AQA – Circular motion – A2 Further Mathematics Mechanics

1. June/2021/Paper_7367/3M/No.7

A light string has length 1.5 metres.

A small sphere is attached to one end of the string.

The other end of the string is attached to a fixed point O

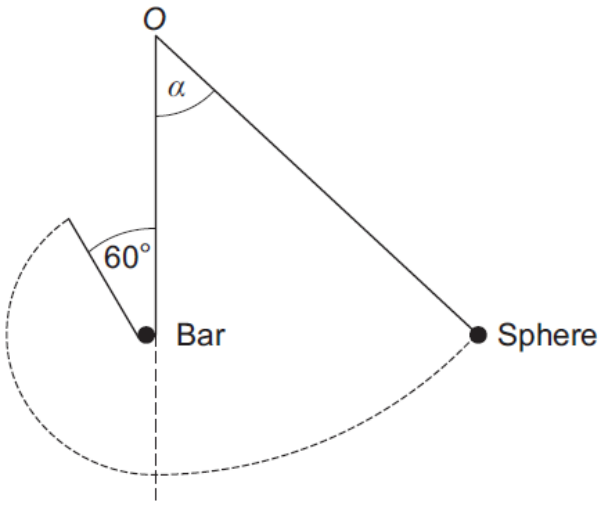
A thin horizontal bar is positioned 0.9 metres directly below O

The bar is perpendicular to the plane in which the sphere moves.

The sphere is released from rest with the string taut and at an angle α to the downward vertical through O

The string becomes slack when the angle between the two sections of the string is 60°

Ben draws the diagram below to show the initial position of the sphere, the bar and the path of the sphere.



(a) State two reasons why Ben's diagram is not a good representation of the situation.

[2 marks]

Reason 1 _____

_____

_____

_____

Reason 2 _____

_____

_____

_____

(b) Using your answer to part **(a)**, sketch an improved diagram.

[1 mark]

(c) Find α, giving your answer to the nearest degree.

[6 marks]

2. June/2021/Paper_7367/3M/No.9

In this question use $g = 9.81\,\text{m s}^{-2}$

A conical pendulum is made from an elastic string and a sphere of mass 0.2 kg

The string has natural length 1.6 metres and modulus of elasticity 200 N

The sphere describes a horizontal circle of radius 0.5 metres at a speed of $v\,\text{m s}^{-1}$

The angle between the elastic string and the vertical is α

(a) Show that

$$62.5 - 200\sin\alpha = 1.962\tan\alpha$$

[5 marks]

(b) Use your calculator to find α

[1 mark]

(c) Find the value of v

[4 marks]