4.

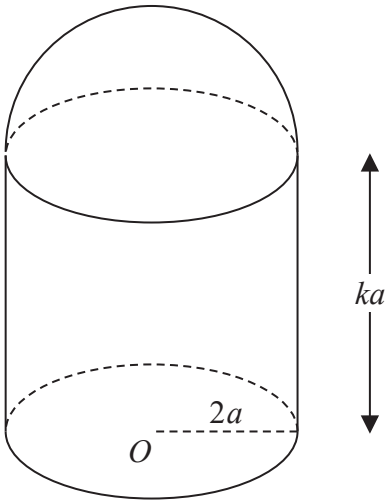


Figure 3

A thin uniform right hollow cylinder, of radius $2a$ and height ka, has a base but no top. A thin uniform hemispherical shell, also of radius $2a$, is made of the same material as the cylinder. The hemispherical shell is attached to the end of the cylinder forming a container C. The open circular rim of the cylinder coincides with the rim of the hemispherical shell. The centre of the base of C is O, as shown in Figure 3.

(a) Show that the distance from O to the centre of mass of C is

$$\frac{(k^2 + 4k + 4)}{2(k + 3)}a$$

(5)

The container is placed with its circular base on a plane which is inclined at 30° to the horizontal. The plane is sufficiently rough to prevent C from sliding. The container is on the point of toppling.

(b) Find the value of k.

(3)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 4 continued

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 4 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 4 continued

(Total for Question 4 is 8 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA