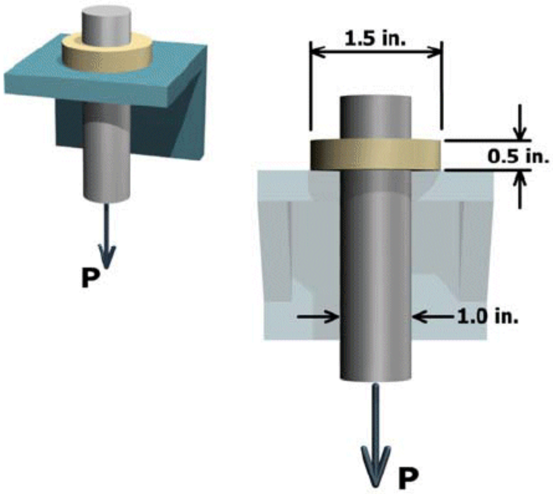
 Name: ___________________________

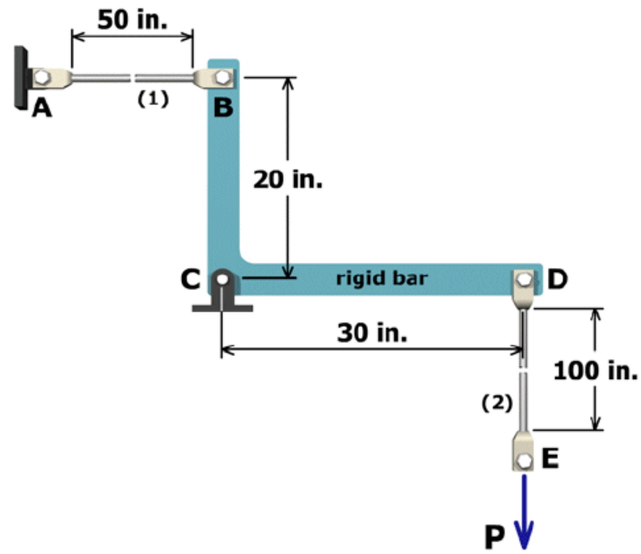
A vertical shaft is supported by a thrust collar and bearing plate. The average shear stress in the collar must be limited to 18 ksi. The average bearing stress between the collar and the plate must be limited to 24 ksi. Based on these limits, determine the maximum axial load *P* that can be applied to the shaft.



Rigid bar *BCD* in Fig. P3-23 is supported by a pin at *C* and by aluminum rod (1). A concentrated load *P* is applied to the lower end of aluminum rod (2), which is attached to the rigid bar at *D*. The cross-sectional area of each rod is $A = 0.20$ in.^{2} and the elastic modulus of the aluminum material is $E = 10{,}000$ ksi. After the load *P* is applied at *E*, the strain in rod (1) is measured as 900 με (tension).

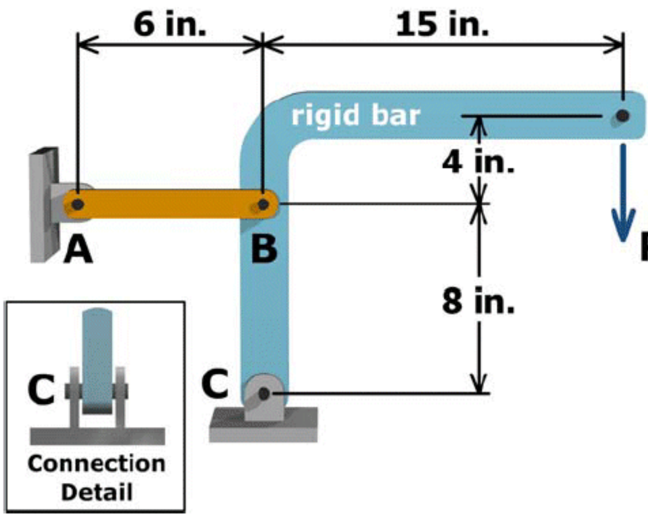
(a) Determine the magnitude of load *P*.

(b) Determine the total deflection of point *E* relative to its initial position.



The simple pin-connected structure carries a concentrated load *P*.

The rigid bar is supported by strut *AB* and by a pin support at *C*. The steel strut *AB* has a cross-sectional area of 0.75 in.^{2} and a yield strength of 60 ksi. The diameter of the steel pin at *C* is 0.5 in., and the ultimate shear strength is 54 ksi. If a factor of safety of 2.0 is required in both the strut and the pin at *C*, determine the maximum load *P* that can be supported by the structure.



Three rods of different materials are connected and placed between rigid supports at A and D. Properties for each of the three rods are given below. The bars are initially unstressed when the structure is assembled at 70°F. After the temperature has been increased to 250°F, determine the force exerted on the rigid supports.

Aluminum (1)	**Cast Iron (2)**	**Bronze (3)**
$L_1 = 10$ in.	$L_2 = 5$ in.	$L_3 = 7$ in.
$A_1 = 0.8$ in.^{2}	$A_2 = 1.8$ in.^{2}	$A_3 = 0.6$ in.^{2}
$E_1 = 10{,}000$ ksi	$E_2 = 22{,}500$ ksi	$E_3 = 15{,}000$ ksi
$\alpha_1 = 12.5\times10^{-6}/°F$	$\alpha_2 = 7.5\times10^{-6}/°F$	$\alpha_3 = 9.4\times10^{-6}/°F$