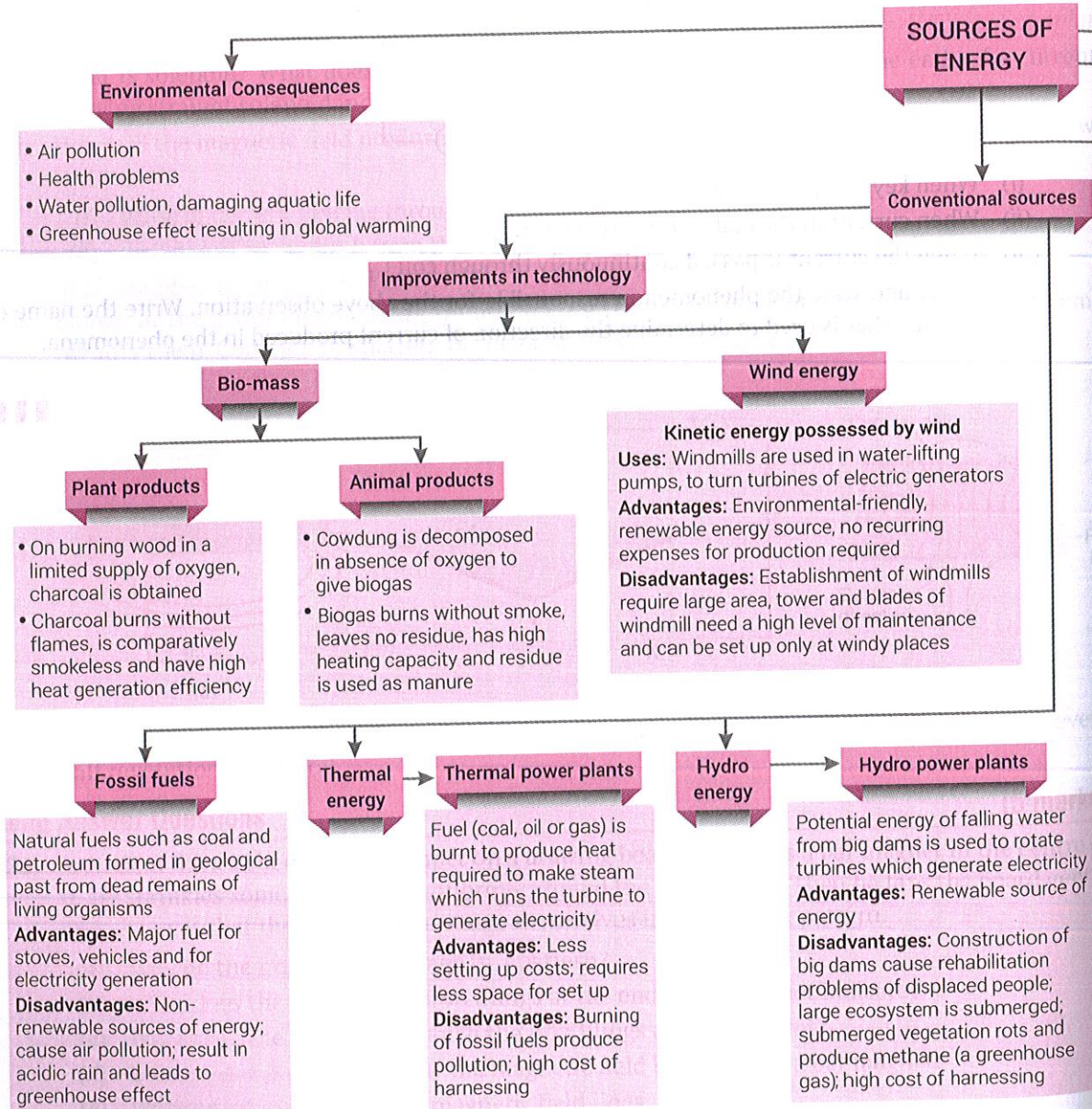


BASIC CONCEPTS – A FLOW CHART



Characteristics of a good energy source

- Easily accessible
- Does a large amount of work per unit volume or mass
- Easy to store and transport
- Economical

Non-renewable sources

Energy sources that once depleted cannot be regenerated. E.g., fossil fuels, nuclear energy, etc

Renewable sources

Energy sources that can be regenerated. E.g., solar energy, wind energy, etc

Non-conventional or alternative sources

Solar energy

Energy obtained from Sun in the form of infra-red, visible light and ultra-violet rays
Uses: Applied by devices like solar cookers, solar heaters, solar cells
Advantages: Renewable energy is used, pollution-free, very economical
Limitations: High cost of set up of solar cells; cannot be used in absence of sunlight

Nuclear energy

Energy released by bombarding the nucleus of a heavy atom with low-energy neutrons (nuclear fission)
Uses: The energy is used to produce steam which further generates electricity
Advantages: Large amount of energy obtained by a small amount of raw material
Limitations: Improper nuclear-waste storage and disposal result in environmental contamination, risk of accidental leakage of nuclear radiation, high cost of installation, limited availability of nuclear fuel (uranium)

Geothermal energy

Internal heat of Earth harnessed to generate electricity
Uses: Steam trapped in rocks is routed to turbines through pipes to generate electricity
Advantages: Low cost of production, renewable energy source
Limitations: Very few commercially viable sites available

Energy from sea

Tidal energy

Energy obtained due to difference in sea levels due to high and low tides; harnessed by constructing dams across a narrow opening to the sea
Uses: Turbine fixed at dam openings produce electricity
Advantages: A renewable energy source, pollution-free
Limitations: Locations for building dams is limited

Wave energy

Energy trapped from strong waves
Uses: Turbines are rotated for production of electricity
Advantages: Renewable energy source, pollution-free
Limitations: Only strong waves can be used

Ocean thermal energy

Energy obtained from the difference between temperatures of water at surface and depths
Uses: Surface water is boiled to vaporise a volatile liquid like ammonia which runs turbine of generator to produce electricity
Advantages: Renewable energy source
Limitations: A temperature difference of 293 K (20°C) is required between surface water and water up to 2 km depth

MORE POINTS TO REMEMBER

- ❑ **Sources of energy** are of two types:
 - **Conventional sources:** Sources which are being used since a long time. *E.g.*, fossil fuels, flowing water, etc.
 - **Non-conventional sources:** Sources whose use has recently started. *E.g.*, sun, tides, etc
- ❑ **Hydro power plant:** In order to produce hydro electricity, high-rise dams are constructed on the river to obstruct the flow of water and thereby collect water in larger reservoirs.
 - The water level rises and in this process the kinetic energy of flowing water gets transformed into potential energy.
 - The water from the high level in the dam is carried through pipes, to the turbine, at the bottom of the dam.
- ❑ **Advantages of biogas:**
 - Burns without smoke.
 - Leaves no residue.
 - Waste left in biogas plant is used as manure.
 - It is a renewable source of energy.
 - Good way of sewage disposal.
- ❑ **Solar cells:** Convert solar energy into electricity. A typical cell develops a voltage of 0.5–1 V and can produce about 0.7 W of electricity
- ❑ **Advantages of solar cells:** They have no moving parts
 - They require little maintenance.
 - They work quite satisfactorily without the use of any focusing device.
 - They can be set up in remote and inaccessible hamlets or very sparsely inhabited areas.
- ❑ **Disadvantages of solar cells:**
 - Availability of the special grade silicon for making solar cells is limited.
 - The entire process of manufacturing is still very expensive.
 - Silver used for interconnection of the cells in the panel further adds to the cost.

NCERT Intext Questions

Q. 1. What is a good source of energy?

- Ans.** A good source of energy is
- (i) one which would do a large amount of work per unit volume or mass.
 - (ii) which is easily accessible.
 - (iii) which is easy to store and transport; and
 - (iv) perhaps most importantly, economical.

Q. 2. What is a good fuel?

- Ans.** A good fuel is one which
- (i) produces more heat per unit mass. It has high calorific value.
 - (ii) produces less harmful gases on combustion.
 - (iii) is cheap and easily available.
 - (iv) is easy to handle, safe to transport, and convenient to store.

Q. 3. If you could use any source of energy for heating your food, which one would you use and why?

- Ans.** We would use a microwave oven for heating the food as it heats uniformly and clearly without any loss in its nutritional value.

Q. 4. What are the disadvantages of fossil fuels?

- Ans.**
- (i) The fossil fuels are non-renewable sources of energy. If we were to continue consuming these sources at such an alarming rate, we would soon run out of energy.
 - (ii) Air pollution is caused by burning fossil fuels.
 - (iii) The oxides of carbon, nitrogen and sulphur that are released on burning fossil fuels are acidic oxides. These lead to acid rain which affects our water and soil resources.
 - (iv) Carbon dioxide produced by burning these fuels produces greenhouse effect.

Q. 5. Why are we looking at alternate sources of energy?

- Ans.** We are looking at alternate sources of energy because
- (i) the fossil fuel reserves in the Earth are limited which may get exhausted soon, if continued to be used at the current rate.
 - (ii) the use of alternate sources of energy will reduce the pressure on fossil fuels making them last for a much longer time.
 - (iii) the pollution being caused by the burning of fossil fuels can be avoided by using alternate sources of energy.

Q. 6. How has the traditional use of wind and water energy been modified for our convenience?

- Ans.** The traditional use of wind has been modified by using windmills and that of water by constructing hydroelectric power plants.

Q. 7. What kind of mirror—concave, convex or plain would be best suited for use in a solar cooker? Why?

- Ans.** A concave mirror would be best suited for use in a solar cooker. When a concave mirror reflector is attached to a solar cooker, it converges a large amount of Sun's heat radiations at its focus due to which a high temperature is produced around the focus area.

Q. 8. What are the limitations of the energy that can be obtained from the oceans?

- Ans.** The limitations of the energy that can be obtained from the oceans (tidal energy, wave energy and ocean thermal energy).
- (i) Tidal energy is not likely to be a potential source of energy in the future because there are very few sites around the world which are suitable for building tidal dams.
 - (ii) Wave energy would be a viable proposition only where waves are very strong.
 - (iii) The energy potential from the sea (tidal energy, wave energy and ocean thermal energy) is quite large, but efficient commercial exploitation is difficult.

Q. 9. What is geothermal energy?

- Ans.** Heat energy from hot molten rocks present inside the Earth under certain favourable conditions created by natural process is known as geothermal energy. This form of energy is the only type of energy which do not use solar energy.

Q. 10. What are the advantages of nuclear energy?

- Ans.**
- (i) It produces huge amount of energy from very small amount of a nuclear fuel.
 - (ii) It does not produce gases like carbon dioxide which contribute to greenhouse effect or sulphur dioxide which causes acid rain.
 - (iii) Once the nuclear fuel is loaded into the reactor, the nuclear power plant can go on producing electricity for two to three years at a stretch. Hence, there is no need for putting in the nuclear fuel again and again.

Q. 11. Can any source of energy be pollution-free? Why or why not?

- Ans.** No, any source of energy cannot be pollution-free. Exploiting any source of energy disturbs the environment in some way or the other. Only the degree and manner of pollution varies. In some cases, the actual operation of a device like the solar cell may be pollution-free, but the assembly of the device would have caused some environmental damage.

Q. 12. Hydrogen has been used as a rocket fuel. Would you consider it a cleaner fuel than CNG? Why or why not?

Ans. Hydrogen is a cleaner fuel than CNG because the burning of hydrogen produces only water, which is completely harmless. The burning of CNG produces carbon dioxide and water. This CO_2 can produce greenhouse effect in the atmosphere and lead to the excessive heating of the environment in the long-run.

Q. 13. Name two energy sources that you would consider to be renewable. Give reasons for your choices.

Ans. (i) Wind energy (ii) Solar energy
These sources of energy can be used again and again, endlessly. They will never get exhausted.

Q. 14. Give the names of two energy sources that you would consider to be exhaustible. Give reasons for your choices.

Ans. (i) Fossil fuels (ii) Nuclear fuels
Fossil fuels are present in a limited amount in the Earth. Once exhausted, they will not be available to us again. It takes millions of years for fossil fuel to be formed.
The nuclear materials which can be conveniently extracted from the Earth are limited and hence, they will get exhausted one day.

NCERT Exercises

Q. 1. A solar water heater cannot be used to get hot water on

- (a) a sunny day (b) a cloudy day (c) a hot day (d) a windy day

Ans. (b) A cloudy day

Q. 2. Which of the following is not an example of a bio-mass energy source?

- (a) Wood (b) Gobar-gas (c) Nuclear energy (d) Coal

Ans. (c) Nuclear energy

Q. 3. Most of the sources of energy we use represent stored solar energy. Which of the following is not ultimately derived from the Sun's energy?

- (a) Geothermal energy (b) Wind energy (c) Fossil fuel (d) Bio-mass

Ans. (a) Geothermal energy

Q. 4. Compare and contrast fossil fuels and the Sun as direct sources of energy.

Ans. (i) The reserves of fossil fuels are limited, *i.e.*, exhaustible whereas solar energy is available in abundance (and that too without cost), *i.e.*, inexhaustible.
(ii) Fossil fuels cause pollution on burning whereas solar energy is pollution-free.
(iii) Fossil fuels can provide energy at any required time whereas solar energy becomes unavailable when the sky is covered with clouds.

Q. 5. Compare and contrast biomass and hydroelectricity as sources of energy.

Ans. (i) Biomass is a renewable source of energy only if we plant trees in a planned manner which is not the case with hydroelectricity.
(ii) The energy from bio-mass can be obtained by using a *chulha* or a *gobar gas* plant whereas hydroelectricity requires construction of dams on rivers.
(iii) Biomass provides pollution-free energy only when converted into bio-gas whereas hydroelectricity is totally pollution-free.

Q. 6. What are the limitations of extracting energy from

- (i) the wind (ii) waves (iii) tides

Ans. (i) (a) It is not available at all times.
(b) It requires a very large area of land.

(c) It is not possible to have a windmill everywhere as to run it, the minimum wind speed of 15 km/hr is required (only possible in open areas like the seaside).

(ii) (a) Wave energy would be a viable proposition only where waves are very strong.
(b) It is costly to set up devices to trap wave energy.

(iii) (a) Very few sea coasts in the world have suitable sites for the purpose of harnessing tidal energy.
(b) The rise and fall of tides happen only twice in a day and is not sufficient to generate electricity continuously.

Q. 7. On what basis would you classify energy sources?

(i) Renewable and non-renewable

(ii) Exhaustible and inexhaustible

Are the options given in (i) and (ii) the same?

Ans. We would classify energy sources as (i) renewable and non-renewable.

Renewable sources of energy are **inexhaustible**; whereas **non-renewable sources** of energy are **exhaustible**. Thus, the options in (i) and (ii) are the same.

Q. 8. What are the qualities of an ideal source of energy?

Ans. An ideal source of energy has the following qualities:

(i) It gives us more heat per unit mass.

(ii) It does not pollute the air on burning by giving out smoke or harmful gases.

(iii) It should be cheap and easily available.

(iv) It should be easy to handle and safe to transport.

Q. 9. What are the advantages and disadvantages of using a solar cooker? Are there places where solar cookers would have limited utility?

Ans. Solar cookers have limited utility at places which remain cloudy or have longer winters; *e.g.*, hilly areas.

Advantages of using a solar cooker:

(i) It cooks food without causing any kind of pollution.

(ii) It is economical to use solar cooker because nothing is to be paid for using solar energy.

(iii) It is easy to handle solar cooker and there is no chance of any kind of accident.

(iv) The nutrients in the food do not get destroyed.

Disadvantages of using a solar cooker:

(i) Solar cooker cannot be used at night and during cloudy weather.

(ii) It takes more time to cook food.

(iii) The direction of solar cooker is to be changed continuously towards the direction of the Sun.

(iv) Solar energy is not available uniformly all the time and at all the places.

(v) It cannot be used for making *chapatis* and for frying purposes.

Q. 10. What are the environmental consequences of the increasing demand for energy? What steps would you suggest to reduce energy consumption?

Ans. (i) Burning of fossil fuels to meet the increasing demand for energy causes *air pollution*.

(ii) Construction of dams on rivers to generate hydroelectricity destroys large ecosystems which get submerged under water in the dams. Further, large amounts of methane (which is a greenhouse gas) is produced when submerged vegetation rots under anaerobic conditions.

In order to reduce energy consumption:

(i) Fossil fuels should be used with care and caution to derive maximum benefit out of them.

(ii) Fuel saving devices such as pressure cookers, *etc.*, should be used.

(iii) Efficiency of energy sources should be maintained by getting them regularly serviced.

(iv) And last of all, we should be economical in our energy consumption as **energy saved is energy produced**.

VERY SHORT ANSWER QUESTIONS

[1 mark]

Q. 1. What type of reactions occur inside the Sun which produces solar energy?

Ans. The nuclear fusion reactions taking place inside the Sun produce solar energy.

Q. 2. Which of the following are renewable and which are non-renewable sources of energy?

Coal, wind, tides, Sun, petrol, biomass, CNG, hydro energy.

Ans. **Renewable sources:** wind, tides, Sun, biomass, hydro energy

Non-renewable sources: coal, petrol, CNG

Q. 3. Which part of Sun's energy is responsible for drying clothes and exposure to which part could be a health hazard?

Ans. Infra-red (IR) radiations are responsible for drying clothes and ultraviolet (UV) radiations could be a health hazard.

Q. 4. What type of energy is possessed by wind?

Ans. Kinetic energy

Q. 5. Though a hot iron emits radiations, yet it is not visible in the dark, why?

Ans. Hot iron emits infrared rays. These rays are invisible to the eyes.

Q. 6. What is bagasse?

Ans. Bagasse is the remaining part of the sugarcane from which juice has been extracted.

Q. 7. Define anaerobic degradation.

Ans. The decomposition which takes place in the absence of oxygen by anaerobic bacteria is called anaerobic degradation.

Q. 8. Name the main constituent of biogas.

Ans. The main constituent of biogas is methane (75%).

[NCERT Exemplar]

Q. 9. What is the minimum wind velocity required for obtaining useful energy with a windmill?

Ans. Minimum velocity required for obtaining useful energy with a windmill is about 15 km/h.

Q. 10. Name two forms of energy in which solar energy manifests itself in oceans.

Ans. (i) Tidal energy, and (ii) Ocean thermal energy.

Q. 11. Name any two materials that are used for making solar cells.

Ans. (i) Silicon, and (ii) Gallium or selenium.

Q. 12. What is the range of wavelength of electromagnetic waves that constitute visible radiation?

Ans. The range of electromagnetic waves is about 4000 Å to 7000 Å, which constitute visible radiation.

Q. 13. What steps would you suggest to help minimise environmental pollution caused by burning of fossil fuels?

Ans. (i) Use of smokeless appliances (ii) Afforestation

[NCERT Exemplar]

Q. 14. State the two forms of energy in which energy is mainly utilised at our homes.

Ans. (i) Heat energy, and (ii) light energy.

Q. 15. What are the different types of nuclear reactions?

Ans. There are two types of nuclear reactions:

(i) Nuclear fission (ii) Nuclear fusion.

Q. 16. Why does acid rain happen?

Ans. Acid rain happens because of burning of fossil fuels which release oxides of carbon, nitrogen and sulphur in the atmosphere.

Q. 17. What energy transformations occur in a hydro power plant?

Ans. In a hydro power plant potential energy possessed by stored water is converted into electrical energy.

Q. 18. What is a chain reaction?

Ans. A reaction in which the particle which initiates (starts) the reaction is also produced during the reaction to carry on the reaction further and further is called a chain reaction.

SHORT ANSWER QUESTIONS-I

[2 marks]

Q. 1. What is the use of the black painted surface in solar heating devices?

Ans. Black colour is a very good absorber of heat but a very poor reflector. So, it is used to absorb the maximum amount of heat from the sunlight. It is used in solar heating devices to maximise the absorption of heat and to minimise heat loss due to reflection.

Q. 2. Give an example of indirect harnessing of solar energy.

Ans. All green plants prepare carbohydrates from carbon dioxide and water in the presence of sunlight by the process of photosynthesis. All non-green plants and animals directly or indirectly consume food from the green plants (producers) and store this food in their bodies in the form of chemical energy. In other words, solar energy is transformed into chemical energy.

Q. 3. State the important uses of wind energy.

Ans. The wind energy is used:

(i) To generate electricity.

(ii) To grind the wheat in flour mills.

(iii) To run a pump to draw water from the ground.

Q. 4. Write two advantages of classifying energy sources as renewable and non-renewable.

Ans. (i) The classification helps us to decide which of the available energy sources need to be conserved to ensure their availability for future generations.

(ii) The classification helps us to look for alternative sources of energy like solar and wind energy. It has, therefore, accelerated the pace of development of technologies suitable for harnessing new sources of energy.

Q. 5. Why is tidal energy not likely to be a potential source of energy?

Ans. The tidal energy is not likely to be a potential source of energy because:

(i) Only few sites are available around the world which are suitable for building field barrages, and

(ii) The rise and fall of sea water during high and low tides is not enough to generate electricity on a large scale.

Q. 6. Why is it not possible to make use of solar cells to meet all our energy needs? State at least two reasons to support your answer.

Ans. (i) In the solar cells, the energy is obtained only during the day, when the Sun shines.

(ii) In the solar cells, the solar panel convert solar energy into electricity, which is stored in storage battery. The storage battery give the direct current but all the appliances are working by the alternating current, so first of all direct current is converted into alternating current by any suitable appliances before it can be used to run various devices. So, it increases the cost of using solar panels as the source of energy.

So, the solar cell is not used to meet all our energy needs.

Q. 7. How is nuclear energy generated during nuclear fusion?

Ans. During fusion, two nuclei of light element combine to form a heavy nucleus with the release of tremendous amount of energy. There is some loss of mass during fusion process which is transformed into tremendous amount of energy.

SHORT ANSWER QUESTIONS-II

[3 marks]

Q. 1. Firewood is a conventional fuel. List any four reasons for replacing it with alternate sources of energy.

- Ans.** (i) Wood has low calorific value as compared to other sources of fuel.
(ii) It causes air pollution on burning.
(iii) Cutting down of trees causes depletion of forest leading to imbalance in nature.
(iv) Only 8-10% energy of burning firewood is utilised and the remaining is wasted.

Q. 2. State two advantages and two disadvantages of geothermal energy.

Ans. Advantages:

- (i) The use of geothermal energy does not cause any pollution.
(ii) The use of geothermal energy is quite economical.

Disadvantages:

- (i) It is not available everywhere.
(ii) Deep drilling in the Earth to obtain geothermal energy is very difficult.

Q. 3. What is biogas? Why is biogas considered an ideal fuel for domestic use?

Ans. Biogas is a combustible mixture of methane (about 75%), carbon dioxide, hydrogen and hydrogen sulphide gas. It is obtained by anaerobic decomposition of human and animal excreta and agricultural and urban waste materials.

Biogas is considered an ideal fuel for domestic use because of the following reasons:

- (i) It has high calorific value.
(ii) It does not produce smoke.

Q. 4. Why is biogas a better fuel than animal dung cakes?

Ans. Biogas is a better fuel than animal dung cakes because:

- (i) Burning of animal dung cake causes lot of pollution whereas biogas is a smokeless fuel.
(ii) The calorific value of animal dung cake is much lower than that of biogas.
(iii) Animal dung cakes leave residue after burning whereas biogas leaves no residue.

Q. 5. What causes the wind to blow?

Ans. The Sun rays fall on the equatorial region more intensively than on any other part of the Earth. Thus, the hot air of equatorial region, being lighter, rises upwards and cooler air from polar region starts blowing towards the equator to fill the space vacated by hot air. This moving air is called wind. Therefore, Sun's energy causes winds on the Earth.

Q. 6. Give some uses and advantages of solar energy.

Ans. Uses:

- (i) For cooking food in a solar cooker.
(ii) For heating water in solar geysers.
(iii) For generating electricity in space satellites, calculators, watches, etc., by solar cells.
(iv) For generating electricity on a large scale by a solar power plant.
(v) To melt metals in solar furnaces.

Advantages:

- (i) It does not cause any pollution.
(ii) It is a renewable source of energy.
(iii) It is free of cost.

Q. 7. State the important uses of solar cells.

- Ans.** Solar cells are used
(i) for providing electricity in artificial satellites.

- (ii) for lighting the street lights, traffic signals, running television sets and radio sets in remote areas.
(iii) for providing electricity in lighthouses.
(iv) for operating electronic watches and calculators.

Q. 8. Explain solar cell panel.

Ans. A solar cell is a device which converts solar energy directly into electricity. A group of solar cells is called a solar cell panel. It consists of a large number of solar cells joined together in a definite pattern. It provides a lot of electric energy required by artificial satellites, water pumps, street lighting, etc. For joining the various solar cells in a solar panel, silver wires are used because silver metal is the best conductor of electricity having a very low resistance and which also increases efficiency.

Q. 9. Explain why only a small part of the solar energy that strikes the upper regions of atmosphere reaches the surface of the Earth.

Ans. When the solar energy falls on the top surface of the atmosphere then the following happens:

- (i) Some solar energy is reflected back into the space by the atmosphere, and
(ii) The atmosphere also absorbs a lot of solar energy; for example, most of the ultraviolet rays are absorbed by the ozone layer.

So, the solar energy which reaches us through the Earth's atmosphere are mainly in the form of heat rays (infra red rays) and visible light, which is a small part of the solar energy.

Q. 10. Why is charcoal considered a better fuel than wood? What are the disadvantages of converting wood into charcoal?

Ans. Charcoal is considered a better fuel than wood because:

- (i) It has high calorific value.
(ii) It does not produce any smoke.

Disadvantages:

- (i) 1 kg of wood on destructive distillation produces only 0.25 kg of charcoal making it an expensive fuel.
(ii) For production of charcoal, more and more trees would have to be cut down which causes deforestation and disturbs the ecological balance of the Earth.

Q. 11. Explain how the energy of flowing water is related to solar energy.

Ans. When solar energy falls on the water surface then evaporation of water from water surfaces like oceans, rivers and other water bodies takes place to form clouds. The clouds are then taken to distant places by air currents, and ultimately water comes back to the surface in the form of rain and snow. During evaporation, a part of solar energy gets converted into potential energy of water molecules. The potential energy of water molecules gets converted into kinetic energy during rain and snowfall.

Thus, energy of water flowing in a river is considered to be an indirect form of solar energy.

Q. 12. Mention any two advantages and two disadvantages of producing hydroelectricity by building dams on rivers.

Ans. Advantages:

- (i) The generation of electricity from water does not produce any environmental pollution.
(ii) Water energy is a renewable source of electric energy which will never get exhausted.

Disadvantages:

- (i) A vast variety of flora and fauna (plants and animals) get affected.
(ii) Dams can be constructed only at a limited number of places.

Q. 13. What is the importance of hydro power plants in India? Describe how electric energy is generated in such plants.

Ans. Importance: Hydro power plants are of prime importance as about 25 per cent of our energy requirement in India is met by hydro power plants.

- (i) A high rise dam is constructed at a suitable place on the river to obstruct the flow of water and thereby, collect water in larger reservoirs. Due to rise in water level the kinetic energy of flowing water is transformed into potential energy of stored water.
- (ii) The water from the high level in the dam is carried through sluice gates and pipes to the turbine of electric generator, which is fitted at the bottom of the dam. Due to flowing water, turbine is rotated at a fast rate and hydel electricity is produced.
- (iii) A hydro power plant converts the potential energy of falling/stored water into electricity.

Q. 14. (i) Name the device used to convert
(a) solar energy into heat, and (b) solar energy into electricity.

(ii) Explain the principle of working of a windmill.

Ans. (i) (a) Solar energy into heat: Solar cooker.

(b) Solar energy into electricity: Solar cell.

(ii) The wind rotates the blades of the windmill. This, in turn, rotates the connecting rod (shaft) and the crank (u-bend) moves up and down. Since the pump rod is connected to the crank, the pump rod of the water pump also moves up and down and lifts the water from the well or flooded mine. Thus, the rotational movement of the blades of the windmill is used to drive a large number of machines.

Q. 15. Describe the steps involved in obtaining biogas and explain what is meant by anaerobic decomposition.

Ans. Following steps are involved in obtaining biogas:

- (i) Mixing (slurry of cattle-dung and water).
- (ii) Digesting (cattle-dung undergoing decomposition by anaerobic bacteria).
- (iii) Formation of biogas (mixture of methane, CO_2 , H_2 and H_2S).
- (iv) Spent slurry (residue left after the formation of biogas).

The process by which the biomass changes into biogas in the absence of air due to an anaerobic microorganisms is termed as an anaerobic decomposition.

Q. 16. Biogas is considered to be a boon to the farmers. Give reasons.

Ans. Biogas is considered to be a boon to the farmers because:

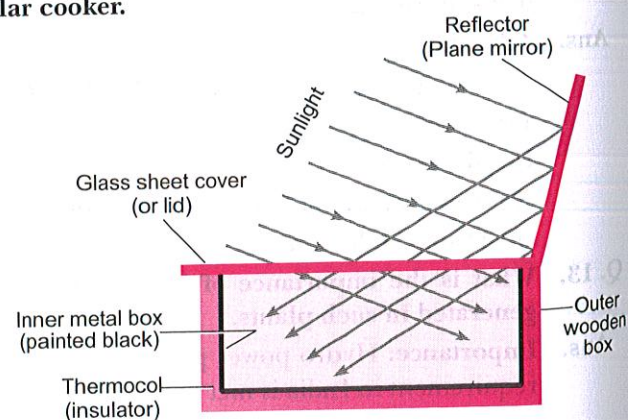
- (i) Farmers can produce clean domestic fuel from the wastes like animal dung, dry leaves, dry plants, etc.
- (ii) Spent slurry can be used in the fields as manure to increase the fertility of the soil.
- (iii) Biogas can be used to generate electricity which can be utilised to run modern machines used in the fields to save time and energy.

LONG ANSWER QUESTIONS

[5 marks]

Q. 1. Give the construction and working of a solar cooker.

Ans. A device that utilises solar energy for cooking purposes is called a solar cooker. The most commonly used form of solar cooker is known as box-type solar cooker. A box-type solar cooker is shown in the figure.



Construction of a box-type solar cooker: A box-type solar cooker consists of the following components:

- (i) **Box (B):** This is an insulated metal or a wooden box. It is painted black from inside because black surface absorbs more heat. The box may be provided with four roll-wheels. There is a thermocol layer between the wooden box and the inner metal box.
- (ii) **Glass cover (G):** A cover made of two sheets of toughened glass held together in an aluminium frame is used as a cover of the box B.
- (iii) **Plane mirror reflector (R):** A plane mirror reflector fixed in a frame is fixed to the box B with the help of hinges. The mirror reflector can be positioned at any desired angle to the box. The mirror is positioned so as to allow the reflected sunlight fall on the glass cover of the box.
- (iv) **Cooking containers (C):** A set of containers made of aluminium and blackened from outside are kept in the box B. These containers are also painted black because black surface absorbs more heat.

Working: The food is cooked in a shallow vessel of the container. The box has a transparent covering of glass sheet over it. The solar cooker is placed in sunlight and reflector (plane mirror) is adjusted in such a way that a strong beam of sunlight enters the box through the glass sheet. The blackened metal surfaces in the wooden box absorb infra-red radiations from the beam of sunlight and heat produced raises the temperature of blackened metal surface to about 100°C . The food absorbs heat from the black surface and gets cooked. The thick glass sheet does not allow the heat produced to escape and thus, helps in raising the temperature in the box to a sufficiently high degree to cook the food. The thermocol layer also does not allow the heat to escape and thus the temperature inside is maintained.

Q. 2. (a) Distinguish between renewable and non-renewable sources of energy.

(b) Choose the renewable sources of energy from the following list.

Coal, biogas, Sun, natural gas

Ans. (a)

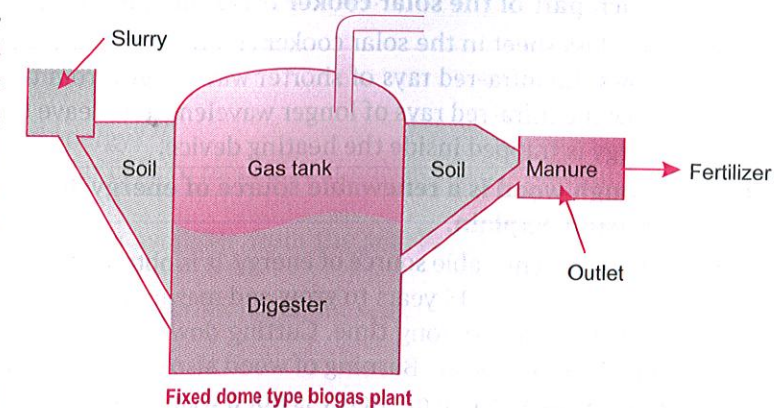
Renewable sources of energy	Non-renewable sources of energy
1. These sources of energy can be used again and again.	1. These sources of energy cannot be used again and again.
2. These type of sources are inexhaustible.	2. These type of sources are exhaustible and cannot be renewed.
3. It does not pollute atmosphere.	3. It causes atmospheric pollution.
4. Example: Solar energy, wind energy, etc.	4. Example: Coal, petroleum, etc.

(b) Sun and biogas.

Q. 3. What is biogas? Describe the working of a biogas plant with the help of a labelled diagram.

Ans. Biogas is a mixture of methane, carbon dioxide, hydrogen and hydrogen sulphide. The major constituent of biogas is methane. Biogas is produced by the anaerobic degradation of animal wastes like cow-dung or plant wastes in the presence of water.

The biogas plant has a dome-like structure built with bricks. A slurry of cow-dung and



water is made in the mixing tank from where it is fed into the digester. The digester is a sealed chamber in which there is no oxygen. Anaerobic micro-organisms that do not require oxygen, decompose or break down complex compounds of the cow-dung slurry. It takes a few days for the decomposition process to be complete and generate gases. The biogas is stored in the gas tank above the digester from which they are drawn through pipes for use.

Q. 4. What are the environmental consequences of using fossil fuels? Suggest the steps to minimise the pollution caused by various sources of energy including non-conventional sources of energy. [NCERT Exemplar]

Ans. Fossil fuels have the following environmental effects:

- (i) **Air pollution:** Burning of fossil fuels release oxides and sulphides in the air and many other harmful gases like carbon monoxide, sulphur dioxide, etc. These cause various health problems and also lead to acid rain which further affects water and soil resources.
- (ii) **Greenhouse effect:** On burning fossil fuels, a large amount of carbon dioxide is released into the atmosphere. This is a greenhouse gas and does not allow the sun rays reflected from the earth surface to escape into the atmosphere. Thus, increasing the temperature of the atmosphere. This is called greenhouse effect which results in global warming.

Following steps can be taken to minimise pollution:

- (i) Use of smokeless appliances.
- (ii) Use of refined technology to increase the efficiency of combustion process and to reduce escape of harmful gases into the atmosphere.
- (iii) Judicious use of energy.

Q. 5. Differentiate between box-type solar cooker and spherical reflector type solar cooker.

Ans.

Box-type solar cooker	Spherical reflector type solar cooker
1. Plane mirror is used as a reflector.	1. Concave or parabolic reflector is used.
2. It does not concentrate solar energy at a point.	2. It concentrates the solar energy at a point called focus.
3. Comparatively low temperature is produced in it.	3. Very high temperature is produced.
4. It is used to cook the food materials which require slow heating.	4. It can cook food materials which require strong heating.
5. Baking and frying is not possible in it.	5. Baking and frying can be done in it.

HOTS (Higher Order Thinking Skills)

Q. 1. Which part of the solar cooker is responsible for greenhouse effect?

Ans. The glass sheet in the solar cooker creates a greenhouse effect. Glass sheet has a property that allows the infra-red rays of shorter wavelength from the Sun to get in the device but does not allow the infra-red rays of longer wavelength to leave the solar heating device. Therefore, heat energy is trapped inside the heating device.

Q. 2. Though wood is a renewable source of energy, but the use of wood as a fuel is not a wise decision. Explain.

Ans. Wood is a renewable source of energy. It is obtained by cutting trees. A new plant sapling usually takes more than 15 years to grow and mature into a tree. Therefore, replenishment of cut down trees takes a very long time. Cutting down of trees causes depletion of the forests leading to imbalance in nature. Burning of wood also causes air pollution. Due to the above reasons, usage of wood as a source of energy is not a wise decision.

Q. 3. Wavelength of radiation incident on a surface is 850 nm. Will the surface become visible when exposed to this radiation? Explain.

Ans. No, the surface will not be visible as the range of wavelength of visible radiation is from 400 nm to 700 nm. The radiation having wavelength greater than 700 nm is termed as infra-red radiations which are heat radiations, so the radiations of wavelength 850 nm are not visible to us.

Proficiency Exercise

Very Short Answer Questions

[1 mark]

- Suggest any two reasons which make the large scale usage of nuclear energy prohibitive.
- Thermal power plants are set up near coal or oil fields. Give reason.
- What type of microorganisms are able to carry out the process of decomposition in a biogas plant?
- List any two steps you would suggest to minimise environmental pollution caused by burning of fossil fuels.
- What type of energy is possessed by huge waves near the seashore?

Short Answer Questions-I

[2 marks]

- A student constructed a model of box-type solar cooker. Instead of using glass sheet he used a transparent plastic sheet to cover the open face of the box. He found that this cooker does not function well. What could be the possible drawbacks in his model? Explain the advantage of painting black the inner and outer surfaces of the cooker and that of cooking vessels.
- Give the disadvantages of constructing big dams across the river. How does construction of dams across the river get linked with production of greenhouse gases?
- Mention three advantages of a solar cell.
- Why is there a need to harness non-conventional sources of energy? Give two main reasons.

[NCERT Exemplar]

- What is meant by nuclear waste? State the main hazard of this waste on the living beings. How is this waste disposed off?
- Name the reaction responsible for large energy production in the sun.

[NCERT Exemplar]

Short Answer Questions-II

[3 marks]

- List any four reasons why we need to look for alternate sources of energy.
- How has the traditional use of wind and water energy been modified for our convenience?
- What is biomass? What can be done to obtain bio-energy using biomass?
- Nuclear power is an excellent non-conventional source of energy still it is not used commonly for power generation. Why? State three reasons.
- How is nuclear energy generated? Give one use of nuclear energy.

[NCERT Exemplar]

Long Answer Questions

[5 marks]

- (a) What is geothermal energy?
(b) What are the advantages of wind energy?
- Why is it not possible to make use of solar cells to meet all our energy needs? State at least three reasons to support your answer.
- Name the various forms in which energy is available from the sea. For any two types give one limitation in harnessing.
- What are the factors that should be taken into consideration for selecting a source of energy? List any three.