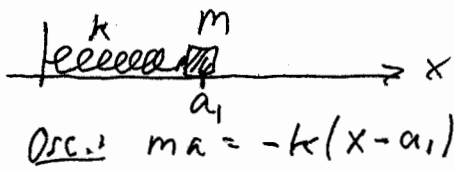
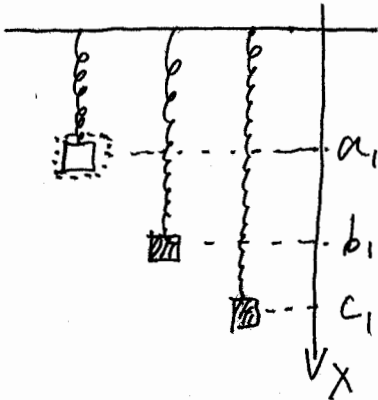


Spring in gravitation-field



Spring (stiffness k) horizontal.
Equilibrium at $x = a_1$.



Spring vertical.

New equilibrium at $x = b_1$
Then stretched out to $x = c_1$.

When hanging in new eq. $x = b_1$:
Net force: $0 = mg - k(b_1 - a_1)$
so: $mg = k(b_1 - a_1)$ *

Osc.: $ma = -k(x - b_1)$

When passing at $x = c_1$:

$ma = -k(c_1 - a_1) + mg$ **

Substituting * into **:

$ma = -k(c_1 - a_1) + k(b_1 - a_1)$
 $= k(b_1 - c_1)$ or

$ma = -k(c_1 - b_1)$

or in general passing x :

$ma = -k(x - b_1)$

Conclusion: The vertical spring oscillates just like the horizontal spring, but around a new equilibrium position $x = b_1$ given by *.