Motion In a Circle:

Uniform Circular Motion:

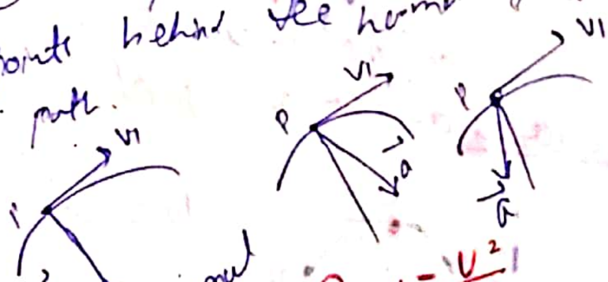
When the particle moves in a circle with constant speed, the motion is called Uniform circular motion

Along curved path.

1) If the speed is constant, $\vec{a}$ is perpendicular to the path and to $\vec{v}$, and points towards concave side of path.

2) If the speed is increasing, $\vec{a}$ points ahead of the normal to the path (because in addition, $\vec{a}$ points ahead of the normal to perpendicular components in the direction of $\vec{v}$ is also present.

3) If speed is decreasing, $\vec{a}$ points behind the normal to the path.



$$a_{rad} = \frac{v^2}{R}$$

In uniform circular motion, the magnitude 'a' of the instantaneous acceleration is equal to the square of the speed 'v' divided by the radius 'R' of the circle. It's direction ⊥ to $\vec{v}$ and inward along the radius. Because the acceleration is always directed toward the centre of the circle, it is sometimes called centripetal acceleration

$$\therefore v = \frac{2\pi R}{T}$$

$\omega = \frac{2\pi}{T}$

$v = \frac{2\pi r}{T}$

$$a_{rad} = \frac{4\pi^2 R}{T^2}$$

*) At later time 't', the object has changed its velocity, but the speed has not changed.

→ speed not changing, but velocity vector is changing, there must be acceleration.

→ $|a_c| = \frac{v^2}{r} = \frac{r^2\omega^2}{r} = r\omega^2$; magnitude of a_c.

→ $a_c \propto r$, ω is same for entire motion.

→ If disc was rotating, you were at the centre of the disc, the 'a_c' would be zero bcz $\boxed{r=0}$.

→ Some thing that must responsible for the change in velocity, and that some thing, I will call 'Push' or 'Pull'. i.e Force.

→ Planets go around the Sun, It must be gravity; It must be something that is pulling on the planets.

Projectile.

Ans

$v_{0x} = v_0\cos\theta = 22.2\,m/s$

$v_{0y} = v_0\sin\theta = 29.6\,m/s$

$x = (v_{0x})t = 44.4\,m$

$y = v_{0y}t - \frac{1}{2}gt^2 = 39.6\,m$

$v_x = v_{0x} = 22.2\,m/s$

$v_y = v_{0y} - gt = 10\,m/s$

$v = \sqrt{v_x^2 + v_y^2} = 24.4\,m/s.$

(b) $v_y = v_{0y} - gt.$

$0 = v_{0y} - gt$ (at highest point)

$t = 3.02\,s$

$h = v_{0y}t_1 - \frac{1}{2}gt_1^2$

$h = 44.7\,m$

(c) $y = v_{0y}t - \frac{1}{2}gt^2$

$0 = v_{0y}t - \frac{1}{2}gt^2$

$t_1 = 0$, $t_2 = 6.04\,s$

$R = (v_{0x})t_2 = 134\,m$

$v_y = v_{0y} - gt_2$

$v_y = -29.6\,m/s$

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