7TH FOUNDATION PLUS NEWTONS SECOND LAW

TEACCHING TASK

1.

Now we know that,

Force (F)=100N

time(t)=10 sec

now ; change in momentum(p)=?

now we know that , change in momentum =impulse

=F*t

=100*10

=1000Ns

2.

The gain of momentum (Δp) is the change in momentum, which is the final momentum minus the initial momentum.

$$\Delta p = p_f - p_i$$

Momentum (p) is calculated as mass (m) times velocity (v).
The initial momentum is $p_i = m \times u = 2 \text{ kg} \times 0 \text{ m/s} = 0 \text{ kg} \cdot \text{m/s}$.
The final momentum is $p_f = m \times v = 2 \text{ kg} \times 6 \text{ m/s} = 12 \text{ kg} \cdot \text{m/s}$.

The gain in momentum is:

$$\Delta p = 12 \text{ kg} \cdot \text{m/s} - 0 \text{ kg} \cdot \text{m/s} = 12 \text{ kg} \cdot \text{m/s}$$

3.

The distance moved is proportional to t^2 (the square of the time). This is because a constant force results in constant acceleration, and starting from rest ($u = 0$), the kinematic equation simplifies to $s = \frac{1}{2}at^2$, where distance (s) is directly proportional to the square of the time (t).

- **Newton's Second Law:** A constant force (F) acting on a body of mass (m) produces a constant acceleration (a) because $F = ma$ and m is constant, so a must also be constant.
- **Kinematic Equation:** The equation for displacement (s) when starting from rest is $s = ut + \frac{1}{2}at^2$.
- **Simplification:** Since the initial velocity (u) is zero, the equation becomes $s = \frac{1}{2}at^2$.
- **Proportionality:** Because the acceleration (a) is constant, the equation shows that s is directly proportional to t^2 ($s \propto t^2$).

4.

The same force (F) now acts on a new body with a different mass (m_2). We can use Newton's Second Law again to find the new acceleration (a_2).

The given values are:

- Force (F): 1.5 N (calculated in Step 1)
- Mass (m_2): 1.5 kg

The new acceleration is calculated as:

$$a_2 = \frac{F}{m_2} = \frac{1.5\text{ N}}{1.5\text{ kg}} = 1.0\text{ m/s}^2$$

5.

For body A:

$$F = m_A a_A$$

$$F = m_A(2.0\ \text{m/s}^2)$$

For body B:

$$F = m_B a_B$$

$$F = m_B(5.0\ \text{m/s}^2)$$

Step 2: Equate the forces and find the ratio

Since the same force (F) is applied to both bodies, we can set the two equations equal to each other.

$$m_A(2.0) = m_B(5.0)$$

To find the ratio of the mass of A to the mass of B, we rearrange the equation to solve for $\frac{m_A}{m_B}$.

$$\frac{m_A}{m_B} = \frac{5.0}{2.0} = \frac{5}{2}$$

6.

- Mass of the first block (m_1): 2 kg
- Mass of the second block (m_2): 2 kg

$$m_{total} = m_1 + m_2 = 2\ \text{kg} + 2\ \text{kg} = 4\ \text{kg}$$

Finally, use Newton's second law again to find the new acceleration of the combined blocks, using the same constant force and the new total mass.

$$a_{new} = \frac{F}{m_{total}} = \frac{2\ \text{N}}{4\ \text{kg}} = 0.5\ \text{m/s}^2$$

The formula for force is $F = ma$.

- Mass of the first block (m_1): 2 kg
- Acceleration of the first block (a_1): 1 m/s²

$$F = m_1 a_1 = (2\ \text{kg})(1\ \text{m/s}^2) = 2\ \text{N}$$

7.

The acceleration can be calculated using the change in speed and the time over which the change occurs. The formula is given by:

$$a = \frac{\Delta v}{t}$$

Given that the change in speed (Δv) is 3 m/s and the time (t) is 2 s:

$$a = \frac{3 \text{ m/s}}{2 \text{ s}} = 1.5 \text{ m/s}^2$$

Step 2: Calculate the force

Using Newton's second law of motion, the force (F) is the product of the mass (m) and the acceleration (a). The formula is:

$$F = ma$$

Given that the mass (m) is 2 kg and the acceleration (a) is 1.5 m/s^2:

$$F = (2 \text{ kg})(1.5 \text{ m/s}^2) = 3 \text{ N}$$

8.

We can rearrange the formula to solve for acceleration:

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

Plugging in the given values:

$$a = \frac{15 \text{ N}}{20 \text{ kg}} = 0.75 \text{ m/s}^2$$

Step 2: Calculate the final velocity

To find the final velocity (v), use the first equation of motion:

$$v = u + at$$

Assuming the object starts from rest, the initial velocity (u) is 0 m/s. We will use the acceleration calculated in Step 1 and the given time.

Plugging in the values:

$$v = 0 \text{ m/s} + (0.75 \text{ m/s}^2)(8 \text{ s})$$

$$v = 6 \text{ m/s}$$

9.

The mass of each bullet (m) is $0.03\ \text{kg}$.
The velocity of each bullet (v) is $30\ \text{m/s}$.
The rate at which the bullets hit the plate (n) is 200 bullets/s.
The average force (F) can be calculated using the rate of change of momentum. Assuming the bullets stop after hitting the plate, the change in momentum for one bullet is $\Delta p = mv$. For multiple bullets hitting at a rate n, the total force is the product of the rate and the change in momentum of a single bullet.

The formula to find the average force is given by:

$$F = n \cdot m \cdot v$$

Step 2: Substitute the values and calculate the force

Substitute the given values into the formula:

$$F = (200\ \text{bullets/s}) \cdot (0.03\ \text{kg}) \cdot (30\ \text{m/s})$$

$$F = 6\ \text{kg} \cdot \text{m/s}^2$$

$$F = 180\ \text{N}$$

10.

of the bullets. The change in momentum for one bullet is $p = mv$. If n bullets are fired per second, the total change in momentum per second is $n \times mv$. This rate of change of momentum is equal to the force exerted by the gun on the man. To hold the gun steady, the man must exert an equal and opposite force.

The relationship between force (F), the number of bullets per second (n), bullet mass (m), and bullet velocity (v) is:

$$F = n \times mv$$

To find the number of bullets per second (n), we can rearrange the formula:

$$n = \frac{F}{mv}$$

Step 3: Calculate the maximum number of bullets per second

Substitute the values from Step 1 into the formula from Step 2:

$$n = \frac{144}{0.040 \times 1200}$$

$$n = \frac{144}{48}$$

$$n = 3$$

14.

The assertion is true and the reason is false. An assertion is true because a constant velocity means there is no change in velocity over time, so acceleration ($a = \frac{\Delta v}{\Delta t}$) is zero. The reason is false because momentum is the product of mass and **velocity**, not mass and acceleration; acceleration is the product of mass and **force** ($F = ma$).

18,19,20.

$$p_{initial} = m \times v_{initial}$$

$$p_{initial} = 10 \text{ kg} \times 0 \text{ m/s}$$

$$p_{initial} = 0 \text{ kgm/s}$$

The final momentum is calculated using the final velocity of 30 m/s.

$$p_{final} = m \times v_{final}$$

$$p_{final} = 10 \text{ kg} \times 30 \text{ m/s}$$

$$p_{final} = 300 \text{ kgm/s}$$

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

$$a = \frac{20 \text{ N}}{10 \text{ kg}}$$

$$a = 2 \text{ m/s}^2$$

LTask jee mains level

1. **momentum= mv. = 10(50). =500kgms^{-1}.**

- Force (F) = 100 N
- Mass (m) = 20 kg
- Final velocity (v) = 100 m/s
- Initial velocity (u) = 0 m/s (since the body starts from rest)

2. **Use Newton's Second Law**:
According to Newton's second law, the force acting on an object is equal to the mass of the object multiplied by its acceleration (F = m * a).

3. **Calculate Acceleration (a)**:
Rearranging the formula gives us:

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

Substituting the values:

$$a = \frac{100\,\mathrm{N}}{20\,\mathrm{kg}} = 5\,\mathrm{m/s^2}$$

2.

- F is the force in Newtons (N)
- m is the mass in kilograms (kg)
- a is the acceleration in meters per second squared (m/s^2)

From the problem, we have:

- $m = 50$ kg
- $a = 15$ m/s^2

Step 2: Calculate the force

Substitute the known values into the formula to find the force:

$$F = (50\text{ kg}) \times (15\text{ m/s}^2)$$

$$F = 750\text{ N}$$

3.

4. 4.

- The formula for force (F) is given by Newton's Second Law:

$F = m \cdot a$

- Here, since the acceleration (a) is 0 (because the velocity is constant), we can substitute the values:

$F = 2\,\mathrm{kg} \cdot 0\,\mathrm{m/s^2} = 0\,\mathrm{N}$

5.

:F=maF=1.5×2F=3N....

6.

$500\,\mathrm{g} = 0.5\,\mathrm{kg}$

Step 2

Identify the given acceleration:

$a = 1\,\mathrm{m/s^2}$

Step 3

Apply Newton's Second Law of Motion:

$F = m \cdot a$

Step 4

Substitute the values into the equation:

$F = 0.5\,\mathrm{kg} \cdot 1\,\mathrm{m/s^2} = 0.5\,\mathrm{N}$

7.

Acceleration of the body $a = 5cm / s^2 = 5 \times 10^{-2} m / s^2$

Mass of the body $m = 20g = 20 \times 10^{-3} kg$

$F = maF = 20 \times 10^{-3} \times 5 \times 10^{-2} N = 100 \times 10^{-5} N = 1 \times 10^{-3} N$

8.

From F=ma

=250x3

=750 dynes or 75×10^{-4}N

9.

- For the 2 kg body ($m_1 = 2$ kg) with acceleration a_1:
  $F = m_1 a_1 \implies F = 2a_1$
- For the 3 kg body ($m_2 = 3$ kg) with acceleration a_2:
  $F = m_2 a_2 \implies F = 3a_2$

Step 3: Find the ratio of accelerations

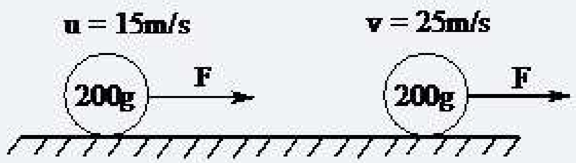
To find the ratio of their accelerations, $\frac{a_1}{a_2}$, we can set the two force equations equal to each other since the force is the same:

$$2a_1 = 3a_2$$

Now, rearrange the equation to find the ratio of a_1 to a_2:

$$\frac{a_1}{a_2} = \frac{3}{2}$$

10.



Given that

$m = 200g = 200 \times 10^{-3}kg$

$u = 15m/s, v = 25m/s, t = 2.5s$

$F = ?$

We know

$F = \frac{m(v-u)}{t} = \frac{200 \times 10^{-3}(25-15)}{2.5}$

$F = 0.8N$

19.

The initial momentum of the ball can be calculated using the formula $p_i = mv_i$. Given mass $m = 2$ kg and initial velocity $v_i = 5$ m/s.

$$p_i = (2 \text{ kg})(5 \text{ m/s}) = 10 \text{ kg} \cdot \text{m/s}$$

The final momentum of the ball can be calculated using the formula $p_f = mv_f$. Given mass $m = 2$ kg and final velocity $v_f = 6$ m/s.

$$p_f = (2 \text{ kg})(6 \text{ m/s}) = 12 \text{ kg} \cdot \text{m/s}$$

The change in momentum (Δp) is the difference between the final and initial momentum.

$$\Delta p = p_f - p_i = 12 \text{ kg} \cdot \text{m/s} - 10 \text{ kg} \cdot \text{m/s} = 2 \text{ kg} \cdot \text{m/s}$$

The force acted on the ball can be calculated using the impulse-momentum theorem, $F = \frac{\Delta p}{\Delta t}$.

Given change in momentum $\Delta p = 2 \text{ kg} \cdot \text{m/s}$ and contact time $\Delta t = 0.1 \text{ s}$.

$$F = \frac{2 \text{ kg} \cdot \text{m/s}}{0.1 \text{ s}} = 20 \text{ N}$$