# PHYS 195: WEEK 2 SOLUTIONS

(1) TAYLOR 3.39 YIKES! EVERYTHING IS UNCERTAIN. SO MAYBE ONE OF THESE DOMINATES THE UNCERTAINTY IN E? LET'S SEE:

$$\frac{\delta m}{m} \simeq 4\times10^{-3}, \quad \frac{\delta k}{k} \simeq 1\times10^{-2}, \quad 2\frac{\delta V}{V} \simeq 2\times10^{-2}$$

$$2\frac{\delta x}{x} \simeq 2\times10^{-2}$$

GOOD! THE UNCERTAINTIES IN m AND k ARE SMALL COMPARED TO THE UNCERTAINTIES IN x AND V. ADDING THESE IN QUADRATURE GIVES

$$\frac{\delta E}{E} = \sqrt{\left(2\frac{\delta V}{V}\right)^2 + \left(2\frac{\delta x}{x}\right)^2} \simeq \sqrt{2.4\times10^{-4}} \simeq 3\times10^{-2}$$

THE ENERGY IS, PLUGGING IN THE NUMBERS,

(a) $E \simeq 0.2474\ \text{J} \Rightarrow E = 0.247 \pm 0.007\ \text{J}$

N.B.: THIS UNCERT. DIFFERS FROM THE SOLN GIVEN IN THE BOOK. IT APPEARS TO BE A TYPO

NOW $E = \frac{1}{2}kx_m^2 \simeq 0.2509\ \text{J}$. THE UNCERTAINTY IN x, $2\frac{\delta x}{x} \simeq 0.006$, STILL DOMINATES OVER THE UNCERTAINTY IN k SO $\frac{\delta E}{E} \simeq 2\frac{\delta x}{x}$ AND

(b) $E = 0.251 \pm 0.001\ \text{J}$

(c.) YES, THE TWO MEASUREMENTS OF E AGREE SINCE $0.247 \pm 0.007 = 0.254 > 0.251$.