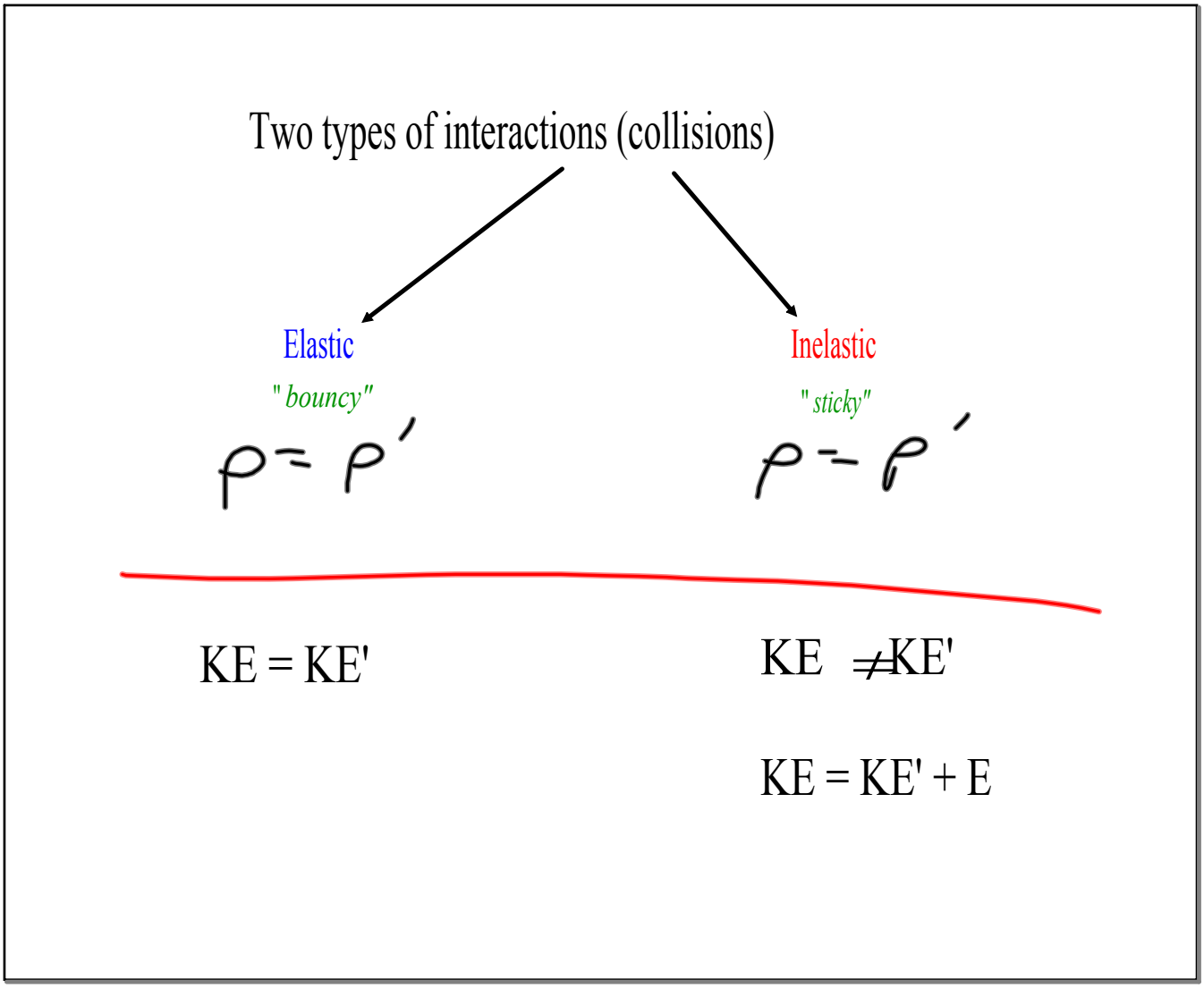
Law of Conservation of Momentum

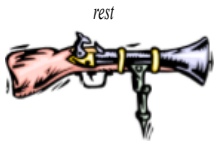
"Law of Interaction"

$\rho = \rho'$ *prime mean after the interaction*

$\rho_{before} = \rho'_{after}$


Two types of interactions (collisions)
Elastic
" bouncy"
p = p'
Inelastic
" sticky"
p - p'
KE = KE'
KE ≠ KE'
KE = KE' + E

What is the recoil velocity of a 3.3 kg rifle if a 45g bullet is shot out at 450 m/s?



$v_b = 0$

$m_g = 3.3\,kg$ $v_g = 0$

$m_b = .045\,kg$

$v_b' = 450\,m/s$

$p = p'$

objects: $mv_b + mv_g = mv_b' + mv_g'$

$3.3\,kg(0\,m/s) + .045\,kg(0\,m/s) = mv_b' + mv_g'$

$0 = mv_b' + mv_g'$

$$v_g' = \frac{-mv_b'}{m_g} = \frac{-[.045\,kg\,(450\,m/s)]}{3.3\,kg}$$

$v_g' = -6.1\,m/s$

mv_g

$3.3\,kg(-6.1\,m/s)$ $\quad .045\,kg(450\,m/s)$

$-20\,kg\,m/s$ $\quad +20\,kg\,m/s$

0

A 250 g ball traveling at 0.20 m/s eastward strikes a second ball of mass 100 g also traveling eastward at 0.10 m/s. After they collide the first ball continues to travel eastward, but at 0.14 m/s. What is the velocity of the second ball after the collision?

"+" east

$m_1 = .25\,kg$

$v_1 = +.20\,m/s$

$m_2 = .10\,kg$

$v_2 = .10\,m/s$

$v_1' = +.14\,m/s$

$v_2' = ?$

$p = p'$

$$mv_1 + mv_2 = mv_1' + mv_2'$$

$$\frac{mv_1 + mv_2 - mv_1'}{m_2} = v_2'$$

$$\frac{.25kg(.20\,m/s) + .1kg(.10\,m/s) - (.2kg)(.14\,m/s)}{.10kg} = v_2'$$

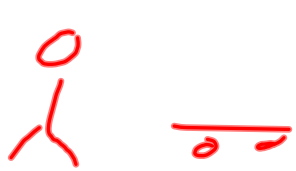
$$v_2' = .25\,m/s$$

Feb 8-6:53 AM

A 55 kg boy runs at 12 km/hr and jumps on a 9.0 kg stationary wagon. What is their velocity after the daring maneuver?

→ 3.3 m/s

$$m v_b + m v_w = m v_b' + m v_w'$$



$$v_b' = v_w' = v'$$

$$m v_b + m v_w = v'(m_b + m_w)$$

$$v' = \frac{m v_b + m v_w}{(m_b + m_w)}$$

$$v' = \frac{55\,kg\,(3.3\,m/s) + 0}{(55\,kg + 9\,kg)}$$

$$v' = 2.9\,m/s$$