

K J Somaiya College of Engineering (A Constituent College of Somaiya Vidyavihar University)

Batch : P4-1

Roll No. : 16010423076

Experiment No. : 5

Grade: AA / AB / BB / BC / CC / CD / DD

Signature of the Staff In-charge with date

Title - Friction

CO4: Analyze applications of equilibrium using free body diagram

Objective

To measure coefficient of friction of different surfaces

Theory

Friction is a force that is created whenever two surfaces move or try to move across each other.

- Friction always opposes the motion or attempted motion of one surface across another surface.
- Friction is dependent on the texture of both surfaces.
- Friction is also dependent on the amount of contact force pushing the two surfaces together

Static friction is friction between two or more solid objects that are not moving relative to each other. For example, static friction can prevent an object from sliding down a sloped surface. The coefficient of static friction, typically denoted as μ_s , is usually higher than the coefficient of kinetic friction.

AIM:

To find the coefficient of friction between two given surfaces and to find the load required to pull a body up on an inclined plane.

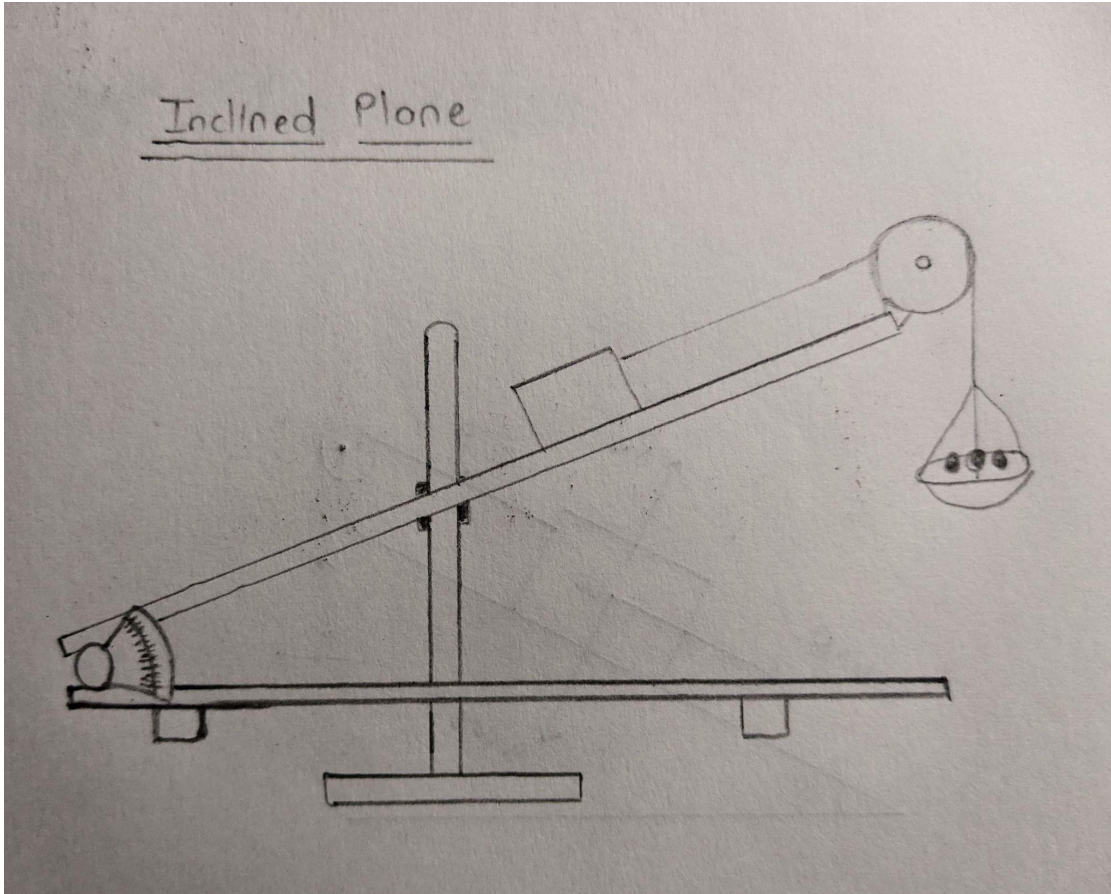
APPARATUS:

An inclined plane that can be set at different angles, bodies with different base materials and weights.

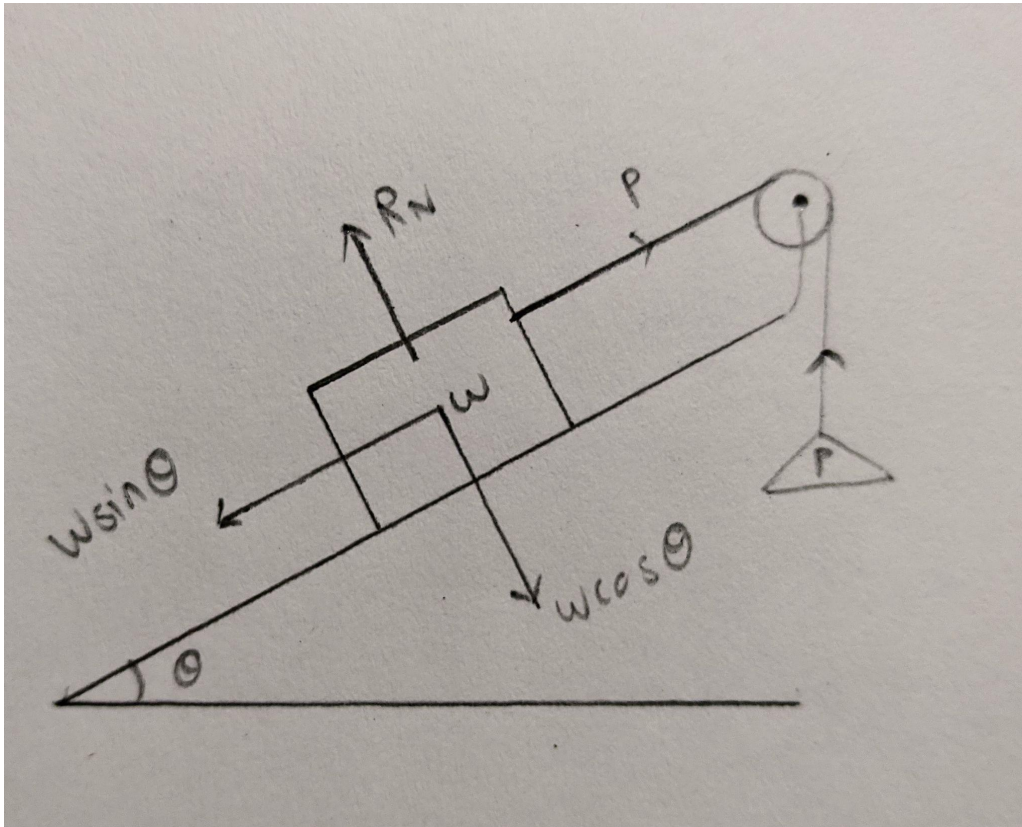
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Setup Diagram:



Free body diagram:



PROCEDURE:

Observation 1:

1. Keep the body on the inclined plane which is initially at the horizontal position. 2. Gradually increase the angle made by the inclined plane till the body just start sliding down.
3. Note the angle made by the inclined plane with horizontal which is angle of repose 4. Tangent of the angle of repose is the coefficient of friction between the two materials (body and the plane).

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Observation 2:

5. Set the inclined plane at any angle. Attach the string to the body whose weight is known. 6. Place the body on the inclined plane and pass the string over the pulley. 7. Load the free end of the string with the pan and the weights.

8. Add weights to the pan till the body is tending to move up. Note the load and compare it with the calculated value.

OBSERVATION TABLE 1

Materials	Angle of Repose (α)				Coefficient of friction (μ)
	1	2	3	Mean	
Ply and wood	16°	16°	16°	16°	0.286
Ply and Aluminium	16°	17°	17°	17°	0.305
Ply and Brass	18°	18°	17°	18°	0.324
Ply and sand Paper	12°	11°	12°	12°	0.212

OBSERVATION TABLE 2

Surfaces	Coefficient of friction	Weight (W)	Angle of plane (θ)	$P_{th} = W\sin\theta + \mu W\cos\theta$	P(expt.)
Ply and Wood	0.286	250g	25°	170.45g	175g
Ply and aluminium	0.305	167g	25°	116.7g	125g
Ply and brass	0.324	288.6g	25°	206.53g	220g
Ply and sand paper	0.212	250g	25°	153.68g	165g

Department of Mechanical Engineering

2023-2024

(Somaiya Vidyavihar University)

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CALCULATION:

To Find Coefficient of Friction(μ)

$$\mu = \tan(\alpha)$$

$$\tan(16^\circ) = 0.286$$

$$\tan(17^\circ) = 0.305$$

$$\tan(18^\circ) = 0.324$$

$$\tan(12^\circ) = 0.212$$

To find P_{th}

$$P_{th} = W \sin \theta + \mu W \cos \theta$$

$$250 \sin(25^\circ) + 0.286(250 \cos(25^\circ)) = 170.45 \text{ g}$$

$$167 \sin(25^\circ) + 0.305(167 \cos(25^\circ)) = 116.7 \text{ g}$$

$$288.6 \sin(25^\circ) + 0.324(288.6 \cos(25^\circ)) = 206.53 \text{ g}$$

$$250 \sin(25^\circ) + 0.212(250 \cos(25^\circ)) = 153.68 \text{ g}$$

RESULT

Coefficient of Friction for

1. Ply and wood = 0.286
2. Ply and aluminium = 0.305
3. Ply and brass = 0.324
4. Ply and sand paper = 0.212

Conclusion:

Therefore, we have analyzed applications of equilibrium using free body diagram by measuring coefficient of friction of different surfaces.