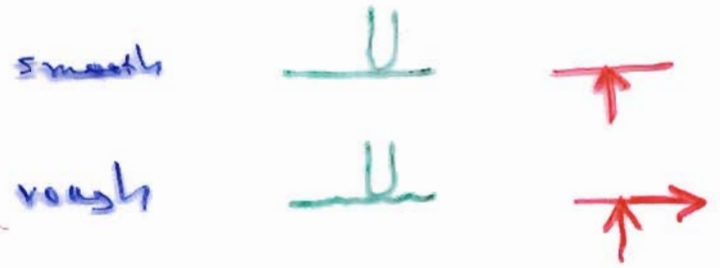
Friction

⊗ "smooth" surface
⊗ "rough" surface

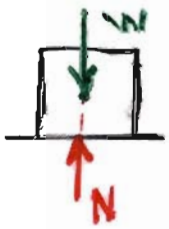


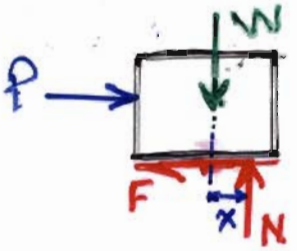
In real life, surfaces are not smooth (≡ frictionless), and they do not prevent the motion entirely either; they are rough to some extent.

⊗ Dry friction ⇐ between rigid bodies

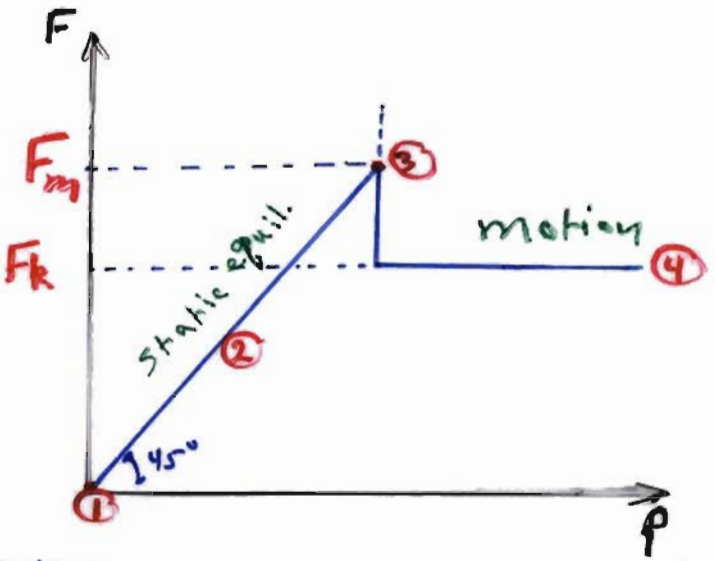
⊗ Fluid friction ⇐ between layers of fluid

Here, we discuss one type of dry friction.





F = static friction force
F_m = max. friction force
F_k = kinetic friction force



Experimentally, $F_m \propto N$

$\Rightarrow F_m = \mu_s N$

μ_s = coefficient of static friction

$F_k = \mu_k N$

μ_k = coefficient of kinetic friction

$\simeq 75\%$ of $\mu_s \Rightarrow F_k \simeq 0.75 F_m$

See Table 8-1 (p. 395) in the textbook for typical values of μ_s for different materials / surfaces.

4 situations are possible, as can be seen from the figure above:

① no friction

② friction force $< F_m$ $\quad [\![P < F_m]\!]$

③ impending motion : $F = F_m = \mu_s N = P$

④ motion : $P > F_k = \mu_k N$ ⇒ The equations of equilibrium no longer apply

$\mu_s = \tan\theta$

((Prove !!))

* Problems involving dry friction:

1) Checking equilibrium ($F < F_m$) ([Σ Forces]): sliding

2) Finding a force P (impending motion)

3) Finding μ_s (impending motion)

4) Checking tipping of the "rigid body".

* The friction force acts tangent to the contacting surfaces in a direction opposed to the relative motion or tendency for motion of one surface against another.

Remember:

* impending motion
* slipping (sliding)
* tipping
* relative motion