Mechanical Properties of Materials Study Guide

A material has been loaded to a stress well below the proportional limit. At this point the stress is 269 MPa and the strain is 0.08 mm/mm.

Assume the elastic region extends directly to zero (0 stress, 0 strain) from this point. Calculate Young's modulus for this material. Enter your answer in MPa to the nearest whole number.

A designer wants to generate exactly 3106.4 PSI of stress in a rectangular bar by suspending a 10,000 lb weight from it. One side of the bar measures 0.9 inches. What should the other dimension of the bar be?

Notice that you need to use the definition of stress (Stress = Force/Area).   You will also need to know how to find the area of a rectangle. You will need to do a bit of algebra to solve for the unknown side.

Round your answer in inches to three decimal places.

A certain rectangular bar has a cross section that is 1.7 mm by 9.8 mm. What is the area of this cross section? Enter your answer in square mm. Your answer needs to be rounded to two decimal places.

A certain rectangular bar has a cross section that is 1.7 mm by 9.8 mm. If this bar supports a 80.4 N load, how much stress is generated? Enter your answer in MEGA Pascals (MPa). Round to two decimal places.

$$1Pa = 1\frac{N}{m^2}$$

Note that this formula uses **meters**. You are given **millimeters** in the problem.

A 7.1 pound load is supported by a round bar with a cross-sectional area of 4.5 square inches. How much stress is generated in the bar?

Round your answer to two decimal places.

What is the cross sectional are of a round steel bar that is 7.4 inches in diameter?

Round your answer to 3 decimal places.

Two marks are made on an aluminum bar 2.0 inches apart. If the bar is stretched until the marks are 2.14 inches apart, how much strain did the bar undergo in that area?

Round your answer to three decimal places. Units are in/in or unitless.

A certain company wants to make a product by bending a particular type of aluminum alloy sheet. Why might a tool designer complain if the ductility was very low?

a. Because the part would be stronger than necessary

b. Because it would weaken tooling

c. Because the part would bend too easily

d. Because the part might break instead of bending

As a part is loaded in tension, it gets longer and the cross-sectional area reduces. When measuring engineering stress, which of the following is true?

a. The cross-sectional area is measured but rounded to the nearest integer value because engineering stress is simply a useful approximation of true stress

b. The part is re-measured as the diameter reduces

c. The reduction in cross-sectional is ignored

d. The test is started over if the cross-sectional area is reduced by more than .2%

What do you know about a 1kg object?

a. How much stress it is generating

b. Its color

c. How much force it is exerting

d. How much mass it has

e. What its density is

f. How much it weighs

A 1 x 6 inch board is being used to support a weight. If the board is turned on edge instead of being laid flat, which of the following variables would change?

a. E (Young's modulus)

b. F (force, load)

c. Length

d. I (area moment of inertia)
e. A (cross-sectional area)

Pounds force (lbf) is a measure of ________.

a. Weight

b. Mass

d. Force

e. Kilograms

_________ is the ability to resist the application of loads without failure.

Stress

b. Strain

c. Strength

d. Hardness

What is the main difference between weight and mass?

a. Only weight can produce a force.

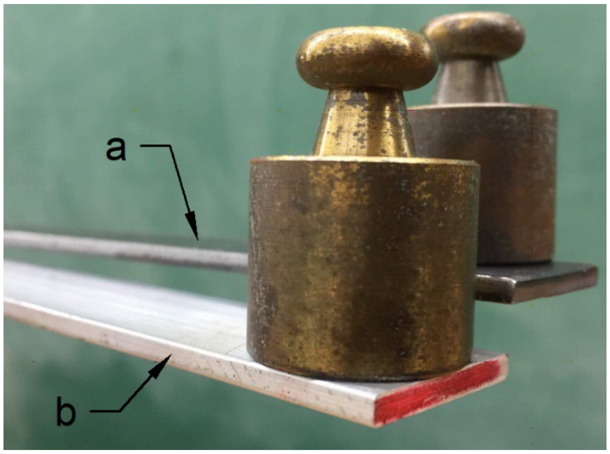
b. Objects typically have more mass than weight

c. There is not difference. They are the same.

d. Gravity is a factor when considering weight.

e. Mass is metric, Weight is US Customary

Both of these workpieces below are loaded under identical conditions. Material "a" (in back) has a Young's modulus of 30,000 ksi. What could you determine from the photograph about the modulus of elasticity of the other material?



a. Young's modulus for both materials is the same

b. Material "a" has a higher Young's modulus

c. Poisson's ratio for material "a" is greater

d. Material "b" has a higher Young's modulus

e. Poisson's ratio for material "b" is greater

A 1000 pound load is suspended by a round bar 1 inch in diameter.

The stress generated in the bar is 1000 PSI. True/False