Summative Assessment: Chapter 1 (Motion)

Subject: Physics Class: 9

Total Marks: 80
Time Allowed: 3 Hours

General Instructions

1. All questions are compulsory.
2. The question paper is divided into five sections: A, B, C, D, and E.
3. **Section A** contains 10 multiple-choice questions (MCQs) of 1 mark each.
4. **Section B** contains 10 objective/short-numerical questions of 1 mark each.
5. **Section C** contains 10 short answer questions of 3 marks each.
6. **Section D** contains 3 long-answer numerical problems of 5 marks each.
7. **Section E** contains 3 case-study-based questions of 5 marks each.
8. Use $g = 9.8$ m/s^2 unless specified otherwise.

Section A: Multiple Choice Questions (10 x 1 = 10 Marks)

Select the correct option for each of the following:

1. What does the odometer of an automobile measure?
   (a) Acceleration
   (b) Distance
   (c) Speed
   (d) Displacement
2. A body is moving with a constant speed of 10 m/s in a circular path. Its motion is:
   (a) Non-accelerated
   (b) In uniform motion
   (c) Accelerated
   (d) In uniform velocity
3. A car accelerates from 18 km/h to 36 km/h in 5 seconds. Its acceleration is:
   (a) 1 m/s^2

(b) 3.6 m/s^2

(c) 5 m/s^2

(d) 2 m/s^2

4. The area under a speed-time graph represents a physical quantity. The unit of this quantity is:

   (a) m

   (b) m/s

   (c) m/s^2

   (d) m^2

5. The magnitude of average velocity is equal to the average speed when an object:

   (a) Moves in a straight line without changing direction

   (b) Moves in a circle

   (c) Moves with non-uniform acceleration

   (d) Returns to its starting point

6. A farmer moves along the boundary of a square field of side 'a'. What is the magnitude of his displacement after he completes 2.5 rounds?

   (a) 0

   (b) 2a

   (c) $a\sqrt{2}$

   (d) 10a

7. Which of the following situations is **impossible**?

   (a) An object with constant acceleration but zero velocity.

   (b) An object moving in one direction with acceleration in the perpendicular direction.

   (c) An object with constant velocity but variable acceleration.

   (d) An object moving with constant speed but variable velocity.

8. The slope of a distance-time graph indicates:

   (a) Acceleration

   (b) Speed

   (c) Displacement

   (d) Uniform motion

9. An artificial satellite orbits the Earth in a circular orbit of radius 42250 km in 24 hours. Its speed is approximately:

   (a) 3.07 m/s

   (b) 11065 km/s

   (c) 3.07 km/s

   (d) 1760 km/h

10. If an object's distance-time graph is a straight line parallel to the time-axis, the object is:

(a) Moving with uniform speed
(b) Accelerating
(c) Stationary
(d) Moving with non-uniform speed

Section B: Objective & Short Numerical Questions (10 x 1 = 10 Marks)

Answer the following in one word or with a single calculated value:

1. Can an object have zero displacement even if it has moved a distance? (Yes/No)
2. A bus decreases its speed from 80 km/h to 60 km/h in 5 s. Calculate its acceleration in m/s^2.
3. What name is given to the acceleration of a body in uniform circular motion?
4. A train starting from rest attains a speed of 40 km/h in 10 minutes. Find its acceleration in m/s^2.
5. Is velocity a scalar or a vector quantity?
6. A ball is gently dropped from a height of 20 m. What is its velocity just before striking the ground? (Use $g = 10$ m/s^2)
7. What physical quantity is represented by the slope of a speed-time graph?
8. A trolley, starting from rest, has an acceleration of 2 cm/s^2. What is its velocity after 3 s?
9. The motion of a freely falling body is an example of what type of acceleration?
10. An athlete completes one round of a circular track of diameter 200 m in 40 s. What is his displacement after 20 s?

Section C: Short Answer Questions (10 x 3 = 30 Marks)

Answer the following questions.

1. Distinguish between **Speed** and **Velocity** (any three points).
2. What is the nature of the distance-time graph for: (a) an object in uniform motion, (b) an object in non-uniform motion, and (c) an object at rest?
3. A racing car starting from rest has a uniform acceleration of 4 m/s^2. What distance will it cover in 10 seconds?
4. A train traveling at 90 km/h applies brakes to produce a uniform acceleration of -0.5 m/s^2. How far will the train go before it is brought to rest?
5. A farmer moves along the boundary of a square field of side 10 m in 40 s. What will be the magnitude of displacement of the farmer at the end of 2 minutes 20 seconds from his initial position?
6. Define (a) uniform acceleration and (b) non-uniform acceleration. Give one real-world example for each.
7. A stone is thrown vertically upwards with a velocity of 5 m/s. If the acceleration of the stone during its motion is 10 m/s^2 in the downward direction, what will be the maximum height attained by the stone and how much time will it take to reach there?
8. Joseph jogs from one end A to the other end B of a straight 300 m road in 2 minutes 30 seconds and then turns around and jogs 100 m back to point C in another 1 minute. Calculate his average speed and average velocity for the entire trip (from A to C).

9. A motorboat starts from rest and accelerates in a straight line at 3.0 m/s^2 for 8.0 s. It then moves with the acquired constant velocity for 4.0 s. Finally, it decelerates at 2.0 m/s^2 until it stops. Find the total distance traveled by the boat.

10. A signal from a spaceship reaches a ground station in 5 minutes. What was the distance of the spaceship from the ground station? (The signal travels at the speed of light, 3×10^8 m/s).

Section D: Long Answer Numericals (3 x 5 = 15 Marks)

Solve the following numerical problems. (Moderate to Difficult)

1. Abdul, while driving to school, computes the average speed for his trip to be 20 km/h. On his return trip along the same route, there is less traffic and the average speed is 30 km/h. What is the average speed for Abdul's entire round trip? (Note: The answer is not 25 km/h).
2. A driver of a car traveling at 52 km/h (Car A) applies the brakes and accelerates uniformly in the opposite direction, stopping in 5 s. Another driver going at 34 km/h (Car B) in another car applies his brakes slowly and stops in 10 s.
   (a) On the same graph paper, plot the speed-time graphs for the two cars. (Use an appropriate scale).
   (b) Calculate the acceleration of each car.
   (c) Which of the two cars traveled farther after the brakes were applied? Show your calculation.
3. (Extremely Difficult) A ball is dropped from a height 'H'. At the exact same instant, another ball is thrown vertically upwards from the ground with an initial velocity 'u' that is just enough to make it reach the height 'H'.
   (a) Find the time 't' when the two balls cross each other, in terms of H and g.
   (b) Find the height 'h' (from the ground) where they cross, in terms of H.

Section E: Case-Study Based Questions (3 x 5 = 15 Marks)

Read the following cases and answer the 5 questions based on each.

1. **Case Study 1: The Circular Track**
   An athlete completes one round of a circular track of diameter 200 m in 40 s.
   (a) What is the radius of the track?
   (b) What is the distance covered in one complete round? (Use $\pi = 22/7$)
   (c) What is the athlete's average speed?
   (d) What is the total distance covered at the end of 2 minutes and 20 seconds?
   (e) What is the magnitude of the displacement at the end of 2 minutes and 20 seconds?

2. **Case Study 2: The Three Travelers**
   [Study the distance-time graph from the source PDF showing three objects: A, B, and C]
   (a) Which of the three objects (A, B, or C) is traveling the fastest? Justify your answer.
   (b) Are all three objects ever at the same point on the road at the same time?
   (c) How far has object C traveled when object B passes object A?
   (d) How far has object B traveled by the time it passes object C?
   (e) Calculate the approximate speed of object B.

3. **Case Study 3: The Car's Journey**
   [Study the speed-time graph from the source PDF showing a curved line followed by a horizontal line]

   (a) What does the area under the graph from $t = 0$ to $t = 4$ s represent?

   (b) Based on the graph, what is the approximate distance traveled by the car in the first 4 seconds?

   (c) What does the slope of the graph from $t = 0$ to $t = 6$ s indicate about the car's acceleration?

   (d) Which part of the graph (in terms of time) represents the uniform motion of the car?

   (e) What is the car's acceleration from $t = 6$ s to $t = 10$ s?