AQA Examination-style questions

1 (a) Define the *density* of a material. *(1 mark)*

(b) Brass, an alloy of copper and zinc, consists of 70% **by volume** of copper and 30% **by volume** of zinc.

density of copper = $8.9 \times 10^3\,\mathrm{kg\,m^{-3}}$

density of zinc = $7.1 \times 10^3\,\mathrm{kg\,m^{-3}}$

(i) Determine the mass of copper and the mass of zinc required to make a rod of brass of volume $0.80 \times 10^{-3}\,\mathrm{m^3}$.

(ii) Calculate the density of brass. *(5 marks)*

AQA, 2004

2 **Figure 1** shows a lorry of mass 1.2×10^3 kg parked on a platform used to weigh vehicles. The lorry compresses the spring that supports the platform by 0.030 m.

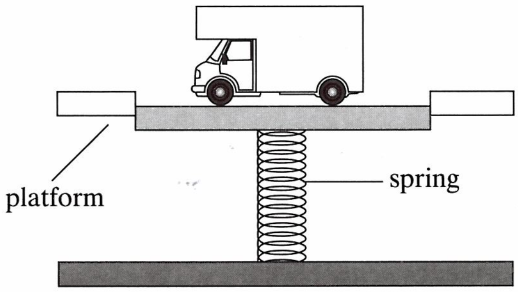

Figure 1

Calculate the energy stored in the spring. *(3 marks)*

AQA, 2002

3 (a) **Figure 2** shows the variation of tensile stress with tensile strain for two wires **X** and **Y**, having the same dimensions, but made of different materials. The materials fracture at the points $\mathbf{F_X}$ and $\mathbf{F_Y}$ respectively.

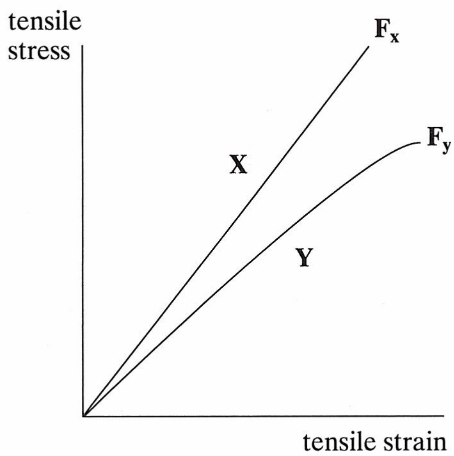

Figure 2

State, with a reason for each, which material, **X** or **Y**,

(i) obeys Hooke's law up to the point of fracture,

(ii) is the weaker material,

(iii) is ductile,

(iv) has the greater elastic strain energy for a given tensile stress. *(8 marks)*

(b) An elastic cord of unstretched length 160 mm has a cross-sectional area of 0.64 mm^2. The cord is stretched to a length of 190 mm. Assume that Hooke's law is obeyed for this range and that the cross-sectional area remains constant.

the Young modulus for the material of the cord = 2.0×10^7 Pa

(i) Calculate the tension in the cord at this extension.

(ii) Calculate the energy stored in the cord at this extension. *(5 marks)*

AQA, 2003

4 A material in the form of a wire, 3.0 m long and cross-sectional area = 2.8×10^{-7} m^2 is suspended from a support so that it hangs vertically. Different masses may be suspended from its lower end. The table shows the extension of the wire when it is subjected to an increasing load and then a decreasing load.

load / N	0	24	52	70	82	88	94	101	71	50	16	0
extension / mm	0	2.2	4.6	6.4	7.4	8.2	9.6	13.0	10.2	8.0	4.8	3.2

(a) Plot a graph of load (on the *y* axis) against extension (on the *x* axis) both for increasing and decreasing loads. *(4 marks)*

(b) Explain what the shape of the graph tells us about the behaviour of the material in the wire. *(4 marks)*

(c) Using the graph, determine a value of the Young modulus for the material of the wire. *(3 marks)*

AQA, 2003

5 **Figure 3** shows two wires, one made of steel and the other of brass, firmly clamped together at their ends. The wires have the same unstretched length and the same cross-sectional area. One of the clamped ends is fixed to a horizontal support and a mass M is suspended from the other end, so that the wires hang vertically.

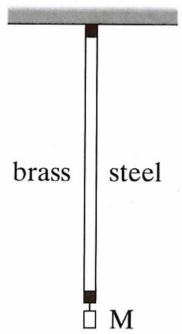

Figure 3

(i) Since the wires are clamped together the extension of each wire will be the same. If E_S is the Young modulus for steel and E_B the Young modulus for brass, show that

$$\frac{E_S}{E_B} = \frac{F_S}{F_B}$$

where F_S and F_B are the respective forces in the steel and brass wire.

(ii) The mass M produces a total force of 15 N. Show that the magnitude of the force F_S = 10 N.

the Young modulus for steel = 2.0×10^{11} Pa

the Young modulus for brass = 1.0×10^{11} Pa

(iii) The cross-sectional area of each wire is 1.4×10^{-6} m^2 and the unstretched length is 1.5 m. Determine the extension produced in either wire. *(6 marks)*

AQA, 2005