Chapter 8: Measurement of Time and Motion

Exercises — Let Us Enhance Our Learning

Q1 Calculate the speed of a car that travels 150 metres in 10 seconds. Express your answer in km/h.

SOLUTION

Given: Distance = 150 m, Time = 10 s
Speed = Distance / Time
Speed = 150 m / 10 s = 15 m/s
Converting to km/h: multiply by 3600/1000 (since 1 m/s = 3.6 km/h)
Speed = 15 × 3600 / 1000 km/h
Speed = 15 × 3.6 km/h = 54 km/h

Answer: Speed = 15 m/s = 54 km/h

Q2 A runner completes 400 metres in 50 seconds. Another runner completes the same distance in 45 seconds. Who has a greater speed and by how much?

SOLUTION

Given: Both runners cover 400 m.
Runner A: time = 50 s
Speed of Runner A = 400 m / 50 s = 8 m/s
Runner B: time = 45 s
Speed of Runner B = 400 m / 45 s = 80/9 m/s ≈ 8.89 m/s
Since Runner B covers the same distance in less time, Runner B is faster.
Difference in speed = 80/9 − 8 = 80/9 − 72/9 = 8/9 m/s ≈ 0.89 m/s

Answer: Runner B (45 s) has greater speed. Runner B's speed ≈ 8.89 m/s vs Runner A's 8 m/s; difference ≈ 0.89 m/s (8/9 m/s).

Q3 A train travels at a speed of 25 m/s and covers a distance of 360 km. How much time does it take?

SOLUTION

Given: Speed = 25 m/s, Distance = 360 km = 360 × 1000 m = 360000 m
Time = Distance / Speed
Time = 360000 m / 25 m/s

Time = 14400 s

Converting: 14400 s ÷ 3600 = 4 h

Answer: Time = 14400 s = 4 hours

Q4 A train travels 180 km in 3 h. Find its speed in: (i) km/h (ii) m/s (iii) What distance will it travel in 4 h if it maintains the same speed throughout the journey?

SOLUTION

Given: Distance = 180 km, Time = 3 h

(i) Speed in km/h:

Speed = 180 km / 3 h = 60 km/h

(ii) Speed in m/s:

Convert km/h to m/s by multiplying by 5/18

Speed = 60 × 5/18 m/s = 300/18 m/s = 50/3 m/s ≈ 16.67 m/s

(iii) Distance in 4 h:

Distance = Speed × Time = 60 km/h × 4 h = 240 km

Answer: (i) 60 km/h (ii) 50/3 m/s ≈ 16.67 m/s (iii) 240 km

Q5 The fastest galloping horse can reach the speed of approximately 18 m/s. How does this compare to the speed of a train moving at 72 km/h?

SOLUTION

Given: Horse speed = 18 m/s, Train speed = 72 km/h

Convert train speed to m/s: multiply by 5/18

Train speed = 72 × 5/18 m/s = 360/18 m/s = 20 m/s

Horse speed = 18 m/s

Comparing: 20 m/s (train) > 18 m/s (horse)

The train is faster than the horse by 20 − 18 = 2 m/s.

Answer: Train speed = 20 m/s; horse speed = 18 m/s. The train is faster than the horse by 2 m/s.

Q6 Distinguish between uniform and non-uniform motion using the example of a car moving on a straight highway with no traffic and a car moving in city traffic.

SOLUTION

Uniform linear motion: An object moves along a straight line with a constant (unchanging) speed. It covers equal distances in equal intervals of time.
Non-uniform linear motion: An object moves along a straight line but its speed keeps changing. It covers unequal distances in equal intervals of time.

Example 1 — Car on a straight highway with no traffic:
The car can maintain a steady speed (e.g., 80 km/h) without needing to stop, slow down, or speed up. It covers the same distance every minute. This is an example of uniform linear motion (approximately).

Example 2 — Car in city traffic:
The car constantly speeds up when the road is clear, slows down at signals, stops at red lights, and accelerates again. The distances covered in equal time intervals keep changing. This is an example of non-uniform linear motion.

Answer: Uniform motion: constant speed, equal distances in equal time — e.g., car on an open highway. Non-uniform motion: changing speed, unequal distances in equal time — e.g., car in city traffic.

Q7 Data for an object covering distances in different intervals of time are given in the following table. If the object is in uniform motion, fill in the gaps in the table.
Time (s): 0, 10, 20, 30, 40, 50, 70. Distance (m): 0, 8, __, 24, 32, __, 56.

SOLUTION

Given known data points: t=0 s → d=0 m; t=10 s → d=8 m; t=30 s → d=24 m; t=40 s → d=32 m; t=70 s → d=56 m.
For uniform motion, speed is constant.
Speed = (8 − 0) / (10 − 0) = 8/10 = 0.8 m/s
Verify with known points:
t=30 s: d = 0.8 × 30 = 24 m ✓
t=40 s: d = 0.8 × 40 = 32 m ✓
t=70 s: d = 0.8 × 70 = 56 m ✓
Fill in missing values:
t=20 s: d = 0.8 × 20 = 16 m
t=50 s: d = 0.8 × 50 = 40 m

Answer: Speed = 0.8 m/s. Missing values: d at t = 20 s is 16 m; d at t = 50 s is 40 m.

Q8 A car covers 60 km in the first hour, 70 km in the second hour, and 50 km in the third hour. Is the motion uniform? Justify your answer. Find the average speed of the car.

SOLUTION

Distances covered in equal time intervals (1 hour each): 60 km, 70 km, 50 km.
For uniform motion, equal distances must be covered in equal time intervals.
Since 60 km ≠ 70 km ≠ 50 km, the distances are NOT equal.
Therefore, the motion is NOT uniform — it is non-uniform.

Average speed:
Total distance = 60 + 70 + 50 = 180 km
Total time = 3 h
Average speed = 180 km / 3 h = 60 km/h

Answer: Motion is non-uniform (distances per hour differ: 60, 70, 50 km). Average speed = 60 km/h.

Q9 Which type of motion is more common in daily life — uniform or non-uniform? Provide three examples from your experience to support your answer.

SOLUTION

Non-uniform motion is more common in daily life.
In everyday situations, objects rarely maintain a perfectly constant speed — they speed up, slow down, or stop due to traffic, obstacles, signals, or terrain.

Three examples of non-uniform motion:
1. A bus in city traffic: it stops at bus stops and traffic signals, then accelerates again. The speed keeps changing.
2. A ball rolling on the ground: friction gradually slows it down, so it covers less distance with each passing second.
3. A person walking: a walker naturally speeds up or slows down depending on the path, obstacles, or fatigue — their speed is rarely constant.

Uniform motion (constant speed in a straight line) is an idealisation rarely achieved in practice over long durations.

Answer: Non-uniform motion is more common. Examples: (1) city bus stopping at signals, (2) ball slowing due to friction, (3) person walking at varying pace.

Q10 Data for the motion of an object are given in the following table. State whether the speed of the object is uniform or non-uniform. Find the average speed. Time (s): 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100. Distance (m): 0, 6, 10, 16, 21, 29, 35, 42, 45, 55, 60.

SOLUTION

Check distances covered in equal time intervals of 10 s:
0→10 s: 6 − 0 = 6 m
10→20 s: 10 − 6 = 4 m
20→30 s: 16 − 10 = 6 m
30→40 s: 21 − 16 = 5 m
40→50 s: 29 − 21 = 8 m
50→60 s: 35 − 29 = 6 m
60→70 s: 42 − 35 = 7 m
70→80 s: 45 − 42 = 3 m
80→90 s: 55 − 45 = 10 m
90→100 s: 60 − 55 = 5 m
The distances covered in equal time intervals are different (6, 4, 6, 5, 8, 6, 7, 3, 10, 5 m).
Therefore, the motion is NON-UNIFORM.

Average speed = Total distance / Total time
Average speed = 60 m / 100 s = 0.6 m/s

Answer: Motion is non-uniform (unequal distances in equal time intervals). Average speed = 60 m / 100 s = 0.6 m/s.

Q11 A vehicle moves along a straight line and covers a distance of 2 km. In the first 500 m, it moves with a speed of 10 m/s and in the next 500 m, it moves with a speed of 5 m/s. With what speed should it move the remaining distance so that the journey is complete in 200 s? What is the average speed of the vehicle for the entire journey?

SOLUTION

Total distance = 2 km = 2000 m, Total time allowed = 200 s

Time for first 500 m at 10 m/s:
t_1 = 500 m / 10 m/s = 50 s

Time for next 500 m at 5 m/s:
t_2 = 500 m / 5 m/s = 100 s

Remaining distance = 2000 − 500 − 500 = 1000 m
Time used so far = 50 + 100 = 150 s
Time remaining = 200 − 150 = 50 s

Speed for remaining 1000 m in 50 s:
Speed = 1000 m / 50 s = 20 m/s

Average speed for entire journey:
Average speed = Total distance / Total time = 2000 m / 200 s = 10 m/s

Answer: Speed for remaining 1000 m must be 20 m/s. Average speed for the entire journey = 10 m/s.