CLASS IX – SCIENCE PRACTICE PAPER (2026-27)

Step-by-Step Solutions and Marking Scheme

Chapter 4: Describing Motion Around Us | Max. Marks: 40

SECTION A – Objective Questions (1 mark each)

Q1 **[1 mark]**

Distance = 30 m + 20 m = 50 m. Taking east as positive, displacement = +30 m – 20 m = +10 m, i.e. 10 m towards east.

Answer: (A)

Q2 **[1 mark]**

Velocity = slope of the position-time graph. P: 60 m ÷ 6 s = 10 m s^{-1}; R: 30 m ÷ 6 s = 5 m s^{-1}; Q is a line parallel to the time axis, so Q is at rest (45 m from the origin).

Hence Q is at rest and P has a greater velocity than R.

Answer: (B)

Q3 **[1 mark]**

The cyclist returns to the starting point, so displacement = 0 and average velocity = displacement ÷ time = 0. Distance, time and average speed are non-zero.

Answer: (B)

Q4 **[1 mark]**

a = (v – u) ÷ t = (30 – 10) ÷ 5 = 20 ÷ 5 = 4 m s^{-2}.

Answer: (B)

Q5 **[1 mark]**

At the highest point the ball momentarily stops, so v = 0. The acceleration due to gravity (10 m s^{-2}) still acts downwards, so the acceleration is not zero.

Answer: (B)

Q6 **[1 mark]**

From Fig. 2: u = 4 m s^{-1} at t = 0 and v = 16 m s^{-1} at t = 6 s.

Displacement = area under the graph = rectangle + triangle = (4 × 6) + ½ × 6 × (16 – 4) = 24 + 36 = **60 m**.

Answer: (A)

Q7 **[1 mark]**

u = 0, a = 2 m s^{-2}, s = 100 m. Using $v^2 = u^2 + 2as$:

$v^2 = 0 + 2 \times 2 \times 100 = 400$, so v = 20 m s^{-1}.

Answer: (B)

Q8 **[1 mark]**

The area between a velocity-time graph and the time axis equals the displacement in that interval.

Answer: (C)

Q9 **[1 mark]**

Assertion: true. Reason: true. The direction of velocity changes continuously, so the velocity changes and the acceleration is non-zero. R correctly explains A.

Answer: (A)

Q10 **[1 mark]**

Assertion: false. The magnitude of displacement is the straight-line distance between the positions, which is never greater than the path length (distance travelled).

Reason: true.

Answer: (D)

SECTION B – Very Short Answer Questions (2 marks each)

Q11 **[2 marks]**

Any two points (1 mark each):

• Distance travelled is the total length of the path covered; displacement is the net change in position (shortest straight line from initial to final position).

• Distance is a scalar (magnitude only, never negative); displacement needs both magnitude and direction.

• Distance can be greater than or equal to the magnitude of displacement, and distance never decreases, while displacement can be zero even when distance is large.

Q12 **[2 marks]**

(a) (1 mark) In part P the car goes from 0 m to 40 m in 4 s. v = 40 m ÷ 4 s = **10 m s^{-1}**.

(b) (1 mark) In part Q the graph is parallel to the time axis, so the position does not change: the car is **at rest**. Over the whole 8 s the car returns to 0 m, so displacement = 0 and average velocity = 0 ÷ 8 = **0**.

Q13 **[2 marks]**

Step 1 (1 mark): Distance covered together in 1 s = 1.5 + 2.5 = 4 m. They must cover 240 m together.

Step 2 (1 mark): Time = 240 ÷ 4 = **60 s**. (Check: 1.5 × 60 = 90 m and 2.5 × 60 = 150 m; 90 + 150 = 240 m.)

Q14 **[2 marks]**

Option A:

(1 mark) Yes, the vehicle is accelerating.

(1 mark) Although its speed is constant, the direction of its velocity changes continuously along the circular path. Hence the velocity changes and the acceleration is not zero.

Option B:

(1 mark) u = 36 km h^{-1} = 10 m s^{-1}, v = 0, t = 5 s. a = (0 – 10) ÷ 5 = **–2 m s^{-2}**.

(1 mark) The negative sign shows that the acceleration is opposite to the direction of velocity, i.e. the car is slowing down.

SECTION C – Short Answer Questions (3 marks each)

Q15 **[3 marks]**

(i) (1 mark) Distance = 12 + 6 = **18 km**. Displacement = 12 – 6 = **6 km towards east**.

(ii) (1 mark) Total time = 36 + 24 = 60 min = 1 h. Average speed = 18 km ÷ 1 h = **18 km h^{-1}**.

(iii) (1 mark) Average velocity = 6 km ÷ 1 h = **6 km h^{-1} towards east**.

Q16 **[3 marks]**

(i) (1 mark) Between 0 and 4 s: a = (12 – 0) ÷ (4 – 0) = **3 m s^{-2}**.

(ii) (1 mark) Between 8 and 12 s: a = (0 – 12) ÷ (12 – 8) = **–3 m s^{-2}**. The negative sign means the acceleration is opposite to the direction of velocity (the car is slowing down).

(iii) (1 mark) Displacement = area under the graph = (½ × 4 × 12) + (4 × 12) + (½ × 4 × 12) = 24 + 48 + 24 = **96 m**.

Q17 **[3 marks]**

Option A: u = 15 m s^{-1}, a = 2 m s^{-2}, t = 6 s.

(i) (1 mark) v = u + at = 15 + 2 × 6 = **27 m s^{-1}**.

(ii) (1 mark for formula, 1 mark for answer) s = ut + ½at^2 = 15 × 6 + ½ × 2 × 36 = 90 + 36 = **126 m**.

Option B: u = 72 km h^{-1} = 20 m s^{-1}, v = 0, s = 200 m.

(i) (2 marks) $v^2 = u^2 + 2as \Rightarrow 0 = 400 + 2 \times a \times 200 \Rightarrow a = -400 \div 400 =$ **–1 m s^{-2}**.

(ii) (1 mark) v = u + at ⇒ 0 = 20 – 1 × t ⇒ t = **20 s**.

SECTION D – Case-Based Questions (4 marks each)

Q18 **[4 marks]**

u = 0, a = 10 m s^{-2} (downward positive).

(i) (1 mark) v = u + at = 0 + 10 × 2 = **20 m s^{-1}**.

(ii) (1 mark) v = 0 + 10 × 4 = **40 m s^{-1}**.

(iii) (1 mark) s = ut + ½at^2 = 0 + ½ × 10 × 16 = **80 m**.

(iv) (1 mark) The acceleration is directed vertically downwards (towards the Earth). It is the acceleration due to gravity, so the velocity increases by the same amount (10 m s^{-1}) in every second.

Q19 **[4 marks]**

(i) (1 mark) 72 km h^{-1} = 72 × 1000 ÷ 3600 = **20 m s^{-1}**.

(ii) (1 mark) During the reaction time the car moves at constant speed: reaction distance = 20 × 0.5 = **10 m**.

(iii) (1 mark) u = 20 m s^{-1}, v = 0, a = –4 m s^{-2}. $v^2 = u^2 + 2as \Rightarrow 0 = 400 - 8s \Rightarrow s =$ **50 m**.

(iv) (1 mark) At 72 km h^{-1} the total stopping distance = 10 + 50 = 60 m < 65 m, so the car stops 5 m short and does **not** hit the truck.

At 108 km h^{-1} = 30 m s^{-1}: reaction distance = 30 × 0.5 = 15 m; braking distance = 900 ÷ 8 = 112.5 m; total = 127.5 m > 65 m, so the car **would hit** the truck.

SECTION E – Long Answer Question (5 marks)

Q20 **[5 marks]**

Given: R = 14 m, T = 44 s, π = 22/7. Circumference = 2πR = 2 × (22/7) × 14 = 88 m.

Option A:

(i) (1 mark) The velocity at any point is along the tangent. Moving clockwise, at A (top) the velocity is horizontal, directed **towards the right**.

(ii) (1 mark) The direction of the velocity changes continuously, so the velocity changes and the motion is accelerated even though the speed is constant.

(iii) (1 mark) Distance in one revolution = 2πR = **88 m**. Average speed = 88 ÷ 44 = **2 m s^{-1}**.

(iv) (1 mark) The child returns to A, so displacement = **0** and average velocity = 0 ÷ 44 = **0**.

(v) (1 mark) A to C is half a revolution: distance = πR = 44 m. Displacement = diameter AC = 2R = **28 m**.

Option B:

(i) (1 mark) Velocity has both magnitude and direction. The speed is constant but the direction (tangent) keeps changing, so the velocity changes.

(ii) (1 mark) A to B is a quarter of a revolution: t = 44 ÷ 4 = **11 s**.

(iii) (1 mark) Distance = quarter of 88 m = **22 m**. (Check: speed × time = 2 × 11 = 22 m.)

(iv) (1 mark) OA ⊥ OB, so AB = $\sqrt{(14^2 + 14^2)}$ = 14√2 = 14 × 1.41 ≈ **19.7 m**.

(v) (1 mark) The marble moves along the tangent at C, in a straight line in the direction of the velocity at that instant (towards the left for clockwise motion), because it continues in the direction it was moving when released.

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