Force & Laws Of Motion (Exercise)

5) $u=0,\ S=400m,\ t=20s$

$S = \cancel{ut}^{0} + \frac{1}{2}at^2$

$400 = \frac{1}{2} \times a \times 20 \times 20 = 200a$

$a = 2m/s^2$

Mass = 7 tonne or 7000 kg

$F = ma = 2 \times 7000 = 14000N$

6) $m = 1kg,\ u = 20m/s,\ S = 50m$

$v^2 = u^2 + 2aS \Rightarrow 0 = 400 + 100a$

$\rightarrow a = -4m/s^2$

$f = ma = 1 \times (-4) = -4N$

7) M (engine) = 8000kg, m (wagon) = 2000 kg

F (friction) = 5000N 5 wagon = 10000kg

(i) net accelerating force = 40000 − 5000 = 35000N

(ii) acceleration of them = $F = ma$

$\rightarrow 35000 = (10000 + 5000)a$

$\rightarrow a = 18000/35000 = 1.94\ m/s$

(8) $m = 1500kg,\ a = -1.7m/s^2$

$f = ma = 1500 \times -1.7 = -2550N$

19) The Student's justification is incorrect. Since action & Reaction pair act on different bodies & in this case the force acting is mg (downward) & Normal.

Important Notes

13) $m = 200g$, $u = 10m/s$, $v = -5m/s$

$P_i = mu = 200 \times 10 = 2000\ g\ m/s$

$P_f = mv = 200 \times -5 = -1000\ g\ m/s$

Change in momentum $= P_f - P_i = -1000 - 2000 = 3000\ m/s$

14) $u = 150m/s$, $v = 0$, $m = 10g$ or $0.01kg$

$t = 0.03\ S$,

let distance or penetration be $= S$

$v = u + at \Rightarrow 0 = 150 + 0.03a$

$\Rightarrow a = -5000\ m/s^2$

$v^2 = u^2 + 2aS$

$\Rightarrow +22500 = +10000S$

$\Rightarrow S = 2.25\ m$

$F = ma = 0.01 \times -5000 = -50\ N$

15) $m_1 = 1kg$, $m_2 = 5kg$

$u_1 = 10m/s$ $u_2 = 0$

As they move together then v will remain same for the both bodies

$m_1u_1 + m_2u_2 = (m_1 + m_2)v$

$\Rightarrow (1 \times 10) + (5 \times 0) = (1+5)v$

$\Rightarrow 10 = 6v$

$\Rightarrow v = \frac{10}{6} = 0.16\ m/s$