VIDYA BHAVAN, BALIKA VIDYAPEETH

SHAKTI UTTHAN ASHRAM, LAKHISARAI, PIN:-811311

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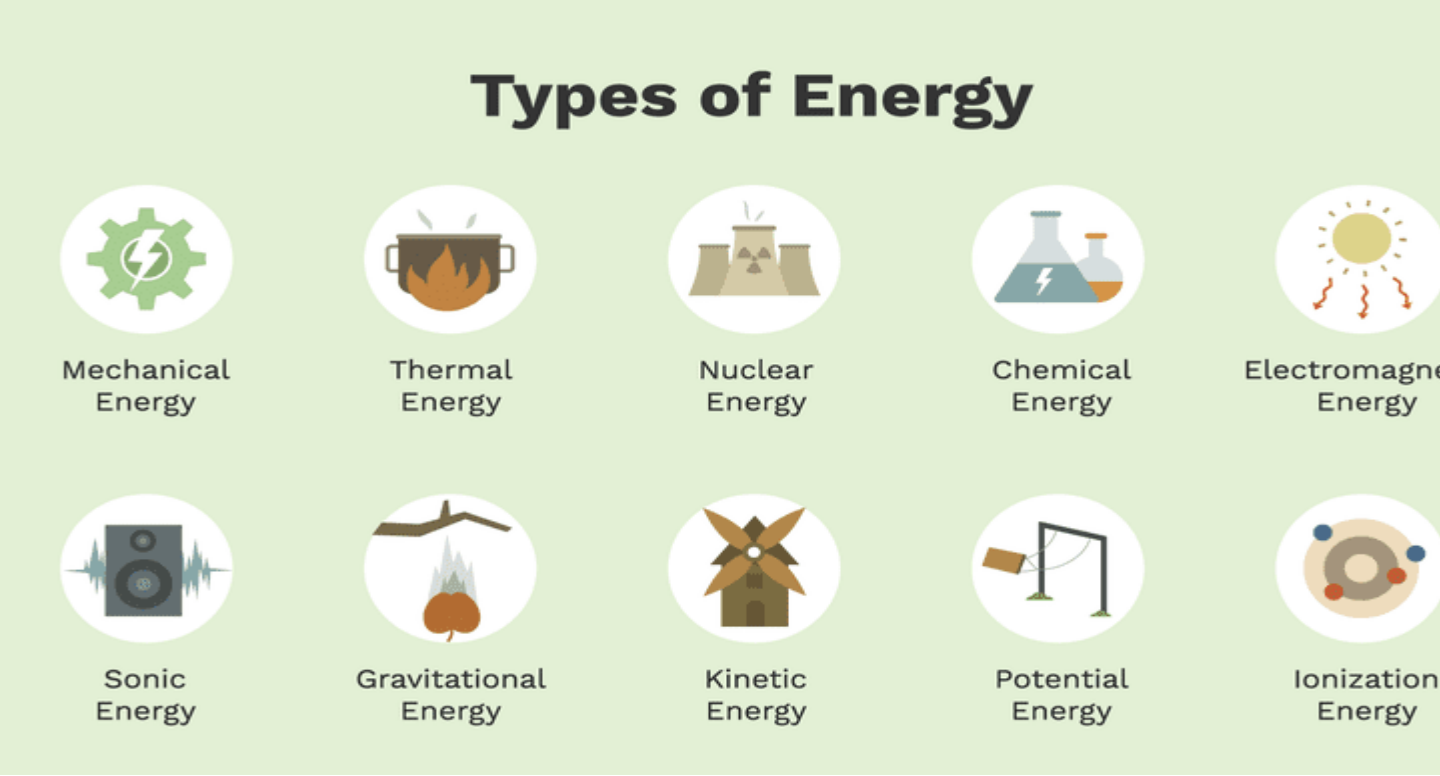
SUBJECT TEACHER:- MR. NEEL NIRANJAN

CHAPTER 4. (WORK, ENERGY & POWER) (BASED ON NCERT PATTERN)

Energy

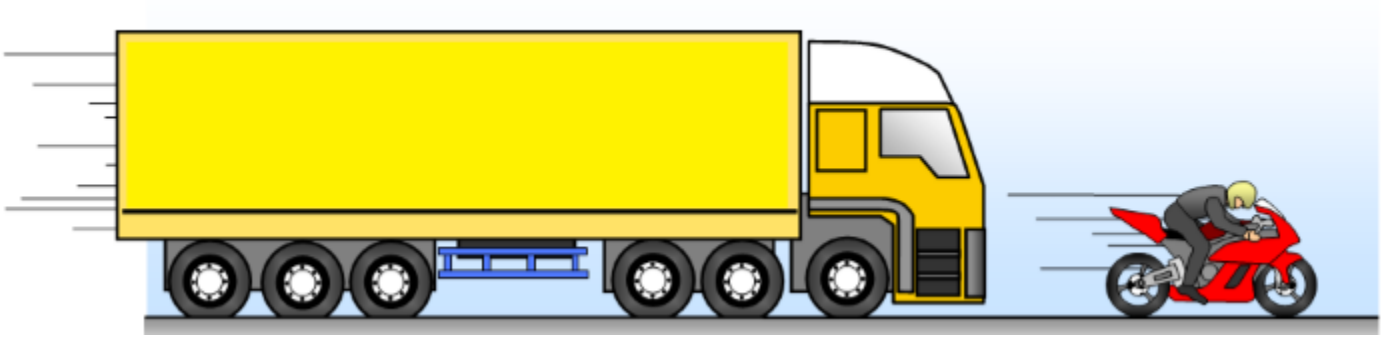
Any object that is capable of doing work processes some energy. The object can gain or lose energy depending upon the work done. If an object does some work it loses its energy and if some work is done on an object it gains energy.

Different forms of energies



Kinetic Energy

Every moving object possesses some energy called Kinetic Energy. As the speed of the object increases so is its kinetic energy.



Formula for Kinetic Energy

$\therefore$ Work done $\rightarrow$ $W = F \times s$ ... (i)

due to force the velocity changes to v, and the acceleration produced is a

$\therefore$ relationship between v, u, a and $s = v^2 - u^2 = 2as$

$$\therefore \quad s = \frac{v^2 - u^2}{2a} \qquad \text{... (ii)}$$

$$F = ma \qquad \text{... (iii)}$$

Substitute (ii) and (iii) in (i) we get

$$W = F \times s$$

$$= ma \times \frac{v^2 - u^2}{2a}$$

$$W = \frac{1}{2} m(v^2 - u^2)$$

if $u = 0$, (object starts at rest)

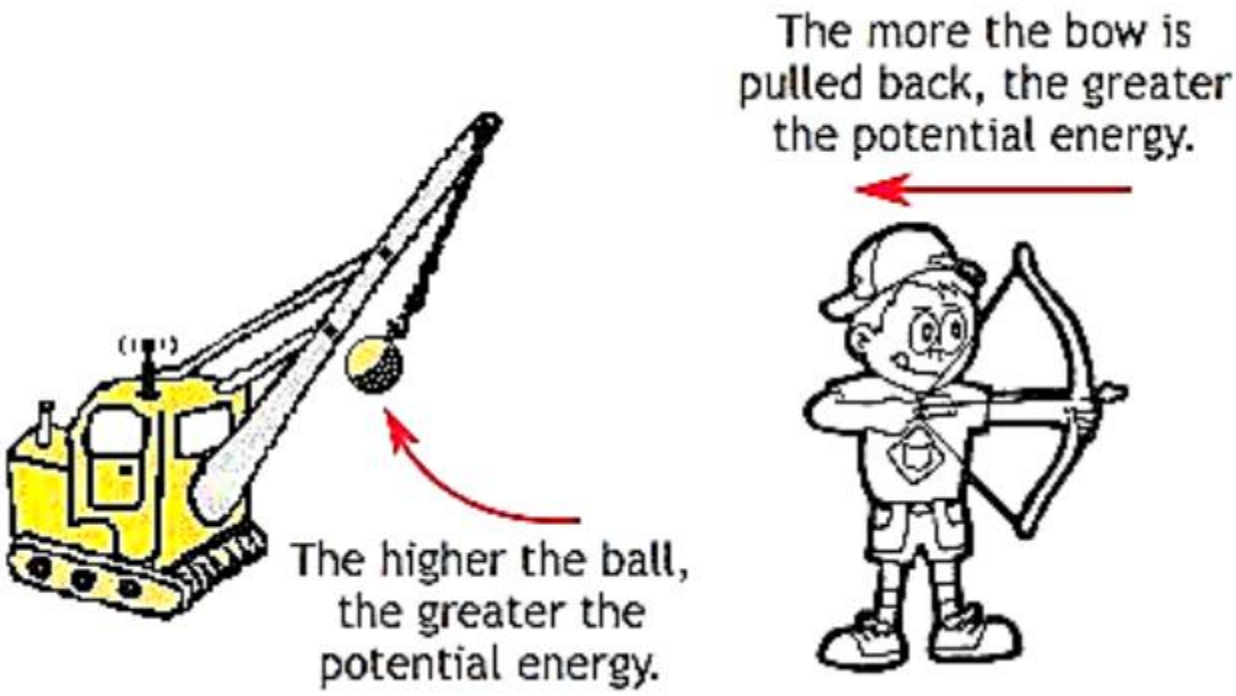
$$\therefore \quad W = \frac{1}{2} mv^2$$

Work done = Change in kinetic energy

$$\therefore \quad \boxed{E_k = \frac{1}{2} mv^2}$$

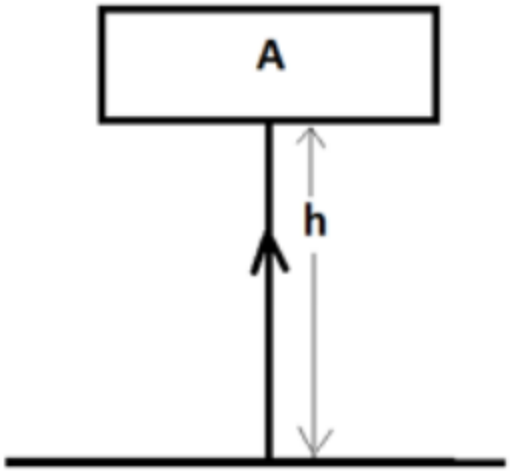
Potential Energy

Every object possesses some energy called Potential Energy. An object when gains energy may store it in itself as potential energy.



We know that when an object rises above the ground some work is done against gravity. Since work is done on the object, the object would gain some energy. The energy that the object gains at a height is called Gravitational Potential Energy. It is defined as the amount of work done required in raising an object above the ground up to a certain point against the gravity

Consider the example given below,



An object 'A' having mass 'm' is raised by height 'h' above the ground. Let us calculate the potential energy of object A at height 'h':

We know that,

W = F * d = F * h (height) And F = m * g (because the force is applied against gravity) So, W = m * g * h Hence potential energy of object A, Ep = m * g * h	

- Gravitational potential energy does not get affected due to the path taken by the object to reach a certain height.

Other forms of Energies:

- Mechanical Energy – It is the sum of kinetic and potential energy of an object. Therefore, it is the energy obtained by an object due to motion or by the virtue of its location. Example, a bicycle climbing a hill possesses kinetic energy as well as potential energy.
- Heat Energy – It is the energy obtained by an object due to its temperature. It is also called Thermal Energy. Example, energy possessed by a hot cup.
- Chemical Energy – It is the energy accumulated in the bonds of chemical compounds. Chemical energy is released at the time of chemical reactions. Example, energy possessed by natural gas and biomass.
- Electrical Energy – It is kind of kinetic energy caused due to the motion of electrons. It depends upon the speed of electrons. As the speed increases so does the electrical energy. Example, electricity produced by a battery, lightning at thunderstorms
- Light Energy – It is the energy due to light or electromagnetic waves. It is also called as Radiant Energy or Electromagnetic Energy. Example, energy from the sun
- Nuclear Energy – It is the energy present in the nucleus of an atom. Nuclear energy releases when the nucleus combines or separate. Therefore, we can say that every atom in this universe comprises of nucleus energy. Example, uranium is a radioactive metal capable of producing nuclear energy in nuclear power plants
- Sonic Energy – It is the energy produced by a substance as it vibrates. This energy flows through the substance in the form of sound waves. Example, music instruments produce sound energy
- Ionization Energy – It is the energy that binds electrons with its nucleus. It is thus the amount of energy required to remove one electron completely from its atom (called First Ionization Energy). Subsequently, the ionization energy increases as we remove the second electron from the atom (called Second Ionization Energy).