Ex 13.5 p398

$m = .5\,kg$

$k = 20\ \frac{N}{m}$

$A = 3\,cm = .03\,m$

a) find $E = ?$

$PE_s = \frac{1}{2}kx^2 = \frac{1}{2}(20)(.03)^2 = 9 \times 10^{-3}\,J$

v_{max} $\quad PE_s = KE$

$\frac{1}{2}kx_i^2 = \frac{1}{2}mv_f^2$

$\sqrt{\frac{kx_i^2}{m}} = v_f$

$v_f = \sqrt{\frac{20(.03)^2}{.5}} = .19\ \frac{m}{s}$

$\Delta E = W$

$E_i = E_f \qquad PE_s = KE_f$

$PE_s = \frac{1}{2}kx^2$

$KE = \frac{1}{2}mv^2$

$v = \pm\sqrt{\frac{k}{m}(A^2 - x^2)}$

A = Amplitude or x_{max}

b) $v = ?$ $\quad x = 2\,cm = .02\,m$

$v = \pm\sqrt{\frac{k}{m}(A^2 - x^2)} = \pm\sqrt{\frac{20}{.03}(.03^2 - .02^2)}$

$= \pm .14\ \frac{m}{s}$

c) at 2cm $KE = \frac{1}{2}mv^2 = \frac{1}{2}(.5)(.14)^2 = 5 \times 10^{-3}\,J$

$PE = \frac{1}{2}kx^2 = \frac{1}{2}(20)(.02)^2 = 4 \times 10^{-3}\,J$