

Motion in a Plane Class 11 NCERT Notes PDF

What is Motion in a Plane?

Before we delve deep into the concepts pertaining to the motion in a plane, let us first understand what the term “Plane” denotes. The plane is nothing, but a flat surface that consists of 2 dimensions. Therefore, the motion that occurs in two dimensions, it is called Motion in a Plane. The plane is denoted by X- and Y-axis. This motion can be a rotational, projectile or even relative in nature. To understand more, let us go through other essential concepts.

What are Vectors and their Basic Operations?

Vectors are entities with both magnitudes as well as direction. They are generally denoted by an arrow (\rightarrow) along with their magnitude. Vectors are a seemingly new topic for class 11 Physics, and hence, we must have a better understanding of it. Vectors have basic operations as vector addition, subtraction, multiplication, and resolution, however, these are different from the mathematical laws we have learned till now. This is because vectors contain directions as well. Hence, the resolution of vectors comes handy in understanding the motion in a plane.

Types of Motions in a Plane

As discussed, there can be different types of motions that occur on a 2D surface. This can be Circular, Projectile, or Relative. The basic details related to types of motion in a plane have been given a rundown below.

Projectile Motion

Whenever we kick a ball to our friend or throw a stone from a cliff, we are observing a type of Planar Motion known as Projectile Motion. In this type of motion, a ‘Projectile’ or an object is thrown at different angles, at different velocities and from different initial heights. This motion can easily be understood using horizontal and vertical components of motion, which are independent of each other.

- Horizontal Component: This consists of the horizontal motion of the projectile. On analysing this, we get results known as Range, Time Period, etc.
- Vertical Component: On carefully applying basic arithmetic to equations of motion, while only considering the vertical quantities of the motion, we get results such as Maximum Height, Velocity at any time, etc.

What is important to note is that if the object is thrown vertically upwards (uniform acceleration), we can determine its motion using the equation of motions. However, if the object is thrown at different angles, we take the horizontal as well as the vertical components of initial velocity into consideration. This can be explained using the image below.

Circular Motion

Unlike projectile motion, circular motion consists of the analysis of the motion of an object moving at the same distances relative to a fixed point, i.e., in a circular path. Again, this motion's attributes can be broken down and understood clearly with the help of horizontal and vertical components of the motion of the object.

Relative Motion

Motion, where we take information according to a relative observer rather than a universal one, is called relative motion. When we consider the heights of two persons, we say that person A is 177 cm and person B is 180 cm tall, but when talking relatively, we say person A is 2 cm shorter than B or vice versa.

Terms Regarding Motion in a Plane

Now that you have got an overview of the basic concepts pertaining to different types of motion in a plane, let us understand some important terms in detail.

1. **Maximum Height:** The maximum height is the altitude an object reaches during its entire interval of time portraying motion in a plane.
2. **Time Interval:** This denotes the entire duration of time while the object was in motion.
3. **Horizontal Range:** The total distance from the initial point of projection of an object to the final point in its journey is called its horizontal range.
4. **The Angle of Projection:** It denotes the initial angle (from the horizontal plane) at which the object is projected.
5. **Angular Displacement:** The angle covered by the initial and final points of an object during its circular motion. Its unit is in radians.
6. **Angular Velocity:** This is the circular counterpart of velocity and is defined as the rate of change in angular displacement. Its unit is radian per second.