# POE Practice Test - Materials

Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. A student weighs 150 lbs and is standing on a beam which spans 96 inches. The Modulus of elasticity of the beam is 1,200,000 lbs/in² and the moment of inertia is 12 in4. Calculate the beam deflection.
   a. 0.192 in
   b. 0.340 in
   c. 57,600 in
   d. 0.0000208 in
   e. none of these

2. The moment of inertia of the beam below would be _____.

Beam "A"

5 1/2 in.

1 1/2 in.
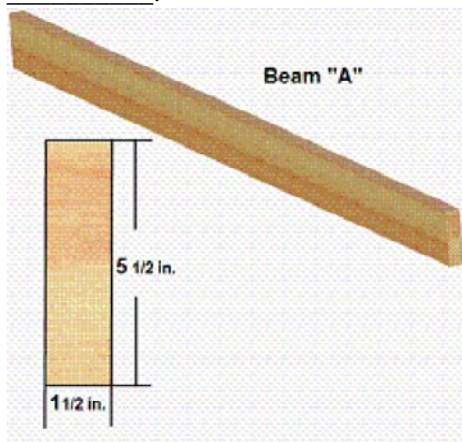
   a. 1.6 in⁴
   b. 20.8 in⁴
   c. 46.8 in⁴
   d. 249.6 in⁴

3. If the modulus of elasticity of the beam is 1.5x10⁶ psi and a 200 lb weight is placed at the center, 4 ft from each end, how much would the beam deflect?
   a. 0.118 in
   b. 6.84x10⁻⁵ in
   c. 1.54 in
   d. 0.57 in
   e. none of these

4. The centroid of the triangle to the right is closest to_____ as measured from (0,0)

(0,0)   1 in
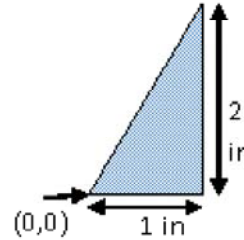
   a. (.33, .33)
   b. (.67, .33)
   c. (.33, .67)
   d. (.67, .67)

5. This diagram represents a

   a. bar graph
   b. pie chart
   c. line graph
   d. histograph

6. Find the centroid of the circle at the right with a diameter of 15 inches.

   a. x = 15 in, y = 15 in
   b. x = 3.2 in, y = 3.2 in
   c. x = 7.5 in, y = 7.5 in
   d. x = 2.2 in, y = 2.2 in

7. Moment of inertia is a cross-sectional property that gives the engineer an indication of the stiffness of a particular shape. Its value can be used to
   a. calculate the amount of deflection that occurs in structural beams.
   b. calculate the weight of a structural beam.
   c. locate the centroidal axis of a structural shape.
   d. describe the linear relationship between stress and strain.

8. Which of the following materials is best known for its resistance to extreme heat?
   a. Metals
   b. Polymers
   c. Ceramics
   d. Organic

9. The figure shows a 100 lb normal force being applied a 12" long x 10" diameter cylinder. What is the resulting copmressive stress in the cylinder?
   a. 10 psi
   b. 8.33 psi
   c. 0.88 psi
   d. 1.27 psi

10. Which of the following manufacturing tools is used almost exclusively to machine holes in parts?
    a. Drill Press
    b. Injection Molder
    c. Lathe
    d. Milling Machine

11. Which of the following manufacturing processes is used to form a piece of metal into a predetermined shape through the application of pressure?
    a. Turning
    b. Forging
    c. Annealing
    d. Threading

12. When a part is stressed only within its elastic region, it will _____ when the stress is removed
    a. break
    b. return to its original size and shape
    c. remain elongated
    d. become smaller than its original size and shape

13. A material that is capable of considerable plastic deformation would be referred to as a _____ material
    a. brittle
    b. polymer
    c. tensile
    d. ductile

14. According to the image, what is the area of object 3?
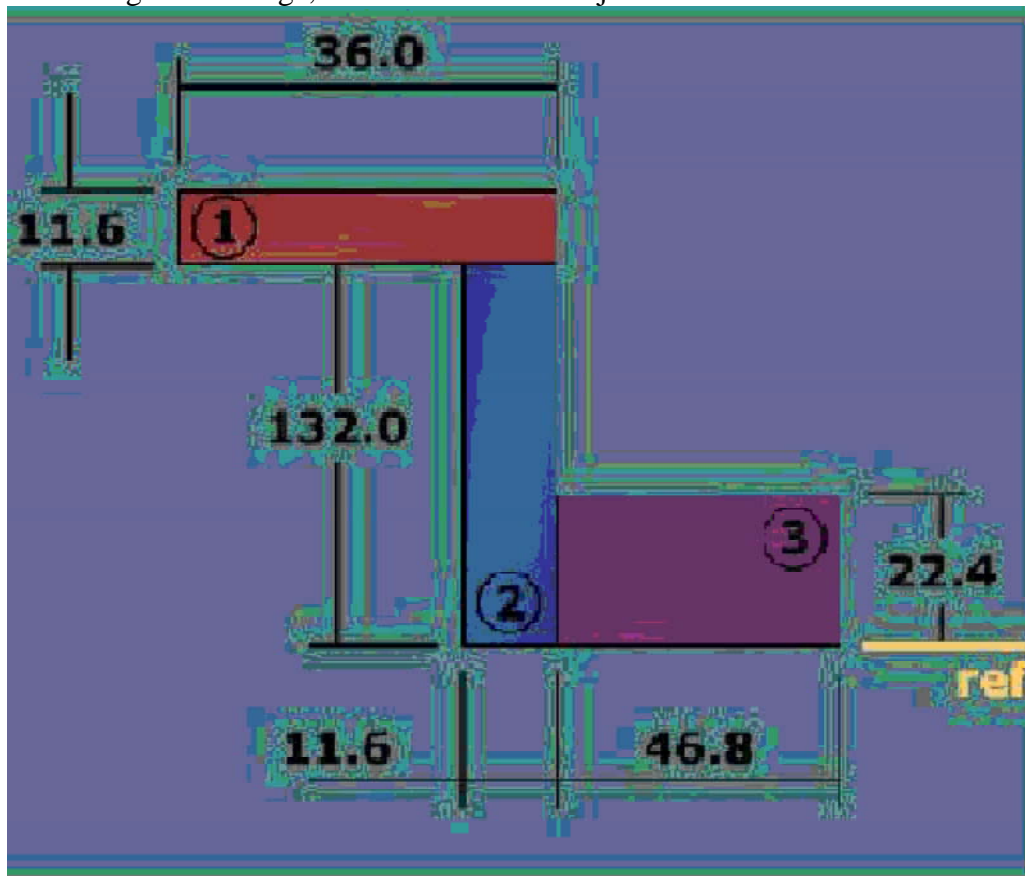
    a.   1048.32
    b.   1308.16
    c.   1531.12
    d.   417.60

15. According to the image above, what is the vertical distance from the reference line to the centroid of object 2?
    a.   11.2
    b.   137.8
    c.   109.6
    d.   66
    e.   none of the above

Problem

16. A test sample, having a cross-sectional area of 0.2 in² and a 2 inch test length, was pulled apart in a tensile test machine. Figure 4 shows the resulting Stress-Strain diagram. Use the information in the diagram to answer the following questions.
    a. Calculate the force that the sample experienced at the proportional limit. (answer precision = 0.0)
    b. Starting at the origin and ending at the proportional limit, calculate the modulus of elasticity for this material.
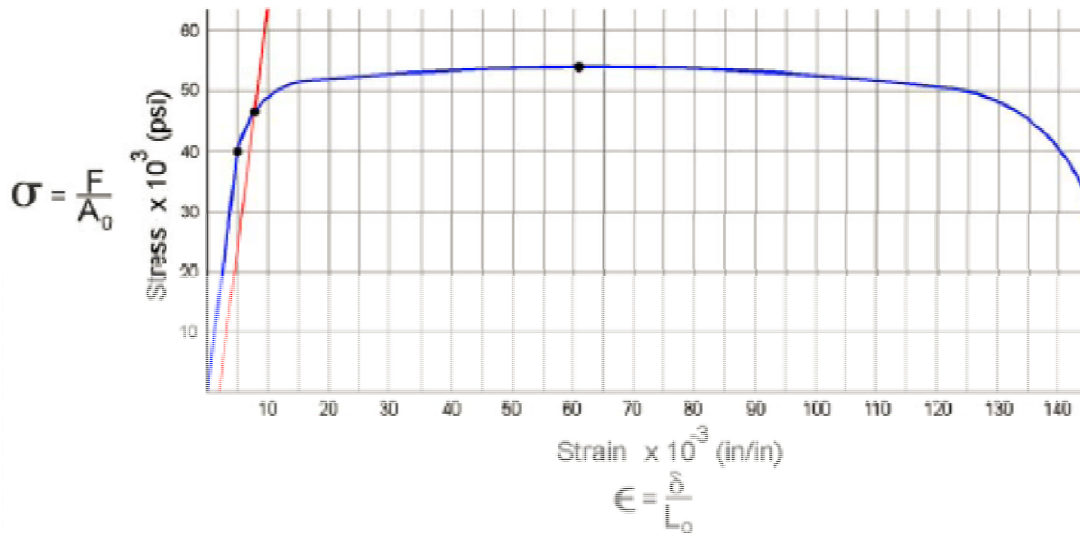

$$\sigma = \frac{F}{A_0}$$

Stress x 10^3 (psi)

Strain x 10^{-3} (in/in)

$$\epsilon = \frac{\delta}{L_0}$$

Figure 4

17. A tensile test sample had an original cross-sectional area of 0.2 in$_2$ and an original test length of 2 in. It was pulled apart in a tensile test machine, and the resulting Force-Displacement diagram is shown in Figure 4. Use this diagram to answer the following questions.

    a. At point "A" on the diagram, the test sample had reached its _____ point.

    b. At point "B" on the diagram, the test sample had reached its _____ force point.

    c. If the change in force identified on the diagram is 100,000 lbs, and the change in displacement is 0.1 in, what is the modulus of elasticity for this material?
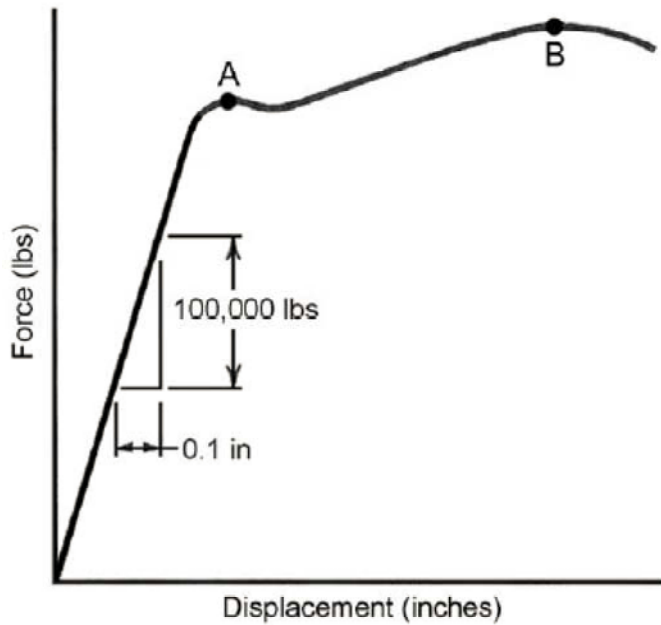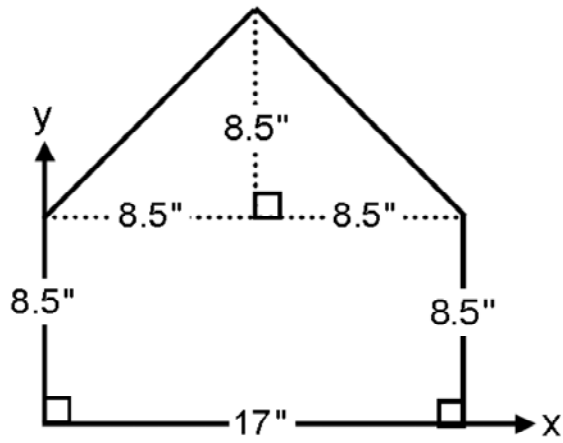

Figure 4

18. In baseball, home plate is the dimensions of the diagram at the right. Given these dimensions, calculate the area and the centroid of the rectangle at the bottom and the two triangles at the top and then the area and centroid of the entire shape as a whole. The location of each centroid should be stated in relation to the given x and y axes.

Bottom rectangle:

Area = _____

x = _____

y = _____

Top left triangle:

Area = _____

x = _____

y = _____

Top right triangle:

Area = _____

x = _____

y = _____

Entire complex shape:

Area = _____

x = _____

y = _____