4.

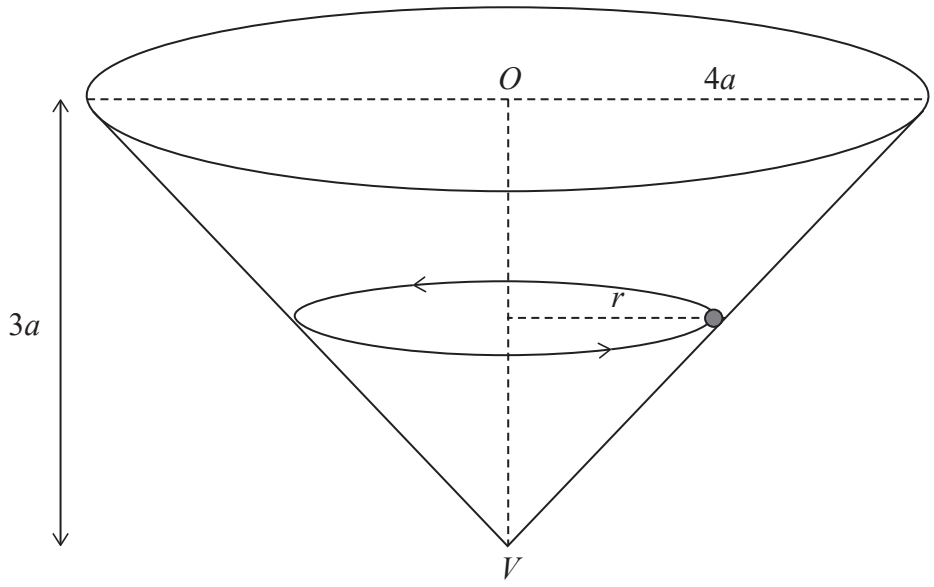


Figure 3

Figure 3 shows a thin hollow right circular cone fixed with its circular rim horizontal.

The centre of the circular rim is O. The vertex V of the cone is vertically below O.

The radius of the circular rim is $4a$ and $OV = 3a$.

A particle P of mass m moves in a horizontal circle of radius r $(0 < r < 4a)$ on the inner surface of the cone.

The coefficient of friction between P and the inner surface of the cone is $\frac{1}{4}$

The particle moves with a constant angular speed.

Show that the maximum possible angular speed is $\sqrt{\frac{16g}{13r}}$

(9)

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Question 4 continued

(Total for Question 4 is 9 marks)