Units and conversion
Length – Meter(m)
Time – Seconds(s)
Mass – Kilogram (kg)
Prefixes and their meanings: A prefix is added to a unit to multiply/ divide its magnitude by a definite factor.

Giga (G)	10^{9}	femto (f)	10^{-15}	milli (m)	10^{-3}
Mega (M)	10^{6}	pico(p)	10^{-12}	centi (c)	10^{-2}
Kilo (K)	10^{3}	nano (n)	10^{-9}	**deci (d)**	10^{-1}
Deca(da)	10^{1}	micro (μ)	10^{-6}	hecta (h)	10^{2}

Acceleration of an object moving along a straight line

The rate at which the velocity of an object changes is called the acceleration of the object. In other words, acceleration is the change in velocity per unit time.
Consider an object moving along a straight path in the same direction. Its velocity changes in a short time period 't'. Its velocity at the beginning of the time interval is 'u' (initial velocity). Its velocity after time 't' is v (Final velocity).

Acceleration is change in velocity per unit time;
Acceleration = (Final velocity - Initial Velocity)/ Time
$a = (v - u)/ t$; where a is the acceleration produced in the body.
The SI unit of acceleration is m /sec ^{2}. It is a vector quantity.
The acceleration is positive, if it is in the direction of velocity.
The acceleration is negative, if it is opposite to the direction of velocity.
The acceleration is zero, if the object is moving with constant velocity.

Deceleration

If the speed of an object decreases, we say that it is decelerating or it has a deceleration or retardation. Negative acceleration is also called retardation.

Types of Acceleration

There are two types of acceleration:

1. Uniform Acceleration: if an object travels in a straight line and its velocity increases or decreases by equal amounts in equal intervals of time, then the object is said to be in uniform acceleration. For e.g., a motion of a freely falling body, or motion of a ball rolling down on an inclines plane.
2. Non-uniform Acceleration: if the velocity an object increases or decreases by unequal amounts in equal intervals of time, then the object is said to be in non-uniform acceleration. For e.g., movement of car in a crowded city road, or motion of train leaving or entering the platform.

Three Equations of Motion:

1. $v = u + at$
2. $s = ut + ½ a t^2$
3. $v^2 - u^2 = 2as$

Where u = initial velocity; v = final velocity; a = acceleration; t = time period; s = displacement.

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Exercise 3

Q1. The velocity of a car at 10:50 am is 60km/hr and at 10:52 am is 80km/hr. assuming constant acceleration in the given time period, find its value. ($600 km/hr^2$)

Q2. An object is sliding down an inclined plane. The velocity changes at a constant rate from 10 cm/sec to 15 cm/ sec in two seconds. What is the acceleration? ($2.5 cm/sec^2$)

Q3. An object is moving up an inclines plane. Its velocity changes from 15 cm/sec to 10 cm/sec in two seconds. What is the acceleration? ($-2.5 cm/sec^2$)

Q4. A boy throws up a ball and catches it when the ball falls back. In which part o d the motion is the ball decelerating?

Q5. A train starting from a railway station and moving with uniform acceleration attains a speed of 40 km/hr in 10min. Find its acceleration. ($0.0185 m/sec^2$)

Q6. A car accelerating at a rate of 3 m/s^2 is moving with a speed of 30 m/s. What was its speed before 5 seconds?

Exercise

Q1. A car stars from rest and accelerates for 6 s with a uniform acceleration of 2 m/s^2. What is the velocity of the car after this time?

Q2. A bus travelling at 60 km/hr comes to rest in 30 s. What is its deceleration in m/s^2?

Q3. A cheetah accelerates from rest to a speed of 72 km/hr in 30 seconds. What is its acceleration?

Q4. A cable car moving at a speed of 6 km/hr is stopped by uniformly decelerating at the rate of 1 m/s^2. After what time does it stop?

Q5. A fast moving train is uniformly accelerating since it started its journey from the previous station. How long has it been running if its present speed is 72 km/hr and the acceleration is 2 m/s^2?

Q6. Can the velocity of a particle ever be in the direction other than in the direction of its acceleration?

Q7. Two cars 'A' and 'B' are moving with a velocity of 10 m/s and 72 km/hr respectively. On applying brakes the retardations produced in the cars 'A' and 'B' are 0.5 m/sec^2 respectively. What is the ratio of time taken by each car to stop?

Q8. Two poles are situated at a distance of 100m from each other. A train of length 200m is running between the two poles with a velocity of 72km/hr. What will be time taken by the train to cross the poles?

Q9. What is a reference point? How position is defined using a reference point?

Q10. What is the acceleration? If a body is under uniform acceleration, is it in uniform motion too?

Q11. What do the positive and negative signs of acceleration indicate? What is the SI unit of acceleration?

Q12. When do we say that a body is undergoing non – uniform acceleration?