Wed
9/8/21

1) Mass of gun (m_G) = 20kg

No. of bullets fired - 10 bullets Per second

Mass of each bullet (m_B) 0.2kg

Muzzle Speed of bullet (v_B) = 150m/s

By law of Conservation of linear momentum

$$m_G v_G + m_B v_B = 0$$

Recoil velocity of gun i.e $v_G = -\frac{m_B v_B}{m_G} = -\frac{0.2 \times 150}{20}$

$$\Rightarrow -(0.1 \times 15) = -1.5 \text{ m/s}$$

2) Conservation of momentum:

Ex- Bullet fired from a Rifle

initially total momentum = 0

Later the trigger is pulled, bullet gains momentum in a direction, but this is cancelled by rifle's momentum

Therefore total momentum = 0

During the process the chemical energy in gunpowder get converted into heat, sound & chemical energy

Before firing

$m \times 0 + m \times 0$

After firing

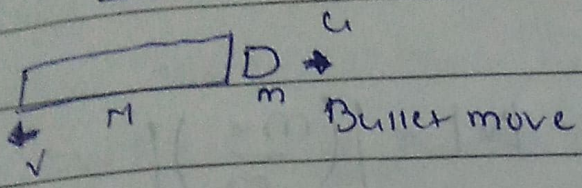
$mu + mv$

$mu + mv = m \times 0 + m \times 0$

$mu + mv = 0$

$mv = -mu$

$$\boxed{v = \frac{-mu}{m}}$$



Gun recoiled

Let after firing; the velocity of bullet (of mass m) = u

the recoil velocity of gun (M) = V

By conservation of linear momentum; $MV + mu = 0$

$V = -\frac{mu}{M}$ = recoil velocity of gun

If n bullets are fired per second

then interaction time between gun & each bullet = $\left(\frac{1}{n}\right)$s

So magnitude of force between gun & each bullet

$$\rightarrow \left(\frac{mu}{\frac{1}{n}}\right) = (n\,mu) = (nMV)$$

$mu - 0$ → Change in momentum of Bullet

$$F = \frac{\Delta P}{\Delta t} = \frac{mu}{\frac{1}{n}} = nmu$$

1 Sec = n bullets fired

1 bullet - $\frac{1}{n}$ Sec

(the time taken)

$MV - 0$ = change in momentum of Gun

3) The conservation of momentum demands that the final momentum should also carry equal & opposite momentum to make total momentum Zero. Thus those parts fly off in different directions

4) Mass of an object $(m_1) = 1.5kg$

its velocity $(v_1) 5m/s$

Mass of wooden block $(m_2) = 5kg$ at rest $(v_2) = 0$

Momentum after Collision =

$m_2 \times v_2 + m_1 \times v_1$

$\Rightarrow 0 + 1.5 \times 5 = 7.5 kgm/s$

Combine velocity $= (m_2 + m_1) v$

$\therefore 5 \times v + 1.5 \times v = 6.5v$

Now equating

$\Rightarrow 6.5v = 7.5$

$v = 7.5/6.5 = 1.15 m/s$