Sources of Energy

Energy is the capacity of a body for doing work. Energy stored in a body or a system is equivalent to total work done by the body till whole of its energy has been completely exhausted. Energy can be converted from one form to another.

Sources of Energy

We have a side range of sources of energy such as the sun, the wind, the earth (geothermal) flowing water, coal, gasoline, diesel, natural gas, biogas, etc., at our disposal. We utilize this energy to perform a wide range of activities, i.e., industrial, commercial, household, etc,

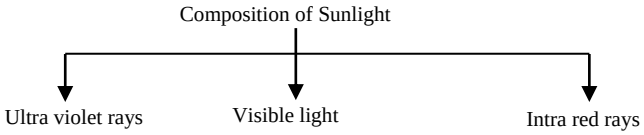
(a) Types of sources of energy:
There are two types of sources of energy.
(i) Renewable sources of energy (or non-conventional sources of energy):
The sources of energy which are in constant supply to us by nature and are inexhaustible are known as renewable sources of energy.
Eg.: the sun (solar energy), oceans, tidal energy, wind energy, running water energy, wood, geothermal energy etc.
(ii) Non-renewable sources of energy (or conventional sources of energy) :
The sources which can't be use again and again and are exhaustible are known as non-renewable sources of energy.
Eg.: Coal, natural gas, petroleum, fossil fuels etc.

(b) characteristics of a source of energy:
For a good source of energy, following conditions must be fulfilled by it:
(i) It should provide large amount of useful energy.
(ii) It must be easily storable in small space.
(iii) It must be easily transportable.
(iv) It must provide the energy in regular manner.
(v) It should be convenient to use.

Solar Energy

The sun is the primary source of energy for all living beings on the earth. It provides all of us heat and light. The energy generated by the sun is the result of reaction called nuclear fusion, occurring continuously in the interior of the sun. Hens Bethe, a physicist proposed that the enormous release of energy from the sun is due to the fusion (combination) of four Hydrogen atoms to yield a single helium atom $({}^{4}_{2}He)$. For this discovery in 1967 he was awarded the Noble prize in physics. The sum emits energy in all direction in space.
Solar energy is trapped by plains, plateaus, mountains, rivers, takes, oceans and ponds. Plants use solar energy to manufacture food by photosynthesis and also solar energy is the source of wind storms, rain, and show fall and ocean waves.

(a) Composition of solar energy (sunlight):



(i) Ultra-violet rays:
The invisible rays whose wavelength is shorter than that of the visible violet light are called ultra-violet rays. We can direct these rays by using a photographic film of a fluorescent paper because they darken the photographic film just like ordinary light rays. They are used to kill bacteria in food stuff and drinking water. Too much ultra-violet radiation is dangerous for our health due to its ionizing effect and can cause skin cancer.

(ii) Visible light:
The rays whose wavelength range from 400 nm (in violet) to 700 nm (in red) is the visible light. The visible part of the sunlight consists of seven different wavelength, each wavelength corresponding to a different colour. Thus the visible part of the sunlight consists of seven different colours.

(iii) Infra-red rays:
The invisible rays whose wavelength is longer than that of the visible red light are called infra-red rays. They can heat the object on which they fall. About one-third of the solar energy consists of infra-red rays. They can be detected by its heating effect, by using a thermometer. Every hot object emit infra-red rays. They are used to get relief from bodyaches.

(b) Uses of solar energy:
(i) Solar cooker absorb solar energy and cook food.
(ii) solar water heaters are used for heating water.
(iii) Solar cell convert solar energy into electricity to run watches, calculators and in spaceships for various experiment.
(iv) Solar energy is absorbed by green plants to make their food by photosynthesis.
(v) Solar energy is used for drying clothes and food grains.
(vi) Solar energy is used for making salt from sea water.

(c) Advantages of solar energy:
(i) It is inexhaustible and renewable as it is produced continuously in the core of sun by nuclear fusion of H-atoms.
(ii) Its quantity is unlimited and is available in all parts of the world in abundance.
(iii) It does not cause any pollution.
(iv) It can be upt to practical appliances.

(d) Limitations of solar energy:
(i) It is not available at night.
(ii) It is not available uniformly in all parts of world.

(iii) Solar energy received by the earth is quite diffused and in scattered form and hence only a part of it is utilized.
(iv) it is not available at constant rate due to clouds, fog, mist, haze, winds etc.

(e) Direct and indirect harnessing (or collection) of solar energy:
(i) Direct utilization of solar energy can be done by collecting the heat radiation on reflecting these by plane mirrors on to black boxes containing uncooked food (in solar cooker) and for heating water in solar heaters. These rays can be converted into electrical energy as in solar cells.
(ii) Indirect utilization of solar energy can be done by first converting solar energy into chemical energy as in biomass of plants. Heat energy of sun can be utilized in sea waves (ocean thermal energy) and onto energy of winds etc.

(f) Solar heating devices:
If is a device which can collect and store heat obtained from solar energy. It is used for heating and cooking purposes. Solar heating devices are designed in such a way so that these can make maximum utilization of solar heat radiations. It is done by adopting following procedure:

(A) Concentration of solar energy by using reflectors:
For moderate heating sun rays are reflected by using plane mirrors, as in solar cookers and solar water heaters. For high temperature, sun's energy is concentrated using concave mirrors as reflectors.

(B) Black paint:
Since black bodies are good absorbers as well as good radiators of heat, hence black paint is used to absorb and store heat radiations in large quantity by using large surface area.

(C) Glass-sheet cover:
Glass sheet cover is used to protect the hot infra red rays of solar energy from escaping the body of black box. It allow the IR radiations (of shorter wavelength) to enter the box of solar heating device and do not allow IR radiations (of longer wavelength) to escape from the solar heating device. Hence more heat is retained by solar heating device for long time.
(i) Solar cooker:
It is a heating device in which heat radiations of sun are used for cooking food in homes.
Principle: Its working is based on the principle of "Green house effect" by making use of the property of glass which allow high energy (lower wavelength) IR rays to pass on to black box absorber but does not allow low energy (higher wavelength) IR rays to go out of box. Hence, heat rays are entrapped inside the box, thus raising its temperature.

- It consist of insulated materials which is painted black from inside, plane mirrors as reflectors and has a glass cover on the top. Metal containers used for cooking are also painted black from outside and kept in the box covered with glass sheet.
  Sun's rays falling on reflectors reflect the rays on to the containers after passing through glass sheet. More and more sun rays get entrapped inside the box and its temperature rises to $100\text{-}150^0$ C. therefore solar cooker is used for cooking rice, dat and vegetables.

(ii) Solar water heater: It is used to heat water by making use of solar radiation and is based on the same principle as that of solar-cooker.

- It consists of a box made of insulated materials, but has a copper coil painted black from outside attached to it on its outer surface. The water circulated through the pipe absorbs solar energy and becomes hot. A solar water heater provides hot water for bathing and cooking.

NOTE: A solar heater can also be used to heat air. The hot air so obtained can be used for drying grains, vegetables, fruits and other materials. Such a device is known as solar dryer.
(iii) Solar cells:
It is used to convert solar energy into electricity.

- Solar cells are made up of semiconductors like germanium, silicon and gallium. When sunlight falls on the P-N junction of semiconductor then the potential difference of the order of 0.5 volt is developed. Solar cells are used in watches, calculators and are used to generate electricity in satellites. They are also used in traffic lights and for the transmission of radio and television programmes from remote areas.
- A group of cell is called a solar cell panel. A solar cell panel contain a large number of solar cells joined together in a definite pattern. A solar cell panel can provide much more electric power than a single solar cell.

Wind Energy

- Wind energy is the energy produced by fast moving winds. The sun is responsible for the generation of this form of energy. It is produced by the uneven heating of the earth's surface by the sun.
- Wind energy is the kinetic energy which can be converted into mechanical and electrical energies. Wind is a renewable source of energy because wind energy can continuously be produced as long as the sun shines on the earth
- The speed of the wind increases with height, being highest in hilly areas. Wind speed is also greater over the sea and in coastal areas, Wind energy is used for running windmills.
- India has the fifth largest wind power installed capacity in the world. The coastal states of Gujarat, Tamil Nadu, Maharashtra and Orissa are better placed in regard to wind energy, as constant speeds above 10 Km/h are prevalent over coastal regions of these states.

(a) Cause of wind:
Since equatorial regions are much hotter due to normal incidence of sun rays in abundance, hence air gets very hot in these regions, rises up and cold air from Polar Regions rushes towards the equatorial region to replace the hot air. Further, due to rotation

of earth about its axis as well as about the sun causes continuous disturbances in air and makes the air to blow. Hence solar energy is the cause of wind energy.

(b) Practical devices making use of wind energy:

(i) Sail boat

Wind mill:

- A wind-mill is a machine which works with the energy of blowing air or wind.
- The windmills can be utilized to grind grains, to pump water or to generate electricity. Electricity produced by single windmill, is quite small and cannot be used for commercial purposes. Therefore, a number of windmills are erected over a large area, this is known as a wind energy farm.
- The energy output from all windmills are couplet together to get electricity on a commercial scale. Wind mill is used to generate electricity.

Wind generator: The wind mill used to generate electricity is called wind turbine and the complete set up of generating electricity be using wind energy is called wind generator.

Principle: It is based on the principle that the wind rotates the blades of a wind turbine. When the wind turbine rotates, it starts rotating the coil (or armature) of the generator and hence generates electricity.

The wind required for generating electricity should be strong and steady to maintain the desired level of generation. The minimum wind speed necessary for satisfactory working of a wind generator is about 15 Km/hr. The wind power potential of India is 45195 MW. At present, we are generating more than 12875 MW of electricity from wind energy. The largest wind energy farm has been established near Kanyakumari in Tamil Nadu, which can generate 380 MW of electricity.

Hydro Energy

Flowing water having a lot of kinetic energy can be utilized as hydro energy. Hydro energy can be stored by storing water in high altitude dams. Hence it is a renewable source of energy. Solar energy is the source of hydro energy. Hydro energy is used to grind crops, to irrigate fields and to transport logs of wood from remote areas. Energy trapped in flowing water is used to generate electricity on a large scale at hydroelectric power station. Dams need to be constructed to utilize the kinetic energy of flowing water. The water stored in dam is made to fall from a height through pipes and made to run over the blades of huge turbines at the bottom. This moves the turbine which in turn rotate the coils of an electrical generator to produce power or electricity.

Tidal Energy

It is the energy generated in oceans and seas when the tides rise and fall. Tides are caused due to a combination of the gravitational forces between the earth, the moon one the sun. These waves of water (i.e. high and low tides) are rich in kinetic energy which can be utilized to turn turbines located in dams, to generate electricity. Dams are built across a narrow opening of the sea, to harness tidal energy for the production of electricity.

Geothermal Energy

- The heat energy in the interior of the earth is called geothermal energy. It is a renewable source of energy. It has no relation with the solar energy directly or indirectly.
- The interior of the earth is very hot and the temperature is high enough to melt the rocks present in this zone of the earth. These molten rocks, collectively called magma. These molten rocks rise up from the earth's interior and settle at a relatively shallower depth below the surface of the earth due to changes occurring within the earth. The water that comes in contact with these hot regions gets converted into steam and gets trapped between the rocks, under pressure.
- The steam compressed under pressure forces out hot water in form of natural geysers. The steam trapped in the earth is used to rotate the turbines to generate power.

Biogas

- The chemical energy stored in different parts of green plant during photosynthesis is called biomass.
- When biomass is subjected to decomposition in the absence of air yields biogas, which is used as a fuel. The decay of garbage, cowdung, sewage and plant residue in the absence of air produces gas. Biogas is a mixture of methane, carbon dioxide and hydrogen sulphide. It is prepared by the anaerobic decomposition of biomass in the plants. These plants are of two types:

(i) Fixed domed type biogas plant:

(ii) Floating gas-holder type biogas plant:

- In these plants along with biogas a by product called slurry, rich in nitrogenous and phosphorous compound is produced and it is used for manuring the fields.
- Biogas is used to produce electricity and as a household and industrial fuel. It is a clean fuel and does not leave any residue.

Fuel and its Types

A fuel is a chemical which releases energy, when heated with oxygen. The energy may release in the form of heat of light.

Eg. : Wood, gas, petrol, kerosene, diesel, coal and animal waste.

- **Note :** Fuels are combustible substances.

(a) Calorific value of a fuel:

The amount of heat energy liberated by 1g of the fuel when it is burnt completely is called the calorific value of the fuel. It is expressed in terms of

Calorie/gram or Joules/gram. Higher the calorific value better the fuel.

(b) Characteristics of a good fuel :

(i) A good fuel is cheap and easily available.
(ii) A good fuel is easy to store, transport and handle.
(iii) A good fuel has a high calorific value, but a low ignition temperature.
(iv) A good does not produce toxic fumes or smoke.
(v) A good fuel does not leave behind any residue.

(c) Fossil fuels :

Fossil fuels may be solid, liquid or gaseous. They are formed from the remains of plants and animals that lived and died millions of years ago.
eg.: coal, petroleum, natural gas etc.

(d) Types of fuels:

There are three types of fuels solid fuels, liquid fuels & gaseous fuels.

(i) Solid fuels :

The various kinds of solid fuels are wood, charcoal, coke, coal, paraffin and tallow. Wood was the first solid fuel to be used by humans. Paraffin and tallow are used to make candles,

(ii) Liquid fuels:

Petrol, kerosene, diesel and methanol are some common liquid fuels. Most liquid fuels are obtained from petroleum. They leave no solid residue when burnt and can be stored easily,

(iii) Gaseous fuels:

Natural gas, coal gas, producer gas, water gas and liquefied petroleum gas are some examples or gaseous fuels.

Solid Fuels

(a) Wood:

Wood is burnt as fuel in traditional chullahs for domestic purposes.

(b) Charcoal:

Charcoal is produced by heating the source material in the absence of air and is named after the source from which it is obtained. There are three types of charcoal, namely, wood charcoal, animal charcoal and sugar charcoal, Out of these it is the wood charcoal which is mainly used as a source of energy.

(c) Coke :

It is a grayish-black, hard solid and is prepared by the destructive distillation of coal. It is used as a fuel in boilers and in steam engines.

(d) Coal :

Coal is a combustible, black sedimentary rock composed predominantly of carbon. It is formed of plant matter that accumulated at the bottom of the earth millions of years ago.
Since coal is formed from dead organic matter, it contains the elements carbon, hydrogen and oxygen. Apart from these elements it may also contain nitrogen, phoshorus and sulphur. In India, the states rich in coal are Jharkhand, West Bengal, Orissa and Madhya Pradesh.

- The different types of coal with varying carbon content are: Peat, lignite, bituminous and anthracite.
- Peat has the lowest percentage of carbon and is the inferior form of coal. Bituminous is the most common form of coal. It is also known as the household coal and produces more heat than peat. Anthracite is the purest form of coal with the highest carbon content and is of superior quality.

Liquid Fuels

Petroleum:

Petroleum is a versatile form of energy. It is also known as black gold. It is an oily mixture of hydrocarbons in their crude form, so it is also called crude oil. Petroleum is a fossil fuel formed by the decomposition of plants and animals matter buried under the earth millions of years ago. It occurs deep under the earth between layers of non-porous rocks. Oil deposits are found under ocean beds due to the conversion of dead marine animals and plants. Natural gas usually occurs above a layer of petroleum. The biggest oil fields are located in Saudi Arabia and Kuwait.

(i) Petroleum mining:

Petroleum is obtained by drilling holes into the earth's crust. When oil wells are drilled, natural gas comes out first through the rocks with great pressure, followed by crude oil. After the pressure subsides, crude oil can be mechanically pumped out of the oil wells.

Fraction	Boiling point range	Number of carbon atoms in chain	Uses
Refinery gas dissolved in the oil	Less than 40^0C	1-4	Fuels, e.g., gas.
Petrol and naphtha	40^0C-170^0C	4-12	Fuel for cars, chemicals for plastics and in sacticides.
Kerosene	150^0C-240^0C	9-16	Paraffin, jet fuel
Diesel oil	220^0C-250^0C	15-25	Fuel for lomes
Lubricating oils	250^0C-350^0C	20-70	Polishes and waxes, oil for machinery
Fuel oil	Above 350^0C	Around 60	Fuel for ships and power stations.
Bitumen	Solid	Around 60	Tar for roads, weather proofing materials

Gaseous Fuels

(a) Natural gas:

It is obtained along with petroleum. Its essential ingredients are methane, ethane, propane, butane, carbon dioxide, nitrogen and oxygen. 85-90% of it is methane. It is the cheapest available gaseous fuel with high calorific value, i.e. 55 KJ/g. It is a smokeless fuel which is clean (non-polluting) and can be supplied directly for domestic and industrial use.

Note: Compressed natural gas can be used as an alternative to gasoline and diesel for running public transport vehicles. Burning of compressed natural gas, does not produce or produces negligible amounts

of pollution-causing nitrogen and sulphur oxides or particulate matter.
Natural gas is an efficient domestic and industrial fuel.

(b) Petroleum gas:

It consist of ethane, propane and butane. The collective mixture of ethane, propane and butane is called petroleum gas. It can also be produced by heating petrol. In petroleum gas, butane is the major component. When the mixture of ethane, propane and butane is pressurized it turns into a liquid. This makes the mixture very useful as a fuel, for liquids are much easier to package and carry around than gases. It is stored in iron cylinders and marketed as Liquefied Petroleum Gas (LPG).
A domestic cylinder contains 14.5 kg of LPG and when the knob of the regulator is turned on, it comes out with pressure and changes to vapours. The leakage of gas from the cylinder, the gas pipe or a gas stove is detected through a foul smell. The contents of the mixture forming LPG are odourless but a compound called ethane thiol. Containing the mercaptan group – SH (C2H2SH), is added while filling the cylinders with LPG as its smell helps detect leakage. Thus, the foul odour of LPG is not of LPG but of ethane thiol.
Liquefied petroleum gas is a clean fuel with a high calorific value (50 KJ/g). It is easy to store and transport and on burning it does not produce any toxis gases.

Nuclear Energy

Nuclear energy is the energy stored in the nucleus of an atom. It is the central portion of the atom where the whole mass is concentrated.
Nuclear energy is produced during the following two reactions:-

(a) Nuclear fusion:

The reaction in which lighter nuclei fuse (or combine) to form a heavier nucleus accompanied by the release of a tremendous amount of energy is known as nuclear fusion. The energy release in nuclear fusion is more as compare to that in nuclear fission.
Eg:- (i) the release of solar energy from the sun. Sun gets energy from the nuclear fusion of hydronen atoms to form helium nuclei at a very high temperature and pressure in its interior.
(ii) Hydrogen bomb is also based on the phenomenon of nuclear fusion.

(b) Nuclear fission:

The phenomenon of splitting of heavy nucleus into smaller nuclei is known as nuclear fission and is followed by the release of a tremendous amount of energy in the form of heat. Nuclear fission was first observed when a Uranium atom was seen split into two smaller nuclei as it was hit by a neutron. On splitting, Uranium releases three fast moving neutrons along with two smaller atoms to split. The process continues and may result in a series of reaction involving the continuous splitting of Uranium atoms and this process in known as chain reaction (reaction in which the substance which initiates the reaction also form during the reaction).

Chain reactions are of two types:

(i) Uncontrolled chain reaction:

When the chain reaction of Uranium is not controlled, then large amount of energy released is also uncontrolled and this reaction may be used in Atom-Bomb which on exploding causes vast damage to the man kind.

(ii) controlled chain reaction (Nuclear power plant):

Nuclear fission if carried out in a controlled manner, is a source of energy which can be utilized for constructive purposes like generation of power of electricity. Such a controlled reaction is brought about in nuclear reactor. Control rods made of boron or cadmium control the chain reaction in a nuclear reactor. These rods absorb the neutrons and slow down the reaction releasing energy more gradually. Moderator is used to slow down the speed of neutrons to carry nuclear fission effectively. Graphite, heavy water, the coolant absorb heat energy from inside the reactor and releases the heat to water, which in turn absorbs the heat and gets converted to super heated steam to run turbine. Liquid sodium, heavy water, Co2, He or air may be used as coolant. Beryllium is used as a moderator. The released energy in nuclear power plants heat up water to produce steam. The steam produced sets turbines into motion and electricity is generated. In our country we have nuclear power stations at Kalpakkam, Natota, Kota and Tarapur.

❖ The six main nuclear power stations in India are following:
(1) Tarapur situated on the borders of Maharashtra and Gujarat.
(2) Rawatbhata situated near Kota in Rajasthan.
(3) Kalpakkam situated near Chennai in Tamil Nadu
(4) Narora in Uttar Pradesh.
(5) Kakrapara in Gujarat.
(6) Kaiga in Krnataka

Energy and Technology Development

Our energy needs have been increasing at a tremendous pace due to two main reasons. One of them is the increase in population. The other more important reason is that as we progress and develop new technologies, we need more energy to run new factories, and to power the new gadgets made by the use of the new technologies. For example, the tremendous development in the field of computers in the last few years has meant that computers are now widely used in factories, offices, shops and homes. Manufacturing and using these billions of computers uses huge amount of electrical energy. Some areas in which energy consumption has increased several times are as follows.
(i) Manufacturing goods in factories uses up huge amount of energy.

(ii) In agriculture, energy is needed for running tube-wells, tractor and other machines.
(iii) Food processing and storage of food in cold storage houses uses up huge amounts of energy.
(iv) Means of transport require large amounts of energy in the form of fuels of electricity.
We use much more energy at home today due to the increased number of electrical gadgets, such as refrigerator, air conditioners, washing machines, etc. Electricity is the major source of energy today. The use of electrical energy has shown a tremendous surge in the past few decades. However, electrical energy is not a natural source of energy and, as we have seen in this chapter, is produced in many ways-both by conventional and by non-conventional sources of energy. Setting up new generation plants is very expensive and time consuming.
In India today, the supply of electrical energy is far lower than our requirements. That is why we suffer power cuts. Several of our villages do not have access to electricity. In several other villages where electricity is available, the supply is insufficient and unreliable. This affect us in several ways. Our food production suffers, as sufficient electricity for proper irrigation is not available. Our industrial production suffers, as factories cannot run full time. Shortage of electricity also limits the use of new technologies for development. All this affects the development of our country.

Impact of Energy Consumption on Environment

The increasing energy consumption has a harmful impact on the environment.
Burning of carbon-containing fuels releases ash and the particles of unburnt carbon in the air. These fine particles, called SPM (Suspended Particulate Matter) are dangerous pollutants.
Combustion of fuels adds carbon dioxide to the environment. A percentage increase in carbon dioxide in the air leads to the greenhouse effect, which can cause global warning. This can result in melting of the polar ice caps and rise in sea levels, leading to flooding of large portions of land on the sea coasts.
Carbon monoxide is produced when fuels containing carbon burn in sufficient supply of sir and is a very dangerous pollutant.
Coal contains sulphur, which produces sulphur dioxide on burning. Besides being a poisonous gas, it dissolves in rain to form sulphuric acid. This gives rise to acid rain, which is very harmful for soil, crops, buildings etc.
The oxides of nitrogen given off from exhausts of engines of vehicle are poisonous gases. Many vehicles now use catalytic converter to convert these poisonous gases to harmless gases.
Lead compounds are released in exhausts of vehicles. They are poisonous. Increasing use of unleaded petrol is expected to reduce lead pollution.
The other effects on the environment are as follows:
(i) Oil spills from oil tankers transporting petroleum have resulted in lots of pollution in the sea leading to the death of a large number of aquatic animals.
(ii) Dams constructed over rivers to produce hydroelectricity cause large areas of land to get filed up with water. This displaces several people from their homes, and leads to the destruction of habitats of a large umber of animals. Besides this, dams increase the chances of earthquakes.
(iii) Extremely dangerous radiation pollution can be caused by nuclear power plants. An accident in such a plant can lead to radiation pollution over a vast area.
(a) Preventing an energy crisis:
As our energy needs increase at a tremendous pace, an energy crisis in the near future is a distinct possibility. The steps we need to take to prevent this is to use energy judiciously.
(b) Using energy judiciously:
Judicious use of energy implies two things.
(i) Not wasting energy:
Switching off lights, fans, etc. when not in use.
Using room coolers, air conditioners, room heaters, geysers, etc. only when needed.
Reducing the flame while cooking and once the water starts boiling saves fuel.
(ii) Using methods where energy spent is less:
Using CFLs and tubelights, which use less energy, instead of bulbs.
Using public transport instead of private vehicles as much as possible, walking or cycling along small distances.
Using pressure cookers for cooking.
Using efficient smokeless chulhas in houses where kerosene, coal or wood is used for cooking.
Reducing cooking time by soaking pulses for sometime before cooking, and keeping vessels covered while cooking.
Judicious use of energy has two main advantages:
(A) It well delay the energy crisis.
(B) It well give our scientists more time to develop more efficient alternate sources of energy.

EXERCISE

1. Electeical energy can be produced form:
(A) mechanical energy (B) chemical energy
(C) radiant energy (D) All of the above

2. The heat energy from hot rocks present inside the earth is known as :
(A) solar energy (B) wind energy.
(C) tidal energy (D) geothermal energy

3. The compressed natural gas (CNG) mainly consists of:
(A) methane (B) butane
(C) hydrogen (D) propane

4. Solar, biomass, geothermal, wind and hydropower energy are all renewable sources of energy. They are called renewable because they:
(A) are clean and free to use
(B) can be converted directly into heat and electricity
(C) can be replenished by nature in a short period of time
(D) do not produce air pollution

5. In biogas, which gas is present in maximum amount:
(A) Carbon dioxide (B) Methane
(C) Hydrogen (D) Oxygen

6. Biogas is produced from biomatter by :
(A) anaerobic fermentation
(B) destructing distillation
(C) fractional distillation
(D) mixing petrol in biomatter

7. L.P.G. is mostly liquefied :
(A) hydrogen (B) oxygen
(C) butane (D) methane

8. In the process of nuclear fusion :
(A) Only heavy nucleus break into light nuclei
(B) Fusion of light nuclei takes place at normal temperature
(C) Fusion of light nuclei takes place at high pressure and low temperature
(D) Fusion of light nuclei takes place at high pressure and high temperature

9. In nuclear power station energy of uranium is used for producing :
(A) Electrical energy (B) Mechanical energy
(C) heat energy (D) Magnetic energy

10. Sun and stars get their radiation energy by:
(A) Fission process (B) Fusion process
(C) Disintegration process (D) Photo-electric effect

11. Atom bomb consists of pieces of 92U235 and a source of :
(A) proton (B) Neutron
(C) Meson (D) Electron

12. The nuclear fuel in the sun is :
(A) helium (B) uranium
(C) alpha particles (D) hydrogen

13. The cause of energy liberated in nuclear reaction is:
(A) change of potential energy onto kinetic energy
(B) Kinetic energy of resultant nucleus
(C) Energy equivalent to mass lost
(D) None of these

14. Which of the following converts sunlight into heat energy?
(A) Solar cooker (B) Solar cells
(C) Petroleum (D) LPG

15. The non-renewable source of energy is:
(A) water (B) wind
(C) biogas (D) petroleum

16. Best moderator for neutron is :
(A) beryllium oxide (B) pure water
(C) heavy (D) graphite

17. Producer gas is a mixture of :
(A) carbon monoxide and nitrogen gas
(B) carbon monoxide and hydrogen gas
(C) carbon monoxide and water vapour
(D) carbon monoxide and nitrous oxide

18. The process of fusion is used for constructing a/an :
(A) atom bomb (B) ordinary bomb
(C) hydrogen bomb (D) none of these

19. Most of the fuels are :
(A) carbon compounds with sulphur
(B) nitrogen compounds with carbon
(C) carbon compounds with hydrogen
(D) none of these

20. Which of the following source of energy is different from others ?
(A) Coal (B) Lignite
(C) Petroleum (D) Plants

21. Which of the following can't be used to make a solar cell?
(A) Silicon (B) Platinum
(C) Gallium (D) Germanium

22. Which of the following is not a form of oceanic energy?
(A) Energy from biomass (B) Tidal energy
(C) Ocean thermal energy (D) Solar energy

23. The group of solar cells joined together in a definite pattern is called a :
(A) Battery (B) Solar heater
(C) Solar cooker (D) Solar cell panel

24. In a nuclear fission, the nucleus of an element splits into two nuclei. The fission products have:
(A) the higher atomic number
(B) the lower atomic number
(C) the same atomic number
(D) the same mall number

25. What is the source of nuclear reactor?
(A) Coal fire (B) Nuclear fusion
(C) Nuclear fission (D) None of these

26. Energy released per gm or U-235 fission in comparison to 1 gm of fusion of hydrogen nuclei is :
(A) Greater (B) Smaller
(C) Equal (D) None of these

27. The source of electrical energy in artifical satellite is:
(A) Uranium
(B) Solar battery
(C) Thorium
(D) None of the above

28. Process of nuclear fission yield nuclear energy. In this process:
(A) light nuclei fuse to form heavier nuclei yielding large amount of energy
(B) nucleus of heavy atom splits into lighter nuclei simultaneously releasing large quantity of energy
(C) nucleus of light atom splits into lighter nuclei yielding large amount of energy
(D) hydrogen nuclei combine to form helium nuclei releasing large amount of energy

29. Match the items in the first column with the items in the second column

Column-I	**Column-II**
I. Coal	A. Hydroelectric power station
II. Water in a dam	B. Nuclear power station
III. Uranium	C. Thermal power station

Which of the following indicates the correct matching?
(A) I-C; II-A; III-B (B) I-C; II-B; III-A
(C) I-A; II-B; III-C (D) I-B; II-A; III-C

30. Which of the following statements is NOT correct?
(A) Winds are generated due to uneven heating of earth's surface.
(B) In the evening the wind flows from the land to the sea.
(C) Air flows from a region of high pressure to one of low pressure.
(D) Hot air rises up and cold air moves down

ANSWER – KEY

SOURCES OF ENERGY

Q.	1	2	3	4	5	6	7	8	9	10
A.	D	D	A	C	B	A	C	D	A	B
Q.	11	12	13	14	15	16	17	18	19	20
A.	B	D	C	A	D	C	A	C	C	D
Q.	21	22	23	24	25	26	27	28	29	30
A.	B	D	D	B	C	B	B	B	A	B