The elastic flexure system shown in Figure 1(a) is designed to allow the right bar to move vertically. Both flexures are of length L, and uniform thickness h and a width b (into the plane of the paper). The material of each flexure has a Young's Modulus, E.

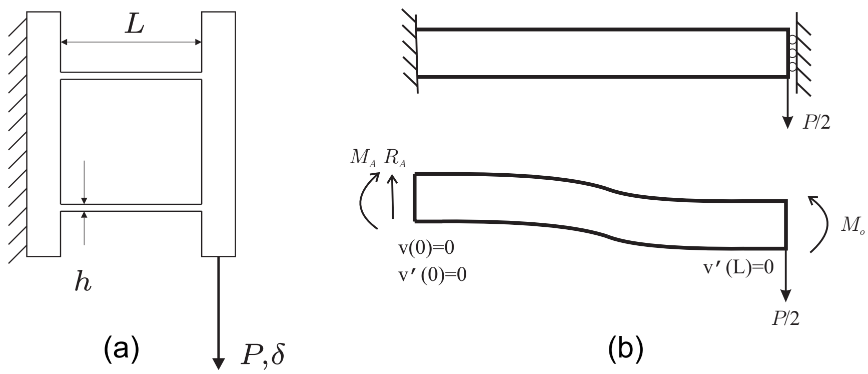

Figure 1: (a) Flexure structure. (b) A free body diagram of one flexure.

1. Derive an expression for the stiffness $k = P/\delta$ of the flexure system.

   Hint: *From the symmetry of the structure (the two flexures have the same material, geometry, and boundary conditions), we can simplify the problem by equivalently considering each flexure acted upon by an applied load $P/2$. Because the two are rigidly connected, each one will have the same deflection. A free body diagram of one flexure is shown in Figure 1(b). You are essentially required to find the tip deflection, $\delta = v(L)$, in Figure 1(b).*

2. Plastic deformation in the flexure occurs when the maximum stress in the flexure reaches the tensile yield strength, σ_y. In terms of the geometric parameters $\{L, h, b\}$ and the material properties $\{E, \sigma_y\}$, determine the maximum deflection δ_{max} which can be obtained without causing any plastic deformation in the flexures.

3. For $L = 50\,\text{mm}$, $h = 1.5\,\text{mm}$, $b = 6\,\text{mm}$, $E = 100$ GPa and $\sigma_y = 350\,\text{MPa}$ (phosphor bronze), what is δ_{max}?