PM SHRI KENDRIYA VIDYALAYA GACHIBOWLI, GPRA CAMPUS, HYD–32
PRACTICE PAPER 02 (2024–25)
CHAPTER 07 MOTION (ANSWERS)

SUBJECT: SCIENCE   **MAX. MARKS : 40**
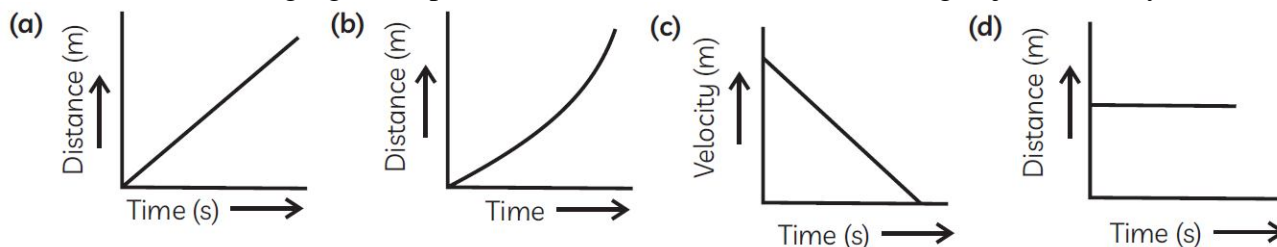**CLASS : IX**   **DURATION : 1½ hrs**

General Instructions:
(i).   **All** questions are compulsory.
(ii).   This question paper contains 2**0** questions divided into five Sections A, B, C, D and E.
(iii). **Section A** comprises of **10 MCQs** of **1 mark** each. **Section B** comprises of 4 questions of **2 marks** each. **Section C** comprises of 3 questions of **3 marks** each. **Section D** comprises of 1 question of **5 marks** each and **Section E** comprises of 2 Case Study Based Questions of **4 marks** each.
(iv).   There is no overall choice.
(v).   Use of Calculators is not permitted

SECTION – A
Questions 1 to 10 carry 1 mark each.
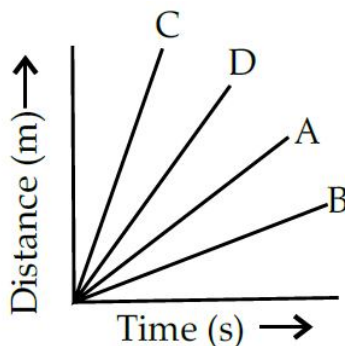
1. For a moving object, the numerical ratio of displacement to distance is:
    (a) always less than 1   (b) always equal to 1
    (c) always greater than 1   (d) equal or less than 1
    Ans: (d) equal or less than 1

2. Rita was enjoying a ride on a Ferris wheel which is revolving at a constant speed of 5 m/s. This shows that Rita is:
    (a) at rest   (b) moving with no acceleration
    (c) in accelerated motion   (d) moving with uniform velocity
    Ans: (c) in accelerated motion

3. The slope of the Distance-Time graph and Velocity-Time graph represents:
    (a) both represent acceleration   (b) speed and acceleration respectively
    (c) acceleration and speed respectively   (d) both represent speed
    Ans: (b) speed and acceleration respectively

4. The horizontal straight line on distance-time graph indicates:
    (a) increasing velocity   (b) decreasing velocity
    (c) zero velocity   (d) constant velocity
    Ans: (c) zero velocity

5. Which of the following figures represents the uniform motion of a moving object correctly?

    Ans: Distance in graph (a) is uniformly increasing with time, hence it represents uniform motion.

6. Name the instrument which is used to measure the instantaneous speed of a vehicle.
    (a) Multimeter   (b) Ammeter   (c) Speedometer   (d) Accelerator
    Ans: (c) Speedometer

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7. Four cars A, B, C and D are moving on a levelled road. Their distance versus time graphs is shown in figure. Choose the correct statement.

(a) Car A is faster than car D
(b) Car B is the slowest
(c) Car D is faster than car C
(d) Car C is the slowest.
Ans. Option (b) is correct.

8. Suppose a boy is enjoying a ride on a merry-goround which is moving with a constant speed of 10 m/s. It implies that the boy is :
(a) At rest
(b) Moving with no acceleration
(c) In accelerated motion
(d) Moving with uniform velocity.
Ans. Option (c) is correct.

In the following questions 9 and 10, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.
(a) Both the Assertion and the Reason are correct and the Reason is the correct explanation of the Assertion.
(b) The Assertion and the Reason are correct but the Reason is not the correct explanation of the Assertion.
(c) Assertion is true but the Reason is false.
(d) Assertion is false but the Reason is true.

9. Assertion (A): The displacement-time graph of a body moving uniformly is a straight line.
Reason (R): A body travelling with uniform velocity covers equal distances in equal intervals of time with changing direction.
Ans: (a) Both the Assertion and the Reason are correct and the Reason is the correct explanation of the Assertion.

10. Assertion (A): If the velocity of a body in uniform motion changes, its acceleration cannot remain constant.
Reason (R): If a body is thrown vertically upward, the relationship between initial velocity (u) and acceleration (a) at any moment is $v^2 - u^2 = 2as$.
Ans: (d) Assertion is false but the Reason is true.

SECTION – B
Questions 11 to 14 carry 2 marks each.

11. A train starting from a railway station and moving with uniform acceleration attains a speed 40 km h^{-1} in 10 minutes. Find its acceleration.
Ans:
Given parameters
Initial velocity (u) = 0

Final velocity (v) = 40 km/h
v = 40 × (5/18)
v = 11.1111 m/s
Time (t) = 10 minute
t = 60 x 10
t = 600 s
Acceleration (a) =?
Consider the formula
v = u + at
11.11 = 0 + a × 600
11,11 = 600 a
a = 11.11/600
a = 0.0185 ms^{-2}

12. A bus decreases its speed from 80 km h^{-1} to 60 km h^{-1} in 5 s. Find the acceleration of the bus.
Ans: Given, the initial velocity (u) = 80km/hour = 80000m/3600s= 22.22 m.s^{-1}
The final velocity (v) = 60km/hour = 60000m/3600s= 16.66 m.s^{-1}
Time frame, t = 5 seconds.
Therefore, acceleration (a) =(v-u)/t = (16.66 m.s^{-1} – 22.22 m.s^{-1})/5s
= -1.112 m.s^{-2}
Therefore, the total acceleration of the bus is -1.112m.s^{-2}. It can be noted that the negative sign indicates that the velocity of the bus is decreasing.

13. A body is thrown vertically upwards with a velocity and caught back.
(a) What is its displacement and distance travelled?
(b) How do the displacement and distance change if its velocity of projection is halved?
Ans: (a) Displacement = zero; distance = twice the height reached by the body.
(b) Displacement remains unchanged, i.e. zero.
Distance travelled reduces as h = u^2/2a (where u is velocity of projection and a is acceleration during vertical motion).

14. Distinguish between uniform and non uniform acceleration.
Ans:

Uniform acceleration	Non-uniform acceleration
• The velocity of the body changes regularly with time. • The velocity-time graph is a straight line inclined at x-axis, having positive or negative slope.	• The velocity of the body changes irregularly with time. • The velocity-time graph is a curve or irregularly shaped.

SECTION – C
Questions 15 to 17 carry 3 marks each.

15. A bus starting from rest moves with a uniform acceleration of 0.1 m s^{-2} for 2 minutes. Find (a) the speed acquired, (b) the distance travelled.
Ans: (a) Given, the bus starts from rest. Therefore, initial velocity (u) = 0 m/s
Acceleration (a) = 0.1 m.s^{-2}
Time = 2 minutes = 120 s
Acceleration is given by the equation a=(v-u)/t
Therefore, terminal velocity (v) = (at)+u
= (0.1 m.s^{-2} * 120 s) + 0 m.s^{-1}
= 12 m.s^{-1} + 0 m.s^{-1}
Therefore, terminal velocity (v) = 12 m/s

(b) As per the third motion equation, $2as = v^2 - u^2$
Since $a = 0.1$ m.s^{-2}, $v = 12$ m.s^{-1}, $u = 0$ m.s^{-1}, and $t = 120$ s, the following value for s (distance) can be obtained.
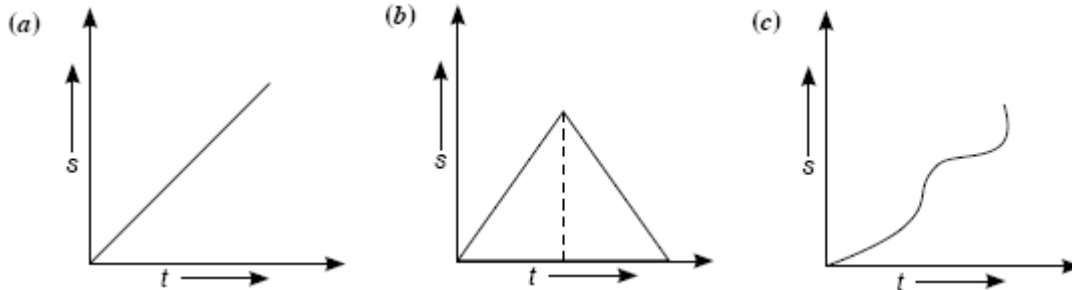Distance, s $= (v^2 - u^2)/2a$
$= (12^2 - 0^2)/2(0.1)$
Therefore, $s = 720$ m.
The speed acquired is 12 m.s^{-1} and the total distance travelled is 720 m.

16. What type of motion is represented by following displacement-time graph:

Ans: (a) Linear motion with constant velocity.
(b) Linear motion with constant velocity after which the direction of motion reverses and body moves with constant velocity.
(c) Non-uniform motion.

17. A stone is thrown in a vertically upward direction with a velocity of 5 m s^{-1}. If the acceleration of the stone during its motion is 10 m s^{-2} in the downward direction, what will be the height attained by the stone and how much time will it take to reach there?
Ans: Given, initial velocity (u) = 5 m/s
Terminal velocity (v) = 0 m/s (since the stone will reach a position of rest at the point of maximum height)
Acceleration = 10 ms^{-2} in the direction opposite to the trajectory of the stone = -10 ms^{-2}
As per the third motion equation, $v^2 - u^2 = 2as$
Therefore, the distance travelled by the stone (s) = $(0^2 - 5^2)/ 2(10)$
Distance (s) = 1.25 meters
As per the first motion equation, $v = u + at$
Therefore, time taken by the stone to reach a position of rest (maximum height) = $(v - u) /a$
$= (0-5)/-10$ s
Time taken = 0.5 seconds
Therefore, the stone reaches a maximum height of 1.25 meters in a timeframe of 0.5 seconds.
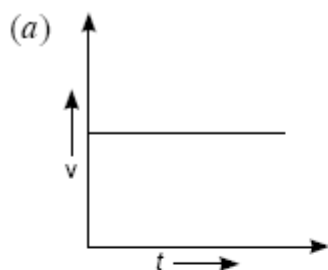
SECTION – D
Questions 18 carry 5 marks each.

18. (a) Draw a velocity-time graph for an object in uniform motion. Show that the slope of velocity time-graph gives acceleration of the body.
(b) An aeroplane starts from rest with an acceleration of 3 ms^{-2} and takes a run for 35 s before taking off. What is the minimum length of runway and with what velocity the plane took off?
Ans:

(a)

$$\text{Acceleration} = \frac{\text{Velocity change}}{\text{Time interval}}$$

or $\qquad a = \dfrac{y - \text{intercept in } v-t \text{ graph}}{x - \text{intercept in } v-t \text{ graph}}$

or $\qquad a = \text{Slope of } v\text{-}t \text{ graph}$

Hence, proved.

(b) $\qquad$ Initial velocity $u = 0$

$\qquad\qquad$ Acceleration $a = 3 \text{ ms}^{-2}$
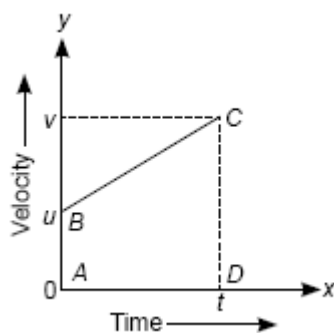
$\qquad\qquad$ Time $t = 35 \text{ s}$

Velocity of taken off $= v = u + at$

$\qquad\qquad = 0 + 3 \times 35 = 105 \text{ ms}^{-1}$

Length of runway, $s = ut + \dfrac{1}{2}at^2$

$\qquad\qquad = 0 + \dfrac{1}{2} \times 3 \times 35 \times 35$

$\qquad\qquad = 1837.5 \text{ m}$

OR

Draw velocity time graph for a body that has initial velocity 'u' and is moving with uniform acceleration 'a'. Use it to derive $v = u + at$; $s = ut + \dfrac{1}{2} at^2$, and $v^2 = u^2 + 2as$

Ans: Slope of graph, $= a = $ acceleration

$\therefore \qquad\qquad a = \dfrac{v - u}{t} \qquad \text{or} \quad v = u + at$

$\qquad\qquad s = \text{area of ABCD}$

$\qquad\qquad s = \dfrac{1}{2}(AB + CD)(AD)$

$$s = \frac{1}{2}(u + v)(t) \qquad \qquad \ldots(i)$$

$$s = \frac{1}{2}(u + u + at)(t) \qquad \text{(from first equation)}$$

$$s = \frac{1}{2}(2u + at)t$$

or

$$s = ut + \frac{1}{2}at^2$$

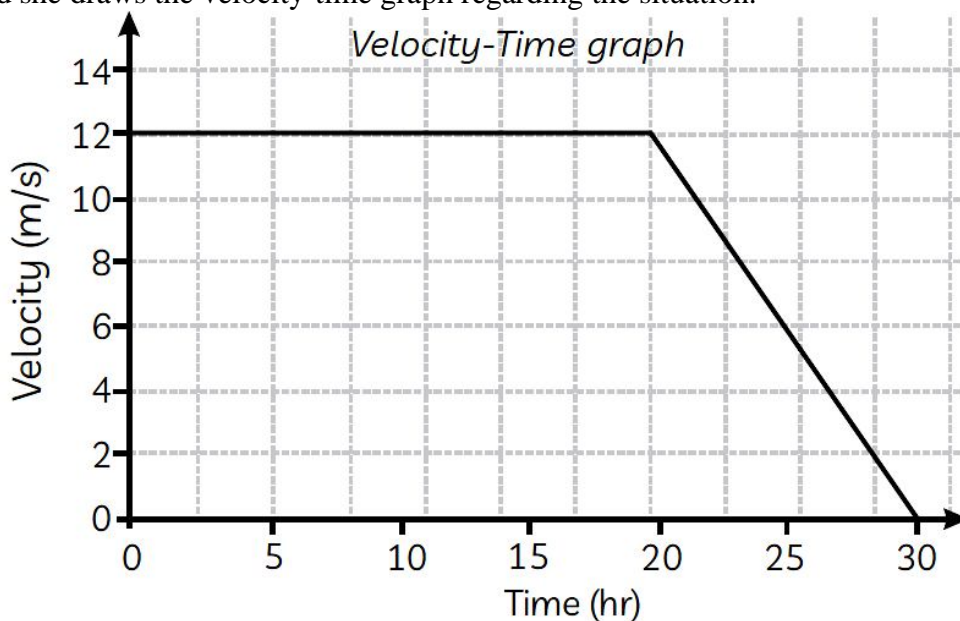$$s = \frac{1}{2}(u + v)\frac{(v-u)}{a}$$

$$s = \frac{v^2 - u^2}{2a}$$

or

$$v = u^2 + 2as$$

SECTION – E (Case Study Based Questions)
Questions 19 to 20 carry 4 marks each.

19. **Read the following information and answer the questions based on information and related studied concepts.**

Ritesh was driving car to his office. When suddenly a boy came in between the road, he applied brakes suddenly to save the child and the car came to the rest. The whole scenario was observed by Sita and she draws the velocity-time graph regarding the situation.

(a) Calculate the displacement of the car after 20 seconds?

(b) After deceleration, how far does the car go?

(c) Describe the motion of the car from 0 s to 30 s.

Ans: (a) The area under the line on a velocity-time graph is equal to the displacement of the object.

The car's displacement is equal to the rectangle's area in 20 seconds.

Displacement = Area of rectangle

s = 20 s × 12 m/s

⇒ s = 240 m

(b) The area of the triangle is equal to the displacement while decelerating.

Time = (30–20) s =10 s

Displacement while deceleration = Area of rectangle

s = 1/2 × 10 s × 12 m/s

⇒ s = 60 m

While decelerating, the car moves 60 metres.

(c) Displacement of the car = Area under the graph of velocity time graph

= Area of rectangle + Area of triangle

= 20 s × 12 m/s + (1/2 × 10 s × 12 m/s)

= 240 m + 60 m

= 300 m

Total time = 30 seconds

The average velocity of the car, v = Total Displacement/Time taken

= 300m/30s = 10 m/s

So, the average velocity of a car is 10 m/s.

20. **Read the given passage and answer the questions that follow based on the passage and related studied concepts.**

A bus is moving with a velocity of 50 km/h. The driver sees a child running across the road and he pressed the brakes. The time taken by him to stop the bus in this emergency was 1/10 th of a second. In a second case, another bus was coming on the same road at the same 50 km/h and the driver saw another child crossing the road. He applied the brakes and time taken by him to the emergency was 0.5 sec. Both the buses started moving to their destination after 10 minutes. Bus A moved at 45 km/h while bus B moved at 60 km/h.

(a) What is the distance between buses A and B?

(b) How much distance did the bus move in the 1st case before the driver could press the brakes? How much is the distance between bus A and bus B after 1.5 hours?

(c) How much distance did the bus move in the 2nd case before the driver could press the brakes?

Ans: (a) Velocity of bus A = 45 km/h

Distance covered in 1.5 hours = Velocity × Time = 45 × 1.5 = 67.5 km

Velocity of bus B = 60 km/h

Distance covered in 1.5 hours = 60 × 1.5 = 90 km

The distance between bus A and bus B is 90 km – 67.5 km = 22.5 km

(b) Initial velocity of the bus, u = 50 km/h. = 50 × 5/18

= 250/18 m/s

Distance moved by the bus in 1/10 th of a second

= Velocity of the bus × Time interval

= 250/18 × 1/10

= 1.39 m.

(c) In the 2nd case, distance covered by the bus in 0.5 sec.

= Velocity of the bus × Time interval

= 250/18 × 0.5 = 6.9 m

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