EXPERIMENT NO. 5
COEFFICIENT OF STATIC FRICTION

Aim: To study the relationship between force of limiting and normal reaction and to find coefficient of friction between a block and a horizontal surface.

Apparatus: Horizontal plane with a pulley, Wooden block with a hook, string, weight box, scale pan etc.

Formula: $\mu_s = \frac{P}{W}$ $\quad f \propto N \therefore f = \mu_s N \quad \therefore \mu_s = \frac{f}{N} = \frac{P}{W}$

Where μ_s = Coefficient of static friction between two surfaces.
P = Horizontal force required just to slide the block (or effort)
W = Weight of the block (or load)

Diagram:

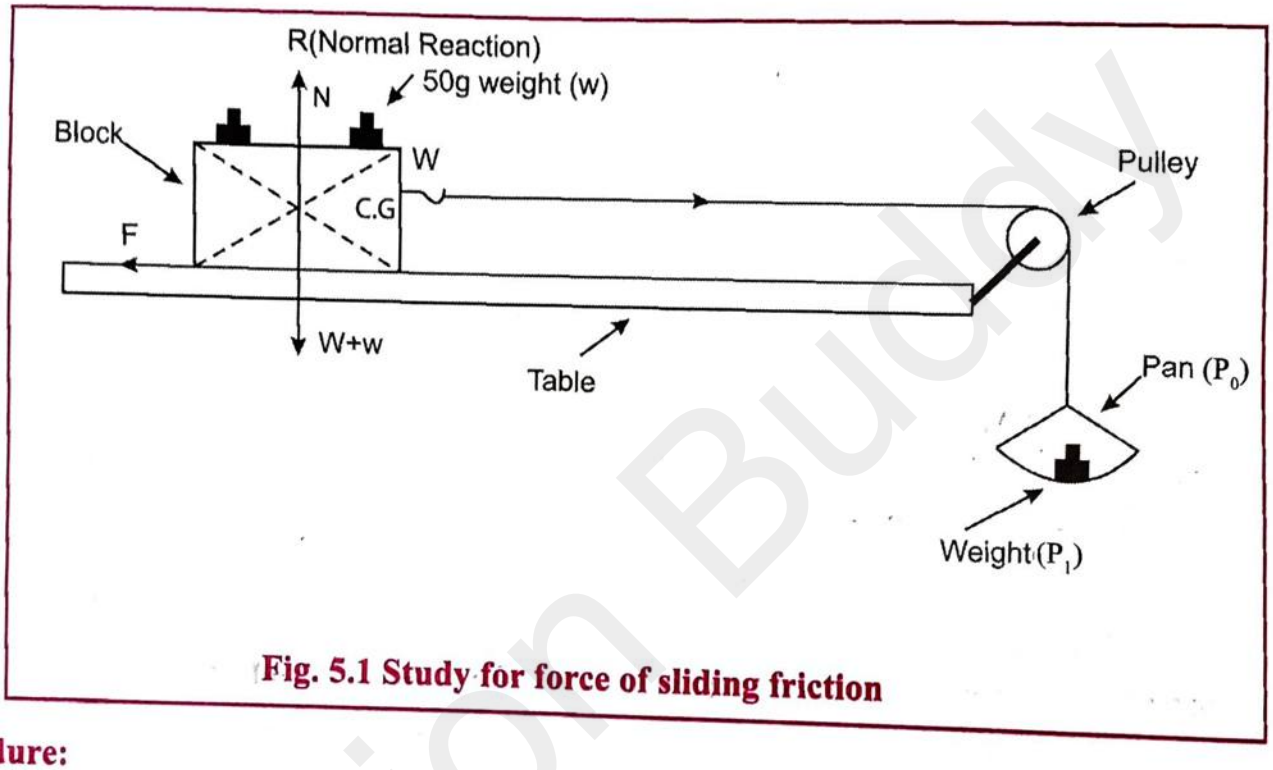


Fig. 5.1 Study for force of sliding friction

Procedure:

1. Measure the weight of block and pan separately (respective masses in g.wt).
2. Clean the surface of block and horizontal plane with the clean cloth every time.
3. Tie one end of the string to the hook of block, pass it over the pulley, and attach the scale pan to the other end.
4. Keep same weight on the block, which is kept on horizontal surface. Add suitable weights in the scale pan so that the block just starts moving and note down the reading.
5. Repeat the same procedure for different values of loads and measure the corresponding efforts.

Observations :

Least count of spring balance = _____ g Zero error of spring balance = _____ g.

1. Mass of the block = W_0 = ... gwt.
2. Mass of the pan = P_0 = ...gwt.

Observation Table:

Obs No.	Mass on the block W_1 gwt	Total load $W=(W_0+W_1)$ gwt	Mass in the pan P_1 gwt	Total Effort $P=(P_0+P_1)$ gwt	$\mu_s = \frac{P}{W}$	Mean μ_s
1	10·9m	9·59m	15	35	0·358	0·347
2	20·9m	10·59m	17	31	0·352	
3	30·9m	11·59m	20	40	0·341	
4	40·9m	1·259m	29	43	0·344	
5	50·9m	135gm	40	66	0·324	

Calculations : $\mu_s = \frac{P}{W}$

① $\frac{15}{96} = 0.0157$

② $\frac{17}{105} = 0.161$

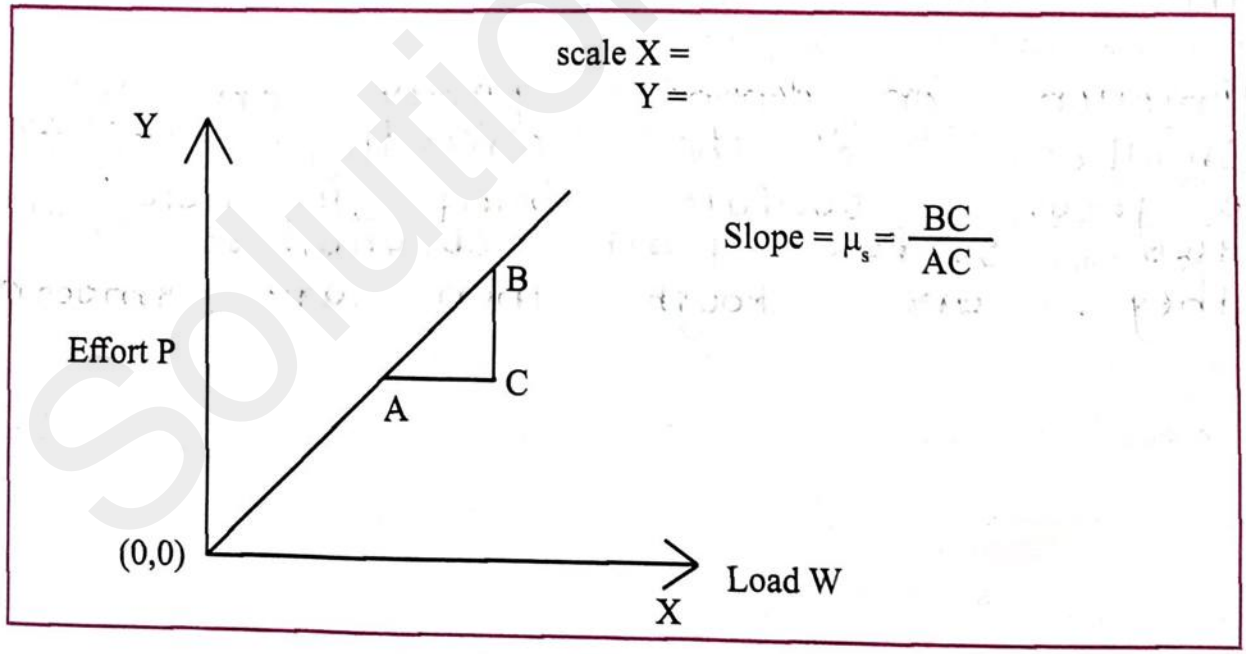
③ $\frac{20}{115} = 0.173$

④ $\frac{23}{125} = 0.184$

⑤ $\frac{40}{136} = 0.295$

Graph :

Plot a graph between load W (on X-axis) against effort P(on Y- axis) and find the slop of the graph.



Result :

1. Coefficient of static friction between the two surfaces by calculation = μ_s = ...
2. Coefficient of static friction between the two surfaces by graph = μ_s = ...

Precautions :

1. Two surface in contact should be dry and clean.
2. Reading must be taken for the weight for which block just start moving.
3. Pan and string should not touch the tabl.
4. String should be parallel to the horizontal surface.

Additional Experiment you can do :

Place the empty block (without pan) on the plane surface. Now gradually increase the angle of inclination of the plan surface such that the block just begins to slide down the plane. The minimum angle of inclination of the plane at which the body kept on the plane just begins to slide down is known as the angle of repose (Q_r). Determine this angle. Than μ_s = tan Q_r

Multiple-choice Questions

1. The value of coefficient of static friction is .....

   a) Greater than 1 b) less than 1 c) equal to 1 d) zero

2. ..... is the force of friction which comes into play when a body does not slide on the surface of another body under the effect of an applied force.

   a) Rolling friction b) Kinetic friction c) static friction d) dynamic friction

Questions

1. How can you say the force of friction is a self adjusting force?

static friction is considered a self adjustic force because it wants to objects to remain at resi and not move, Therfore if an exeternal force is applied the statie friction force will equal the magnitude of the external force unit is sapsses the thes Hold of motion.

2. On which factor the force of friction depends?

friction on depends party on the smathness of the contacting surface a great surface being in more two surface part of anather if they are Rough then are smath.

Remark and sign of teacher: .....