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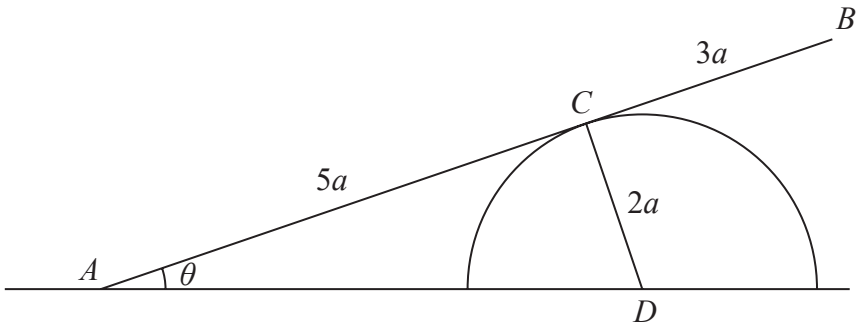


Figure 1

A uniform rod AB has length $8a$ and weight W.
The end A of the rod is freely hinged to horizontal ground.
The rod rests in equilibrium against a block which is also fixed to the ground.
The block is modelled as a smooth solid hemisphere with radius $2a$ and centre D.
The point of contact between the rod and the block is C, where $AC = 5a$
The rod is at an angle θ to the ground, as shown in Figure 1.
Points A, B, C and D all lie in the same vertical plane.

(a) Show that $AD = \sqrt{29}a$

(1)

(b) Show that the magnitude of the normal reaction at C between the rod and the block is $\frac{4}{\sqrt{29}}W$

(3)

The resultant force acting on the rod at A has magnitude kW and acts at an angle α to the ground.

(c) Find (i) the exact value of k
(ii) the exact value of $\tan\alpha$

(8)

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(Total 12 marks)