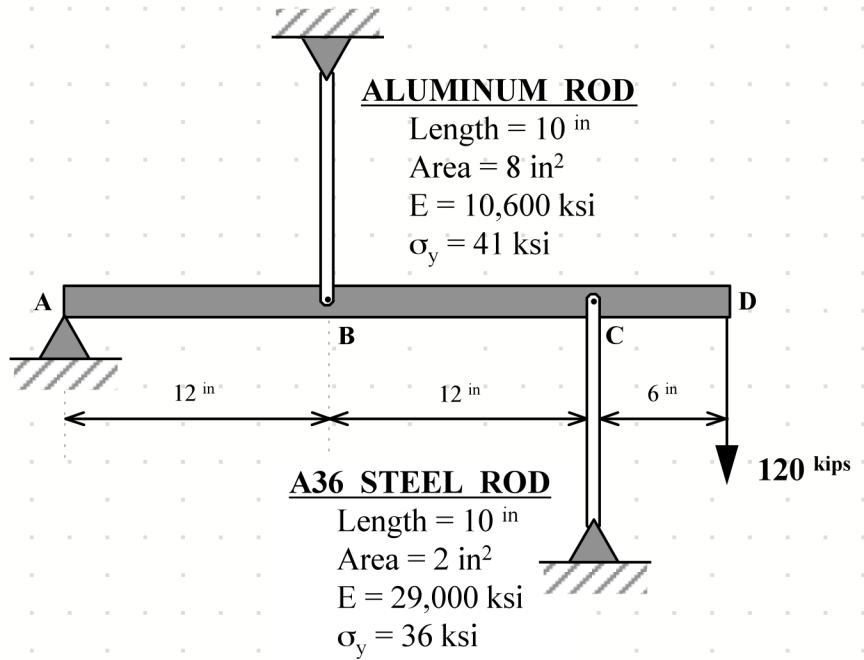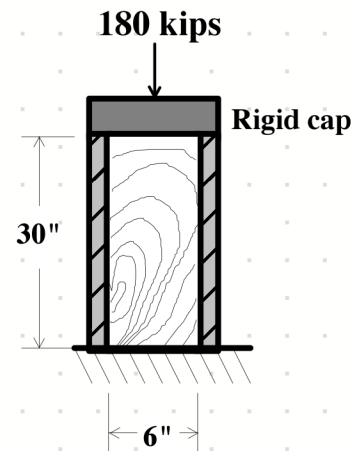## Worksheet #6A
Statically Indeterminate Structures

The rigid bar ABCD is supported by 2014-T4 aluminum and structural steel rods and must support a 120 kip load at D. Find the axial stress in the two rods and the deflection at point D.

ALUMINUM ROD
Length = 10 ^{in}
Area = 8 in^2
E = 10,600 ksi
σ_y = 41 ksi

A

B

C

D

12 ^{in}

12 ^{in}

6 ^{in}

120 ^{kips}

A36 STEEL ROD
Length = 10 ^{in}
Area = 2 in^2
E = 29,000 ksi
σ_y = 36 ksi

180 kips

A 6"x6"x30" southern pine block is subjected to an axial load of 180 kips. Use a modulus of elasticity of 1,800,000 psi and a yield stress 2000 psi. The block is reinforced with 2 A36 steel plates which are each .25" thick. Determine the actual stresses in the wood and steel members.
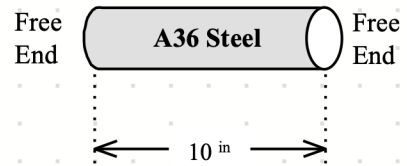
Rigid cap

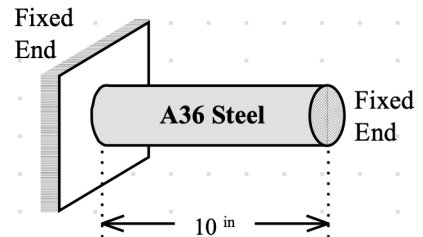30"

6"

Worksheet #6C
Axial & Thermal Deformation

A solid, circular rod is made of A36 steel with a total length of 10 inches. The bar experiences a temperature increase of 50 degrees Fahrenheit. For each of the three cases below, determine the total axial deformation and the normal stress (σ).
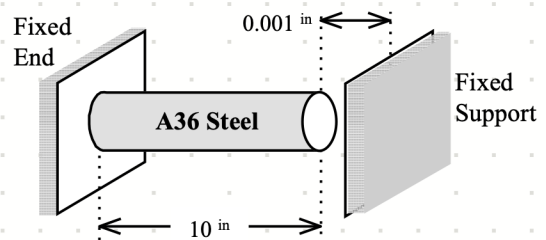
      a. Case 1: **Unconstrained**: Ends are free; no applied load.

Free End | A36 Steel | Free End

10 in

      b. Case 2: **Fully Constrained**: Both ends are fixed.

Fixed End | A36 Steel | Fixed End

10 in

      c. Case 3: **Partially Constrained**: One end is fixed but with a fixed support located 0.001 inches from the free end.

Fixed End | 0.001 in | A36 Steel | Fixed Support

10 in

Worksheet #6D
Statically Indeterminate Structures

The rigid bar ABCD is supported by brass and 2014-T6 aluminum rods as shown and must support a 30 kip load at D. Determine the axial stress in the two rods when the temperature decreases 50 degrees Fahrenheit.

ALUMINUM ROD
Length = 10 ^{in}
Area = 3 in^2
E = 10,600 ksi
σ_y = 41 ksi
α_t = 12.5 $^{\mu/\circ}$F

A   B   C   D

12 ^{in} 6 ^{in} 6 ^{in}

30 ^{kips}

BRASS ROD
Length = 15 ^{in}
Area = 2 in^2
E = 15,000 ksi
σ_y = 60 ksi
α_t = 9.8 $^{\mu/\circ}$F