H10

FORCES AND LAWS OF MOTION

1 Mass = 1200kg; Uniform Velocity = 90km/h.
Velocity slowing rate = 18km/h in 4s.
$\Delta P = mv - mu = 1200 \times 5 - 1200 \times 25 = -24000 kg\,m/s$.
$v = u + at \Rightarrow 5 = 25 + a \times 4 \Rightarrow a = -5 m/s^2$ (-ve shows retardation)
$F = ma = 1200 \times 5 = 6000N$.

2 Mass, m = 100kg; Time interval, $\Delta t = 10s$.
i Distance travelled in next 5s, d = 100m.
Velocity $v = \frac{d}{t} = \frac{100}{5} = 20 m/s$.
ii Acceleration $a = \frac{v}{\Delta t} = \frac{20}{10} = 2 m/s^2$.
iii Magnitude of force $F = ma = 100 \times 2 = 200N$.

3 Ans Ans Law of motion - Force is directly proportional to rate of change of momentum.
F = direct proportional to $\frac{dp}{dt}$.
Momentum, $p = mv$.
$F = \frac{d(mv)}{dt} = m\left(\frac{dv}{dt}\right)$. Thus, $F = ma$.

4 $F = ma$ or $F = \frac{m(v-u)}{t}$ or $F = mv - mu$.
that is, when $F = 0$, $v = 0$ for time t. This means that the object will continue moving with uniform velocity, v is throughout the time, t. If $v = 0$, then $v = 0$, i.e., object will remain at rest.

5 a Action - Force exerted on bullet.
Reaction - Recoil experienced by gun.
b Action - Force exerted by hammer on nail.
Reaction - Force applied by nail on hammer.
c Action - Weight of book acting downwards.
Reaction - Force acted by table upwards.
d Action - Force exerted by rocket on gases backwards.
Reaction - force exerted by outgoing gases of rocket forward.
e Action - Force exerted by feet on ground backwards
Reaction - Force exerted by ground on feet forward.
f Action - Force exerted by moving train on stationary one
Reaction - Force exerted by stationary train on moving one

6a It is difficult to hold a hose as it exerts a force backwards towards us when it is ejecting water at high velocity. This is because of Newtons 3rd law of motion

b Action and Reaction dont cancel each other as they act on different objects, not on the same object.

7a When someone jumps to shore from boat, he/she applies force on boat in opposite direction to move forward. Hence, boat moves in opposite direction.

b When air from a inflated balloon is released, balloon moves in direction opposite to that of air, as air escapes from downward direction (suppose), pushing balloon upwards.