**التجربة الرابعة**

**اسم التجربة:- معامل الاحتكاك**

**The Coefficient of Friction**

**Equipment :**

Friction coefficient device 1-

2- pieces of wood

3- weight holder

4- dumbbells

5- Reel

**Objectives :**

To measure the coefficients of static and kinetic friction

between a wooden block and a wooden plane.

**Theory**

Friction is the force that resists the relative motion of one surface in contact with another.

There are two types of friction: static and kinetic. Usually, the

kinetic frictional force is less than the maximum value of the static frictional force. The maximum value of static frictional force is given by *fs*,max = μ*sFw* and the kinetic frictional force is given by *fk* = μ*kFw* , where μ*s* is the coefficient of static friction, μk is the coefficient of kinetic friction and Fw is the weight force. If f k versus Fw is graphed, the slope of the line is μk for the system. Similarly, if *fs*,max versus Fw is graphed, the slope of the line is μ*s* . The *angle of repose* is defined as the angle at which an object just starts to slide down an inclined plane. If θ The angle at which the body moves, it can be shown that

μ*s* = tan θ. We will call this method to determine the static coefficient of friction.the *angle of repose method*. It can also be shown that when an object slides

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Figure 1- Block on incline plane

down an incline at constant velocity, μ*k* = tan θ . In this experiment, the frictional force between a wooden block and the wooden surface of a horizontal and inclined plane will be measured, and from these plotted data, the coefficients of *static and kinetic friction* will be obtained.

The angle of repose method will also be used to determine the coefficient of static friction. Lastly, the coefficient of kinetic friction will be determined by a second method *(called constant velocity method*) by noting the angle θ that the block slides down an incline without accelerating and then using μ*k* = tan θ .

**Method :**

1. Calculate the mass of the wooden piece using a balance, let it be (1W(K).
2. Place the wooden piece on the horizontal surface of the device and tie its end with a fine thread that passes over a smooth pulley and the thread ends with a weight holder.
3. Add appropriate weights at the end of the stand, which represent Mkg, so that the wooden piece moves at a regular speed.
4. According to the value of the pulling force = the mass of the suspended weight x the ground acceleration.
5. Place weights on top of the wooden piece so that the mass of the wooden piece, including the weights, is
6. M = (M + M)Kg
7. Find the compressive force from the equation.

**Measurements and Calculations:**

1. **Finding the coefficient of initial friction**

|  |  |
| --- | --- |
| **reading** | **θs** |
| **1** |  |
| **2** |  |
| **3** |  |
| **4** |  |
| **5** |  |

θs: The angle at which the body moves

μs = tan θs

μs= Fs/Fw

Fw=m\*g

1. **is the coefficient of kinetic friction**
2. Arrange your results according to the following table

|  |  |  |  |
| --- | --- | --- | --- |
| M1 | W= m1 \* g | M2 | F= m2 \* g |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

M1: T he mass of the wooden piece .

M2: The mass of the weight hanging on the wooden pice .

W :The weight force.

F:The force of the weight hanging.

1. 2- Draw the graphical relationship between the pulling force (F) on the y-axis and the compressive force ( W ) On the x-axis you will get a straight line with a slope representing the coefficient of direct friction.

μk= Fk/Fw

F (N)

Slope =ΔF/ΔW

μ*k* =Slope

W(N)

**Questions:**

1. Show that μk=tanθ for the constant velocity method. Include a diagram of all

the forces on the block as it slides down the inclined plane

2. When the mass on the block is was doubled, what happens to the angle of repose? Were your results as expected. Explain.

3. Why was it necessary to tap the block to get it started in section 11 of the lab?

4. Why can anti-lock brakes stop a car in a shorter distance than regular brakes?

5. Which method do you think would yield the more accurate value for the coefficient of kinetic friction and why?