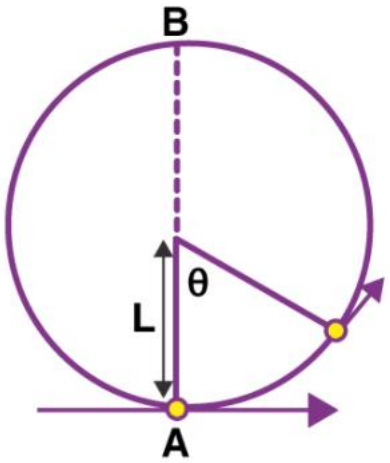
Q5: A bob of mass M is suspended by a massless string of length L. The horizontal velocity V at position A is just sufficient to make it reach point B. The angle at which the speed of the bob is half of that at A satisfies



1. $\theta = \pi/2$
2. $\pi/4 < \theta < \pi/2$
3. $\pi/2 < \theta < 3\pi/4$
4. $3\pi/2 < \theta < \pi$

Solution

This is the case of vertical motion when the body just

completes the circle. Here

$v = \sqrt{5gL}$

Applying energy conservation,

½ mv_0^2 = ½ mv^2 + mgl(1-cosθ)———(1)

where v_0 is the horizontal velocity at the bottom point, v is the velocity of bob where the bob inclined θ with vertical.

Also, we know the relation between the velocity at the topmost and velocity at the bottom point.

mg(2l) =½ mv_0^2 -1/2mv_{top}^2———(2)

Since v_0 is just sufficient

mv_{top}^2/l = T + mg

T = 0

$v_{top} = \sqrt{gl}$

Then equation 2 becomes

$v_0 = \sqrt{5gl}$

According to the question v= $v_0/2$

So from equation (1)

½ m(5gl) = ½ m (5gl/4) + mgl(1-cosθ)

(20mgl – 5mgl)/8 = mgl(1-cosθ)

(1-cosθ) = 15/8

Cosθ = ⅞

Hence, 3π/2 < θ < π

Answer:(4) 3π/2 < θ < π