Consider a mass-spring system, where the oscillation is describe by \( x = A \cos \omega t \). The kinetic energy is \( K = \left( \frac{1}{2} \right) m \left( \frac{dx}{dt} \right)^2 \). The potential energy is \( U = \frac{k x^2}{2} \). The maxima are \( K_{\text{max}} = \frac{m (\omega A)^2}{2} \), and \( U_{\text{max}} = \frac{k A^2}{2} \).

Which choice below gives the total energy of oscillations?

A) \( E = K_{\text{max}} = U_{\text{max}} = \frac{m (\omega A)^2}{2} \).

B) \( E = K_{\text{max}} + U_{\text{max}} = m (\omega A)^2 \).

C) \( E = K_{\text{max}} + U_{\text{max}} = k A^2 \).
The total energy $E = K + U$, of the mass-spring system is a conserved quantity.

$E$ stays the same throughout the oscillations.

When the mass passes the point $x = 0$, its potential energy is 0 and its kinetic energy is at its maximum.

At the maximum stretch, its potential energy is maximum and its kinetic energy is 0.

Answer A.

13.02-06 ‘Total Energy of a Simple Harmonic Motion’ 2004-3-24