What is Energy?

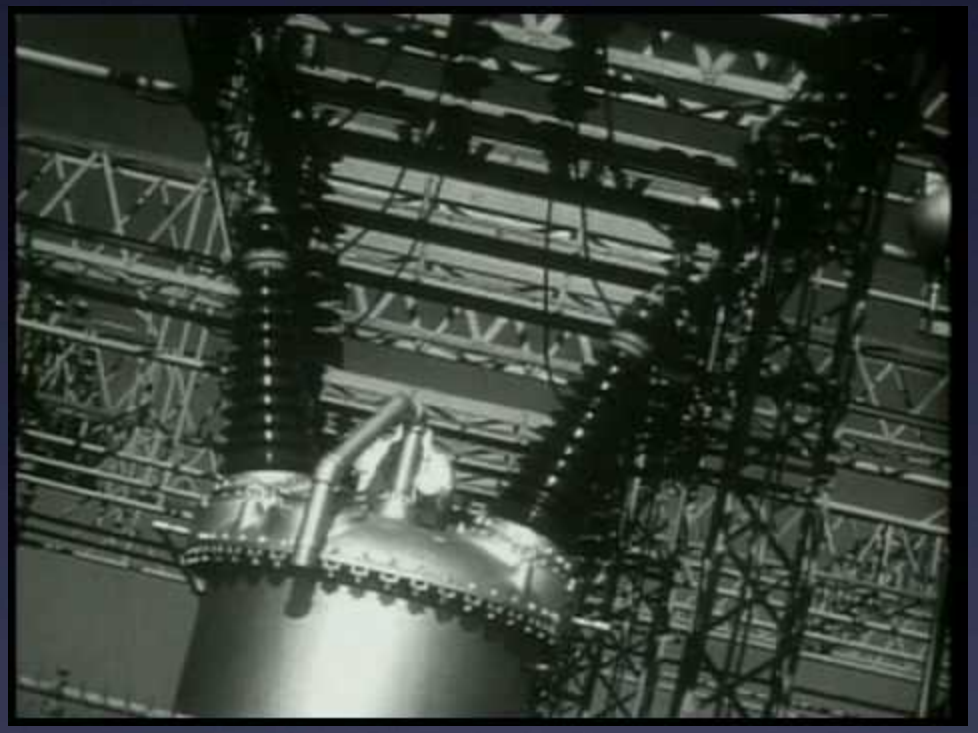
Developed by Steven Taylor Wichmanowski based in part on *Pearson Environmental Science* by Jay Withgott

Energy is the ability to do work or cause a change

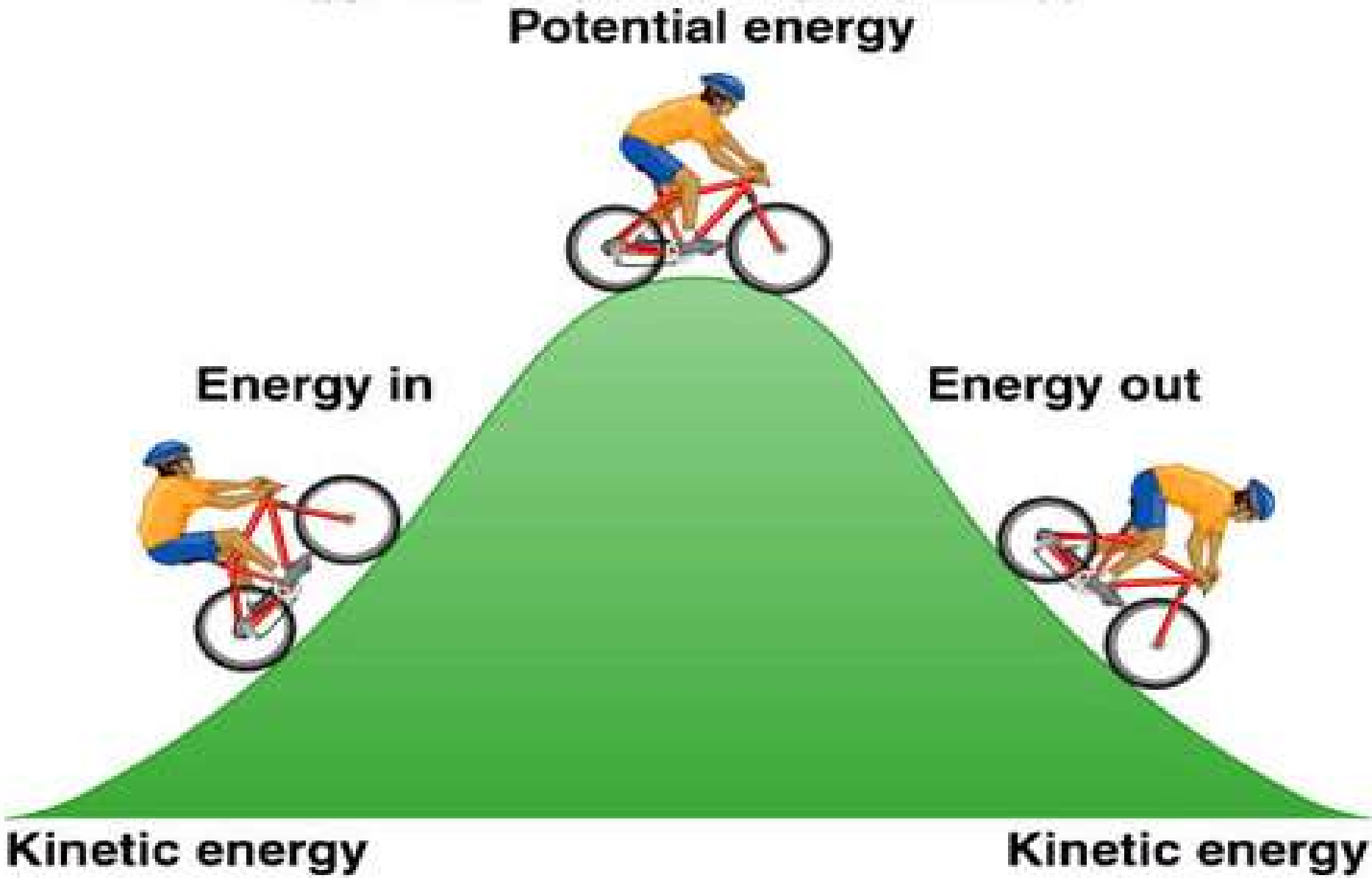
Potential Energy is the energy an object has due to its position

Kinetic energy is the energy that an object has due to motion (i.e., energy in action!)

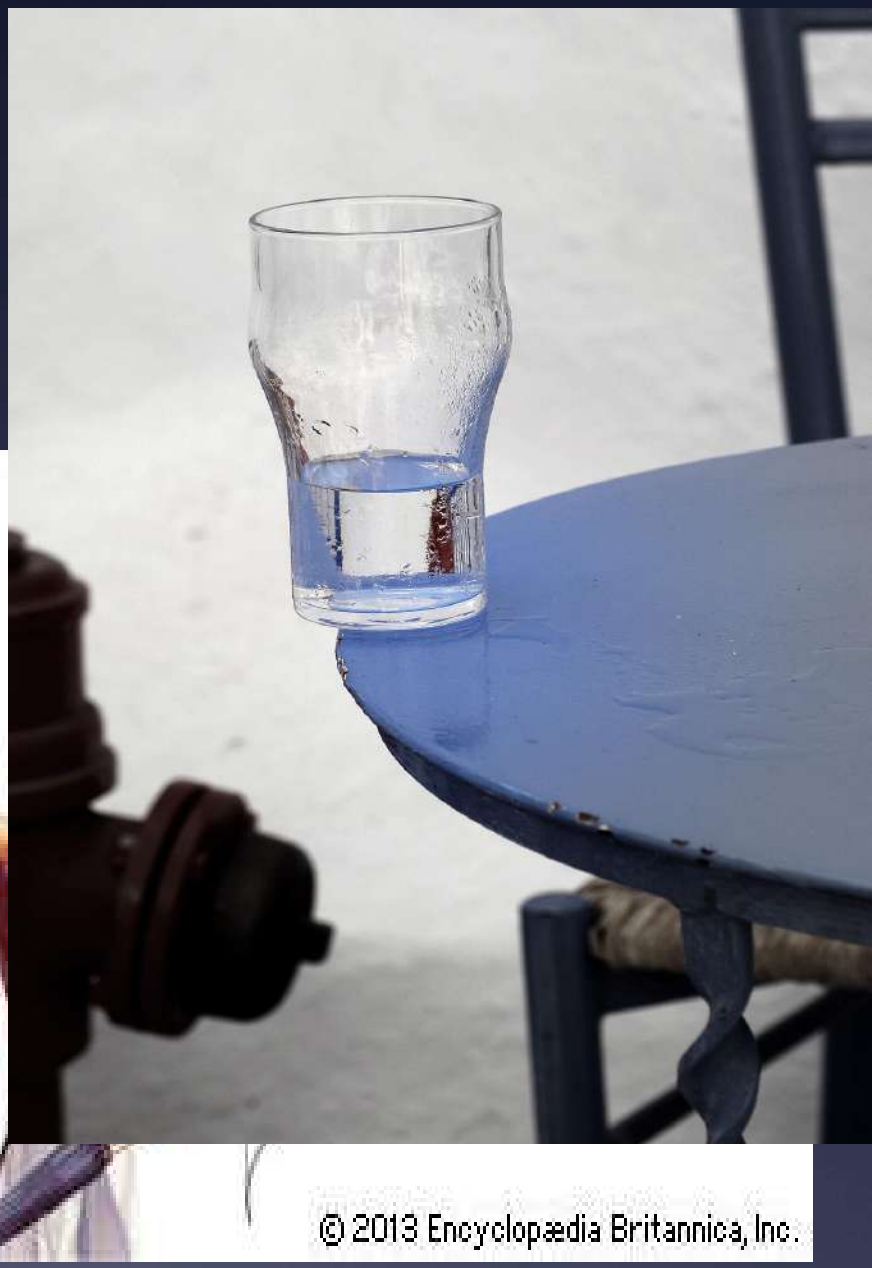
Bill Nye Energy!



Potential Energy vs. Kinetic Energy



Mechanical energy is energy associated with the motion or position of an object.



Heat energy is the kinetic energy of all the atoms in an object

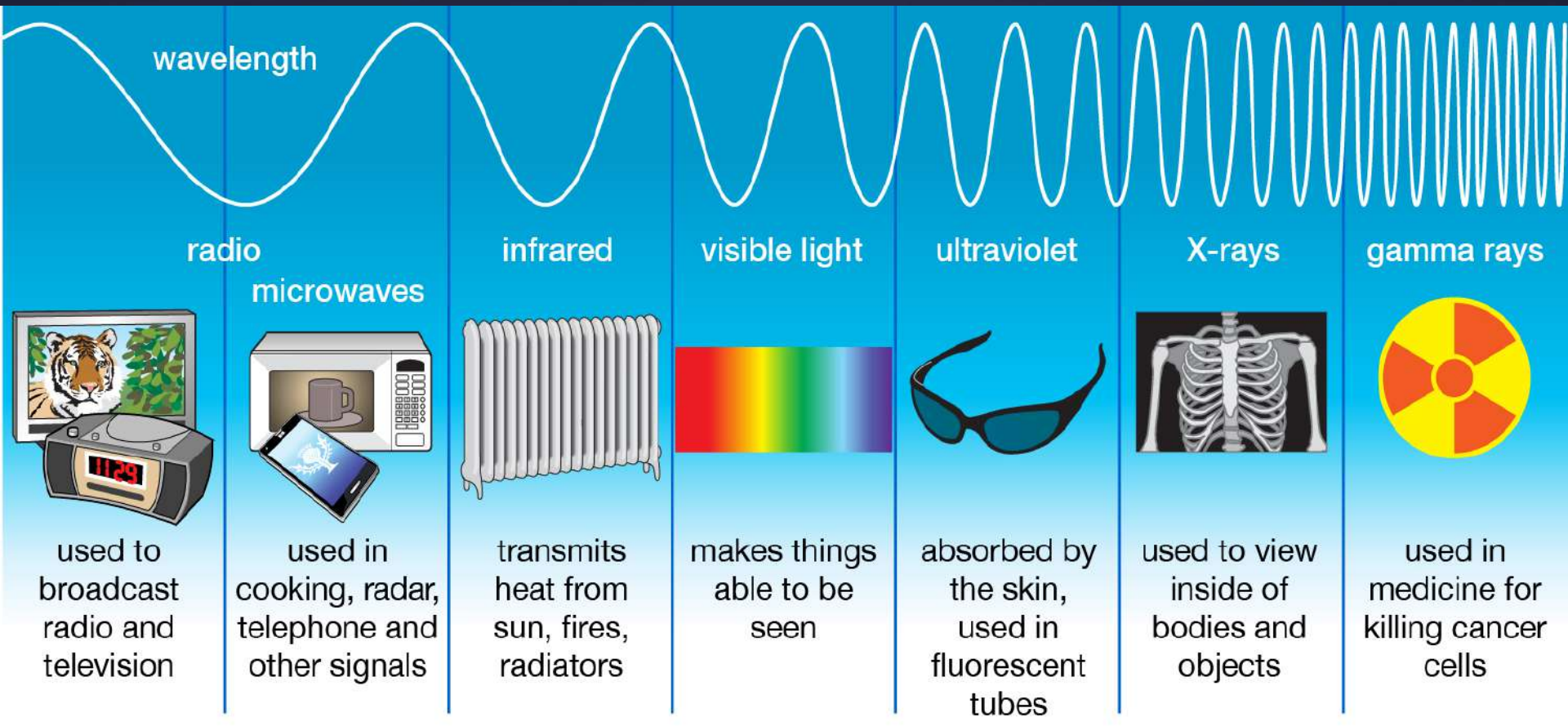
All matter radiates some thermal energy, but matter with particles that have more motion (liquids, gases, etc.) radiate more thermal energy (higher temperature).

Light energy or ***electromagnetic energy*** is energy that travels through space in the form of waves

All matter radiates electromagnetic energy.

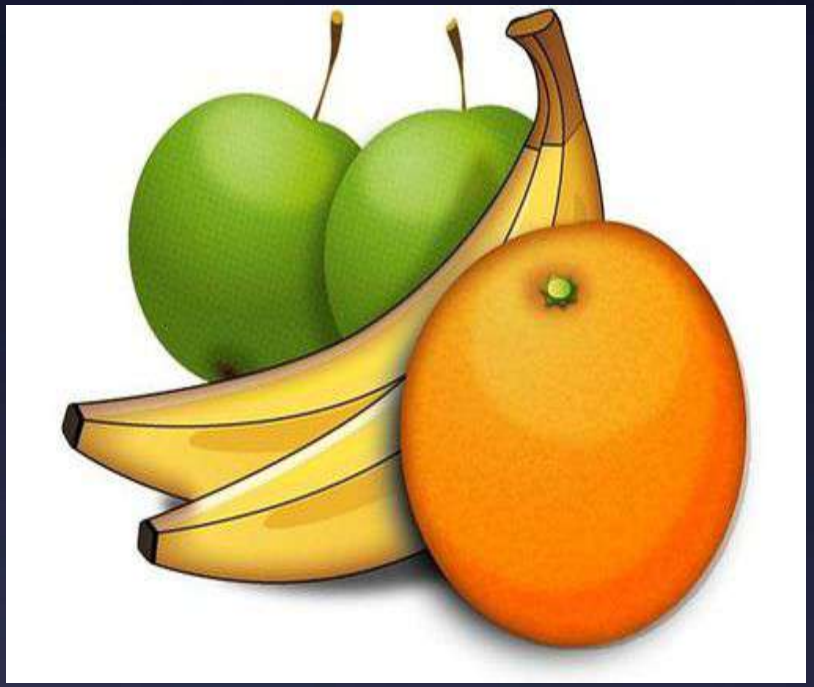
The ***electromagnetic spectrum*** ranges from low frequency radio waves to high frequency gamma radiation.

The higher the frequency, the more energy carried by the wave.



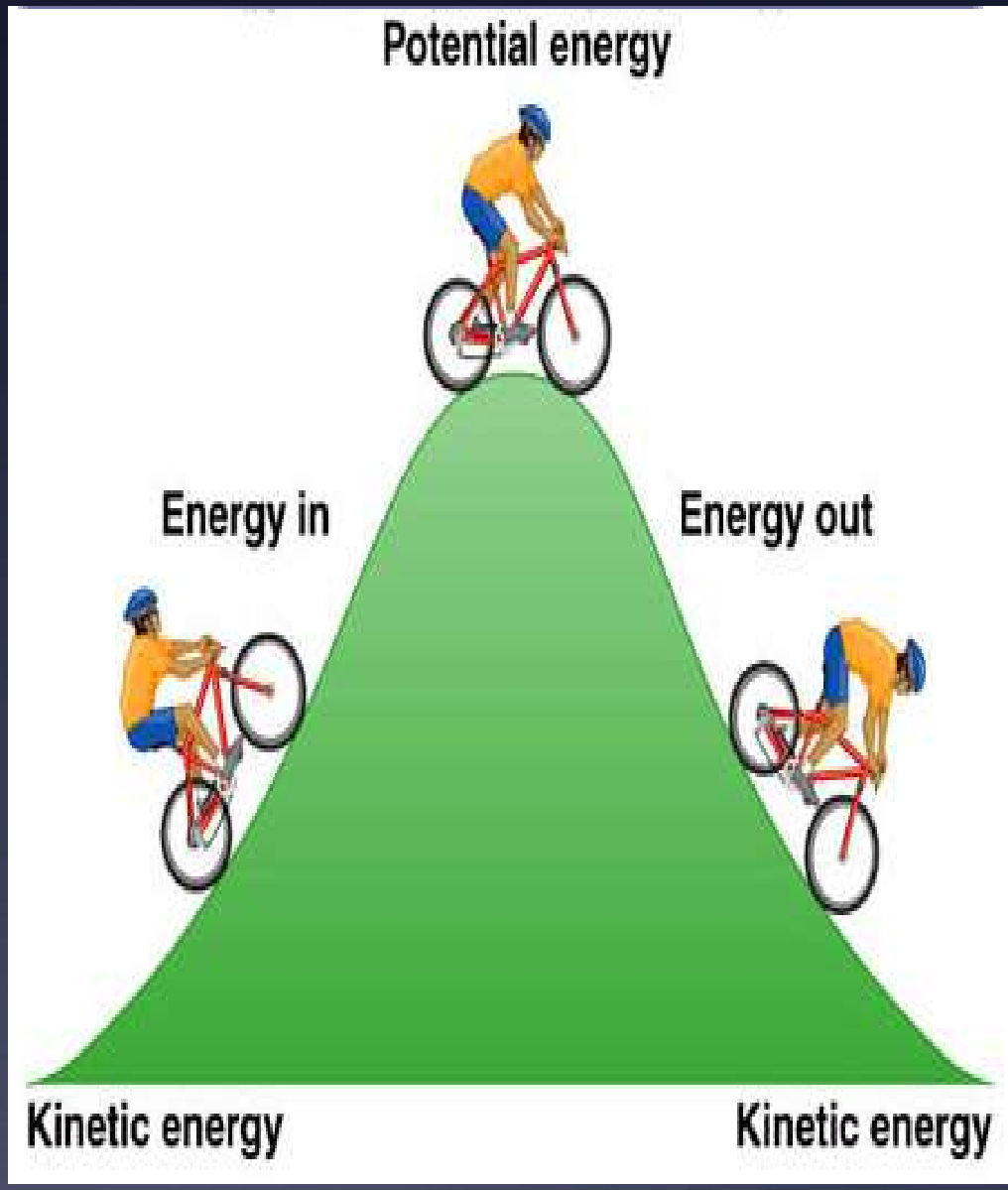
Chemical energy is stored in the bonds between atoms in molecules

When you use energy, **chemical energy from foods** is converted to **mechanical and thermal energy**.



1st Law of Thermodynamics: in a closed system, the **total amount of energy does not change**

This means that energy **cannot be created nor destroyed**, simply **converted** from one form to another.

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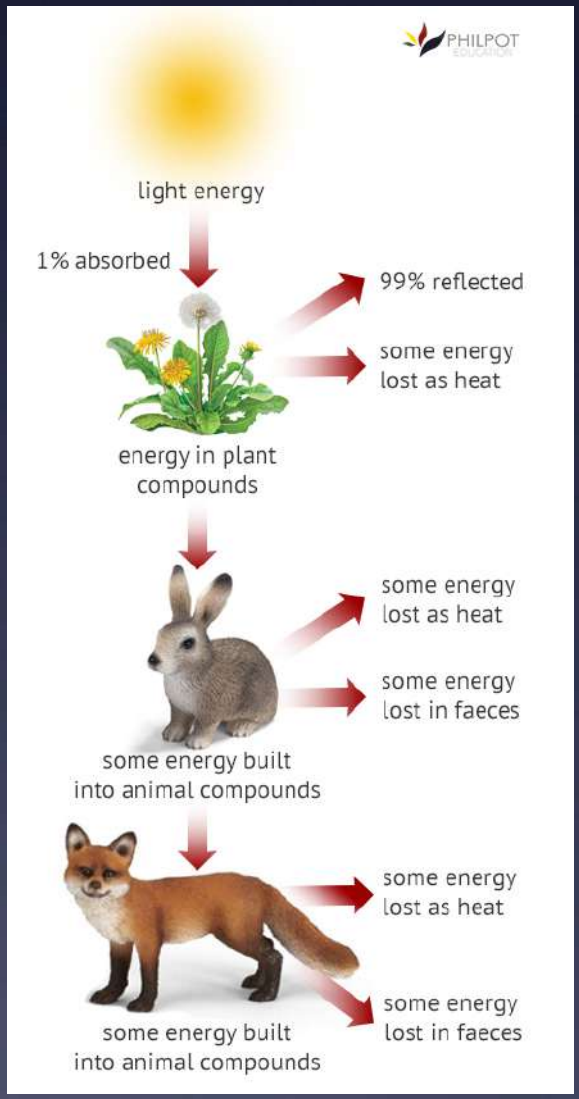
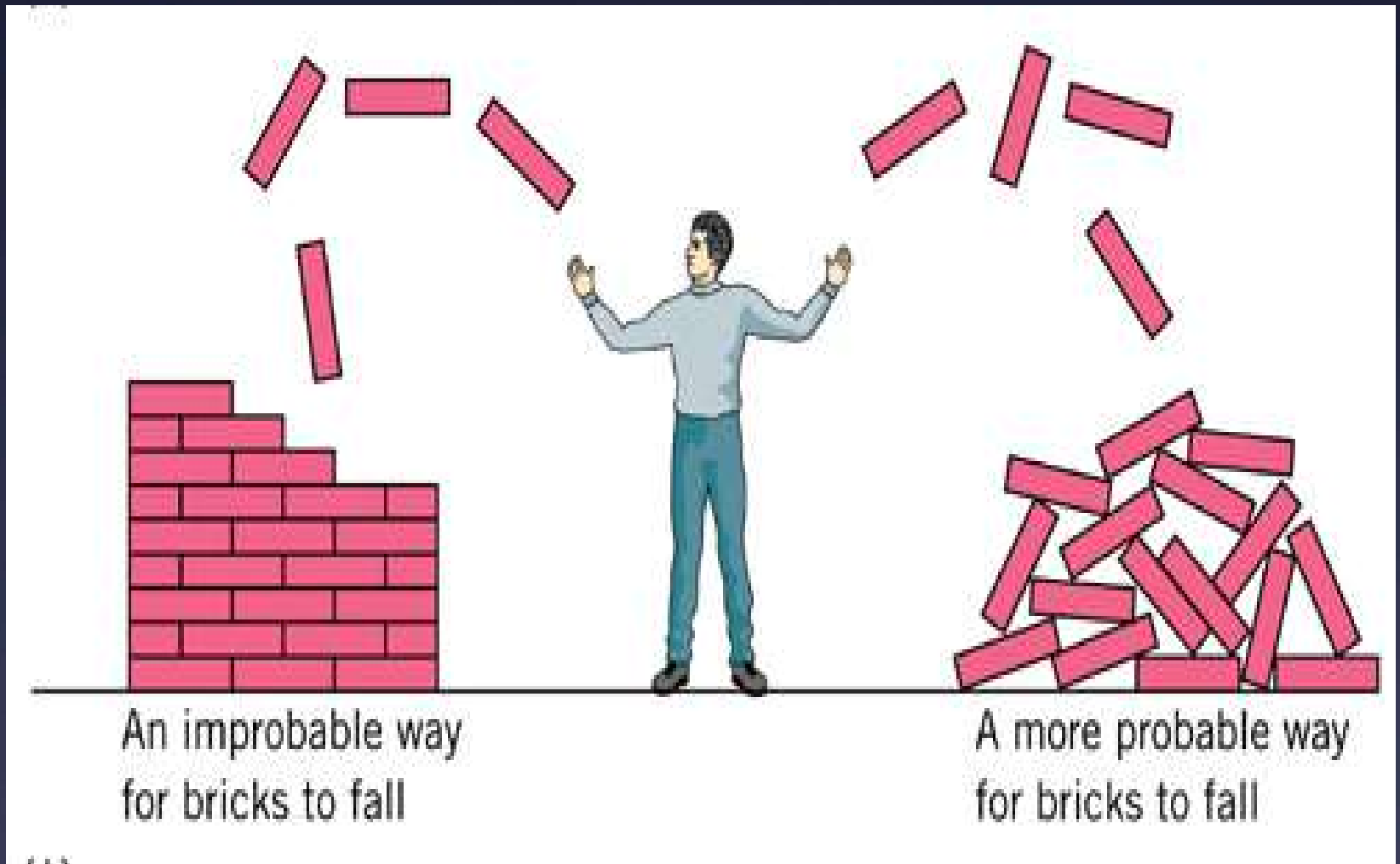
Second law of thermodynamics

- when energy converted from one form to another, energy lost
- usually in the form of heat



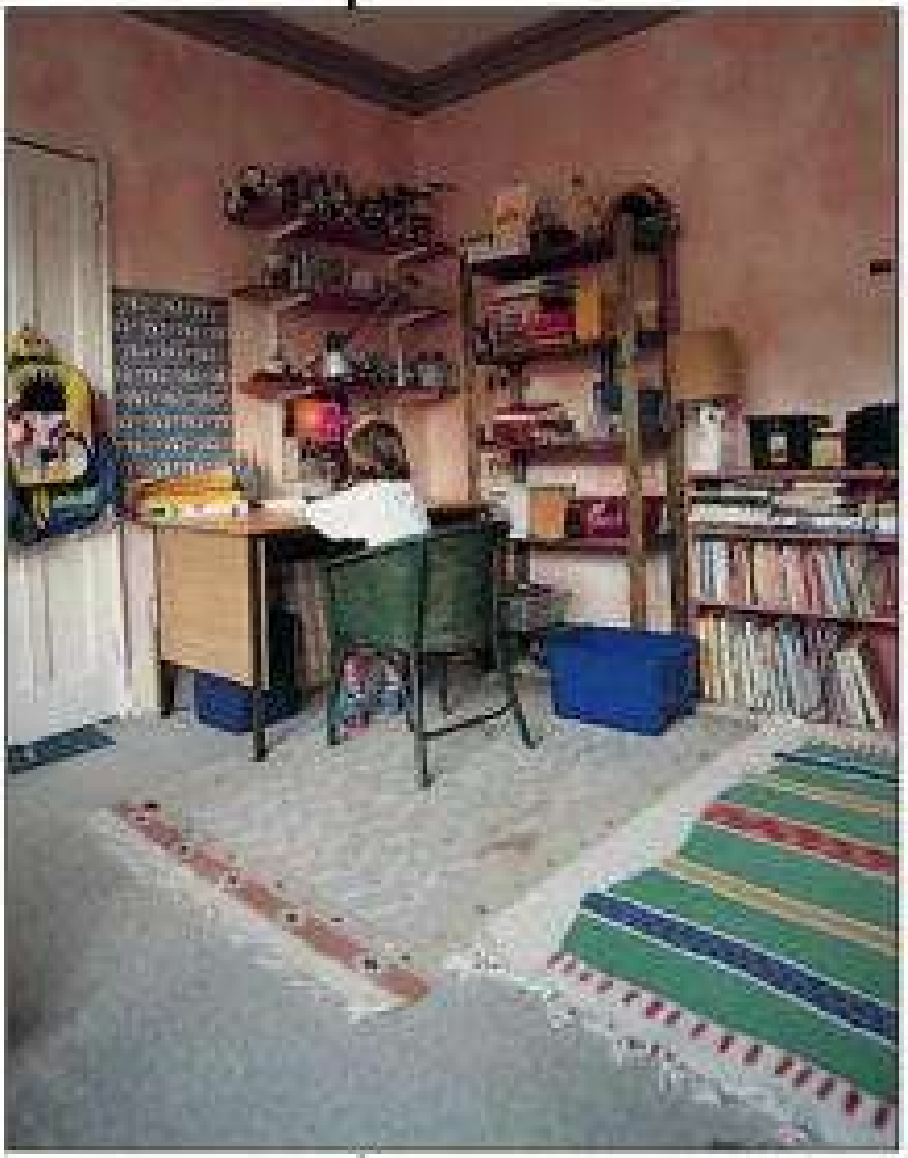
Entropy: is a measure of disorder.

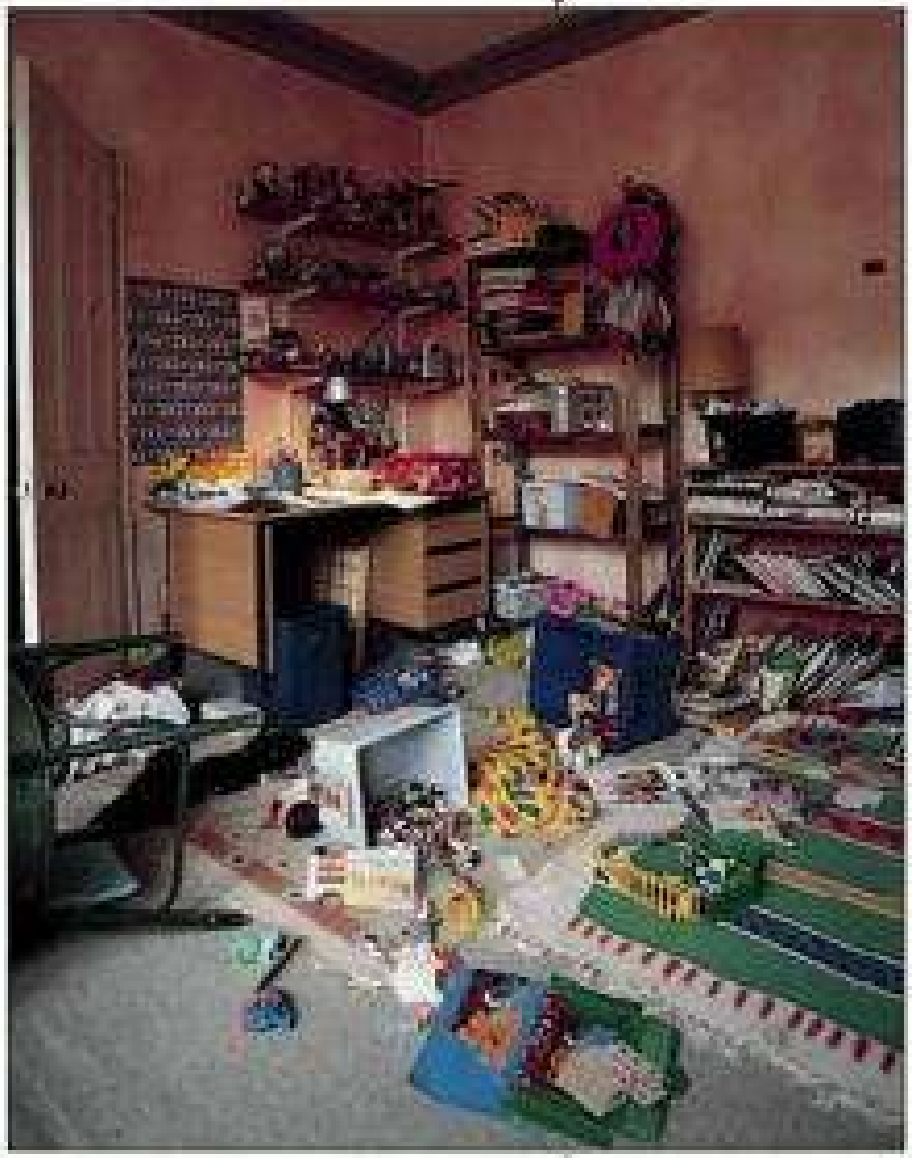
In other words, over time, **disorder increases** as useful energy dissipates.



"SPONTANEOUS" REACTION

as time elapses





ORGANIZED EFFORT REQUIRING ENERGY INPUT

How does this apply to organisms in the environment?

There's no such thing as a "free lunch."

Energy has to come from somewhere, and its **conversion from one form to another always means some becomes unavailable**.

Organisms eat in different ways.

Autotrophs make their own food.

They are also known as **producers.**

They use **light energy** from the sun to make **glucose** (sugar) through the process of **photosynthesis**.

Organisms eat in different ways.

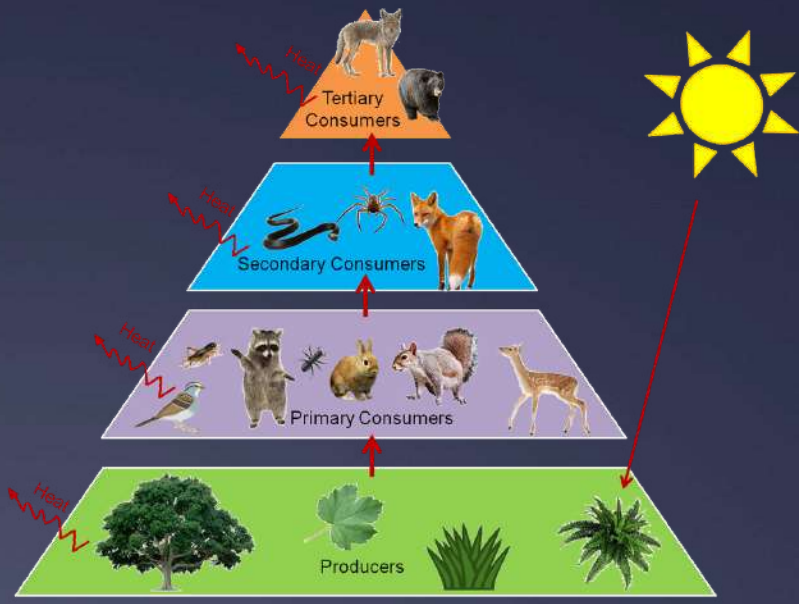
Heterotrophs cannot make their own food.

They must **eat**!

Consumers

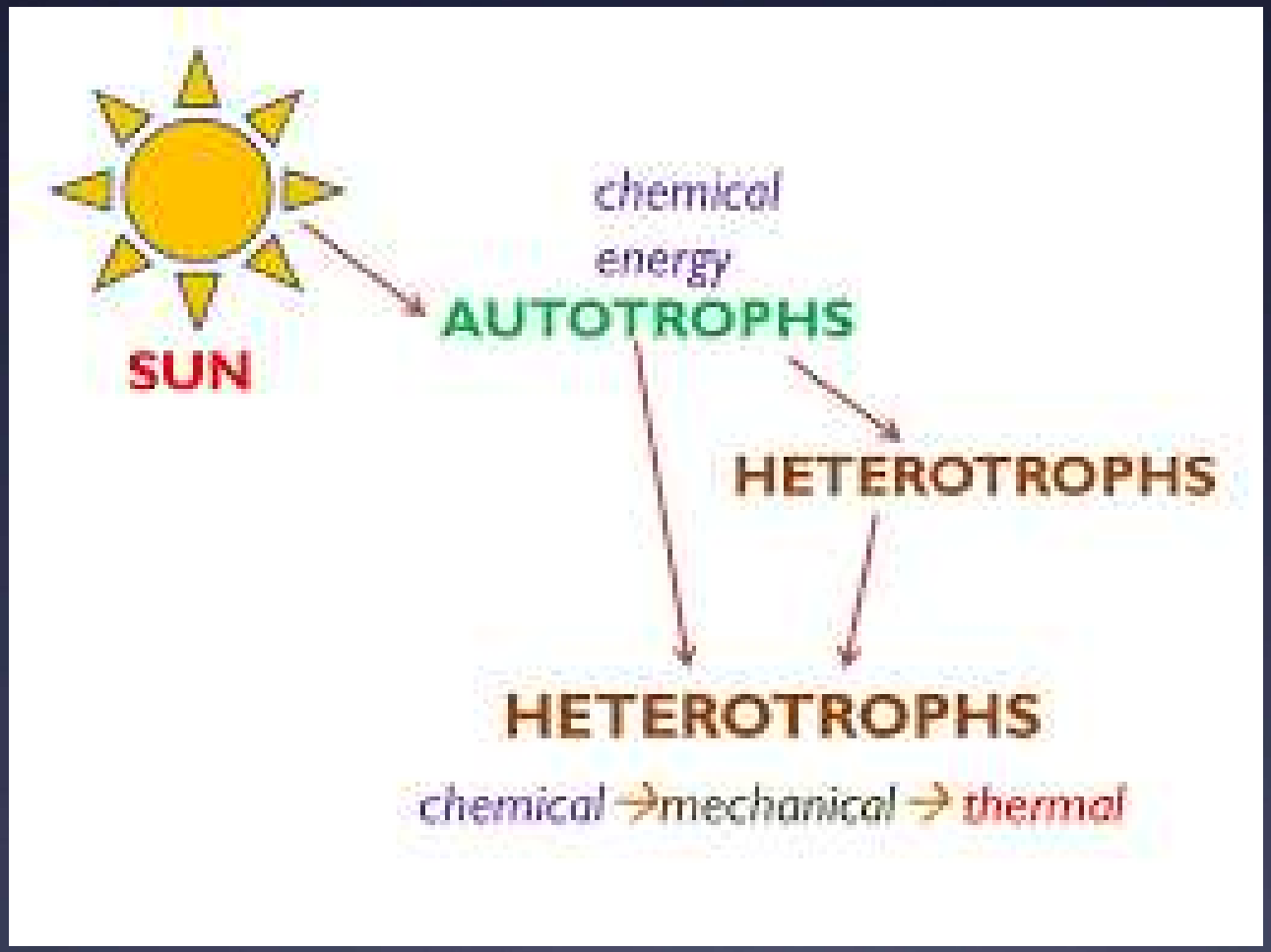
take chemical energy in food & convert to

- kinetic energy (body motion and motion in cells)
- stored chemical energy in body
- heat energy (loss due to entropy)



Organisms eat in different ways.

Heterotrophs use **chemical energy** stored in the **bonds between atoms.**



Autotroph or Heterotroph?

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