**Class – 7th motion & time**

**1. Define speed. Write its formula and SI unit.**

**Answer:**  
**Speed** is the distance traveled by an object per unit time. It indicates how fast an object is moving.

**Formula:**

Speed=DistanceTime\text{Speed} = \frac{\text{Distance}}{\text{Time}}Speed=TimeDistance​

**SI Unit:**  
The SI unit of speed is meters per second (m/s).

**2. Differentiate between uniform motion and non-uniform motion.**

| **Uniform Motion** | **Non-Uniform Motion** |
| --- | --- |
| An object covers equal distances in equal intervals of time. | An object covers unequal distances in equal intervals of time. |
| The speed remains constant. | The speed changes over time. |
| Example: A car moving at 60 km/h without changing speed. | Example: A car accelerating or decelerating. |

**3. What is velocity? How is it different from speed?**

**Answer:**  
**Velocity** is the speed of an object in a specific direction.

**Difference:**

| **Speed** | **Velocity** |
| --- | --- |
| Scalar quantity (magnitude only). | Vector quantity (magnitude and direction). |
| Does not indicate direction. | Indicates direction. |

**Example:**  
Speed: 20 m/s  
Velocity: 20 m/s north

**4. What is acceleration? Write its formula and SI unit.**

**Answer:**  
Acceleration is the rate of change of velocity with respect to time.

**Formula:**

Acceleration=Change in velocityTime taken=v−ut\text{Acceleration} = \frac{\text{Change in velocity}}{\text{Time taken}} = \frac{v - u}{t}Acceleration=Time takenChange in velocity​=tv−u​

Where:

* vvv = Final velocity
* uuu = Initial velocity
* ttt = Time

**SI Unit:**  
The SI unit of acceleration is meters per second squared (m/s²).

**5. A car starts from rest and accelerates uniformly at 5 m/s25 \, \text{m/s}^25m/s2. Find its velocity after 10 seconds.**

**Answer:**  
Given:

* Initial velocity (uuu) = 0 m/s
* Acceleration (aaa) = 5 m/s25 \, \text{m/s}^25m/s2
* Time (ttt) = 10 s

Using the formula:

v=u+atv = u + atv=u+at v=0+5×10=50 m/sv = 0 + 5 \times 10 = 50 \, \text{m/s}v=0+5×10=50m/s

**Velocity after 10 seconds = 50 m/s.**

**6. State the three equations of motion and explain their significance.**

**Answer:**  
The three equations of motion are:

1. **First equation of motion:**

v=u+atv = u + atv=u+at

It relates velocity, initial velocity, acceleration, and time.

1. **Second equation of motion:**

s=ut+12at2s = ut + \frac{1}{2}at^2s=ut+21​at2

It gives the displacement of an object under uniform acceleration.

1. **Third equation of motion:**

v2=u2+2asv^2 = u^2 + 2asv2=u2+2as

It relates the square of velocities with displacement and acceleration.

**7. Define distance and displacement. How are they different?**

**Answer:**

| **Distance** | **Displacement** |
| --- | --- |
| Total path covered by an object. | Shortest straight-line path between initial and final positions. |
| Scalar quantity. | Vector quantity. |
| Cannot be zero or negative. | Can be zero, positive, or negative. |

**Example:**  
If a person moves 5 m forward and 5 m back, the distance is 10 m, but the displacement is 0 m.

**8. A train travels 120 km in 3 hours. Calculate its average speed.**

**Answer:**  
**Given:**

* Distance = 120 km
* Time = 3 hours

Using the formula:

Average Speed=DistanceTime\text{Average Speed} = \frac{\text{Distance}}{\text{Time}}Average Speed=TimeDistance​ Average Speed=1203=40 km/h\text{Average Speed} = \frac{120}{3} = 40 \, \text{km/h}Average Speed=3120​=40km/h

**Average speed = 40 km/h.**

**9. A ball is dropped from a height of 20 m. How long does it take to hit the ground? (Take g=10 m/s2g = 10 \, \text{m/s}^2g=10m/s2)**

**Answer:**  
Using the second equation of motion:

s=ut+12gt2s = ut + \frac{1}{2}gt^2s=ut+21​gt2

Here:

* s=20 ms = 20 \, \text{m}s=20m, u=0u = 0u=0, g=10 m/s2g = 10 \, \text{m/s}^2g=10m/s2

20=0+12×10×t220 = 0 + \frac{1}{2} \times 10 \times t^220=0+21​×10×t2 20=5t2⇒t2=420 = 5t^2 \quad \Rightarrow \quad t^2 = 420=5t2⇒t2=4 t=4=2 secondst = \sqrt{4} = 2 \, \text{seconds}t=4​=2seconds

**Time taken = 2 seconds.**

**10. What is the significance of a distance-time graph?**

**Answer:**  
A distance-time graph:

1. Represents the motion of an object visually.
2. Shows the speed of an object:
   * A straight line indicates uniform speed.
   * A curved line indicates non-uniform speed.

**Example:**

* A horizontal line indicates the object is at rest.