

VERY SHORT ANSWER TYPE QUESTIONS

[1 MARK]

Previous Years' Questions

1. Uranium-235.
2. Germanium, Silicon.
3. Nuclear fusion.
4. Nitrogen and phosphorous.
5. Starting material for biogas is mainly cow-dung. So, it is also known as gobar gas.
6. Advantages of burning charcoal over burning wood.
 - (i) It has high calorific value.
 - (ii) It produces less smoke and less ash.
7. **Practical uses of biogas in rural areas.**
 - (i) It is an excellent fuel which burns without smoke with high heating capacity.
 - (ii) It is also used for lighting.
8. 15 km/h.
9. In nuclear fusion, the difference in mass, Δm , between original nucleus (two deuterons) and a product nuclei (${}^3\text{He}$) gets converted to energy as per Einstein's mass energy equation i.e. $E = \Delta m.c^2$.
10. With the help of wind energy, rotatory motion of windmill utilised to
 - (i) lift water from a well or
 - (ii) turn the turbine of electric generator that generate electricity.

Important Questions

11. Solar cooker, solar water heater.
12. Sun
13. (i) Extraction of fossil fuels can result in extensive environmental degradation.
 - (ii) Large ecosystems are destroyed by the construction of dams.
14. To conserve electricity in our house, we should
 - (i) use energy efficient electrical appliances and
 - (ii) switch off the electrical appliances when not needed.
15. Ocean thermal energy.
16. Infrared rays.
17. Maximum conversion efficiency of solar cell is about 25% at present.
18. Carbon dioxide, methane.
19. Wind power generation potential of India is estimated to be nearly 45,000 MW.
20. 1.4 KJ per second per square metre or 1.4 KW/m².
21. Compressed Natural Gas.
22. CNG does not produce any harmful gases on burning. atmosphere does not gets polluted.
23. Hot springs location in India :
 - (i) Sohna, Gurgaon (Haryana)
 - (ii) Manikaran, Kullu district (Himachal Pradesh)
24. Denmark.
25. Nuclear energy.
26. Biogas, Sun.

27. Geothermal energy and nuclear energy.
28. (i) Tehri Dam on the river Ganga and
(ii) Sardar Sarovar project on the river Narmada.
29. Yes, it is because in Bihar/Jharkhand/Orissa, coal for thermal power plant is locally available whereas it has to be transported for any thermal power plant to be located in Gujrat/Maharashtra.

30. **Importance of hydropower plant in India :** Hydropower plants contribute 20 to 25% of energy requirement in India. It is one of the major sources of electrical energy in the states where a few waterfalls or dam sites are available for its construction.
31. Sulphur dioxide and nitric oxide.

NCERT Questions

32. A good source of energy is one which would
(i) perform a large amount of work per unit volume or mass
(ii) be easily accessible
(iii) be economical and
(iv) be easy to store and transport.
33. A good fuel is the one which
 - has high calorific value,
 - is non-polluting,
 - is easy to transport and is easily available and
 - has moderate ignition temperature.
34. We would use a natural gas as the source of energy for heating our food because
(i) it has high calorific value.
(ii) it does not produce large amount of smoke on burning.
(iii) it is easier to store and
(iv) it can also be transported through pipes in the form of PNG (Piped Natural Gas).
35. **Disadvantages of fossil fuels**
(i) On burning, they are the largest emitter of green house gases which causes global warming.
- (ii) On burning, acidic oxide releases which leads to acid rain. It affects water and soil resources.
36. **Geothermal energy** – The energy obtained from hot molten rocks and trapped hot fluid inside the earth is called geothermal energy.
37. **Advantages of nuclear energy**
(i) A small quantity of nuclear fuel is needed to produce a large amount of useful energy.
(ii) Nuclear power plant produces less atmospheric pollution than thermal power plants, if the nuclear fission reaction performs properly.
(iii) Small amount of nuclear fuel can run a nuclear power plant over a long period of time. There is no need of inserting the nuclear fuel in the nuclear reactor again and again as in case of thermal power plant.
38. (b) Solar energy for solar water heater is not available on a cloudy day.
39. (c) Atomic energy is not obtained from biomass. Wood, gobar gas and coal are the examples of biomass energy source.
40. (a, c) Geothermal energy and nuclear energy are not derived from the solar energy. They are alternative sources of energy.

SHORT ANSWER TYPE QUESTIONS(I)

[2 MARKS]

Previous Years' Questions

1. (i) Source of excellent manure, rich in nitrogen and phosphorous which can be obtained from the biogas plant in addition to biogas.
(ii) It provides the safe, efficient and profitable disposal method for bio-waste and sewage material.
2. **Advantages of nuclear energy**
(i) A small amount of nuclear fuel releases a tremendous amount of nuclear energy.
(ii) Once the nuclear fuel is loaded in the nuclear reactor, then it can operate for two to three years without any need of refuelling.
3. **Solar cell panel** : A large number of solar cells combined in an arrangement is called solar cell panel.
Applications of solar cell panel
It provides the electric power for the
(i) Working of artificial satellites stationed in outer space.
(ii) Running of irrigation water pump by the farmers in rural areas.
(iii) Street lighting in remote areas.
4. **Limitations in harnessing wind energy**
(i) Speed of wind is not available at all time and at all places.
(ii) To establish the wind energy farm, a large area of land is needed.
(iii) Speed of wind should be higher than 15 km/h to harness the wind energy.
- (iv) Construction of wind-mill and its installation is very expensive.
5. When wood is burnt in a limited supply of oxygen, volatile materials present in it get removed and is cooled to get wood tar. Wood gas is collected.
The residue left behind after the reaction is known as charcoal.
Advantages of using charcoal as a fuel over wood
(i) Burning of charcoal does not produce any type of smoke. On the other hand, wood produces a lot of smoke on burning.
(ii) Charcoal produces more heat than wood.
6. Methane, carbon-dioxide, hydrogen and hydrogen sulphide.
Advantages of using biogas over fossil fuels
(i) Biogas burns without smoke, leaves no residue unlike coal.
(ii) Biogas is cheaper as compared to fossil fuels.
7. The waste obtained from nuclear power plants are highly radioactive in nature which emits harmful radiation whereas waste produced in a thermal power plant is non-radioactive.
Management of nuclear waste
(i) Some products of nuclear waste are buried in sealed steel/lead containers for a long term storage, buried under the ground or dumped in vacated coal mines.
(ii) Other waste products transforms into less harmful products or to products with a shorter half life.

8. The solar cooker which was covered with a plane glass slab will be more efficient. The glass lid allows the heat radiation from sun to enter the solar cooker but does not allow the reflected heat radiation to escape or go outside the box. Thus heat trapped inside the box increases the temperature. Glass lid also reduces heat loss due to reflection.

9. Many thermal power plants are set up near coal or oil fields :

- to ensure continuous supply of coal or oil without any delay.
- in order to minimise transportation cost, and
- transmission of electricity is more efficient than transporting coal or oil over the same distance.

10. (a) Uranium-235 and Plutonium-239.

- less availability of nuclear fuel in the country.
- the construction of nuclear power plants and power generation cost are greater than the other manufactured sources of energy.

11. (a) To avoid loss of heat from solar cooker to the surroundings.
 (b) Black surface absorbs more heat radiations of incident energy.
 (c) Transparent glass sheet does not allow the reflected heat radiation to go outside the box.
 (d) To increase the amount of solar energy incident on the transparent glass sheet.

12. Conversion of hydro energy into electrical energy

- High rise dams are constructed on the river to obstruct the flow of water to collect it at a suitable height.
- The stored water has a lot of potential energy.
- The water from a suitable height is allowed to fall on the blades of a turbine located at the bottom of a dam through a pipe.
- Kinetic energy of flowing water rotates the turbine rapidly.

- Rotation of turbine helps the armature coil of generator to rotate rapidly in the magnetic field.
- Hydroelectricity is generated.

Limitations of hydro energy

- All river-sites are not suitable for construction of dams.
- Large ecosystems are destroyed when submerged under the water in dam.

13. **Energy generated in nuclear fission reaction** – According to Einstein's Mass energy relation, ($\Delta E = \Delta mc^2$) the lost mass between the sum of masses of disintegrated nucleus and original nucleus in nuclear fission reaction reappears in the form of tremendous amount of energy.

Large scale use of nuclear energy is prohibited because

- improper nuclear-waste storage and disposal results in environmental contamination
- of high cost of installation of a nuclear power plant
- of limited availability of uranium
- of risk of accidental leakage of nuclear radiation due to some natural or man made causes.

14. Biogas as an ideal fuel

- It is an environmental friendly fuel as it lowers the green house effect.
- Its heating capacity is high i.e., it has high calorific value.
- It burns without smoke, leaves no residue, therefore causes no atmospheric pollution.
- It can be produced anywhere with less production cost and does not involve any running cost.

15. Nuclear fusion reaction

Conditions

- Presence of hydrogen.
- High temperature ($\approx 10^7\text{K}$) and millions of pascals pressure.

Important Questions

16. Burning of fossil fuels causes air and soil pollution due to :

- large amount of carbon dioxide gas production. It increases green house effect.
- smoke produced which pollutes the air.

- it leaves residue or ash after burning.
- acidic oxides such as oxides of carbon, nitrogen and sulphur that are released on burning lead to acid rain which affects our water and soil resources.

17. Thermal Power Plant

- Fossil fuel is burnt to produce heat energy which is converted into electrical energy.
- Cost of electricity produced by it is susceptible to fuel cost fluctuations.
- It pollutes the environment.

Geothermal Power Plant

- The steam trapped in rocks beneath the earth is used to generate the electricity.
- Harnessing geothermal energy does not involve any fuel which means lesser cost fluctuations and thus stable electricity price.
- It is considered as environment friendly.

18. Biogas is better fuel than animal dung cakes as :

- it has higher calorific value than animal dung cake as fuel.
- it leaves no residue after burning whereas animal dung cake leaves ash after burning.
- it burns efficiently and does not cause air pollution while dung cakes burn inefficiently and produce a lot of smoke. This causes air pollution.
- it can be used as a fuel for cooking, running engines and as an illuminant in gas lanterns whereas dung cake is used as a fuel for domestic use only.

19. Energy transformation in hydropower plants

K.E. of flowing water \rightarrow P.E. of stored water \rightarrow K.E. of falling water \rightarrow Mechanical energy of rotating turbine \rightarrow Electrical energy.

20. Conversion of energy in solar cell panels

Solar energy \rightarrow Electrical energy.

21. Drawbacks of solar heating devices

- They do not work at night as well as on a cloudy day.
- There is a need of frequent adjustment of the reflector mirror to let the reflected rays fall on the glass lid.

22. Wind energy farms can be established only at those places where wind blows for the greater part of the year. The wind speed at those places should also be higher than 15 km/h to maintain the required speed of turbine.

23. Energy concentrated = Reflecting percentage of energy \times surface area \times time \times rate of solar energy delivered

$$= \frac{80}{100} \times 5 \times (2 \times 60 \times 60) \times 0.4 \times 10^3 \text{ J}$$

$$= 11520 \times 10^3 \text{ J} = 11.52 \times 10^6$$

$$= 11.52 \text{ MJ.} \quad (10^6 \text{ J} = 1 \text{ MJ})$$

Box Type Solar Cooker	Spherical Reflector Type Solar Cooker
(i) Plane mirror is used to reflect the solar energy.	(i) Concave mirror is used to reflect the solar energy to a small region called focus.
(ii) Temperature rises to 100-140°C.	(ii) Temperature rises to 200°C.

25. **Windmill** – It is a turbine which rotates due to the force exerted by wind on its adjustable vanes or sails.

Energy conversion in the working of windmill – Kinetic energy of wind is converted into mechanical energy into useful mechanical work.

26. Flowing water have kinetic energy. The different ways of harnessing the energy of flowing water is to

- (i) generate electricity by establishing hydropower plant.
(ii) rotate the waterwheel or watermill to grind grains.

27. The large scale utilisation of bio-waste and sewage material in biogas plant provides a safe and efficient method of waste disposal besides supplying energy and manure.

28. Fossil fuels take millions of years for their formation. So it is impossible for us to replenish these resources quickly. Also they are only in limited reserves. Hence, they are known as conventional or non-renewable source of energy.

29. Device used to convert :

- (a) solar energy into heat energy – solar cooker and solar water heater.

- (b) solar energy into electricity – solar cells in solar panel.

30. It is advantageous to convert biomass into a biogas rather than burning directly because

- (i) The heating capacity of biogas is more than that of biomass.
(ii) biogas produces lesser pollution as compared to biomass.

31. The characteristics of fuels that determine their quality are

- (i) high calorific value
(ii) moderate ignition temperature and
(iii) less polluting.

32. In both the cases, the generated electricity is stored in a storage cell like battery. It provides the energy needs during a period when there is no wind in the case of windmill and no Sun in the case of a solar panel.

NCERT Questions

33. With the growing population and the progress in technology, the demand for energy is increasing day by day. We are highly dependent upon non-renewable sources of energy like coal and petroleum. As a result, these resources are depleting fast. That's why, there is a growing need to conserve them and look for renewable and alternate sources of energy.

34. The traditional use of wind energy has been modified to windmill which is used to generate electricity as well as in water lifting pumps.

The traditional use of flowing water energy has been modified to hydroelectric power plants to generate electricity.

35. Concave mirror would be best suited for use in solar cooker because concave mirror focusses all the sun rays (infrared rays) at a point. Thus raising the temperature of that small region. This heat is utilised to cook the food.

36. **Limitations of the energy obtained from oceans are :**

(Any four)

- (i) low energy conversion efficiency.
(ii) high maintenance cost of the plant.
(iii) power output is variable, intermittent and is not on a large scale.
(iv) There are very few sites suitable for harnessing the various forms of energy obtained from the oceans that too with a high installation cost.
(v) Technology to harness the oceanic energy has not been fully developed.
37. No source is pollution free. Even if the conversion of energy to the required form is pollution free, the assembly of the device

used would have caused some damage to the environment.

38. (i) Energy due to flow of water – due to continuous water cycle in nature.

- (ii) Wind energy – repetitive currents of wind are more or less available at all the places.

39. Coal and petroleum are considered as exhaustible source of energy because millions of years ago, large plants, ancient creatures died. They decomposed and were buried layer upon layer under the earth. Due to high pressure and excess amount of heat, generated, over millions of years, these layers converted into fossil fuels. Once they are exhausted, they cannot be produced quickly in nature. Therefore, they are considered as exhaustible sources of energy.

Sun	Fossil Fuels
(i) It is a renewable source of energy.	(i) They are non-renewable sources of energy.
(ii) Energy is available in diffused (scattered) form.	(ii) Energy is available in concentrated form.
(iii) A conversion device like solar cell, solar cooker is always needed to utilize the energy.	(iii) No device is always required to utilize the energy from fossil fuels.
(iv) Solar energy is pollution free.	(iv) Burning of fuels causes a lot of pollution.
(v) It is a large source of energy, so can be used to fulfill our need.	(v) It cannot be used unjudiciously because of limited reserves.

41. **Biomass**
- (i) It is a renewable source of energy but causes pollution if it burns directly.
 - (ii) Amount of electricity that can be generated from it is very low.
 - (iii) Biomass can be converted to biogas which has an end product which can be used as manure.
 - (iv) Initial cost of installation of biomass plant using biogas as fuel is low.
 - (v) Biomass possesses chemical energy.
- Hydroelectricity**
- (i) It is a renewable source of energy which does not cause any environmental pollution.
 - (ii) A considerable amount of electricity can be generated using hydroelectric power plant.
 - (iii) There is no end product in hydroelectric power plant.
 - (iv) Initial cost of installation of hydropower plant is high.
 - (v) Hydroenergy is due to kinetic energy of flowing water from a higher altitude.
42. (a) **Renewable sources of energy** are the ones that are constantly being regenerated and supplied by nature.

SHORT ANSWER TYPE QUESTIONS(II)

[3 MARKS]

Previous Years' Questions

- 1.
- | Renewable Source of Energy | Non-renewable Source of Energy |
|--|---|
| (i) They are constantly supplied by nature and are inexhaustible. | (i) They do not renew or regenerate and are exhaustible. |
| (ii) Low cost of operation. | (ii) High cost of operation. |
| (iii) They produce little or no pollutants. Thus minimum impact on environment. e.g., wind energy, solar energy. | (iii) They produce a lot of pollutants e.g., coal, petroleum etc. |
2. It is not possible to make use of solar cells to meet all our energy needs because :
- (i) of limited availability of special grade semiconducting materials such as silicon, germanium.
 - (ii) it has lower efficiency as it depends entirely on intensity of solar radiation.
 - (iii) the process of manufacturing of solar cells is very expensive, silver used for interconnection of cells in the panel further adds to the cost.
- Uses of solar cells**
- (i) It provides electric power to satellites and space probes
 - (ii) It provides electric power to off-shore drilling platforms and light houses.
 - (iii) TV relay stations or wireless transmission systems located in remote areas use solar panels to get electric power.
3. (a) For a **nuclear reactor** – element 'B' with mass number 235 is suitable as a fuel in a nuclear reactor.

Example : solar energy, wind energy, biomass energy, etc.

Non-renewable sources of energy are the ones that do not renew or regenerate in nature over a short period of time.

Example : fossil fuels – coal, petroleum and natural gas.

- (b) **Exhaustible sources of energy** are the ones that are limited in supply and formed over a millions of years ago and will get depleted in short period.

Example : coal, petroleum and natural gas.

Inexhaustible sources of energy are the ones that are always available in nature.

Thus the basis for classification of energy source in both cases (a) and (b) are same but have some exceptions. For example, wood is a renewable source of energy only if we plant trees periodically.

43. Characteristics of ideal source of energy

- (i) It should provide an adequate amount of continuous supply of energy per unit mass.
- (ii) It should be cheap and easily available.
- (iii) It should be safe to handle and should be easy to store and transport.
- (iv) It should not pollute the environment.
- (v) It should have neither very low ignition temperature nor very high ignition temperature.

- (b) For a **hydrogen bomb** – element 'A' with mass number 2 is suitable for making the hydrogen bomb.

The nuclear reaction involved in a

- (a) **nuclear reactor** is nuclear fission reaction and
- (b) **nuclear bomb** is nuclear fusion reaction.

Difference between fission and fusion

Fusion reaction releases much greater energy with non-radioactive products than the energy released in fission reaction with radioactive products.

4. Hazards of nuclear wastes

- (i) Nuclear waste contain radioactive substances which emit harmful nuclear radiations.
- (ii) High risk of environmental contamination.
- (iii) It is highly toxic.

Effect on plants and animal life

The radiation emitted from the nuclear waste penetrate deep inside the human or animal body where they can damage biological cells thereby initiate cancer or cause genetic diseases.

Increase mortality of plants, soil invertebrates and mammals and reproductive losses in plants and animals have also been observed.

5. (a) Charcoal is considered to be a better fuel than wood because :

- (i) It burns without flames.
 - (ii) Comparatively smokeless and
 - (iii) higher calorific value i.e., higher heat generating efficiency.
- (b) Biogas plant helps to reduce the problem of pollution in the following ways:
- (i) It provides better sanitation due to safe disposal of bio-waste and sewage material.

- (ii) Biogas obtained from this plant produces no smoke on burning.
- (iii) The residue left can be used as a manure which can be used as an alternative of fertilizers. Thus it prevents soil and water from degradation.
6. (a) **Geothermal energy** : The heat energy obtained from the molten rocks formed in the deeper hot regions inside the earth are called geothermal energy.
- (b) **Advantages of wind energy**
- It is an inexhaustible source of energy.
 - It does not cause any environmental pollution.
 - It is available at free of cost.
- (a) A vast variety of plants get submerged in water, rot under anaerobic conditions and produce large amount of greenhouse gases such as methane.
- (b) Traditional uses of biomass fuels are not only inefficient but they produce a lot of pollutants which are hazardous to health. Therefore technological inputs are necessary to improve the efficiency of these fuels and make them environment friendly. With the help of technology, smokeless chulhas and biogas plants have been designed.
8. (a) **Biomass** - The residue of living organisms such as cow-dung, residue of plants and animal products from which fuel can be obtained is called biomass.
- Biogas is obtained from biomass by its anaerobic decomposition in a biogas plant.
- (b) **The characteristics such as :**
- high calorific value and low cost
 - easy to handle and low cost of transport
 - environmental friendly
 - renewable source of energy and
 - burning without smoke makes biogas an ideal fuel.
- (c) A - Mixing tank
B - Over flow tank
C - Digester
9. (a) **Anaerobic decomposition** : The process in which the complex compound of cow dung slurry decomposes or breaks down in the absence of oxygen by anaerobic microorganisms *i.e.*, anaerobic bacteria is known as anaerobic decomposition.
- It generates gases like methane (75%), carbon dioxide, hydrogen and hydrogen sulphide.

Steps involved in obtaining biogas :

- Slurry is made by mixing of animal dung with an equal amount of water.
 - Slurry is passed through an inlet chamber of an underground digester tank.
 - In digester tank, slurry is decomposed by anaerobic bacteria in about 50-60 days to produce biogas.
 - The biogas collected in domes built over the digester tank has a gas outlet with valve.
 - The pressure exerted by the biogas on the slurry forces the spent slurry to the overflow tank *via* outlet chamber.
 - The spent slurry is periodically removed and used as a good manure.
 - The whole process is repeated again for regular supply of biogas.
- (b) $^{235}_{92}\text{U}$ can undergo fission readily.
10. (a) Methane, carbon dioxide, hydrogen and hydrogen sulphide.
- (b) **Advantages of using biogas over fossil fuels.** (any two)
- Biogas burns without smoke and does not cause air pollution while fossil fuels burning causes air pollution.
 - Biogas does not leave any residue after burning while fossil fuels leave residue like ash which have a disposal problem.
 - Biogas is cheaper than fossil fuels.
11. (a) (i) Solar energy into heat—solar cooker
(ii) Solar energy into electricity—solar cell.
- (b) **Principle of working of a windmill** : When the blowing air strikes across the specially designed blades of a windmill, blades start rotating. The speed of rotation, however, may increase or decrease depending upon the wind velocity at that place.
12. **Principle of generation of electricity by nuclear reactor**
- It is based on the self sustaining fission chain reaction of nuclear fuels such as uranium, plutonium or thorium, that releases energy at a controlled rate. The heat energy produced is taken out by the coolant such as water, liquid sodium to the heat exchanger to heat the water and convert it into steam. The hot pressurised steam rotates the turbine, the electric generator connected to it generates the electricity.

Important Questions

13. **The disadvantages of burning fossil fuel are :**
- Non renewable** - Their excessive exploitation may cause energy crisis in the future.
 - Pollutes the environment** - On burning, they release oxides of sulphur, nitrogen and carbon. Thus, they are responsible for acid rain, which is disastrous to the environment.
 - Threatens ecological balance** - Widescale extraction of fossil fuels such as coal mining threatens the ecological balance.
14. **Characteristics of a good source of energy :**
- It should provide adequate amount of energy at constant rate over a long period of time.
 - It should burn without giving out any smoke or harmful gases.
 - It should be easily available and convenient to use.
- Qualities of a good fuel :** It should
- be easy to store,
 - be economical,
 - leave less residue on burning.
15. **Ocean thermal energy** - The energy available due to the temperature difference between the warm surface of ocean and water at a depth of 2 km approximately is called ocean thermal energy.

Harnessing of ocean thermal energy

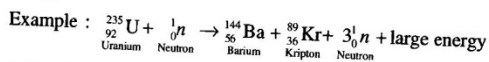
- The Ocean Thermal Energy (OTE) can be utilized to run Ocean Thermal Energy Conversion (OTEC) plant to produce electricity.
- In OTEC plant, the energy of warm surface water is used to convert liquid ammonia into gaseous state.
- The vapours of ammonia at high pressure are used to run the turbines of generators to produce electricity.
- The used vapours pass through the condenser where cold water, pumped from the deeper parts of ocean condenses it to liquid again.
- This process is repeated again and again to get continuous production of electricity.

Limitations – The limitations in harnessing the energy from the oceans are :

- low conversion efficiency and
- high initial cost.

16. Geothermal energy – The energy obtained from the hot molten rocks and trapped hot fluids in the rocks inside the earth is called geothermal energy. The hot regions inside the earth's crust are called hot spots. When underground water comes in contact with these hot spots, steam is produced. At some places, dry steam comes out of the surface of the earth directly through the vent but at some other places, the steam mixed with hot water is obtained by deep drilling inside the earth's crust. The collected steam at high pressure can be used to turn turbines to generate electricity.

17. Nuclear fission – When a heavy nucleus is broken into two nearly equal fragments due to bombardment of suitable projectile, a tremendous amount of energy is released. This process is called nuclear fission and released energy is known as nuclear energy.



Safety Measures – The safety measures which should be taken while handling the nuclear processes such as generation of electricity by nuclear reactors are :

- The used nuclear fuel rod must be carefully handled and stored properly.
- The nuclear waste should be sealed in a strong concrete or steel containers before dumping them in deep mines which are not in use or in deep deserts.
- Ensure that there is no leakage from nuclear reactors.

18. Nuclear waste – The waste obtained from nuclear power plants is highly radioactive in nature and emits harmful radiations is a nuclear waste.

Main hazards of nuclear waste on living beings are

- Somatic effect** – The disorder caused by nuclear radiations in the cells of living beings leading to cancer like disease are not passed to the next generation.
- Genetic effect** – The disorder caused by nuclear radiation in the genes of living beings are passed to the next generation.

For long term storage the nuclear waste products are stored in steel/lead containers and buried deep under the ground or dumped in vacated mines.

- Water has 'high specific heat capacity'. This property enables the oceans to act as store-house of solar energy.
 - The three forms in which energy from ocean can be harnessed are tidal energy, wave energy and ocean thermal energy.
- Tidal energy** – Due to gravitational pull of moon on the spinning earth, the water level in the sea rises and falls, giving us tidal energy.
 - Wave energy** – The strong winds blowing across the sea generate waves which possess huge kinetic energy, thus giving us wave energy.
 - Ocean thermal energy** – The energy available due to temperature difference between the warm surface of ocean and water at a depth of 2 km approximately is called ocean thermal energy.

20.

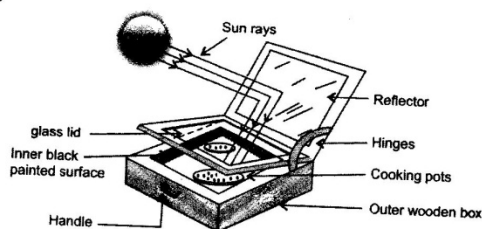


Fig. Solar cooker

The box type solar cooker is blackened from inside which absorbs the heat radiation (infrared rays) coming from the sun. The glass lid reduces the heat loss by not allowing rays to return back to space. The overall design helps to reduce the loss of heat.

Limitations (Any three)

- It does not work at night as well as on cloudy days.
- It cannot be used for frying purposes or preparing chapatis.
- There is a need of frequent adjustment of the reflecting mirror to let the reflected rays fall on the glass lid.
- The performance of the cooker depends upon the intensity of solar radiation. Hence, cooking time may vary from time to time.

21. Wind energy factors – The factors responsible for the blowing of wind are :

- Uneven heating of equatorial region and polar region of earth by sun rays.
- Rotation of earth about its own axis.
- Prevailing local condition in the region.

Advantages (Any three)

- Wind is freely available at no cost and can be captured efficiently.
- It does not cause any environmental pollution.
- It is an efficient source of renewable energy.
- Remote areas that are not connected to the electricity power grid can use wind turbine to produce their own electric supply.

22. Wind energy farm – The place where a large number of windmills are erected over a large area is called wind energy farm.

Practical application – The energy output of each windmill is coupled together to get the electricity power on a large scale.

Limitations of using wind energy farm (Any three)

- (i) Wind energy farm can be established only at those places where wind blows for the greater part of the year.
- (ii) Wind speed should be higher than 15 km/h to maintain the speed of turbine.
- (iii) It requires large area of land.
- (iv) Initial cost is quite high and needs a high level of maintenance as it is exposed to the atmosphere.
- (v) It requires backup facility also.

23. The three energy sources that are considered to be inexhaustible are

- (i) **Sun** – The sun will continue to radiate energy at the present rate for another five billion years.
- (ii) **Biomass** – As it can be produced in a short span of time, it is considered as inexhaustible.
- (iii) **Flowing water** – Hydroelectricity can be obtained by storing the flowing water in a reservoir and allow it to fall from a height on the turbine blades to turn it. This water can be replenished through water cycle in the nature.

24. The two ways in which animal dung can be utilized as a fuel are :

- (i) Anaerobic decomposition of animal dung produces biogas which can be used as fuel.
- (ii) Making cow-dung cakes by drying it in the sun and then burning it as a fuel.

Anaerobic decomposition process is better because biogas is an excellent fuel with high heating capacity. It burns without smoke and has no residue whereas cow-dung cakes do not produce much heat on burning and also produce a lot of smoke during burning which has hazardous effect on health.

25. **Advantages of producing hydroelectricity** by building dam on rivers are

- (i) The water after generation of electricity can be reused for irrigation.
- (ii) Floods can be controlled by storing the water behind the dam.
- (iii) It does not produce any environmental pollution.
- (iv) It is a renewable source of energy as water in reservoir would be refilled each time it rains. [any three]

Disadvantages

- (i) Large area of agriculture land and human habitation is to be sacrificed as it gets submerged at the dam-site.
 - (ii) Large ecosystems are destroyed when submerged under water.
 - (iii) The decomposition of vegetation under anaerobic condition produces methane gas which is also a greenhouse gas.
26. (i) Hydrogen is considered as cleaner fuel than CNG because hydrogen on burning with the help of oxygen produces water whereas, CNG on burning produces CO₂ which causes pollution, though much less than what is produced by burning of other fossil fuels.
- (ii) Solar cells are used as a source of energy in
 - (a) powering remote sensing telecommunication stations and
 - (b) street lighting.
 - (iii) **Biggest hindrance in trapping geothermal energy** is that the deep drilling in the earth to obtain the energy is very difficult.
27. (i) CNG on burning produces only carbon-dioxide and water.
(ii) It does not produce smoke.
(iii) It does not leave unburnt hydrocarbons, lead particulates etc. which pollutes the environment.
- Hence, there is so much emphasis on changing over from petrol/diesel driven automobiles to CNG-driven vehicles.

NCERT Questions

28. Yes, hydrogen is a cleaner fuel than CNG. Rocket carries oxygen (in liquid form) which helps in burning the hydrogen (in liquid form) which is used as a fuel and produces water. Water does not cause any damage to environment.

On the other hand, CNG on burning produces carbon dioxide and water. CO₂ is not a pollutant yet it leads to rise in the temperature. This would affect the polar ice and life on the earth is at risk due to global warming (green house effect).

This shows that hydrogen is a cleaner fuel than CNG.

29. **Limitations of extracting energy from :**

(a) **The wind**

- (i) The minimum velocity of wind required for a windmill to function is 15 km/h which is not available everywhere and every time.
- (ii) With high initial and maintenance costs, the large area of land is also required for establishment of wind energy farms.

(b) **Waves**

- (i) The power output varies as strong waves are not available everytime.

- (ii) It is costly to trap wave energy and the device used must also be capable of withstanding storms.
- (c) **Tides**
- (i) The power output is variable, intermittent and is not on a large scale.
 - (ii) There are very few suitable sites that too with high installation and maintenance cost.

30. **Advantages of a solar cooker are**

- (i) It does not consume any conventional fuel. Thus is economical to use.
- (ii) It does not cause any pollution while cooking food.
- (iii) It preserves the nutritional value of food while keeping the food hot for four to five hours.

Disadvantages of a solar cooker are

- (i) It does not work at night as well as on a cloudy day.
- (ii) There is a need of frequent adjustment of the reflecting mirror to let the reflected light fall on the glass sheet cover.
- (iii) The performance of cooker will depend upon the intensity of solar radiation. Hence cooking time of solar cooker may vary from time to time.

Yes, there are places where solar cooker have limited utility. At high altitudes, such as hilly areas, where the sun shines for limited period of time and in dense forests, where the sun rays never reach the surface. So the use of solar cooker is limited.

31. Rapid modernisation and industrialisation have tremendously increased the demand for energy.

The environmental consequences of increasing demand for energy are :

- (i) Excessive exploitation of conventional sources of energy which are limited in nature may cause energy crisis in the future.
- (ii) In some cases, even if the conversion of energy to the

- (iii) required form is pollution free, the assembly of the device used would have caused some damage to the environment.
- (iii) Some energy conversion plants or farms like that of windmill requires a lot of land for their establishment which otherwise could be used for other purposes.

Suggestions to reduce energy consumption are

- (i) The judicious use of energy by avoiding wastage can reduce the energy consumption.
- (ii) The dependence on fossil fuels should be reduced by switching to alternate sources of energy.
- (iii) Regular servicing of energy conversion devices should be done in order to maintain efficiency.

[5 MARKS]

LONG ANSWER TYPE QUESTIONS

Previous Years' Questions

1. (i) It is because a piece of fresh wood is not dry and therefore, it is to be heated at high temperature before it catches fire, that is why it is difficult to burn.
- (ii) It cuts off the supply of air (oxygen) which is required for combustion to take place.

- (iii) Hydrogen is highly combustible and burns with an explosion, therefore, it is difficult to store and transport.
- (iv) Charcoal has higher calorific value than wood and produces less smoke than wood.

Important Questions

2. **Solar water heater** – It is a device which heats the water using solar energy.

Principle :

- (i) A black surface absorbs more heat as compared to white or reflecting surface under identical conditions.
- (ii) Greenhouse effect is provided by glass lid.

Structure – It consists of an insulated box which is painted black from inside having a coiled black chrome painted copper pipe. The box is covered with glass lid so as to prevent heat loss by convection and radiation. The two ends of the copper pipe of solar water heater are joined to the water storage tank which is insulated to prevent heat loss.

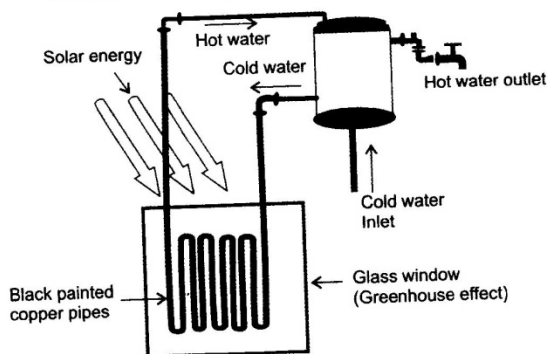


Fig. Schematic diagram of solar water heater

Working :

- The copper pipe warms-up due to solar radiations incident on it.

- The glass lid on the box provides the green house effect to optimise the heating.
- The water flowing through the tube gets heated by absorbing solar energy.
- The hot water becomes lighter which flows up into the tank and heavier cold water from same tank enters into the copper pipe.
- The circulation of water from the tank through the pipe and back to the same tank continues automatically, due to density difference between cold and hot water.

3. (i) **Nuclear Energy** – The energy produced during nuclear reaction such as nuclear fission or fusion is called nuclear energy.
- (ii) For peaceful purposes, nuclear energy can be converted into electrical energy by means of nuclear reactor in which self sustained controlled chain reaction of uranium-235 produces energy at constant rate by fission process. This intense heat is absorbed by liquid sodium which circulates continuously in the reactor and transfers the heat to the water in heat exchanger to produce steam. This high pressure super heated steam rotates the steam turbine to generate electricity.
- (iii) Kundankulam nuclear power project in the state of Tamil Nadu (India) faced the opposition from the local public over its implementation. It is due to :
 - (a) fear of Fukushima (Japan) like disaster.
 - (b) more than one million people live within 30 km radius of the nuclear power plant. So it is quite impossible to evacuate such a large population in case of any disaster.

SHORT ANSWER TYPE QUESTIONS

- There is a need to harness non-conventional sources of energy because :
 - fossil fuels are limited sources and are depleting fast.
 - burning of fossil fuels causes a lot of pollution.
- Ocean thermal energy and tidal energy.
- Suggestions to minimise environmental pollution caused by burning of fossil fuels are :**
 - The dependency on fossil fuels should be reduced by switching to alternate sources of energy.
 - The judicious use of energy by avoiding wastage can reduce environmental pollution.
 - Regular servicing of energy conversion devices should be done in order to maintain efficiency.

LONG ANSWER TYPE QUESTIONS

- Environmental consequences of using fossil fuels are :**
 - They are the largest emitters of greenhouse gases such as carbon dioxide and methane.
 - Extraction of conventional fuels threatens the ecological balance in many areas.
 - These fuels cause environmental problem due to pollution.

Steps to minimize the pollution

 - The dependency on fossil fuels should be reduced by switching to alternate sources of energy.
 - The judicious use of energy by avoiding wastage can reduce environmental problems.
 - Regular servicing of energy conversion devices should be done in order to maintain efficiency.
 - We should focus on developing technology that could make the energy conversion devices much more efficient and cleaner.
 - Research should be continued to produce long lasting devices so that the environmental damage caused by assembly of devices gets minimized.
- Yes, sun is the ultimate source of energy. Directly or indirectly, all the forms of energy are derived from solar energy.

- Non renewable sources of energy :** Fossil fuels like coal, petroleum and natural gas are formed due to burial of large plants and animal creatures whose ultimate source of energy is sun.
- Renewable sources of energy** – They are indirectly derived from solar energy such as

- Energy from flowing water** – Clouds are formed when water in lakes, rivers, seas etc. evaporates 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.
- 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, wind possesses kinetic energy.
- Bio 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 biomass which can be utilised as a source of energy.
- Wave energy** – The waves are generated by strong winds (due to solar energy) blowing across the sea.

- Ocean thermal energy** – Sun is responsible for the temperature difference between the water at the surface and water at depth in seas and oceans.
- Solar heating devices** 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.
- Biomass :** The residue of living organisms such as cow dung, remains of plants and animal products from which fuel can be obtained is called biomass.

Principle : The decomposed biomass releases biogas which is rich in methane having a high calorific value.

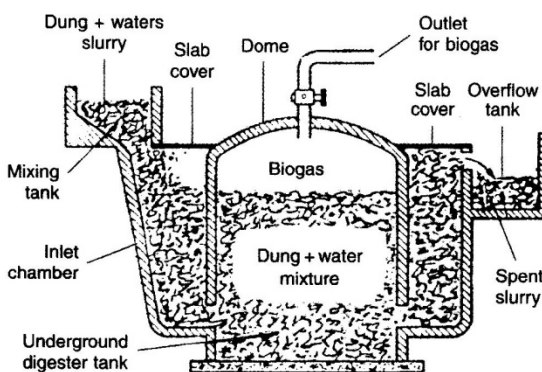


Fig. Fixed domed type biogas plant

Working.

- Slurry is made by mixing animal dung with an equal amount of water in a mixing tank.
- Slurry is fed into the underground digester tank through a sloping inlet chamber.
- The anaerobic microorganism that do not require oxygen decompose or break down complex compounds of cow dung slurry in about 50-60 days to produce bio gas.
- The produced biogas is collected inside the dome built over the digester tank.
- As more and more biogas starts collecting, the pressure exerted by the biogas increases this forces the spent slurry into over flow tank via outlet chamber.

- (vi) The collected biogas is taken out through the outlet valve and is supplied wherever it is required.
- (vii) The spent slurry is periodically removed and is used

- as a manure for plants.
- (viii) To get the continuous supply of gas, a prepared slurry is fed into the plant regularly.

VALUE BASED QUESTIONS

1. (a) No, It will not help the nature because
- excessive use of fossil fuels pollute the environment and
 - fossil fuels are non-renewable sources of energy.
- (b) To help the nature, they can use car-pool or public transport system.
- (c) Ecofriendly life style, coordination and friendship.
2. (a) Second village, as they use biogas for their basic necessities by using modern technology.
- (b) One should adopt the renewable sources of energy like solar energy, biofuel etc.
3. (a) Renewable sources of energy as they are non-polluting.
- (b) It saves electrical energy, money, creates more jobs and employment.
- (c) Solar water heater, solar panel, solar cooker etc.
- (d) People should adopt the modern technology so that they can take the advantage of renewable sources of energy.
4. (a) Tsunami damaged the cooling system of nuclear reactor and the heat evolved during nuclear fission reaction damaged the nuclear reactor.
- (b) Damage to the property and life, genetical disorder, infertile soil.
- (c) Yes, it produces a large amount of energy with small quantity of nuclear fuel provided, all the necessary precautions for harnessing of nuclear energy are taken.
5. (a) (i) Use renewable sources of energy.
(ii) Population Control.
(iii) Planting of trees (afforestation).
(iv) Limited fossil fuel consumption.
- (b) We should encourage others to play their role as responsible citizen in the conservation of energy resources.