

CLASS 9 SCIENCE — CHAPTER 4 NCERT SOLUTIONS

Describing Motion Around Us

Complete Exercise New NCERT *Exploration* | 2026–27

Below is the **complete Chapter 4 exercise**, with the numerical problem



Q1. Journey to the Shop

Question:

A person goes from home to a shop 250 m away, returns home, goes to the shop again and finally returns home. Find:

- (i) Total distance travelled
- (ii) Displacement

Solution:

Distance for one journey = 250 m

Number of journeys = 4

Total distance:

$$\text{Distance} = 250 \times 4$$

$$= 1000 \text{ m}$$

Since the person finally returns home:

$$\text{Displacement} = 0 \text{ m}$$



Answer:

- (i) Distance = 1000 m

(ii) Displacement = 0 m



Q2. Running Between Floors

Question:

A student runs from the ground floor to the fourth floor and then comes down to the second floor. Each floor is 3 m high. Find:

(i) Total distance travelled

(ii) Displacement

Solution:

Step 1: Ground floor → Fourth floor

Distance = 4×3

= 12 m

Step 2: Fourth floor → Second floor

Difference = $4 - 2 = 2$ floors

Distance = 2×3

= 6 m

Total distance:

$12 + 6$

= 18 m

Displacement:

Final position is 2 floors above the ground.

Displacement = 2×3

= 6 m upward

✓ **Answer:**

(i) Distance = 18 m

(ii) Displacement = 6 m upward



Q3. Constant Speed and Acceleration

Question:

A girl is riding a scooter and the speedometer reading remains constant. Can the scooter still be accelerating?

✓ **Answer:**

Yes.

Acceleration occurs when **velocity changes**.

Velocity depends on:

- Speed
- Direction

Even if the speed remains constant, the direction can change.

Example:

If the scooter moves around a circular path at constant speed, its direction continuously changes.

Therefore, its velocity changes and the scooter is accelerating.

★ **Answer:**

Yes, a scooter can have constant speed but still have acceleration if its direction changes.



Q4. Car Starting from Rest

Question:

A car starts from rest and reaches a velocity of 24 m/s in 6 s. Find:

(i) Acceleration

(ii) Distance travelled

Given:

$$u = 0 \text{ m/s}$$

$$v = 24 \text{ m/s}$$

$$t = 6 \text{ s}$$

(i) Acceleration

Formula:

$$a = (v - u) / t$$

$$a = (24 - 0) / 6$$

$$a = 4 \text{ m/s}^2$$

(ii) Distance

Formula:

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

$$s = 0 \times 6 + \frac{1}{2} \times 4 \times 6^2$$

$$s = 2 \times 36$$

$$s = 72 \text{ m}$$



Answer:

Acceleration = 4 m/s²

Distance = 72 m



Q5. Motorbike Coming to Rest

Question:

A motorbike has an initial velocity of 28 m/s and comes to rest after travelling 98 m. Find:

(i) Acceleration

(ii) Time taken to stop

Given:

$$u = 28 \text{ m/s}$$

$$v = 0 \text{ m/s}$$

$$s = 98 \text{ m}$$

(i) Acceleration

Formula:

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

$$0^2 = 28^2 + 2 \times a \times 98$$

$$0 = 784 + 196a$$

$$196a = -784$$

$$a = -4 \text{ m/s}^2$$

The negative sign means the motorbike is slowing down.

(ii) Time

Formula:

$$v = u + at$$

$$0 = 28 - 4t$$

$$4t = 28$$

$t = 7 \text{ s}$

✓ **Answer:**

Acceleration = -4 m/s^2

Time = 7 s



Q6. Position-Time Graph

Question:

A position-time graph for two objects A and B is given. Do A and B ever have equal velocity? Give a reason.

Solution:

The slope of a position-time graph represents velocity.

Velocity = Slope of position-time graph

The slopes of the graphs of A and B are different.

Therefore, their velocities are different.

✗ **Answer:**

No, A and B do not have equal velocity because their position-time graph slopes are different.



Q7. Average Speed and Average Velocity

Question:

Two objects A and B move in the same direction as shown in the position-time graph. Which statements are correct?

Options:

- (i) Average velocity of both is equal because they have the same initial and final positions.
- (ii) Average speeds are equal because both cover equal distance in equal time.
- (iii) Average speed of A is lower than B because A covers a shorter distance.
- (iv) Average speed of A is greater than B because B's speed is lower than A's in some segments.

✓ Answer:

(i) and (ii)

Explanation:

Average velocity:

Average velocity = Displacement / Total time

Both have the same displacement and same time.

Therefore, average velocity is equal.

Both also cover the same distance in the same time.

Therefore, average speed is equal.

★ Answer:

Correct options = (i) and (ii)



Q8. Truck Slowing Down

Question:

A truck travels at 54 km/h and slows down to 36 km/h in 36 s. Find the distance travelled.

Given:

$u = 54 \text{ km/h}$

$$v = 36 \text{ km/h}$$

$$t = 36 \text{ s}$$

Convert to m/s:

$$54 \times 5/18 = 15 \text{ m/s}$$

$$36 \times 5/18 = 10 \text{ m/s}$$

Average velocity:

$$\text{Average velocity} = (u + v) / 2$$

$$= (15 + 10) / 2$$

$$= 12.5 \text{ m/s}$$

Distance:

$$\text{Distance} = \text{Average velocity} \times \text{time}$$

$$= 12.5 \times 36$$

$$= 450 \text{ m}$$

✓ **Answer:**

$$\text{Distance} = 450 \text{ m}$$



Q9. Three Stages of Car Motion

Question:

A car starts from rest and reaches 20 m/s in 5 s. It then moves at 20 m/s for 10 s and finally stops uniformly in 6 s. Find the total distance travelled.

Stage 1:

$$u = 0 \text{ m/s}$$

$$v = 20 \text{ m/s}$$

$$t = 5 \text{ s}$$

Average velocity:

$$(0 + 20) / 2 = \mathbf{10 \text{ m/s}}$$

Distance:

$$10 \times 5 = \mathbf{50 \text{ m}}$$

Stage 2:

$$v = 20 \text{ m/s}$$

$$t = 10 \text{ s}$$

Distance:

$$20 \times 10 = \mathbf{200 \text{ m}}$$

Stage 3:

$$u = 20 \text{ m/s}$$

$$v = 0 \text{ m/s}$$

$$t = 6 \text{ s}$$

Average velocity:

$$(20 + 0) / 2 = \mathbf{10 \text{ m/s}}$$

Distance:

$$10 \times 6 = \mathbf{60 \text{ m}}$$

Total distance:

$$50 + 200 + 60$$

$$= \mathbf{310 \text{ m}}$$

 **Answer:**

Total distance = 310 m



Q10. Bus and Obstacle

Question:

A bus travels at 36 km/h. The driver sees an obstacle 30 m ahead. The driver takes 0.5 s to react. During braking, the acceleration is 2.5 m/s^2 . Will the bus stop before the obstacle?

Given:

Speed = 36 km/h

= 10 m/s

Reaction time = 0.5 s

Distance to obstacle = 30 m

Braking acceleration = -2.5 m/s^2

Step 1: Reaction distance

Distance = Speed $\times$ Time

= 10×0.5

= 5 m

Remaining distance:

$30 - 5 = 25 \text{ m}$

Step 2: Braking distance

Formula:

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

$$0^2 = 10^2 + 2 \times (-2.5) \times s$$

$$0 = 100 - 5s$$

$$5s = 100$$

$$s = 20 \text{ m}$$

Total stopping distance:

$$5 + 20 = 25 \text{ m}$$

Obstacle = 30 m away.

Therefore:

$$30 - 25 = 5 \text{ m}$$

✓ **Answer:**

Yes, the bus will stop before the obstacle.

It stops **5 m before the obstacle.**



Q11. Rest and Motion

Question:

A student says, "The Earth moves around the Sun." Can an object kept on Earth be considered to be at rest?

✓ **Answer:**

Yes.

Rest and motion depend on the **reference point**.

With respect to Earth:

The object does not change its position.

So it is:

At rest relative to Earth.

With respect to the Sun:

Earth is moving around the Sun.

Therefore, the object is also moving around the Sun.

★ **Answer:**

An object can be at rest relative to Earth but in motion relative to the Sun.



Q12. Velocity-Time Graph

Question:

A velocity-time graph for a cyclist is given. Find:

- (i) Regions showing constant velocity
- (ii) Region showing decreasing velocity
- (iii) Displacement
- (iv) Average acceleration

Important rules:

Area under velocity-time graph = Displacement

Slope of velocity-time graph = Acceleration

From the graph:

Initial velocity = 0 m/s

Final velocity = 6 m/s

Total time = 120 s

Average acceleration:

$$a = (v - u) / t$$

$$= (6 - 0) / 120$$

$$= 0.05 \text{ m/s}^2$$

Displacement:

Total area under the velocity-time graph:

Displacement = 360 m

✓ **Answer:**

Displacement = 360 m

Average acceleration = 0.05 m/s^2



Q13. Marathon Runner

Question:

A runner moves at 2.5 km/h for 2 h, 5 km/h for 2 h and 7.5 km/h for 2 h. Find the total distance.

First 2 hours:

Distance = 2.5×2

= 5 km

Next 2 hours:

Distance = 5×2

= 10 km

Last 2 hours:

Distance = 7.5×2

= 15 km

Total distance:

$5 + 10 + 15$

= 30 km

✓ **Answer:**

Total distance = 30 km



Q14. Car on a State Highway

Question:

A car moves at 6 m/s for 2 minutes and then accelerates at 1 m/s² for 6 s. Find its displacement during the entire journey.

Given:

Velocity = 6 m/s

First time = 2 min = 120 s

Acceleration = 1 m/s²

Second time = 6 s

First part:

$$s_1 = vt$$

$$= 6 \times 120$$

$$= 720 \text{ m}$$

Second part:

Formula:

$$s_2 = ut + \frac{1}{2} at^2$$

$$= 6 \times 6 + \frac{1}{2} \times 1 \times 6^2$$

$$= 36 + 18$$

$$= 54 \text{ m}$$

Total displacement:

$$720 + 54$$

$$= 774 \text{ m}$$

✓ **Answer:**

Displacement = 774 m



Q15. Comparing Two Cars

Question:

Two cars A and B start from rest with constant acceleration.

Car A reaches 5 m/s in 5 s.

Car B reaches 3 m/s in 10 s.

Find their displacement using the velocity-time graphs.



Car A

The v-t graph is a triangle.

Base = 5 s

Height = 5 m/s

Displacement = $\frac{1}{2} \times \text{base} \times \text{height}$

= $\frac{1}{2} \times 5 \times 5$

= 12.5 m



Car B

Base = 10 s

Height = 3 m/s

Displacement = $\frac{1}{2} \times 10 \times 3$

= 15 m

✓ **Answer:**

Car A = 12.5 m

Car B = 15 m



Q16. Tip of the Minute Hand

Question:

The length of the minute hand of a clock is 7 cm. From 6 PM to 7:30 PM, find:

(i) Distance travelled

(ii) Displacement

(iii) Speed

(iv) Average velocity

Given:

Radius = 7 cm

Time = 90 min

Number of revolutions = 1.5

(i) Distance

Circumference:

$$2\pi r$$

$$= 2 \times \frac{22}{7} \times 7$$

$$= 44 \text{ cm}$$

For 1.5 revolutions:

$$\text{Distance} = 44 \times 1.5$$

$$= 66 \text{ cm}$$

 **Distance = 66 cm**

(ii) Displacement

After 1.5 revolutions, the tip is at the opposite point.

Therefore:

$$\text{Displacement} = \text{Diameter}$$

$$= 2 \times 7$$

$$= 14 \text{ cm}$$

 **Displacement = 14 cm**

(iii) Speed

$$\text{Speed} = \text{Distance} / \text{Time}$$

$$= 66 \text{ cm} / 90 \text{ min}$$

Converting to SI units:

$$\text{Speed} = 11/900 \text{ m/s}$$

 **Speed = 11/900 m/s**

(iv) Average velocity

$$\text{Average velocity} = \text{Displacement} / \text{Time}$$

$$= 14 \text{ cm} / 90 \text{ min}$$

Average velocity = 7/2700 m/s

 **Average velocity = 7/2700 m/s**

CHAPTER 4 — COMPLETE ANSWER KEY

Q.	Final Answer
1	Distance = 1000 m; Displacement = 0 m
2	Distance = 18 m; Displacement = 6 m upward
3	Yes, if direction changes
4	Acceleration = 4 m/s²; Distance = 72 m
5	Acceleration = -4 m/s²; Time = 7 s
6	No
7	(i) and (ii)
8	450 m
9	310 m
10	Yes; stops 5 m before obstacle
11	Depends on reference point
12	Displacement = 360 m; Average acceleration = 0.05 m/s²
13	30 km
14	774 m
15	A = 12.5 m; B = 15 m
16	Distance = 66 cm; Displacement = 14 cm; Speed = 11/900 m/s; Average velocity = 7/2700 m/s

CHAPTER 4 FORMULAS

Acceleration

$$a = (v - u) / t$$

First equation of motion

$$v = u + at$$

Second equation of motion

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

Third equation of motion

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

Average speed

$$\text{Average speed} = \text{Total distance} / \text{Total time}$$

Average velocity

$$\text{Average velocity} = \text{Displacement} / \text{Total time}$$

Graphs

$$\text{Slope of position-time graph} = \text{Velocity}$$

$$\text{Slope of velocity-time graph} = \text{Acceleration}$$

$$\text{Area under velocity-time graph} = \text{Displacement}$$