

HW
28/12/21

1) Mass of car = 1200 kg

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

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

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

Time taken (t) = 4 s

$$\Delta p = mv - mu$$

$$\Delta p = 1200 \times 5 - 1200 \times 25 = -24000 \text{ kg m/s}$$

$$v = u + at$$

$$5 = 25 + a \times 4$$

$$\rightarrow a = -5 \text{ m/s}^2 \text{ (-ve shows retardation)}$$

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

(2) MASS $(m) = 100\text{kg}$

Time interval $(t) = 100\text{m}$

Distance traveled in next 5 seconds $d = 100\text{m}$

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

velocity = 20m/s

(ii) Acceleration produced by bounce

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

(iii) magnitude of force

$$F = ma = 100 \times 2 = 200\text{N}$$

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 - $\frac{mv - mu}{t} \propto F$

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

$$F \propto ma$$

4) ~~Newton's~~ Newton's first law provides quantitative definition for second law. Newton's second law provides a quantitative measure of the force that will produce a given acceleration of mass.

If $F = 0$, we have $a = \frac{F}{m} = 0$, therefore $v = \text{constant}$ as the first law states.

5) a) Force on bullet is action

Force of gun's Recoil is 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.

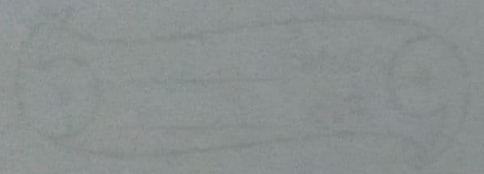
e) Force exerted by the keet on the ground in downward direction is the action

Force exerted by ground on keet 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.

g) a) When a fire 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 don't cancel each other because they act on different objects

7) a) according to Newton's 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 in opposite direction in order to move forward & hence boat moves in opposite direction.

b) When air is released from inflated balloon the air rushes out & pushes against the air around the balloon to move it in the opposite direction. This happens according to the Newton's 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 $a = 2a \dots \textcircled{1}$

Mass remain same = m

$$F = ma$$

But $a = 2a$ from $\textcircled{1}$

Hence $F = m \times 2a$

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

(d) mass is twiced ($m = 2m \dots \textcircled{1}$)

acceleration remain same = a

$$F = ma$$

but $m = 2m$ from $\textcircled{1}$

$$F = 2m \times a$$

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

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

$$F = ma$$

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

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

Force exerted on rocket by gas.

$$F = ma$$

$$F = 2m \times 2a = 4ma \quad \dots (i)$$

Force in original situation

$$F = ma \quad \dots (ii)$$

\therefore From (i) & (ii) force exerted in (i) is 4 times more than in (ii)