

Class 9 Science Chapter 4 – Important Questions

Describing Motion Around Us

 **New NCERT *Exploration* | 2026–27**

These questions are based on the **new Chapter 4** of *Exploration*, covering **motion in a straight line, position, distance, displacement, average speed, velocity, acceleration, motion graphs, equations of motion, free fall, motion in a plane and uniform circular motion.**

SECTION A – VERY SHORT ANSWER QUESTIONS

1. What is motion?
2. What is meant by linear motion?
3. What is a reference point?
4. Why is a reference point needed to describe motion?
5. When is an object said to be at rest?
6. When is an object said to be in motion?
7. What is position?
8. What is distance travelled?
9. What is displacement?
10. What is speed?

11. What is velocity?
 12. What is acceleration?
 13. What is uniform motion?
 14. What is non-uniform motion?
 15. What is average speed?
 16. What is average velocity?
 17. What is average acceleration?
 18. What is uniform circular motion?
 19. What is free fall?
 20. What is acceleration due to gravity?
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SECTION B – POSITION, DISTANCE & DISPLACEMENT

21. How is the position of an object described?
22. Why must both distance and direction from a reference point be specified to describe position?
23. Differentiate between distance and displacement.
24. Why is distance a scalar quantity?
25. Why is displacement a vector quantity?
26. Can displacement be zero even when distance travelled is not zero? Explain with an example.

27. Can the magnitude of displacement be greater than the distance travelled? Give a reason.

28. When are distance travelled and magnitude of displacement equal?

29. An athlete completes one full lap of a circular track and returns to the starting point. What are the distance and displacement?

30. A person walks 5 m east and then 5 m west. Find:

- a) Distance travelled
- b) Displacement

31. A car travels 20 km north and then 15 km south. What is its net displacement?

32. Why can displacement be positive, negative or zero?

The textbook defines motion relative to a reference point and emphasises that position requires both **distance** and **direction** from that reference point.

SECTION C – SPEED & VELOCITY

33. Define speed.

34. Define velocity.

35. Differentiate between speed and velocity.

36. Why is speed a scalar quantity?

37. Why is velocity a vector quantity?

38. Write the formula for average speed.

39. Write the formula for average velocity.

40. What is the SI unit of speed?

41. What is the SI unit of velocity?
 42. What is the difference between average speed and average velocity?
 43. Can an object have zero average velocity but non-zero average speed? Explain.
 44. Can two objects have the same speed but different velocities? Explain.
 45. A car travels 100 km in 2 hours. Calculate its average speed.
 46. A cyclist travels 30 m in 5 s. Calculate the average speed.
 47. A person walks 50 m east in 10 s. Calculate the average velocity.
 48. Why is direction important when describing velocity?
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SECTION D – ACCELERATION

49. What is acceleration?
50. Write the formula for average acceleration.
51. What is the SI unit of acceleration?
52. What does positive acceleration mean?
53. What does negative acceleration mean?
54. Can an object have acceleration even when its speed is constant? Explain.
55. Give an example of an object moving with constant speed but changing velocity.
56. What is uniform acceleration?
57. What is non-uniform acceleration?

58. A car increases its velocity from 10 m/s to 20 m/s in 5 s. Calculate its acceleration.
59. A bicycle slows from 12 m/s to 4 m/s in 4 s. Calculate its acceleration.
60. Why does a change in direction also mean a change in velocity?
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SECTION E – MOTION GRAPHS

61. Why are graphs useful for describing motion?
62. What information can a position-time graph provide?
63. What does a horizontal line on a position-time graph represent?
64. What does a straight inclined line on a position-time graph represent?
65. What does the slope of a position-time graph represent?
66. What does a steeper position-time graph indicate?
67. What does a velocity-time graph represent?
68. What does a horizontal line on a velocity-time graph represent?
69. What does the slope of a velocity-time graph represent?
70. What does the area under a velocity-time graph represent?
71. How can a velocity-time graph be used to identify uniform acceleration?
72. How can graphs help distinguish uniform and non-uniform motion?

The textbook specifically uses **position-time** and **velocity-time** graphs to describe motion and identifies the slope of a velocity-time graph with acceleration.



SECTION F – EQUATIONS OF MOTION

73. What are kinematic equations?
74. Under what condition are the kinematic equations valid?
75. Write the three equations of motion.
76. What does u represent in the equations of motion?
77. What does v represent?
78. What does a represent?
79. What does t represent?
80. What does s represent?
81. Write the equation relating initial velocity, final velocity, acceleration and time.
82. Write the equation relating displacement, initial velocity, acceleration and time.
83. Write the equation relating final velocity, initial velocity, acceleration and displacement.
84. Why must acceleration be constant when using the standard kinematic equations?
85. How do the signs of velocity, acceleration and displacement indicate direction?

The textbook explicitly states that these equations are valid for **constant acceleration** and explains the significance of the signs of (u), (v), (a) and (s).



SECTION G – NUMERICAL QUESTIONS

86. A car starts from rest and accelerates at 2 m/s^2 for 5 s. Find its final velocity.
87. A car starts from rest and accelerates at 3 m/s^2 for 4 s. Find the distance travelled.
88. A cyclist moving at 5 m/s accelerates at 2 m/s^2 for 6 s. Find the final velocity.
89. A vehicle travelling at 20 m/s slows down at 4 m/s^2 . How much time does it take to stop?
90. A car moving at 15 m/s accelerates uniformly at 2 m/s^2 for 5 s. Find:
- a) Final velocity
 - b) Distance travelled
91. An object starts from rest and reaches a velocity of 20 m/s in 10 s. Calculate its acceleration.
92. A train moving at 25 m/s comes to rest in 5 s. Find its acceleration.
93. A body moves with an initial velocity of 10 m/s and acceleration of 2 m/s^2 for 5 s. Calculate its displacement.
94. A car moving at 30 m/s is brought to rest with an acceleration of -5 m/s^2 . Find the stopping distance.
95. A vehicle moving at 54 km/h is brought to rest with an acceleration of -4 m/s^2 . Calculate the stopping distance.
96. A vehicle moving at 108 km/h is brought to rest with an acceleration of -4 m/s^2 . Calculate the stopping distance.

The textbook itself uses braking-distance problems with **54 km/h** and **108 km/h**, requiring conversion into m/s and use of the third equation of motion.



SECTION H – FREE FALL

97. What is free fall?
98. What force causes objects to fall towards Earth?
99. What is acceleration due to gravity?
100. What symbol is used for acceleration due to gravity?
101. What is the approximate value of g near Earth's surface?
102. Does the mass of an object affect its acceleration during ideal free fall?
103. What happens to the velocity of an object during free fall?
104. Write the equations of motion applicable to free fall.
105. A stone is dropped from rest. What is its initial velocity?
106. Why should air resistance be neglected when discussing ideal free fall?
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SECTION I – MOTION IN A PLANE

107. What is motion in a plane?
108. How is motion in a plane different from one-dimensional motion?
109. Give two examples of motion in a plane.
110. Why does motion in a plane require more than one coordinate to describe position?
111. How can the motion of an object be represented using components?
112. Why is direction important when describing motion in a plane?
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SECTION J – UNIFORM CIRCULAR MOTION

113. What is uniform circular motion?
114. Give two examples of uniform circular motion.
115. In uniform circular motion, what remains constant?
116. Does velocity remain constant during uniform circular motion? Explain.
117. Why does an object in uniform circular motion have acceleration even if its speed is constant?
118. Why does the direction of velocity continuously change during circular motion?
119. A stone tied to a string is rotated in a circle at constant speed. Is its velocity constant? Why?
120. How is uniform circular motion different from uniform straight-line motion?

The chapter's revision material specifically includes **uniform circular motion**, and its MCQ practice highlights that constant speed does not imply constant velocity when direction changes.



SECTION K – APPLICATION-BASED QUESTIONS

121. 🚗 A car moves along a straight road.

It travels 60 km in the first hour and 40 km in the next hour.

- a) What is the total distance travelled?
 - b) What is its average speed?
 - c) Is its motion necessarily uniform? Explain.
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122.  A runner completes one complete circular lap and returns to the starting point.

- a) Is the distance zero?
 - b) Is the displacement zero?
 - c) Explain the difference.
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123.  A train travels at constant speed along a curved track.

- a) Is its speed constant?
 - b) Is its velocity constant?
 - c) Does it have acceleration?
 - d) Explain.
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124.  A bus starts from rest and gradually increases its speed.

- a) Is its velocity changing?
 - b) Does it have acceleration?
 - c) What type of motion is this?
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125.  A cyclist moves at 10 m/s and then applies brakes.

- a) What happens to velocity?
 - b) What happens to acceleration?
 - c) Is the acceleration positive or negative if the chosen positive direction is the direction of motion?
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SECTION L – COMPETENCY-BASED QUESTIONS

126. Case Study – Position-Time Graph

A position-time graph shows a straight horizontal line.

Answer:

- a) What does the graph indicate?
 - b) Is the object moving?
 - c) What is its velocity?
 - d) What does the slope represent?
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127. Case Study – Velocity-Time Graph

A velocity-time graph is a straight line with a positive slope.

- a) What does the graph indicate?
 - b) Is acceleration constant?
 - c) What does the slope represent?
 - d) Is velocity increasing or decreasing?
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128. Case Study – Braking

A car travels at 20 m/s and brakes are applied, producing an acceleration of -5 m/s^2 .

- a) What is the final velocity when the car stops?
 - b) Which equation would be most convenient for finding stopping distance?
 - c) Calculate the stopping distance.
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129. Case Study – Falling Ball

A ball is dropped from a height.

- a) What is its initial velocity?
 - b) What acceleration acts on it?
 - c) Which equations can be used to determine its velocity and displacement?
 - d) What assumption is made about air resistance?
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130. Case Study – Circular Motion

A child rides a merry-go-round at constant speed.

- a) Is the speed constant?
 - b) Is the velocity constant?
 - c) Does the child experience acceleration?
 - d) Why?
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SECTION M – HIGHER-ORDER THINKING QUESTIONS

131. Can an object be at rest relative to one observer and in motion relative to another? Explain.

132. Why is motion said to be relative?

133. Can an object have zero displacement but non-zero distance? Give an example.

134. Can an object have constant speed but changing velocity? Explain with an example.

135. Can an object have zero velocity but non-zero acceleration at an instant? Explain using an example.

136. Why does changing direction count as acceleration?

137. Why is distance never negative but displacement can have a negative value?

138. Why is average speed not always equal to the magnitude of average velocity?

139. Why is the slope of a position-time graph useful for determining velocity?

140. Why is the slope of a velocity-time graph useful for determining acceleration?

141. Why does the area under a velocity-time graph give displacement?

142. Why can't the standard kinematic equations be used when acceleration is continuously changing?

143. A car moves at constant speed around a circular track. A student says, "There is no acceleration because the speed is constant." Is the student correct? Explain.

144. Why is choosing a positive direction important when solving numerical problems?

The textbook explicitly instructs students to choose a direction consistently when using signed quantities in the equations of motion.



SECTION N – LONG ANSWER QUESTIONS

145. Explain how the position of a moving object is described using a reference point.

146. Explain the difference between distance and displacement with suitable examples.

147. Explain speed, velocity and acceleration and write their mathematical expressions.

148. Differentiate between uniform and non-uniform motion.
149. Explain how position-time graphs can be used to describe motion.
150. Explain how velocity-time graphs can be used to determine velocity and acceleration.
151. Derive and explain the three equations of motion for uniformly accelerated motion.
152. Explain the motion of a freely falling object.
153. Explain motion in a plane with suitable examples.
154. Explain uniform circular motion. Why is it accelerated motion even when speed remains constant?
155. Explain the relationship between distance, displacement, speed and velocity.
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MOST IMPORTANT QUESTIONS FOR EXAM

If students have limited time, prepare these **first**:

- ★ 1. Define motion and explain the importance of a reference point.
- ★ 2. Differentiate between distance and displacement.
- ★ 3. Differentiate between speed and velocity.
- ★ 4. Define acceleration and write its formula and SI unit.
- ★ 5. Explain uniform and non-uniform motion.
- ★ 6. Explain position-time and velocity-time graphs.
- ★ 7. What does the slope of a position-time graph represent?
- ★ 8. What does the slope of a velocity-time graph represent?

- ★ 9. What does the area under a velocity-time graph represent?
 - ★ 10. Write the three equations of motion and explain each symbol.
 - ★ 11. Solve numerical problems using the equations of motion.
 - ★ 12. Explain free fall and acceleration due to gravity.
 - ★ 13. Differentiate between speed and velocity in uniform circular motion.
 - ★ 14. Why does an object have acceleration in uniform circular motion?
 - ★ 15. Solve braking-distance problems using ($v^2 = u^2 + 2as$).
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IMPORTANT FORMULAS



Average Speed

Average speed = Total distance / Total time



Average Velocity

Average velocity = Displacement / Time interval



Average Acceleration

Average acceleration = Change in velocity / Time interval



First Equation of Motion

$$v = u + at$$



Second Equation of Motion

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



Third Equation of Motion

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



Symbols

u = Initial velocity

v = Final velocity

a = Acceleration

t = Time

s = Displacement

These are the standard constant-acceleration equations used in the new chapter; the textbook explicitly notes that they apply when acceleration is constant.



QUICK REVISION BOX



Position → Location relative to a reference point



Motion → Position changes with time



Distance → Total path length



Displacement → Net change in position



Speed → Distance travelled per unit time



Velocity → Displacement per unit time



Acceleration → Change in velocity per unit time



Position-time slope → Velocity



Velocity-time slope → Acceleration



Velocity-time area → Displacement



Free fall → Motion under gravity



Uniform circular motion → Constant speed but changing velocity



TOP NUMERICALS TO PRACTISE

1.  Car starts from rest and accelerates
2.  Vehicle changes velocity in a given time
3.  Train comes to rest
4.  Cyclist accelerates
5.  Braking and stopping distance
6.  Free-fall problems
7.  Position-time graph interpretation
8.  Velocity-time graph interpretation
9.  Circular-motion reasoning
10.  Conversion of km/h into m/s

★ Exam Tip

For every numerical, follow this simple format:

Given → Formula → Substitution → Calculation → Answer with unit

And for motion equations, **choose the positive direction first and keep the sign convention consistent throughout the calculation.**