POONAM LATA YADAV

SOURCES OF ENERGY

CLASS X

Any substance which can produce adequate amount of useful energy at a steady rate over long span of time is called Source of Energy.

eg: Wind, Sdar, Coal, Petrol, etc.

Saurce of Energy

CONVENTIONAL SOURCES

↓

Sources which can be exhausted after continuous Usage.

eg: Petrol, LPG, CNG, Coal

Used for long due to their easy availability.

NON-CONVENTIONAL SOURCES

↓

Which can be used for longer duration.

eg: Sun, Wind

↓

Alternative Sources of energy

CHARACTERISTICS OF AN IDEAL SOURCE OF ENERGY

① Convenient to transport, store and use.

② Should be economical

③ Should be capable of giving adequate amount of energy.

④ should be able to supply desired quantity of energy

Sources of energy

Renewable (Inexhaustible Sources)

Donot get exhausted by human activities

They are present in unlimited supply in nature and gets replenished through natural process.

eg: Air, Water, Solar radiation, Biomass, Ocean waves, Geothermal

Non-renewable (Exhaustible)

Gets exhausted by human activity over certain period of time.

They are present in nature in limited quantity and are not replenished.

eg: Coal, Petrol, Natural Gas, Fissionable material.

FOSSIL FUELS

The combustible materials formed due to decomposition of remains of prehistoric plants and animals inside earth.

They are energy-rich molecules of carbon compounds made up of plants.

eg: Coal
Natural Gas
Petroleum

The ultimate source of energy in fossil fuels is the SUN.

NOTE -

① Natural gas mainly consist of Methane

② LPG consists of butane.

③ LPG is byproduct of petroleum refining.

④ Special grade Kerosene is used as fuel for Jet planes.

⑤ Commercial unit of Crude oil is barrel.
1 barrel = 159 litres

⑥ CNG - Compressed Natural Gas

THERMAL POWER PLANT

They are the coal or natural gas based electricity generating units.

Chemical energy of fuel → Heat energy of steam → K.E of turbine → Electrical energy

HYDROENERGY

It is the K.E of flowing water or the potential energy of water stored at a height.

Water flows from higher level to a lower level.

ADVANTAGES OF HYDROENERGY

1. It is renewable or inexhaustible source of energy.
2. Does not cause pollution
3. It is cheap source of electricity

DISADVANTAGE

① Fast flowing water is not available everywhere.

* The electrical energy produced by using Kinetic energy of water is called HYDROELECTRICITY.

Construction of Tehri Dam on river Ganga and Sardar Sarovar on river Narmada has raised many ecological and social issues.

The purpose of constructing dams are -

① To prevent flooding of rivers
② To provide water for irrigation purposes
③ To generate hydroelectricity

The Ultimate Source of water energy is the energy of the Sunlight (Solar energy).

BIOMASS

Agricultural and animal waste material which can be used as a fuel or acts as a source of fuel is called BIOMASS.

Biomass contains the compounds of Carbon with hydrogen and Oxygen.

eg: ① Wood and wood shavings
② Agricultural waste
③ Sewage
④ Cattle dung

The energy stored in a biomass is called BIOENERGY.

Biomass can be used directly as a fuel
eg: dry wood, dry leaves etc can be used to produce heat.
We can also convert biomass into a fuel.

eg: (i) Cattle dung can be converted to gobar gas.

(ii) Wood can be converted to Charcoal.

(iii) Sewage can be used to produce methane gas.

In rural areas Wood and dry dung-cakes are typical biomass fuels used.

Charcoal is obtained by destructive distillation of wood.

Advantages of Using Charcoal -

(i) Less polluting than wood.

(ii) Has high Calorific value than wood.

(iii) Needs less preheating than wood for burning.

(iv) It produces more heat that Coal.

(v) Charcoal leaves less ash after burning.

DISADVANTAGES of using Dry Dung Cakes as a fuel -

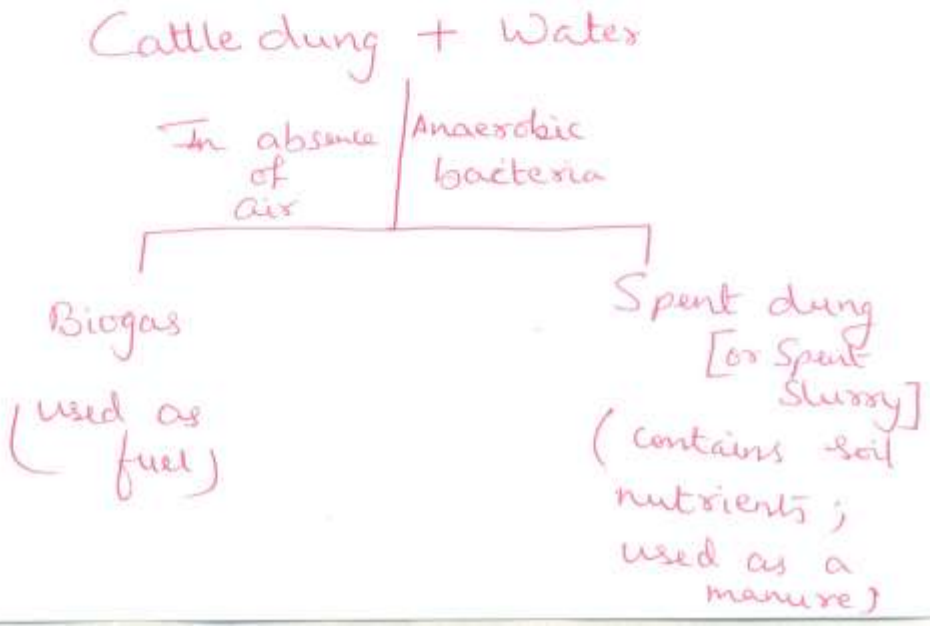
(i) Its burning causes pollution of air.

(ii) After burning it leaves large quantity of ash.

(iii) It destroys useful plant nutrients.

(iv) Has a low calorific value.

BIOGAS (gobar gas) burns with smokeless flame and leaves no ash.
Biogas is a clean ~~flame~~ fuel.



The mixture of Combustible gases obtained by bacterial degradation of Cattle dung in absence of air is Called BIOGAS.

Biogas Contains - Methane (CH_4), Carbon di-oxide (CO_2), Hydrogen (H_2), Hydrogen Sulphide (H_2S) and Nitrogen (N_2)

BIOGAS is termed as a Clean fuel because-

(i) Doesnot cause pollution of air

(ii) Doesnot have any problem of residual disposal.

(iii) It is cheaper

(iv) Has higher Calorific value

(v) Use of biogas will save forests and fossil fuels.

WIND ENERGY

The kinetic energy of moving air is called Wind energy.

WIND is caused by the unequal heating of atmospheric air near the earth's surface.

ADVANTAGES OF WIND ENERGY

(1) It is cheap and inexhaustible
(2) It doesnot cause any pollution

LIMITATIONS

(1) Kinetic energy of wind can be used only at site of windmill.
(2) Wind is not a dependable source of energy.

USES of a WINDMILL -

① Windmill is used to run a water pump.

② Wind mill is used to grind grains.

③ Windmill is used to generate electricity.

Non Conventional Sources of Energy

① SOLAR ENERGY

The light and heat energies of the sunlight are called as Solar Energy.

SOLAR CONSTANT -

The amount of solar energy reaching the periphery of the earth's atmosphere at an average distance between sun and earth, per second per square meter area exposed at right angles to the sun rays is called Solar Constant.

Solar Constant = 1.4 KJ/s/m²

Solar energy can be utilised for -

1. Cooking
2. Heating Water
3. Producing electricity

Advantages of Solar energy

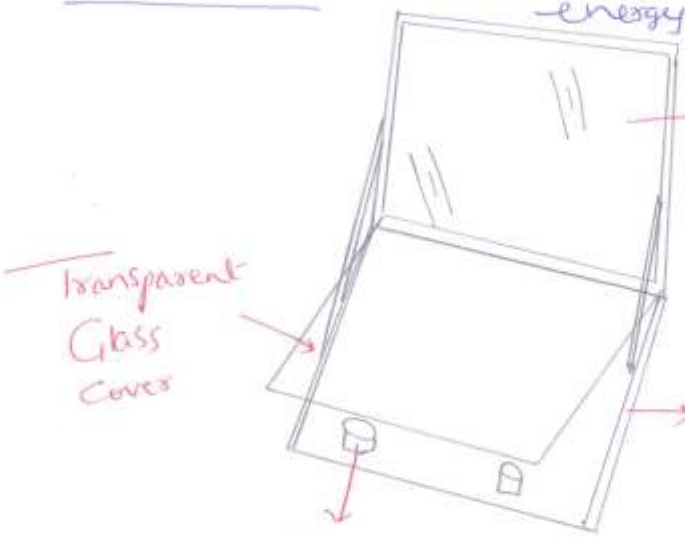
1. It is renewable source of energy.
2. It is cheap and easily available
3. It doesn't cause pollution

LIMITATIONS of Solar Energy

1. Not available at all places, all time.
2. It is low intensity source of energy.
3. It is available for lesser duration during raining and winter season.

Wavelength of Infrared radiation > Wavelength of visible radiation > Wavelength of Ultraviolet radiation

SOLAR COOKER - A device that utilises solar energy for cooking purposes



① The box is painted black from inside because black surface absorbs heat.

② A flat mirror reflector is used in devices where moderately high temperature is to be produced.

③ A spherical mirror reflector is used where much higher temperature is to be produced.

Solar Cooker is used for cooking food items which require slow heating. Solar Cooker cannot be used for baking and frying.

Advantages -

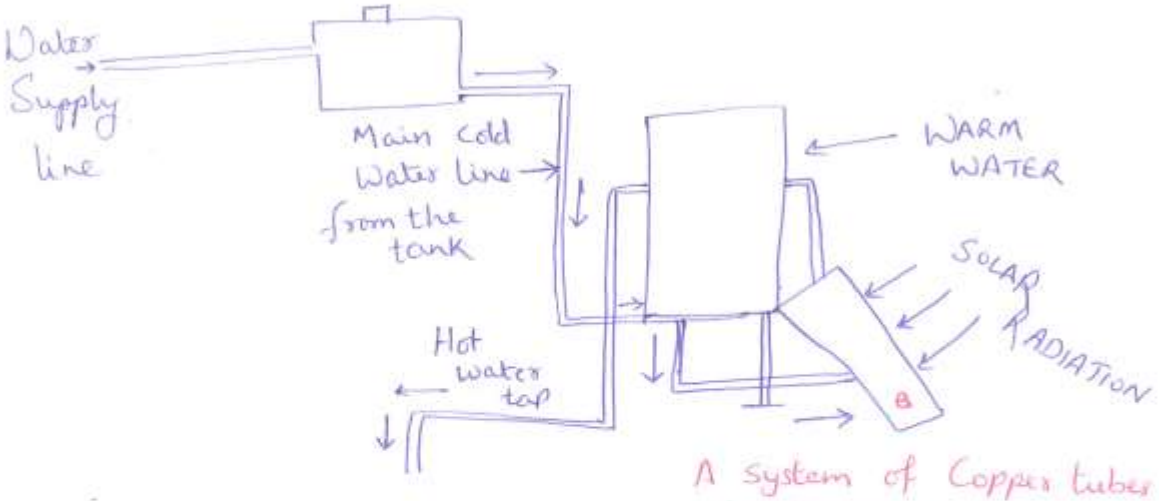
(i) It saves fuel.
(ii) It doesnot produce smoke.
(iii) It saves time.
(iv) It helps in retaining nutritive value of food.

Limitations -

(1) Cannot be used for baking and frying.
(2) Cannot be used on cloudy/rainy day.
(3) It has to be adjusted after every half an hour to keep it facing sun.

SOLAR HEATER -

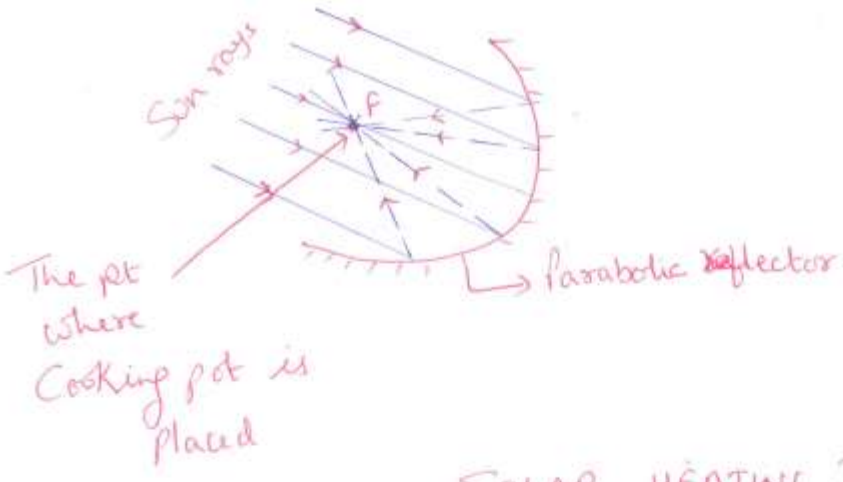
It is a device which is used for heating water by utilising the heat energy of the sunlight.



A system of Copper tubes fitted inside the box with glass top cover

SOLAR HEATING DEVICE

Flat Reflector Type	Spherical / Parabolic Reflector Type
① Reflector is plane mirror.	① Reflector is spherical or parabolic type.
② Temp. can go up to 120–140°C	② Much higher temp. Can be obtained.
③ It simply reflects the light falling on it towards the glass cover.	③ It concentrates sunlight falling on it as its focal point.



SOLAR HEATING DEVICE WITH PARABOLIC REFLECTOR

SOLAR CELL -

A device that converts sunlight directly into electricity. Solar cells are usually produced from semiconductors like - Silicon, gallium.

Solar Cells are also called PHOTO VOLTAIC CELL

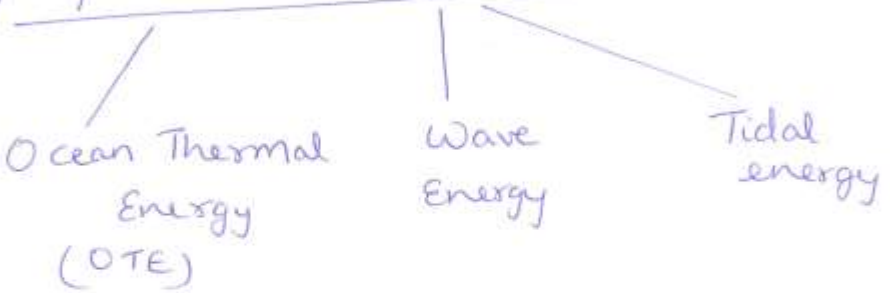
A combination of large number of solar cells is called SOLAR CELL PANEL

Solar cell panels are used for producing electricity for use in SPACE STATIONS and ARTIFICIAL SATELLITE.

Advantages of SOLAR CELLS

1. Dont cause any pollution
2. It can be used in remote and isolated areas.
3. It is cheap energy source.

Energy from Sea / Ocean



OTEC (Ocean Thermal Energy Conversions)

Power plants are devices used to harness the ocean thermal energy.

TIDE - Up and down movement of Sea water along the shore is called **Tide**.

The energy possessed by the rising and falling tidal water is known as **TIDAL ENERGY**.

Tidal energy can be harnessed to produce electricity.

To harness tidal energy, a huge dam is constructed across a narrow opening to the sea.

GEO THERMAL ENERGY -

It is a renewable source of energy.

Region between crust and core of earth is MANTLE. Mantle consist of molten rocks and hot gases. This heat of the interior of earth is called GEOTHERMAL ENERGY.

ADVANTAGES of Geothermal energy.

1. It can be harnessed almost round the year.
2. It is clean and environment friendly.
3. It is cost efficient.

NUCLEAR ENERGY -

The reaction in which composition of the reacting nuclei changes to form nuclei of lighter elements with a simultaneous release of a large amount of energy is called NUCLEAR REACTION.

Here, the atomic number and mass numbers are conserved.

Nuclear Reaction

- Nuclear Fission
- Nuclear Fusion

Nuclear reactions are irreversible.

Change of temperature will have no effect on rate of a nuclear reaction

NUCLEAR FISSION REACTION

Isotopes of Uranium are U-235 ($^{235}_{92}U$) and U-238 ($^{238}_{92}U$).

U-235 is fissionable.

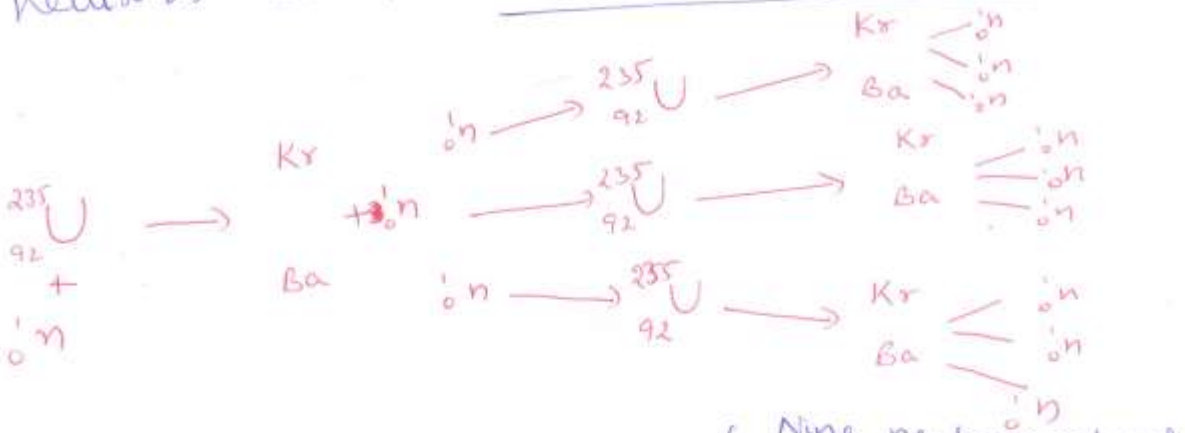
Splitting of nucleus of $^{235}_{92}U$ by bombarding with slow neutron into 2 lighter nuclei with simultaneous release of huge amount of energy.

$$^{235}_{92}U + {}^{1}_{0}n \longrightarrow {}^{236}_{92}U \longrightarrow {}^{139}_{56}Ba + {}^{94}_{36}Kr + 3\,{}^{1}_{0}n + \text{Energy}$$

The energy released in nuclear reactions is usually expressed in terms of mega-electron-volt (MeV).

NUCLEAR CHAIN REACTIONS -

Fission of U-235 nucleus with slow neutrons is a nuclear chain reaction.



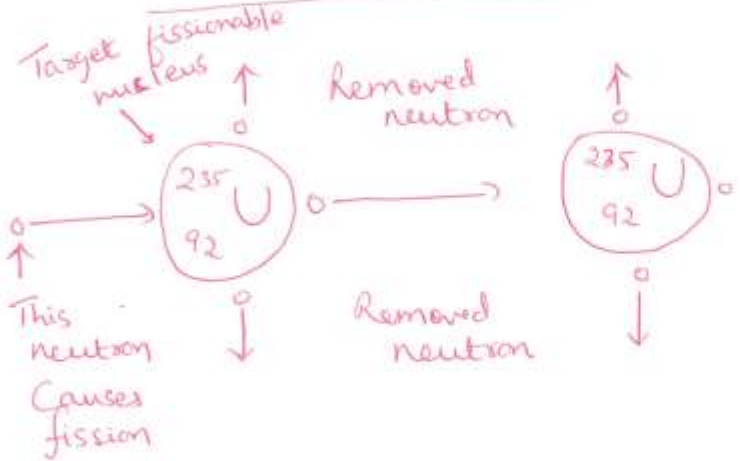
(Nine neutrons released in IInd reaction)

The energy released in an uncontrolled fission reaction cannot be utilised for any practical use.

The atomic bomb is based on principle of uncontrolled fission of U-235 or any other fissionable material.

A nuclear fission reaction in which only one neutron from a fission is able to cause another fission and remaining extra neutrons are removed without causing any fission is called a

CONTROLLED NUCLEAR FISSION



A nuclear fission reaction in which one fission causes just one further fission is called CONTROLLED NUCLEAR FISSION

Nuclear Power Plant is the setup used to generate electricity from heat released in controlled nuclear fission

Nuclear energy of U-235 nucleus → Heat energy of fission reaction → Heat energy of steam → Kinetic energy of turbine → Kinetic energy of the alternator → ELECTRICAL ENERGY

Components of a nuclear Power Plant

1. Nuclear reactor
2. Heat Exchanger
3. Steam Turbine
4. Electric generator (or dynamo)

Few atomic Stations in India

- Tarapur, Maharastra
- Madras at Kalpakam
- Narora near Bulandshahar

NUCLEAR FUSION

It is a process in which two lighter nuclei fuse together to form a stable heavier nucleus with a simultaneous release of very large amount of energy.

They are also called as

THERMO NUCLEAR REACTION

eg: Fusion b/w 2 deutron nuclei forming helium-3 and a neutron

$$^{2}_{1}H + {}^{2}_{1}H \longrightarrow {}^{3}_{2}He + {}^{1}_{0}n$$

deutron nuclei — Helium + neutron

$$d + d \longrightarrow {}^{3}_{2}He + {}^{1}_{0}n$$

eg: $$^{2}_{1}H + {}^{2}_{1}H \longrightarrow {}^{3}_{1}H + {}^{1}_{1}H$$

deutron nuclei — triton + proton

$$d + d \longrightarrow t + p$$

Nucleus of deutreium is deutron

Nucleus of tritium is triton

where, d is deuteron → nucleus with one proton & one neutron

t is triton → nucleus containing one proton and 2 neutron

$$_1^1H + _1^1H \longrightarrow _1^1H + _0^1n + e^+ + \underset{\text{neutrino}}{\nu} + \text{Huge amount of energy}$$

Proton Proton (Hydrogen nuclei) Proton (H_2 nucleus) neutron Positron

* Neutrino is a neutral particle having negligible mass. It has high Penetrating power.

eg: Hydrogen bomb is based on fusion of deutrium

NUCLEAR FISSION	NUCLEAR FUSION
① A heavy nucleus breaks down into 2 or more lighter ones.	① 2 lighter nuceles Combine to form heavier nucleus.
② Can take place at all temperature.	② Can take place only at very high temperature.
③ It needs minimum amount of fuel.	③ There is no minimum limit of fuel.
④ Products of fission are Radioactive	④ Products are not radioactive.

NUCLEAR HAZARDS -

① Somatic effects - Involves damage to body cells.

② Genetic effects - Involves damage to genes of affected person.

Parts of Nuclear reactor -

① Moderator - It slows down speed of released neutron in a nuclear reactor.

② Coolant - It is a substance which is circulated through nuclear reactor to take away heat produced.

③ Control rods - It is made of Cadmium or boron.
Used to regulate the number of neutrons in the reactor.