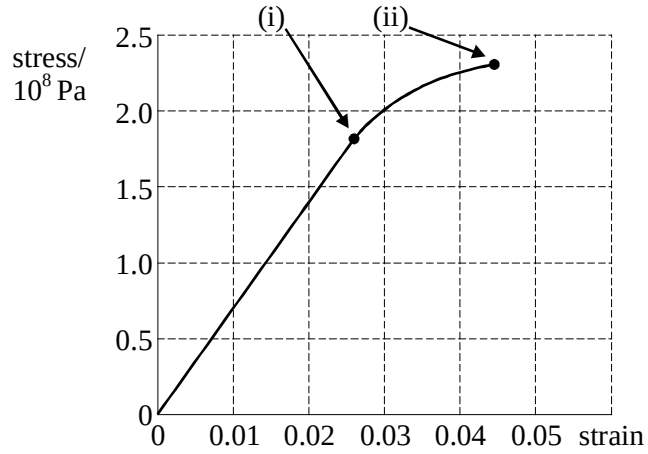
1. (a) (i) strain = 0.026 **(1)**
$E = 6.92 \times 10^9$ Pa **(1)**

(ii) $A = 1.96 \times 10^{-7}$ (m^2) **(1)**
stress = 2.30×10^8 Pa **(1)**

(iii) breaking strain = 0.044 **(1)** 5

(b)



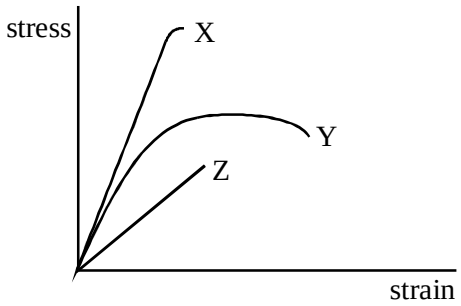
shape overall **(1)**

(i) straight line **(1)**
0 to (0.026, 1.8) **(1)**

(ii) curve **(1)**
to (0.044, 2.3) **(1)** Max 4

[9]

2.



(a) Y **(1)**
significant plastic deformation (or Young modulus less than X) **(1)**

(b) Z **(1)**
no plastic deformation (or smallest value of Young modulus) **(1)**

(c) X **(1)**
small amount of plastic deformation (or Young modulus greater than Y) **(1)**

[6]

3. uses slope of straight line region **(1)**
slope = 1.54×10^{5} (Nm^{-1}) **(1)**
E = slope × $\frac{l}{A}$ **(1)**
$A = 5.03 \times 10^{-7}$ (m^2) **(1)**
$E = 1.5 \times 10^{11}$ Pa **(1)**
$F_y = 87$ (N) **(1)**
yield stress = 1.7×10^{8} Pa **(1)**

[6]

4. (a) (i) diagram to show:
(long) wire fixed at one end **(1)**
mass/weight at other end **(1)**
measuring scale **(1)**
mark on wire, or means to measure extension **(1)** max 3

[alternative for two vertical wires:
two wires fixed to rigid support **(1)**
mass/weight at end of one wire **(1)**
other wire kept taut **(1)**
spirit level and micrometer or sliding vernier scale **(1)**]

(ii) measurements:
length of the wire between clamp and mark **(1)**
diameter of the wire **(1)**
extension of the wire **(1)**
for a known mass **(1)** max 3

(iii) length measured by metre rule **(1)**
diameter measured by micrometer **(1)**
at several positions and mean taken **(1)**
(known) mass added and extension measured
by noting movement of fixed mark against vernier scale
(or any suitable alternative) **(1)**
repeat readings for increasing (or decreasing) load **(1)** max 4

[10]