Regents Physics

Energy

Types of energy
&
Conservation of energy

APlusPhysics

What is Energy?

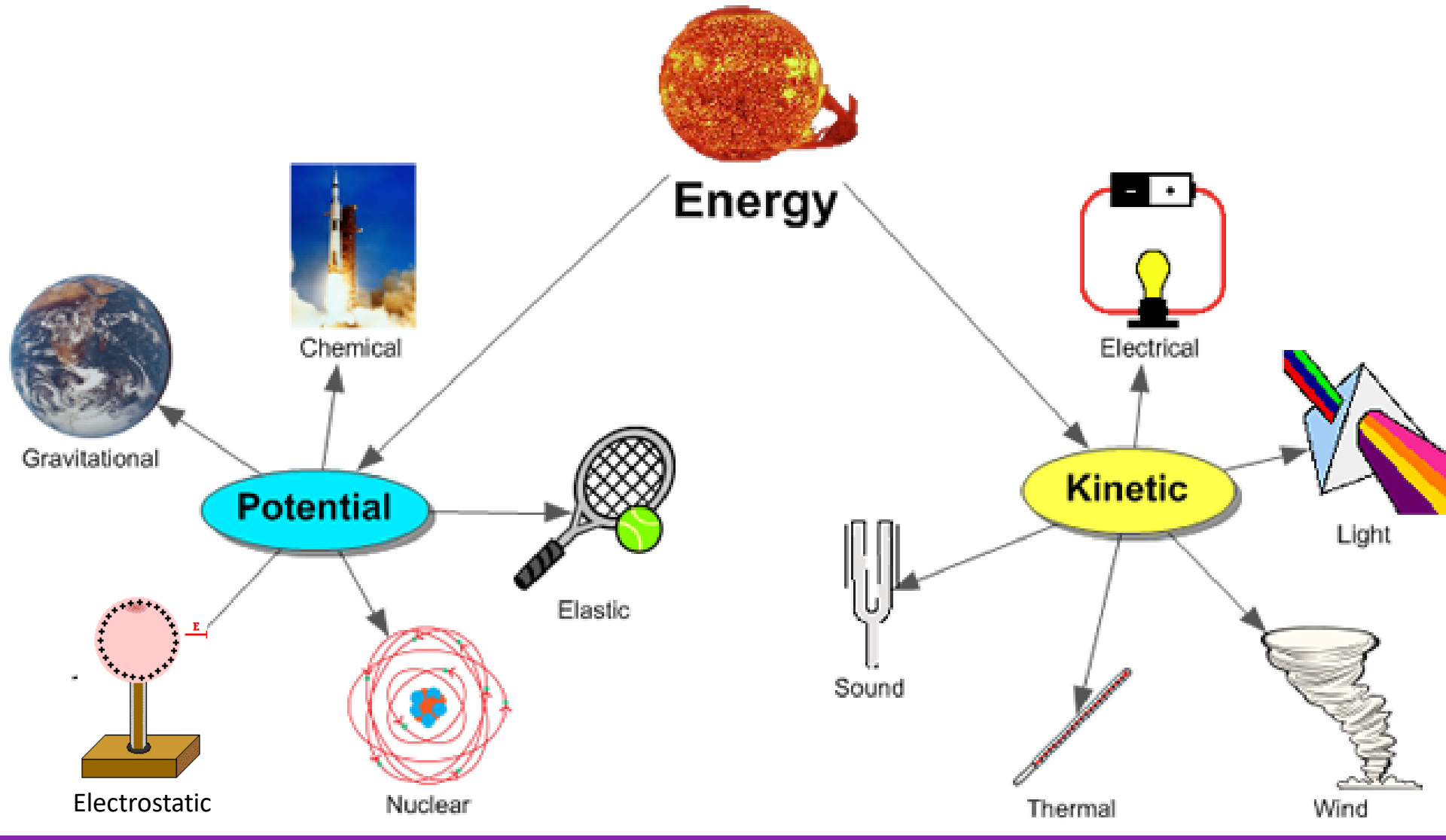
- Energy is the ability or capacity to do work.
- Work is the process of moving an object.

→ Energy is the ability or capacity to move an object!

Types of Energy

- Energy is broadly classified as Kinetic Energy and Potential Energy.
- Kinetic energy is the energy which an object contains because of a particular motion.
- Potential energy is the stored energy, because of its state of rest.

Types of Energy



Energy Transformations

- Energy can be transformed from one type to another.
- You can transfer energy from one object to another by doing work.
- Work-Energy Theorem
  - Work done on a system by an external force changes the energy of the system.

$$\Delta E_T = W$$

$$\Delta E_T = F\cos\theta\, d$$

- Units of energy are the same as the units of work, joules (J).

$$1\ \mathrm{J} = 1\ \mathrm{N\cdot m} = 1\ \frac{\mathrm{kg\cdot m^2}}{\mathrm{s^2}}$$

Kinetic Energy

$$K = \frac{1}{2} mv^2$$

- Kinetic Energy is energy of motion.
  - A moving object has the ability or capacity to move another object

Potential Energy

- Potential Energy (U) is energy an object possesses due to its position or condition.
- Gravitational potential energy (U_g) is due to its position in a gravitational field (height).
- Elastic Potential Energy (U_s) is due to its position in a stressed elastic system, for example, a compressed spring.

Gravitational Potential Energy U_g

- 10 kg box on floor
- Set current U_g to 0 as reference point
- Find the U_g of the box if we do work to lift it to a height of 1.0m.

$$\Delta U_g = mg\Delta h$$

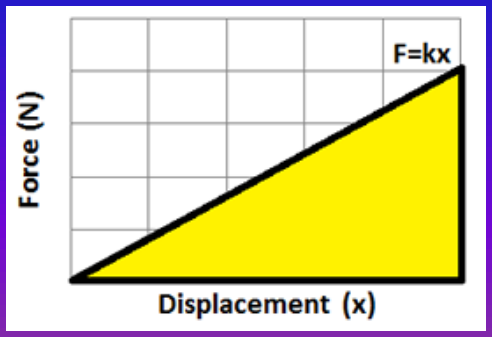
Elastic Potential Energy U_s

Work done in compressing the spring is stored as elastic potential energy.

$$U_s = \frac{1}{2} kx^2$$

Hooke's Law

$$F_s = kx$$



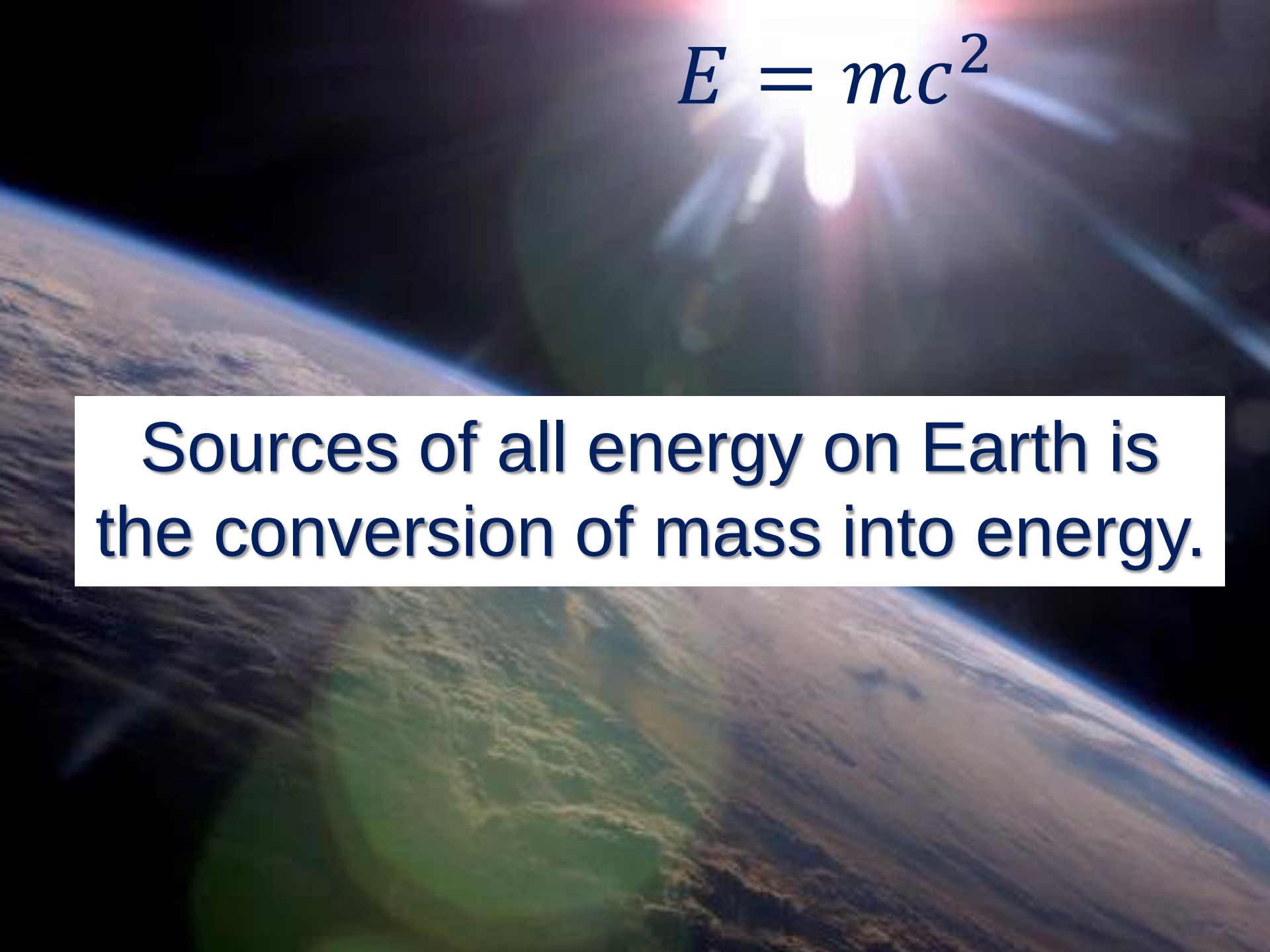
Law of Conservation of Energy

- "Energy cannot be created or destroyed… it can only be changed."

  Energy can only be transformed from one form to another or transferred from system to system.

- Conservation Laws:
  - ◎ Total Energy of an isolated system is conserved.
  - ○ Mechanical Energy is conserved, under conservative forces.

Mechanical Energy = $K + U_g + U_s$


$E = mc^2$
Sources of all energy on Earth is the conversion of mass into energy.