3 A thin metal wire X, of diameter 1.2×10^{-3} m, is used to suspend a model planet, as shown in Fig. 3.1.

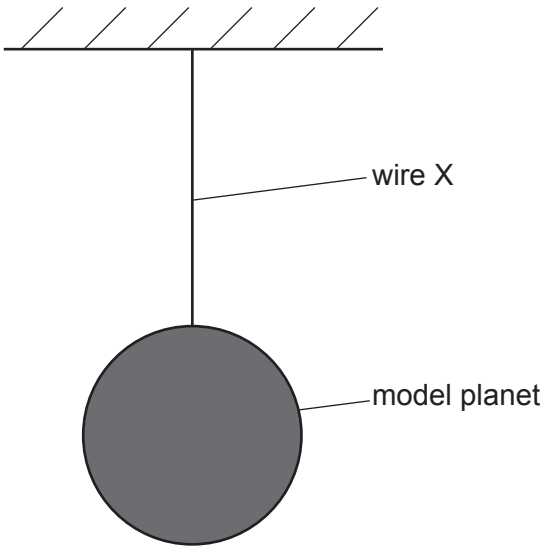

Fig. 3.1 (not to scale)

The variation with strain of the stress for wire X is shown in Fig. 3.2.

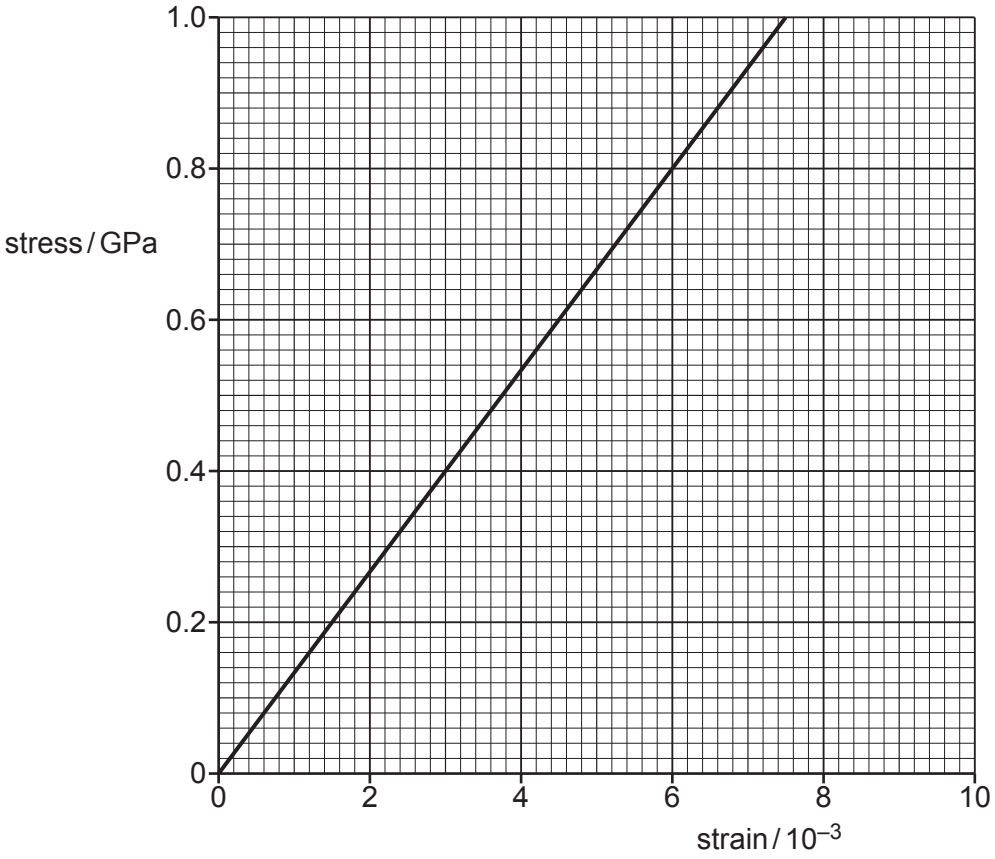

Fig. 3.2

(a) The strain in X is 5.4×10^{-3}.

(i) Use Fig. 3.2 to calculate the force exerted on the wire by the model planet.

force = ... N [3]

(ii) The elastic potential energy of X is 0.31 J.

Calculate the original length of the wire before the model planet was attached.

original length = ... m [3]

(b) Wire X is replaced by a new wire, Y, with the same original length and diameter but double the Young modulus of X. Wire Y also obeys Hooke's law.

On Fig. 3.2, draw a line representing the variation with strain of the stress for Y. [2]

[Total: 8]