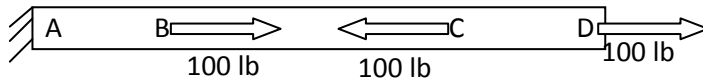


## EM204 - First Day Questions

In the absence of other information, assume all questions concern a uniform cross section under axial load.

- 1) State the difference between force and stress.
- 2) State the difference between pressure and stress.
- 3) Name the SI units for stress.
- 4) Define Strain
- 5) Name the SI units for strain.
- 6) An aluminum bar of length  $L_0$  freely expands by  $\Delta L$  when heated. Which of the following are true?
  - a)  $\epsilon_{\text{thermal}} = \Delta L / L_0$
  - b)  $\epsilon_{\text{thermal}} = 0$
  - c)  $\sigma = E \epsilon_{\text{thermal}}$
  - d)  $\sigma = 0$
- 7) Suppose we currently make 4 lb fishing line and wish to make 8 lb fishing line. Name one change the designer could make that would result in a stronger line.
- 8) Define Factor of Safety.
- 9) What would a typical factor of safety be for fracture of an airframe of a commercial jetliner?
- 10) If FOS on yield strength is 3 and the yield strength of a material is 60 (in some units), the designer should make sure that the applied stress stays below
  - a) 20 in the same units
  - b) 180 in the same units
- 11) Define Yield Strength.
- 12) Define Ultimate Tensile Strength.
- 13) Define Young's Modulus (elastic modulus).
- 14) Name the SI units for Young's Modulus (elastic modulus).
- 15) Define %Elongation.
- 16) The elastic modulus of steel is higher, lower, the same as the elastic modulus of aluminum.
- 17) State the value of the elastic modulus of steel (with units).
- 18) Describe a cantilevered beam.
- 19) Describe a simply supported beam.
- 20) Show, on a free body diagram, the reaction forces in any section of a cantilevered beam that has arbitrary loading at the free end (random combination of forces and moments).
- 21) Describe the difference between a force and a moment.
- 22) Describe the difference between a torque and a moment.



The bar shown above has a cross sectional area of  $1 \text{ in}^2$ .

- 22) Determine the stress
  - a) between A and B
  - b) between B and C
  - c) between C and D
- 23) To solve the problem 22, what is the first step you should do after reading the problem?



- 24) For the axially loaded pinned link shown above, locate the region of highest axial stress. (How would this change if the load changed from tension to compression?)
- 25) Name the type of stress the pins would see and how the magnitude of that stress would change if the loading was in compression rather than in tension.