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WORK, POWER & ENERGY

work: work is said to be done when a force acts on a body and it covers a distance

its SI unit is Joule (J)

work done = force x distance

power: rate of doing work / rate of energy transfer

its SI unit is Watt (W)

$$\text{power} = \frac{\text{work}}{\text{time}}$$

ENERGY

→ ability to do work

→ it is measured in Joules

→

kinetic energy: the energy posessed by a body due to its motion

$$E_k = \frac{mv^2}{2}$$

E_k = kinetic energy

v = speed of the body

m = mass of the body

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gravitational potential energy: energy possessed by a body when it is vertically elevated in gravitational field

$E_p = mgh$: energy stored in an object due to its position above the Earth's surface

m = mass of body

g = gravitational field strength

h = height to which body is raised

Forms of Energy	Some common examples
Chemical	Fuels such as oil, wood, coal, electric cells, food and explosives
Nuclear	Atomic bombs, nuclear reactors
Radiant	The Electromagnetic spectrum (specify for examples)
Electrical	The energy associated with the current in ~~the~~ an electric drill, power tools, immersion heater and electrical appliances
Internal Energy	The energy posessed by the atoms or molecules of matter in the form of kinetic and potential energy
Mechanical (K.E & P.E)	(a). kinetic energy of all objects in motion
	(b). potential energy
(i). Gravitational P.E	(i). a waterfall, raised objects
(ii). Elastic	(ii). compressed/stretched springs, bent condition of a diving board or the stretched band of a catapult

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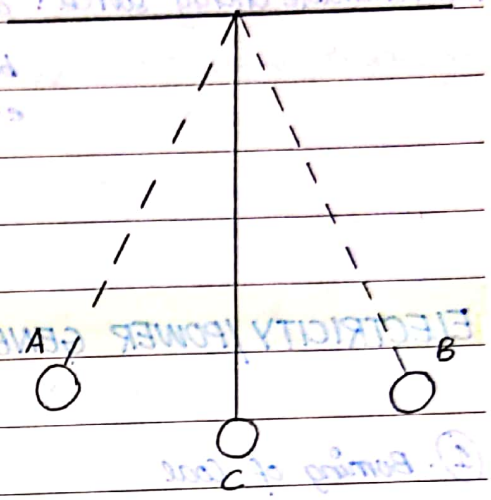
principle of conservation of energy: energy can neither be created nor destroyed, however it can be converted from one form to the other and total amount of energy remains constant

e.g/ a swinging pendulum

* at A, E_p is maximum and E_k is zero
* at O, E_k is maximum and E_p is minimum
* at B, E_p is maximum and E_k is zero



Major energy conversions:

1. An object falling from certain height on floor
   $E_p \rightarrow E_k \rightarrow$ sound & heat energy.
2. A cyclist riding the bicycle up the hill
   Chemical energy $\rightarrow E_k \rightarrow E_p$
3. An object released from a catapult, hitting the target.
   Elastic $E_p \rightarrow E_k \rightarrow$ sound & heat energy
4. To switch on filament lamp connected to battery
   Chemical energy $\rightarrow$ Electrical energy $\rightarrow$ heat & light energy
5. A diver on a spring board, jumping into pool.
   Chemical energy $\rightarrow$ Elastic $E_p \rightarrow E_k \rightarrow$ sound energy
6. A person knocking the nail into wooden block with hamer
   Chemical energy $\rightarrow E_p \rightarrow E_k \rightarrow$ sound & heat energy

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renewable energy sources : a source of energy which infinite and will never run out

e.g/ wind, tidal, geothermal, solar, hydroelectric

non-renewable energy source : a source of energy which is finite and can't be replaced easily once it runs out

e.g/ coal, oil, gas, radioactive nuclei

ELECTRICITY / POWER GENERATION

(1). Burning of Coal

chemical energy → heat energy → steam energy → kinetic energy → electrical energy

(2). Hydro-electric Generations

gravitational potential energy → kinetic energy → electrical energy

(3). Windmills

wind energy → kinetic energy → electrical energy

(4). Nuclear Power Generation

nuclear energy → heat energy → steam energy → kinetic energy → electrical energy

(5). Solar energy

solar energy → electrical energy

(6). Geo-thermal energy

heat energy → steam energy → kinetic energy → electrical energy

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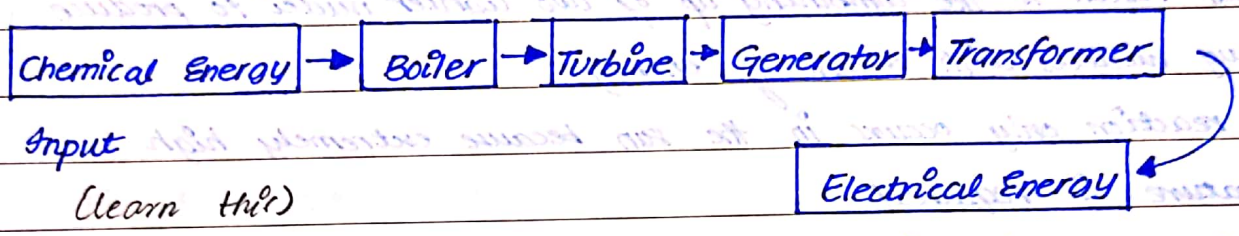
→ Fuels such as coal, oil, gas are stored forms of chemical energy

→ the burning of fuels is used to heat up water which produces steam

→ the steam energy then converted to K.E of turbine, which produces electricity

Chemical Energy → Heat energy → Steam energy → K.E → electricity



Input (learn this)

Output

Environmental issues of Power generation :

- the burning of fuel like coal causes air pollution and produces harmful gas like CO
- the construction of huge dams causes destruction of forests and habitats of the water species
- the nuclear power generation produces radioactive waste and by products, which remain harmful for a very long time

Einstein's mass energy equation states that mass can be changed into charge and vice versa.

$$E = mc^2$$

m = decrease/loss in mass

E = energy produced

c = speed of light = 3×10 m/s

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NUCLEAR FISSION AND FUSION :

→ Nuclear Fission is used to split up heavy nucleus into two lighter nuclei with release of energy

→ the thermal energy released from the process can be used to turn water into steam which is then used to turn turbines

→ Nuclear Fusion is the combining up of two lighter nuclei to produce a heavy nucleus with release of energy

→ this reaction only occurs in the sun because extremely high temperature is required

→ we still have to invent a usable Fusion reactor

efficiency : it is the ratio of power output to power input
it can never be 100% b/c some of the energy is lost to the surroundings

$$\text{efficiency} = \frac{\text{power output}}{\text{power input}} \times 100$$

$$\text{efficiency} = \frac{\text{energy output}}{\text{energy input}} \times 100$$

How to increase efficiency:

⇒ use insulator coverings

⇒ reduce friction

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elastic potential energy : energy possessed by an object when it is stretched or compressed

internal energy :· heat hogaye matlab

$E_{ep} = \frac{ke^2}{2}$

g.p.e → h.e → i.e
(for a ball rolling down a hill

k = spring constant (N/m)
e = extension (m)

$\text{Efficient} = \frac{\text{output energy}}{\text{input energy}}$

Input = output + wasted