Total Energy of a Spring-Mass System

Apparatus

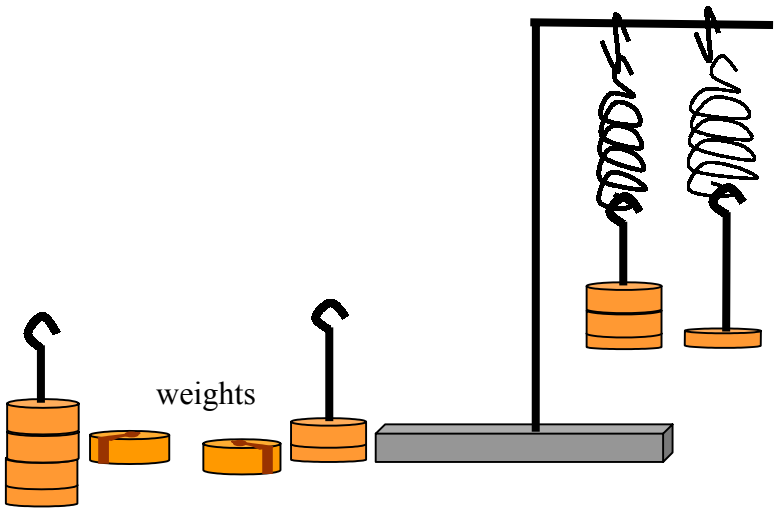
two springs with different spring constants and same lengths, suspended from a stand, with a selection of masses with mass holders

Action

The students hang weights on the two springs such that they have the same extension. They should discuss which system will have the greater energy when it is set oscillating, and which will have the greater period. They then test their prediction of which will have the greater period.

The Physics

When mass m_1 is hung from spring A and a smaller mass m_2 is hung from spring B, the springs are stretched by the same distance. Using $F = mg = k\Delta x$, if Δx is the same for both springs, but the mass on A is greater, then the spring constant of A, k_A, must be greater than that for B, k_B.
The elastic potential energy is $\frac{1}{2} kx^2$. As both systems are at the same extension, x, but A has a greater k, spring A has more elastic potential energy than B.
When the springs are stretched then released and allowed to oscillate, the initial elastic potential energy is converted to kinetic energy and gravitational potential energy, but the total energy is conserved.
The period is equal to $T = 2\pi\sqrt{\frac{m}{k}}$, but we know that $\Delta x = mg/k$ was the same for both springs, therefore T will be the same.



Accompanying sheet

Total Energy of a Spring-Mass System

The two springs have different spring constants.
Hang weights on the springs such that they have the same extension.

Which spring will have the greater energy for a given amplitude of oscillation?

Which will have the longer period?
Test your prediction.
Explain what happens.