CONCEPT: EQUILIBRIUM

- IF all the forces acting on an object _____, the object is at **EQUILIBRIUM:** _____ ⇔ _____
  - Equilibrium **DOESN'T** mean an object isn't *moving* ($\boldsymbol{v}$ **= 0**)! It means the object isn't ***accelerating*** ($\boldsymbol{a}$ = __)!

$$\Sigma F = ma$$

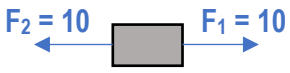
- In some problems, you'll know **ΣF=0**, which means _____

$$\Sigma F = ma$$

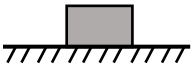
- In other problems, you'll know **a=0**, which means _____

EXAMPLE**:**

a) Two equal forces pull on a box moving at a constant 5m/s**.** Assuming the box has no weight, calculate the box's acceleration**.**



b) A 2kg book rests on a table and stays at rest**.** Assuming the book has weight, calculate the forces acting on the book**.**



FORCES
1) Draw FBD**:** W,F_A,T,N,f
2) Write $\boldsymbol{\Sigma F = ma}$
3) Solve

PROBLEM: A 3-kg box of junk is being lowered on a string at a constant speed. What is the tension in the string?

A) 0 N
B) 3 N
C) 29 N
D) 32 N

FORCES
1) Draw FBD: **W,F_A,T,N,f**
2) Write $\Sigma F = ma$
3) Solve

PROBLEM: A loudspeaker is held in place by four vertical cables. The tension in each cable is 30 N. What is the mass of the loudspeaker?

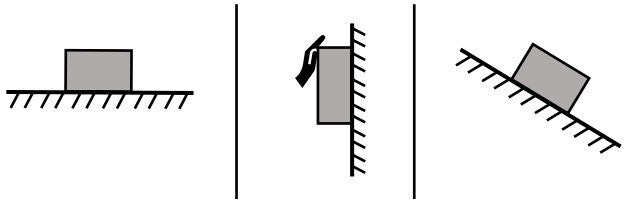
A) 3.06 kg
B) 12.2 kg
C) 30 kg
D) 120 kg

FORCES
1) Draw FBD: **W,F_A,T,N,f**
2) Write $\Sigma F = ma$
3) Solve

CONCEPT: THE NORMAL FORCE

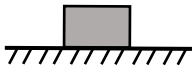
● IF anything is pushed against a surface in ANY direction, the surface pushes back with a force called _____ (___).

- **Normal** is always _____ **(**_____**)** to surface**.**
- **NO EQUATION** for $\vec{N}$! Always calculate $\vec{N}$ using **ΣF=ma.**



EXAMPLE**:**

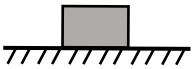
a) A 2.04kg book rests on a table**.** Calculate ***N*.**



- No other applied forces**:**

N **mg**

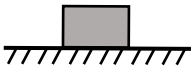
b) You push the book down with 10N**.** Calculate ***N*.**



- Push down (**F_y** along with **mg**)**:**

N **mg**

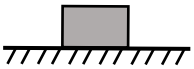
c) You pull the book up with 15N**.** Calculate ***N*.**



- Pull up, not enough to lift (**$|F_y|$** < |**mg**|)**:**

N **mg**

d) You pull up with 30N**.** Calculate the acceleration**.**



- Pull up, enough to lift (**$|F_y|$** ≥ |**mg**|)**:**

N