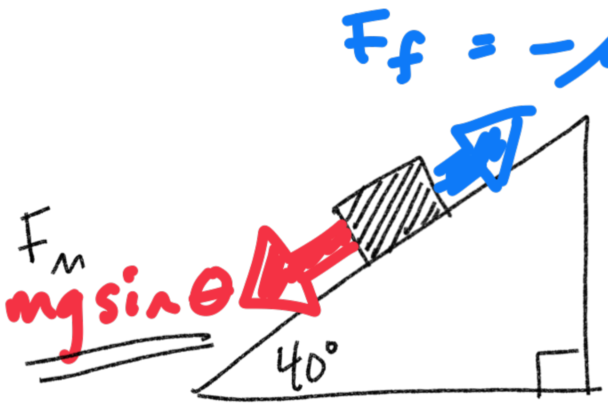
M-6P General Physics Week 27 4/22



mass = 8 kg

$\mu = 0.31$

calc

1.) Find F_{net}

2.) Does it move?

3.) If so, what is the acceleration?

$$F_{net} = F_m + F_f$$

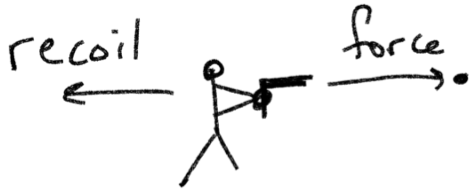
$$F_m \rightarrow mg\sin\theta + (-\mu mg\cos\theta)$$

$$(8\,kg)(-9.8\,m/s^2)(\sin 40) + (-0.31)(8\,kg)(-9.8\,m/s^2)(\cos 40)$$

$$-50.4\,N + 18.6\,N = \boxed{-31.8\,N}$$

$$F = ma \qquad a = \frac{F_{net}}{m} = \frac{-31.8\,N}{8\,kg} = \boxed{-3.98\,m/s^2}$$

Linear Momentum and Collisions



Newton's 3rd Law

equal & opposite reaction.

Momentum is conserved

momentum = mass * velocity

$$\boxed{p = mv}$$

$kg\,m/s \quad kg\,m/s$

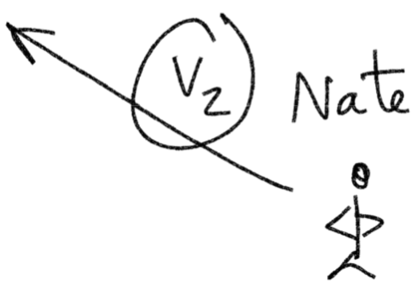
$F = ma$

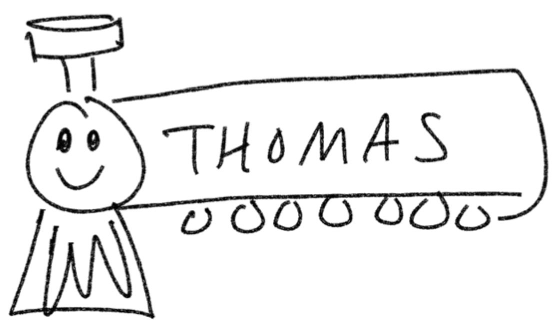
$kg \cdot m/s^2$

$p = F \cdot t$

$kg\,m/s^{\not 2} \cdot \not s$

momentum is the duration of a force.





m_2

79 kg

m_1

53,600 kg

$V_1 = 17.8\ m/s$

$$\frac{m_1 V_1}{m_2} = \frac{m_2 V_2}{m_2}$$

$$V_2 = \frac{m_1 V_1}{m_2} = \frac{(53{,}600\ kg)(17.8\ m/s)}{79\ kg} = 12{,}077\ m/s$$

27,000 mi/hr

0.050 kg bullet travels at 1500 m/s

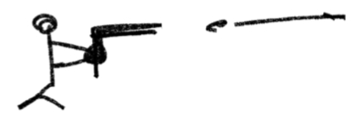
what is the momentum?

$$p = mv$$

$$= (0.050\ kg)(1500\ m/s) = 75\ kg\ m/s$$

Nate = 79 kg

V_2 ?



$$\frac{m_1 V_1}{m_2} = \frac{m_2 V_2}{m_2}$$

$$V_2 = \frac{m_1 V_1}{m_2} = \frac{(0.050\ kg)(1500\ m/s)}{79\ kg} = \boxed{0.95\ m/s}$$

A10 Warthog mass = 29,000 lbs →

missile mass = 460 lb

missile velocity = 1150 km/hr

velocity → 706 km/hr

$$\frac{m_1 V_1}{m_2} = \frac{m_2 V_2}{m_2}$$

recoil velocity

$$V_2 = \frac{m_1 V_1}{m_2} = \frac{(460)(1150\ km/hr)}{29000} = 18\ km/hr$$

$706 - V_2$

$706 - 18\ km/hr = 688\ km/hr$

Mike Tyson's 4 kg fist travels at 40 m/s. What is Nate's resulting ($m = 79\,kg$) velocity if Tyson punches him in his stupid, stupid face? Please assume Nate's head remains attached to his body.

Nate   Fist

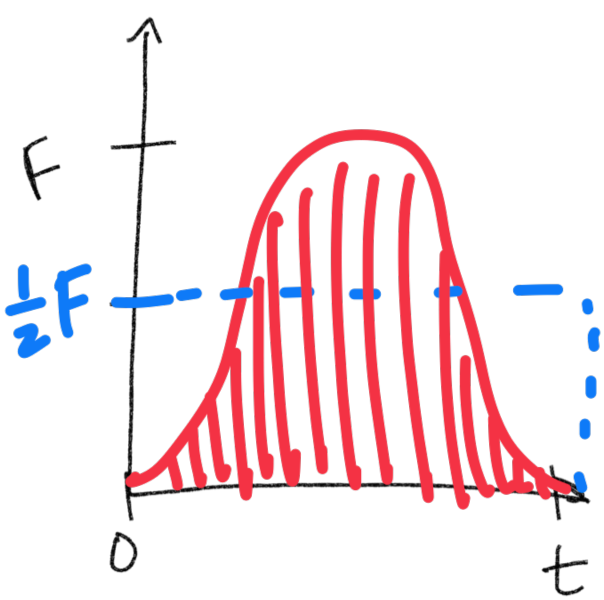
$$\frac{m_1 v_1}{m_1} = \frac{m_2 v_2}{m_1}$$

$$v_1 = \frac{m_2 v_2}{m_1} = \frac{(4\,kg)(40\,m/s)}{79\,kg} = \boxed{2.02\,m/s}$$

Impulse → change in moment

$$I = \bar{F}\Delta t$$

↑ average force



Impulse = area under the curve

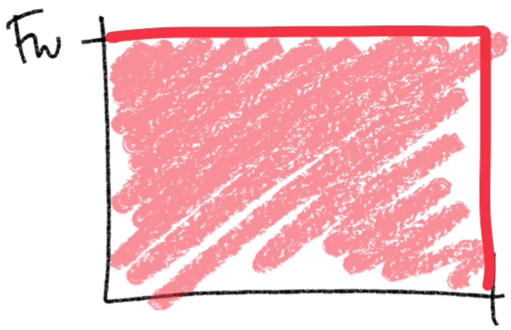
Which is worse? (Impulse)

Hobbit

60 lbs → 27 kg

If Hobbit sat on you for 20 minutes

$I = \bar{F}\Delta t$



$F_w = (27\ kg)(9.8\ m/s^2)$

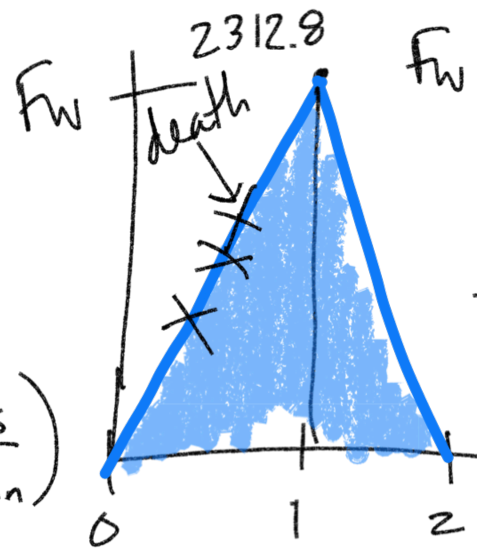
$\approx (264.6N)(20min * \frac{60\ s}{1min})$

317,500 kg m/s

Andre the Giant

520 lbs → 236 kg

If Andre the Giant slowly sat on you and got up over a 2 minute period



$F_w = (236kg)(9.8\ m/s^2)$

(2312.8N)

Triangle area

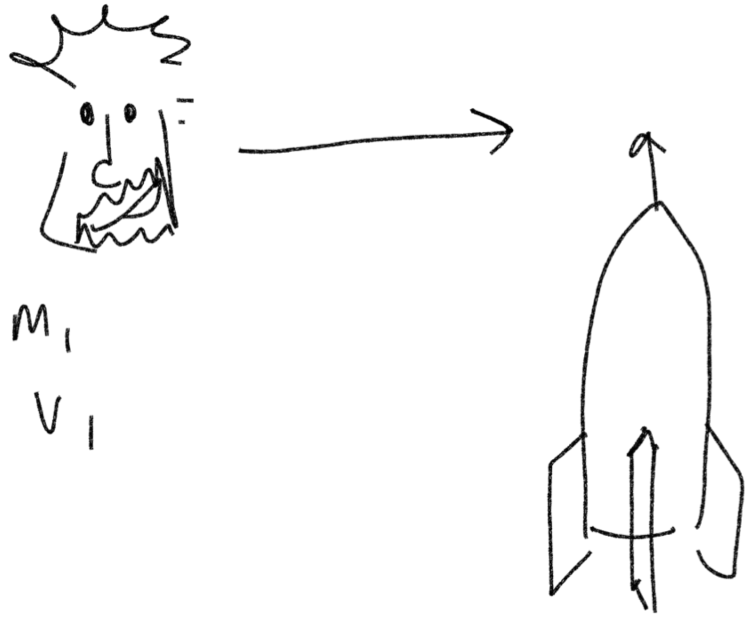
$\frac{1}{2}bh$

$\frac{1}{2}(120s)(2312.8)$

138,768 kg m/s

Next time... collisions

$$m_1 v_1 + m_2 v_2 = (m_1 + m_2) v_f$$



m_1

v_1

m_2 — 460 lb

v_1 — 1150 km/hr