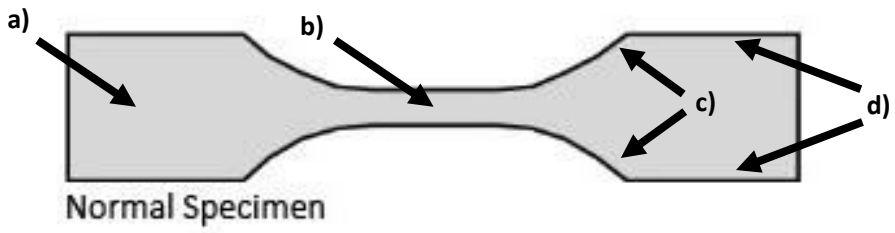
1) A metal specimen is loaded in tension slightly beyond the limit of the elastic region. Upon unloading, it is found that the Young's modulus is which of the following?
a) Greater than it was on initial loading
b) Less than it was on initial loading
c) The same as it was on initial loading
d) The Young's modulus cannot be determined upon
unloading.

2) This a standard tensile test sample. Where will the strain be the highest?



Answer : b)

3) During a tensile test of a given material, Young's modulus depends on :
a) The length of the sample
b) The diameter of the gauge region
c) The angle of the sample's shoulders
d) None of the above

Structurally independent

4) The Young's modulus is related to which of the following?
a) The slope of the interatomic force separation curve taken at r = 0
b) The slope of the proton energy separation curve close to the equilibrium
c) The slope of the interatomic force separation curve near the equilibrium interatomic spacing
d) Both a) and c)

5) Tempered glass is more resistant to breakage compared to regular
glass because the outer surface is treated to be
a) Smooth with all residual stresses removed
b) Under tension
c) Under compression
d) Under both tension and compression simultaneously

6) With a sample bar with dimensions of width: 12 mm × height: 35 mm × length: 67 cm, and you need to test whether or not the material can withstand a stress of 90 MPa. Assuming you apply a load along the long axis, what load would you need to apply to achieve this stress?
a) 1,600 N
b) 37,800 N
c) 378,000 N
d) 3,780 N

$F = A*P = 12*10^{-3}*35*10^{-3}*90*10^{6} = 37\ 800$ N

7) Which of the following represents the typical elastic moduli of the three classes of solids?
a) Ceramics > Metals > Polymers
b) Metals > Polymers > Ceramics
c) Ceramics > Polymers > Metals
d) Polymers > Metals > Ceramics

Short questions.

I. A hypothetical material fractures at a stress of 500MPa. A sample of this material with 1.2 m in length with a cross section of 3cm*3cm is loaded along the long axis. Just before fracture, when the load is still applied, the length is 2m and when the load is released the length is 1.4m. Calculate the elasticity modulus and give your answer to the nearest GPa (no decimals).

$$\epsilon = \frac{\Delta l}{l_0} = \frac{2 - 1.4}{1.2} = 0.5$$

$$E = \frac{\delta}{\epsilon} = \frac{500\ MPa}{0.5}$$

$$= 1000\ MPa$$

$$= 1\ GPa$$

II. A metal bar is loaded with a force F in a three-point bending test, as shown in the figure below. The bar has a length of 60 cm, a width of 4 cm and a height of 1.5 cm. This sample is able sustain a maximum of 200MPa without being permanently deformed. What is the maximum value of F associated with this stress?

$$\sigma = \frac{3FL}{2bd^2} = \frac{3 \times F \times 0.6}{2 \times 0.04 \times 0.015^2} = 200MPa = 200 \times 10^6 Pa$$

$$F = 2000N$$