

Energy.

The energy of a body is defined as its capacity for doing work.

(1) Since energy of a body is the total quantity of work done therefore it is a scalar quantity.

(2) Dimension: $[ML^2T^{-2}]$ it is same as that of work or torque.

(3) Units: Joule [S.I.], erg [C.G.S.]

Practical units : electron volt (eV), Kilowatt hour (KWh), Calories (Cal)

Relation between different units: $1 \text{ Joule} = 10^7 \text{ erg}$

$$1 \text{ eV} = 1.6 \times 10^{-19} \text{ Joule}$$

$$1 \text{ KWh} = 3.6 \times 10^6 \text{ Joule}$$

$$1 \text{ Calorie} = 4.18 \text{ Joule}$$

(4) Mass energy equivalence : Einstein's special theory of relativity shows that material particle itself is a form of energy.

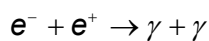
The relation between the mass of a particle m and its equivalent energy is given as

$$E = mc^2 \quad \text{where } c = \text{velocity of light in vacuum.}$$

If $m = 1 \text{ amu} = 1.67 \times 10^{-27} \text{ kg}$ then $E = 931 \text{ MeV} = 1.5 \times 10^{-10} \text{ Joule}$.

If $m = 1 \text{ kg}$ then $E = 9 \times 10^{16} \text{ Joule}$

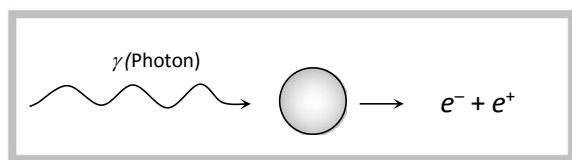
Examples : (i) Annihilation of matter when an electron (e^-) and a positron (e^+) combine with each other, they annihilate or destroy each other. The masses of electron and positron are converted into energy. This energy is released in the form of γ -rays.



Each γ photon has energy = 0.51 MeV.

Here two γ photons are emitted instead of one γ photon to conserve the linear momentum.

(ii) Pair production : This process is the reverse of annihilation of matter. In this case, a photon (γ) having energy equal to 1.02 MeV interacts with a nucleus and give rise to electron (e^-) and positron (e^+). This energy is converted into matter.



(iii) Nuclear bomb : When the nucleus is split up due to mass defect (The difference in the mass of nucleons and the nucleus) energy is released in the form of γ -radiations and heat.

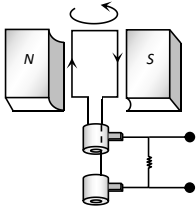
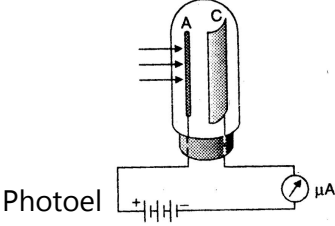
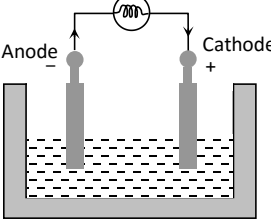

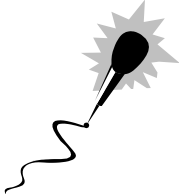
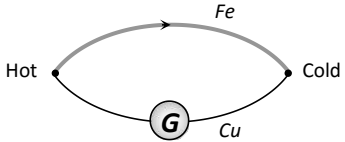
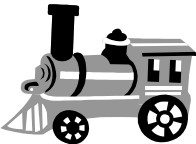


(5) Various forms of energy


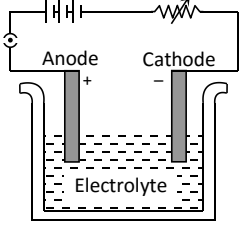

(i) Mechanical energy (Kinetic and Potential) (ii) Chemical energy (iii) Electrical energy

(iv) Magnetic energy (v) Nuclear energy (vi) Sound energy

(vii) Light energy (viii) Heat energy

(6) Transformation of energy : Conversion of energy from one form to another is possible through various devices and processes.

Mechanical → electrical	Light → Electrical	Chemical → electrical
 <p data-bbox="169 954 280 987">Dynamo</p>	 <p data-bbox="651 857 746 925">Photoel cell</p>	 <p data-bbox="1129 981 1233 1070">Primary cell</p>
Chemical → heat	Sounds → Electrical	Heat → electrical
 <p data-bbox="169 1525 272 1615">Coal Burning</p>	 <p data-bbox="651 1585 810 1619">Microphone</p>	 <p data-bbox="1129 1585 1337 1619">Thermo-couple</p>
Heat → Mechanical	Electrical → Mechanical	Electrical → Heat
		

Engine	Motor	Heater
Electrical → Sound	Electrical → Chemical	Electrical → Light
		
Speaker	Voltmeter	Bulb