Friction:

1) caused by the interaction of 2 + objects

2) opposite (opposes) motion

3) Types- Kinetic, static, sliding, rolling

4) size:
nature of surfaces
force pushing surfaces together

Nov 13-8:22 AM

frictional characteristic of the surfaces
"coefficient of friction"

$$F_f = \mu F_N$$

force of friction

Normal Force
force pushing surfaces together
⊥ to surface

Nov 14-7:49 AM

"μ" is the "coefficient of friction" and is the frictional property of the two surfaces in contact. Each pair of surfaces has its own unique value of μ. Note that μ is a ratio of forces, and therefore a pure number.

$$\mu = F_f / F_N$$

Nov 14-7:50 AM

You pull a 25.0 kg box across a floor at a consant velocity with a horizontal force of 125 N. What is μ?

Nov 14-8:12 AM

You pull a 25.0 kg box across a floor at a consant velocity with a horizontal force of 125 N. What is μ?

1) data?

Nov 14-8:08 AM

You pull a 25.0 kg box across a floor at a consant velocity with a horizontal force of 125 N. What is μ?

m_{box} = 25 kg
f_h = 125 N
v_c
μ?

With the question of Type Motion and Type force you have to consider planes parallel and perpendicular to motion.

2) Type motion?

3) Type force?

Nov 14-8:08 AM

You pull a 25.0 kg box across a floor at a consant velocity with a horizontal force of 125 N. What is μ?

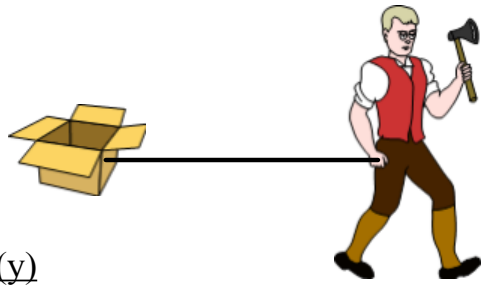
m_{box} = 25 kg
f_h = 125 N
v_c
μ?

horizontal (x)	vertical (y)
parallel	*perpendicular*
v_c ∴ 1st Law	rest
ΣF = 0	ΣF = 0

4) picture? (diagram)

Nov 14-8:08 AM

You pull a 25.0 kg box across a floor at a consant velocity with a horizontal force of 125 N. What is μ?



m_{box} = 25 kg
f_h = 125 N
v_c
μ?

horizontal (x)	vertical (y)
parallel	*perpendicular*
v_c ∴ 1st Law	rest
ΣF = 0	ΣF = 0

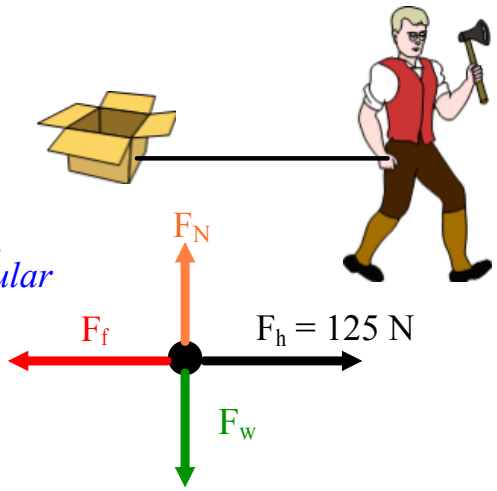
5) force diagram

Nov 14-8:09 AM

You pull a 25.0 kg box across a floor at a consant velocity with a horizontal force of 125 N. What is μ?

m_{box} = 25 kg
f_h = 125 N
v_c
μ?

horizontal (x)	vertical (y)
parallel	*perpendicular*
v_c ∴ 1st Law	rest
ΣF = 0	ΣF = 0



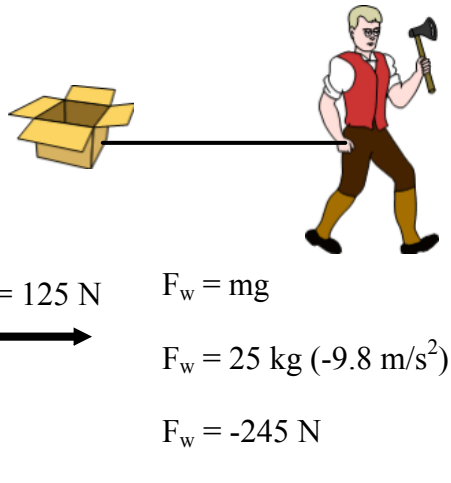
6) Determine any forces you don't know

Nov 14-8:09 AM

You pull a 25.0 kg box across a floor at a consant velocity with a horizontal force of 125 N. What is μ?

m_{box} = 25 kg
f_h = 125 N
v_c
μ?

horizontal (x)	vertical (y)
parallel	*perpendicular*
v_c ∴ 1st Law	rest
ΣF = 0	ΣF = 0



horizontal (x)	vertical (y)
ΣF = 0	ΣF = 0
$F_f + F_h = 0$	$F_w + F_N = 0$
$F_f = -F_h$	$F_N = -F_w$
$F_f = -(125\ N)$	$F_N = -(mg)$
	$F_N = -(-245\ N)$
$F_f = -125\ N$	$F_N = (245\ N)$

$F_w = mg$

$F_w = 25\ kg\ (-9.8\ m/s^2)$

$F_w = -245\ N$

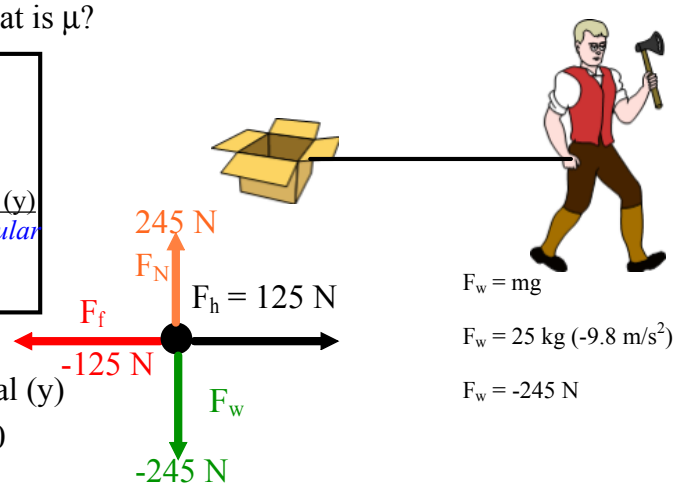
7) Find unknown

Nov 14-7:55 AM

You pull a 25.0 kg box across a floor at a consant velocity with a horizontal force of 125 N. What is μ?

m_{box} = 25 kg
f_h = 125 N
v_c
μ?

horizontal (x)	vertical (y)
parallel	*perpendicular*
v_c ∴ 1st Law	rest
ΣF = 0	ΣF = 0



F_w = mg

F_w = 25 kg (-9.8 m/s^2)

F_w = -245 N

horizontal (x)

ΣF = 0

$F_f + F_h = 0$

$F_f = -F_h$

$F_f = -(125\ N)$

$F_f = -125$ N

vertical (y)

ΣF = 0

$F_w + F_N = 0$

$F_N = -F_w$

$F_N = -(mg)$
$F_N = -(-245\ N)$
$F_N = (245\ N)$

$\mu = F_f/F_N$

$\mu = -125\ N/245\ N$

$\mu = 0.510$

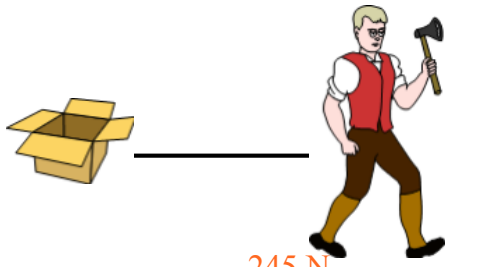
Nov 14-7:55 AM

You pull a 25.0 kg box across a waxed floor with an acceleration of 2.50 m/s^2 with a horizontal force of 125 N. What is μ?

Nov 14-8:24 AM

You pull a 25.0 kg box across a waxed floor with an acceleration of 2.50 m/s^2 with a horizontal force of 125 N. What is μ?

m_{box} = 25 kg
f_h = 125 N
a = 2.50 m/s^2
μ?



horizontal
a ∴ 2nd Law
ΣF = ma

$F_f + F_h = ma$

$F_f = ma - F_h$

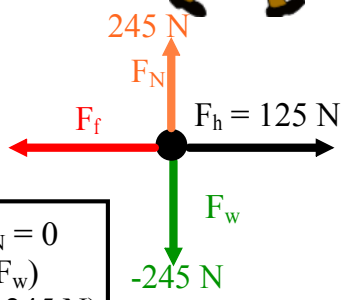
$F_f = 25.0\ kg(2.50\ m/s^2) - (125\ N)$

$F_f = 62.5\ N - (125\ N)$

$F_f = -62.5\ N$

vertical
rest
ΣF = 0

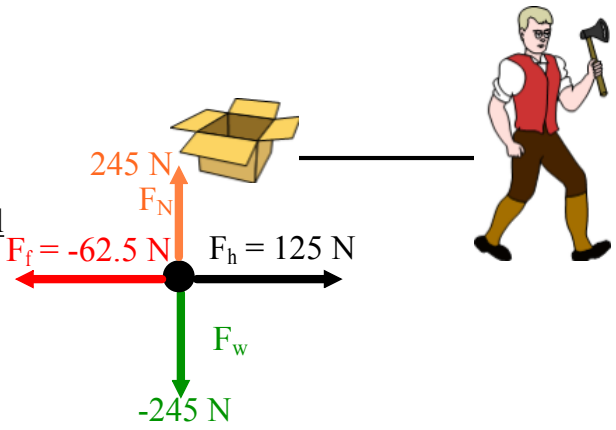
$F_w + F_N = 0$
$F_N = -(F_w)$
$F_N = -(-245\ N)$
$F_N = 245\ N$



Nov 14-8:25 AM

You pull a 25.0 kg box across a waxed floor with an acceleration of 2.50 m/s^2 with a horizontal force of 125 N. What is μ?

m_{box} = 25 kg
f_h = 125 N
a = 2.50 m/s^2
μ?



horizontal
a ∴ 2nd Law
ΣF = ma

vertical
rest
ΣF = 0

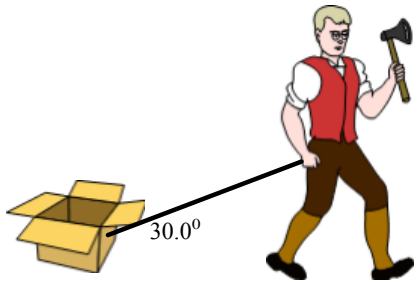
$\mu = F_f/F_N$

$\mu = -62.5\ N/245\ N$

$\mu = 0.255$

Nov 14-8:25 AM

You pull a 25.0 kg box across a floor at a consant velocity with a force of 125 N directed 30.0^0 above the horizontal. What is μ?

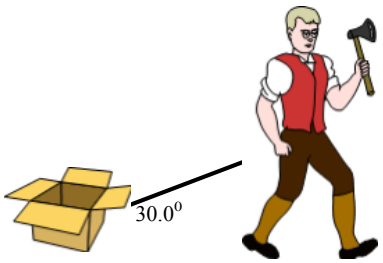


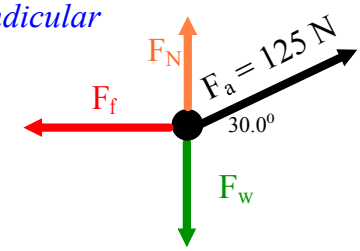
Nov 14-10:08 AM

You pull a 25.0 kg box across a floor at a consant velocity with a force of 125 N directed 30.0^0 above the horizontal. What is μ?

m_{box} = 25 kg
f_a= 125 N at 30.0^0
v_c
μ?

horizontal	vertical
parallel	*perpendicular*
v_c ∴ 1st Law	rest
ΣF = 0	ΣF = 0





F_a isn't parallel or perpendicular to motion, it's both, so break it down into its parallel and perpendicular components.

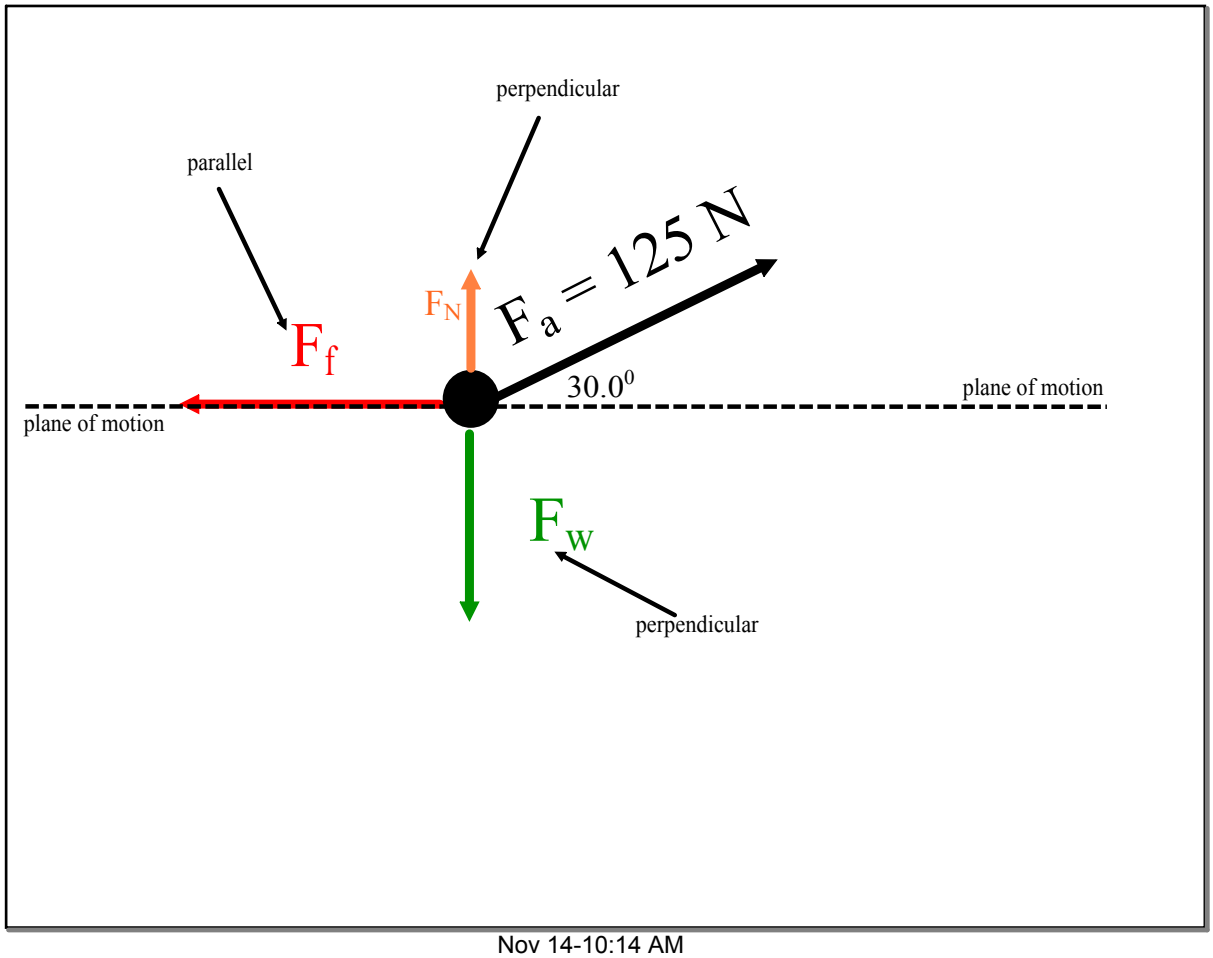
parallel to motion

$\mu = F_f/F_N$

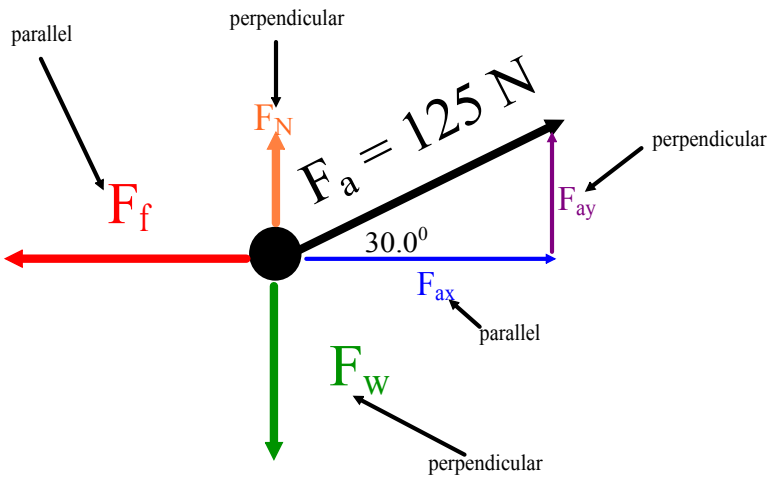
perpendicular to motion

break down (resolve) all forces into their parallel and perpendicular components!!!!!

Nov 14-10:06 AM



Nov 14-10:14 AM



F_{ay} = sin. 30^0 (125 N) = + 62.5 N

F_{ax} = cos. 30^0 (125 N) = +108 N

Now that you've broken the angled 125 N force into its "x" and "y" (horizontal and vertical) components you don't use it (the 125 N force), you just use its components!!!

Nov 14-10:16 AM

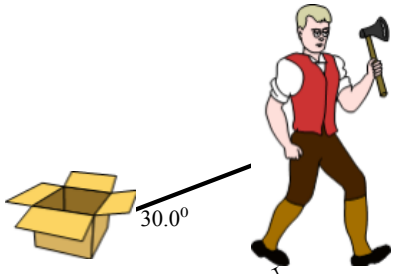
You pull a 25.0 kg box across a floor at a consant velocity with a force of 125 N directed 30.0^0 above the horizontal. What is μ?

m_{box} = 25 kg
f_a= 125 N at 30.0^0
v_c
μ?

$F_w = mg$

$F_w = 25\ kg\ (-9.8\ m/s^2)$

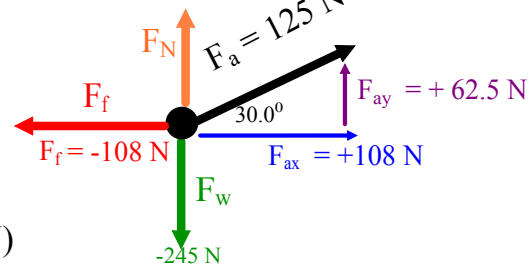
$F_w = -245\ N$



horizontal	vertical
parallel	*perpendicular*
v_c ∴ 1st Law	rest
ΣF = 0	ΣF = 0

ΣF = 0
$F_f + F_{ax} = 0$
$F_f = -F_{ax}$
$F_f = -(108N)$
$F_f = -108\ N$

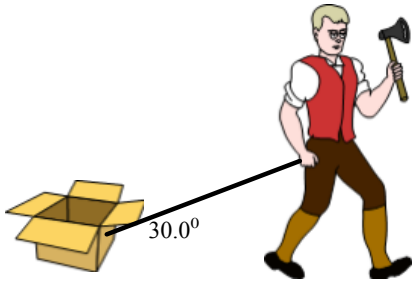
ΣF = 0
$F_w + F_N + F_{ay} = 0$
$F_N = -F_w - F_{ay}$
$F_N = -(-245\ N) - (62.5N)$
$F_N = 182.5\ N$



$\mu = F_f/F_N$
$\mu = -108\ N/182.5\ N$
$\mu = 0.592$

Nov 14-10:06 AM

You pull a 25.0 kg box across a waxed floor with an acceleration of 2.00 m/s^2 with a force of 125 N directed 30.0^0 above the horizontal. What is μ?



Nov 14-10:08 AM

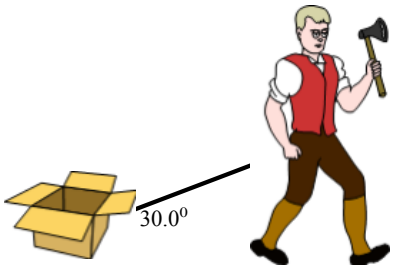
You pull a 25.0 kg box across a waxed floor with an acceleration of 2.00 m/s^2 with a force of 125 N directed 30.0^0 above the horizontal. What is μ?

m_{box} = 25 kg
f_a= 125 N at 30.0^0
acceleration
μ?

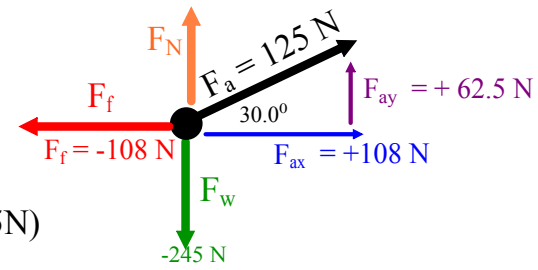
$F_w = mg$

F_w = 25 kg (-9.8 m/s^2)

F_w = -245 N



horizontal	vertical
parallel	*perpendicular*
a ∴ 2nd Law	rest
ΣF = ma	ΣF = 0
	ΣF = 0
	$F_w + F_N + F_{ay} = 0$
$F_f + F_{ax} = ma$	$F_N = -F_w - F_{ay}$
$F_f = ma - F_{ax}$	$F_N = -(-245\ N) - (62.5N)$
	$F_N = 182.5\ N$



$F_f = 25.0\ kg(2.00\ m/s^2) - (108N)$
$F_f = -58\ N$

$\mu = F_f/F_N$
$\mu = -58\ N/182.5\ N$
$\mu = 0.32$

Nov 14-10:06 AM