Uniform Circular Motion-AUS VIDEO.ver.1.0 LR

Uniform Circular Motion Objective To learn about uniform circular motion Observe the motion of this toy train. It's moving along a circular path. So we can say that the toy train is exhibiting a circular motion.

At the same time the toy train is moving at a constant speed. So its motion is called uniform circular motion. The motion of the earth around the sun and the moon around the earth are other examples of uniform circular motion.

Here we can see a ball moving along the circumference of a circle. We observe that the speed of the ball remains constant. However, its velocity changes due to a continuous change in the direction.

Like the ball, when a body moves along a circular path at a constant speed, it has a uniform circular motion. And, due to a continuous change in its velocity, it has accelerated motion. So we understand that uniform circular motion is accelerated motion.

Now, let's find out the reason behind the continuous change in the velocity of a body as it moves along a circular path. Observe the motion of the ladybird along the rectangular track. It changes its direction of motion four times to complete one round.

Now, the ladybird is moving along a hexagonal path. In this case, the ladybird changes direction six times to complete one round. Similarly, to complete one round on an octagonal path, it changes direction eight times.

So, we observe that as the number of sides of the track increases, so does the frequency of change in direction. If the number of sides is increased indefinitely, the shape of the track approaches the shape of a circle, and the length of each of the sides decreases to a point. Therefore, the ladybird has to change its direction at every point while moving along a circular path.

Thus, we understand that when a body moves along a circular path at a constant speed, its direction of motion changes at every point. Let's take the example of a stone tied to a string which is swung in a circle. The stone is said to be in uniform circular motion.

When the thread is released, we observe that the stone moves in a straight line tangential to the circular path. This happens because while moving along a circular path, when the body is released, it tends to move along the direction it was moving in at that specific instant. For the same reason, a discus thrown by an athlete moves in a straight line tangential to the circular path.

By this, we understand that when a body moves at a constant speed along a circular path, its direction of motion is tangential to the circular path at any point in its motion. To summarise, when an object moves along a circular path at a constant speed, its motion is called uniform circular motion. Uniform circular motion is an accelerated motion.

We understand that when a body moves at a constant speed along a circular path, its direction of motion is tangential to the circular path at any point.

Summary of Uniform Circular Motion

Understanding Uniform Circular Motion

Uniform circular motion refers to the movement of an object along a circular path while maintaining a **constant speed**. A **toy train moving on a circular track** is an example of this motion. Similarly, the **Earth orbiting the Sun** and the **Moon revolving around the Earth** are also examples of uniform circular motion.

Velocity and Acceleration in Uniform Circular Motion

- A ball moving along the circumference of a circle maintains a **constant speed**, but its **velocity keeps changing** because of the continuous change in **direction**.
- When a body moves along a circular path at **constant speed**, it experiences **uniform circular motion**.
- Due to the **continuous change in velocity**, uniform circular motion is also classified as **accelerated motion**.

Why Does Velocity Keep Changing?

- Imagine a **ladybird moving on a rectangular path**. It changes direction **four times** to complete one round.
- On a **hexagonal path**, the ladybird changes direction **six times**.
- On an **octagonal path**, the direction changes **eight times**.
- As the number of sides increases indefinitely, the **track approaches the shape of a circle**, meaning that the object must change its direction **at every point** while moving along a circular path.
- Thus, in **uniform circular motion, the direction of motion changes continuously**.

Tangential Motion in Circular Paths

- Consider a **stone tied to a string and swung in a circle**. When the string is released, the stone moves in a **straight line tangential to the circular path**.
- This happens because when an object in circular motion is suddenly released, it continues moving in the direction it was traveling at that instant.
- A **discus thrown by an athlete** also follows a **tangential trajectory** after being released.
- Hence, in **uniform circular motion, the motion of an object at any point is always tangential to the circular path**.

Key Takeaways

✔ Uniform circular motion occurs when an object moves in a circular path at a constant speed.
✔ Despite maintaining constant speed, the object's velocity keeps changing due to the continuous change in direction.
✔ Since velocity changes continuously, uniform circular motion is an example of accelerated motion.
✔ At any given point in its motion, the direction of the moving object is tangential to the circular path.

Quiz on Uniform Circular Motion

1. What is uniform circular motion?
✅ **Motion along a circular path at a constant speed**
❌ Motion along a straight line at a constant speed
❌ Motion along a circular path with varying speed
❌ Motion that is non-accelerated

2. Why is uniform circular motion considered accelerated motion?
✅ **Because the direction of velocity changes continuously**
❌ Because speed keeps increasing
❌ Because the object moves faster near the center
❌ Because acceleration is zero

3. When a stone tied to a string is swung in a circle and the string is released, in which direction does the stone move?
✅ **Tangential to the circular path**
❌ Towards the center
❌ In a random direction
❌ In a curved trajectory

4. What happens when the number of sides in a polygonal track increases indefinitely?
✅ **The shape approaches a circle**
❌ The object moves in a zigzag manner
❌ The velocity of the object becomes zero
❌ The object stops moving