

Question Number	Answer	Mark
16(a)	<ul style="list-style-type: none"> Micrometer (screw gauge) Or digital (not Vernier) calliper(s) 	(1) 1
16(b)(i)	<ul style="list-style-type: none"> Attempt to calculate gradient (1) Use of linear section, or tangent at origin, with use of large triangle (1) $E = 1.2 \pm 0.05 \times 10^{11} \text{ Pa}$ (1) <p><u>Example of calculation</u> Extending straight section to 1% $120 \times 10^6 \text{ Pa} \div 0.01 = 1.2 \times 10^{11} \text{ Pa}$</p>	3
16(b)(ii)	<ul style="list-style-type: none"> Breaking stress read from graph (1) Use of $A = \pi r^2$ (1) Use of $\sigma = F/A$ (1) $F = 2.6 \times 10^4 \text{ N}$ (1) <p><u>Example of calculation</u> Area = $\pi \times (2.525 \times 10^{-3})^2 = 2.00 \times 10^{-5} \text{ m}^2$ Force = $1\,280 \times 10^6 \times 2 \times 10^{-5} = 2.56 \times 10^4 \text{ N}$</p>	4
16(b)(iii)	<ul style="list-style-type: none"> Use of area under graph = $\frac{1}{2}\sigma\epsilon$ (1) Substitution of $F = \sigma A$ and $\Delta x = \epsilon x$ (1) Substitution of $Ax = V$ and $\Delta W = \frac{1}{2} F \Delta x$ (1) <p><u>Example of calculation</u> Area = $\frac{1}{2}\sigma\epsilon$ = $\frac{1}{2} (F / A) (\Delta x / x)$ = $\frac{1}{2} F \Delta x / (A x)$ = $\Delta W / V$</p>	3
16(b)(iv)	<ul style="list-style-type: none"> Calculation of area under graph by a valid method. (1) Area in range 60 to 64 (MJ m^{-3}) (1) Calculation of volume of sample (1) Energy = $500 \pm 20 \text{ J}$ (1) <p><u>Example of calculation</u> One large square = $200 \times 10^6 \times 0.01 = 2 \times 10^6 \text{ J m}^{-3}$ 31 large squares Volume of sample = $0.40 \text{ m} \times 2.0 \times 10^{-5} \text{ m}^2 = 8.0 \times 10^{-6} \text{ m}^3$ Work = $31 \times 8 \times 10^{-6} \text{ m}^3 \times 2 \times 10^6 \text{ J m}^{-3} = 4.96 \times 10^2 \text{ J}$</p>	4
Total for question 16		15