DATE:-
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TENDER HEART HIGH SCHOOL, SEC-33B, CHD

CLASS- VIII

SUBJECT - PHYSICS

CHAPTER- MOTION (2)

2(c) NUMERICALS

① A body starts from rest with a uniform acceleration of $2m/s^2$. Find the distance covered by the body in 2s?

Solution :→ As body starts from rest ($u=0$)

$a = 2m/s^2$

S = distance = ?

$t = 2s$

$v = u + at$

$v = 0 + (2) \times t$

$v = 0 + 2 \times 2$

$v = 0 + 4 = 4 m/s$

↑ Final Velocity

So using equation of motion $v^2 - u^2 = 2aS$

$v^2 - u^2 = 2aS$

$(4)^2 - (0)^2 = 2(2)(S)$

$16 - 0 = 4S$

$16 = 4S$

or $\frac{16}{4} = \frac{4}{4}S$

So, $\boxed{S = 4m}$

Ans $S = 4m$ (distance)

② A body starts with an initial velocity of 10m/s and acceleration $5m/s^2$. Find the distance covered by a body in 5s.

(2) Solution :→ $u = 10 m/s$
$a = 5 m/s^2$
$t = 5 sec$
$S = ?$ (distance)

$v = u + at$
$v = 10 + 5 \times 5$
$v = 10 + 25$
$v = 35 m/s$

Using $v^2 - u^2 = 2as$
$(35)^2 - (10)^2 = 2 \times 5 \times s$
$1225 - 100 = 10s$
$1125 = 10s$
$\frac{1125}{10} = s$
or $112.5 = s$
$\therefore \boxed{s = 112.5 m}$

Numerical-3 :→ A body, initially at rest starts moving with a constant acceleration of $2 m/s^2$. Calculate (a) velocity acquired (b) the distance travelled in 5s.

Solution →
(a) The Body is initially at rest $\therefore u = 0$
$a = 2 m/s^2$
$t = 5s$

$v = u + at$
$v = 0 + 2 \times 5$
$\boxed{v = 10 m/s}$

(b) $s = ?$ (distance)
$v^2 - u^2 = 2as$
$(10)^2 - (0)^2 = 2 \times 2 \times s$ ($\because v = 10 m/s$)
$100 - 0 = 4s$
$100 = 4s$
$\frac{100}{4} = s$ or $\boxed{s = 25 m}$ Ans

Numerical 3 :→ A Bullet initially moving with velocity 20m/s strikes a target and comes to rest after penetrating a distance 10cm in the target. Calculate the retardation caused by the target ?

Solution :→ $u = 20 m/s$

$v = 0$

$s = 10cm = \frac{10}{100} m = \frac{1}{10} m = 0.1m$ [$\because 1m = 100cm$]

$s = 0.1m$

Retardation $= ? = a$

Using $v^2 - u^2 = 2as$

$(0)^2 - (20)^2 = 2 \times a \times 0.1m$

$0 - 400 = 0.2a$

$-400 = 0.2a$

$\frac{-400}{0.2} = a$

or $a = \frac{-400 \times 10^5}{2} \neq -2000$

$a = -2000 m/s^2$

So retardation $= 2000 m/s^2$

Numerical 4 :→ A train is moving with a velocity of 90 Km/h. It is brought to stop by applying the brakes which produce a retardation of $0.5 m/s^2$. find :- (i) the velocity after 10s (ii) the time taken by the train to come to rest.

Solution :→ $u = 90 Km/hr = \frac{90 \times 5}{18} = 25 m/s$

$t = 10s$

Retardation $= a = -0.5 m/s^2$ (* Retardation comes therefore we use negative sign)

(i) velocity after 10s = ?

$v = u + at$

$v = 25 + (-0.5) \times 10$

$v = 25 - 10 \times 0.5$

$v = 25 - 10 \times \frac{5}{10}$

$v = 25 - 5 = 20\ m/s$ Ans

(ii) $t = ?$ (time taken by the train when it comes to rest, it means $v = 0$ (final velocity)

$u = 25\ m/s$ Ans

$v = u + at$

$0 = 25 + (-0.5) \times t$

$0 = 25 - 0.5t$

or $25 = 0.5t$

or $0.5t = 25$

$t = \frac{25}{0.5} = \frac{25^{5} \times 10}{5} = 50\ sec$

$t = 50\ sec$ Ans

Numerical 5 :→ A car travels a distance of 100m with a constant acceleration and average velocity of 20m/s. The final velocity acquired by the car is 25m/s find (i) the initial velocity (ii) acceleration of the car

Solution :→

$s = 100m$

Av. velocity $= 20\ m/s$

$v = 25\ m/s$

(i) Initial velocity, $u = ?$

We know av. velocity $= \frac{u + v}{2}$ — (1)

So average velocity = 20m/s (given)

Using values in Equation ① we get;

$$20\,m/s = \frac{u+25}{2} \quad \text{(u we have to find)}$$

$$40 = u + 25$$

So $u = 40 - 25 = 15\,m/s$

So initial velocity = 15m/s Ans

(ii) Acceleration = ? as $v = 25\,m/s$, $u = 15\,m/s$

$a = ?$, $s = 100\,m$

Using relation; $v^2 - u^2 = 2as$

$$(25)^2 - (15)^2 = 2 \times a \times 100$$

$$625 - 225 = 200a$$

$$400 = 200a$$

$$\text{or } a = \frac{400}{200} = 2 \quad \text{or } \boxed{a = 2\,m/s^2}$$

Ans

Numerical-6 :→ When brakes are applied to bus, the retardation produced is 25 cm/s² and bus takes 20s to stop Calculate (i) The initial velocity of the bus (ii) The distance travelled during this time by bus

Solution :→ Retardation (a) = $-25\,cm/s^2$

$$= \frac{-25}{100}\,m/s^2 \qquad [1m = 100\,cm \text{ or } 1cm = \frac{1}{100}\,m]$$

$$= -0.25\,m/s^2$$

$t = 20s$, $u = ?$, $v = 0$ (∵ body stops)

$u = ?$

$$v = u + at$$

$$0 = u + (-0.25) \times 20$$

$$0 = u - 20 \times 25/100$$

$$0 = u - \frac{25}{100} \times 20$$

$$0 = u - 5$$

$$u = 5 \text{ m/s}$$ Ans

(ii) $s = ?$, $t = 20s$, $v = 0$, $u = 5 \text{ m/s}$, $a = -0.25 \text{ m/s}^2$

So using $v^2 - u^2 = 2as$

$$(0)^2 - (5)^2 = 2 \times (-0.25) \times s$$

$$0 - 25 = -2 \times 0.25 \times s$$

$$-25 = -\frac{25}{100} \times 2 \times s$$

$$+25 = +\frac{s}{2}$$

$$25 \times 2 = s$$

$$s = 50 \text{ m}$$ Ans

Numerical 7:→ A Car travels with a uniform velocity of 25 m/s for 5s. The brakes are applied then it comes to rest in further 10s.

Find (i) The distance which the car travels before the brakes applied

(ii) The retardation

(iii) The distance travelled by the car after applying brakes.

Solution:→ $u = 25 \text{ m/s}$, $v = 0$, $t = 10s$

$$v = u + at$$

$$0 = 25 + a \times 10$$

$$0 = 25 + 10a$$

or, $10a = -25$

$$a = -\frac{25}{10} = -2.5 \text{ m/s}^2$$

(ii) So retardation ; $a = -2.5 m/s^2$ (Ex-7)

(i) The distance travelled by the car before applying the brakes = ? , $t = 5s$

uniform speed = 25 m/s

$s = ?$

Speed = $\frac{\text{distance}}{\text{Time}}$

or distance = Speed x time

$s = 25 \times 5$

$\boxed{s = 125 m}$ Ans

(iii) distance After brakes were applied = ?

$v = 0$

$u = 25 m/s$

$a = -2.5 m/s^2$, $s = ?$

Using ; $v^2 - u^2 = 2as$

$(0)^2 - (25)^2 = 2 \times (-2.5) \times s$

$0 - 625 = -2 \times 2.5 \times s$

$-625 = -2 \times 2.5 \times s$

$625 = 5s$

or $\frac{625}{5} = s$

$\frac{125}{}$

$\boxed{s = 125 m}$ Ans