Preview, Review Summary - University Physics I

Dr. Hulan E. Jack Jr.

Preface

Contact friction is very important in our daily lives. A world without contact friction would be a disaster. Without contact friction we would slip and slide, and probably fall, as we often do on an icy or oily surface. Without contact friction things would not stay safely in their place unless glued, nailed or bolted in place. For examples, objects would slip off tables that were not absolutely horizontal; furniture would slide to the lowest point on floors that are not exactly horizontal (few floors are exactly horizontal - as buildings settle they often are tilted on a very small, usually imperceptible, angle and floors often sag with time). Even objects on perfectly horizontal surfaces would move as a result of the slightest force like the air steam from a summer's breeze or a fan could send your furniture drifting across the floor. A strong sneeze could send you flying across the floor or ground, only stopping when hitting a wall or some other fixed object. So, contact friction is something worth exploring .

Level 0

Do I. the slide and fill in the SAMPLE DATA SHEET with your own experiences and data in II.

Level 1

Do Level 0 and do ANALYSES 1 and 2 in III.

Level 2

Do everything - Level 0 and do all ANALYSES.

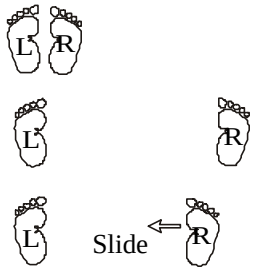
I. DO THE FRICTION SLIDE (It's corny but it makes the points)

1. Start out easy.

First put your feet together.

Then spread your feet apart by about one to two feet depending on the length of your legs. Shorter legs closer together, longer legs farther apart.

Put a **very small amount of weight** on your right foot, then slide it towards your left foot.



2. Let's make it a little harder.

Do the same steps as above, but now with a little more weight on the sliding right foot.

3. Do it all again with more weight on the sliding foot.

4. Finally, with as much weight as you can put on t the sliding foot, slide, slide ,

slide.

II. WHAT DO YOU OBSERVE?

Use as many **foot-floor** variations as you can.

Foot - Bare, cotton sock, nylon sock, wool sock, leather soled shoes, rubber soles shoes (sneakers)

Floor - Smooth wood, vinyl tile, linoleum, ceramic tile (often in the bathroom), bath tube or shower floor.

SAMPLE DATA SHEET

Foot	Floor	Weight on sliding foot	Comments
in cotton sock	ceramic tile	light	slides very very easily.
in cotton sock	ceramic tile	heavier	slides easily, but more difficult.
in cotton sock	ceramic tile	very heavy	still easy, but getting harder.
In sneaker	ceramic tile	light	hard to slide, harder than and cotton sock.

Features: Features are those items or entities that seem to describe the situation. From thinking about your own experiences and collected data you have probably suspected that there might be at least two features. Notice that for a variety of foot and floor combinations you are always doing two things - putting weight on one foot and sliding it. Do you find any connection between these two features?

In the jargon of physics these two features have official names as listed below.

1. **The Normal**. By Newton's 3rd Law of Motion, when you push down on the floor with your foot, in reaction, the floor pushes up on your foot. This reaction force is called the Normal. It is **perpendicular**, at a right angle, at a 90°, to the surface of the floor.

2. **The Friction Force** Again, by Newton's 3rd Law of Motion, as you apply a force on the floor **parallel** to the surface of the floor to move your foot across the floor, the reaction is the floor applying the friction force on your foot parallel to the floor opposing your force.

III ANALYSES

1. Sketch your foot showing all forces acting on it as you slide it, or attempt to slide it . That is, draw a Free Body Diagram of your foot.

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2. First, discuss in words any relationships that you observe between the normal and the friction force.

3. Then quantify these relationships by putting your words into mathematical form - writing equations.

4. Do you notice anything interesting just as your foot slips? Compare any differences between just before it slips with just after it starts slipping. If so, discuss them in words.

5. Now quantify your observations by putting them into mathematical form - writing equations.
