HW
28/7/21

1) Mass of car - 1200kg

Initial velocity of car (u) = 90km/h

$90^{5} \times \frac{5}{18} = 25m/s$

final velocity of car (v) = 18km/h = $18 \times \frac{5}{18} = 5m/s$

Time taken(t) = 4s

$\Delta p = mv - mu$

$\Delta p = 1200 \times 5 - 1200 \times 25 = -24000 kg\,m/s$

$v = u + at$

$5 = 25 + a \times 4$

$\Rightarrow a = -5\ m/s^2$ (-ve shows retardation)

$\vec{F} = ma = 1200 \times 5 = 6000N$

Date
Page

(2) Mass (m) = 100kg

Time interval (t) = 100m

Distance traveled in next 5 Seconds d = 100m

(i) $V = \frac{d}{t} = \frac{100}{5} = 20m/s$

velocity = 20m/s

(ii) Acceleration produced by force

$a = \frac{v}{t} = \frac{20}{10} = 2m/s^2$

(iii) magnitude of force

$F = ma = 100 \times 2 = 200N$

3) According to Newton's Second law of motion

$$\text{Force} = \frac{\text{Change in momentum}}{\text{time taken}}$$

Rate of change in momentum $\Rightarrow \frac{mv - mu}{t}$

But according to second law of Newton - $\frac{mv - mu}{t} \propto F$

$F \propto \frac{mv - mu}{t}$ Here $\frac{v - u}{t}$ = acceleration(a)

$F \propto ma$

4) ~~[illegible]~~ Newton's first law provides quantitative definition from second law
Newton's second law provides a quatitative measure of the force that will produce a given acceleration of mass
If $F = 0$, we have $a = \frac{F}{m} = 0$, therefore v = constant as the first law states

5) a) Force on bullet is action
Force of Gun's Recoil the Reaction

b) Force exerted by hammer on nail is action
Force applied by the nail on hammer is Reaction

(c) Weight of book acting downward is action
Force acted by table upward is reaction

(d) Force exerted by the rocket on the gases downward is the action
Force exerted by the thrust upward is reaction.

(e) Force exerted by the feet on the ground in downward direction is the action
Force exerted by ground on feet in upward direction

(f) Force exerted by a moving train on a stationary train is called action
Force exerted by the stationary train on a moving train is the reaction.

6) a) When a fireman holds a hose which is ejecting large amounts of water at a high velocity then a reaction force is exerted on him by the ejecting water in backward direction. This is due to Newton's third law of motion i.e in every action, there is an equal & opposite reaction. Hence it is difficult to remain in stable position.

b) Action and reaction forces pair donot cancel each other because they act on different objects

7)(a) according to Newtons third law of motion, to every action there is an equal & opposite reaction. When we jump on the shore from the boat we are applying force on boat on opposite direction in order to move forward & hence boat moves in opposite direction

(b) When air is released from inflated baloon the air rushes out & pushes against the air around the baloon to move it in the opposite direction. This happens according to the Newtons third law of motion to every action there is an equal & opposite reaction

(8) a) The direction in which the gas is expelled (Action) will make the rocket to move in the opposite direction (Reaction)

(b) Yes the expelled gas exert a force on rocket which must be in downward direction

(c) Acceleration(a) is = 2a --- ①

mass remain same = m

$F = ma$

But a = 2a from ①

Hence $F = m \times 2a$

$a = \frac{F}{2m}$

(d) mass is twiced (m) = 2m --- ①

acceleration remain same = a

$F = ma$

but m = 2m from ①

$F = 2m \times a$

$a = \frac{F}{2m}$

(e) mass(m) & acceleration(a) are twiced = mass(m) = 2m & acceleration(a) = 2a

$F = ma$

~~xxx~~ $F = 2m \times 2a$

$a = \frac{F}{4m}$

Date

Page

Force exerted on rocket by gas.

$f = ma$

$f = 2m \times 2a = 4ma$ -- (I)

Force in original situation

$f = ma$ .. (II)

$\therefore$ From (I) & (II) force exerted in (I) is 4 times more than in (II)