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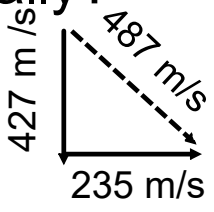
v_j = 525 mph
↳ 235 m/s

d_y = 30,500 ft
↳ 9300 m

m = 66.0 kg

$v_y = \sqrt{2g(9300\text{ m})} = 427$ m /s

really?



p = m*v* = 66.0 kg(487 m/s)

p = 32,200 kg m/s

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A jet is flying at 525 mph at 30,500 ft. and, oh no, Joe falls out. What momentum does Joe strike the ground if he has a mass of 66.0 kg? But wait, it is Joe's lucky day, terminal velocity for a human is a mere 120 mph. Does Joe survive?

v_j = 525 mph
↳ 235 m/s

d_y = 30,500 ft
↳ 9300 m

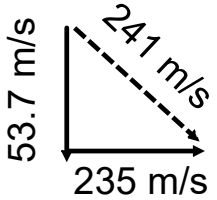
m = 66.0 kg

v_y = 120 mph
53.7 m/s

v_y =

p = mv = 66.0 kg(241 m/s)

p = 15,900 kg m/s



What impulse does an apple give a 45 g bullet traveling at 424 m/s if it slows it to 380 m/s as hits and exits the unfortunate apple? The apple doesn't move upon impact!

Ft =?
F = ?
dia. = 11.0 cm

What impulse does an apple give a 45 g bullet traveling at 424 m/s if it slows it to 380 m/s as hits and exits the unfortunate apple? The apple doesn't move upon impact!

m_b = 45 g
v1 = 424 m/s
v2 = 380 m/s
Ft_{a-b} = ?
dia. of apple is 11.0 cm (big apple)
F = ? --- need t9o find time! d,v,t

$Ft_{a-b} = \Delta m v_a$

$Ft = mv_a' - mv_a$

$Ft = m(v_a' - v_a)$

$Ft = .045\ kg(380\ m/s - 424\ m/s)$

$Ft = -1.98\ N\text{-}s$

$Ft_{a-b} = \Delta m v_a$

$Ft = -1.98\ N\text{-}s$

$F = \frac{-1.98\ kg\ m/s}{.00027\ s}$

$F = 7200\ N$

$d = v_{ave}t$

$t = d/v_{ave}$

$t = .11\ m/402\ m/s$

$t = .00027\ s$

What impulse does an apple give a 45 g bullet traveling at 424 m/s if it slows it to 380 m/s as hits and exits the unfortunate apple? The apple doesn't move upon impact!

m = 45 g
v1 = 424 m/s
v2 = 380 m/s
Ft = ?
dia. of apple is 11.0 cm (big apple)
F = ?

$Ft = \Delta mv$

$Ft = .045kg(380 m/s - 424 m/s)$

$Ft = -1.98 kg\,m/s$

$d = \bar{v}t$

$t = \frac{d}{\bar{v}} = \frac{.11\,m}{\left(\frac{424 m/s + 380 m/s}{2}\right)}$

$t = .00027 s$

$F = \frac{mv_f - mv_i}{\Delta t}$

$Ft = mv$

$F = mv/t = \frac{1.98 kg\,m/s}{.00027 s}$

$F = 7300 N$

What impulse is applied to a 325 g ball thrown at 91 mph if it is hit and flies out at 105 mph? What average force is applied to the ball as it is thrown if the pitcher's wind-up and pitch is 2.1 m? (2 ways to find force?)

What impulse is applied to a 325 g ball thrown at 91 mph if it is hit and flies out at 105 mph? What average force is applied to the ball as it is thrown if the pitcher's wind-up and pitch is 2.1 m?

91 miles/hr(1hr/3600 s)(1610 m/mile) = 41 m/s

-105 miles/hr(1hr/3600 s)(1610 m/mile) = -47 m/s

$Ft = mv = m(v_2 - v_1)$

$Ft = .325\ kg[-47\ m/s - (41\ m/s)] = -28.6\ kg\ m/s$

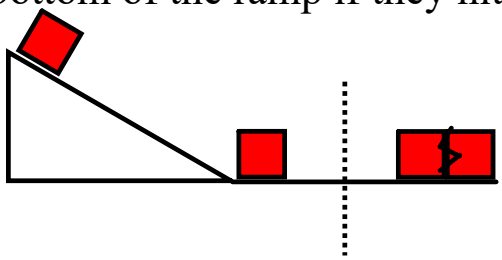
$t = d/\bar{v} = 2.1\ m\ /(20.5\ m/s) = .102\ s$

$Ft = mv \qquad F = mv/t = .325\ kg(41\ m/s)/.102\ s = 131\ N$

$a = v^2/2d = (41\ m/s)^2/[2(2.1\ m)] = 400\ m/s^2$

or, $F = ma = .325\ kg(400\ m/s^2) = 130\ N$

A 13.5 kg box slides down a 22.0^0 ramp that is 2.55 m long. What is the speed of the box at the bottom of the ramp if μ is .330? What velocity does it give an identical box at the bottom of the ramp if they hit and stick together?



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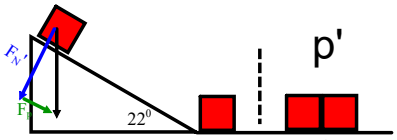


m = 13.5 kg
F_w = 132 N

d = 2.55 m
θ = 22.0^0
μ = .330

F_N' = Cos22(132 N) = 122 N
F_p = Sin 22(132 N) = 49 N

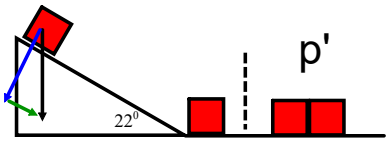
$\mu = F_F/F_N$ $F_F = \mu F_N$ = .33(122 N) = -40. N

$\Sigma F = F_F + F_p = ma$
$a = F_F + F_p/m$
a = (-40. N + 49 N) /13.5 kg = .667 m/s²
$v_2 = \sqrt{2(.667\ m/s^2)2.55\ m}$ = 1.84 m/s

$\rho = \rho'$
$mv_a + mv_b = mv_a' + mv_b'$
$mv_a = (m_a + m_b)v'$
$mv_a/(m_a + m_b) = v'$

v' = (13.5 kg x 1.84 m/s)/(13.5 kg + 13.5 kg)
v' = .92 m/s

A 13.5 kg box slides down a 22.0^0 ramp that is 2.55 long. What is the speed of the box at the bottom of the ramp if μ is .330? What velocity does it give an identical box at the bottom of the ramp if they hit and stick together? **What is μ of the horizontal surface if the two blocks slide 2.30 m after contact?**



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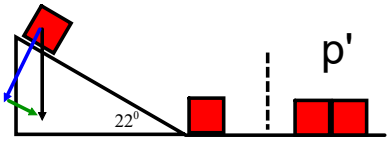

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$a = (-40.\ N + 49\ N)\ /13.5\ kg = .667\ m/s^2$
$v_2 = \sqrt{2(.667\ m/s^2)2.55\ m} = 1.84\ m/s$

$a = v^2/2d$
$a = (.92\ m/s)^2/(2 \times 2.30m)$
$a = .184\ m/s^2$

$\mu = F_f/F_N = ma/mg = a/g$
$\mu = 0.184\ m/s^2/9.81\ m/s^2$
$\mu = .0187$

$\rho = \rho'$
$mv_a + mv_b = mv_a' + mv_b'$
$mv_a = (m_a + m_{b)}v'$
$mv_{a/}(m_a + m_b) = v'$
v' = (13.5 kg x 1.84 m/s)/(13.5 kg + 13.5 kg)
v' = .92 m/s

A 500 g cue ball traveling at 3.0 m/s strikes a 500 g stationary #2 ball. After the collision the #2 ball takes off at 32 degrees above its original position. What is the momentum and velocity of each ball after the collision?

ex 1

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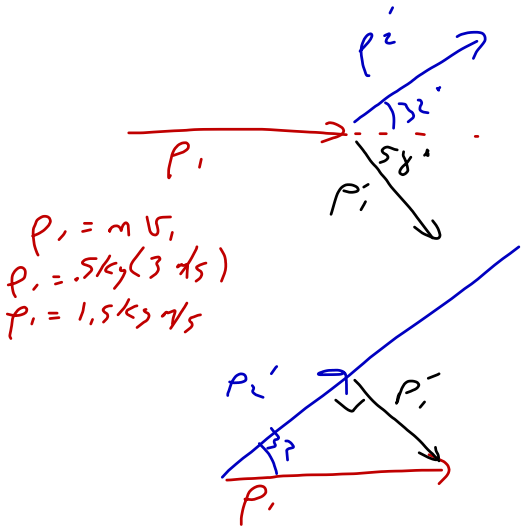
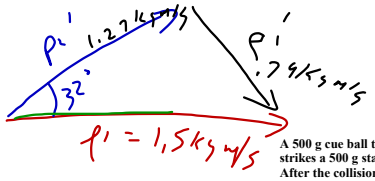


$p_1 = m v_1$

$p_1 = .5kg(3\ m/s)$

$p_1 = 1.5kg\ m/s$



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$\cos 32 = \frac{p_2'}{1.5kg\ m/s}$

$p_2' = \cos 32 (1.5kg\ m/s)$

$p_2' = 1.27kg\ m/s$

$p_2' = m v_2'$

$v_2' = \frac{p_2'}{m_2} = \frac{1.27kg\ m/s}{.5kg}$

$v_2' = 2.54\ m/s$

$\sin 32 = \frac{p_1'}{1.5kg\ m/s}$

$p_1' = \sin 32 (1.5kg\ m/s)$

$p_1' = .79kg\ m/s$

$p_1' = m v_1'$

$v_1' = \frac{p_1'}{m} = \frac{.79kg\ m/s}{.5kg}$

$v_1' = 1.58\ m/s$

A 2.3 kg ball traveling at 4.3 m/s strikes a stationary ball of 2.9 kg. What are the respective velocities of each ball if the 1st ball takes off at a 14 degree angle after they strike?

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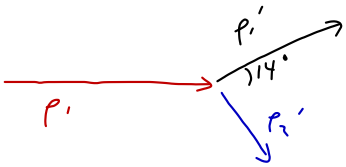
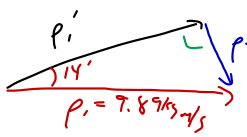


$p_1 = mv_1$

$p_1 = 2.3kg(4.3 m/s)$

$p_1 = 9.89kg\,m/s$



$p_1' = \cos 14\,(9.89kg\,m/s)$

$p_1' = 9.60kg\,m/s$

$v_1' = \frac{p_1'}{m} = \frac{9.60kg\,m/s}{2.3kg} = 4.2\,m/s$

$p_2' = \sin 14\,(9.89kg\,m/s)$

$p_2' = 2.39kg\,m/s$

$v_2' = \frac{p_2'}{m_2} = \frac{2.39kg\,m/s}{2.9kg}$

$v_2' = .83\,m/s$

What force is applied to a 6.2 kg head traveling at 78 km/hr if it stops in 0.083 s?

F = ?

a = ?

d = ?

What force is applied to a 6.2 kg head traveling at 78 km/hr if it stops in 0.083 s?

m = 6.2 kg
v = 78 km/hr
└ 22 m/s
t = 0.083 s
F = ?
a = ?
d = ?

$a = \frac{F}{m} = \frac{-1600\,N}{6.2\,kg}$

$a = -260\,m/s^2$

Ft =mv

F = mv/t = 6.2 kg(22 m/s)/0.083 s

F = 1600 N

$a = \frac{\Delta v}{t} = \frac{0 - 22\,m/s}{.083\,s}$

$a = -260\,m/s^2$

$d = \bar{v}t$

$d = 11\,m/s\,(.083) = .91\,m$

$d = \frac{1}{2}at^2 = \frac{1}{2}(260\,m/s^2)(.083\,s)^2 = .90\,m$

$d = \frac{v_2^2 - v_1^2}{2a} = \frac{0 - (22\,m/s)^2}{2(-260\,m/s^2)} = .93\,m$