Spring-mass system

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Solution: *Since the mass is released at rest, it will periodically return to the starting point. By conservation of energy the falling distance is twice the oscillation amplitude, which is equal to the resting position in the gravitational field,*

$$y_1 = 2y_0 = \tfrac{mg}{2k} \ .$$

So the oscillation frequency is,

$$\omega_0 = \sqrt{\frac{k}{m}} = \frac{2g}{y_1} \ .$$