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Answers Key:

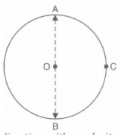
5 Marks

1. By definition
$a = \frac{dv}{dt}$
$dv = a\,dt$
Integrating both sides
$\int_{v_0}^{v} dv = \int_0^t a\,dt$
$= a\int_0^t dt$
(a is constant)
$v - v_0 = at$
$v = v_0 + at$
Further,
$v = \frac{dx}{dt}$
$dx = v\,dt$
Integrating both sides
$\int_{x_0}^{x} dx = \int_0^t v\,dt$
$= \int_0^t (v_0 + at)dt$
$x - x_0 = v_0 t + \frac{1}{2}at^2$
$x = x_0 + v_0 t + \frac{1}{2}at^2$
We can write
$a = \frac{dv}{dt} = \frac{dv}{dx}\frac{dx}{dt} = v\frac{dv}{dx}$
or, $v\,dv = a\,dx$
Integrating both sides,
$\int_{v_0}^{v} v\,dv = \int_{x_0}^{x} a\,dx$
$\frac{v^2 - v_0^2}{2} = a(x - x_0)$
$v^2 = v_0^2 + 2a(x - x_0)$
The advantage of this method is that it can be used for motion with non-uniform acceleration also.
Now, we shall use these equations to some important cases.

3 Marks

2. (i) Time taken by man to go from his home to market
$t_1 = \frac{Distance}{Speed} = \frac{2.5}{5}h$
Time taken by man to go from market to his home
$t_2 = \frac{2.5}{5} = \frac{1}{3}h$
Total time taken,$t_1 + t_2 = \frac{1}{2} + \frac{1}{3} = \frac{5}{6}h = 50min$
0 to 30 min
(a) Average velocity $= \frac{Displacement}{Time} = \frac{2.5}{1/2} = 5km/h$
(b) Average speed $= \frac{Distance}{Time} = \frac{2.5}{1/2} = 5km/h$
(ii) Time taken by man to go from his home to market
$t_1 = \frac{Distance}{Speed} = \frac{2.5}{5}h$
Time taken by man to go from mae=rket to his home
$t_2 = \frac{2.5}{5} = \frac{1}{3}h$
Total time taken,$t_1 + t_2 = \frac{1}{2} + \frac{1}{3} = \frac{5}{6}h = 50min$
0 to 50 min
Total distance travelled = 2.5 + 2.5 = 5 km.
Total displacement = 2.5 -2.5 = 0
(a) Average velocity $= \frac{Displacement}{Time} = 0$
(b) Average speed $= \frac{Distance}{Time} = \frac{5}{5/6} = 6km/h$
(iii) Time taken by man to go from his home to market
$t_1 = \frac{Distance}{Speed} = \frac{2.5}{5}h$
Time taken by man to go from mae=rket to his home
$t_2 = \frac{2.5}{5} = \frac{1}{3}h$
Total time taken,$t_1 + t_2 = \frac{1}{2} + \frac{1}{3} = \frac{5}{6}h = 50min$
Distance moved in 30 in (from home to market)
= 25 km
Distance moved in 10 min (from market to home) with speed
7.5 km/h $= 7.5 \times \frac{10}{60} = 1.25km$
So, displacement = 2.5-1.25 = 1.25km
Distance travelled = 2.5+1.25 = 3.75 km
(a) Average velocity $= \frac{1.25}{(40/60)} = 1.875km/h$
(b) Average speed $= \frac{3.75}{(40/60)} = 5.625km/h$
3.

Length of minute hand = radius of circle described by minute hand r = 10 cm = 0.1 m.
From 12.00 noon to 12.30 p.m., the tip of minute hand covers a net displacement equal to the diameter of circle. Hence
Displacement $\overline{AOB}$ = 2 x r = 2 x 0.1 m = 0.2 m
During the same time total distance covered by tip of minute hand = semicircular path ACB = πr = 3.14 x 0.1 = 0.31 m.



4. Three important characteristics of displacement are:
(i) Displacement is a vector quantity having both magnitudes as well as direction.
(ii) Displacement of a particle between two given positions is unique and is the shortest path through which particle may go from its initial to final position.
(iii) Displacement is independent of the choice of origin to the co-ordinate system.

2 Marks

5. (i) u = 0, a = 0.1 m / s^2 and t = 2 min 120 m / s
v = u + at
= 0 + 0.1 $\times$120
= 12 m / s
(ii) u = 0, a = 0.1 m / s^2 and t = 2 min 120 m / s
$v = ut + \frac{1}{2}at^2$
$= 0 + \frac{1}{2} \times 0.1 \times (120)^2$
$= \frac{1}{2} \times 0.1 \times 120 \times 120$
= 720 m
6. The effective distance travelled by drunked in 8 steps = 5-3 = 2 m
Therefore, he takes 32 steps to move 8 m
Now he will have to cover 5 m more to reach the pit, for which he has to take only 5 forward steps.
Therefore, he will have to take = 32 + 5 = 37 steps to move 13 m. Thus, he will fall into the pit after taking 37 steps. i.e., after 37 s from the start.
7. The change in the position co-ordinates of a particle over a given period of time is called the displacement of the particle.
8. $t = \sqrt{2\frac{h}{g}}$
$t' = \sqrt{\frac{2}{g}.\left(\frac{h}{2}\right)} = \sqrt{\frac{h}{g}}$
$\Rightarrow t' = \frac{t}{2}$.
9. Speed is always +ve. Displacement can have -ve, 0 or +ve values.
10. (i) OB, because the slope has greater angle
(ii) Ratio of two velocities
$\frac{v_A}{v_B} = \frac{\tan 30^\circ}{\tan 60^\circ} = \frac{1/\sqrt{3}}{\sqrt{3}} = \frac{1}{3}$

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Multiple Choice Question

11. (a) 7/4 m/s
12. (d) None
13. (a) 14m/s
14. (a) Displacement
15. (c) Straight line inclined to both the axis
16. (a) 40 kmph
17. (d) remains constant
18. (b) 9.8 m
19. (d) the acceleration of the particle is '2a'.