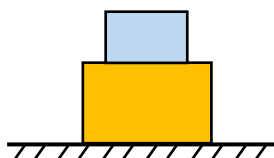


CONCEPT: STACKED BLOCKS

- When objects are stacked on top of each other, the force that causes the top objects to move is _____.
 - Unlike for previous problems, friction acts in the [**SAME** | **OPPOSITE**] direction as the direction of motion!
 - Friction is [**KINETIC** | **STATIC**] when the **relative velocity** between 2 surfaces is [**NOT ZERO** | **ZERO**].
 - Friction is [**KINETIC** | **STATIC**] when the **relative velocity** between 2 surfaces is [**NOT ZERO** | **ZERO**].

EXAMPLE: A 10kg box rests on a frictionless floor, with a 5kg box on top of it. The coefficients of friction **between the boxes** are $\mu_s = 0.7$ and $\mu_k = 0.3$. You pull the bottom box with a force **F**. What is the maximum acceleration the bottom box can have so that the 2 boxes remain moving together, i.e. the top box does not slide on the bottom box?



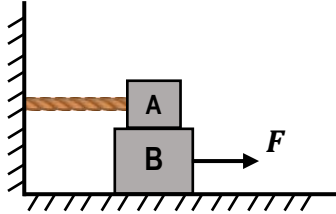
CONNECTED OBJECTS + FRICTION

- 1) Draw FBD for all obj's, choose direction of +
- 2) Determine if $f = f_s$ or f_k from text or:
If ΣF_s on axis of motion $> f_{s,max}$, $f = f_k$
- 3) Write $\Sigma F = ma$, start with simplest (fewest Fs)
- 4) Solve **a** (EQ Addition / Substitution)
- 5) Plug **a** into eq's, solve other targets if needed

- The friction *between* the stacked blocks always depends on the _____ between the blocks.

PROBLEM: A 5kg block **A** is placed on a 10kg block **B**. Block A is tied to a wall, while Block B is pulled with a Force of 45N and moves to the right. The coefficient of kinetic friction between all surfaces is $\mu_k = 0.2$. What is the Tension on Block A?

- A) 45 N
- B) 9.8 N
- C) 49 N
- D) 1.8 N



CONNECTED OBJECTS + FRICTION

- 1) Draw FBD for all obj's, choose direction of +
- 2) Determine if $f = f_s$ or f_k from text or:
If ΣF_s on axis of motion $> f_{s,max}$, $f = f_k$
- 3) Write $\Sigma F = ma$, start with simplest (fewest Fs)
- 4) Solve **a** (EQ Addition / Substitution)
- 5) Plug **a** into eq's, solve other targets if needed

PROBLEM: A 4kg block sits on top of a 6kg block which is on a frictionless surface. The coefficients of friction between the two blocks are $\mu_s=0.5$ and $\mu_k=0.3$. Calculate the maximum force you can pull on the bottom block with so that the objects move together.

- E) 49 N
- F) 19.6 N
- G) 3.27 N
- H) 4.9 N

CONNECTED OBJECTS + FRICTION

- 1) Draw FBD for all obj's, choose direction of +
- 2) Determine if $f = f_s$ or f_k from text or:
If ΣF_s on axis of motion $> f_{s,max}$, $f = f_k$
- 3) Write $\Sigma F = ma$, start with simplest (fewest Fs)
- 4) Solve **a** (EQ Addition / Substitution)
- 5) Plug **a** into eq's, solve other targets if needed