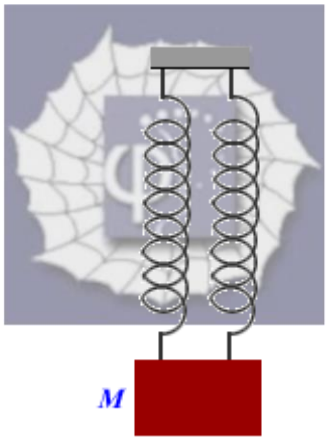
107.

Problem 15.24(RHK)

A massless spring of force constant 3.60 N/cm *is cut into halves. We have to find* (a) *force constant of each half.* (b) *Consider the situation when the two halves, suspended separately, support a block of mass M and the system vibrates at a frequency of* 2.87 Hz. *We have to find the value of the mass M.*



Solution:

We use the results of the Problem 106. The force constant of each half of the original spring will be twice its value. It is given that the force constant of the original spring is 3.60 N cm^{-1}, the force constant of each half of the spring will therefore be 7.20 N cm^{-1}.

When the mass is supported by two springs as shown in the figure, the effective force constant will be the sum of the spring constants of each one.

Therefore, the frequency of oscillation for the SHM of the block when attached to two springs, in terms of the force constant and the mass of the block, is given by the standard relation

$$M = \frac{k}{(2\pi\nu)^2} = \frac{14.40\times10^2 \text{ N m}^{-1}\text{s}^2}{(2\pi\times2.87)^2} = 4.43 \text{ kg.}$$