

**Course Code: ESC106A**

**Course Title: Construction Materials and Engineering  
Mechanics**

**Lecture No. 46:  
Block Friction and Related Problems**

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# Lecture Intended Learning Outcomes

**At the end of this lecture, students will be able to:**

- Define Block friction and understand block friction
- Draw Free Body diagrams of Blocks in the given problems
- Evaluate frictional forces or weight of the block or find tension in the string connecting the blocks by assuming impending state of the block

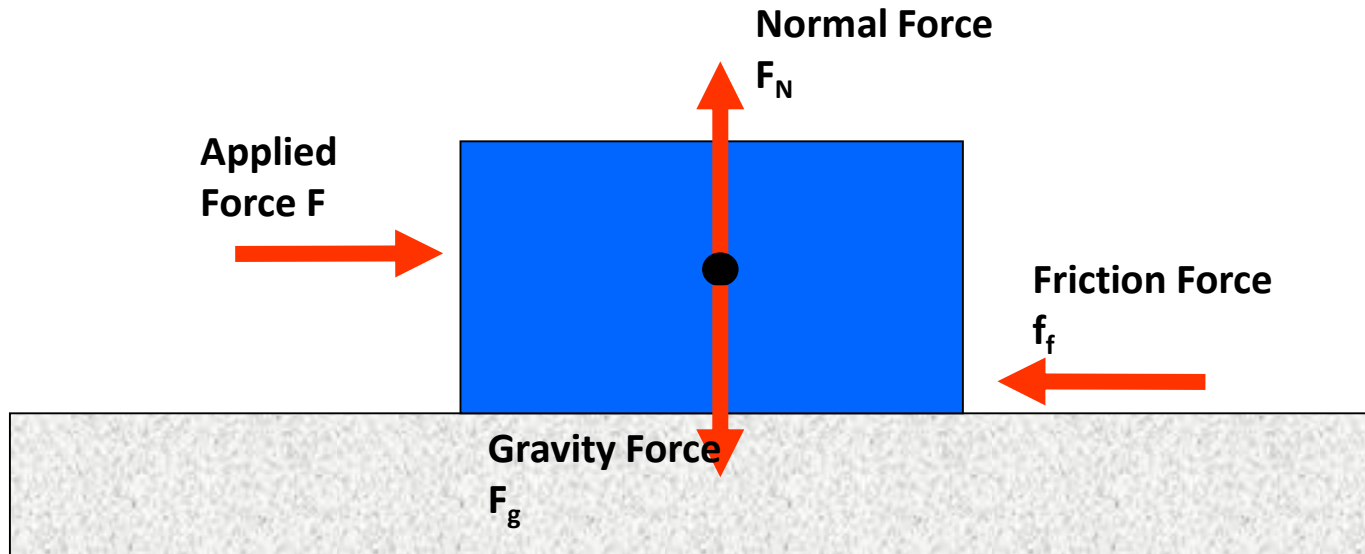


# Contents

- Mechanism of block friction
- Generating free body diagrams for blocks
- Numerical problems on block friction



# Block Friction



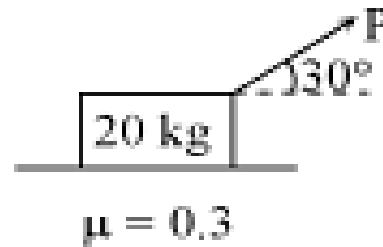
$$F_g = mg$$

$$F_N = F_g$$

$$f_f = F$$

# Block Friction: Problem 1

**Example:** Find the force  $P$  needed to just move the block of weight 20 kg to the right. Take  $\mu_s$  as 0.3

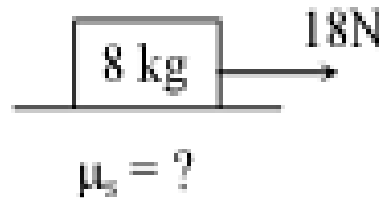


Ans:  $P=58.04\text{kN}$



## Block Friction: Problem 2

**Example:** A minimum horizontal force of 18N is required to move the 8 kg block to the right on a flat horizontal surface. Find the coefficient of friction between the block and the floor.



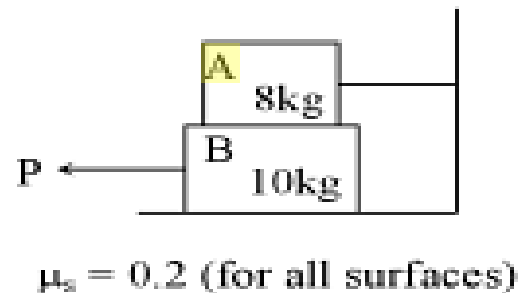
Ans:  $F_s = 18\text{N}$

$\mu_s = 0.229$



## Block Friction: Problem 3

**Example:** Find the magnitude of force  $P$  required to just move the block B having mass 10 kg. Block A having mass 8 kg is placed on block B and is restrained by a string connected to a rigid wall. Take coefficient of friction for all contact surfaces as 0.2.  $T$  is the tension in the string and  $N$  is the normal reaction between block B and the surface



Ans:  $T=15.69\text{N}$

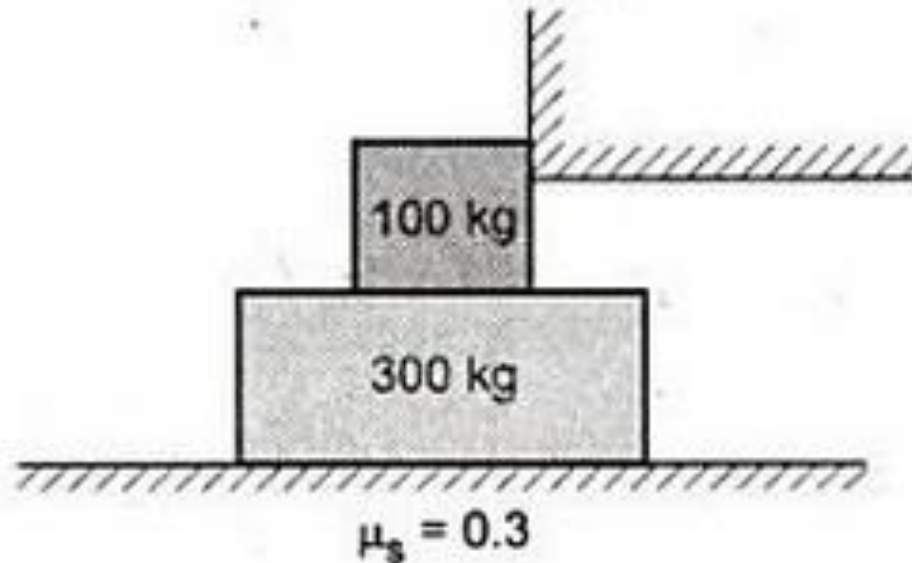
$N=176.58\text{N}$

$P=51.27\text{N}$



## Block Friction: Problem 4

**Example:** If coefficient of friction between all surfaces shown in figure is 0.30. What is the horizontal force required to get 300kg block moving to the right?

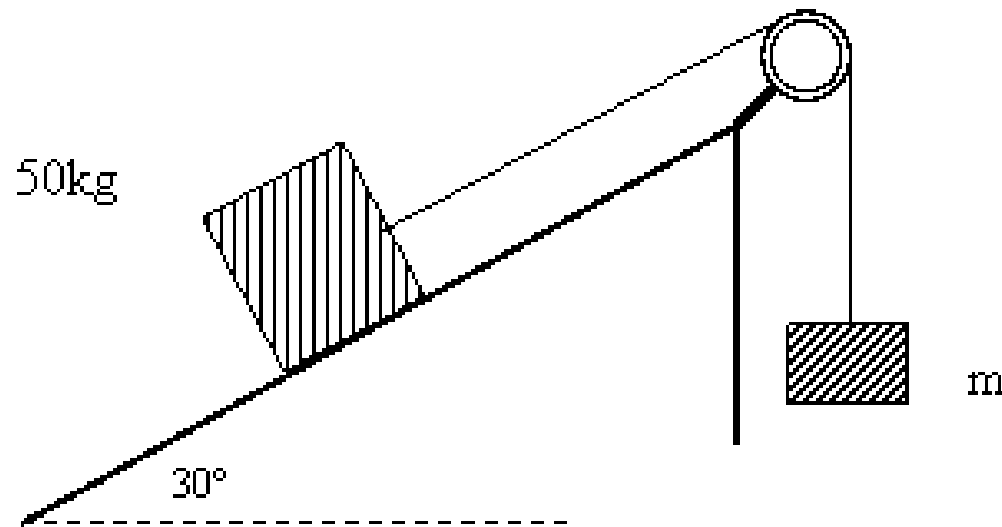


Ans:  $P = 1471.5 \text{ N}$



## Block Friction: Problem 5

**Example:** A  $50\text{kg}$  block is on an inclined plane of  $30^\circ$ . The coefficient of static friction between the block and the plane is  $0.3$ . We wish to determine the range of  $m$  under the block will be in equilibrium.



Ans:  $m_1 = 12\text{kg}$   
 $m_2 = 38\text{kg}$

# Summary

- Friction is the force resisting the relative motion of solid surfaces, fluid layers and material elements sliding against each other
- Based on the concept of friction the sliding problems are solved

