Question #17210

For a mass on a spring, $x = A\cos(\omega t + \varphi), \omega = \sqrt{\frac{k}{m}}$. Total energy includes kinetic and potential energy: $E = K + U = \frac{m\dot{x}^2}{2} + \frac{k x^2}{2}$. Plugging the first expression into this expression, obtain: $E = \frac{m A^2 \omega^2}{2}$. Hence, for $x = A/2$, $\frac{U}{E}|_{x=A/2} = \frac{\omega^2 m x^2}{2} \cdot \frac{2}{m A^2 \omega^2}|_{x=A/2} = \frac{x^2}{A^2}|_{x=A/2} = \frac{1}{4}$.