FlashyScience Tensile Testing Quick Activities

1. Choose any of the materials and use small strain increments to determine its Young's modulus.
2. Which material has *(a)* the highest and *(b)* the lowest Young's modulus from your measurements in the experiment above?
3. Which of the five materials can stretch elastically the most?
4. a. Choose one of the metal samples (1 – 3) and use small strain increments to determine its elastic limit.
   b. (Advanced question) Continue to stretch the sample with small strain increments and determine the 0.2% yield strength.
5. Determine the UTS for all five sample types. Which has the highest UTS and which has the lowest?
6. a. Measure the full stress-strain curve for samples 1 (steel), 2 (brass) and 3 (aluminium alloy).
   b. What type of behaviour is observed from these stress-strain curves?
   c. Which material has the greatest UTS?
   d. Which material should be chosen when high strength is required?
   e. Why are the other two materials still used (hint – think about other properties not explored here)?
7. a. Measure the full stress-strain curve for samples 4 (glass) and 5 (Kevlar).
   b. What type of behaviour do these materials exhibit?
   c. Why are these properties useful in applications?
8. (Advanced experiment)
   a. For one or more materials, measure the full stress-strain curve to fracture.
   b. Convert the data to true stress and true strain.
   c. Estimate the work done in fracturing each sample investigated.
9. a. Select one of the metal samples (1 – 3) and increase the strain to determine the sample's yield strength.
   b. Continue to increase the strain a little more (use your judgement but record what you do) and then reduce the applied strain in steps to relax the sample (the applied load will be at zero)
   c. Record the strain (permanent deformation) at this point.
   d. Increase the strain again to calculate the new yield strength of the material.
   e. Repeat steps b – d to find how the yield strength changes as the sample undergoes these repeated strain cycles (work hardening).