The Energy in Simple Harmonic Motion:

The energy of a linear oscillator transfers back and forth between kinetic energy & potential energy. while the sum of the two, the mechanical energy E of the oscillator, remains constant.

The potential energy of a linear oscillator is associated entirely with the spring. It's value depends on how much the spring is stretched or compressed.

$$U(t) = \frac{1}{2}kx^2 = \frac{1}{2}kx_m^2\cos^2(\omega t + \phi)$$

The kinetic energy of the system is associated entirely with the block. It value depends on how fast the block is moving., that is on $v(t)$

$$K(t) = \frac{1}{2}mv^2 = \frac{1}{2}m\omega^2 x_m^2 \sin^2(\omega t + \phi)$$

$$= \frac{1}{2}m\frac{k}{m}x_m^2\sin^2(\omega t + \phi)$$

$$= \frac{1}{2}kx_m^2\sin^2(\omega t + \phi)$$

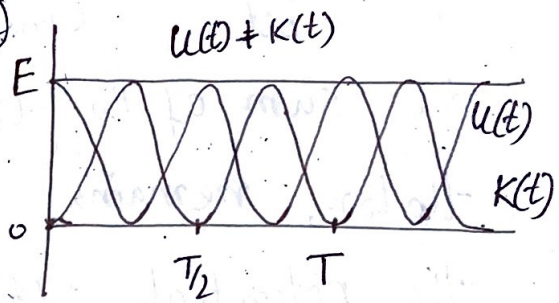
The mechanical energy

$$E = U + K$$

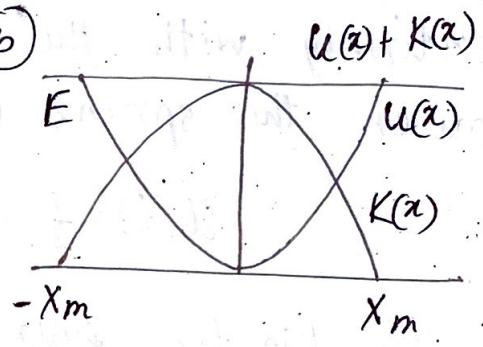
$$= \frac{1}{2}kx_m^2\cos^2(\omega t+\phi) + \frac{1}{2}kx_m^2\sin^2(\omega t+\phi)$$

$$= \frac{1}{2}kx_m^2$$

The mechanical energy of a linear oscillator is indeed constant and independ of time. The potential energy and kinetic energy of a linear oscillator are shown as functions of time in Fig (a) and function of displacement.



An oscillating system normally contains an element of springiness and an element of inertia. The formers stores its potential energy and the latter stores its kinetic energy.



Check point 3

.5J, 2J, 5J

The block has a kinetic energy of 3J and the spring has an elastic potential energy of 2J when the block is at $x = +2cm$. (a) What is the kinetic energy when the block is at $X = 0$? What is the elastic potential energy when the block is at (b) $x = -2cm$ (c) $x = -X_m$ 5J, 2J, 5J.

Damping

Wave

4-12-19
SAC 207
3-6 pm

SAC 513
9.40 - 11.10
11.20 - 12.50

Types of wave: There are three main types of waves such as.

① Mechanical waves: These Waves are controlled by Newton's law and these waves can exist only within a material medium such as water, air & rock. Common examples of this wave : water wave, sound wave

② Electromagnetic waves: These waves require no material medium to exist. Light waves from stars, for example, travel through a vacuum at the same speed c.

③ Matter waves: These waves are associated with electron, protons and other fundamental particles and even atoms and molecules. Because we commonly think of these particles as constituting matter, such waves are called matter waves.

Wave: A disturbance propagating through space. usually transfering energy.