4.

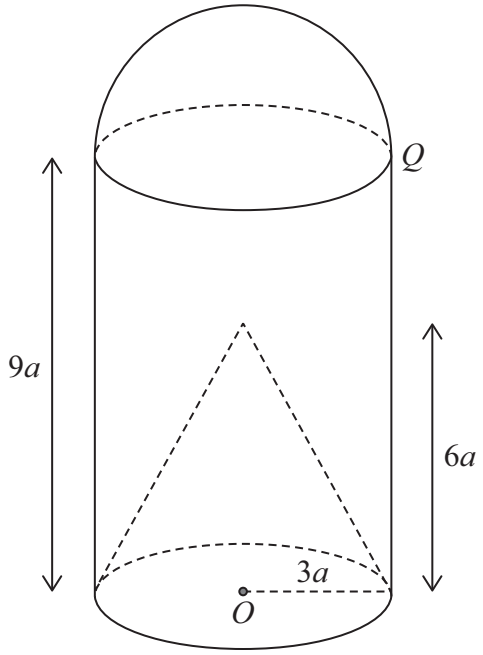


Figure 2

A uniform solid right circular cylinder has radius $3a$ and height $9a$

A uniform solid hemisphere of radius $3a$ is attached to the cylinder so that the plane face of the hemisphere coincides with one of the plane faces of the cylinder.

A solid right circular cone, of radius $3a$ and height $6a$, whose plane face is the other plane face of the cylinder, is now removed from the cylinder to form the uniform solid S
The point O is the centre of the circular base of S, as shown in Figure 2.

(a) Show that the distance from O to the centre of mass of S is $\frac{77}{12}a$

(5)

The solid S is placed with its circular base on a rough horizontal surface.
The point Q, shown in Figure 2, lies on the circumference of the top of the cylinder.

A horizontal force of magnitude H is applied to S at Q
The force acts towards the axis of symmetry of S
The horizontal surface is sufficiently rough to prevent S from sliding.

The solid S is on the point of tipping.

Given that the weight of S is W

(b) find H in terms of W

(2)

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Question 4 continued

(Total for Question 4 is 7 marks)