PHYSICS – CLASS XI

Chapter 2 : Motion in a Straight Line

PRACTICE PAPER (Chapter-wise Test)

Time : 1½ Hours **Max. Marks : 35**

General Instructions

(a) All questions are compulsory.

(b) There are 17 questions in total. Section A: Q. 1 to 8 carry 1 mark each. Section B: Q. 9 to 12 carry 2 marks each. Section C: Q. 13 to 15 carry 3 marks each. Section D: Q. 16 and 17 carry 5 marks each.

(c) There is no overall choice. An internal choice is given in one 2-mark question (Q. 11), one 3-mark question (Q. 14) and both 5-mark questions (Q. 16, Q. 17). Attempt only one of the given choices.

(d) Use of calculators is not permitted. Take g = 9.8 m s^{-2} unless a different value is given in the question.

(e) Figures are schematic and not drawn to scale. Write the unit with every numerical answer.

SECTION A

Questions 1 to 8 carry 1 mark each.

1. The position of a particle moving along the x-axis is $x = 4t^2 - 3t + 1$, where x is in metres and t in seconds. Its velocity at $t = 2$ s is **(1)**

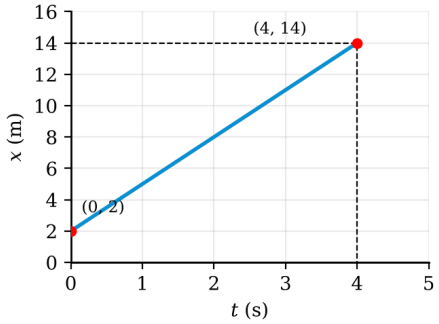
(a) 8 m s^{-1}

(b) 13 m s^{-1}

(c) 16 m s^{-1}

(d) 5 m s^{-1}

2. The position–time graph of a particle moving in a straight line is shown in the figure. The velocity of the particle is **(1)**



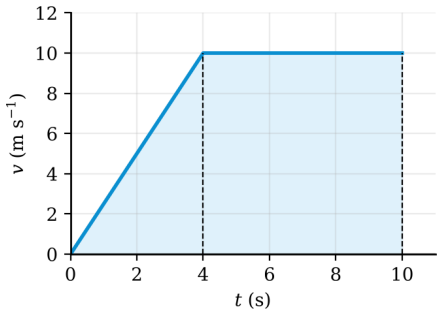
(a) 2 m s^{-1}

(b) 12 m s^{-1}

(c) 3 m s^{-1}

(d) 14 m s^{-1}

3. The velocity–time graph of a body is shown in the figure. The displacement of the body in the first 10 s is **(1)**



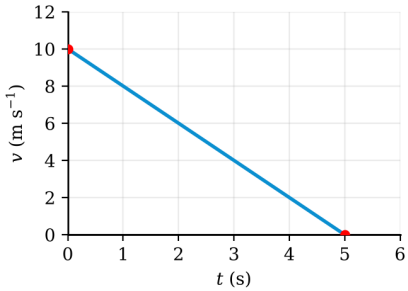
(a) 60 m
(b) 80 m
(c) 100 m
(d) 40 m

4. **Assertion (A):** A body can have zero velocity at an instant and still have a non-zero acceleration at that instant. **(1)**
Reason (R): Acceleration is the rate of change of velocity, not the velocity itself.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

5. A ball thrown vertically upwards is at its highest point. Neglecting air resistance, its velocity and acceleration at that instant are **(1)**
(a) zero and zero
(b) zero and 9.8 m s^{-2} downwards
(c) zero and 9.8 m s^{-2} upwards
(d) non-zero and zero

6. A car moving at 20 m s^{-1} is brought to rest with a uniform retardation of 5 m s^{-2}. Find its stopping distance. **(1)**

7. The figure shows the velocity–time graph of a particle moving along a straight line. Find the acceleration of the particle. **(1)**

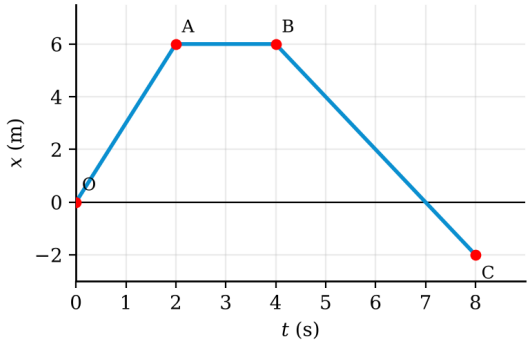


8. A body is released from rest and falls freely under gravity. The ratio of the distances covered by it in the 1st, 2nd and 3rd seconds of its fall is **(1)**
(a) 1 : 2 : 3
(b) 1 : 4 : 9
(c) 1 : 3 : 5
(d) 1 : 3 : 6

SECTION B

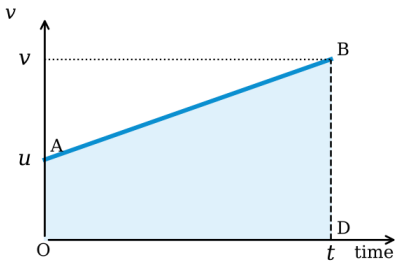
Questions 9 to 12 carry 2 marks each.

9. The position–time graph of a particle moving along a straight line is shown in the figure. (i) Find the velocity of the particle in the intervals OA, AB and BC. (ii) Find the average speed and the average velocity of the particle over the interval 0 to 8 s. **(2)**



10. The position of a particle moving along a straight line is given by $x = t^3 - 6t^2 + 9t$ (in metres, t in seconds). Using differentiation, find (i) the velocity and (ii) the acceleration of the particle at $t = 2$ s. **(2)**

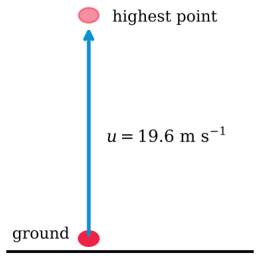
11. The velocity–time graph of a body moving with uniform acceleration a is a straight line AB (figure), the initial velocity being u and the velocity at time t being v. Using the area under the graph, derive the relation $s = ut + \frac{1}{2}at^2$. **(2)**



OR

Show that the distances travelled by a freely falling body (starting from rest) in successive equal intervals of time are in the ratio 1 : 3 : 5 : 7 … .

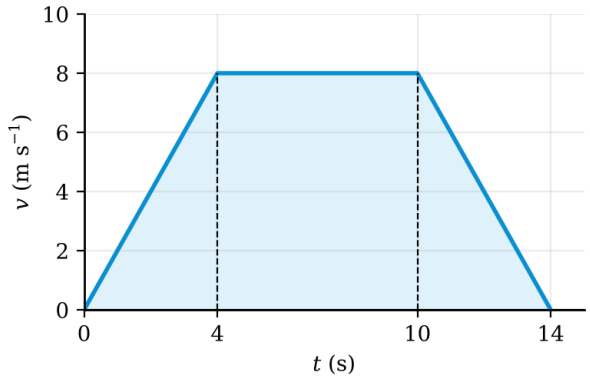
12. A ball is thrown vertically upwards from the ground with a speed of 19.6 m s^{-1} (figure). Neglecting air resistance, find (i) the maximum height reached by the ball and (ii) the time taken by it to return to the ground. **(2)**



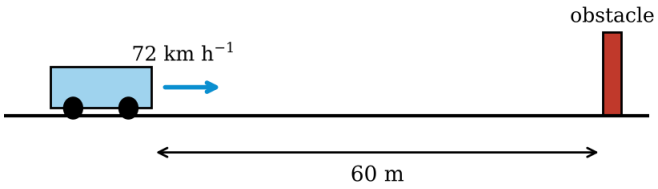
SECTION C

Questions 13 to 15 carry 3 marks each.

13. The velocity–time graph of a lift moving upwards in a building is shown in the figure. (i) Find the acceleration of the lift in each of the three stages of its motion. (ii) Find the total distance travelled by the lift. **(3)**



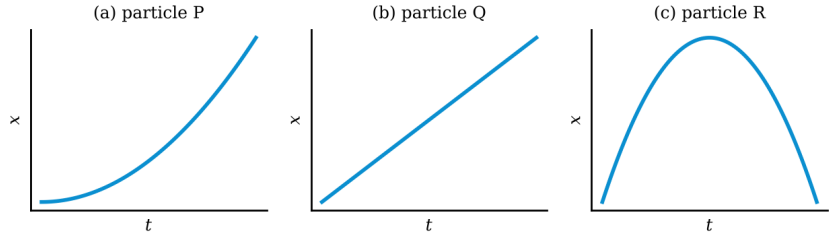
14. A driver travelling at 72 km h^{-1} sees an obstacle 60 m ahead on the road (figure). The driver's reaction time is 0.5 s and the brakes then produce a uniform retardation of 5 m s^{-2}. Will the car stop before reaching the obstacle? Support your answer with calculation. **(3)**



OR

A student measures her reaction time by asking a friend to drop a ruler through her fingers. (i) The ruler falls through 19.6 cm before she catches it. Find her reaction time. (ii) How far would the ruler fall if her reaction time were 0.3 s?

15. The position–time graphs of three particles P, Q and R moving along a straight line are shown in the figure. For each particle, state the sign of the acceleration (positive, zero or negative) with a reason, and say whether the velocity of the particle is increasing, constant or changing from positive to negative. **(3)**



SECTION D

Questions 16 and 17 carry 5 marks each.

16. The position of a particle moving along a straight line is given by $x = 2 + 12t - 3t^2$ (in metres, t in seconds). Its x–t graph is shown in the figure. **(5)**

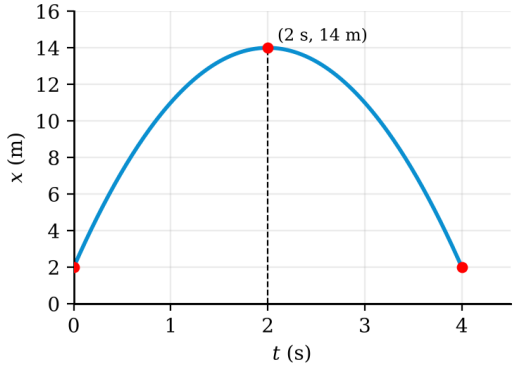
(a) Define instantaneous velocity. (1)

(b) Obtain expressions for the velocity and acceleration as functions of time. (1)

(c) At what time is the particle momentarily at rest? Find its position then. (1)

(d) Find the displacement and the total distance travelled in the first 4 s. (1)

(e) Find the average velocity and average speed for the first 4 s. (1)



OR

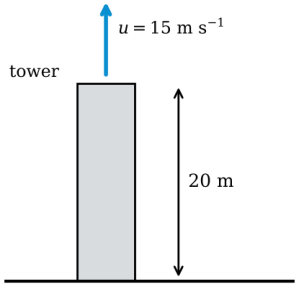
A stone is thrown vertically upwards with a speed of 15 m s^{-1} from the top of a tower 20 m high (figure). Taking g = 10 m s^{-2} and neglecting air resistance, find

(a) the maximum height reached above the top of the tower, (1)

(b) the time taken by the stone to reach the ground, (2)

(c) its velocity just before it strikes the ground, (1)

(d) the total distance travelled by the stone. (1)



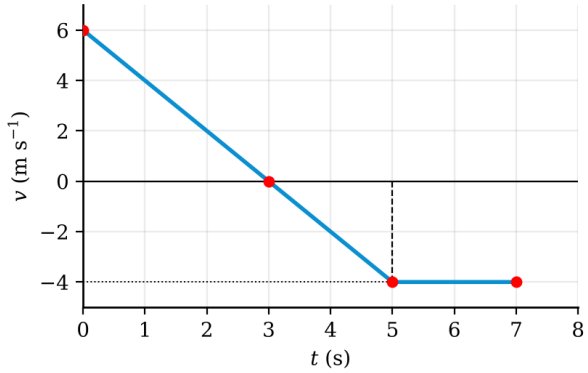
17. The velocity–time graph of a particle moving along a straight line is shown in the figure. **(5)**

(a) Find the acceleration of the particle in the intervals 0–5 s and 5–7 s. (1)

(b) At what instant does the particle reverse its direction of motion? (1)

(c) Find the displacement of the particle in 7 s. (2)

(d) Find the total distance travelled in 7 s. (1)



OR

A car starts from rest and accelerates uniformly at 2 m s^{-2} for 10 s. It then moves with constant velocity for 20 s and finally brought to rest by uniform retardation in the next 5 s.

(a) Sketch the velocity–time graph of the motion. (1)

(b) Find the retardation in the last stage. (1)

(c) Find the total distance travelled by the car. (2)

(d) Find the average speed of the car for the whole journey. (1)

— END OF QUESTION PAPER —