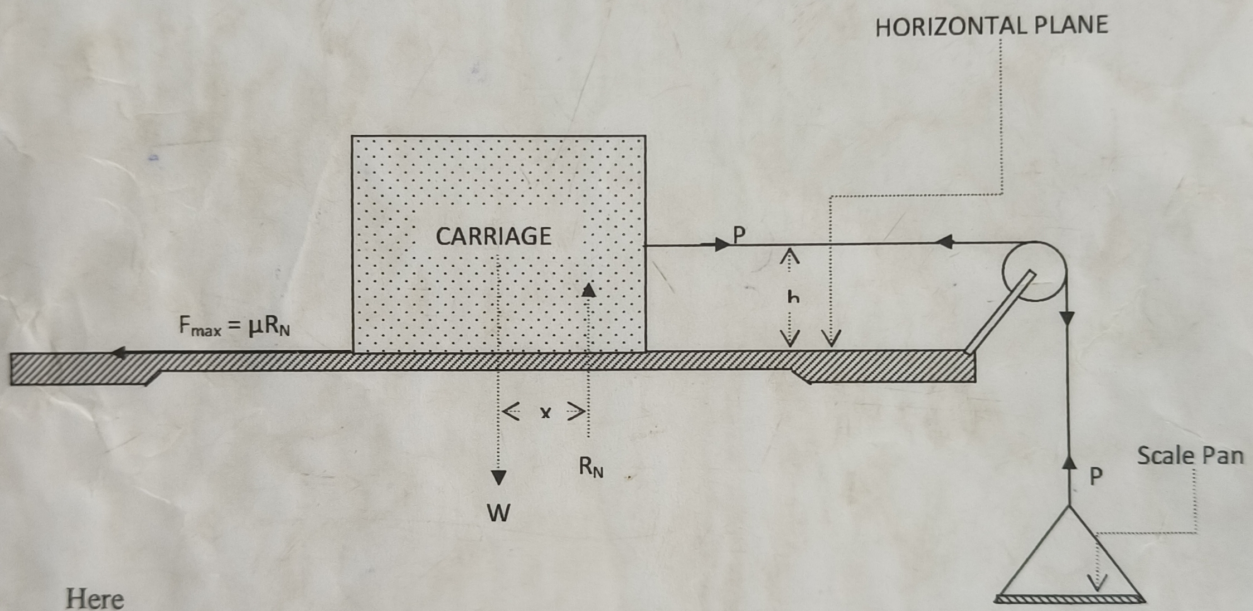
EXPERIMENT NO. 1

Object- To find the coefficient of sliding friction between two surfaces on a horizontal plane.

Apparatus- A wooden horizontal plane, wooden carriages having different bottom surfaces, scale plane, weight box, slotted weights.

Theory- When a body rests on any surface/plane and when it is forced to move in any direction, by virtue of the property of the surface called 'Friction', a force called 'Frictional force' will be generated there and it will resist the motion. Frictional force is a resisting, self adjusting and passive force, means when there is no external force to change the condition of rest of body into moving condition, frictional force will also not be there. As any force compels the body to change it static condition into moving, frictional force will be generated and will be exactly equal and opposite to the force acting. As we increase the external force responsible for the movement of the body up to a stage when the body is about to move, frictional force at this condition is also equal to external force and having its maximum value which is also fixed. This state is called the 'Limiting equilibrium condition". The value of limiting frictional force F_{max} is equals to μR_N.



Here

μ = coefficient of friction

R_N = normal reaction offered by the plane

P = wt. of scale pan + wt. put in it (at the limiting stage.)

F_{max} = max frictional force at the limiting equilibrium condition.

Applying laws of static equilibrium, we get

$\sum H = 0 \leftrightarrow F_{max} = P$, therefore $\mu R_N = P$ (1)

$\sum V = 0 \leftrightarrow R_N = W$ (2)

Thus $\mu = \frac{P}{W}$ [From equations (1) and (2)]

$\sum M = 0 \leftrightarrow W.x = P.h$; therefore $x = \frac{P}{W} h \leftrightarrow x = \mu.h$

PROCEDURE:

First note down the self weights of scale pan and carriages. Now connect the scale pan to the hook of the carriage with inextensible string of suitable length. Put the carriage on the horizontal plane for a particular combination of surfaces. Now put some wt. into carriage and note them. Hang the scale pan over the frictionless pulley mounted at the end of the plane. Now gradually increase weight in the scale pan and simultaneously gently strike the plane with fingers to check whether it is in its limiting condition or not. Now increase the weight in the scale pan up to that where carriage is in its limiting condition. Note the wt. is put in the scale pan and in the carriage also. Take number of readings by adding more wt. to the carriage.

Repeat the whole procedure for various other combinations.

OBSERVATIONS:

Wt. of scale pan = 50 gms.

Wt. of carriage (wooden base) = 174 gms.

(steel base) = 245 gms.

Combination = wood/wood

S No.	Effort (P)			Load(W)			Coefficient of friction $\mu = \frac{P}{W}$
	Wt. Of scale pan	Wt in scale pan	Total	Wt. of carriage	Wt. In carriage	Total	

RESULT: The coefficient of sliding friction for the various combination are

(1) Wood/ wood = ...
(2) Wood/ wool= .....
(3) Steel/ wood = ...
(4) Steel/ wool= .....

Graph is plotted between load on x-axis and effort on y-axis for all the combinations.

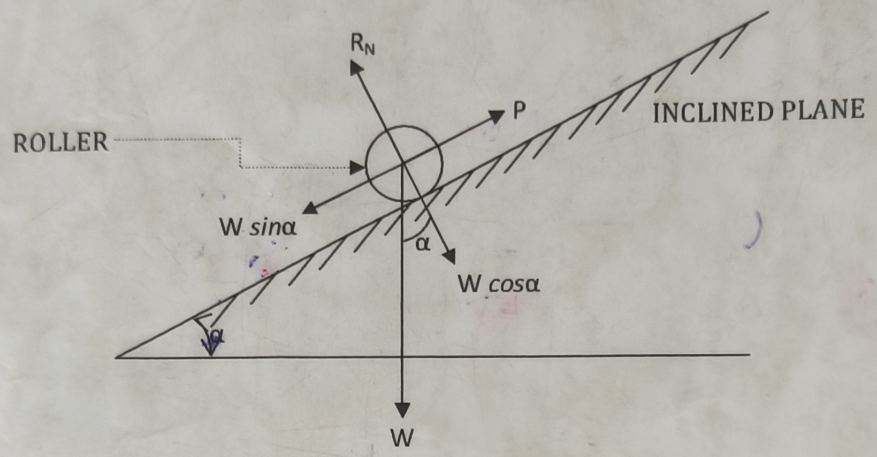
DISCUSSIONS:

EXPERIMENT NO. 2

OBJECT: To find the coefficient of rolling friction between any type of surface and a roller moving on an inclined plane

APPARATUS: An inclined plane carriage, roller, scale pan, slotted weights and weight box.

THEORY: In the limiting condition, considering the equilibrium of a roller (assuming the body of the roller is small so considering it as an element)



Thus applying the laws of static equilibrium-

$\sum F_{\text{normal to plane}} = 0 \quad \leftrightarrow \quad R_N = W\cos\alpha \qquad (1)$

$\sum F_{\text{parallel to plane}} = 0 \quad \leftrightarrow \quad \mu R_N = P - W\sin\alpha \qquad (2)$

With equations (1) and (2), we get

$$\mu = \frac{(P - W\sin\alpha)}{W\cos\alpha}$$

where α = angle of inclination

W = weight of roller

P = Wt. of scale pan+ Wt. in the scale pan.

OBSERVATIONS:

(1) Wt. of scale pan = 50 gms.
(2) Wt. of brass roller = 978 gms.

Combination = wood/brass

S No.	Effort (P)			Wt. of roller(W) (gm)	Coefficient of friction μ
	Wt. Of scale pan	Wt in scale pan	Total		

RESULT: The coefficient of rolling friction for the various combinations are

(1) Wood/ brass = ...

(2) Leather/ brass= .....

DISCUSSIONS: