BK BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
SENIOR SECONDARY CO-ED DAY CUM BOYS' RESIDENTIAL SCHOOL

PRE MID TERM EXAMINATION -2024-25

PHYSICS (042)

Class : XI
Date : 02/08/2024

Duration: **1 Hr**
Max. Marks: **25**

Marking Scheme

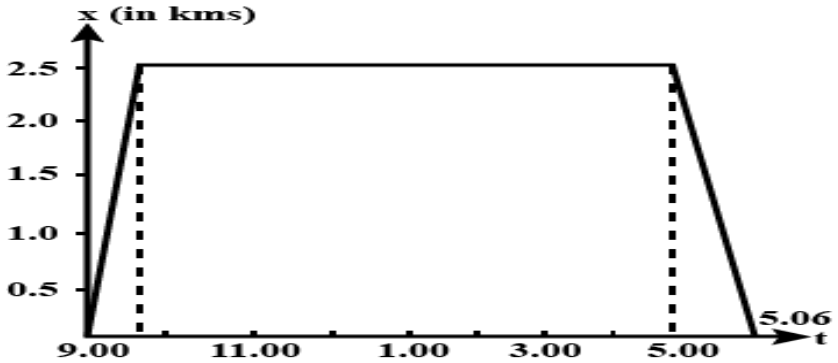
Section A

1. (b) velocity
2. (c) 13 m/s
3. (a) 5 hours
4. (c) If Assertion is true but Reason is false.
5. (a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.

Section B

6. If the velocity of a body varies unequally in equivalent gaps or intervals of time, then the body is said to have a non-uniform motion. Hence, we can say that the rate of change of its velocity variates at different points of time during its motion. Motion of a car in huge traffic. 1+1

7. Speed of the woman = 5 km/h 2
   Distance between her office and home = 2.5 km
   Time taken = Distance / Speed
   = 2.5 / 5 = 0.5 h = 30 min
   It is given that she covers the same distance in the evening by an auto.
   Now, speed of the auto =25 km/h
   Time taken = Distance / Speed
   = 2.5/25=1/10=0.1h=6 min
   The suitable x-t graph of the motion of the woman is shown in the given figure.



8. Speed: (Any Other Difference is also acceptable) 1

Speed is how fast an object is moving. It is calculated by the distance covered per unit of time.

Speed has only magnitude, i.e. it is a scalar quantity.

Velocity: 1

Velocity is the rate at which an object changes position in a certain direction. It is calculated by the displacement per unit of time in a certain direction.

Velocity has a direction as well as magnitude, i.e. it is a vector quantity.

9. Average acceleration refers to the rate at which the velocity changes. 1/2

Aavg = Δv / Δt 1/2

Instantaneous acceleration a, or acceleration at a specific instant in time 1/2

Instantaneous acceleration is expressed mathematically as

a(t)=dv(t)/dt

1/2

Section C

10. (a) Total distance travelled = 23 km (1.5+1.5)

Total time taken = 28 min = 28/60 h

∴Average speed of the taxi = Total Distance Travelled / Total Time Taken

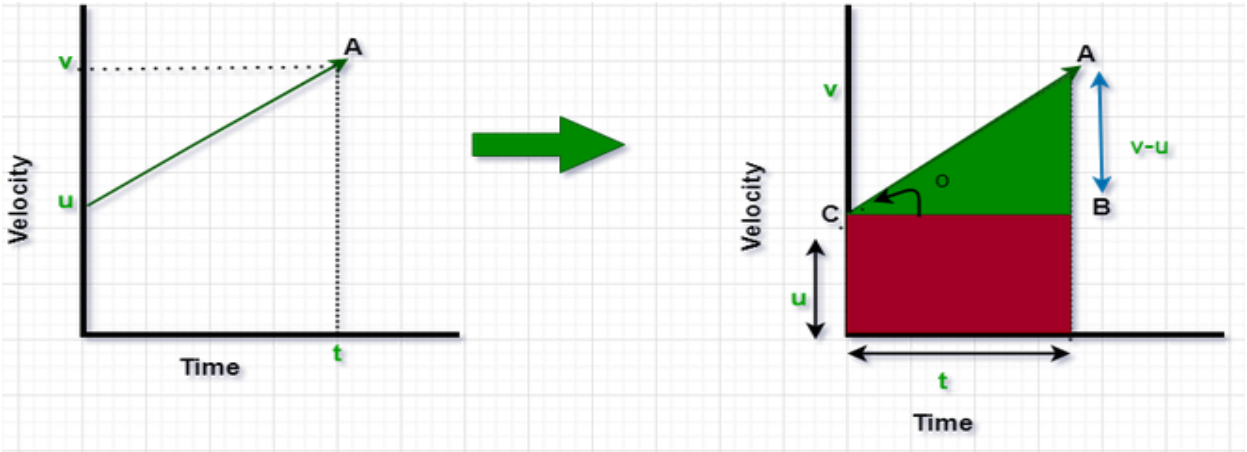
= 23 / (28/60) = 49.29 km/h

(b) Distance between the hotel and the station = 10 km = Displacement of the car

∴Average velocity = 10 / (28/60) = 21.43 km/h

therefore, these two: average speed and average velocity are not equal.

11. The plot shows that the object has a variable velocity that is increasing from u to v as the slope is positive velocity is increasing in a positive direction. (1+1+1)



The velocity-time graph

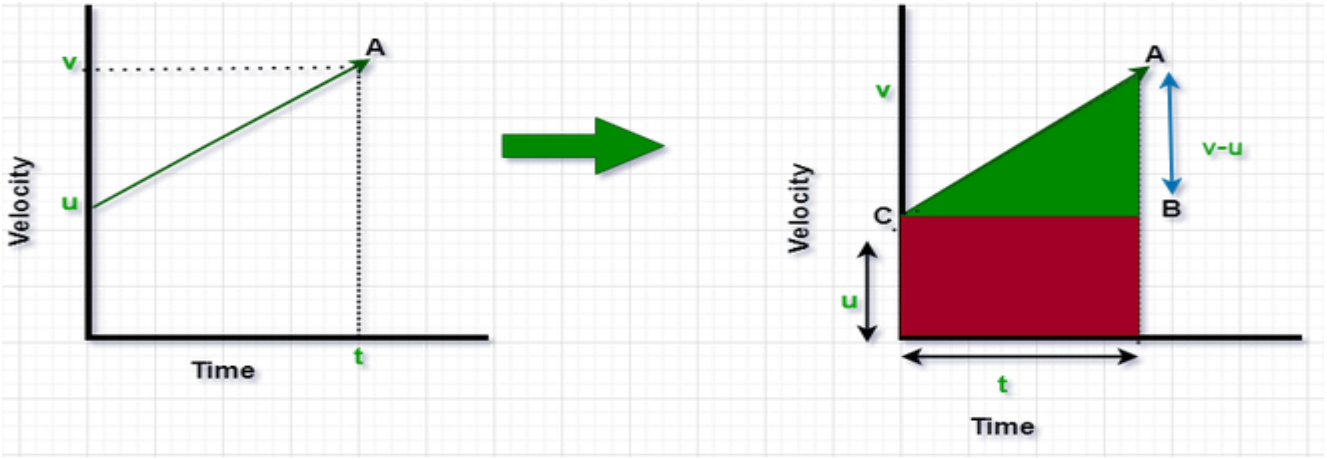
Now we will calculate the acceleration using this motion graph. Acceleration is the tangent of the angle in v-t graph.

$a=\frac{v-u}{t}$

v= u+at

Derivation of Second equation of motion graphically:

Below v-t graph shows the velocity and time relationship of an object with an initial velocity of u m/s and final velocity of v m/s. As we know the area of the v-t graph gives the displacement of the object, so we will calculate the area of the graph and find out the equation of displacement.



The Displacement of the object (d) = Area of triangle ABC + Area of rectangle BCOT

Here, the area of the triangle ABC = 1/2 × Base × Height

= 1/2 × t × (v-u)

And the area of the rectangle BCOT = Length × Width

= u × t

Therefore, the displacement of the object, d = 1/2 × t × (v-u) + ut

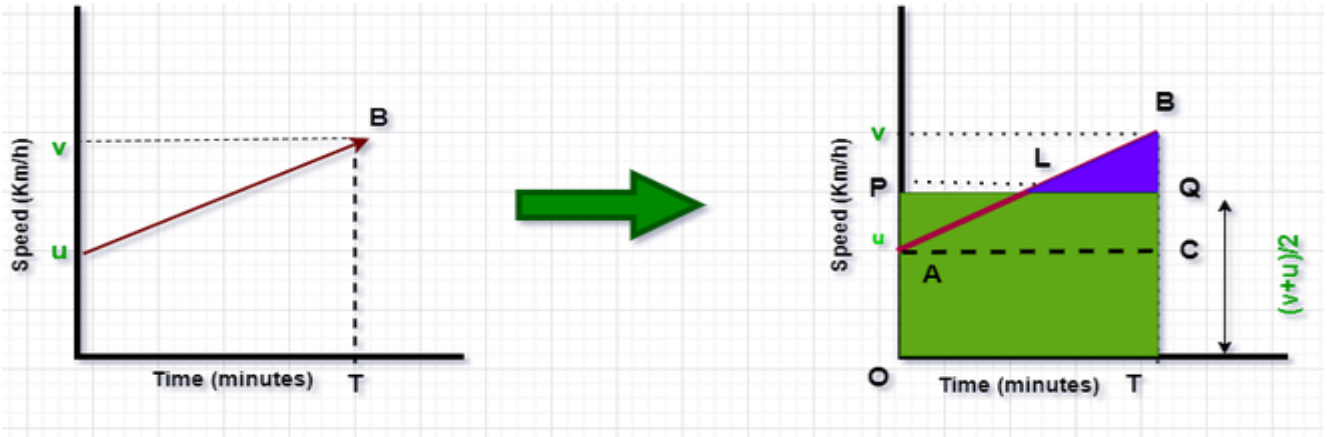
Also, from the first equation of motion, v – u = at

Substitute at for v-u in the equation (1),

d = 1/2 × t × (at) + u × t

$d = ut + (1/2)at^2$

Derivation of Third equation of motion graphically:



Original graph to highlighted graph

Here, P is the Centre point, so the speed of the object is (v + u) / 2.

Therefore, the displacement of the object (d) = the area of the triangle ABC + the area of the rectangle ACTO = the area of the rectangle OPQT

The displacement of the object, d = Length × Width

= t × (v + u)/2

Also, from the first equation of motion, v – u = at or t = (v – u) / a

Therefore, the equation (2) becomes:

d = (v – u) / a × (v + u) / 2

v2 = u2 – 2ad

12. u=126 km/h=126×518m/s=35m/s

v=0

s=200m

Newton's Equation of motion

v2−u2=2as 1

02−352=2a(200)

a=−3.**0625 m**/s^2 1

Also

v=u+at

0=35−3.06t

t=11.4s 1

13. Position is given as $x = a + bt^2$

$= 8.5 + 2.5t^2$

Position at t = 2 s, $x_2 = 8.5 + 2.5(2)^2 = 18.5$ m 1

Position at t = 4 s, $x_1 = 8.5 + 2.5(4)2 = 48.5$ m

Displacement, $S = x_2 - x_1 = 48.5 - 18.5 = 30$ m

Time taken, t = 4 − 2 = 2 s Average velocity,

Vavg = S/t = 30/2 = 15 m/s 1/2

$x(t) = a + bt^2$

$$v = \frac{dx}{dt} = \frac{d}{dt}\left(a + bt^2\right) = 2bt$$

V(t)=2bt

v(0)=0

$v(2)=2b(2)=4b=4(2.5) = 10\ ms^{-1}$

$v(2)= 10\ ms^{-1}$ 1.5

----------**The End**----------