

Pre-lab 3:

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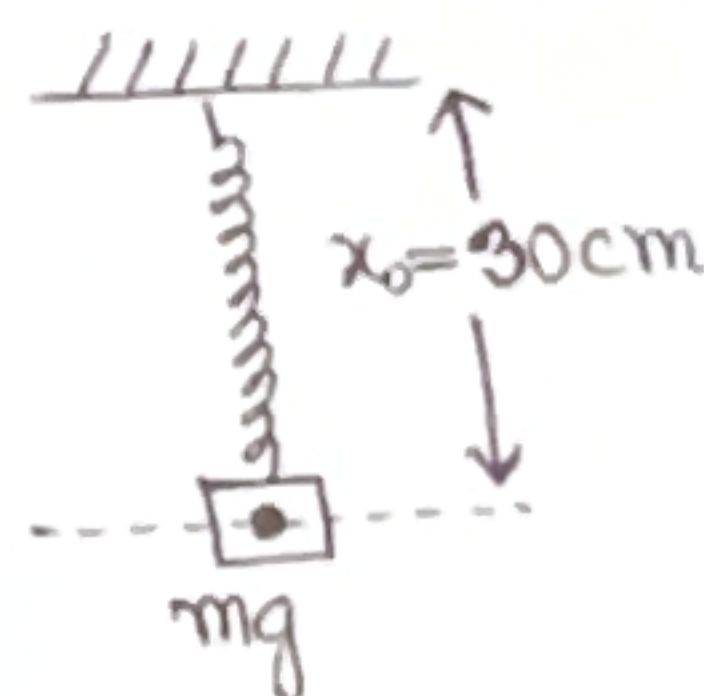
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1. What is the meaning of negative sign in the Hooke's law?

The negative sign in the Hooke's law ($F = -x$) indicates that the direction of the spring force is always opposite the direction of the displacement of springs. Because a spring always wants to stay in the equilibrium position (relaxed state), like if we stress the spring downward it will try to pull it upward, and if we try to compress it will push. This is the nature of restoring force. Since, the restoring force always opposes the direction, there is a negative sign in the Hooke's law.

2. You have a certain set-up of a vertical spring, and when hung freely the equilibrium position reading is 30cm on earth. If you take the same set-up on the moon surface, would the equilibrium position be more than, less than or equal to 30cm? Explain.

If I take the same set-up (earth surface) on the moon surface, the equilibrium position will be less than 30 cm.



Here, the equilibrium position (x_0) is determined by the restoring force, $kx_0 = mg$. On the moon the gravitational acceleration (g_{moon}) is $\frac{1}{6}$ th of the earth's gravitational acceleration. So, for the same set-up,

$$\begin{aligned}
 x_0' &= \frac{mg_{\text{moon}}}{k} \\
 &= \frac{m \times \frac{1}{6}g}{k} \\
 &= \frac{1}{6} \times \frac{mg}{k} = \frac{1}{6}x_0
 \end{aligned}$$

Hence, the spring's equilibrium position will be x_0' unit smaller than earth's x_0 .
(ans)