You add masses so that F_N is about twice as large ($1 \text{ mass} \rightarrow 3 \text{ masses}$). What happens to the peak force?			
4. You turn the block onto its small face (smaller contact area). What happens to the peak force?			
5. You change the pull rate from 1.0 N s^{-1} to 3.0 N s^{-1} . What changes?			

6. Sketch the force–time graph you expect for one run. Label the **peak** and the **sliding** value, and mark where the block is at rest and where it slides.

Sketch: pull F / N (vertical) against time t / s (horizontal)

7. Calculate the pull needed to start the 0.250 kg wood block sliding ($\mu_s = 0.41$, $\theta = 0^\circ$). Use the five steps: Given/Find → Physics → Equation → Working → Answer.

Working

$F =$ _____ N Sim check: _____ N

Part 2 — During the lab: compare the simulation with your measurements

Wood on bench, $\theta = 0^\circ$, noise ON. Use the same loads as in your lab. Fill in the sim values and your group's newton-meter values.

Slotted masses	m / kg	$F_N = mg / \text{N}$	Sim peak / N	Sim sliding / N	Our peak / N	Our sliding / N
0	0.250					
1	0.450					
2	0.650					
3	0.850					
4	1.050					
5	1.250					

8. For 2 slotted masses ($m = 0.650 \text{ kg}$): μ_d from the sim = $F_f \div F_N =$ _____

9. μ_d from your group's data for the same load = _____

10. Give **two** reasons why your measured values differ from the simulation.

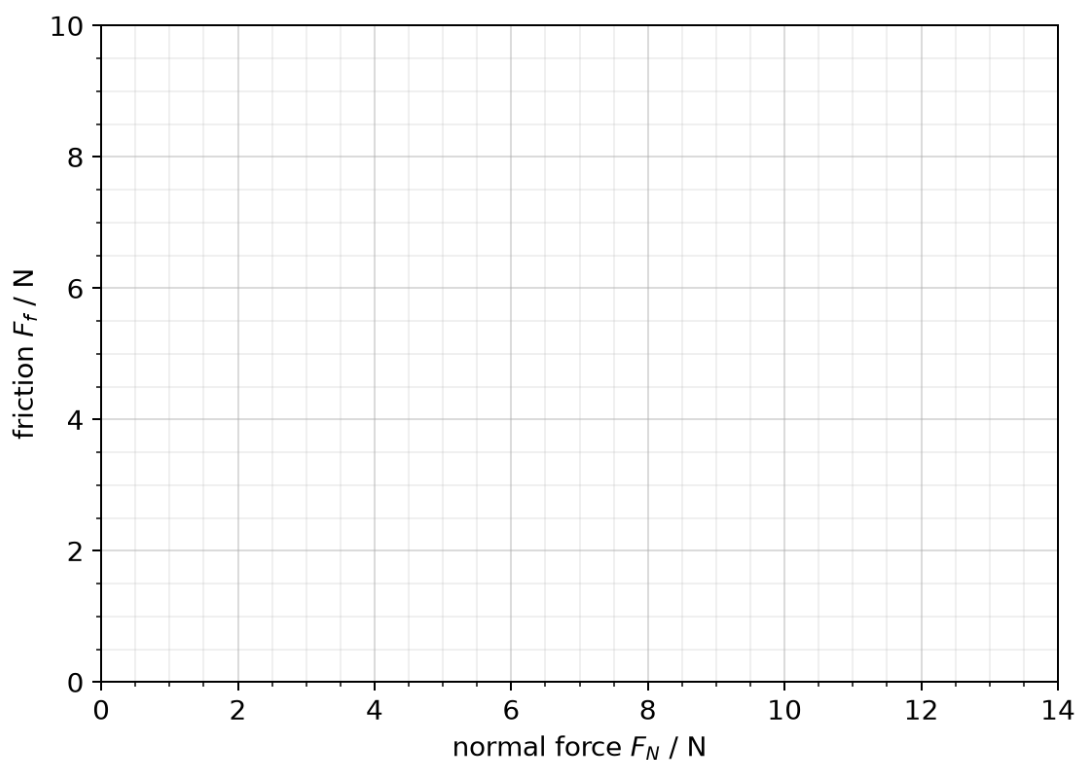
11. Which peak value is harder to read in the real lab, and why? How does a slow-motion video help?

Part 3 — Homework: find μ_s and μ_d from a graph

Rubber sole on bench, $\theta = 0^\circ$, noise ON. Run and **Record trial** for 0–5 slotted masses. Copy your table.

Slotted masses	m / kg	F_N / N	$F_{f,\text{max}} (\text{peak}) / \text{N}$	$F_{f,d} (\text{sliding}) / \text{N}$
0	0.250			
1	0.450			
2	0.650			
3	0.850			
4	1.050			
5	1.250			

12. Plot $F_{f,\text{max}}$ and $F_{f,d}$ against F_N on the grid. Draw a best-fit line through the origin for each set. Use different symbols for the two sets.



13. Draw a large gradient triangle on each line. $\mu_s = \text{gradient} = \underline{\hspace{2cm}}$ $\mu_d = \text{gradient} = \underline{\hspace{2cm}}$

14. Why should each line pass through the origin?

Angled pull

15. Wood on bench, $m = 0.650$ kg, the string pulls at $\theta = 20^\circ$ above the horizontal. Draw the free-body diagram, then calculate the pull F needed to start the block sliding and the normal force at that moment. Check both with the simulation.

Free-body diagram (label W , F_N , F_f , F and the components of F)

Working

$F =$ _____ N $F_N =$ _____ N

16. Explain why F_N is smaller than mg when you pull at 20° , and why this makes the block easier to move.

17. Name **one** way the simulation is simpler than the real experiment.
