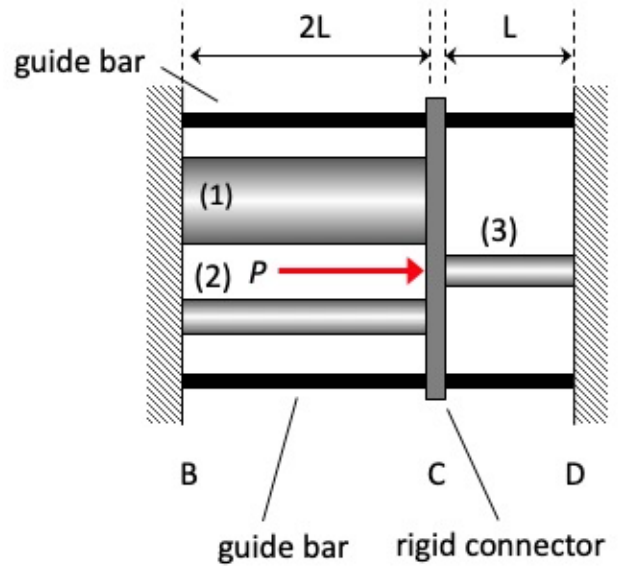


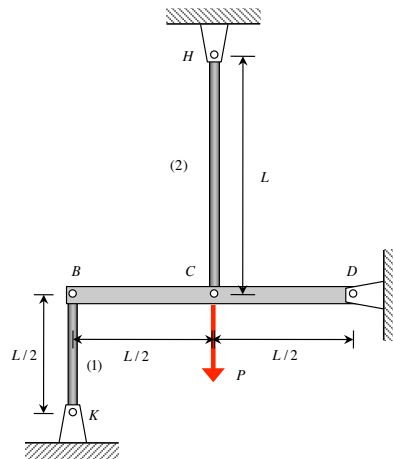
**PART A** (10 points): Circular cross-section rods (1), (2) and (3) are made of the same material having a Young's modulus of  $E$ , with outer diameters of  $2d$ ,  $d$  and  $d$ , respectively, and with lengths  $2L$ ,  $2L$  and  $L$ , respectively. Connector C is able to slide freely along two parallel guide bars to maintain a vertical orientation for C. A horizontal load  $P$  is applied to C, as shown.



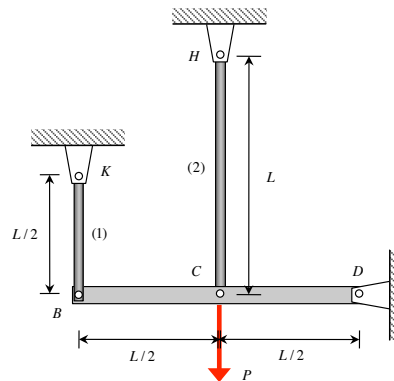
- 1) **Equilibrium.** Draw a free body diagram (FBD) of connector C. Write down the appropriate equilibrium equation for connector C using your FBD. Is this system determinate?
- 2) **Force/elongation equations.** Write down the force/elongation equations for rods (1), (2) and (3).
- 3) **Compatibility.** Write down the appropriate compatibility equation(s) relating the elongations of rods (1), (2) and (3).
- 4) **Solution.** Solve your equations above for the loads carried by the three rods. From these, determine the axial stress in each rod.

Leave your answers in terms of the given parameters of, at most:  $E$ ,  $d$ ,  $P$  and  $L$ . Verify that your answers have appropriate units.

**PART B** (4 points): Consider the two structures below, (i) and (ii). In each case, let  $F_1$  and  $F_2$  represent the axial loads carried by members (1) and (2), with the sign conventions that  $F_i > 0$  and  $e_i > 0$  for the  $i$ th member being in tension. For each structure, write down the *compatibility equation* relating the elongations  $e_1$  and  $e_2$ .



Structure (i)



Structure (ii)