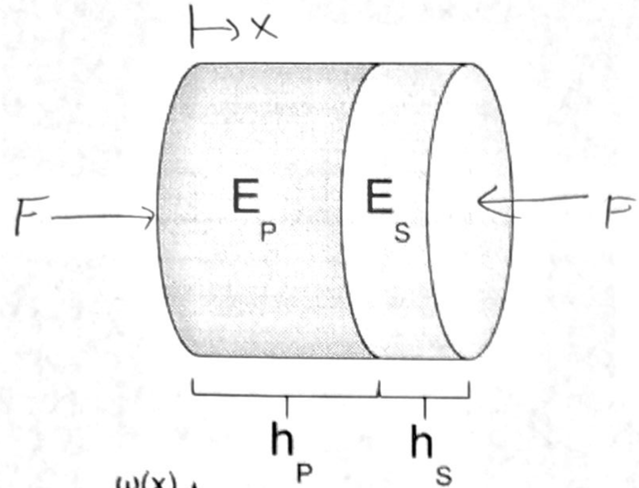
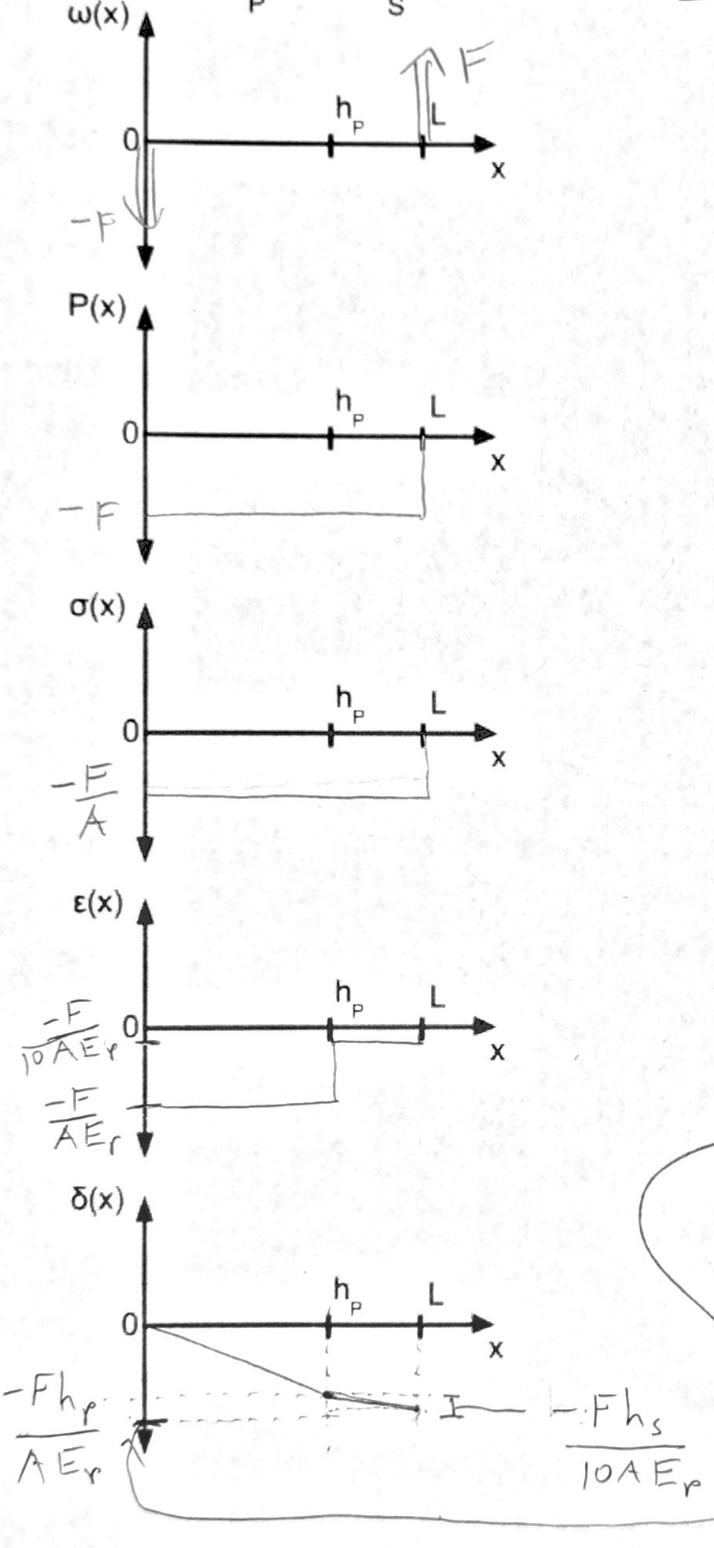


1) Complete the free body diagram (FBD) to the left by drawing the loads on the tissue column when the finger pushes on the surface with force F.

2) Draw graphs for the five functions shown with axes on the left of the page. Label key values for full credit. **Only use variables from the table** when labeling your graphs. ***Do not use values from the table.***

$E_s = 10 E_p$



$h_p = 2h_s$

$$\delta(x=L) = \delta_{total} = \frac{-Fh_p}{AE_p} + \frac{-Fh_s}{10AE_p}$$

$$= \frac{-F}{AE_p}\left(h_p + \frac{h_p}{20}\right)$$

$$\boxed{\delta_{total} = \frac{-Fh_p}{AE_p}\left(1 + \frac{1}{20}\right)}$$

3) Using your graph for $\delta(x)$, find an equation for δ_{total}, which is the total change in length of the tissue column when pressing on the surface with force F. Do not use values from the table.

$$\delta_{total} = \frac{-F h_p}{A E_p}\left(1 + \frac{1}{20}\right)$$

4) Use your model to find an equation that estimates the contact pressure, C, when a fingertip deformation of δ_{total} has been observed. Only use variables from the table, not values.

$$C = \frac{F}{A} \qquad \delta_{total} = \frac{-C h_p}{E_p}\left(1 + \frac{1}{20}\right)$$

$$\boxed{C = \frac{-\delta_{total} E_p}{h_p\left(1 + \frac{1}{20}\right)}}$$

5) Use your equation to estimate the contact pressure, C, when a fingertip deformation of $\delta_{total} = -2\ mm$ has been observed.

$$C = \frac{(2 \times 10^{-3}\ m)(10 \times 10^{3}\ Pa)}{(4 \times 10^{-3}\ m)\left(1 + \frac{1}{20}\right)} = \frac{20\ Pa}{(4 \times 10^{-3})\left(1 + \frac{1}{20}\right)}$$

$$= \frac{5 \times 10^{3}\ Pa}{1 + \frac{1}{20}} \qquad 1 + \frac{1}{20} = 1.05$$

$$\boxed{C \approx 5\ kPa}$$