Stress, Strain, Young Modulus – Practice

1. The breaking stress of a particular steel is about $10^9 N/m^2$.
   A wire of cross-sectional area $0.01mm^2$ is made of this steel.
   Calculate the greatest force that the wire can withstand. *(10N)*

2. A certain type of steel has a breaking stress of 300MPa. Calculate the maximum mass that can be hung from a steel wire of diameter 0.20mm. *(0.96kg)*

3. Calculate the minimum diameter of an alloy cable, tensile strength 75MPa, needed to support a load of 15kN. *(16mm)*

4. Calculate the tensile stress in a suspension bridge supporting cable, diameter of 50mm, which pulls up on the roadway with a force of 4kN. *(2.0MPa)*

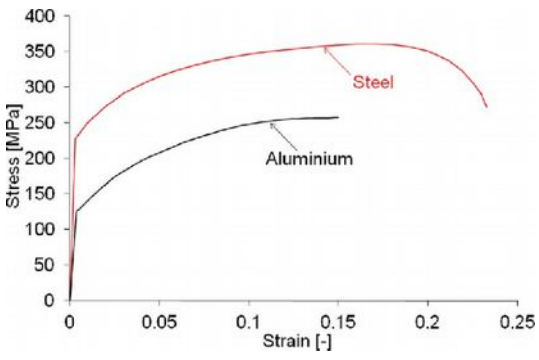
5. One end of a 2.0m length of copper wire, diameter 0.32mm, is attached to the ceiling. When a 1.0kg mass is hung from the bottom end, the wire extends elastically by 2.1mm.

   Calculate:
   (a) the stress in the wire? *($1.22x10^8 Pa$)*
   (b) the strain of the wire? *($1.05x10^{-3}$)*
   (c) the Young modulus of the copper? *($1.16x10^{11} Pa$)*

6. A large crane has a steel lifting cable of diameter 36mm. The steel used has a Young modulus of 200GPa. When the crane is used to lift 20kN, the unstretched cable length is 25m. Calculate the extension of the cable. *(2.5mm)*

7. Use the graphs to complete the table with estimates of yield stress and ultimate tensile stress:

	steel	aluminium
yield strength (MPa)		
ultimate tensile stress (MPa)		



8. Tensile tests are carried out on a plastic specimen.
The stress and strain results are below.

(a) Plot a graph of stress (y-axis) against strain (x-axis) on the axes provided.

(b) Measure the yield stress, using the graph. *(45MPa)*

(c) Calculate the Young modulus of the plastic, using the graph. *(2.4GPa)*

stress (MPa)	strain
8.0	0.0032
17.5	0.0073
25.6	0.0111
31.1	0.0129
39.8	0.0163
44.0	0.0184
48.2	0.0209
53.9	0.0260
58.1	0.0331
62.0	0.0429
62.1	fracture