102. (a) From the graph, it is clear that $x_m = 0.30$ m.

(b) With $F = -kx$, we see k is the (negative) slope of the graph – which is $75/0.30 = 250$ N/m. Plugging this into Eq. 16-13 yields

$$T = 2\pi\sqrt{\frac{m}{k}} = 0.28 \text{ s} \quad .$$

(c) As discussed in §16-2, the maximum acceleration is

$$a_m = \omega^2 x_m = \frac{k}{m}\, x_m = 150 \text{ m/s}^2 \ .$$

Alternatively, we could arrive at this result using $a_m = \left(\frac{2\pi}{T}\right)^2 x_m$.

(d) Also in §16-2 is $v_m = \omega x_m$ so that the maximum kinetic energy is

$$K_m = \frac{1}{2} m v_m^2 = \frac{1}{2} m\omega^2 x_m^2 = \frac{1}{2} k x_m^2$$

which yields $11.3 \approx 11$ J. We note that the above manipulation reproduces the notion of energy conservation for this system (maximum kinetic energy being equal to the maximum potential energy).