Motion in One Dimension

1. **When a body is said to be Rest or Motion?**
   Ans. When a body does not change its position with respect to surroundings, the body is said to be in Rest.
   When a body changes its position with respect to its surroundings, it is said to be in Motion.

2. **"Rest and Motion are relative terms"- Why? Describe with example.**
   Ans. Rest and motion are opposed to each other, yet there is a close relation between them, and sometimes it is very difficult to say, whether a body is actually in a state of rest or in a state of motion.
   A person is sitting in the compartment of a moving train is in the state of rest, with respect to the surroundings of compartments.
   Yet he is in the state of motion, if he compares himself with the surroundings outside the compartment.

3. **What is Scaler Quantity?**
   Ans. The physical quantity which are expressed in magnitude only are called Scalar Quantity.
   Ex: Mass, Length, Time, Area etc.

4. **Which parameters are essential to express a scaler quantity?**
   Ans. We need to follow two parameters to express a scaler quantity completely.
   i. Unit in which the quantity is being measured
      and
   ii. Numerical value of measured quantity.

5. **What is Vector Quantity?**
   Ans. The physical quantities which are expressed in magnitude as well as direction are called Vector Quantities.
   Ex: Displacement, Velocity, momentum etc.

6. **How can we represent a vector quantity?**
   Ans. A vector quantity can be represented by an arrow ahead.
   The length of the arrow represents the magnitude of the vector quantity.
   The arrowhead represents the direction of the vector quantity.

7. **What is the difference between Scaler and Vector quantities?**
   Ans.

Scaler Quantities	Vector Quantities
They are expressed in magnitude only.	They are expressed in magnitude as well as direction.
They can be added by simple arithmetic means.	They cannot be added by simple arithmetic means.
They cannot be easily plotted on graph paper.	They can be easily plotted on graph paper.

8. **What is One Dimensional Motion?**
   Ans. When a body moves along a straight-line path its motion is said to be One Dimensional Motion.

9. **What is Two-Dimensional Motion?**
   Ans. If a body moves on a plane along a carved path its motion is called Two-Dimensional Motion.

10. **What is Three-Dimensional Motion?**
    Ans. If a body moves in space its motion is called three-dimensional motion.

11. **What is the definition of Distance?**
    Ans. The length of the path travelled by a body in certain interval of time is called Distance.
    It is a **Scaler Quantity**.

12. **What is the definition of Displacement?**
    Ans. The shortest distance between the initial position and the final position of a body is called Displacement.
    Displacement is **Vector Quantity**.

13. **Is it possible to have a moving body with zero displacement, but covering a large distance? Describe with example.**
    Ans. Yes, it is possible.
    When a body completes one revolution along a circular path of radius r, then the distance covered by the body is $2\pi r$.
    But its initial and final position is same. So, displacement is zero.

14. **Why the magnitude of displacement can never be greater than distance travelled by the body?**
    Ans. If motion is along a fixed direction, the magnitude of displacement is equal to that of distance, but if motion is along a curve or along zig-zag path the magnitude of displacement is always less than that of distance.
    Thus, the magnitude of displacement can never be greater than distance travelled by the body.

15. **'Displacement is either positive or Negative but distance is always positive'- why?**
    Ans. The distance is the length of the path travelled by the body, so it is always positive, but displacement is the shortest length in direction from initial position to the final position so it can be positive or negative depending on its direction.

16. Write the difference between Distance and Displacement?

Ans.

Sl. No.	Differentiating Property	Distance	Displacement
1	Definition	The complete length of the path between any two points is called distance.	Displacement is the direct length between any two points when measured along the minimum path between them.
2	Denotation	d	s
	Quantity	Distance is a scalar quantity as it only depends upon the magnitude and not the direction.	Displacement is a vector quantity as it depends upon both magnitude and direction.
4	Formula	Speed × Time	Velocity × Time
5	Possible Values	The distance can only have positive values.	Displacement can be positive, negative, and even zero.
6	Path Dependence	Distance depends upon the path i.e., it changes according to the path taken.	Displacement does not depend upon the path and it only depends upon the initial and final position of the body.

17. What is Speed?

Ans. Rate of change of motion or Distance covered by a moving body per unit time is called Speed.

If S is the distance covered by a body in time t then

Speed = Distance/ Time = S/t

18. What is Uniform Speed?

Ans. If a body covers equal distance in equal interval of time, it is said to be moving with Uniform Speed.

19. What is Variable Speed?

Ans. If a body covers un-unique distance in equal intervals of time, it is said to be moving with a Variable Speed.

20. What is Average Speed?

Ans. The ratio of the total distance travelled by the body to the total time taken by the body to cover the distance is called average speed.

Average Speed = Total distance travelled / Total Time taken.

21. What is Instantaneous speed?

Ans. If the speed of a body is continuously changing with time, then the speed at same particular instant during the motion is called Instantaneous Speed.

Instantaneous Speed = Distance travelled in a short time interval / Time Interval

22. What is Velocity?

Ans. The rate of change of motion in specified direction or Rate of change of displacement is called Velocity.

23. What is Uniform Velocity?

Ans. When a body covers equal distance in equal intervals pf time in a specified direction the body is said to be moving with uniform velocity.

24. What is Variable Velocity?

Ans. When a body covered un-unique distance in equal intervals of time in a specified direction, the body is said to be moving with a variable velocity.

25. How a velocity of a body become variable?

Ans. The velocity of a body becomes variable when

i. The magnitude changes
ii. The direction changes.

26. What is Average Velocity?

Ans. The ratio of the total distance travelled in a specified direction to the total time taken by the body to travel that distance is called Average Velocity.

Average Velocity= Total distance travelled in specified direction / Total Time taken.

27. What is Instantaneous Velocity?

Ans. If a body moves with variable velocity, the velocity of the body at any instant is called Instantaneous Velocity.

28. Is it possible to have a moving body with an average velocity zero, but its average speed is not Zero? Describe with example.

Ans. Yes, it is possible.

We know Average Velocity = $\frac{Total\ Displacement}{Total\ Time}$

Average Speed = $\frac{Total\ Distance}{Total\ Time}$

Now Distances can be zero, So average speed zero.

but displacement cannot be zero so Average velocity can be zero.

29. What are the differences between Velocity and Speed?

Ans.

Sl. No.	Differentiating Property	Velocity	Speed
1	*Definition*	Velocity can be defined as the rate at which an object changes position in a certain direction.	The rate at which an object covers a certain distance is known as speed.
2	*Type of quantity*	Vector quantity	Scalar quantity
3	*Magnitude*	Velocity can be zero, negative, or positive.	Speed can never be negative or zero.

4	*Change of direction*	The velocity of the object changes with the change in direction, therefore the object must follow one direction.	The average speed will continue to count even if the object changes direction.
5	*Interrelation*	An object may possess different velocities but the same speed.	Speed may or may not be equal to velocity.
6	*Unit (SI)*	Velocity is measured in m/s	Speed is measured in m/s

30. What is Acceleration?

Ans. The rate of change of velocity of a body, is called Acceleration.

Acceleration = Displacement / Time^2

It is denoted by '**a**'.

Let a body be moving in a straight line in a fixed direction with an initial velocity u. Its velocity changes in a short time interval t and the final velocity becomes v after time t.
Then change in velocity= (v - u) and time taken= t.

Acceleration a = (v-u)/t
Or, **v= u+at**

Acceleration is **Vector Quantity**.

SI unit of Acceleration is **m/s^2**
CGS unit of Acceleration is **cm/s^2**

If the velocity of a body is increased with respect of time the acceleration is positive.
If the velocity of a body is decreased with respect of time then the acceleration is negative.
It is also called **Retardation** or **Deceleration**.

31. What is Uniform Acceleration?

Ans. When a body describes equal changes in velocity in equal intervals of time, it is said to be moving with uniform acceleration.

32. What is Variable Acceleration?

Ans. If change in velocity is not same in the same intervals of time, the acceleration is said to be variable.

33. What is Acceleration due to Gravity?

Ans. The acceleration of a freely falling body under the action of gravity of earth, is called Acceleration due to gravity.
It is denoted by '**g**'.

CGS unit of **g** is **980 cm/s²**
SI unit of **g** is **9.8 m/s²**

34. On which factor the acceleration due to gravity does not depend?

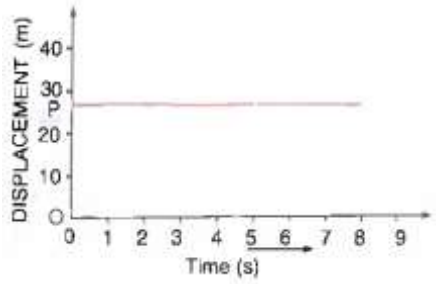
Ans. Acceleration due to gravity does not depend on the mass of the body. Hence if two bodies of different masses are simultaneously dropped from a height, both will reach the ground simultaneously in vacuum because then there is no effect of friction and buoyancy due to air.

35. Draw Displacement-Time graph when

i. When a body in stationary condition
ii. When a body moving with uniform velocity
iii. When a body moving with un-uniform velocity

Ans.

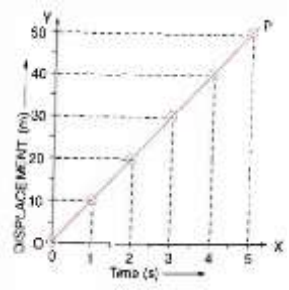
Case 1: When a body in stationary condition



If the position of a body does not change with time, the body is said to be stationary and the displacement as measured from the origin at all instant is same as that at t = 0, so the displacement-time graph is a straight line parallel to the time axis.

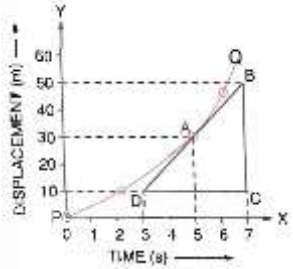
Case 2: When a body moving with uniform velocity

If a body is moving with uniform velocity, its displacement increases by the same amount in each second and so the displacement time graph is a straight line inclined to the time axis. The velocity of body can be obtained by finding the slope of the straight line.



Case 3 When a body moving with un-uniform velocity

If a body moves with varying speed in a fixed direction the displacement time graph is not a straight line but it is a curve.



36. Draw the shape of the velocity-time graph for a body moving with

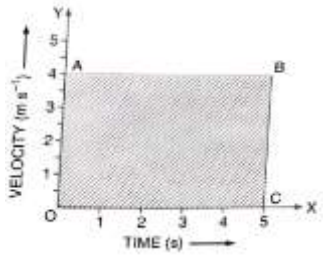
i. uniform velocity

ii. uniform acceleration.

Ans

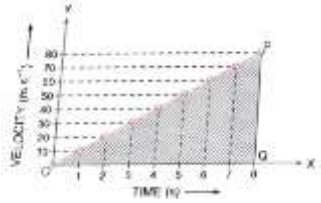
Case 1: If a body is in motion with uniform velocity

The velocity-time graph is a straight line parallel to the time axis.



Case 2: If a body is in motion with uniform acceleration

If the body is in motion with uniform acceleration (i.e., equal changes in velocity take place in equal intervals of time), the velocity time graph is a straight line inclined to the time axis. The slope of the line gives the acceleration.



37. Draw Acceleration-Time graph when

i. A body in stationary condition

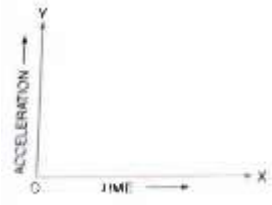
ii. The velocity of body in motion increases uniformly with time

iii. The velocity of body changes in an irregular manner

Ans.

Case 1: When a body in stationary condition

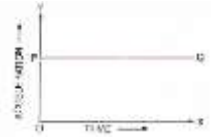
If a body is stationary condition or if it is moving with a uniform velocity, the acceleration is zero. The acceleration-time graph in such a case is a straight line coinciding with the time axis.



Case 2: When the velocity of body in motion increases uniformly with time

If the velocity of body in motion increases uniformly with time the acceleration is constant.

In such case the acceleration-time graph is a straight line parallel to time axis on the positive side.

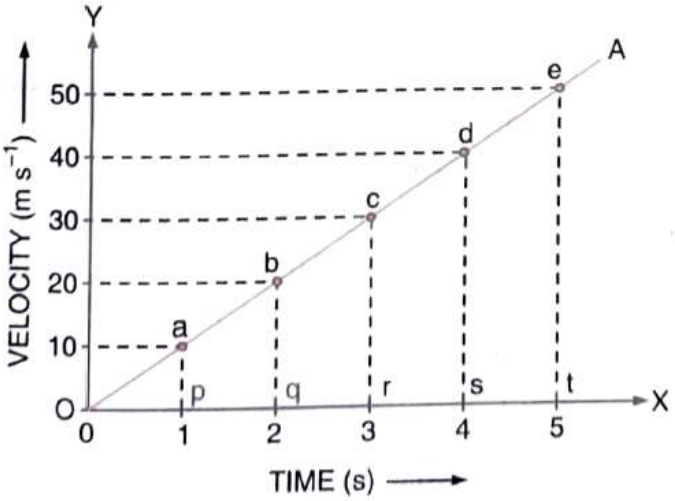


Case 3: If the velocity of body changes in an irregular manner

If the velocity of body changes in an irregular manner, the acceleration is variable. The acceleration-time graph will then be curve of any shape

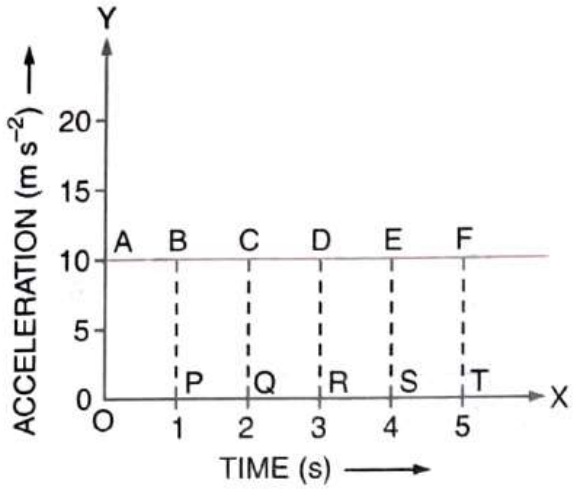
38. Draw Velocity and Time Graph when a body is freely falling due to gravity?

Ans.



39. Draw the acceleration Time Graph when a body is freely falling due to gravity.

Ans.



Equations of Motion

If a body moves **S** distance at **t** time
And the initial velocity is **u** and the final velocity is **v**
And the acceleration is **a** then

$V = u + at$

$S = ut + 1/2\ at^2$

$v^2 = u^2 + 2aS$

Short Question

1. Distance is _____ quantity.
2. SI unit of Distance is _____
3. Mass is _____ quantity
4. Distance is denoted by _____.
5. Speed is _____ quantity.
6. SI unit of speed is _____.
7. If a body moves in space, it□ motion is _____.
8. Vector quantities requires _____ and _____.
9. Velocity is _____ quantity.
10. Negative Acceleration is called _____.
11. SI unit of Acceleration is _____.
12. Acceleration is _____ Quantity.
13. Acceleration is denoted by _____.
14. Acceleration due to gravity is denoted by _____.
15. The SI value of g is _____
16. SI unit of Distance and Displacement is _____.
17. If a body moves on a plane along a curved path, its motion is _____.
18. Acceleration = _____ / $Time^2$
19. SI unit of Acceleration is _____.
20. The motion of á body under gravity is the example of _____ acceleration.
21. The Average value of g is _____.
22. Acceleration due to gravity does not depend on the _____ of the body.
23. If the speed of a vehicle is 36 km/hr then its speed is _____ m/sec.
24. The value of **g** is maximum at _____ and minimum at on the _____.
25. SI Unit of Retardation is _____.
26. The slop e of displacement-time graph gives the_____.
27. The displacement-time graph is a straight line parallel to the time axis when the body is _____.
28. For a body moving with uniform velocity, the displacement is directly proportional to the _____.
29. The slope of the velocity-time sketch gives the_____.
30. For a uniformly retarded motion, the velocity-time graph is _____.
31. A body starts from rest with a uniform acceleration of 2 m s^{-2}. The distance covered by the body in 2 s is _____.

Answer

1) Scaler
2) Meters
3) Scaler
4) S
5) Scaler
6) m/s
7) three dimensional
8) Magnitude, direction
9) Vector
10) Retardation.
11) m/s^2
12) Vector
13) a
14) g
15) 9.8 m/s^2
16) Meter (m)
17) two dimensional
18) Displacement
19) m/s^2
20) Uniform
21) 9.8 m s^{-2}
22) Mass
23) 10
24) Poles , earth surface
25) ms^{-2}
26) velocity
27) Stationary Condition
28) time
29) Acceleration
30) a straight line inclined to the time axis.
31) 4m