**Answer on Question #41350 – Physics – Other**

When a 2 kg mass is hung from a vertically suppported spiral spring, it stretches the spring by 10 cm. What mass must be hung on the spring if its to oscillate with a period of 1 s?
a. 4.96 kg
b. 3.47 kg
c. 1.76 kg
d. 5.44 kg

**Solution:**
$m = 2\text{kg} -$ mass of the weight that initially hangs on a spring;
$k -$ spring constant;
$\Delta x = 10\text{cm} = 0.1\text{m} -$ initial stretching of the spring;
$T = 1\text{s} -$ period of oscillations;
$M -$ unknown mass;

Equilibrium equation for the mass in initial position along Y-axis:
$$\text{y: } mg - F_{\text{spring}} = 0 \qquad (1)$$
$$F_{\text{spring}} = k \cdot \Delta x \qquad (2)$$
$(2)\text{in}(1)$:
$$k \cdot \Delta x = mg$$
$$k = \frac{mg}{\Delta x} \qquad (3)$$
Equation for the perid of oscillations of the spring with unknown mass M:

$$T = 2\pi \sqrt{\frac{M}{k}}$$
$$T^2 = \frac{4\pi^2 M}{k}$$
$$M = \frac{T^2 k}{4\pi^2} \qquad (4)$$
$(3)\text{in}(4)$:
$$M = \frac{T^2 mg}{4\pi^2 \Delta x} = \frac{(1\text{s})^2 \cdot 2\text{kg} \cdot 9.8\frac{N}{\text{kg}}}{4 \cdot 3.14^2 \cdot 0.1\text{m}} = 4.96\text{kg}$$
**Answer:** a. 4.96 kg.