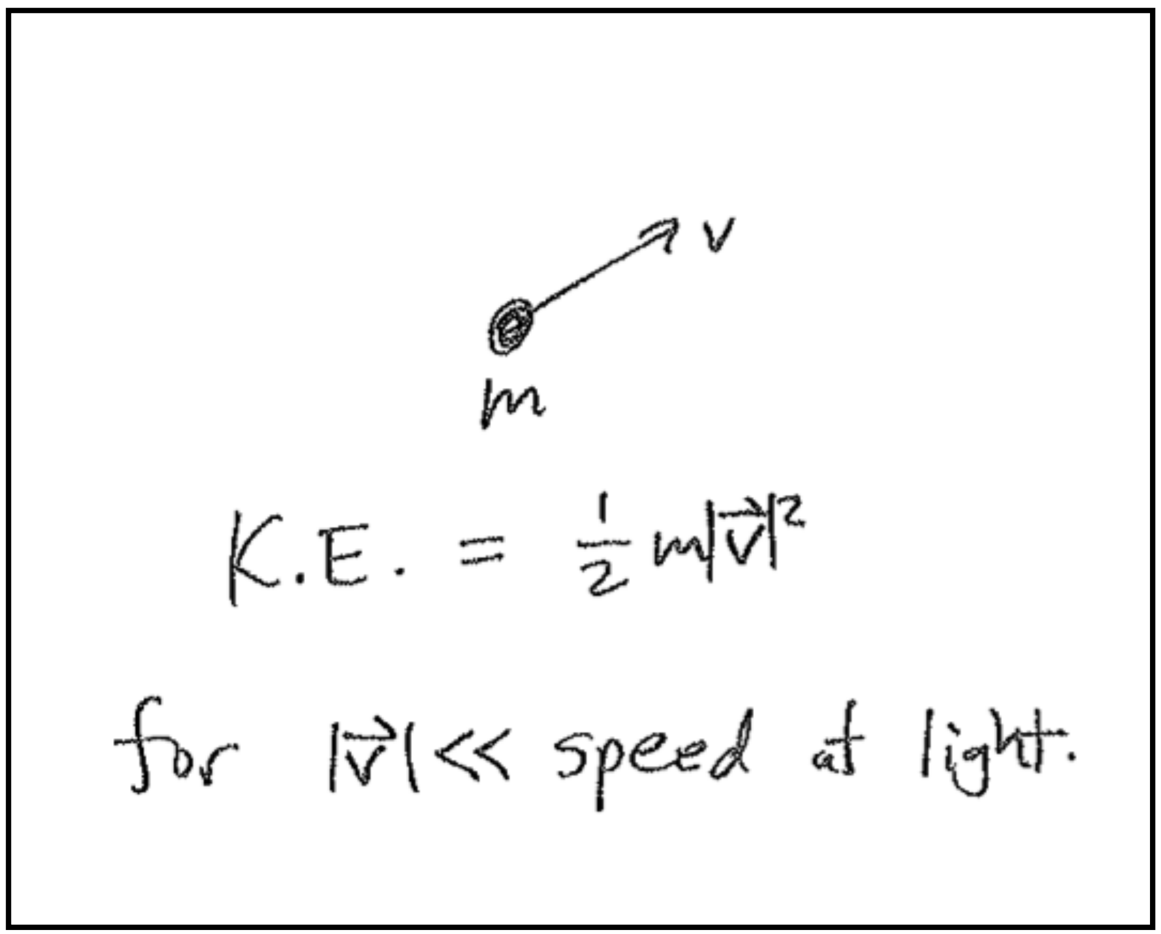
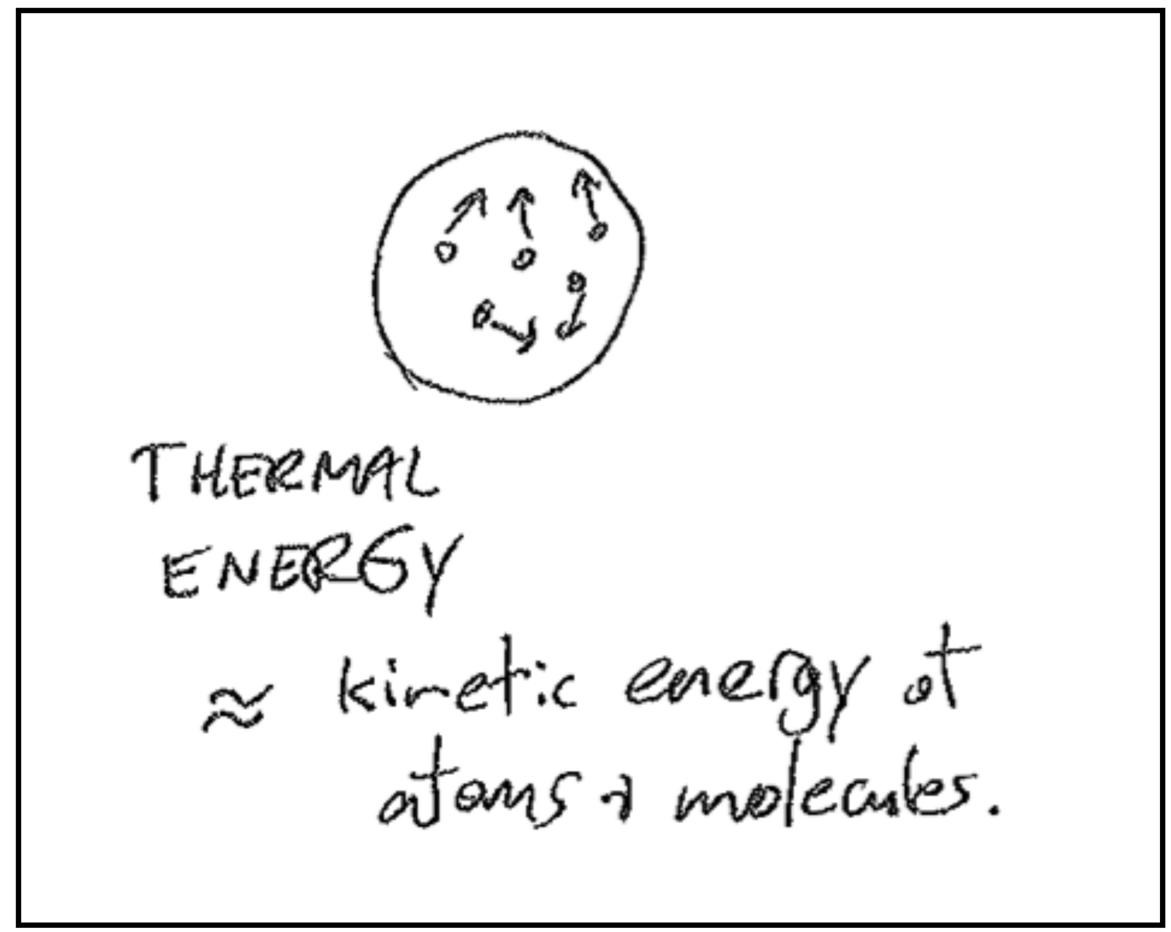
Clec8

Kinetic Energy

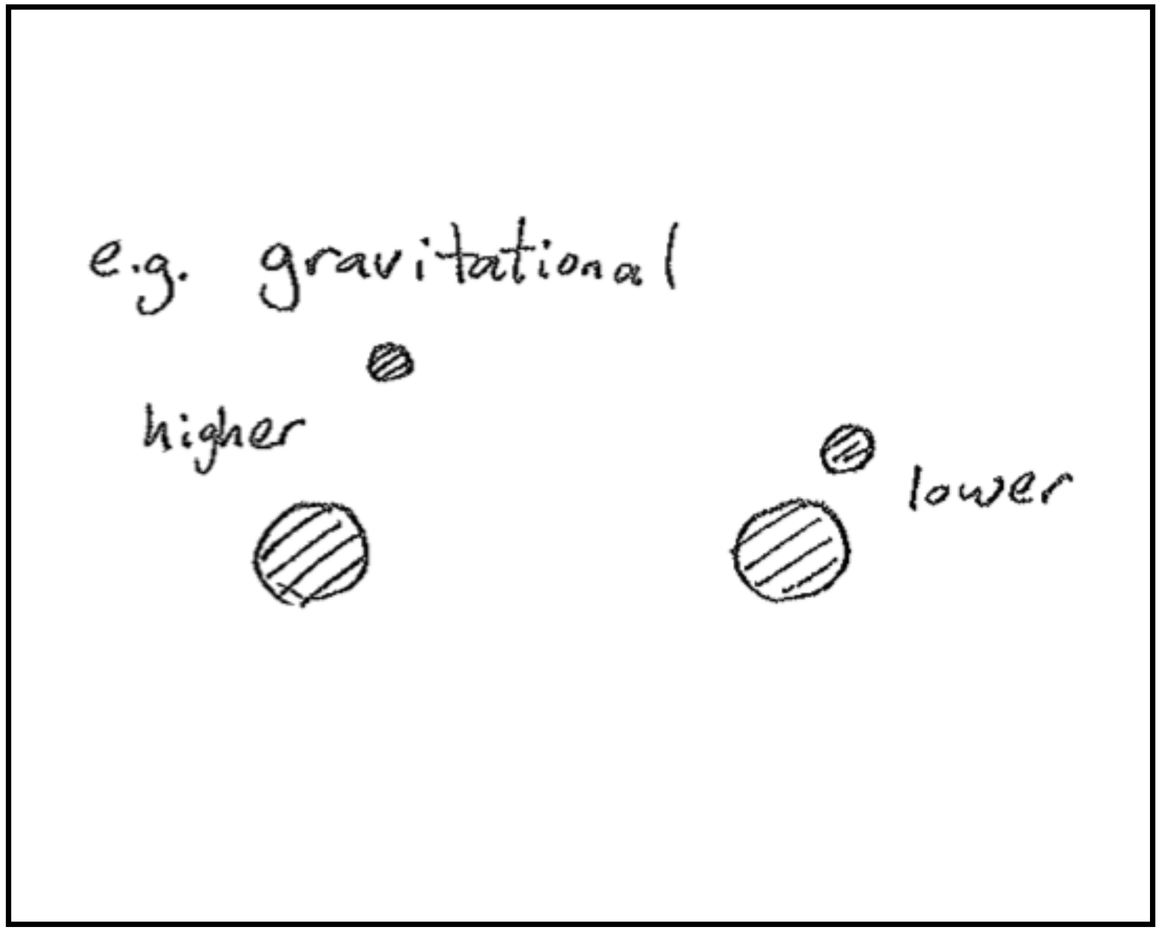
Associated with motion:

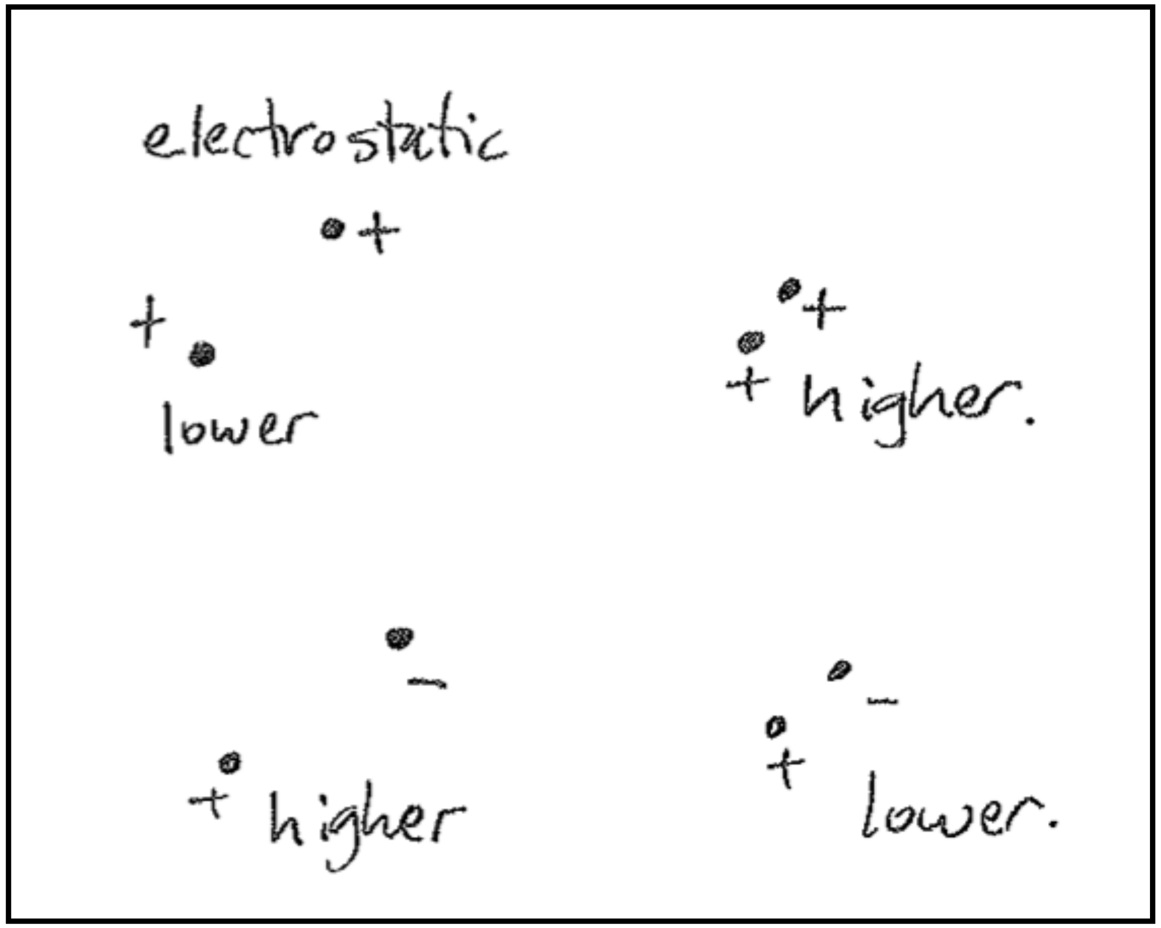




Potential Energy

Associated with configuration:

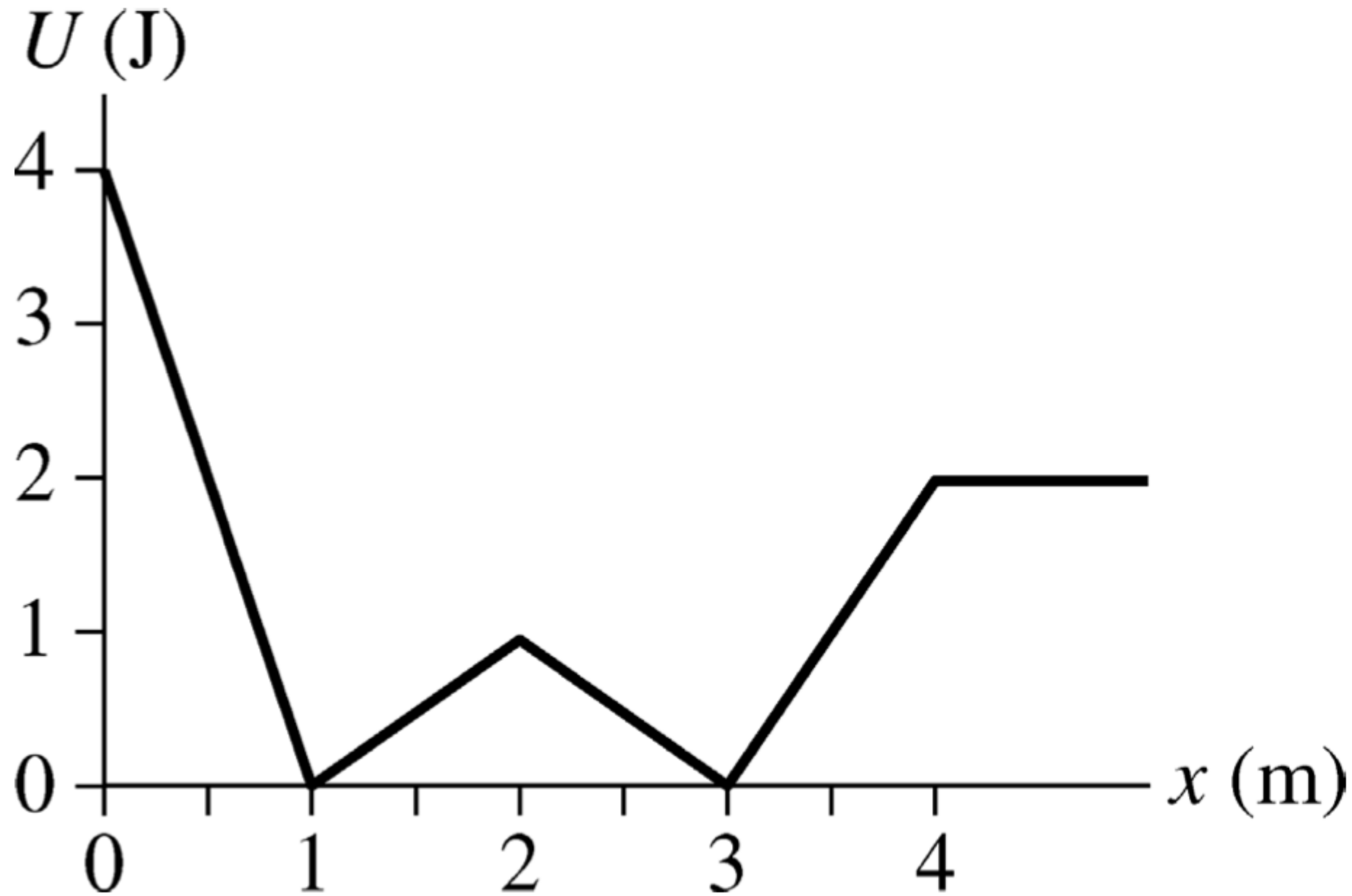




Easy way to remember: initially stationary systems move toward configurations of lower potential energy.

Clicker Question

A particle with a total energy of 1.5 J is at x = 2 m and is traveling to the right. Locate the turning point of the particle.



A) 3 m

B) 3.25 m

C) 3.5 m

D) 3.75 m

E) no turning point

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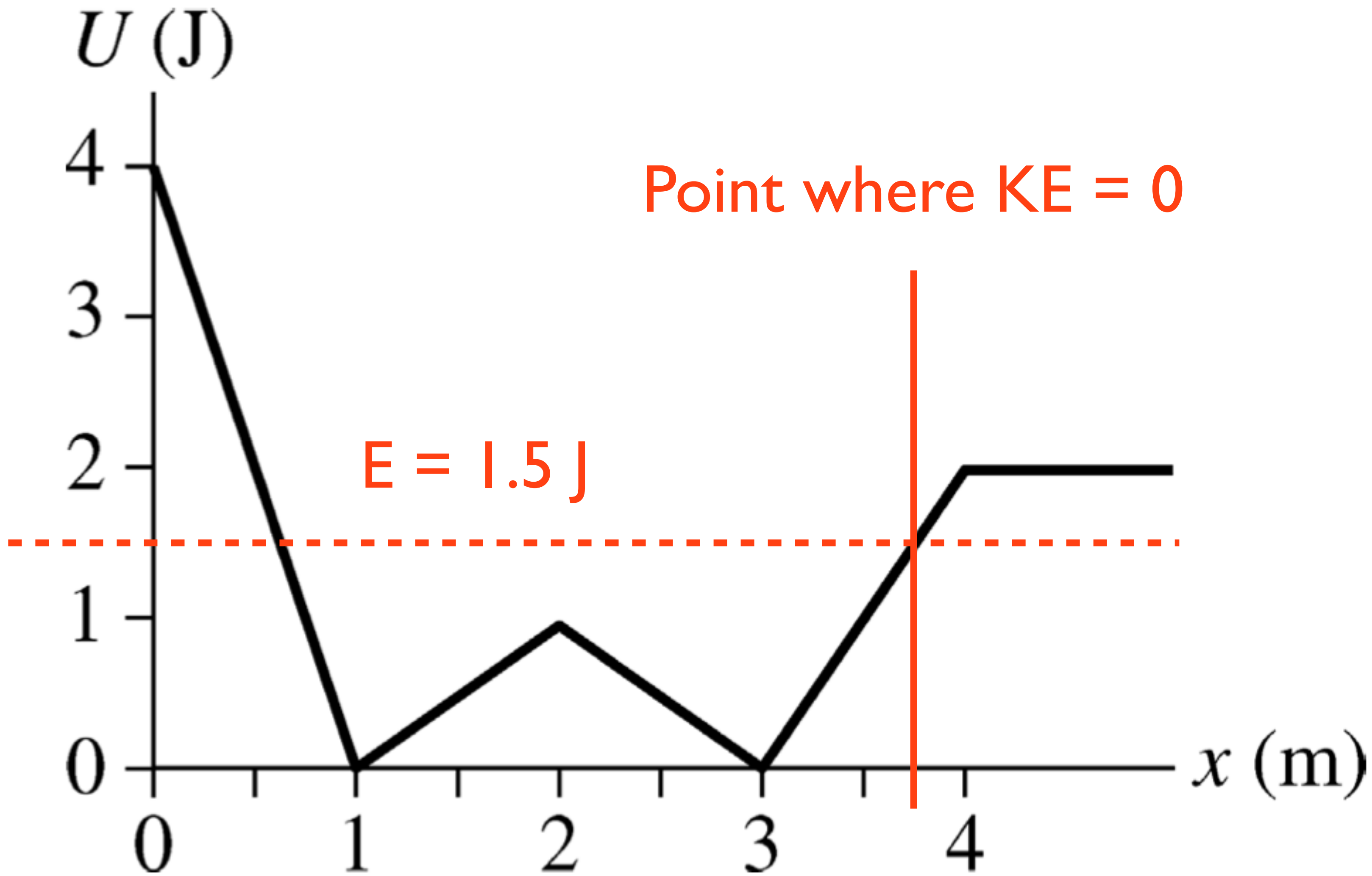

A) 3 m

B) 3.25 m

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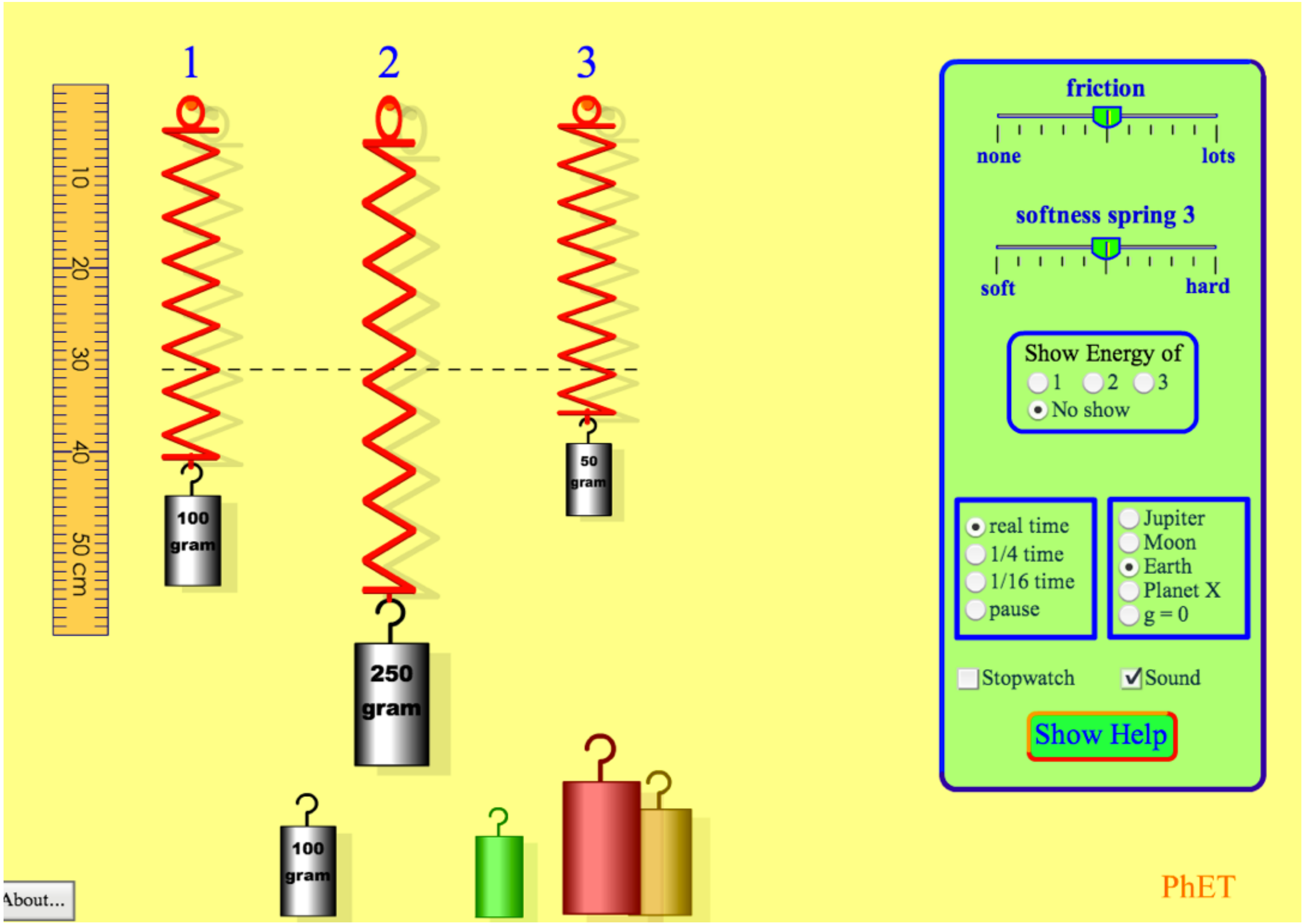
E) no turning point

Spring Potential Energy



Hooke's Law

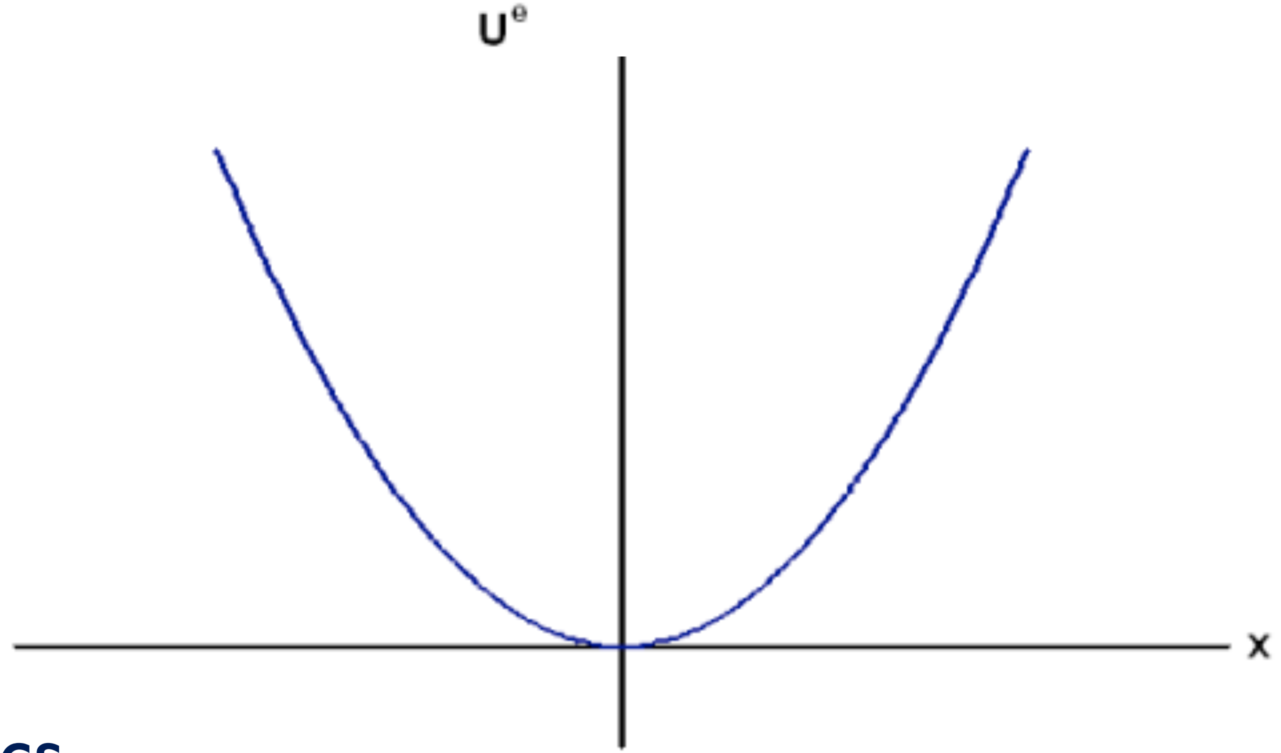
Hooke (1678) told us that the spring force is

$$F = -k\,\Delta x$$

where Δx is the distance from equilibrium.

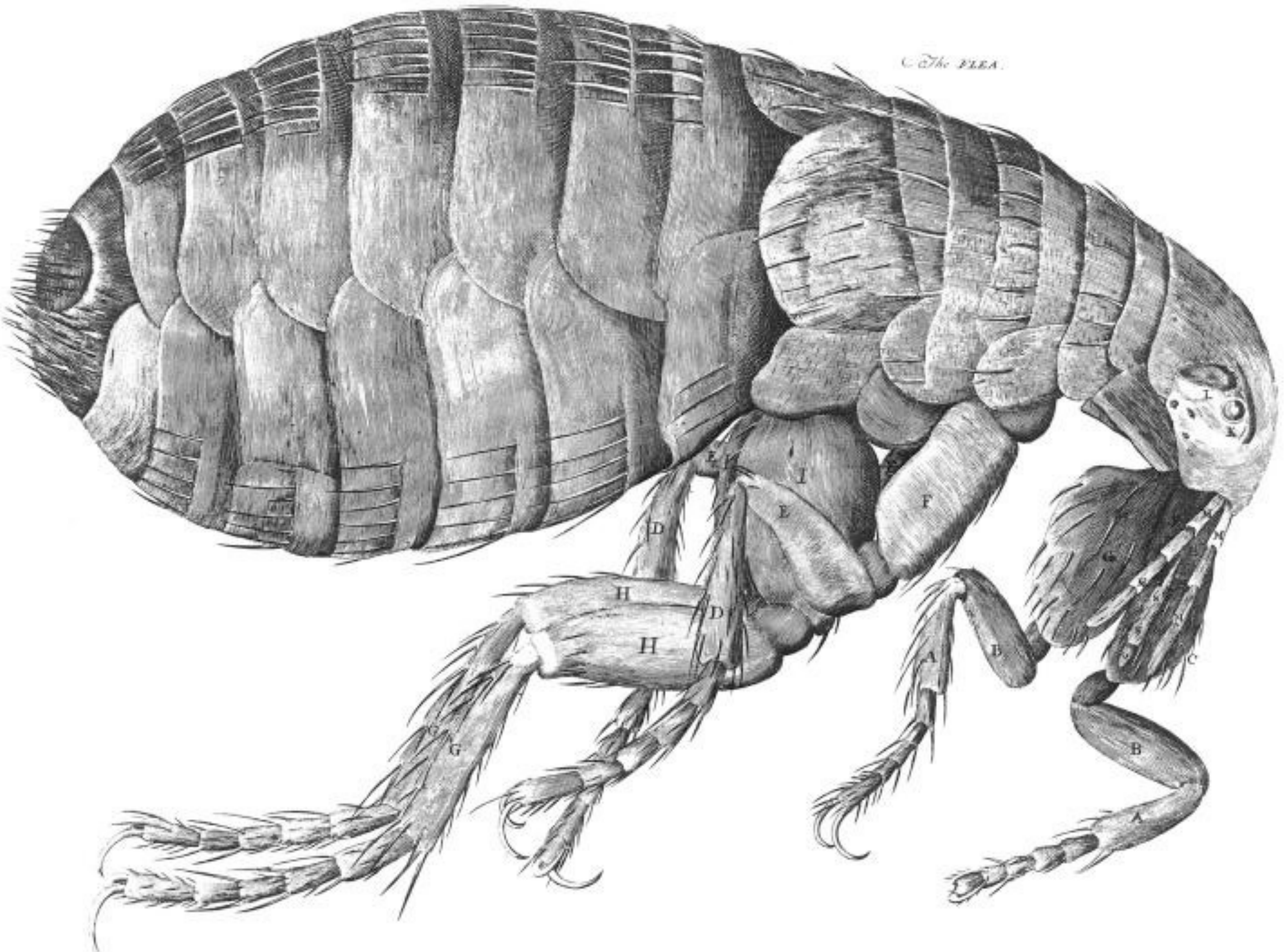
The potential energy stored in a stretched or compressed spring is

$$U = \frac{1}{2}k\,(\Delta x)^2$$



The most important potential in physics.

Micrographia (1665)

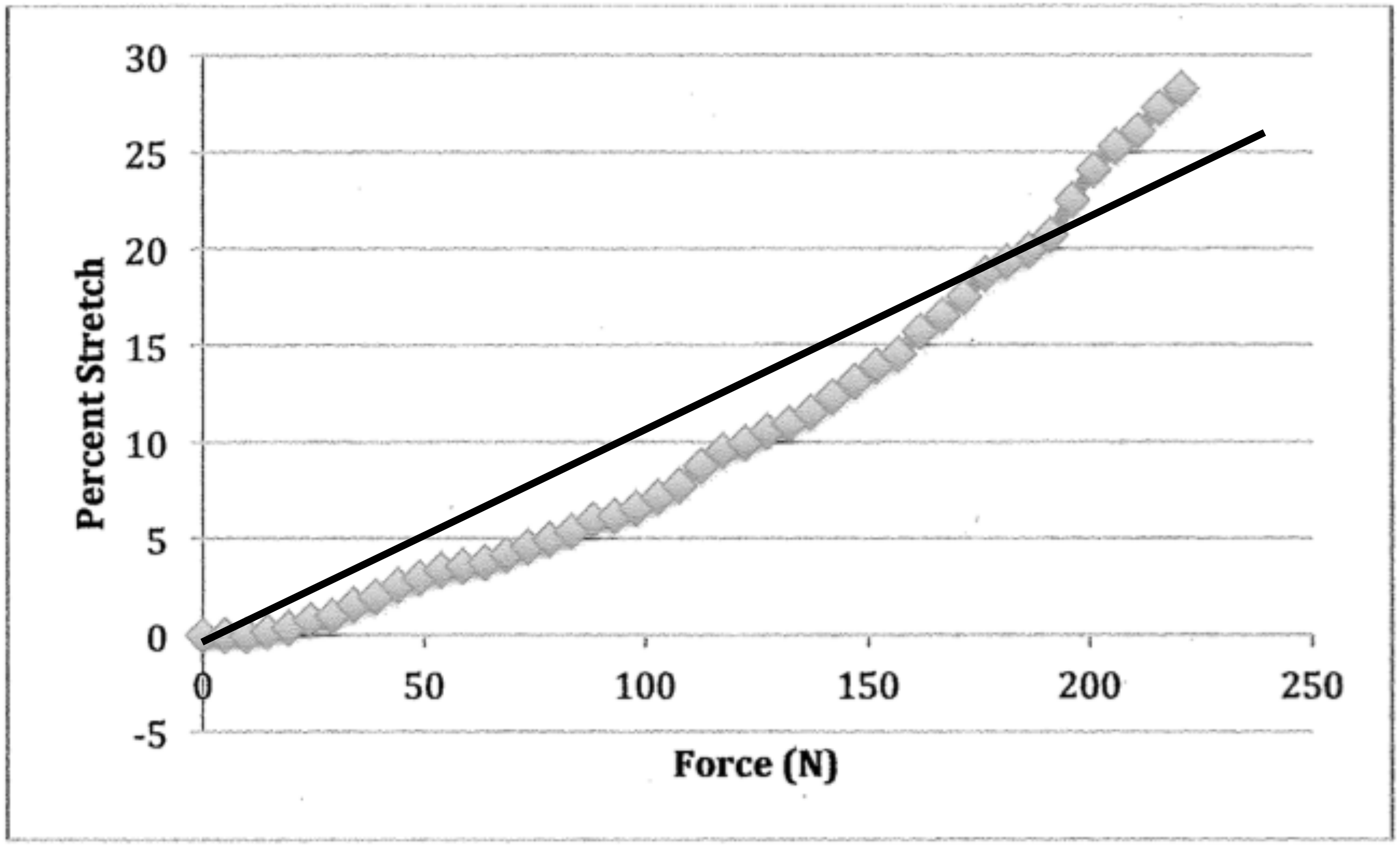


Kelp Potential Energy

It's tempting to model kelp stretching using Hooke's Law

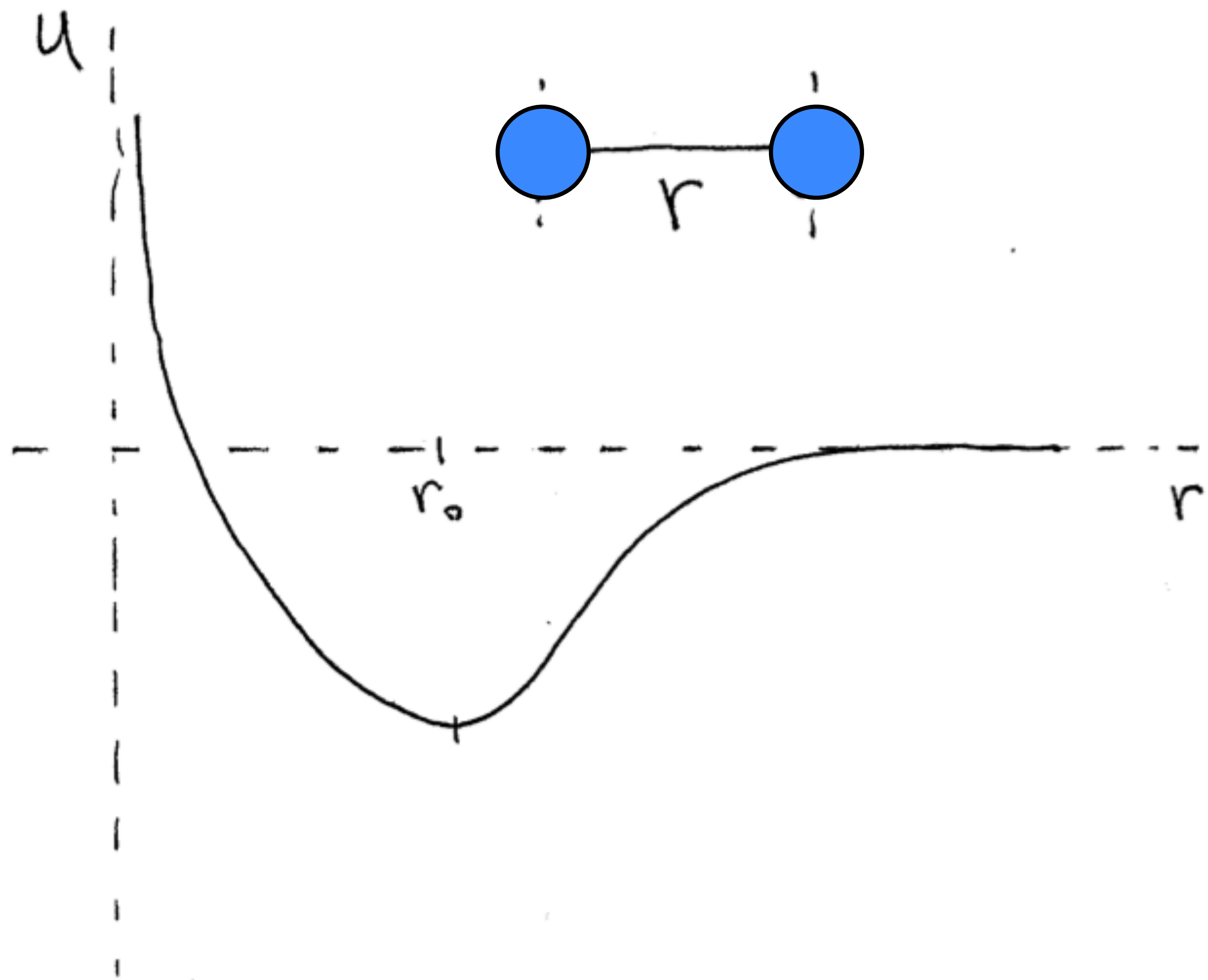
$$F = -k\,\Delta x$$

Why doesn't it match?



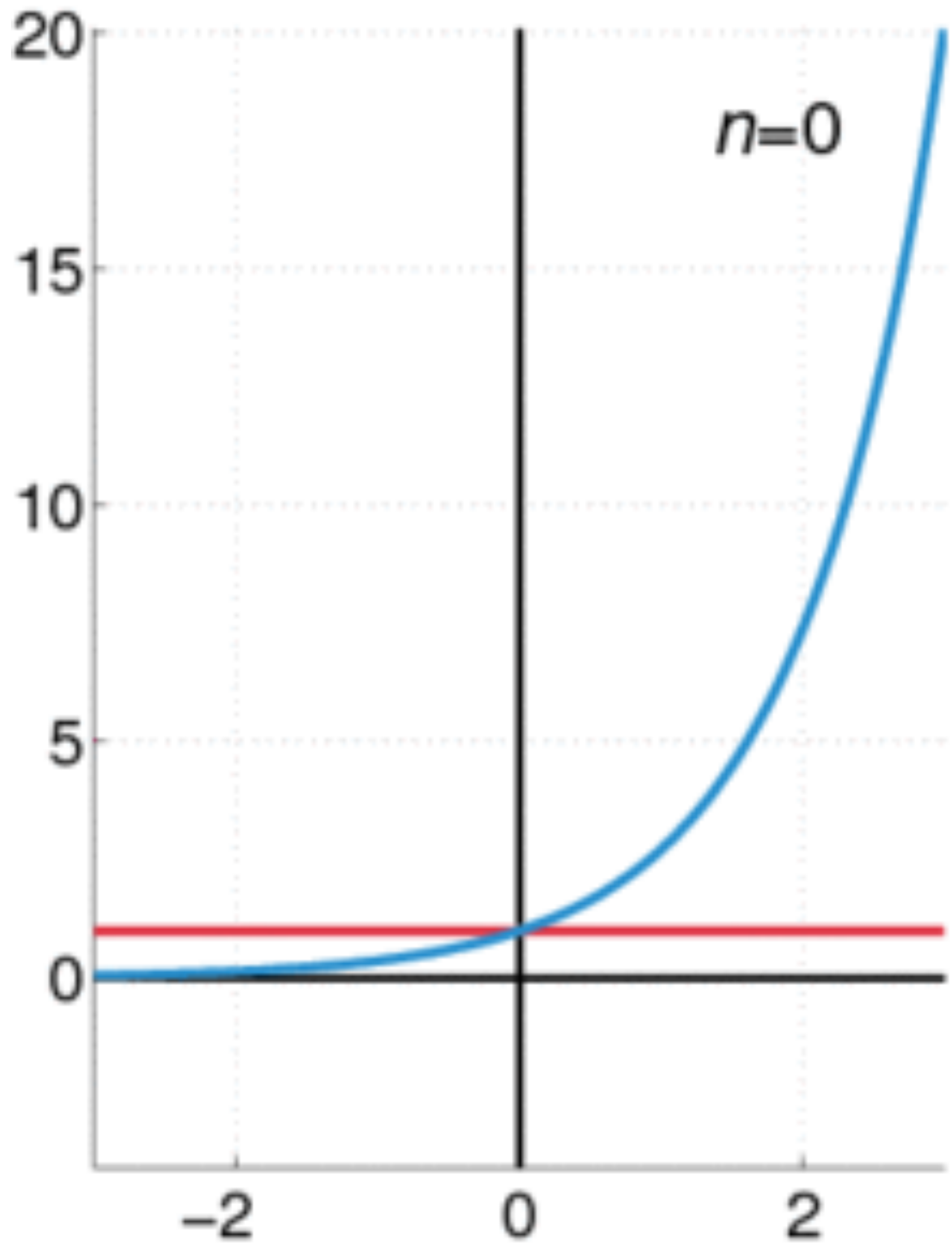
Molecular Potential Energy

Molecular interactions are modelled with a potential energy that looks like this:



Lennard-Jones potential

Taylor expansion



Molecular Potential Energy

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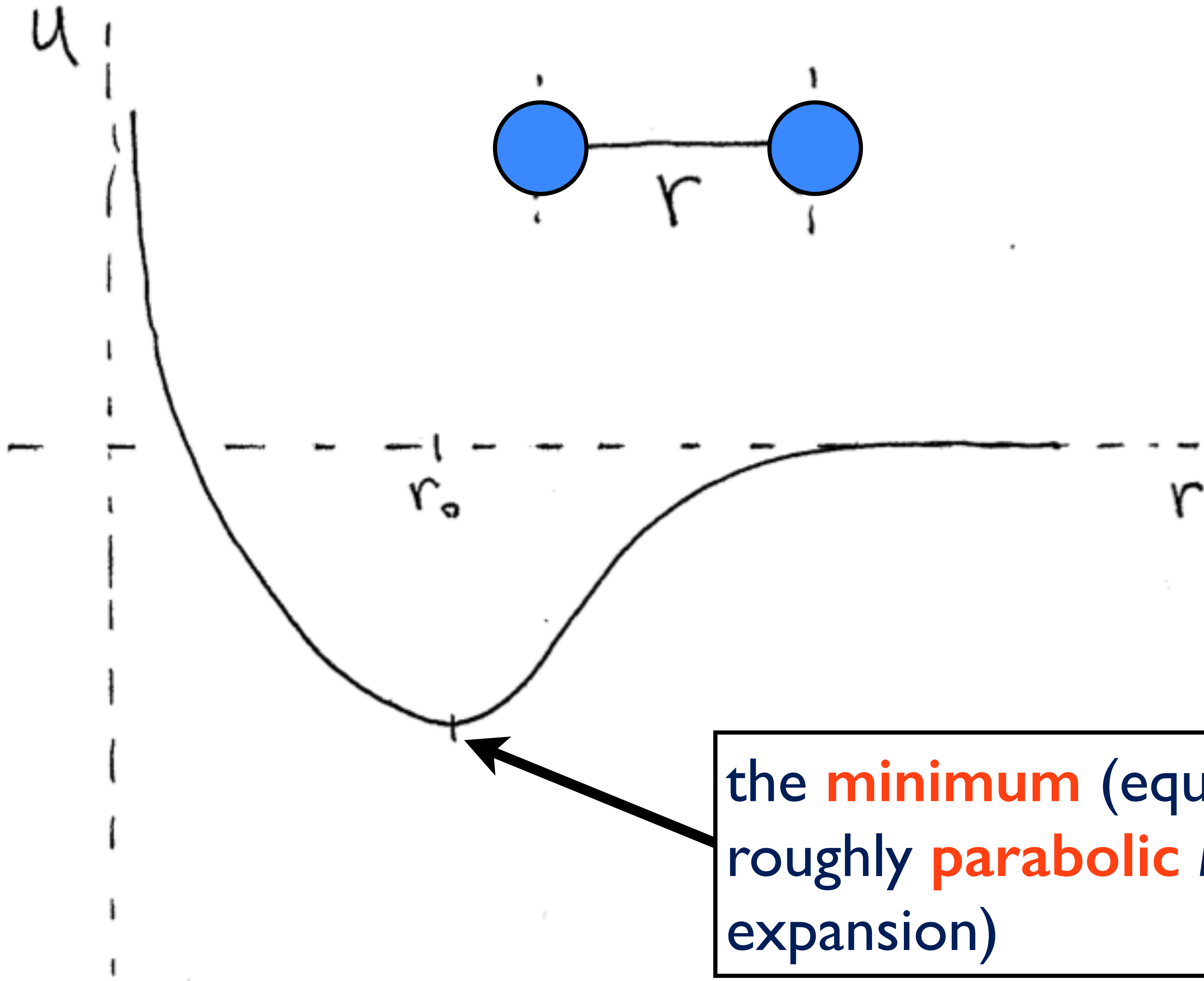
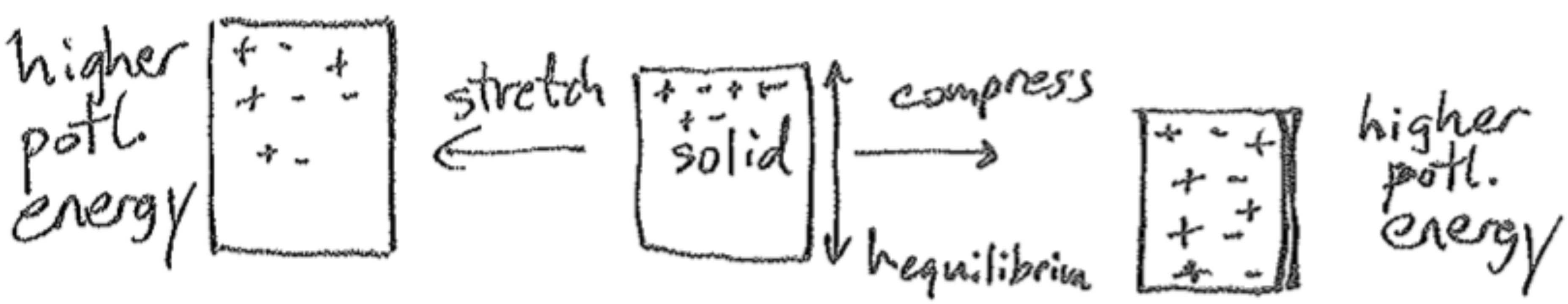


the **minimum** (equilibrium) is roughly **parabolic** r^2 (Taylor expansion)

Lennard-Jones potential

Everything Wiggles

Every objects rests at a **minimum energy** (equilibrium). When disturbed they oscillate about that equilibrium.



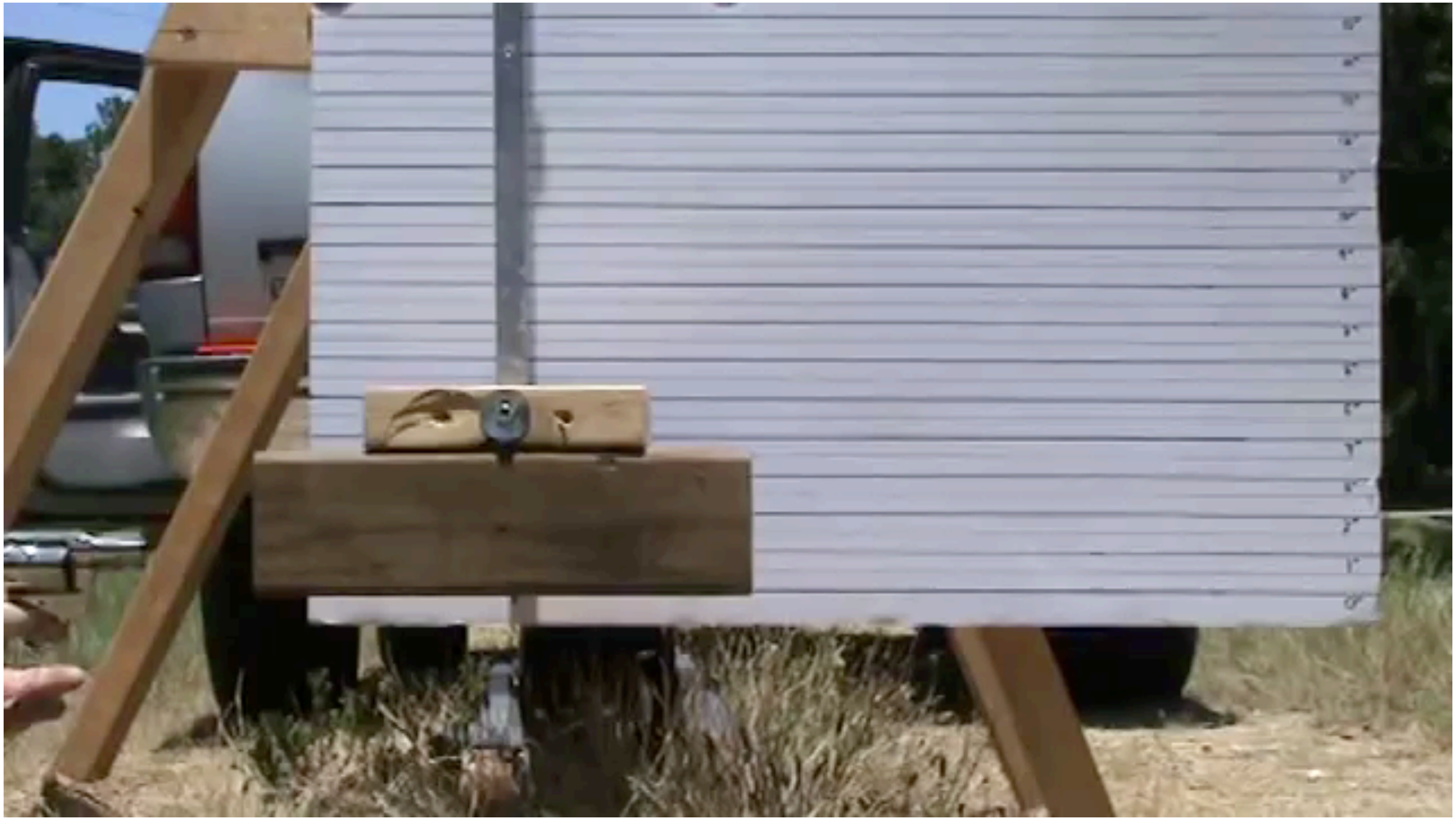
For small enough deviations, **any potential energy function** can be approximated by

$$U = \frac{1}{2}k\left(\Delta x\right)^2$$

Knock on Wood

Everything Wiggles

Ballistic Pendulum



A .38 cal 110gr 8.6 g bullet was fired at a ballistics pendulum with a mass of 1.6 kg.

Ballistic Pendulum