Attempt All Questions - Motion

Q1. An athlete runs exactly two and a half rounds around a circular running track of radius r. What is the net displacement of the athlete?

(a) Zero

(b) \pi * r

(c) 2 * r

(d) 2 * \pi * r

Q2. A student plots a graph with Velocity on the y-axis and Time on the x-axis for a braking car. What physical quantity is determined by calculating the slope of this graph line?

(a) Net distance covered

(b) Instantaneous velocity

(c) Uniform acceleration

(d) Magnitude of displacement

Q3. A smart vehicle's speedometer records a change in speed from 18 km/h to 36 km/h in exactly 5 seconds. The constant acceleration value is:

(a) 1 m/s^2

(b) 2 m/s^2

(c) 3.6 m/s^2

(d) 5 m/s^2

Q4. Explain why the odometer reading of a vehicle only tells us the distance travelled and cannot directly show its displacement.

Q5. Identify which of these parameters can be zero even when an object is in continuous motion: Average Speed or Average Velocity.

Q6. Give a real-world example where an object has an instantaneous velocity of zero but is still experiencing non-zero acceleration.

Q7. A micro-drone takes 40 seconds to finish one full round of a circular path having a diameter of 200 m. Calculate the final distance covered by the drone at the end of 2 minutes 20 seconds.

Q8. A mechanical rover starts from rest and moves with a uniform acceleration of 4 m/s^2. Evaluate the exact distance it covers within 10 seconds of starting.

Q9. Use a velocity-time graph to analyze an object moving with a uniform

negative acceleration. Explain how the area bounded beneath this line

reveals the net displacement.

Q10. A person rides a carousel moving at a perfectly constant speed of 5 m/s. Explain the scientific reason why this motion is defined as an 'accelerated motion' despite the speed never changing.

(Note: Attempt any THREE questions from this section)

Q11. Two cars apply brakes under different conditions. Car A travels at 52 km/h and stops in 5 seconds under hard braking. Car B travels at 30 km/h and decelerates smoothly to a stop over 10 seconds. Plot their motion profiles together on a speed-time graph. Determine mathematically which vehicle covered more distance post-braking.

Q12. A ball is projected vertically upward from the ground with an initial velocity of 5 m/s. Due to gravity, it faces a downward deceleration of 10 m/s^2. Compute the peak height achieved by the ball and the exact time interval required to reach that point.

Q13. An automated delivery bot starts from rest, accelerating uniformly at 2 m/s^2 for 5 seconds. It then maintains a constant velocity for the next 10 seconds, before a uniform deceleration brings it to a halt in 2 seconds. Construct its velocity-time profile and deduce the total distance covered.

Q14. A train covers the first half of its total journey distance at a uniform speed of 40 km/h and the remaining half at a uniform speed of 60 km/h. Prove why the average speed for the entire journey is not the simple mean (50 km/h), and calculate the correct value.