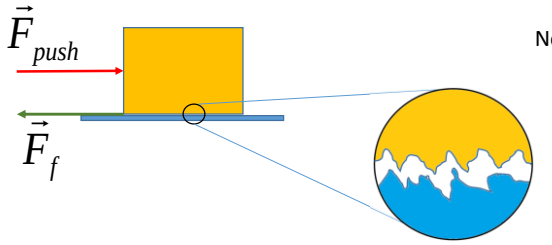
Friction



No movement: $F_{net} = 0$ $\quad F_{push} = F_f$

The force of the push can rise: as long as there is no movement: the frictional force rises the same amount.

$$F_f = \mu_s . F_n \qquad F_f \leq \mu_s . F_n$$

Static coefficient of friction

Movement: $F_f = \mu_k . F_n$

Kinetic coefficient of friction

Object accelerates: $F_{push} > F_f$

Object has constant speed: $F_{push} = F_f$

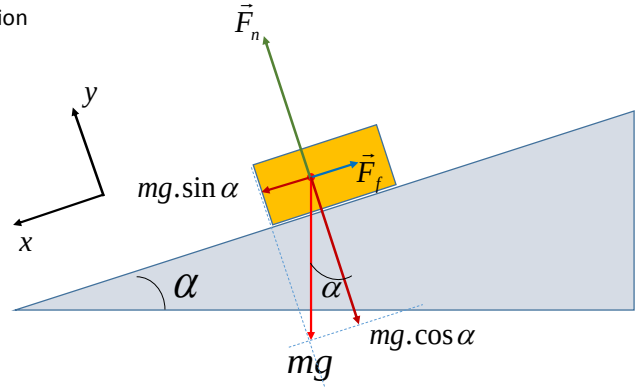
Friction

Experimental measurement of coefficient of friction

No movement:

$$\Sigma F_x = mg.\sin\alpha - F_f$$
$$\Sigma F_y = F_n - mg.\cos\alpha$$

$$mg.\sin\alpha = F_f$$
$$F_n = mg.\cos\alpha$$



$$mg.\sin\alpha = \mu.F_n \qquad mg.\sin\alpha = \mu.mg\cos\alpha$$

$$\frac{\sin\alpha}{\cos\alpha} = \mu$$

$$\tan\alpha = \mu$$

Friction

Example: An object with a 30,0 kg mass is on a surface inclined to the horizontal with an angle of 20,0°. The block would start sliding down, but when exerting a downward pushing force of 100 N as indicated on the drawing, The block is at the point of not sliding. Calculate the coefficient of friction.

$$\Sigma F_y = 0 = F_n - mg.\cos\alpha - F_{push}$$

$$F_n = mg.\cos\alpha + F_{push}$$

$$F_n = 30{,}0kg.9{,}81\frac{N}{kg}.\cos 20{,}0 + 100 = 377N$$

$$\Sigma F_x = 0 = mg.\sin\alpha - F_f$$

$$mg.\sin\alpha = F_f$$

$$F_f = 30{,}0kg.9{,}81\frac{N}{kg}.\sin 20{,}0 = 101N$$

$$F_f = \mu.F_n \qquad \mu = \frac{F_f}{F_n}$$

$$\mu = \frac{101N}{377N} = 0{,}268$$