1.103 (See Fluids in the News article titled "Walking on water," Section 1.9.) **(a)** The water strider bug shown in Fig. P1.103 is supported on the surface of a pond by surface tension acting along the interface between the water and the bug's legs. Determine the minimum length of this interface needed to support the bug. Assume the bug weighs 10^{-4} N and the surface tension force acts vertically upwards. **(b)** Repeat part (a) if surface tension were to support a person weighing 750 N.
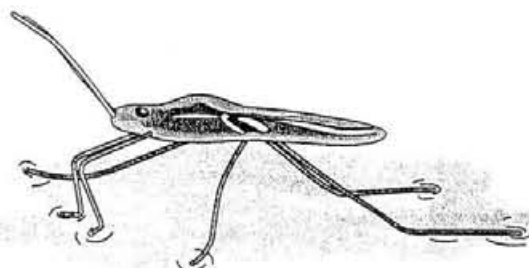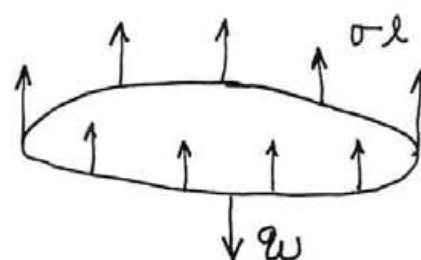

■ F I G U R E P1.103

For equilibrium,
$$\mathcal{W} = \sigma \ell$$

(a) $\ell = \dfrac{\mathcal{W}}{\sigma} = \dfrac{10^{-4}\,N}{7.34 \times 10^{-2}\,\frac{N}{m}}$

$\mathcal{W} \sim$ weight
$\sigma \sim$ surface tension
$\ell \sim$ length of interface

$\quad = 1.36 \times 10^{-3}$ m

$\quad = \left(1.36 \times 10^{-3}\,m\right)\left(10^{3}\,\frac{mm}{m}\right) = \underline{1.36\ mm}$

(b) $\ell = \dfrac{750\,N}{7.34 \times 10^{-2}\,\frac{N}{m}} = \underline{1.02 \times 10^{4}\,m}\ \left(6.34\ mi\ !!\right)$