

Physics 122: Finding the Force of Friction

Objective: To find the coefficient of static and kinetic friction for various materials.

Materials: Wiimote, Long PASCO track, PASCO car, paper towel, piece of wood.

Procedure for μ_s :

1. Connect the Wii remote to the PC (click on the CPU Devices shortcut on the desktop then click add a device)
2. Start *Wii Physics* and change the collection mode to measure the acceleration in the wiimote's y-direction.
3. Right click on the blank Wii Physics screen and select *Show Point Values*.
4. Have the track level and then place the wiimote on one of the three objects – *ensure the wiimote is parallel to the track*. Start collecting data by pressing ctrl+F5.
5. Slowly start increasing the angle of the ramp until the object just starts to move. Stop collecting data by pressing ctrl+F6.
6. Check the acceleration value on the graph. That is the fraction of the acceleration of gravity acting down the ramp. The angle is the inverse sine of that number. Use the angle to calculate the coefficient of static friction between the ramp and the selected object.
7. Repeat the process one more time with the same material for consistency.
8. Repeat the entire process for two other materials.

Procedure for μ_k :

1. Use the start up instructions as above.
2. Prop up the ramp to an angle that will result in the object moving down the ramp. Place the wiimote on an object and be sure the wiimote is parallel to the ramp. Check the exact angle by calculating the inverse sine of the fraction of gravity that acts down the ramp.
3. Start collecting data. Release the object (prevent a crash at the bottom!). Stop collecting data. – note that this happens quickly!
4. Use the graph to determine the acceleration of the object down the ramp. This is a bit tricky – if there is no friction the acceleration will read zero (free fall). Therefore the actual acceleration is your value from #2 minus the value when moving down the ramp. This is your net acceleration down the ramp.
5. Determine the coefficient of kinetic friction by calculating the force of friction and the normal force. Show this calculation once for each material.
6. Repeat the above for two more different angles.
7. Repeat the entire process for one other material.

Summarize all of your data in a table using Word or Excel.

Analysis Questions

1. How does the force of friction change with increasing angle? What about the normal force?
2. Does μ_k for a material depend on the angle of the ramp?
3. How would μ_s and μ_k change if you used a different side of your piece of wood? Does the force of friction depend on surface area?