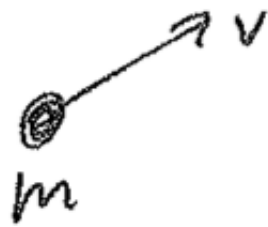


Clec8



Kinetic Energy

Associated with motion:



$$\text{K.E.} = \frac{1}{2} m |\vec{v}|^2$$

for $|\vec{v}| \ll \text{speed at light.}$

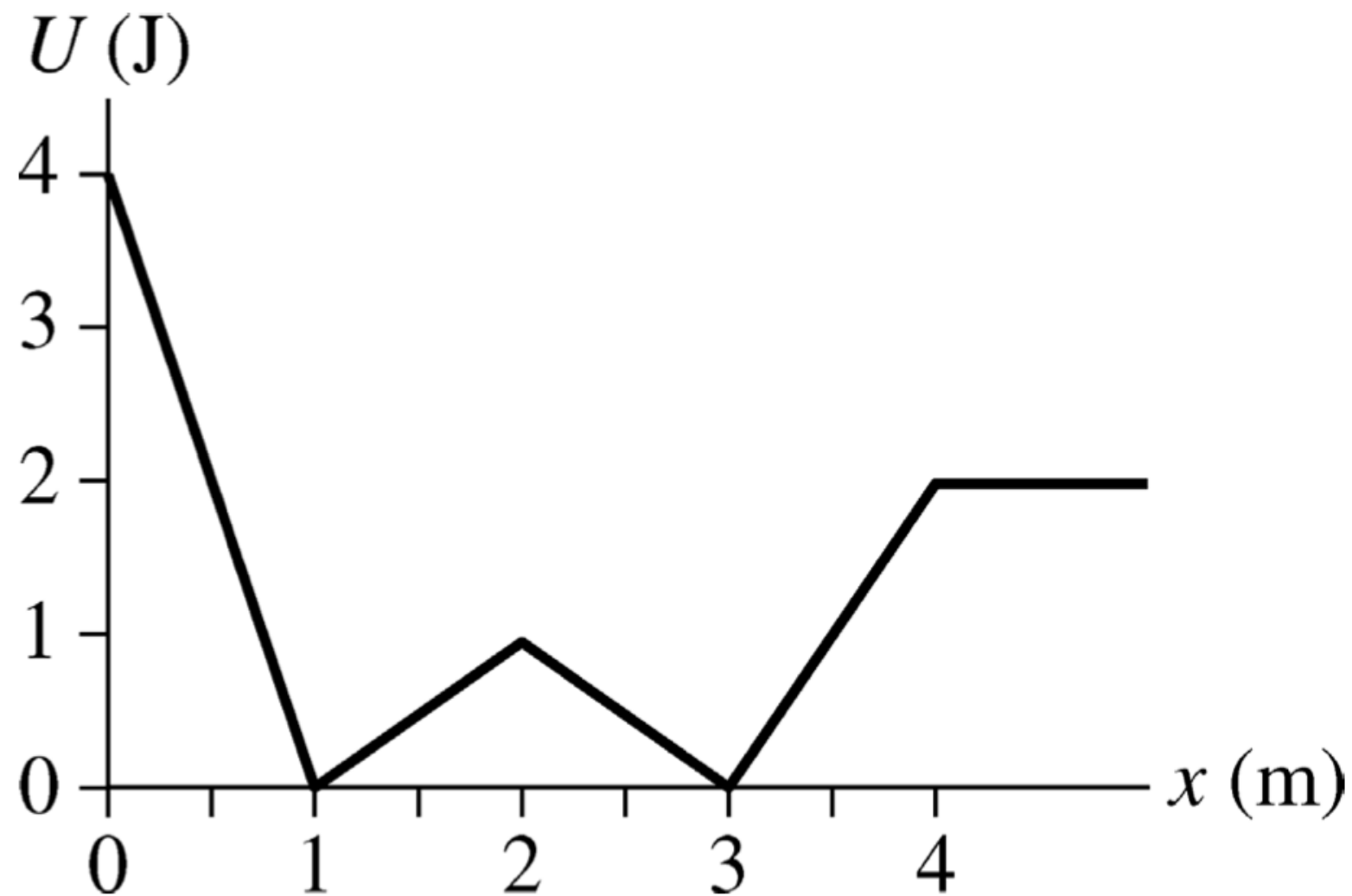


THERMAL
ENERGY

\approx kinetic energy of
atoms \rightarrow molecules.

Clicker Question

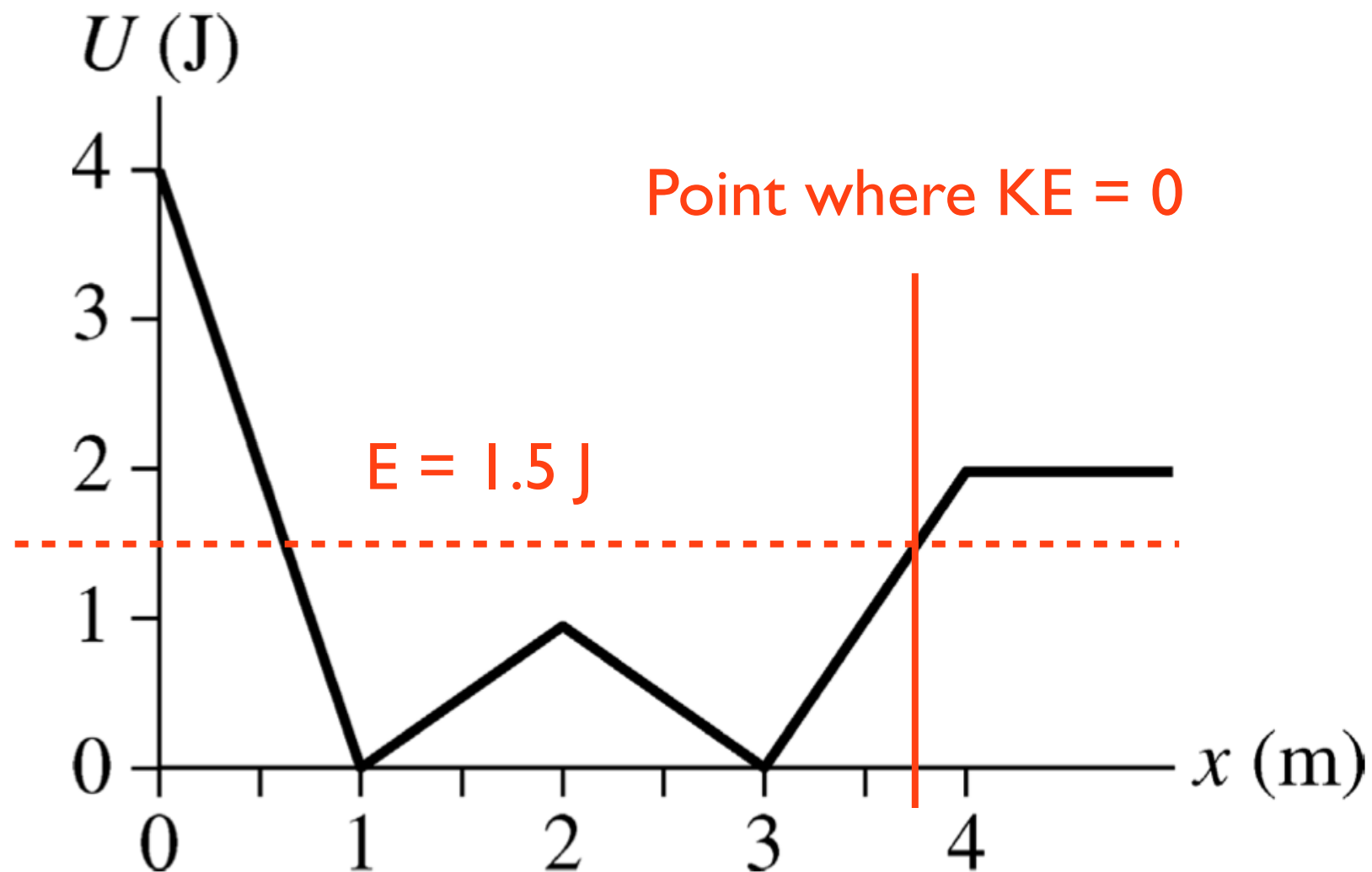
A particle with a total energy of 1.5 J is at $x = 2$ m and is traveling to the right. Locate the turning point of the particle.



- A) 3 m
- B) 3.25 m
- C) 3.5 m
- D) 3.75 m
- E) no turning point

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

Spring Potential Energy

The simulation displays three springs, labeled 1, 2, and 3, hanging from a horizontal dashed line at the 30 cm mark on a vertical ruler. Spring 1 has a 100 gram mass attached, spring 2 has a 250 gram mass, and spring 3 has a 50 gram mass. Below the springs are three blocks: a 100 gram mass, a green block, and a red and brown block. The control panel on the right includes:

- friction**: A slider from none to lots, currently set at the middle.
- softness spring 3**: A slider from soft to hard, currently set at the middle.
- Show Energy of**: Radio buttons for 1, 2, 3, and No show.
- Simulation Settings**: Radio buttons for real time, 1/4 time, 1/16 time, pause, Jupiter, Moon, Earth, Planet X, and g = 0.
- Stopwatch**: An unchecked checkbox.
- Sound**: A checked checkbox.
- Show Help**: A button.

About... PhET

Hooke's Law



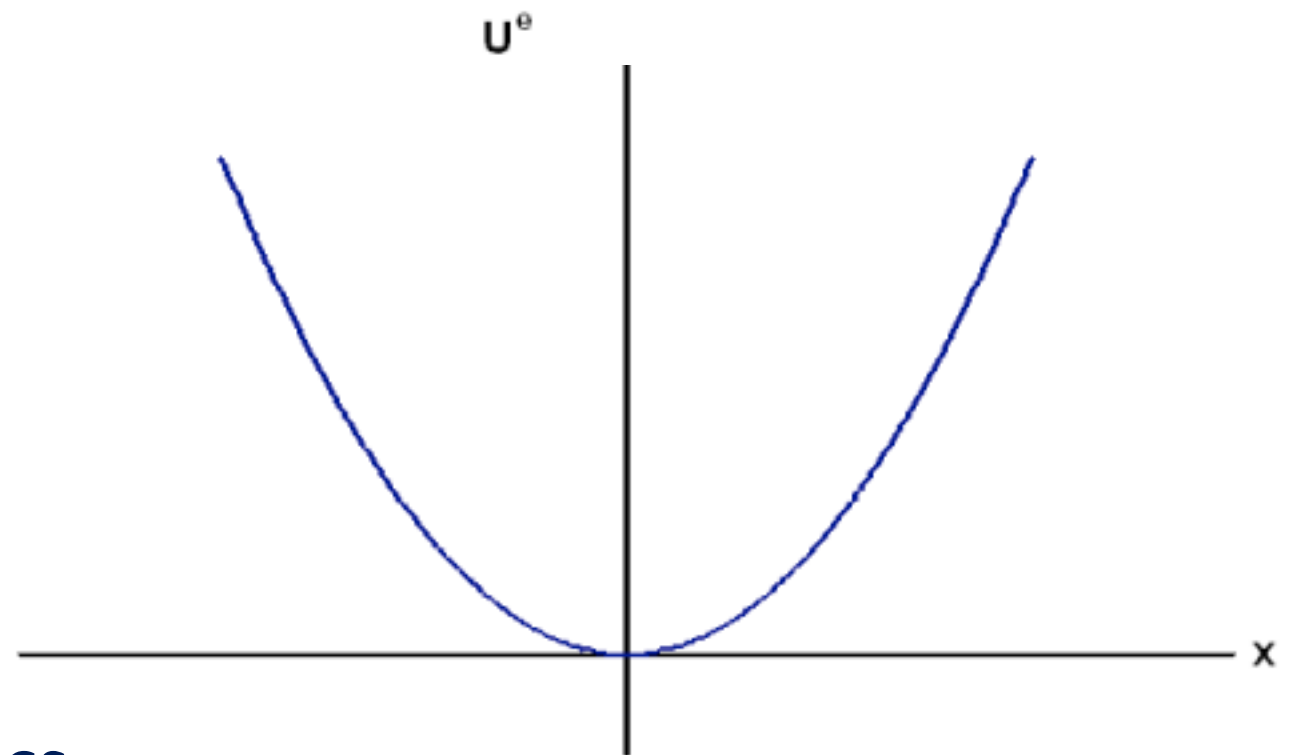
Hooke (1678) told us that the spring force is

$$F = -k \Delta x$$

where Δx is the distance from equilibrium.

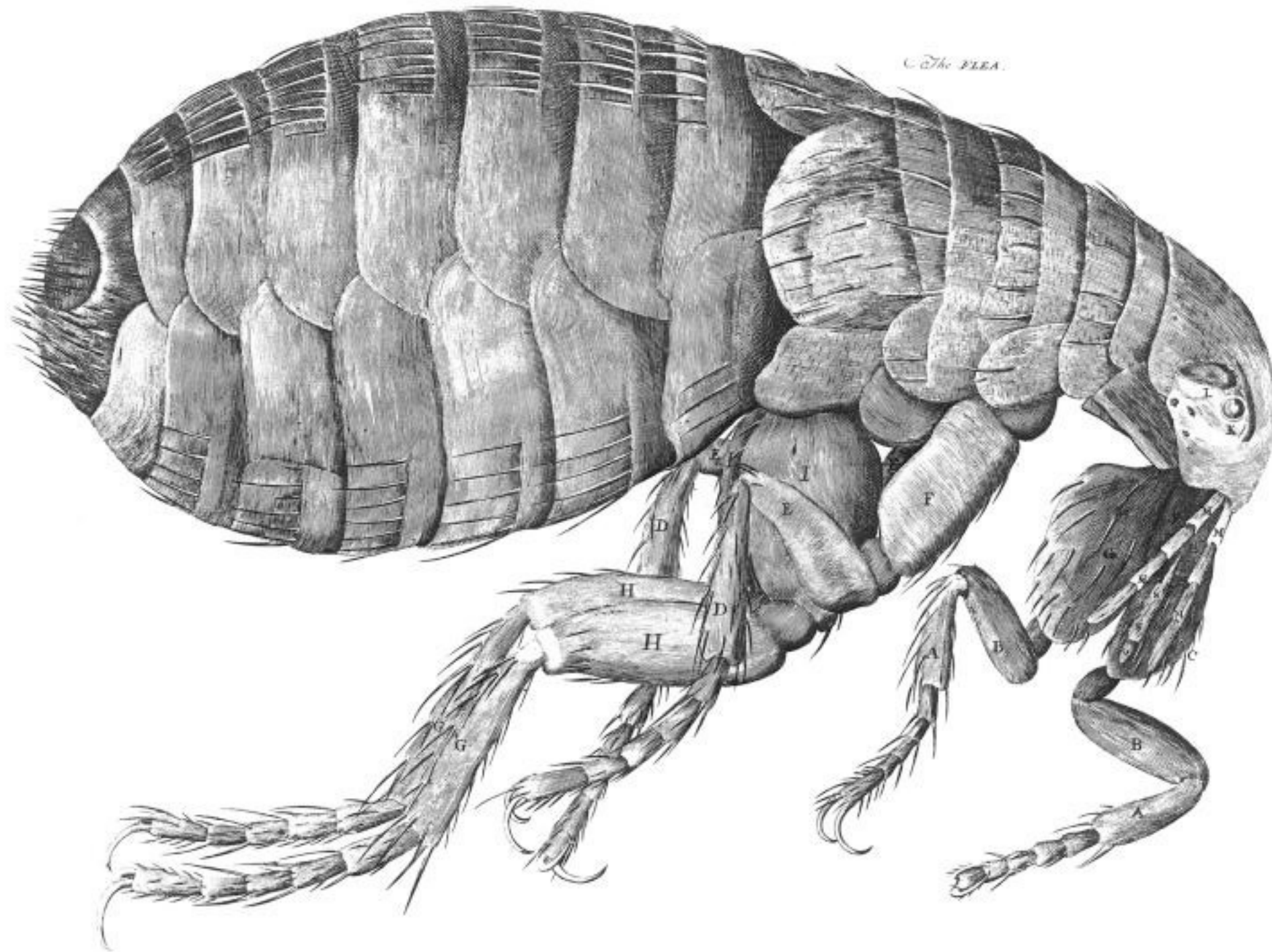
The potential energy stored in a stretched or compressed spring is

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



The most important potential in physics.

Micrographia (1665)



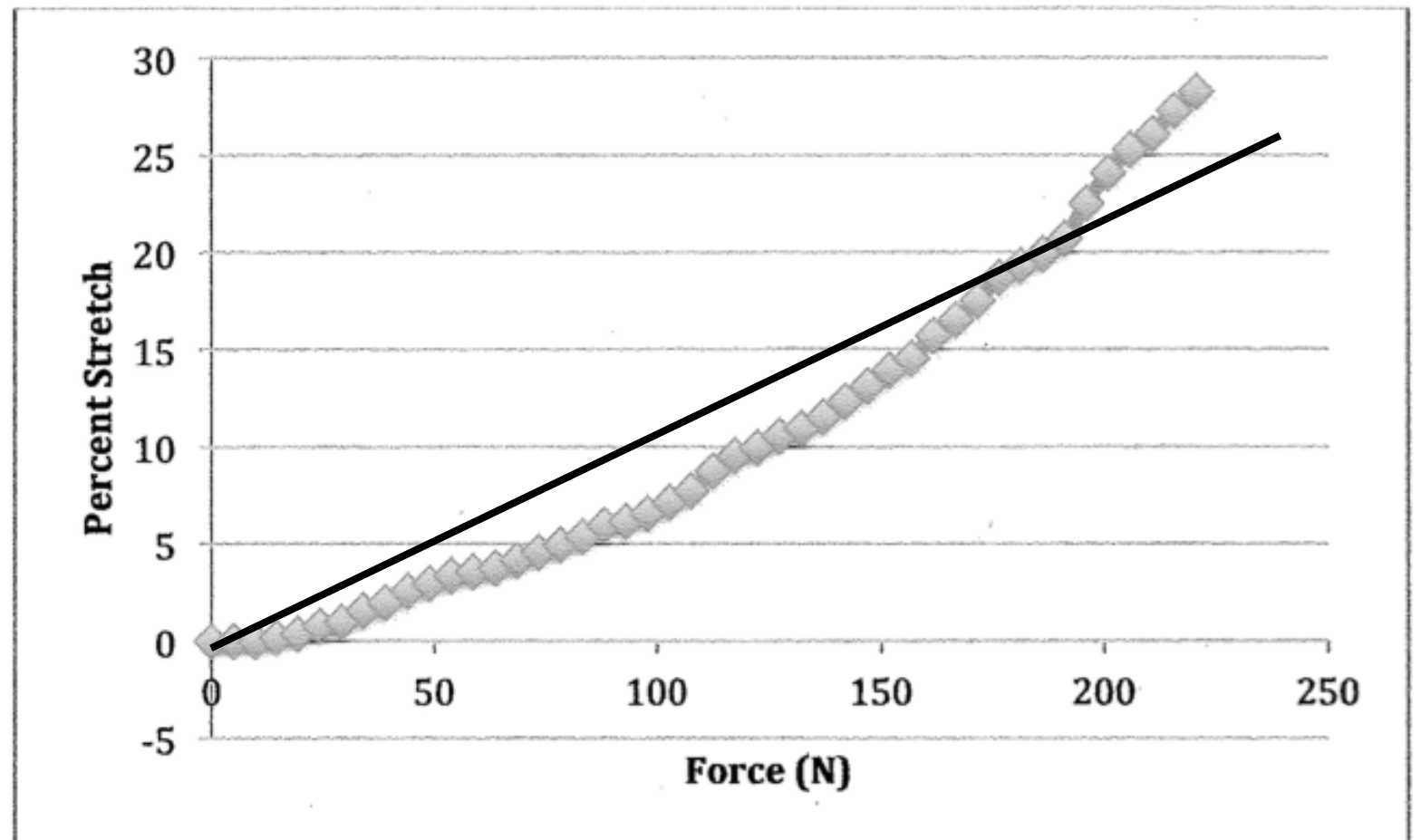
Kelp Potential Energy



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

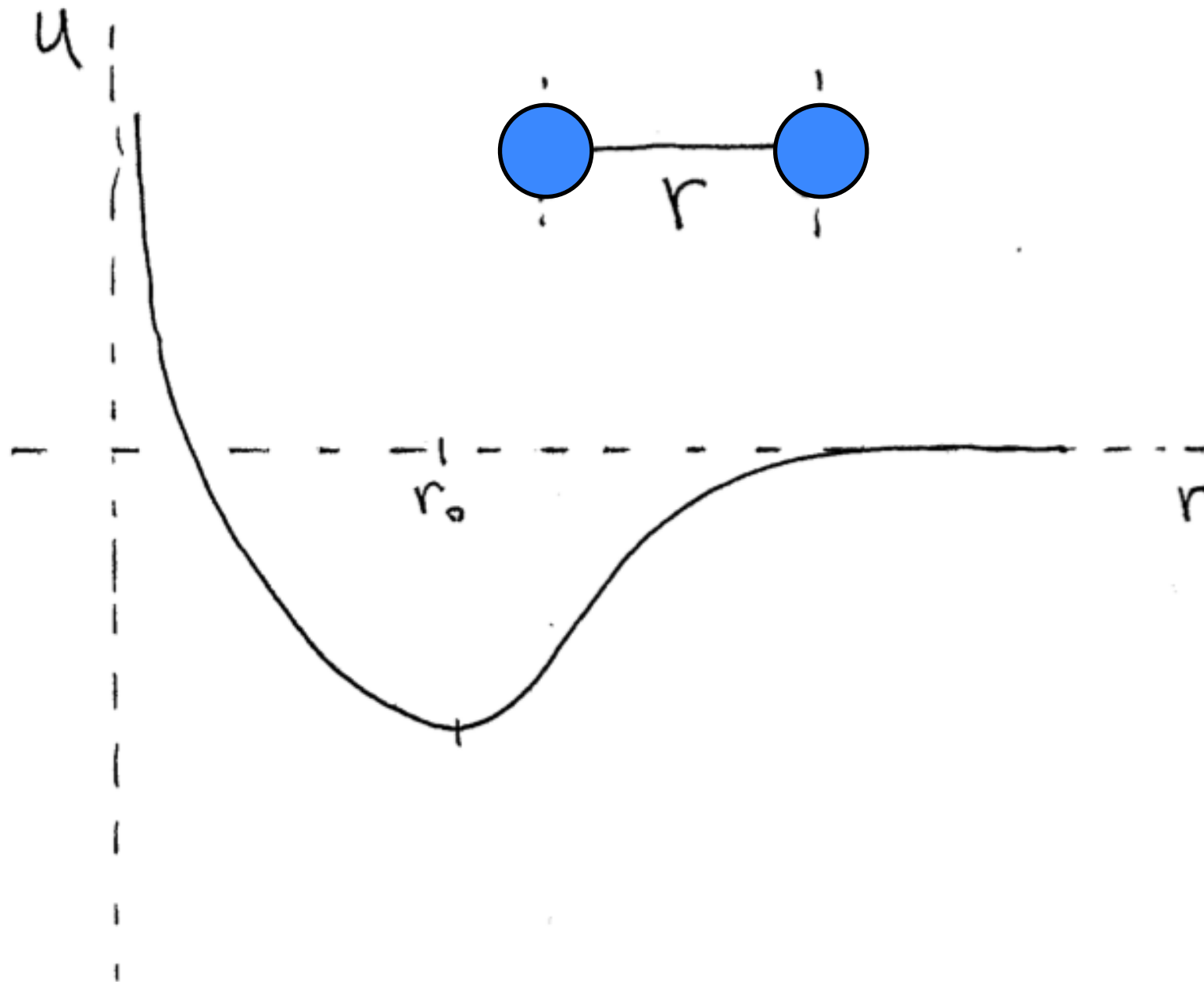
$$F = -k \Delta x$$

Why doesn't it match?



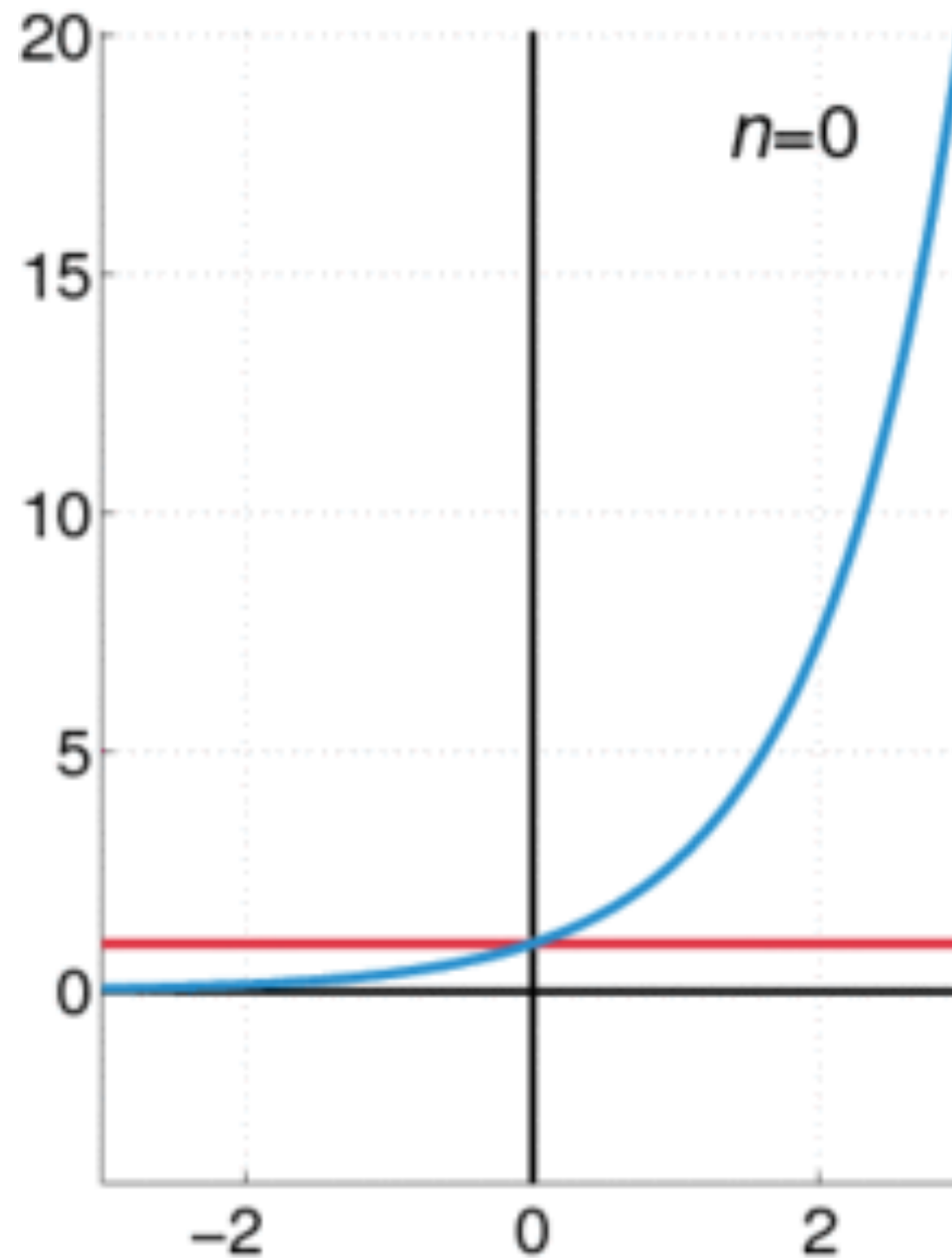
Molecular Potential Energy

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



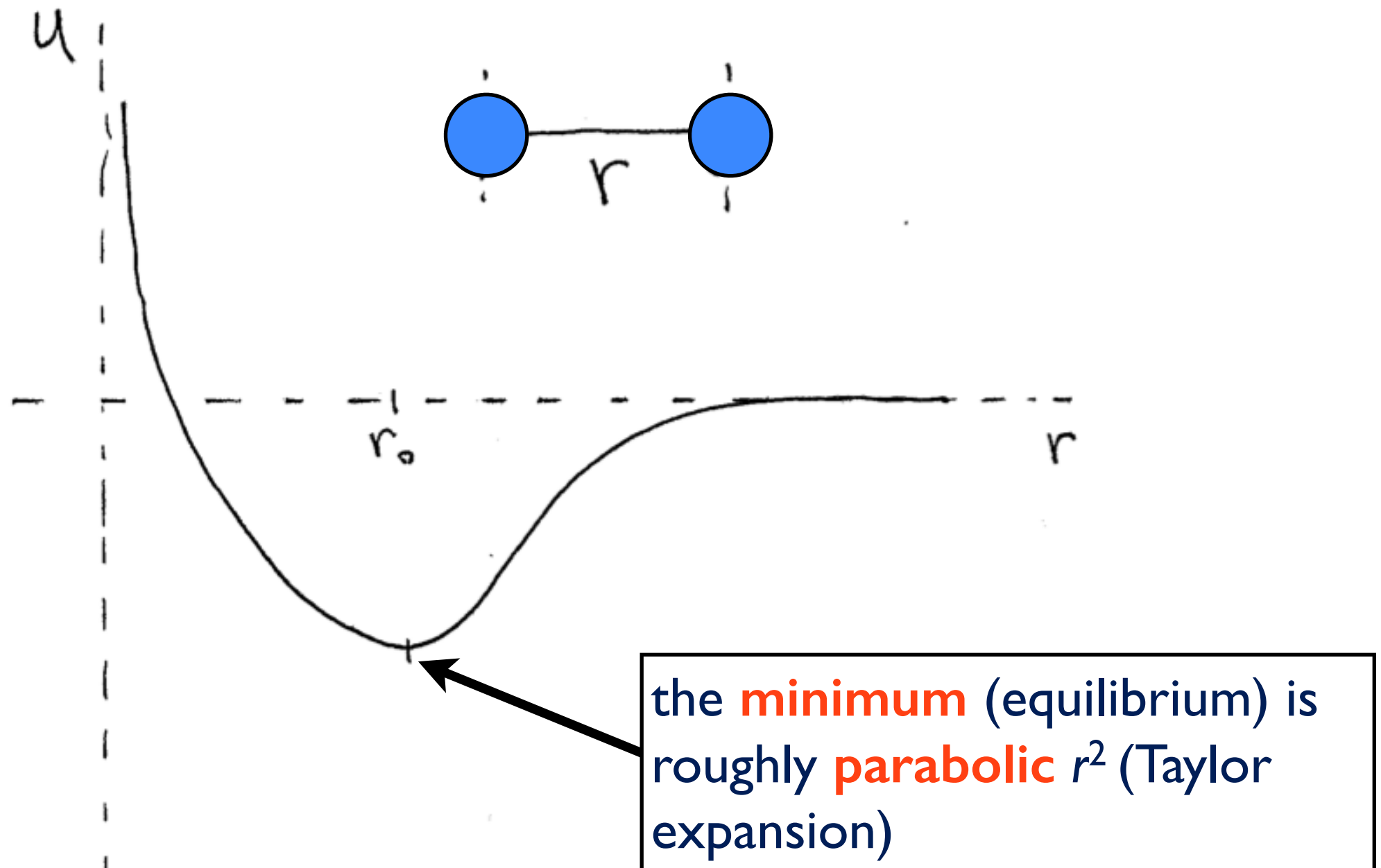
Lennard-Jones potential

Taylor expansion



Molecular Potential Energy

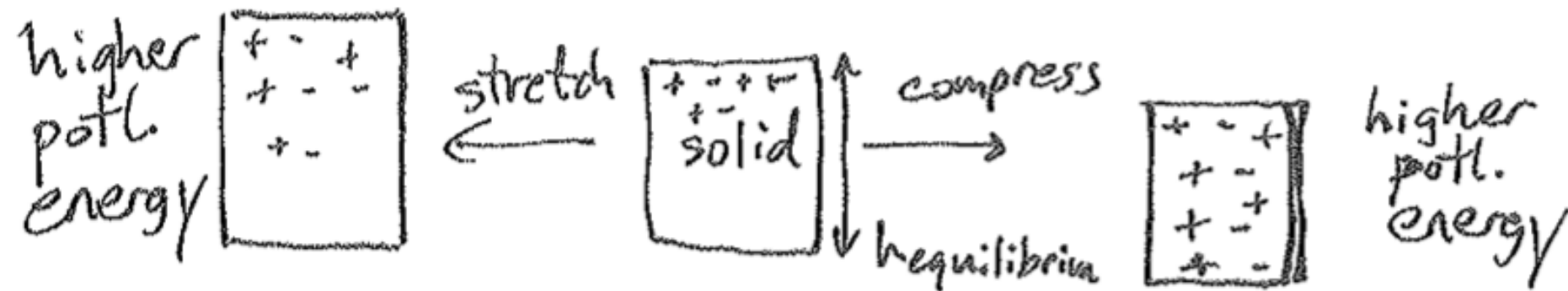
Molecular interactions are modelled with a potential energy that looks like this:



Lennard-Jones potential

Everything Wiggles

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



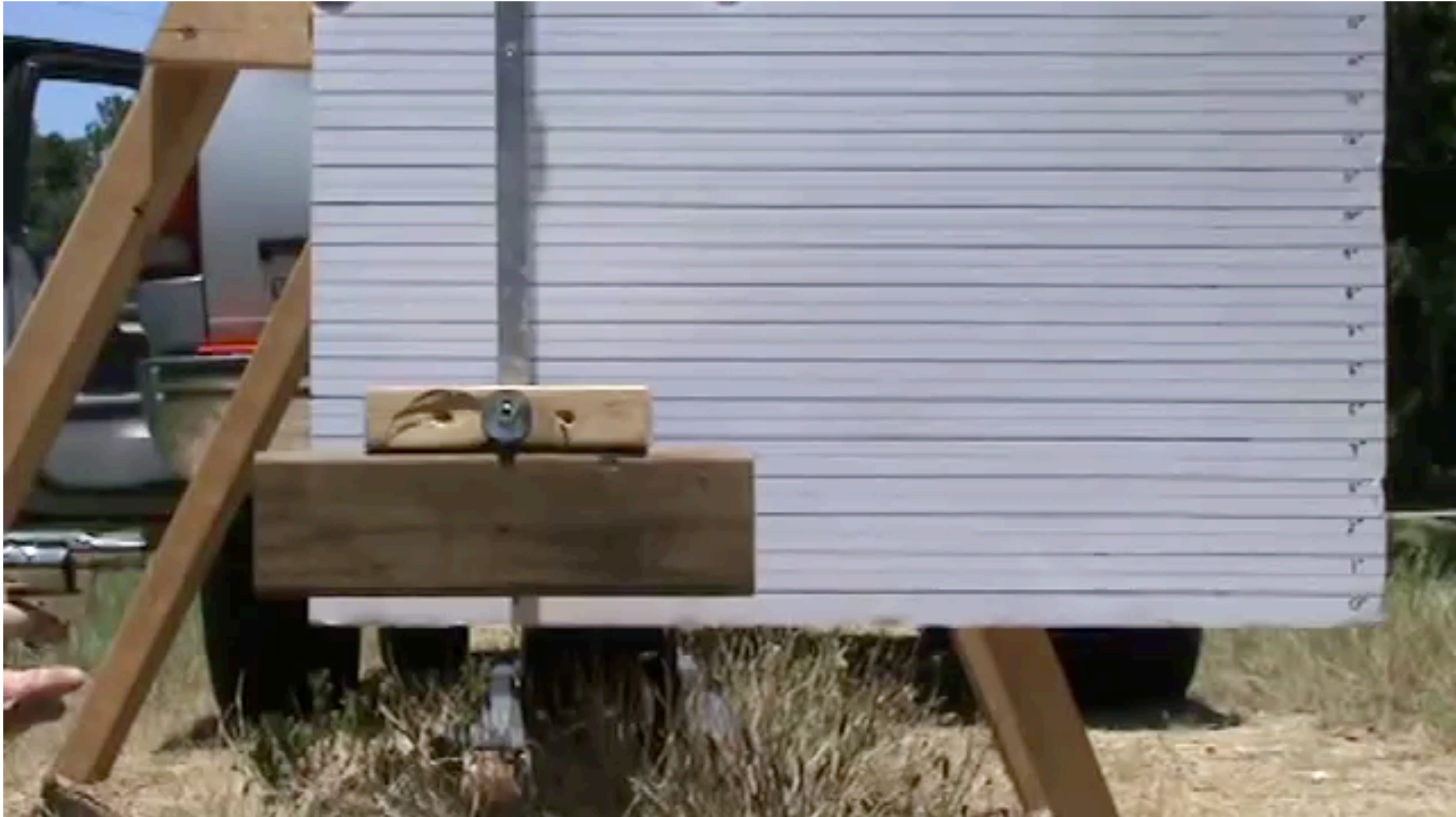
For small enough deviations, **any potential energy function** can be approximated by

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

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

