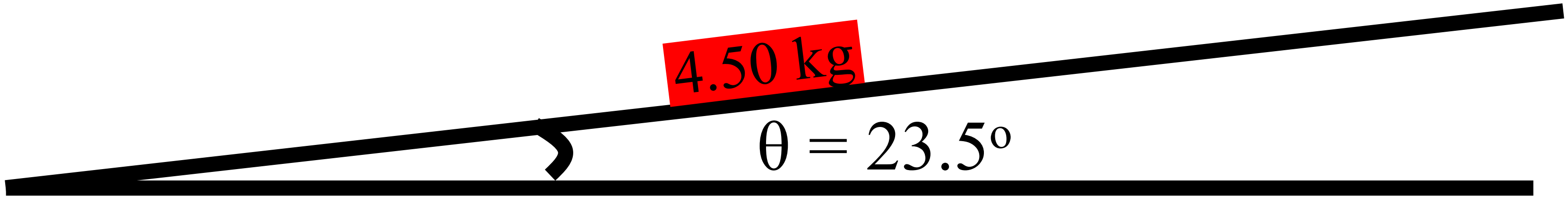


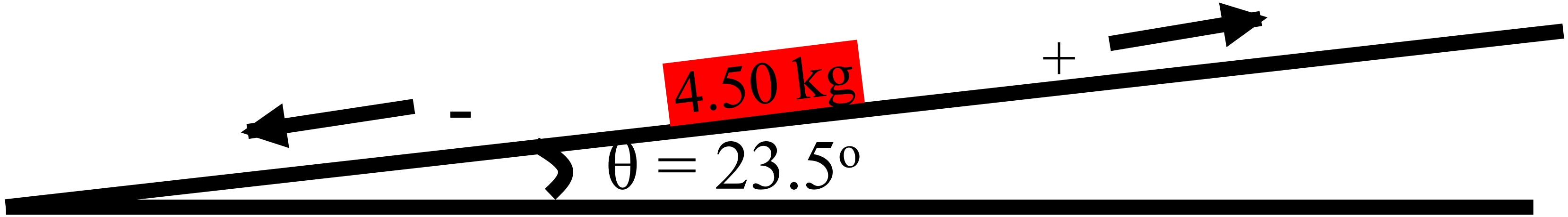

Find the component of gravity acting into the plane, and the component acting down along the plane:

$F_{perp}$ = **mg**cos( ) = (4.5 kg)(9.8 N/kg)cos(23.5°) = 40.44 N

$F_{||}$ = **mg**sin( ) = (4.5 kg)(9.8 N/kg)sin(23.5°) = 17.58 N

Note that this makes sense - mostly into the plane

40.4 N, 17.6 N




The plane is frictionless, so the component of gravity parallel to the plane is unopposed. What is the acceleration of the block down the plane?

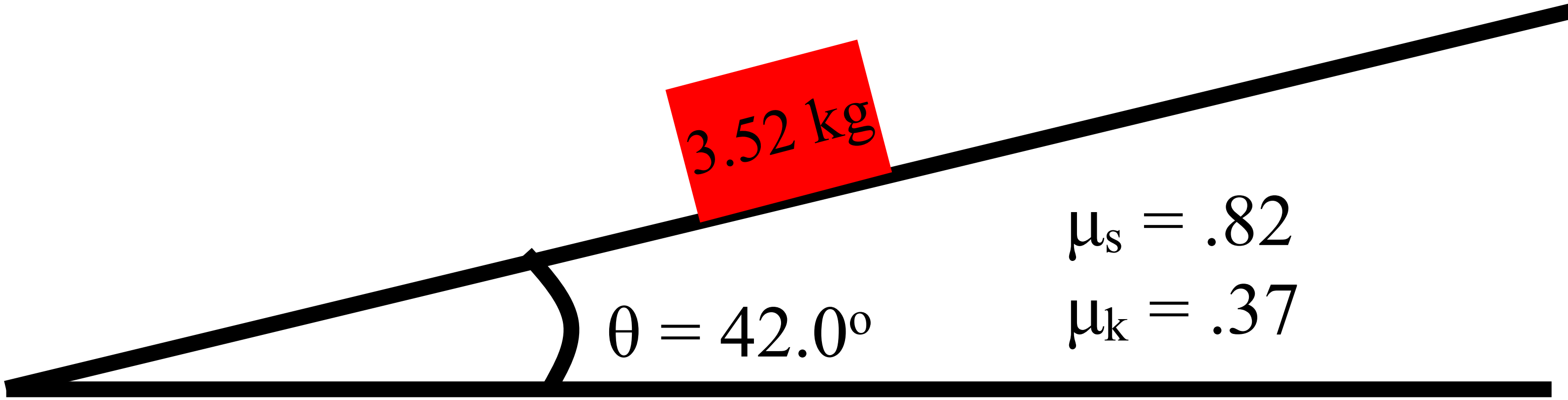
$F_{perp}$ = 40.44 N, $F_{||}$ = 17.58 N, F = ma,
<-17.58 N> = (4.50 kg)a
a = F/m = $F_{||}$/m = (-17.58 N)/(4.50 kg) = -3.91 m/s/s

-3.91 m/s/s

# Whiteboards:

## Inclines with friction

1 | 2 | 3 | 4 | 5




Find $F_{perp}$, $F_{||}$, the kinetic and maximum static friction:

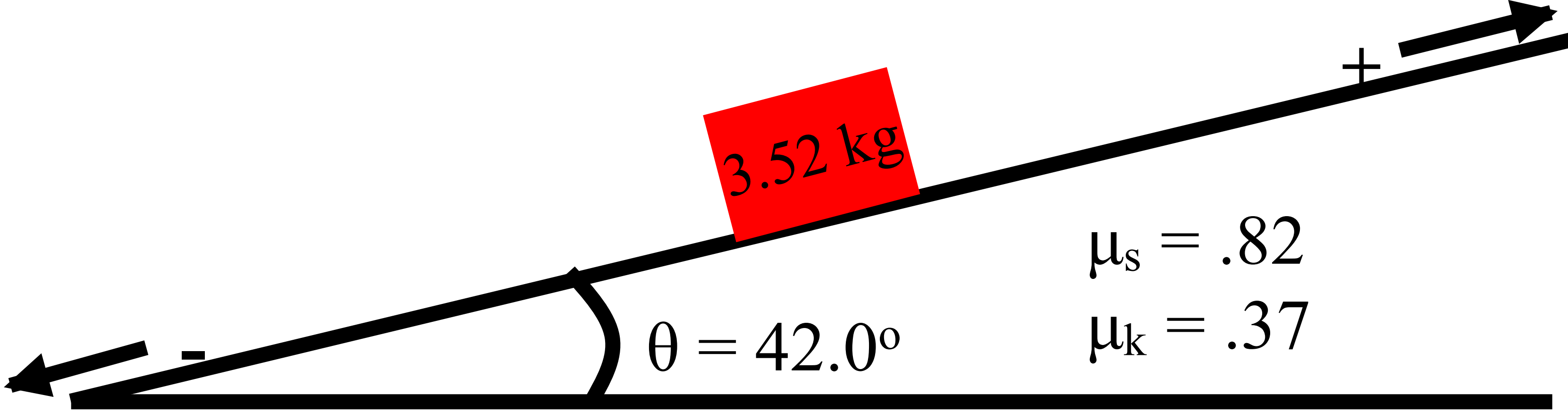
$F_{||} = \mathbf{mg}\sin(\ \ ) = (3.52\text{ kg})(9.8\text{ N/kg})\sin(42.0^o) = 23.08\text{ N}$

$F_{perp} = \mathbf{mg}\cos(\ \ ) = (3.52\text{ kg})(9.8\text{ N/kg})\cos(42.0^o) = 25.64\text{ N}$

$F_{Fr(kinetic)} = \ \ {}_kF_N = (.37)(25.64\text{ N}) = 9.49\text{ N}$

$F_{Fr(static)} \leq \ \ {}_sF_N = (.82)(25.64\text{ N}) = 21.02\text{ N}$

26 N, 23 N, 9.5 N, 21 N

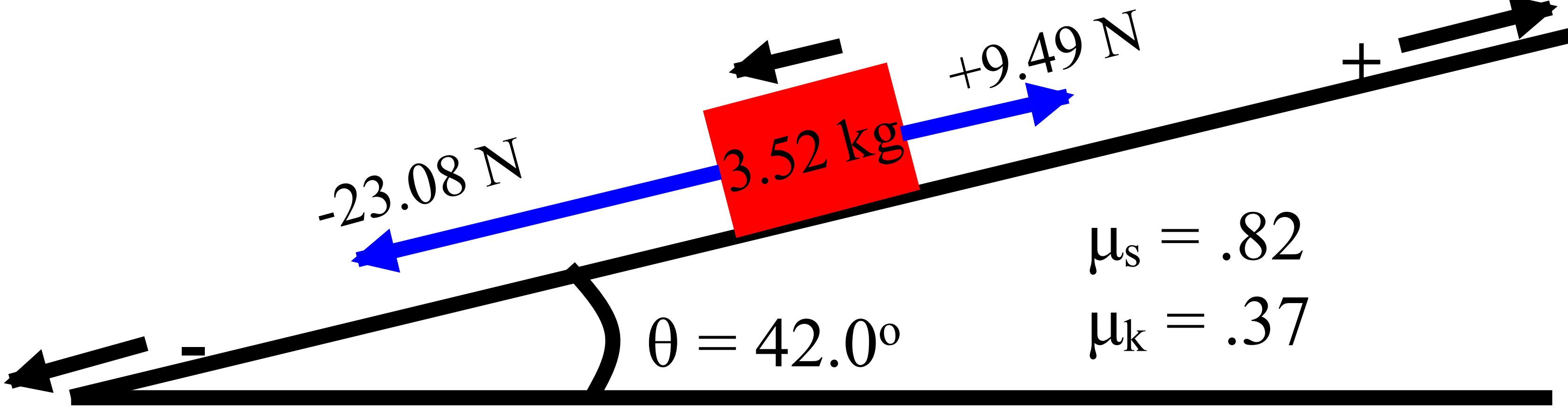



$F_{||} = 23.08$ N, $F_{Fr(kinetic)} = 9.49$ N, $F_{Fr(static)} \leq 21.02$ N

- Will it stay on the plane if u = 0?

- No, it will not stay. The maximum static ($F_{Fr(static)} \leq 21.02$ N) friction is smaller than the gravity parallel to the plane ($F_{||}$ =23.08 N)

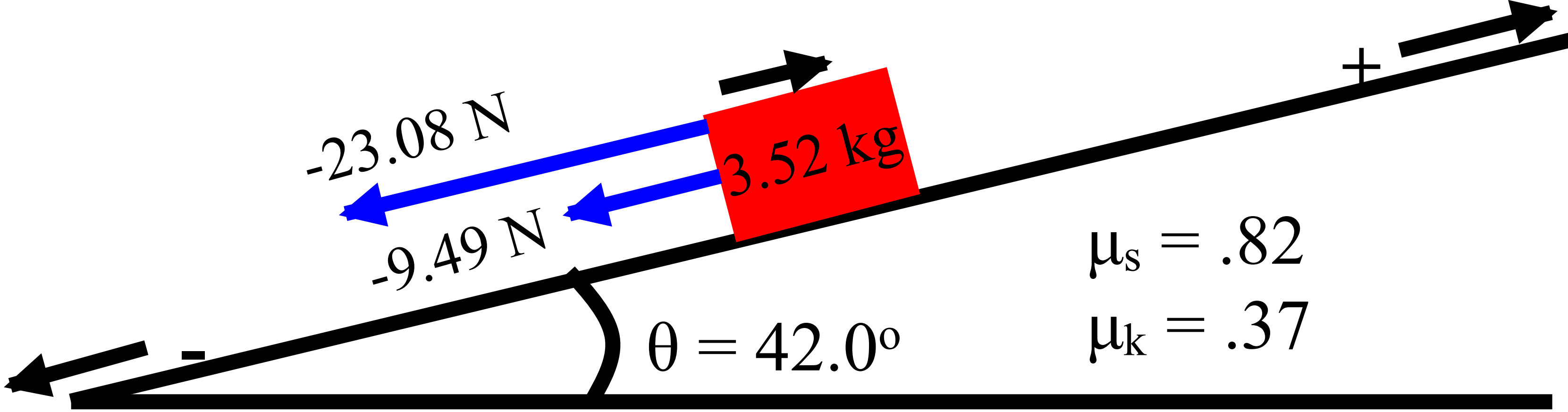
No, Blue




$F_{||} = 23.08$ N, $F_{Fr(kinetic)} = 9.49$ N, $F_{Fr(static)} \leq 21.02$ N

- What will be its acceleration down the plane if it is sliding down the plane?
- Down the plane is negative, so we have the parallel force down (-) the plane, and kinetic friction up (+) the plane:
- <-23.08 N + 9.49 N> = (3.52 kg)a, a = -3.86 m/s/s = -3.9 m/s/s

-3.9 m/s/s




$F_{||}$ = 23.08 N, $F_{Fr(kinetic)}$ = 9.49 N, $F_{Fr(static)} \leq$ 21.02 N

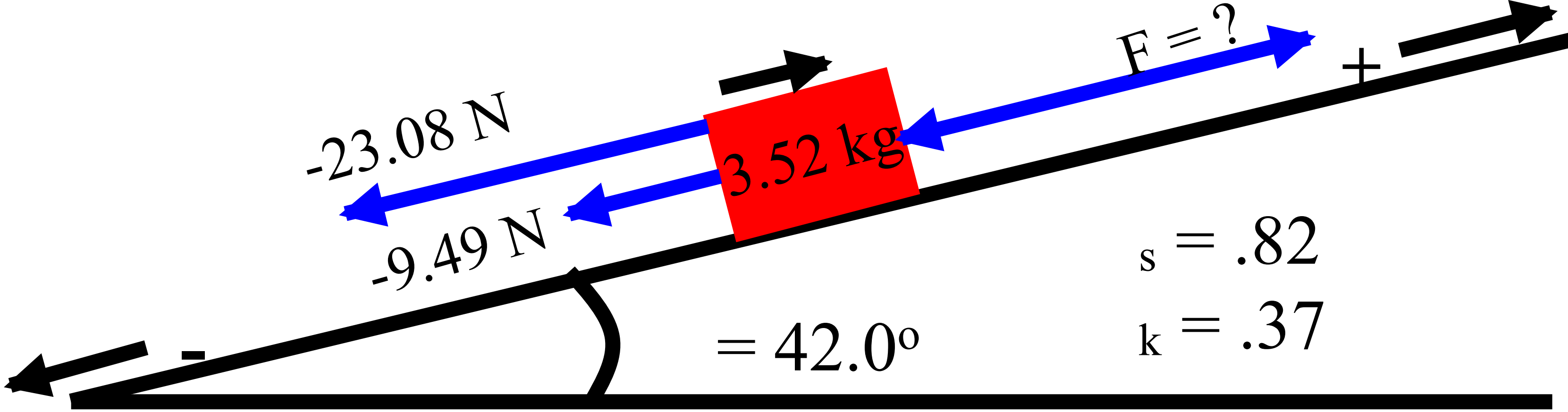
The block is given an initial velocity of 5.0 m/s up the plane. What is its acceleration as it slides up the plane? How far up does it go?

As it slides up the plane, the parallel force is down (-) the plane (always), and since the velocity is up the plane, the kinetic friction is now also down (-) the plane:

<-23.08 N - 9.49 N> = (3.52 kg)a, a = -9.25 m/s/s = -9.3 m/s/s

v = 0, u = 5.0 m/s, a = -9.25 m/s/s, $v^2=u^2+2as$, s = 1.35 m = 1.4 m

-9.3 m/s/s, 1.4 m



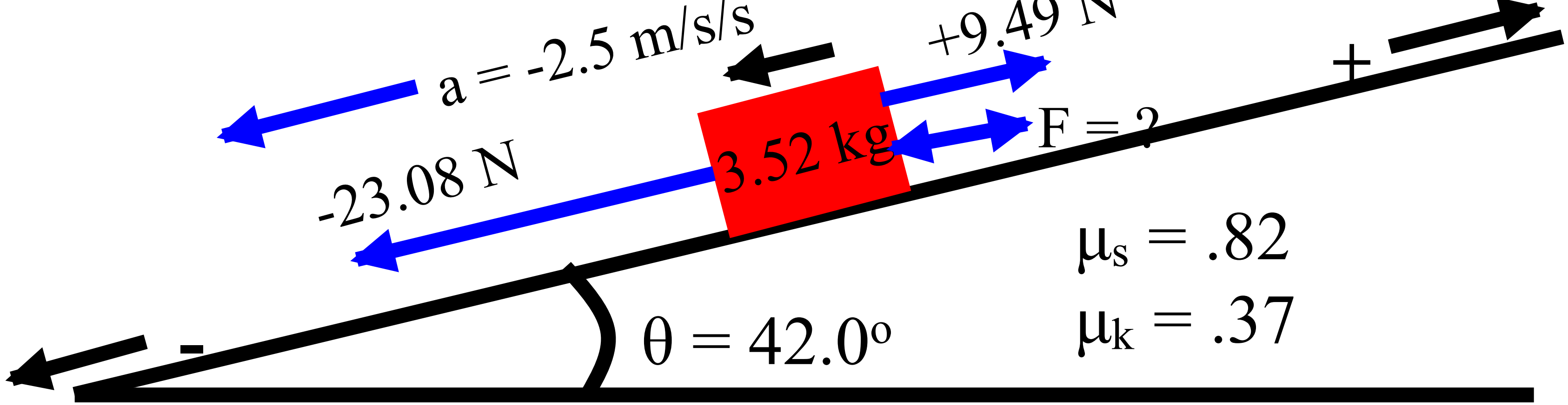

$F_{||}$ = 23.08 N, $F_{Fr(kinetic)}$ = 9.49 N, $F_{Fr(static)} \le$ 21.02 N

# What force in what direction will make it accelerate and slide up the plane at 6.7 m/s/s?

So now we have an unknown force F probably up the plane, and the parallel force as always down (-) the plane, and friction which is down (-) the plane, because the velocity is up the plane, as well as an acceleration that is up (+) the plane:

<-23.08 N - 9.49 N + F> = (3.52 kg)(+6.7 m/s/s), F = 56.15 N = 56 N

56 N




$F_{||}$ = 23.08 N, $F_{Fr(kinetic)}$ = 9.49 N, $F_{Fr(static)} \leq$ 21.02 N

# What force in what direction will make it accelerate and slide down the plane at 2.5 m/s/s?

So now we have an unknown force F , and the parallel force as always down (-) the plane, and friction which is up (+) the plane, because the velocity is down the plane, as well as an acceleration that is down (-) the plane:

$<-23.08 \text{ N} + 9.49 \text{ N} + F> = (3.52 \text{ kg})(-2.5 \text{ m/s/s})$,
$F = 4.797 \text{ N} = +4.8 \text{ N}$

4.8 N