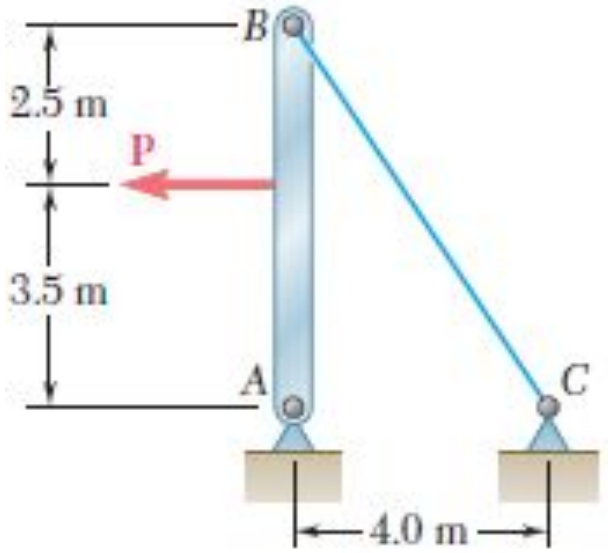
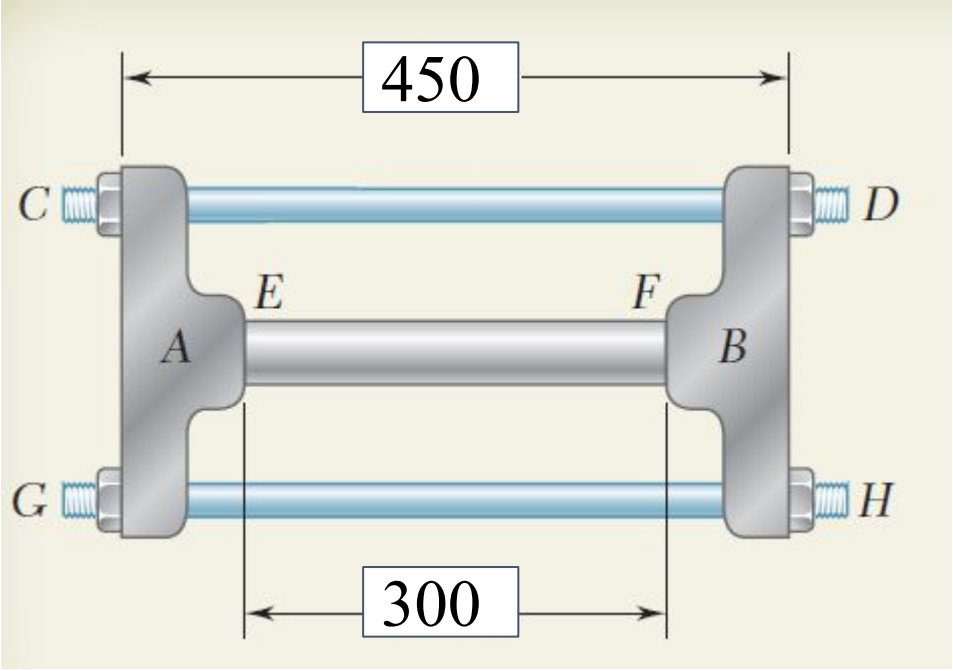
Question 1

The 4-mm-diameter cable *BC* is made of a steel with $E = 200$ GPa. The maximum stress in the cable must not exceed 190 MPa. The elongation of the cable must not exceed 6 mm.

Find the maximum load **P** that can be applied as shown.



Question 2



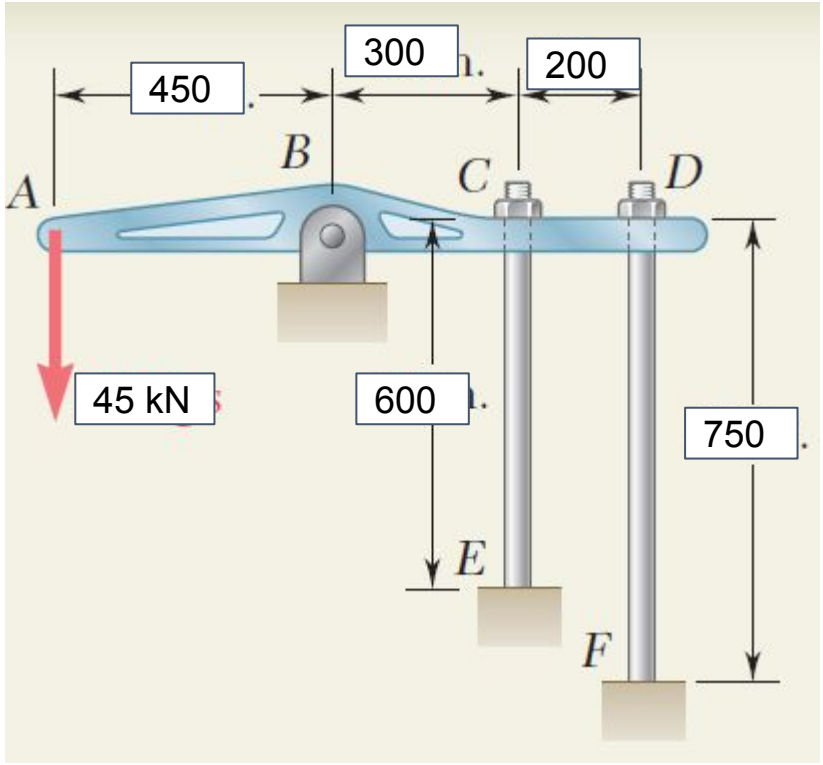
All dimensions are in mm

The rigid castings A and B are connected by two 20 mm diameter steel bolts CD and GH and are in contact with the ends of a 40 mm diameter aluminum rod EF. Each bolt is single-threaded with a pitch of 2.5 mm, and after being snugly fitted, the nuts at D and H are both tightened one-quarter of a turn.

E_{steel} is 200 GPa for steel and E_{Al} = 70 GPa

Determine the normal stress in the rod.

Question 3



All dimensions are in mm

The 12 mm diameter rod CE and the 20 mm diameter rod DF are attached to the rigid bar ABCD.

The rods are made of aluminum.
E = 70 GPa
Determine (a) the force in each rod caused by the loading shown, (b) the corresponding deflection of point A.

Question 4

An aluminum pipe must not stretch more than 1.3 mm when it is subjected to a tensile load. $E = 69.6$ GPa

The maximum allowable normal stress is 96.5 MPa

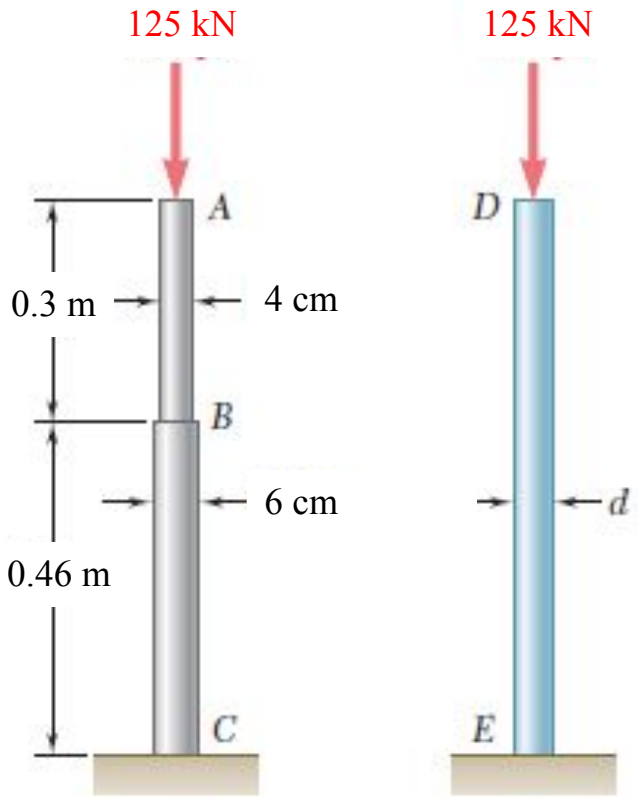
Determine (*a*) the maximum allowable length of the pipe, (*b*) the required area of the pipe if the tensile load is 567 kN.

Question 5

The aluminum rod ABC (E = 69.6 GPa), consists of two cylindrical portions AB and BC.

The rod is to be replaced with a cylindrical steel rod DE (E = 200 GPa) of the same overall length.

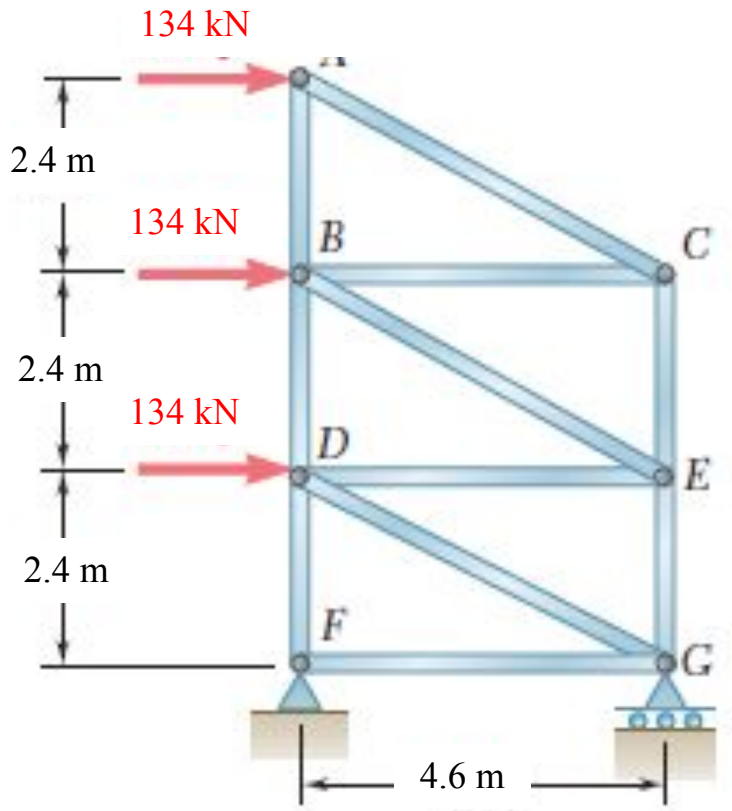
Determine the minimum required diameter d of the steel rod if its vertical deformation is not to exceed the deformation of the aluminum rod under the same load and if the allowable stress in the steel rod is not to exceed 165 MPa.



Question 6

For the steel truss (E = 200 GPa) and loading shown, determine the deformations of members BD and DE.

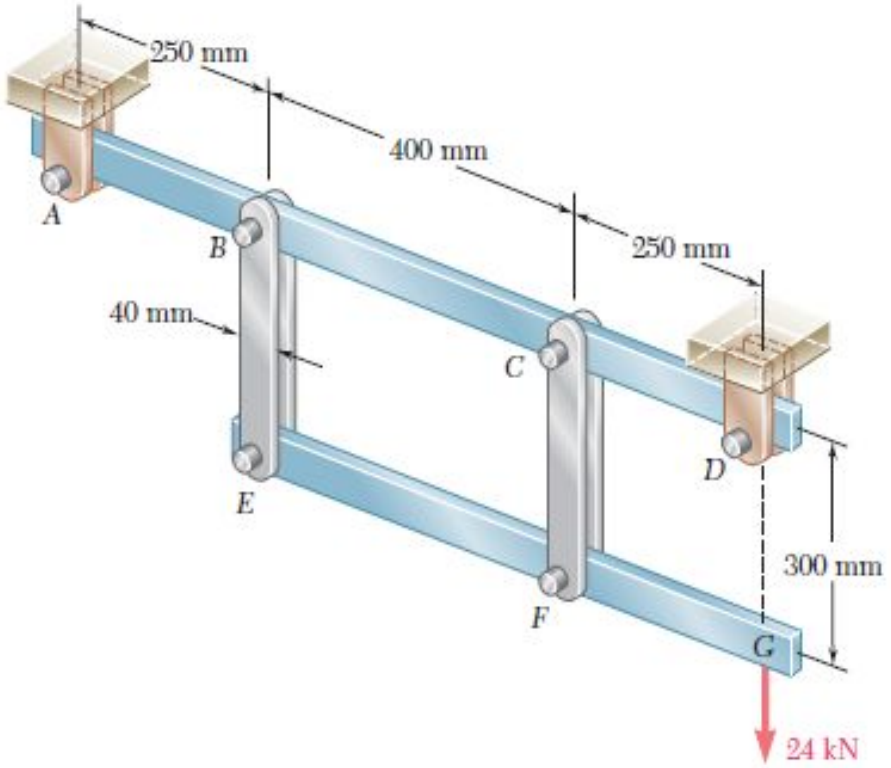
Cross-sectional areas are 13 cm^2 and 19 cm^2, respectively.



Question 7

Each of the four vertical links connecting the two rigid horizontal members is made of aluminum (E = 70 GPa) and has a uniform rectangular cross section of 10 x 40 mm.

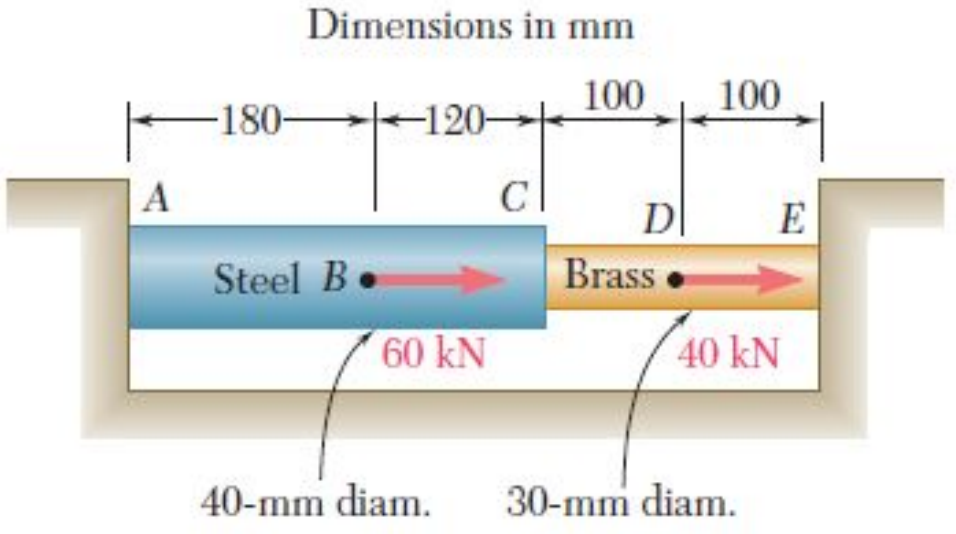
Determine the deflection of (a) point E, (b) point F, (c) point G.



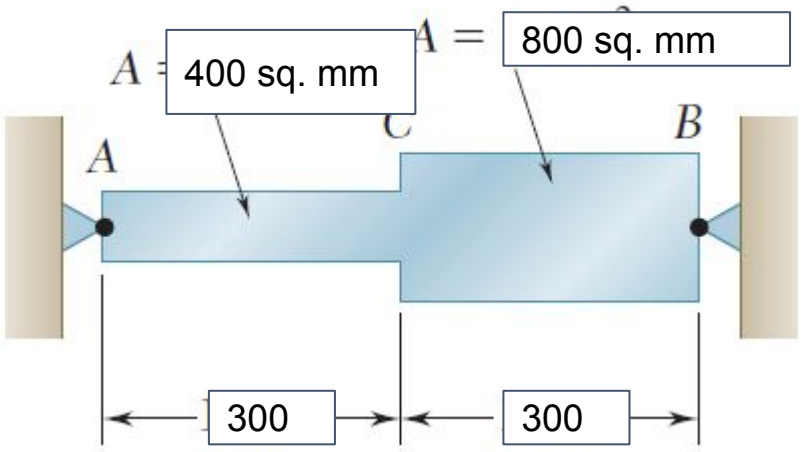
Question 8

Two cylindrical rods, one of steel and the other of brass, are joined at C and restrained by rigid supports at A and E. For the loading shown and Es = 200 GPa and Eb = 105 GPa,

Determine (a) the reactions at A and E, (b) the deflection of point C.



Question 9

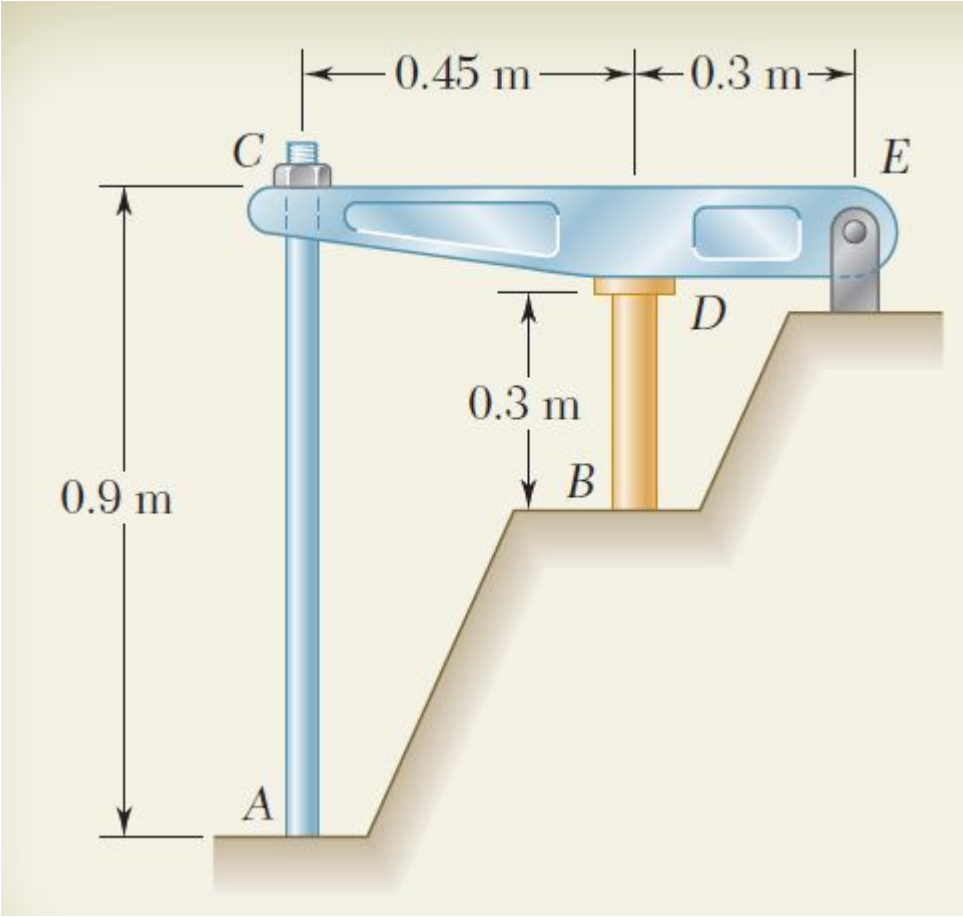


Determine the values of the stress in portions AC and CB of the steel
bar when the temperature of the bar is - 45 ^{O}C.

A close fit exists at both of the rigid supports when the temperature is +25 ^{O}C.

E = 200 GPa and alpha = 1.2x10$^{(-5)}$ /^{O}C

Question 10



The rigid bar CDE is attached to a pin support at E and rests on the 30-mm diameter brass cylinder BD. A 22-mm-diameter steel rod AC passes through a hole in the bar and is secured by a nut which is snugly fitted when the temperature of the entire assembly is 20 ^{O}C.
The temperature of the brass cylinder is then raised to 50 ^{O}C while the steel rod remains at 20 ^{O}C.

No stresses were present before the temperature change.

Determine the stress in the cylinder.

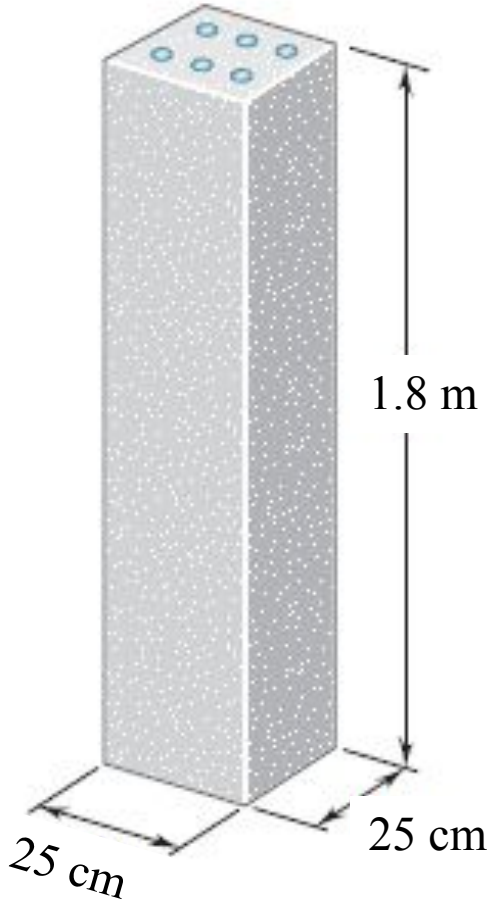
Rod AC: Steel
E 200 GPa
alpha 1.2 x $10^{(-5)}$ /°C

Cylinder BD: Brass
E 105 GPa
alpha 20.9 x $10^{(-6)}$/°C

Question 11

The concrete post (Ec = 25 GPa and α_c = 1.63 x 10^{-7} / ^{0}C is reinforced with six steel bars, each of 2 cm in diameter (Ec = 200 GPa and α_s = 1.92 x 10^{-7} / ^{0}C).

Determine the normal stresses induced in the steel and in the concrete by a temperature rise of 18 ^{0}C .



Question 12

Tutorial 6 : Chapter 2
Mechanics of Materials

Two steel bars (E_s = 200 GPa and α_s = 11.7 x 10^{-6}/ ^{0}C) are used to reinforce a brass bar (E_b = 105 GPa, α_b = 20.9 x 10^{-6}/ ^{0}C) that is subjected to a load P = 25 kN. When the steel bars were fabricated, the distance between the centers of the holes that were to fit on the pins was made 0.5 mm smaller than the 2 m needed. The steel bars were then placed in an oven to increase their length so that they would just fit on the pins. Following fabrication, the temperature in the steel bars dropped back to room temperature. Determine (*a*) the increase in temperature that was required to fit the steel bars on the pins, (*b*) the stress in the brass bar after the load is applied to it.