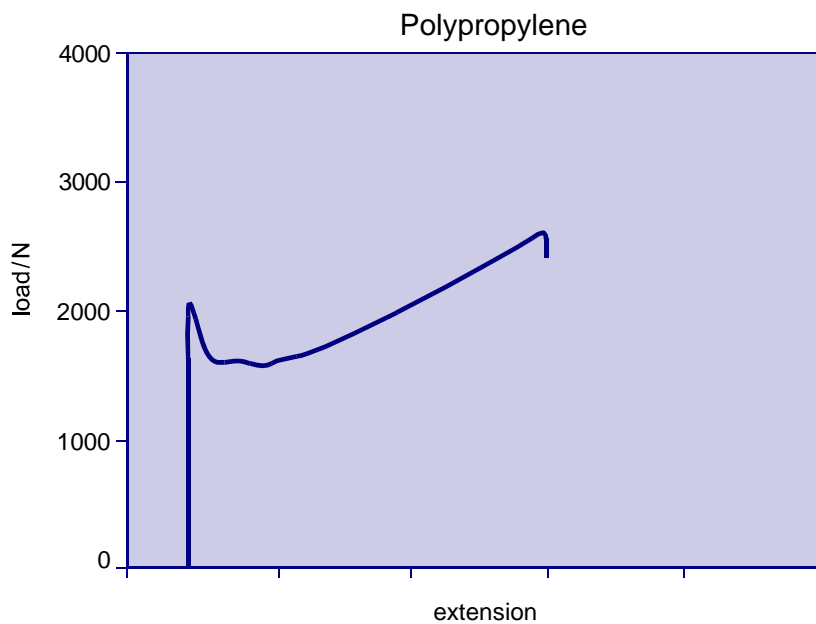
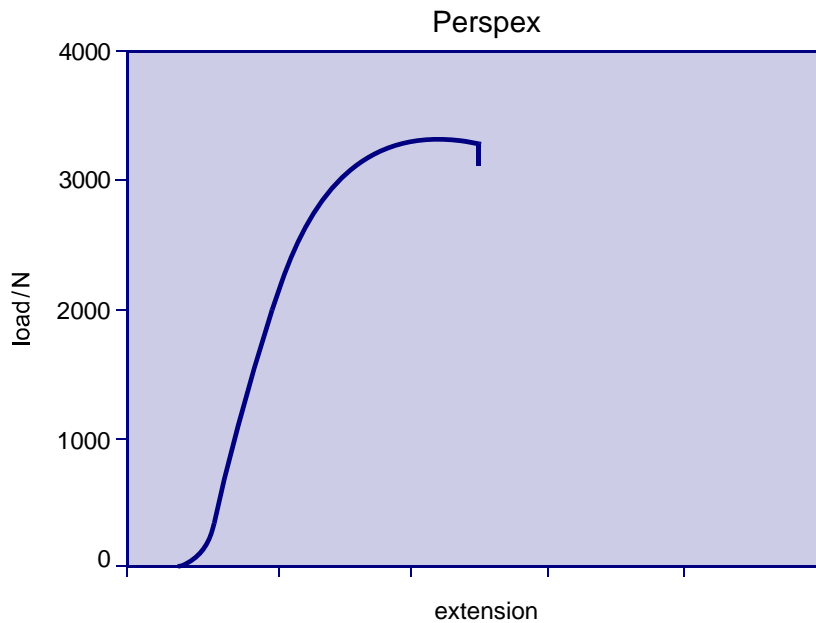


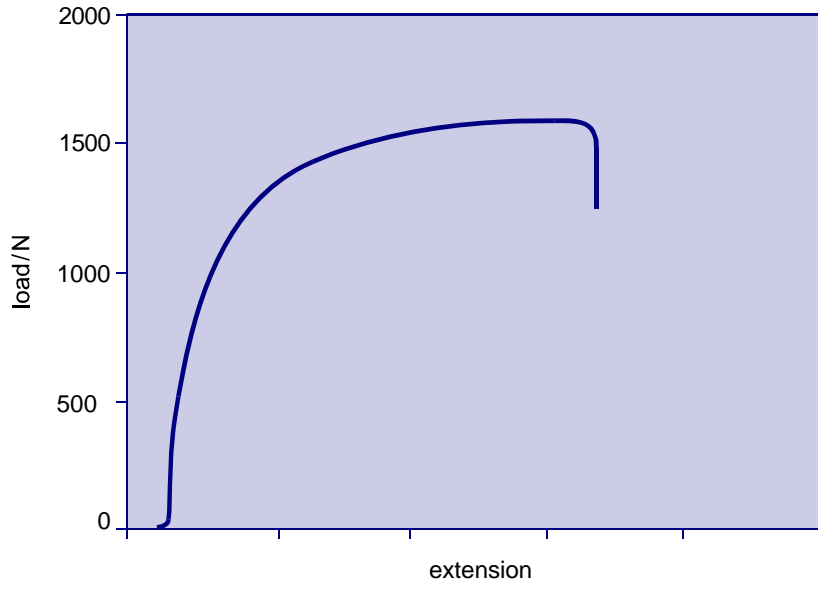
TAP 229- 1: Analysis of tensile testing experiments

Procedure

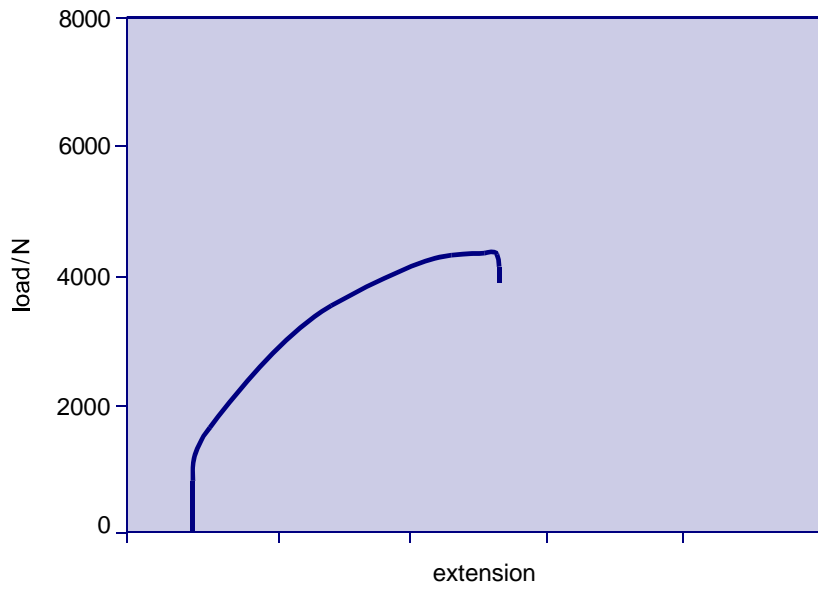
Here is the graphical output from tensile testing of five materials: Perspex, polypropylene, aluminium, brass and mild steel, along with the dimensions of the specimen. No values are given on the x axis, for extension, to simplify these questions. This is because the scales differ – except for aluminium and mild steel where they are identical. The load in Newtons is given on the y axis. Use the graphs to answer the questions below.

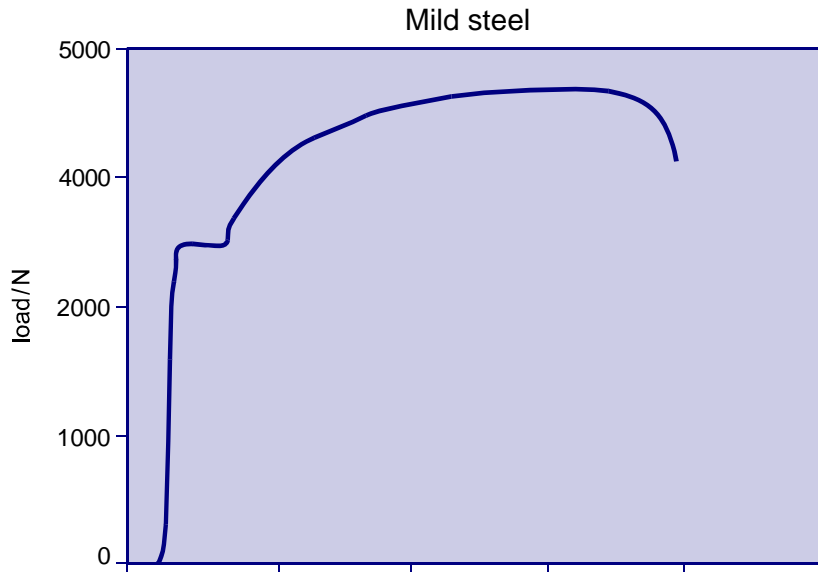


Aluminium



Brass





Questions

1. Find the yield load for each specimen.
2. Find the maximum load for each specimen.
3. Which has the larger Young modulus – aluminium or mild steel?

Hints

1. The yield point is the point where the graph stops being linear – i.e. it passes from the elastic region, where load is proportional to extension, into the non-linear plastic region where additional load produces increasingly larger extensions. Mark this and measure off the corresponding load.
2. This is, literally, the maximum value of the load. Note that the graph dips down after this before fracture actually occurs (at the end point of the graph). This occurs because of the local narrowing, known as necking, of the specimen on application of the maximum load. Since stress is load divided by area, if the area is decreased, then so is the load required to produce the same stress, which is already sufficient to break the specimen.
3. Think about the steepness of the gradient.

Practical advice

The chart speeds differ for each specimen, and this gives different scales on the x axis. The graphs are not sensitive enough to allow accurate determination of the Young modulus, so a comparison between aluminium and mild steel is asked for instead.

Answers and worked solutions

1. Perspex 1260 N, polypropylene 970 N, aluminium 300 N, brass 1080 N, mild steel 2300 N.
2. Perspex 3070 N, polypropylene 1230 N, aluminium 1470 N, brass 4100 N, mild steel 3440 N.
3. Steel – the gradient of the straight part of the line is steeper and the Young modulus is the slope.

External references

This activity is taken from Advancing Physics Chapter 4, 40S