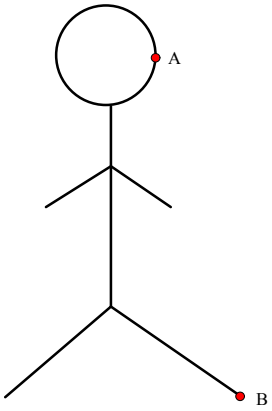
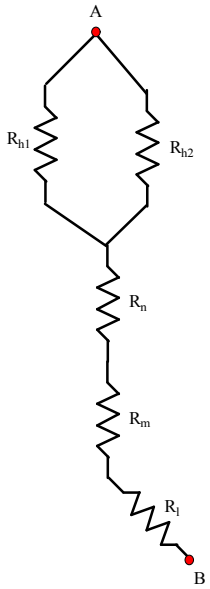
A scientist created a two-dimensional circuit made of uniform wire, which he called *manav* during his research to find the lowest resistance path in human bodies. He experimented with it by connecting it across various points across a battery. Can you help him to find the resistance between the ear* (A) of this *manav* and the toe (B)?



Take the resistance per unit length of the wire= λ,
Radius of head = a,
Length of neck=n,
Length of one arm=h,
Length of the mid-section=m,
Length of one leg=l.

*Assume that the length of the arc joining the ear A to the upper part of neck is 1/4th of the circle.

Solution



Resistances offered by both arms and one leg are not considered in the figure as they do not form part of the circuit.

$$R_{h1}=\left(\frac{3}{4}\times 2\pi a\right)\lambda=\frac{3}{2}\pi a\lambda$$

$$R_{h2}=\left(\frac{1}{4}\times 2\pi a\right)\lambda=\frac{1}{2}\pi a\lambda$$

$$R_{AB}=R_{h1}\,||\,R_{h2}+R_n+R_m+R_l$$

$$\therefore R_{AB}=\frac{3}{8}\pi a\lambda+n\lambda+m\lambda+l\lambda$$

$$\Rightarrow R_{AB}=\left(\frac{3}{8}\pi a+n+m+l\right)\lambda$$