Class 9 Science Practice Worksheet

New NCERT Syllabus (2026-27) - Exploration Science

Chapter 1: Describing Motion

Section A: Conceptual Section (5 Questions)

Q1. Identify the fundamental terms of kinematics:
(a) The total path length covered by an object is distance, while the shortest straight-line path between the initial and final position is called _______________.
(b) The rate of change of velocity per unit time is known as _______________.
(c) On a distance-time graph, a straight line slanted upward indicates that the object is moving with _______________ speed.

Q2. Match the physical quantities with their correct SI units:
(a) Speed or Velocity: _______________
(b) Acceleration: _______________
(c) Displacement: _______________

Q3. State whether the following statements are True or False:
(a) The displacement of a moving object can be zero even if it has covered a non-zero distance. (*)*
***(b) An object moving at a constant speed in a straight line is undergoing accelerated motion. (***)
(c) The area under a velocity-time graph represents the total distance or displacement traveled by the object. (________)

Q4. Write down the complete equations of motion matching the descriptions:
(a) First equation of motion (Velocity-Time relation): _______________
(b) Second equation of motion (Position-Time relation): _______________
(c) Third equation of motion (Position-Velocity relation): _______________

Q5. An athlete runs along a circular track of radius 7 metres and completes one full round in 40 seconds. Calculate the total distance covered and the net displacement of the athlete at the end of this round. Show your steps. [1, 2, 3]

Section B: Logical Section (5 Questions)

Q6. Look carefully at a car's dashboard instruments: Instrument X displays the instantaneous speed of the vehicle at any given moment. Instrument Y tracks the total cumulative distance the vehicle has driven over its lifetime.
(a) Logically identify Instrument X: _______________

(b) Logically identify Instrument Y: _______________

(c) If a car travels 50 km due North and then immediately turns around and drives 50 km due South, compare the final reading change on Instrument Y to the total displacement.

Q7. An object is moving in a circle with a completely constant speed. Explain logically why its velocity is considered to be non-uniform and changing at every point along the path. [1, 2]

Q8. A driver spots a hazard and slams on the brakes. The vehicle comes to a complete stop with a uniform deceleration of 5 m/s^2 over a duration of 4 seconds. Logically deduce the initial velocity of the car before the brakes were applied.

Q9. Look at two distinct velocity-time graphs: Graph A shows a flat horizontal line parallel to the time axis. Graph B shows a straight line sloping downward toward the time axis.

(a) Logically deduce the acceleration of the object in Graph A: ________

(b) Logically deduce the nature of motion of the object in Graph B: ________

Q10. Predict motion patterns logically: An object starts from rest and falls freely under the influence of gravity. If it gains velocity uniformly, compare its average velocity during the first few seconds to its final velocity. Formulate a logical statement for the average velocity of a uniformly accelerated object.

Section C: High Thinking Section / HOTS (5 Questions)

Q11. A train travels from Station P to Station Q at a uniform speed of 40 km/h and returns from Station Q to Station P at a higher uniform speed of 60 km/h. A student calculates the average speed by simply adding the two numbers and dividing by two, arriving at 50 km/h. Explain why this logic is incorrect, and calculate the actual average speed.

Q12. Analyze a graphic kinematic scenario: A sports car accelerates uniformly from rest at a rate of 2 m/s^2 for 10 seconds. It then maintains this constant maximum velocity for the next 20 seconds, and finally decelerates uniformly to a stop in 5 seconds. Sketch out the mental layout of its velocity-time graph and calculate the total distance covered.

Q13. Derivation logic challenge: Use the first equation of motion, $v = u + at$, and the concept of average velocity for uniform acceleration to logically derive the second equation of motion, $s = ut + 0.5at^2$, showing how geometric graph areas match algebraic substitutions. [1]

Q14. A ball is thrown vertically upward with a starting velocity of 20 m/s. Assuming gravity decelerates it at a constant uniform rate of 10 m/s² in the upward direction:
(a) Calculate the maximum vertical height reached by the ball.
(b) Calculate the total time it takes to return back to the thrower's hand. [1]

Q15. Think deeply about everyday frames of reference: You are sitting inside a moving train looking out the window. A nearby parallel train moving in the same direction appears to be moving incredibly slowly, while trees on the ground appear to be flying backward at high speeds. Explain this perceptual difference using relative motion and reference points.

Answer Key (For Teachers and Parents)

Section A:
Q1: (a) displacement, (b) acceleration, (c) uniform.
Q2: (a) m/s (metres per second), (b) m/s² (metres per second squared), (c) m (metres).
Q3: (a) True (like a round trip returning to start), (b) False (straight line at constant speed means zero acceleration), (c) True.
Q4: (a) $v = u + at$, (b) $s = ut + 0.5at^2$, (c) $v^2 - u^2 = 2as$.
Q5: Distance = Circumference of circle = $2 \times pi \times r = 2 \times (22/7) \times 7 = 44$ metres.
Displacement = 0 metres, because the athlete returned back to the exact initial starting point.

Section B:
Q6: (a) Speedometer, (b) Odometer. (c) Instrument Y (Odometer) increases by 100 km (total path length), while the net displacement is 0 km since the car returned to its starting spot.
Q7: Velocity is a vector quantity that depends on both speed and direction. Even if the speed is constant, the direction of motion changes continuously at every point along the circular path, which causes the velocity to change, making it accelerated motion.
Q8: Final velocity (v) = 0 m/s, Acceleration (a) = -5 m/s² (negative due to deceleration), Time (t) = 4 s. Using $v = u + at$, we get $0 = u + (-5 \times 4) \rightarrow 0 = u - 20 \rightarrow u = 20$ m/s.

Q9: (a) Acceleration is zero because the velocity is completely constant. (b) Uniform retardation or negative acceleration (slowing down uniformly).

Q10: Average velocity = (Initial velocity + Final velocity) / 2. For an object starting from rest (u=0), average velocity is exactly half of its final velocity (v/2). [1, 2]

Section C:

Q11: Simple average fails because the train takes different amounts of time for the two journeys (it spends more time traveling at the slower speed). Let the distance between P and Q be d. Time taken to go = d/40. Time taken to return = d/60. Total time = d/40 + d/60 = 5d/120 = d/24. Average Speed = Total Distance / Total Time = 2d / (d/24) = 48 km/h.

Q12: Max velocity reached = u + at = 0 + 2(10) = 20 m/s.

Distance 1 (acceleration phase) = Area of triangle = 0.5 × 10 × 20 = 100 m.

Distance 2 (constant phase) = Area of rectangle = 20 × 20 = 400 m.

Distance 3 (deceleration phase) = Area of triangle = 0.5 × 5 × 20 = 50 m.

Total distance = 100 + 400 + 50 = 550 metres.

Q13: Distance (s) = Average Velocity × Time. Under uniform acceleration, Average Velocity = (u + v) / 2. Therefore, s = [(u + v) / 2] × t. Substitute v = u + at from the first equation into this formula: s = [(u + u + at) / 2] × t -> s = [(2u + at) / 2] × t -> s = [u + 0.5at] × t -> s = ut + $0.5at^2$.

Q14: (a) At maximum height, final velocity v = 0. Initial velocity u = 20 m/s, acceleration a = -10 m/s^2. Using $v^2 - u^2 = 2as$, we get $0^2 - 20^2 = 2(-10)s$ -> -400 = -20s -> s = 20 metres. (b) Using v = u + at to find time to top: 0 = 20 - 10t -> 10t = 20 -> t = 2 seconds. Total time to go up and come back down = 2 + 2 = 4 seconds.

Q15: Motion is always relative and depends on the chosen reference frame. When observing the parallel train from your moving train, your relative velocity is small because you subtract your speeds (v_relative = v1 - v2). When observing the fixed ground from a moving train, the reference point is stationary, making the trees appear to move backward at the full speed of your train. [1]