

Motion Lab: Inertia, Net Force, and How Fast

Name: _____

Date: _____

Grading. Worth **50 points**: 25 for completion, 25 for effort. Effort means readable work, a labeled sketch where one belongs, and a real attempt on every part, not a correct final number. Point values are marked next to each part. Record every reading exactly as the panel gives it, units included, and describe what you actually saw rather than what you expected to see. Follow the assignment etiquette posted on the Assignment Center before you submit.

The simulations are on the lab page, physicsatsteds.com/conceptual-physics/motion-lab/, and you can type your answers straight into it if you would rather not write on paper. Work down the page and use the simulations as you go. Nothing here is calculated. Set what you are told to set, watch, and write down what you see and what the panel tells you.

1. Warm-up: take the rubbing away

[5 pts]

A puck on a long track. The push button gives exactly the same push every time. The roughness slider decides how fast the surface takes the motion away, and it goes all the way down to nothing.

Simulation: "A puck on a long track, and the same push every time."

Set the roughness slider all the way down to nothing and press Same push. Watch what happens to the speed and to **Where it stops**. Then slide the roughness back up and push again. Write **one sentence** saying what the rough surface does that the smooth one does not. [5 pts]

2. The same push, four different pucks

[15 pts]

The same simulation as Part 1, above. **Leave the roughness at the middle mark and leave the Moon box unticked until the last question.**

Simulation: "The same puck and the same track as Part 1."

(a) Move the mass slider from 1 kg up to 6 kg, pressing Same push at each setting. Say what happens to **Speed right after the push** as the puck gets heavier, and say which puck was the hardest one to get moving. [7 pts]

(b) Fill the table in. Then set the mass to 3 kg and tick **Put the track on the Moon**. Say which of the two numbers in your table changes on the Moon and which one does not, and say what that tells you about mass and weight. [8 pts]

Mass of the puck	Speed right after the push (m/s)	Weight on the Earth (N)
1 kg		
2 kg		
3 kg		
6 kg		

3. Two ropes on one block**[15 pts]**

One block on a floor with nothing to rub on, and a rope on each side. The two sliders set how hard each rope is pulled. The small box in the corner shows all four forces at once.

Simulation: "One block, two ropes, and a floor with nothing to rub on."

(a) Set both pulls to 20 N and press Reset. Say what the block does and what the panel gives for the net force. Now press **Give it a nudge** and say what the block does after that, and what the net force is while it does it. **[7 pts]**

(b) Press Reset, then fill the table in, resetting before each row. Then say what the panel gives for the net force up and down, why that number is what it is, and what has to be true of the sideways forces for the speed to change at all. **[8 pts]**

The two pulls	Net force, sideways	What the block does from rest
20 N and 20 N		
20 N and 30 N		
40 N and 25 N		
45 N and 45 N		

4. How fast are you going?**[15 pts]**

A moving walkway with you on it. One slider moves the walkway, the other is how fast you walk along it. A negative walking speed means walking back against the way the walkway is carrying you. Each run lasts ten seconds.

Simulation: "A moving walkway with you on it."

(a) Set the walkway to 2.0 m/s and your walking to 0.0, and run it. Then set the walkway to 0.0 and your walking to 2.0, and run it again. The two runs give the same **Speed compared with the ground**. Say what is different between them, and what somebody standing on the walkway beside you would say about your speed in each one. **[7 pts]**

(b) Fill the table in, pressing Run for each row. Then find the setting where you are walking hard and getting nowhere over the ground, and explain how you can be moving and not moving at the same moment. **[8 pts]**

Walkway and walking	Speed compared with the walkway	Speed compared with the ground	Distance over the ground in 10 s
2.0 and 0.0			
2.0 and 1.0			
2.0 and -2.0			
0.0 and 1.5			