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Newton's first law of Motion or law of Inertia

It states that any object will remain in the state of rest or in uniform motion and haws of motion along a straight line until it compelled to change the state by applying external force.

2.) Inertia

Definition: Inertia is a property or tendency of every object to resist any change in its state of rest or uniform motion in a straight line.

It is measured by the mass of an object. The heavier the object the greater will be its inertia.

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3.) a) If someone tries to get out of a moving bus that moment -um make the person move forward. A person might fall in the forward direction due to moment of inertia when the speed is fast. This can be explained by the Newton's law of inertia. As the person gets out of the moving bus the mom -entum is reduced to zero.

b) Inertia is the reason that people in cars need to wear seat belts when the driver applies the brakes, an unbalanced force is applied to the car. So, to reduce chem -ces of any injury seat belts are provided to all the cars, or all the cars are provided with seat belts to prevent accidents.

c.) A luggage is usually tied with a rope the roof of buses. When a moving bus suddenly stops, the luggage on its roof tends to continue in the state of motion due to inertia of motion thus to avoid the falling off the luggage, it is tied with a rope on the roof of a bus.

d.) When the tree is shaken, the fruits and dry leaves fall because of inertia of rest. If the fruits and leaves fall naturally without any force then it is because of the force of gravity acts on all bodies whether it is in state of rest or motion.

e.) Initially when the bus is at rest our body also follows the same state. Also a person standing in a bus will be in state of motion, and when the brakes are applied the lower part of our body comes to the state of rest but our upper part is in the state of motion. Hence, we tend to fall forward when the bus applies brakes.

f.) When a car or a bus suddenly starts, our body is in rest the lower part of the body which is in contact with the car or bus tends to move forward but the upper part of the body is in the inertia of rest, so our body feels backward.

4.) a) cricket ball
b.) a truck
c.) A fat man
d.) Five rupee coin

5) $m = 150g$
$V = 90 km/h$

momentum $= m \times V$
$= 150 \times 90$
$= 13,500 km/h$

Hence the momentum of a Cricket ball is 13500 km/h or 13.5m/s

6) man $= 60kg$

man is movin with uniform velocity

$V = 5m/s$

momentum $= 2mV$
$= (60 \times 2)\ kg\ m\ s^{-1}$
$= 120\ kg\ m\ s^{-1}$

7) $m = 4kg$
$V = 35 m/s$
mass of bullet fired $= 50g$
momentum of bullet $= m \times V$

$(50kg = 1000) \times 35 m/s$

$= 0.05 kg \times 35 m/s$
$= 1.75 kgm/s$

momentum of rifle $= m \times V$
let the recoil velocity be $V \times \frac{m}{s}$

According to the law of conservation of momentum of bullet = momentum of rifle.

$1.75 = 4V$
$V = 1.75 \div 4$
$= \frac{175}{100} \times \frac{1}{4}$

$= \frac{175}{400} = \frac{35}{80} = \frac{7}{16}$

Recoil velocity = 0.4375 m/s.

Q) Refile mass (m) = 6 kg
Refile initial velocity (u) = 0
Refile final velocity (v) = ?

Bullet mass (m_2) = 0.01 kg
" initial velocity = 0
" final velocity (v_2) = 300 m/s

Recoil velocity of gun $= m_1u_1 + m_2u_2$
$= m_1v_2 + m_2v_2$

$= 6(0) + (0.01)(0) = 6(v_1) + 0.01(30$

$= 0 = 6v_1 + 3$
$-6v_1 = 3$
$v_1 = \frac{-3}{6}$
$v_1 = \frac{-1}{2}$ m/s

$v_1 = -0.5$ m/s

Recoil velocity of gun is -0.5 m/s.

9.) Bullet :-

mass $= \frac{10}{1000}$ kg $= 0.01$ kg

Velocity = 400 m/s

Wodden block
mass = 900g + 0.01kg
$= \frac{900}{1000}$ kg + 0.01kg

= 0.91 kg

Velocity = V
We know that
P of bullet = recoil P of gun
$0.01 \times 400 = 0.91V$

$u = 0.9V$

$V = \frac{u}{0.9}$

$= 4.39 m/s$

10.) Given that,

mass of bullet = 60g

$= 0.06 kg$

Speed of the bullet = 500 m/s

mass of the gun = 5kg

So,

mass of bullet × velocity of bullet = mass of the gun × recoil of gun.

$0.06 \times 500 = 5 \times V$

$30 = 5V$

$V = 30/5$

$= 6$

So the recoil speed of the gun = 6 m/s

12.) $F = ma$

given, $m = 5kg$

$a = u = 10 m/s$

$V = 35 m/s$

$t = 25 s$

$= V - u / t$

$= (35 - 10) / 25$

$= 1$

$F = ma$

$F = 5 \times 1$

$F = 5N$

13.) $m = 2 kg$

$u = 0 m/s$

$V = 30 m/s$

$t = ds$

$a = \frac{V-u}{t}, = \frac{(30-0) m/s}{1} = 30 m/s^2$

$$P = ma = 2kg \times 30 m/s^2$$
$$= 60 kg\ m/s^2$$
$$= 60N$$