Answer on Question #55610, Physics / Mechanics | Relativity

In an experiment to determine the period of oscillation of a loaded spiral spring, T^2 was plotted on the vertical axis and M on the horizontal axis. T is the period while M is the effective mass. Which of the following is CORRECT?

A. the slope of the graph gives the acceleration due to gravity, g
B. the inverse of the slope of the graph gives M
C. the intercept on the vertical axis of the graph gives M
D. the intercept on the horizontal axis of the graph gives M

Solution:

There is a relationship between the period of oscillation T, the loaded mass M and the effective mass of the spiral spring m.

$$T = 2\pi\sqrt{\frac{M+m}{k}}$$

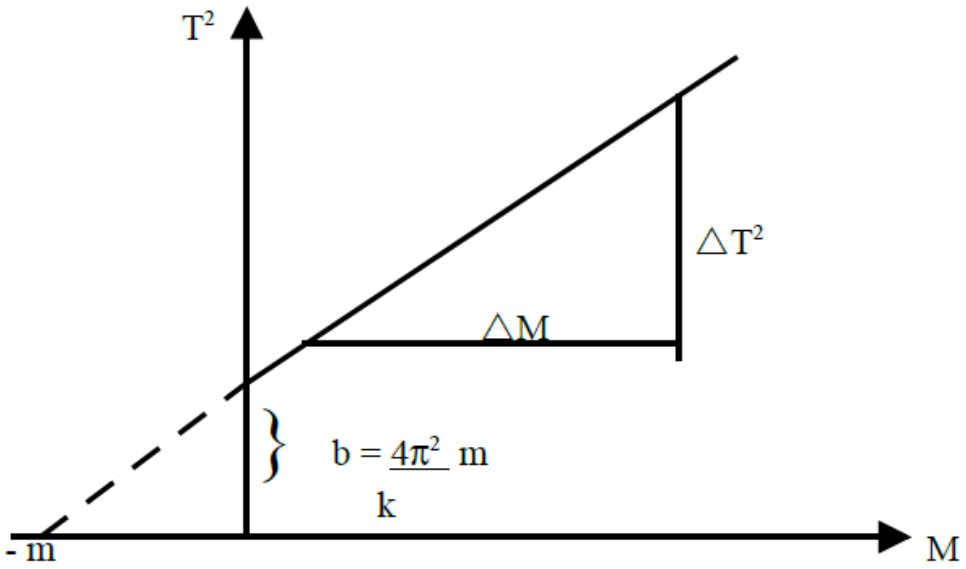
where, k is the spring constant.

We then reduce the expression to a linear one by squaring both sides of the equation.

$$T^2 = 4\pi^2\frac{M+m}{k}$$

$$T^2 = 4\pi^2\frac{M}{k} + 4\pi^2\frac{m}{k}$$

By plotting the values of T^2 against the corresponding values of M, we would obtain a straight line graph which does not pass through the origin as shown in figure.



The intercept on the horizontal axis is obtained when $T^2 = 0$.

$$M = -m$$

which gives us the effective mass of the spiral spring.

Answer: D. the intercept on the horizontal axis of the graph gives M