

Sources of Energy

# NCERT Exercises (Questions-Solutions)

# **Intext Questions**

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

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

#### 2. What is a good fuel?

- Ans.: A good fuel is one which:
  - (i) has high calorific value, i.e., produces large amount of heat on burning completely in air or oxygen, (ii) produces less smoke on burning,
  - (iii) has low cost and is easily available,
  - (iv) has an ignition temperature that is well above the normal temperature.

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

Ans.: For heating food, I shall prefer to use solar energy (through the use of solar cooker/reflector) because it is virtually free and nonpolluting.

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#### 1. What are the disadvantages of fossil fuels?

- **Ans.:** Various disadvantages of fossil fuels are:
  - (a) Fossil fuels cause air pollution.
  - (b) Fossil fuels produce gases like, CO<sub>2</sub>, SO<sub>2</sub>, SO<sub>3</sub>, NO<sub>2</sub>. The gases such as SO<sub>2</sub>, SO<sub>3</sub>, and NO<sub>2</sub> cause acid rain.
  - (c) Excess of CO<sub>2</sub>, contributes to the global warming due to its greenhouse effect.

#### 2. Why are we looking at alternate sources of energy?

Ans.: Fossil fuels were formed due to extraordinary conditions that prevailed on the Earth many million years ago. No new reservoirs of these fuels are being formed due to the absence of those conditions. As such fossil fuels are non-renewable sources of energy. In case we continue to use these sources at the present rate, we would soon be deprived of these sources. It is due to this reason that we should conserve these sources and look for alternate sources of energy.

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

Ans.: Traditional use of wind and water energy have been modified in the following ways:

(a) **Wind energy :** Through windmill-Windmill can be used for running water pump, grinding grains and generating electricity.

(b) **Water energy :** Through the use of hydro energy, by constructing dams and setting up hydroelectric power stations.

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#### 1. What kind of mirror concave, convex or plane-would be best suited for use in a solar cooker? Why?

Ans.: A concave mirror is best suited for use m a solar cooker. This is due to the reason that a concave mirror reflects and concentrates solar energy from over a large area into a small area. Such a mirror is called a solar concentrator.

#### 2. What are the limitations of energy that can be obtained from the oceans?

#### Ans.: The energy obtained from the oceans is :

(i) tidal energy for which very few suitable sites are available for construction of dams and the power generation is intermittent and not very large.

(ii) wave energy where power output is variable and the presently available technologies are very expensive. (iii) ocean thermal energy where the conversion efficiency is low (3% - 4%) and a lot of capital investment is required.

#### 3. What is geothermal energy?

Ans.: The heat of the interior of the earth is called geothermal energy.

#### 4. What are the advantages of nuclear energy?

Ans.: Some advantages of nuclear energy are:

(a) On equal mass basis, nuclear energy systems produce much more energy than fossil fuels. One gram of uranium-235 produces  $8.25 \times 10^7 kJ$  of energy whereas one gram of coal produces only 30 kJ.

(b) If maintained and operated properly, nuclear energy systems produce almost no air pollution.

(c) Nuclear energy systems consume very little fuel. Once loaded/ a nuclear reactor operates for years together.

#### 5. Can any source of energy be pollution-free? Why or why not?

Ans.: No source of energy can be called pollution-free, because, the use of any source of energy disturbs the environment in one way or the other. A source of energy like a solar cell is pollution free in actual operation but the assembly of the device might have caused some damage to the environment. So, in absolute sense, no source of energy can be called pollution free.

#### 6. 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. This is due to the reason that it produces water on burning whereas CNG on burning produces  $CO_2$ , though much less than that produced when coal or oil is burnt. The increase in concentration of  $CO_2$  in the atmosphere increases the temperature of atmosphere.

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- 1. Name two energy sources that you consider to be renewable. Give reasons for your choices.
- Ans.: (i) Water energy (hydro-energy); (ii) biomass energy.

Water on Earth can be used again and again to generate hydro-energy as obvious from water cycle in nature. Solar energy also appears in the form of energy of water flowing in the rivers.

This is obvious from the water cycle in nature which is as follows.

(a) Solar energy changes into potential energy of water vapour rising in the atmosphere during evaporation of water from rivers, seas, oceans and other water masses. The water vapour form clouds and also cover mountains with snow.

(b) When the clouds bring rain and the snow on the mountains melts their potential energy changes into the kinetic energy of water flowing in the river and streams. Biomass can be managed by replacing the trees that have been cut down for fire-wood. By doing so, we can get a constant supply of energy at a particular rate.

- 2. Give the names of two energy sources that you would consider to be exhaustible. Give reasons for your choices.
- Ans.: (i) Coal (ii) Petroleum and Natural gas.

Both these sources are present only in limited amounts and will be exhausted soon if we continue to use them at the present rate. These sources were formed over millions of years under special conditions.

# **Exercises Questions**

#### 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.: The correct answer is (b). Because on a cloudy day, heat radiation coming from the sun do not reach the solar water heater.

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2.	Which of the following is not an example of a biomass energy source?		
	(a) wood	(b) gobar-gas	

- (c) nuclear energy (d) coal
- **Ans.:** The correct answer is (c). Nuclear energy uses uranium which is mineral.

# 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) nuclear energy (d) biomass
- Ans.: The correct answers are (a) and (c). Geothermal energy and nuclear energy are not, in any way, derived from the sun's energy.

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

- Ans.: (i) The reserves of fossil fuels are limited, i.e., exhaustible whereas solar energy in available in abundance and that too without cost), i.e., is 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.

#### 5. Compare and contrast bio-mass and hydro-electricity as sources of energy.

**Ans.:** (i) Bio-mass 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 chullah or a gobar gas plant whereas hydroelectricity requires construction of dams on rivers.

(iii) Bio-mass provides pollution-free energy only when converted into biogas whereas hydroelectricity is totally pollution-free.

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

- (a) wind (b) waves (c) tides
- Ans.: (a) Limitations of extracting energy from the wind:

Wind flowing with a sufficient speed is not available everywhere and all the time. Thus wind is not a dependable source of energy. The kinetic energy of wind (wind energy) can be used only at the site of windmill.

(b) Limitations of extracting energy from ocean waves:

Wave energy would be commercially viable only at places where the waves are strong.

The energy produced from waves has to be transmitted through long distances at the possible of use.

(c) Limitations of extracting energy from tides:

There are very few sites suitable for harnessing tidal energy.

The rise and fall of water during tides is not very large. So, large scale generation of electricity is not possible.

#### 7. On what basis would you classify energy sources as

- (a) renewable and nonrenewable?
- (b) exhaustible and inexhaustible?

Are the options given in (a) and (b) the same?

Ans.: (a) Energy sources can be classified as renewable and nonrenewable on the following basis:

- (i) Quantity available in nature
  - (ii) Mode of replenishment
  - (iii) Rate of consumption

(b) Energy source can be classified as exhaustible and inexhaustible sources of energy on the basis of the rate of consumption and replenishment:

If the rate of consumption is higher than the rate of replenishment, then the source of energy is exhaustible. If the rate of consumption is lower than the rate of replenishment, then the source of energy is inexhaustible.

The options given in (a) and (b) are essentially the same.

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

Ans.: An ideal source of energy should possess the following characteristics.

(a) It should be capable of giving an adequate amount of useful energy.

- (b) It should be convenient to transport, store and use.
- (c) It should be economical.

(d) It should be capable of supplying the desired quantity of energy at a steady rate over a long period of time.

- 9. What are the advantages and disadvantages of using a solar cooker? Are there places where solar cookers would have limited utility?
- Ans.: The use of a solar cooker has the following advantages.(a) It saves fuel.

(b) It does not produce smoke. Therefore, it does not cause any air pollution.

(c) The food cooked in a solar cooker retains its nutritive value. This is because, in a solar cooker, the food is cooked at relatively much lower temperature.

(d) Cooking by using a solar cooker saves time.

A solar cooker gets energy direct from the sun. Therefore, it cannot be used when and where there is no sunlight.

# **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 increasing demand for energy causes air-pollution.

(ii) Construction of dams on rivers to generate hydroelectricity destroys large ecosystem- 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:

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

- (b) Fuel saving devices such as pressure cookers etc. should be used.
- (c) Efficiency of energy sources should be maintained by getting them regularly serviced.
- (d) And last of all, we should be economical in our energy consumption as energy saved is energy produced.



# Multiple Choice Questions (MCQs)

#### 1. Which of the following is a non-renewable source of energy?

(a) Wood (b) Sun (c) Fossil fuels (d) Wind

Ans. (c) Non-renewable sources of energy are those which are exhaustible and cannot be replaced, once they have been used.

Non-renewable sources of energy also known as conventional sources of energy. The fossil fuels are non-renewable sources of energy whereas wood, the sun and wind are renewable sources of energy.

#### 2. Acid rain happens because

- (a) sun leads to heating of upper layer of atmosphere
- (b) burning of fossil fuels release oxides of carbon, nitrogen and sulphur in the atmosphere
- (c) electrical charges are produced due to friction amongst clouds
- (d) the earth atmosphere contains acids
- Ans. (b) Acid rain happens because of several human activities of polluting the atmosphere.

The emission of carbon, sulphur and nitrogen from the industries, burning of fossil fuels, etc., and also by the natural phenomena such as emission from volcanoes make the water vapour in the cloud more acidic thereby causing acid rain.

#### 3. Fuel used in thermal power plants is

(a) Water	(b) Uranium	(c) Biomass	(d) Fossil fuels
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Ans. (d) The thermal power plant generates electric power from heat produced by burning fossil fuels i.e., coal and petroleum. Every day we burn large amount of fossil fuels to heat up water to produce steam. The steam so produced runs turbines to generate electricity.

#### 4. In a hydro power plant

- (a) potential energy possessed by stored water is converted into electricity
- (b) kinetic energy possessed by stored water is converted into potential energy
- (c) electricity is extracted from water
- (d) water is converted into steam to produce electricity
- Ans. (a) In a hydro power plant, water from the top of the dam is allowed to fall through pipelines over the blades of turbine at the bottom of the dam. In this process, the potential energy of water changes into its kinetic energy which is transferred to the turbine.

The moving turbine rotates the armature of a generator to produce electricity i.e., turbine changes the kinetic energy into electricity. Thus, potential energy possessed by stored water is converted into electricity.

#### 5. Which is the ultimate source of energy?

- (a) Water
  (b) Sun
  (c) Uranium
  (d) Fossil fuels
  (b) The sun is considered as the ultimate source of energy to r several reasons. The main reason is that all form of energy, directly or indirectly is derived from sun. Without the sun, no food (meat or plant based) would grow and thus, we would not be able to gain the energy needed to live.
- 6. Which one of the following forms of energy leads to least environmental pollution in the process of its harnessing and utilization?

(a) Nuclear energy (b) Thermal energy (c) Solar energy (d) Geothermal energy

Ans. (c) Solar energy leads to least environmental pollution in the process of its harnessing and utilization. In nuclear energy, emission of radiation is a high risk for environmental contamination.
 In thermal energy, heat produced by burning fossil fuels causes huge environmental pollution. In geothermal energy, noise pollution is created by drilling operations at geothermal sites.

#### 7. Ocean thermal energy is due to

- (a) energy stored by waves in the ocean
- (b) temperature difference at different levels in the ocean
- (c) pressure difference at different levels in the ocean
- (d) tides arising out in the ocean
- Ans. (b) The water at the surface of the sea or ocean is heated by the sun while the water in deeper sections is relatively cold. This difference in temperature between these layers ranges from 10°C to 30°C is exploited to obtain energy. Thus, ocean thermal energy is due to temperature difference at different levels in the ocean.

#### 8. The major problem in harnessing nuclear energy is how to

(a) split nuclei

(b) sustain the reaction

- (c) dispose of spent fuel safely (d) convert nuclear energy into electrical energy
- Ans. (c) The major hazard of nuclear power generation is the storage and disposal of spent or used fuels. Improper nuclear-waste storage and disposal result in environmental contamination, as well as, risk of accidental leakage of nuclear radiation.

It happened in Chernobyl disaster 1986, Fukushima Nuclear disaster 2011 caused great damage to the living beings and habitats.

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

- (a) Coating with black colour inside the box
- (c) Glass sheet

(b) Mirror

(d) Outer cover of the solar cooker

(d) hydrogen sulphide

Ans. (c) Glass sheet present in the solar cooker easily passes the radiation into the solar cooker and these radiation get absorbed and reflected back by the black coating is of longer wavelength and can't pass back out through the glass. Thus glass sheet produces greenhouse effect in solar cooker.

### 10. The main constituent of biogas is

# (a) methane (b) carbon dioxide (c) hydrogen

Ans. (a) The composition of biogas is

- (i) methane  $(CH_4)$ , 65-75% (combustible).
- And other constituent of biogas are as follows
- (ii) carbon dioxide  $(CO_{\rm 2})\,$  , 20-30% (non-combustible)
- (iii) hydrogen  $(H_2)$ , 5-10% (combustible)
- (iv) hydrogen sulphide  $(H_2S)$ , traces (combustible)
- (v) nitrogen  $(N_2)$ , 2-6% (non-combustible) Thus. the main constituent of biogas is methane.

### 11. The power generated in a windmill

- (a) is more in rainy season since, damp air would mean more air mass hitting the blades
- (b) depends on the height of the tower
- (c) depends on wind velocity
- (d) can be increased by planting tall trees close to the tower
- **Ans.** (c) Wind energy farms can be located only in vast open areas located in favourable wind conditions as the minimum velocity for a windmill to function is 11 km/h to 16 km/h and is called as cut-in speed. Thus, the power generated in a windmill depends on wind velocity.

# 12. Choose the correct statement

- (a) Sun can be taken as an inexhaustible source of energy
- (b) There is infinite storage of fossil fuel inside the earth
- (c) Hydro and wind energy plants are non-polluting sources of energy
- (d) Waste from a nuclear power plant can be easily disposed off
- Ans. (a) The sun has been radiating an enormous amount of energy at the present rate for nearly 5 billion years and will continue radiating at that rate for about 5 billion years more, so, the sun can be taken as an inexhaustible source of energy.

# **13.** In a hydroelectric power plant more electrical power can be generated if water falls from a greater height because

- (a) its temperature increases
- (b) larger amount of potential energy is converted into kinetic energy
- (c) the electricity content of water increases with height
- (d) more water molecules dissociate into ions
- Ans. (b) In a hydroelectric power plant more electrical power can be generated if water falls from a greater height because the rise in water level, causes the increase in potential energy of water.

Thus when it flows from higher position more amount of kinetic energy is formed by the conversion of higher potential energy and this kinetic energy in the form of moving water can produce more electrical power.

#### 14. Choose the incorrect statement regarding wind power.

- (a) It is expected to harness wind power to minimum in open space
- (b) The potential energy content of wind blowing at high altitudes is the source of wind power

(c) Wind hitting at the blades of a windmill causes them to rotate. The rotation thus achieved can be utilised further

(d) One possible method of utilising the energy of rotational motion of the blades of a windmill is to run the turbine of an electric generator

Ans. (b) To generate wind power, we require wind at a very high speed. Due to this motion it possess kinetic energy and as such they are capable of doing mechanical work by virtue of its motion.

The energy possessed by the wind is due to its high speed. When the blowing wind strikes across the blades of a windmill, it exerts a force on them due to which the blades of the windmill start rotating. This rotational motion of the blades is used to run the turbine of an electric generator. Thus, the option (b) is the incorrect statement.

#### 15. Choose the incorrect statement.

- (a) We are encouraged to plant more trees so as to ensure clean environment and also provide biomass fuel (b) Gobar-gas is produced when crops, vegetable wastes etc., decompose in the absence of oxygen
- (c) The main ingredient of biogas is ethane and it gives a lot of smoke and also produces a lot of residual ash (d) Bio-mass is a renewable source of energy
- Ans. (c) Encouraging to plant more trees we ensure clean and pollution free environment and it also provide biomass fuel. Gobar-gas is made from the decomposition of cow dung; crops, vegetable wastes, etc., decompose in the absence of oxygen.

The main ingredient of bio-gas is methane. It burns without smoke, leaves no residue like ash in wood, charcoal and coal burning. Bio-mass is living matter or its residues and is a renewable source of energy. Thus, part (c) is the incorrect statement.

# **Short Answer Type Questions**

#### 16. Why is there a need to harness non-conventional sources of energy? Give two main reasons.

Ans. There is a need to harness non-conventional sources of energy due of the following reasons

(i) The energy demands are increasing rapidly because of population explosion and our efforts to improve the quality of life by adopting faster means of transportation, rapid industrialization and extensive use of energy-fed appliances.

(ii) The sources of energy which are available are mainly fossil fuels which are non-renewable sources of energy and are limited. It will get exhausted after a time being. So, we need to harness non-conventional sources of energy.

#### 17. Write two different ways of harnessing energy from ocean.

Ans. The two different ways of harnessing energy from ocean are as follows

(i) Tidal energy The energy derived from rising and falling ocean tides is called tidal energy. The tidal energy can be harnessed by constructing a tidal barrage or tidal dam across a narrow opening to the sea.

(ii) Ocean thermal energy Solar energy stored in the oceans in the form of heat is known as ocean thermal energy. Temperature differences between the deep ocean water and upper level is used to produce ocean thermal energy. The process of harnessing the thermal energy of the sea is called ocean thermal energy conversion.

#### 18. What steps would you suggest to minimise environmental pollution caused by burning of fossil fuels?

- Ans. The following steps can be would suggested to minimise environmental pollution caused by burning of fossil fuels
  - (i) Using smokeless appliances and using various techniques to reduce the escape of harmful! gases.
  - (ii) Converting land into forest by planting trees.
  - (iii) Using clean fuels like CNG, LPG, etc.
  - (iv) By using public transport instead of private vehicles.
  - (v) By increasing the efficiency of combustion process.

#### 19. What is the role of a plane mirror and a glass sheet in a solar cooker?

Ans. The role of a plane mirror and a glass sheet in a solar cooker are as follows

(i) Plane mirror They are used as reflector in solar cookers to focus the maximum rays of the sun into the cooker to achieve a higher temperature.

(ii) Glass sheet The transparent glass sheet kept over the open end of the heating devices

allows the infrared rays and visible rays to enter the device but does not allow the infrared radiations to move out of the heating device due to increase in the wavelength of radiation inside the cooker and the temperature of heating device rises appreciably.

#### 20. Mention three advantages of a solar cell.

- Ans. The three advantages of a solar cell are as follows
  - (i) Solar cell is pollution-free during use.

(ii) Its maintenance cost is very low and work quite satisfactorily without the use of any focusing device. It is also a ultimate source of energy.

(iii) It can be set up in remote and inaccessible hamlets or very sparsely inhabited areas in which laying of a power transmission line may be expensive and not commercially viable.

#### 21. What is bio-mass? What can be done to obtain bio-energy using biomass?

Ans. The waste material of living things (cattle dung) and dead parts of plants and animals are called bio-mass. It has been a traditional source of energy, e.g., wood, crop residue, biogases (residue of sugarcane after extracting juice) cow-dung cake are used as fuels for domestic as well as industrial uses.

Bioenergy in the form of biogas can be produced from Biomass by the decomposition in the absence of air. Biomass such as wood, cow-dung etc, are directly used as fuel.

#### 22. What are the limitations in obtaining energy from wind?

Ans. The limitations in obtaining energy from wind are as follows

(i) It can be established only at those places where wind blows whole of the year.

(ii) The minimum wind speed necessary for satisfactory working of a wind generator is 15 km/h, which is not gained continuously.

(iii) Wind energy farm requires quite large area of land nearly 2 hectares lend is needed for 1 MW generator.

(iv) The setting up of wind energy farm is very expensive.

(v) As the blades are exposed to vagaries of nature like rain, the sun, storm and cyclone, they need high level of maintenance.

(vi) The wind energy farms disturb rainfall pattern.

# Long Answer Type Questions

#### 23. Which is the process used to harness nuclear energy these days? Explain it briefly.

Ans. Nuclear reactor is the process used to harness nuclear energy these days. Nuclear fission reaction takes place in the nuclear reactor. The reaction in which a heavy nucleus splits into two or more smaller nuclei with the evolution of large amount of energy, when it is bombarded with slow moving neutron is called nuclear fission.

The nucleus of a heavy atom (such as uranium, plutonium or thorium), when bombarded with low energy neutrons, can be split apart into lighter nuclei along with the release of tremendous amount of energy. U-235 nucleus splits up broadly into two groups of nuclei

(i) A heavy group of nuclei, with mass number in the range A = 130 to A = 149,

() A light group of nuclei, with mass number in the range A = 85 to A = 104.

In the form of a nuclear reaction, we represent nuclear fission of U-235 as follows

 $\overset{^{235}}{_{92}}U \xrightarrow{\overset{^{1}}{_{0}n}} \overset{^{236}}{_{92}}U \longrightarrow \overset{^{144}}{_{56}}Ba + \overset{^{89}}{_{36}}Kr + 3^{1}_{_{0}}n + \text{Energy (in huge amount)}$ 

The major hazards of nuclear power generation are as follows

(i) The improper nuclear-waste storage and disposal may result into environmental contamination.

(ii) There is a risk of accidental leakage of nuclear radiation and its leakage causes huge loss to living things.

(iii) The high cost of installation of a nuclear power plant and high risk of environmental contamination and limited availability.

- 24. How can solar energy be harnessed? Mention any two limitations in using solar energy. How are these limitations overcome?
- Ans. Solar energy can be harnessed directly as well as indirectly which are as follows

(i) **Direct utilisation** The direct utilisation of solar energy can be done either by collecting it as heat (solar cooker, solar heater) or by converting it to electricity (solar cells).

(ii) **Indirect utilisation** It can be done by converting solar energy into chemical energy like bio-mass of plants, etc.

The limitations in using solar energy are as follows

(i) Energy reaching the surface is very much diffused so, direct utility is limited,

(ii) It is not available uniformly all the time and at all the places.

(iii) It is not available in night.

(iv) It is not available on a cloudy day.

These limitations of using solar energy are overcome by using solar cells that convert solar energy into electricity.

# 25. Make a list of conventional and non-conventional sources of energy. Give a brief description of harnessing one non-conventional source of energy.

Ans. The following are the list of conventional and non-conventional sources of energy

(i) **Conventional sources of energy** They are those which are used extensively and meet a major portion of our energy requirement. These are fossil fuels (wood, coal and petrol), hydro energy, biomass energy and wind energy.

(ii) **Non-conventional sources of energy** They are those which are not used as extensively as conventional ones and meet our energy requirement only on a limited scale. These are solar energy, ocean energy (tidal energy, wave energy and ocean thermal energy), geothermal energy and nuclear energy,

The harnessing of one non-conventional source of energy is as follows

**Nuclear energy** Nuclear energy is produced by the release of heat from unstable elements such as uranium. The energy is harnessed by using the energy to heat water.

The radioactive water is then pumped through a heat exchanger where the dirty water is used to heat clean water. The clean water can then be used to drive turbines and other forms of engine.

#### 26. Why is there a need for harnessing non-conventional sources of energy? How can energy be harnessed from the sea in different ways?

Ans. There is a need for harnessing non-conventional sources of energy because of following reasons

(i) The demand for energy is increasing day-by-day to meet out the basic requirement of our changed lifestyles, growing use of machines and industrialisation in order to improve our living standards.

(ii) The fossil fuels are non-renewable sources of energy and were formed over millions of years ago and there are only limited reserves of fossil fuels.

The energy from the sea can be harnessed in the different forms are as follows

(i) **Tidal energy** It is harnessed by constructing a dam across a narrow opening to the sea, A turbine fixed at the opening of the dam converts tidal energy to electricity.

(ii) Wave energy A wide variety of devices have been developed to trap huge waves near

the seashore for rotation of turbine and production of electricity.

(iii) **Ocean thermal energy** The water at the surface of the sea or ocean is heated by the sun while the water in deeper sections is relatively cold. This difference in temperature is exploited to obtain energy in ocean thermal energy conversion plants. These plants can operate if the temperature difference between the surface water and water at depths up to 2 km is 293 K (or 20°C) or more.

The warm surface water is used to boil a volatile liquid like ammonia. The vapours of the liquid are then used to run the turbine of the generator. The cold water from the depths of the oceans is used to condense vapour again to liquid.

The devices used to harness this form of ocean energy are known as Ocean Thermal Energy Conversion [OTEC] power plants.

# 27. 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 causes global warming.

Ans. The environmental consequences of using fossil fuels are as follows

(i) The air pollution caused by burning of coal or petroleum products.

(ii) 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.

(iii) The generation of greenhouse effect of gases like carbon dioxide leading to global warming.

The following are the steps to minimise the pollution caused by various sources of energy including nonconventional sources of energy

(i) The pollution caused by burning fossil fuels can be reduced by increasing the efficiency of the combustion process and using various techniques to produce the smokeless appliances.

(ii) The air pollution caused by burning of coal or petroleum products can be reduced by forestation.

(iii) The planned and judicious use of energy can minimise the pollution e.g., use of Liquid Petroleum Gas (LPG) and Compressed Natural Gas (CNG) as domestic fuel and transportation vehicles.

(iv) Proper and safe disposal of nuclear wastes.

- 28. Energy from various sources is considered to have been derived from the sun. Do you agree? Justify your answer.
- Ans. Yes, Sun is the ultimate source of energy directly or indirectly, all the forms of energy are derived from solar energy. Because of the following reasons

(i) **Non-renewable sources of energy** Fossil fuels like coal, petroleum and natural gas are formed due to burial of large plants and ancient creatures whose ultimate source of energy is the sun.

(ii) **Renewable sources of energy** They are indirectly derived from solar energy such as

(a) **Energy from flowing water** Clouds are formed when water in lakes, rivers, seas, etc., evaporate due to solar energy. They bring rainfall and snowfall. The rain and melting snow feed rivers, streams, etc. This flowing water can be used for getting hydroelectricity.

(b) **Wind energy** Wind energy arises due to uneven heating of the earth's surface by the sun rays at two different adjoining places. Due to this, a pressure difference is created and wind possesses kinetic energy.

(c) **Bid-energy** Plants in the process of photosynthesis converts the solar energy into food (chemical energy). This food is consumed by animals. Thus, the animal wastes and remains of the plants constitute bio-mass which can be utilised as a source of energy.

(d) Wave energy The waves are generated by strong winds (due to solar energy) blowing across the sea,

(c) **Ocean thermal energy** Sun is responsible for the temperature difference between the water at the surface and water at depth in seas and oceans.

(iii) **Solar heating devices** They derive their energy directly from solar energy and convert it into other usable forms of energy. Thus, the energy from various sources are considered to have been derived from the sun.

#### 29. What is bio-mass? Explain the principle and working of a biogas plant using a labelled schematic diagram.

Ans. Bio-mass refers to the organic fuel obtained from plants and animal wastes like wood, cow-dung, residue after harvesting the crop, vegetable waste and sewage, etc. It has been used as a fuel for a long time. These fuels, however, do not produce much heat on burning and a lot of smoke is given out when they are burnt. Bio-energy can be produced in a plant, known as 'bio-gas plant or gobar-gas plant' using bio-mass like cow-dung, various plant materials like the residue after harvesting the crops, vegetable waste and sewage are decomposed in the absence of oxygen to give bio-gas.

The labelled diagram of 'gobar gas" plant is given below

#### Principle

It is based on the principle that the anaerobic micro-organisms decompose or breakdown complex compounds of the cow-dung slurry, in absence of oxygen, in a few days and generate gases like methane, carbon dioxide, hydrogen and hydrogen sulphide which burn without smoke and leaves no residue like ash.



**Working** The plant has a dome-like structure built with bricks. A slurry of cow-dung, various plant materials like the residue after harvesting the crops, vegetable waste, sewage and water is made in the mixing tank from where it is fed into the digester. The digester is a sealed chamber which is free from oxygen.

Anaerobic micro-organisms decompose or break down complex compounds of the cow-dung slurry in a few days and generate gases like methane, carbon dioxide, hydrogen and hydrogen sulphide. The bio-gas is stored in the gas tank above the digester from which they are drawn through pipes for use.