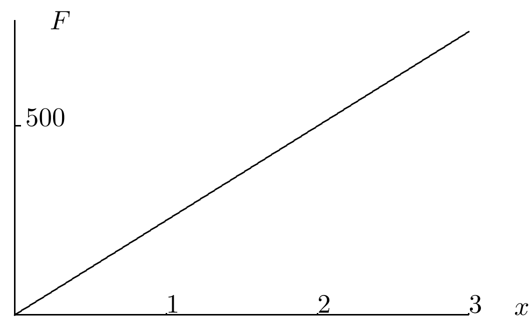
66. (a) The compression is "spring-like" so the maximum force relates to the distance x by Hooke's law:

$$F_\mathrm{x} = kx \quad \Longrightarrow \quad x = \frac{750}{2.5 \times 10^5} = 0.0030 \text{ m} .$$

(b) The work is what produces the "spring-like" potential energy associated with the compression. Thus, using Eq. 8-11,

$$W = \frac{1}{2}kx^2 = \frac{1}{2}\left(2.5 \times 10^5\right)(0.0030)^2 = 1.1 \text{ J} .$$

(c) By Newton's third law, the force F exerted by the tooth is equal and opposite to the "spring-like" force exerted by the licorice, so the graph of F is a straight line of slope k. We plot F (in Newtons) versus x (in millimeters); both are taken as positive.



(d) As mentioned in part (b), the spring potential energy expression is relevant. Now, whether or not we can ignore dissipative processes is a deeper question. In other words, it seems unlikely that – if the tooth at any moment were to reverse its motion – that the licorice could "spring back" to its original shape. Still, to the extent that $U = \frac{1}{2}kx^2$ applies, the graph is a parabola (not shown here) which has its vertex at the origin and is either concave upward or concave downward depending on how one wishes to define the sign of F (the connection being $F = -dU/dx$).

(e) As a crude estimate, the area under the curve is roughly half the area of the entire plotting-area (8000 N by 12 mm). This leads to an approximate work of $\frac{1}{2}(8000)(0.012) \approx 50$ J. Estimates in the range $40 \leq W \leq 50$ J are acceptable.

(f) Certainly dissipative effects dominate this process, and we cannot assign it a meaningful potential energy.