A mass of 2.0 kg is hung from a spring whose constant is 5.0 N/m. The mass is pulled 20 cm down from equilibrium and released.

(a) what is the force exerted by the spring on the 2.0 kg mass just before its release?

(b) what is the frequency of the simple harmonic motion?

Solution: a) spring exerts force which is equal to the sum of weight of the load and the elastic force of the spring, emerged from the equilibrium: $F_s = m \cdot g + k \cdot \Delta L$, where m is the mass of the load, kg;

$g = 9.81$ m/s^2 – standard gravity; k – constant of the spring, N/m; ΔL – deformation of the spring, m;

Then, $F_s = 2 \cdot 9.81 + 5 \cdot 0.2 = 20.62$ N.

b) The harmonic oscillations of the spring pendulum have a period $T = 2\pi\sqrt{\frac{m}{k}}$, frequency of oscillations is inversely proportional to the period: $f = \frac{1}{T} = \frac{1}{2\pi}\sqrt{\frac{k}{m}} = \frac{1}{2 \cdot 3.14}\sqrt{\frac{5}{2}} = 0.252$ Hz

Answer: a) 20.62 N; b) 0.252 Hz.