

2 (a) Define the moment of a force about a point.

.....  
 ..... [1]

(b) A tree of mass 270 kg grows out of sloping ground and is supported by a post, as shown in Fig. 2.1.

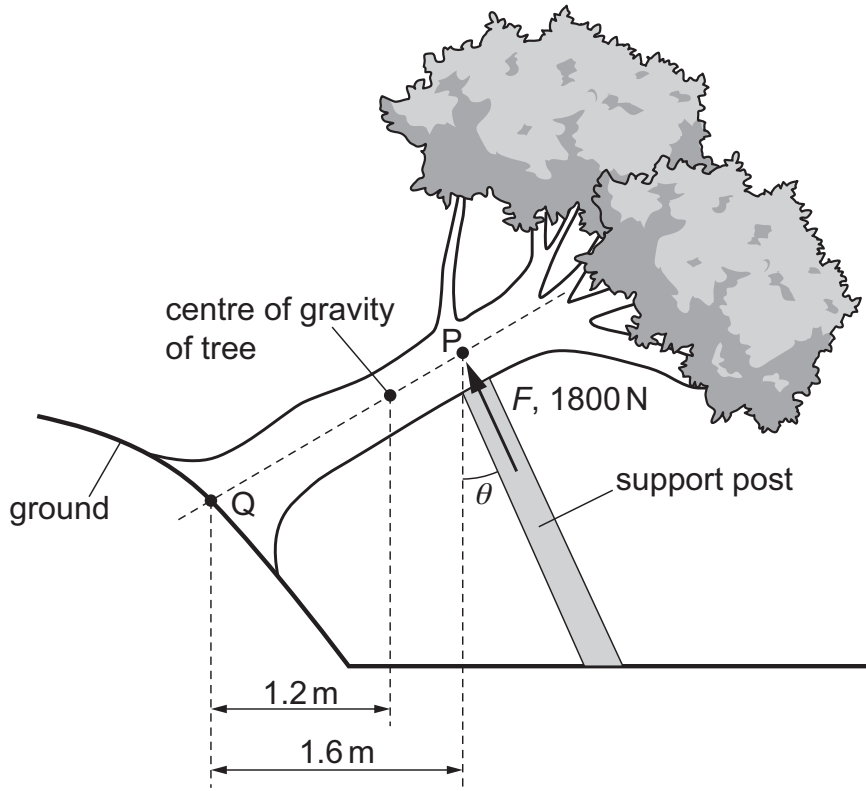


Fig. 2.1 (not to scale)

The ground applies a total force  $R$  on the tree at point Q.  
 The centre of gravity of the tree is a horizontal distance of 1.2 m from Q.  
 The post applies a force  $F$  of 1800 N perpendicular to the line PQ. The line of action of  $F$  passes through point P at an angle  $\theta$  to the vertical. P is a horizontal distance of 1.6 m from Q.  
 The tree is in equilibrium and all forces act on the tree in the same plane.

(i) By taking moments about point Q, show that  $\theta$  is  $25^\circ$ .

[3]

(iii) The tree exerts a pressure of 150 kPa on the top of the post.

Determine the surface area of the tree in contact with the post.

area = ..... m<sup>2</sup> [2]

[Total: 8]