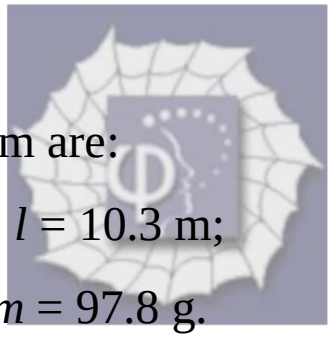
**123.**

**Problem 19.19 (RHK)**

*A wire* 10.3 m long and having a mass of 97.8 g/s *is stretched under a tension of* 248 N. If *two pulses, separated in time by* 29.6 ms, *are generated one at each end of the wire, we have to find where the pulses will meet.*

**Solution:**



Data of the problem are:

length of the wire, $l$ = 10.3 m;

mass of the wire, $m$ = 97.8 g.

Mass per unit length of the wire will be,

$$\mu = \frac{m}{l} = \frac{0.0978}{10.3} \text{ kg m}^{-1} .$$

Wire is under tension, $T$ = 248 N.

Speed of transverse wave motion in the wire will therefore be

$$v = \sqrt{\frac{T}{\mu}} = \sqrt{\frac{248}{0.95\times10^{-2}}} = 161.6 \text{ m s}^{-1}.$$

Distance travelled by the first pulse in 29.6 ms from the end where it is generated will be

$$l_1 = 161.6 \times 29.6 \times 10^{-3} \text{ m} = 4.8 \text{ m}.$$

Distance of the position $l_1$ from the other end of the wire will be

$$d = (10.3 - 4.8) \text{ m}.$$

As the second pulse is released from the second end of the wire at 29.6 ms, the two pulses will meet at a distance y from the first end, given by

$$y = (4.8 + d/2) \text{ m} = (4.8 + 5.5/2) \text{ m} = 7.5 \text{ m}.$$