



Basic knowledge

STATIC AND KINETIC

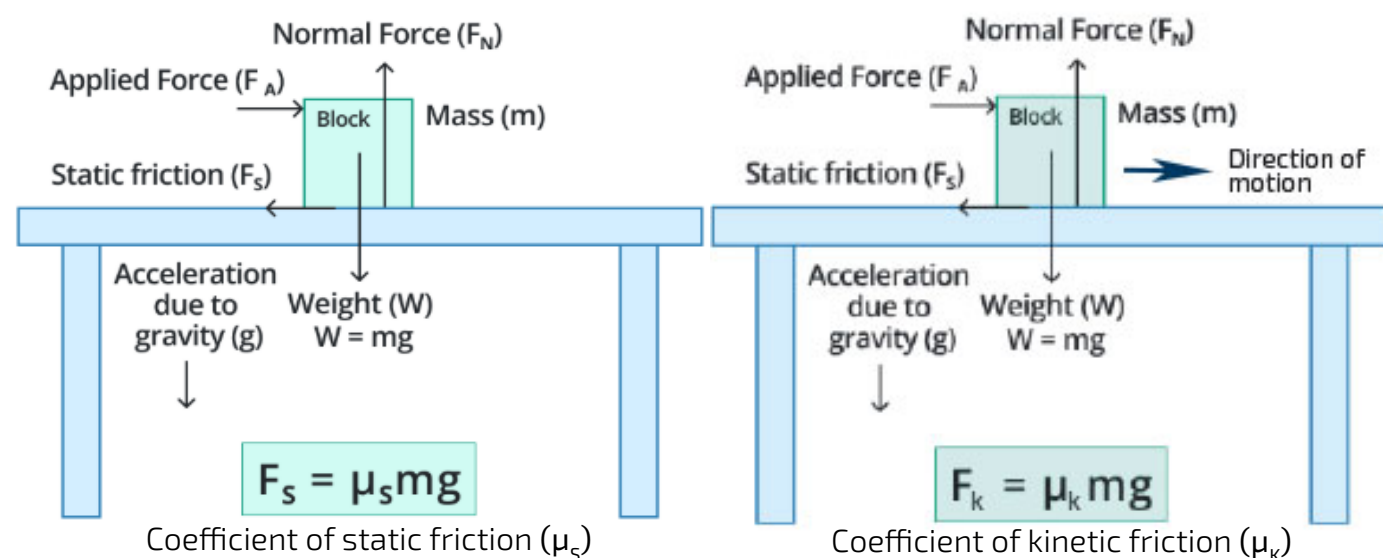
While in statics, we study idealised bodies excluding frictional forces, in the study of static and kinetic friction, we investigate real solid bodies. Friction occurs in all solid bodies that are in contact and that are moved against each other. The cause of the occurring forces is, among other things, the surface roughness, which causes the surfaces to interlock.



When we look at any object, we see a smooth surface, but when we examine the same object under a microscope, it becomes clear that even a seemingly smooth object has rough edges. Tiny hills and grooves are visible through a microscope, and these are called surface irregularities. Therefore, when one object moves over another, these irregularities on the surfaces become entangled, resulting in friction. The greater the roughness, the more irregularities there are, and the greater the force applied.

Static Friction

Kinetic Friction



Static friction is the frictional force on an object that is not moving. It opposes any change in the object's state that would cause it to move.

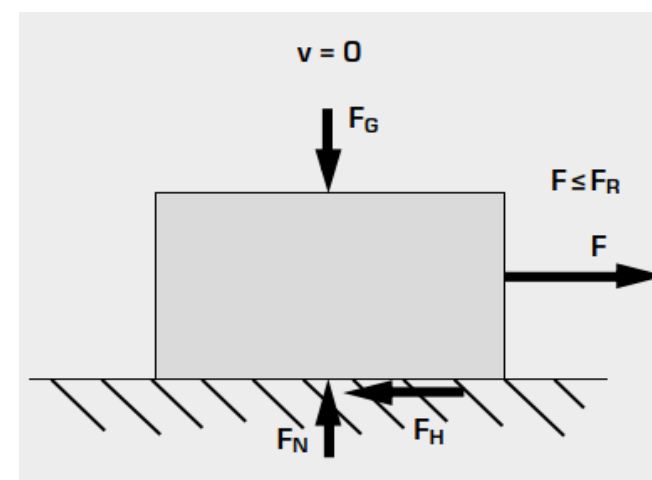
Static friction is present if displacing forces are acting on both bodies, but the bodies have not started to move relative to each other yet. This is why we also talk about static friction that has to be overcome if we want to move a body. Static friction is a reaction force; in statically determinate systems, it can be determined from the equilibrium conditions.

Kinetic friction is the friction between two surfaces that are moving or sliding relative to each other. It is the friction that exists between the contact surface of moving objects. Kinetic friction is also known as sliding friction or dynamic friction. When a body at rest is set in motion, the force of friction in action changes from static friction to kinetic friction.

Dynamic friction occurs when a body moves along another and in contact with it, i.e. it actually rubs against it. Dynamic friction increases with the roughnesses of the bodies' surfaces and the pressure applied between the bodies. The dynamic friction force is a physical force (active force) and proportional to the normal force F_N .

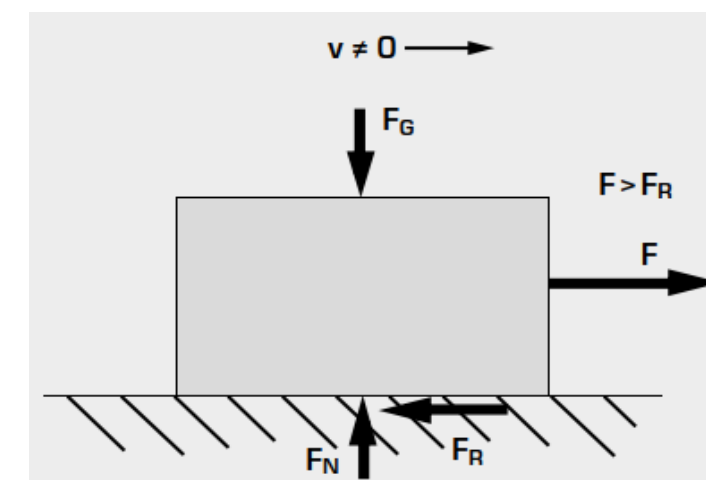
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The body adheres to its under-layer

F_G weight, F_H force of static friction, F_N normal force, F external force, v velocity



The body slides over its underlayer

F_G weight, F_R force of dynamic friction, F_N normal force, F external force, v velocity

$$F \leq F_{Hmax}$$

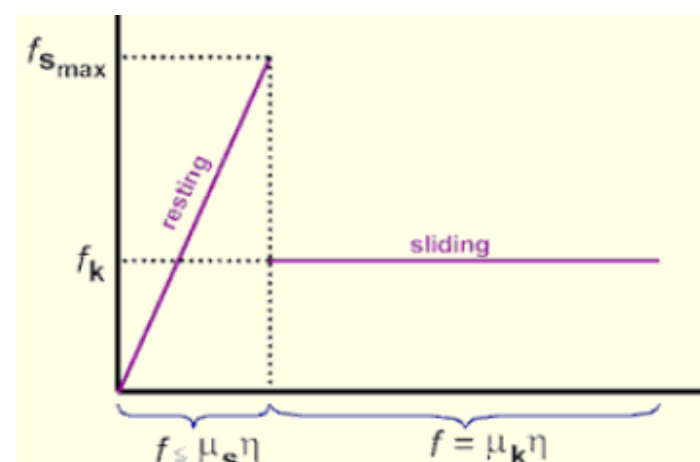
$$F_{Hmax} = \mu_s \cdot F_N$$

$$F > F_R$$

$$F_R = \mu_k \cdot F_N$$

F_{Hmax} maximum force of static friction, μ_s coefficient of static friction, F_N normal force, F external force

F_R force of dynamic friction, μ_k coefficient of dynamic friction, F_N normal force, F external force



When the applied force is equal to the maximum static friction, the object slips and begins to slide. When calculating friction: the coefficient of dynamic friction μ_k is generally smaller than the coefficient of static friction μ_s .

