







2. An open container  $C$  is modelled as a thin uniform hollow cylinder of radius  $h$  and height  $h$  with a base but no lid. The centre of the base is  $O$ .

(a) Show that the distance of the centre of mass of  $C$  from  $O$  is  $\frac{1}{3}h$ . **(5)**

The container is filled with uniform liquid. Given that the mass of the container is  $M$  and the mass of the liquid is  $M$ ,

(b) find the distance of the centre of mass of the filled container from  $O$ . **(5)**

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**Question 6 continued**

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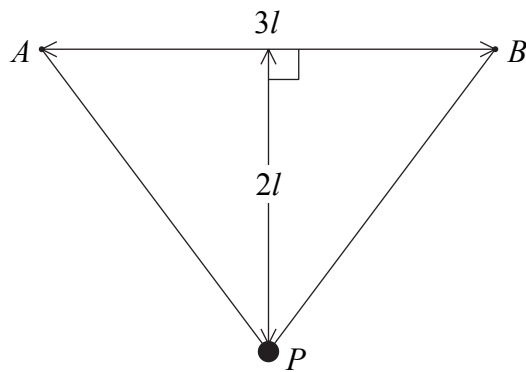






7.

**Figure 1**



A light elastic string, of natural length  $3l$  and modulus of elasticity  $\lambda$ , has its ends attached to two points  $A$  and  $B$ , where  $AB = 3l$  and  $AB$  is horizontal. A particle  $P$  of mass  $m$  is attached to the mid-point of the string. Given that  $P$  rests in equilibrium at a distance  $2l$  below  $AB$ , as shown in Figure 1,

(a) show that  $\lambda = \frac{15mg}{16}$ . **(9)**

The particle is pulled vertically downwards from its equilibrium position until the total length of the elastic string is  $7.8l$ . The particle is released from rest.

(b) Show that  $P$  comes to instantaneous rest on the line  $AB$ . **(6)**

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**Question 7 continued**

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