(1) Mass of gun (M_G) = 20 kg

No. of bullets fired = 10 bullets/sec.

Mass of each bullet (M_B) = 0.2 kg

Muzzle speed of bullet (V_B) = 150 m/s

By the law of conservation of linear momentum

$M_G V_G + M_B V_B = 0$

Recoil velocity i.e. $V_G = \frac{-M_B V_B}{M_G} = \frac{-0.2 \times 150}{20}$

$\Rightarrow -0.2 \times 15 = -1.5$ m/s

(2) Conservation of Momentum :-

Ex - Bullet fired from a rifle.

Initially momentum = 0

bullet

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

∴ Total momentum = 0

During the process the chemical energy in gun-powder is converted to heat, sound & chemical energy.

Signed / Examined by

Before Firing

After Firing

$mx0 \quad tmx0$

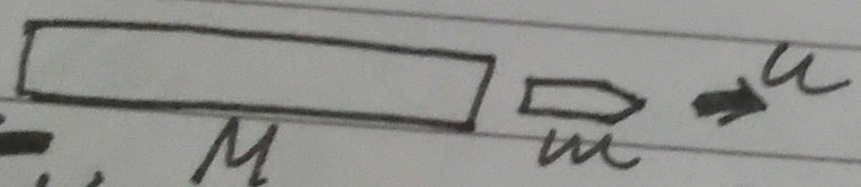
$mut + mv = mxu + mxv$

$mu + mv = 0$

$mv = -mu$

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

$mu + mv$



Bullet moved

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

In n bullets are fired / second the interaction time b/w gun & each bullet $\Rightarrow$ [illegible] $(\frac{1}{n})s$

So magnitude of force b/w gun & each bullet $\Rightarrow \frac{(mu}{\frac{1}{n}})$
$= (nmu) = (nMV)$, $mu - 0 \Rightarrow$ Change in momentum of bullet, $F = \frac{\Delta P}{\Delta T} = \frac{mu}{1} = nmu$
1 sec = n bullets fired $\frac{1}{n}$
1 bullet - $\frac{1}{n}$ sec (the time taken), $MV - 0$ = change in momentum of gun.

Signed / Examined by

(3) The conservation of momentum demands that the final momentum should also carry equal & opposite momentum to make total momentum 0. Thus, there parts fly off in ~~same~~ different directions.

(4) Mass of an object $= (m_1) = 1.5\,kg$
Its velocity $= (v_1) = 5\,m/s$

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

Momentum after collision $= m_2 v_2 + m_1 v_1$
$\Rightarrow 0 + 1.5 \times 5 = 7.5\,kgm/s$

Combine velocity $\Rightarrow (m_2 + m_1) v$
$\Rightarrow 5 \times v + 1.5 \times v = 6.5v$

Now equating
$\Rightarrow 6.5v = 7.5$
$\Rightarrow v = \frac{7.5}{6.5} = 1.15\,m/s$