Answer on Question #60590, Physics / Mechanics | Relativity

A ball bearing of mass m=50.0g, is sitting on a vertical spring whose force constant is 120.0N/m. The initial position of the spring is at y=0m. The spring is compressed downward a distance x=0.200m. From the compressed position, how high will the ball bearing rise? How high does the ball bearing rise above the equilibrium position at y=0m?

Solution:

Assume frictionless system and massless spring
The potential energy of ball is

$$PE = mgh$$

The potential energy of spring is

$$PS = ½kx^2$$

The kinetic energy of ball is

$$KE = ½mv^2$$

A) I assume the question is how high the ball will rise if the spring were released after compression of 0.200m

$$PS = ½kx^2$$

$$PS = \frac{1}{2} \cdot 120 \cdot (0.2)^2 = 2.4 \text{ J}$$

What height would give a 50 g ball a potential energy of 2.4 J?

$$PE = PS$$

$$PE = mgh$$

$$h = \frac{PE}{mg} = \frac{2.4}{0.05 \cdot 9.8} \approx 4.90 \text{ m}$$

The second question asks how far from our origin of uncompressed spring so we need to subtract the distance of spring compression.

$$h_0 = 4.9 - 0.2 = 4.7 \text{ m}$$

Answer: 4.90 m; 4.7 m.