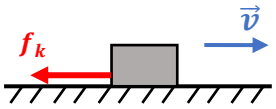
CONCEPT: STATIC FRICTION

- **Static Friction** is another type of friction similar to kinetic friction.

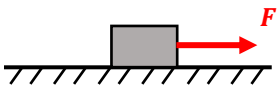
KINETIC FRICTION



- When $v \neq 0$
- Tries to *stop* objects already moving
- Direction: opposite of motion ($\vec{v}$)

$f_k = \mu_k N$

STATIC FRICTION

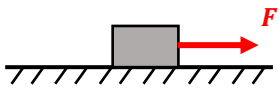


- When v ___ 0
- Tries to _____ an object from starting to move
- Direction: _____ to where the object *would* move without friction.

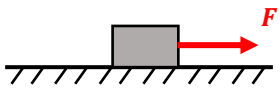
$f_{s,\_\_\_} =$ _____ *, μ_s = coeff. of *static* friction; μ_s always __ μ_k

EXAMPLE: A 5.1kg block is at rest on the floor. The coefficients of static & kinetic friction are 0.6 and 0.3, respectively. Determine the magnitude of the friction force on the block when you push it with a force of:

a) F = 20N

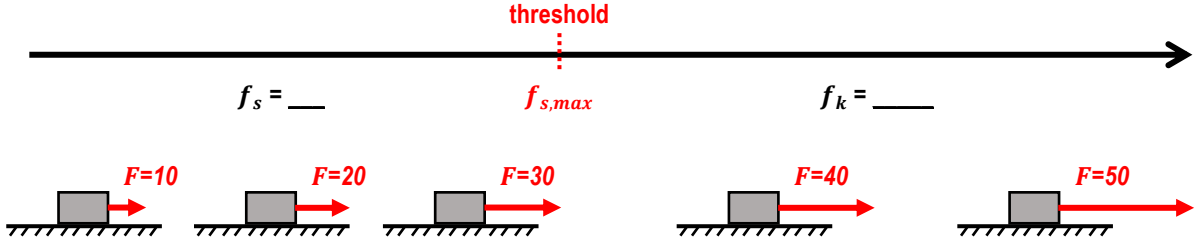


b) F = 40N



- $\mu_s N$ is a threshold: the force you must overcome to *get* an object moving, so $\mu_s N$ is the _____ value of f_s: $f_{s,\_\_\_}$ =_____
  - This is ***NOT*** always the actual friction acting on an object. To determine if f_s vs. f_k, compare **F** to $f_{s,max}$:

IS F STRONG ENOUGH TO GET OBJECT MOVING?		
	NO (F ___ $f_{s,max}$)	YES (F ___ $f_{s,max}$)
Object…	[STAYS AT REST | STARTS MOVING]	[STAYS AT REST | STARTS MOVING]
Friction is…	[STATIC (f_s) | KINETIC (f_k)]	[STATIC (f_s) | KINETIC (f_k)]



PROBLEM: A 5.1 kg block is at rest on the floor. The coefficients of static & kinetic friction are $\mu_s = 0.7$ and $\mu_k = 0.5$. Calculate the force needed to ***get the block moving***, and the force needed to ***keep*** it moving at ***constant speed.***

A) F = 0.014 N; F = 0.01 N
B) F = 3.57 N; F = 2.55 N
C) F = 35; F = 25
D) Impossible to tell

FRICTION
1) Draw FBD **2)** Determine if $\boldsymbol{f} = \boldsymbol{f_s}$ or $\boldsymbol{f_k}$ from text or: If ΣFs on axis of motion > $f_{s,max}$, $\boldsymbol{f} = \boldsymbol{f_k}$ **3)** Write $\boldsymbol{\Sigma F = ma}$ **4)** Solve

● Remember: $\boldsymbol{\mu_s \geq \mu_k}$! It's always harder to **[GET | KEEP]** something moving than it is to **[GET | KEEP]** it moving.

PROBLEM: A 15 kg block is initially at rest on a horizontal surface. The coefficient of static friction between the block and the surface is μ_s=0.7. How hard must you push *down* on the block to keep a 300 N horizontal force from moving it?

A) 147 N
B) 210 N
C) 282 N
D) 429 N

FRICTION
1) Draw FBD **2)** Determine if $\boldsymbol{f} = \boldsymbol{f_s}$ or $\boldsymbol{f_k}$ from text or: If ΣFs on axis of motion > $f_{s,max}$, $\boldsymbol{f} = \boldsymbol{f_k}$ **3)** Write $\boldsymbol{\Sigma F = ma}$ **4)** Solve

PROBLEM**:** A 36N force is needed to start a 7.0 kg box moving across the floor**.** If the 36.0 N force continues, the box accelerates at 0.70 m/s^2**.** What are the coefficients of static and kinetic friction?

A) μ_s=0.52 and μ_k=0.64
B) μ_s=0.64 and μ_k=0.64
C) μ_s=0.52 and μ_k=0.45
D) μ_s=0.45 and μ_k=0.32

FRICTION
1) Draw FBD **2)** Determine if $\boldsymbol{f} = \boldsymbol{f_s}$ or $\boldsymbol{f_k}$ from text or**:** If ΣFs on axis of motion > $f_{s,max}$, $\boldsymbol{f} = \boldsymbol{f_k}$ **3)** Write $\boldsymbol{\Sigma F = ma}$ **4)** Solve