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Sources of Energy

In the Chapter

- Our energy needs increase with our standard of living.
- In order to fulfil our energy needs, we try to improve the efficiency of energy usage and also try and find out new sources of energy.
- We also have to look for new sources of energy because the conventional sources of energy such as fossil fuels are in danger of getting exhausted soon.
- Many of the sources ultimately derive their energy from the Sun.
- The energy source we select would depend on factors such as the ease and cost of extracting energy from the source, the efficiency of the technology available for using that source of energy and the environmental impact of using that source.

Intext Exercises

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1. What is a good source of energy?

Ans. A good source of energy has following characteristics :
(i) It would be easily accessible.
(ii) It could do a large amount of work per unit volume or mass.
(iii) It would be economical.
(iv) It would be easy to store and transport.

2. What is a good fuel?

Ans. A good fuel has following characteristics :
(i) It should have high calorific value.
(ii) It should be economical and easy to handle.
(iii) It should have normal ignition temperature.
(iv) It should not leave more ash and should not produce harmful gases on burning.

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

Ans. I would use renewable and pollution free sources of energy to heat my food. Because, it would not disturb the ecological balance as well as it would be reproduced in nature by cyclic process when it would be used once.

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1. What are the disadvantages of fossil fuels?

Ans. The disadvantages of fossil fuels are as follows:
(i) Fossil fuels are non-renewable sources of energy.
(ii) Fossil fuels are formed under the earth's surface by a long process which takes million years to form fossil fuel and there are only limited reserves.
(iii) Burning of fossil fuels causes air pollution. The oxides of carbon, nitrogen and sulphur which are released on burning fossil fuels cause acid rain and other respiratory problems for human beings.

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

Ans. With the development of technology, the demand of energy is increasing continuously. Our changing life style and use of more machines to do more and more of tasks easily and has increased the demand of energy rapidly. This demand of energy cannot be fulfilled by using traditional sources of energy. Therefore we are looking at alternate sources of energy.

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

Ans. Wood and water are traditional sources of energy. Continuous supply of energy from these sources cannot be maintained because it requires enough trees to be planted. So, following modifications are for our convenience :
(i) Wood is converted into charcoal by destructive distillation of wood which is a better fuel than wood.
(ii) Use of charcoal is also eco friendly as it does not produce smoke on burning. It has higher calorific value and leaves less residue on burning.
(iii) Use of water energy requires the construction of big dams. So these dams are being established at limited number of places. To improve the output of water energy, the technology is being developed to increase the efficiency of devices used to convert water energy into electricity.

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

Ans. Concave mirror would be best suited for use in a solar cooker because, concave mirror can focus all the radiations coming from sun properly at a point and produces more heating.

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

Ans. The energy potential from ocean is large but efficient commercial exploitation is difficult.

3. What is geothermal energy?

Ans. The heat from inside earth heats up the water below the surface. This hot water can be used under favourable condition as source of energy. It is known as geothermal energy.

4. What are the advantages of nuclear energy?

Ans. Nuclear energy is a non-conventional source of energy and gives large quantity of usable form of energy. This is the major advantage of nuclear energy.

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

Ans. Exploiting any source of energy disturbs the environment. Therefore, we can say that any source of energy cannot be pollution free. For instance, if we use wood as source of energy then it causes ecological imbalance as well as it causes air pollution due to the production of harmful gases like CO_2, SO_2 and NO_2 during burning of wood directly. Even use of solar energy causes excessive trapping of infrared radiation which causes global warming.

2. 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 of the following reasons :
(i) Hydrogen has high calorific value than CNG.

(ii) CNG is green house gas but H_2 is not.
(iii) CNG is conventional source of energy but H_2 is not.
(iv) Burning of CNG gives out CO and CO_2 gases but burning of H_2 does not produce any such harmful gases.

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

Ans. Two renewable sources of energy are as following :
(i) **Wind energy :** Wind energy is trapped to perform various activities. The wind energy is caused in atmosphere by natural cyclic process. Therefore, it is a renewable source of energy.
(ii) **Hydro energy :** Hydro energy is the energy possessed by running water. The running water at high altitude is used and unused water is gone to oceans. Due to cyclic process we get running water at high altitude again. So hydro energy is a renewable source of energy.

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

Petroleum and coal are the two exhaustible sources of energy because even they are reproduced in nature but it takes millions of years to be reproduced in nature.

Exercise

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.

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

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) bio-mass

Ans. (a) geothermal energy

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

Ans. Fossil Fuels
(i) Fossil fuels can be used as source of energy at any time.
(ii) It is conventional source of energy.
(iii) Fossil fuels cannot be used unjudiciously because it is limited in quantity.
(iv) Sun is the ultimate source of all fossil fuels.
(v) It costs to buy fossil fuel.

Sun
(i) Solar energy can be used only in day time.
(ii) It is non-conventional source of energy.
(iii) Sun is larger source of energy and can be used at large scale as according to our need.
(iv) Sun is the ultimate and final source of energy on earth.
(v) It is cost free source of energy.

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

Ans. Biomass
(i) Biomass is a renewable and conventional source of energy.
(ii) Use of biomass does not cause ecological imbalance.
(ii) Biomass possesses chemical energy.

Hydroelectricity

(i) Hydroelectricity is also a renewable and conventional source of energy.
(ii) Construction of dam for hydroelectricity causes ecological imbalance.
(iii) Hydro energy is pollution free source of energy.
(iv) Hydro energy possesses kinetic energy of running water at high altitudes.

6. What are the limitations of extracting energy from—
(a) wind? (b) waves? (c) tides?

Ans. (a) Wind energy

Limitations

(a) Everywhere and every time the blowing air is not available.
(b) To produce electricity the wind should have speed more than 15 km/h

(b) Wave energy

(a) The wave is not available every time for producing electricity.
(b) It is costly to set up device to trap wave energy.

(c) Tides

(a) Construction of dams for harnessing tidal energy is costly.
(b) The locations for constructing dams for harnessing tidal energy are limited.

7. On what basis would you classify energy sources as
(a) renewable and non-renewable?
(b) exhaustible and inexhaustible?
Are the options given in (a) and (b) the same?

Ans. (a) If the source of energy can be converted back to its original form after extracting energy, then it is said to be renewable source, for example, hydroelectricity. If the source of energy cannot be replenished after use, it is known as non-renewable source, for example, coal.
(b) Sources of energy that will not exhaust in significant time are called inexhaustible source. For example, sun, water. Sources of energy that will exhaust in reasonable time are known as exhaustible source, for example, coal.

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

Ans. The qualities of ideal sources of energy are following :
(i) It could do a large amount of work per unit volume of mass.
(ii) It would be economical.
(iii) It would be easy to store and transport.
(iv) It would be easily accessible.

9. What are the advantages and disadvantages of using a solar cooker? Are there places where solar cookers would have limited utility?
Advantages of use of solar cooker are as follows :

Ans. (i) A solar cooker cooks food without causing any kind of pollution.
(ii) It is easy to handle solar cooker and there is no chance of any kind of accident.
(iii) It is economical to use solar cooker because nothing is to be paid for using solar energy.
(iv) The nutrients of food do not get destroyed.

Disadvantages of use of solar cooker are as follows :

(i) It cannot be used at night and in 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 sun.
(iv) Sun energy is not available uniformly all the time and at all the places.
(v) It cannot be used for making chapaties and for frying.

Yes, there are some places where solar cookers would have limited utility. At poles where sun is absent for half of the year the solar cooker has limited utility.

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

Ans. Industrilisation and modernisation have increased the demand of energy. The consequences of

increasing energy are listed below :

(i) Increasing demand of energy makes excessive use of conventional sources of energy which are limited in nature. Thus, energy crisis for future may be caused.

(ii) The increase of energy demand can make excessive exploitation of sources of energy which disturbs the environmental balance.

Following steps can be suggested to reduce the energy consumption :

(i) The judicious use of energy and avoiding misuse of energy can reduce the energy consumption.

(ii) The alternative sources of energy such as solar energy, wind energy and hydro energy should be used to reduce the load of energy or non-renewable source of energy.

Additional Questions

1. What is the wavelength range of visible solar energy ?

Ans. 400 run to 700 run.

2. Name the components of solar energy not visible to us.

Ans. Ultraviolet and infrared rays.

3. Give some examples of utilisation of solar energy.

Ans. Drying of clothes and food grains.

4. Name forms of solar energy manifesting itself in ocean.

Ans. Ocean thermal energy and tidal energy.

5. What is full name of L.P.G. ?

Ans. Liquefied Petroleum Gas.

6. What is full form of C.N.G. ?

Ans. Compressed Natural Gas.

7. What is used to make solar cell ?

Ans. Gallium and silicon.

8. What is a solar panel ?

Ans. Group of solar cells arranged in a definite pattern is called a solar panel.

9. What is the range of temperature which can be achieved in box type solar cooker?

Ans. From 100°C to 150°C.

10. What is tidal energy ?

Ans. Energy obtained due to difference in levels of ocean water between high tide and low-tide is called tidal energy.

11. Where are the wind power plants located?

Ans. Okha and Lamba (Porbandar) in Gujrat.

12. What is the main constituent of biogas ?

Ans. Methane.

13. What is merits of solar cell ?

Ans. It provide clean, pollution free, noiseless, safe and cheap energy.

14. What part of solar energy is harmful to us ?

Ans. Ultra violet rays. These cause skin cancer.

15. What is geothermal energy ?

Ans. It is energy inside the earth in form of hot water springs and hot lava.

16. What are constituents of L.P.G. ?

Ans. Mainly butane. It also contains propane and ethane.

17. How is slurry left over after production of biogas used ?

Ans. As a useful manure rich in nitrogen.

18. Name the process by which large scale energy is produced in the sun.

Ans. By nuclear fusion.

19. Name the chemical added to L.P.G. to detect its leakage.

Ans. Ethyl mercaptan which is C_2H_5 - SH.

20. What is natural gas ? What are its advantages over other fuels ?

Ans. Natural gas is fossil fuel. It consists mainly of methane and small quantities of ethane and propane. Thus, methane is the principal constituent of natural gas (upto 97%). It occurs deep under the earth either alone or along with oil above of the petroleum deposits.

21. Name four gases whose concentration is likely to be higher in the atmospheric air near a busy road-crossing through which a large number of automobiles pass at every instant.

Ans. Carbon monoxide (CO), carbon dioxide (CO_2), nitrogen dioxide (NO_2) and sulphur dioxide (SO_2).

22. Hydrogen compounds are abundantly available on earth and it has a high calorific value but this gas is not commonly used as a domestic fuel. Give any two reasons for this.

Ans. Hydrogen is not used as a domestic fuel because of following reasons :

1. Hydrogen is highly combustible and is difficult to handle safely. Because of its high combustible nature, it burns with explosion.
2. It is not easy to store or transport hydrogen from one place to another safely.

23. Write any two advantages of using biogas over cow-dung cakes.

Ans. Advantages of using biogas over cow-dung cakes are :

1. The calorific value of biogas is much higher than that of cow-dung cakes.
2. Biogas does not give out smoke like cow-dung cakes.

24. Name the fuel that provides most of the energy needs of the world.

Ans. Petroleum and coal (fossil fuel).

25. Which way of using cow-dung as fuel for domestic use is better: use of cow dung cakes or use of cow-dung in a biogas plant? Give three reasons in support of your answer.

Ans. When cow-dung burns, it produces a lot of smoke, which causes air pollution as well as loss of very useful elements. However, the use of cow-dung in biogas plant is better because of the following reasons :

(i) bio-gas burns without smoke.
(ii) bio-gas produces a large amount of heat.
(iii) the residue (slurry) left in the plant is rich in nitrogenous and phosphorus compounds and can be used as manure.

26. Kerosene burns in a cooking stove to give a blue flame while it gives yellow flame when burns in a lantern. Give reasons for this difference.

Ans. Kerosene burns in a cooking stove gives a blue flame because excess of oxygen is available for burning of kerosene in a cooking stove. However, due to less availability of oxygen, a yellow flame (indicating partial burning) is produced in a lantern.

27. What is bagasse? For what purpose is it used?

Ans. Bagasse is the leftover biomass material of sugarcane from which juice has been extracted. It is dried in the sun and can be used as a fuel.

28. In chulhas, it is difficult to burn wood if logs of wood are fully packed. Why?

Ans. If logs of wood are fully packed in wood chulhas, then, there is less scope for air (supporter of combustion) to enter. Without air, the combustion becomes difficult. Therefore it is necessary to leave gaps between logs of wood in chulhas to facilitate burning.

29. What is the scope of wind energy in India?

Ans. After Germany, U.S.A. and Denmark, India ranks fourth in world in wind power generation. To promote utilization of wind power, a Centre of Wind Energy (C-WET) has been set up at Chennai. Out of a total capacity of 1,025 MW power in India, 380 MW is being generated at Kanya Kumari, Kerala.

30. What is Bio-energy ?

Ans. Bio-energy is the energy generated from bio-mass. Bio-fuel is an indirect source of solar energy and is renewable sources of energy.

31. How is bio-mass used as fuel?

Ans. Bio-mass is being used as a fuel since ancient times. Animal dung cakes and wood are still primary sources of heat in rural and tribal area. These bio-fuels are burnt in traditional chullahs which is very inefficient. To increase their efficiency, smokeless chullahs have been designed.

Method to convert bio-mass into bio-energy fuel

Biological process involves conversion of biomass into fuels by means of decay of biomass by microorganisms. The method provides us bio-gas which is mainly methane.

Methane burns with blue flame and is without odour. Bio-gas is formed in absence of oxygen.

32. What are the constituents of bio-gas ?

Ans. Bio-gas is produced from animal and plants origin like cattle dung, domestic sewage, poultry waste, organic manure, slaughter house or fishery waste. Biogas generated by them is called Gobar Gas.

Anaerobic bacteria convert biomass into biogas. Biogas is a mixture of 50 to 70% methane, 30 to 40% carbon dioxide, 5 to 10% hydrogen, 1 to 2% nitrogen and traces of hydrogen sulphide.

33. What is Sea Wave Energy? How is it obtained?

Ans. Sea wave energy is energy of the waves produced in sea due to winds. Sea wave tidal energy is harnessed in three ways :

1. Wave surge or Focussing devices. To overcome the problem of low height of water, the barriers are constructed in such a manner that water is channelled and concentrated into small area. The technique raises the height of water waves greatly. The raised water is channelled into an elevated reservoir. Now water is made to pass through channels in which water turbines rotate to produce electricity.

2. Pitching or Floats devices rise or fall with rising and falling waves. They are connected to a shaft by some mechanical arrangement to produce electricity.

3. Oscillating Column Water (OCW's) are pneumatic devices using up and down motion to compress and decompress air. The rising and falling water devices air into or out of the top of cylindrical shaft powering an air driven turbine.

34. Write uses of the dams on rivers.

Ans. 1. Potential energy of the stored water is first converted to kinetic energy of the falling water which is finally converted to electric energy.

2. Water is stored in the dams during rains and used for irrigation purposes during draught.

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

Ans. 1. Solar energy since it is available in ample and is absolutely free.

2. Wind energy is easily available and is free. It can be used in very remote areas.

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

Ans. 1. Sources of fossil fuel are limited and shall be exhausted within a few decades.
2. With a rapid growth of population and ever increasing standard of living the demand for more energy is increasing everyday.
Hence we have to look forward towards non-conventional sources of energy.

37. Write different ways of harnessing energy from ocean.

Ans. 1. Ocean thermal energy due to difference in temperature of the various layers of sea.
2. Energy associated with the sea waves called sea wave energy.
3. Tidal waves can provide good source of energy.
4. Energy from sea vegetation and biomass present in sea.

Multiple Choice Questions

1. Which gas cannot be used as a fuel ?
(a) C.N.G. (b) L.P.G.
(c) Oxygen (d) Hydrogen
Ans. (c) Oxygen

2. Infra-red rays are :
(a) harmful to skin (b) bright red in colour
(c) having more energy than ulraviolet rays
(d) having less energy as compared to ultraviolet rays.
Ans. (d) having less energy as compared to ultraviolet rays.

3. Spent slurry produced after producing gobar gas is :
(a) useless residue (b) used as a fuel afer drying it
(c) used as manure (d) used as food for animals.
Ans. (c) used as manure

4. Which energy is freely available in ample amount?
(a) sunlight (b) water gas
(c) hydrogen (d) wind energy
Ans. (a) sunlight

5. Gobar gas is :
(a) foul smelling gas (b) sweet smelling gas
(c) having high calorific value (d) useless
Ans. (c) having high calorific value

6. Bio-gas is produced from bio-matter by :
(a) anaerobic fermentation (b) destructive distillation
(c) fractional distillation (d) mixing petrol in bio-matter
Ans. (a) anaerobic fermentation

7. Natural gas is mostly :
(a) oxygen (b) hydrogen
(c) ammonia (d) methane
Ans. (d) methane

8. L.P.G. is mostly liquefied :
(a) hydrogen (b) oxygen
(c) butane (d) methane.
Ans. (c) butane

9. Unit of calorific value of a substance is :
(a) kcal (b) calorie
(c) J kg (d) $j\ kg^{-1}$
Ans. (d) $j\ kg^{-1}$

10. If a person catches fire, he should be :
(a) immediately thrown in a tank or pond of water or put under continuous flow of water.
(b) wrapped tightly in a blanket
(c) taken to a doctor
(d) wrapped tightly in a blanket and rushed to a doctor.
Ans. (a) immediately thrown in a tank or pond of water or put under continuous flow of water.

11. Which of the following causes maximum pollution on burning ?
(a) Gobar cakes (b) Petrol
(c) C.N.G. (d) L.P.G.
Ans. (a) Gobar cakes

12. Which causes maximum pollution ?
(a) Carbondioxide (b) Nitrogen
(c) Oxygen (d) Carbon Monoxide
Ans. (d) Carbon Monoxide

13. Ideal fuel should :
(a) have high calorific value necessarily
(b) have low calorific value
(c) leave no residue and have high calorific value
(d) have low calorific vale and burn at once.
Ans. (c) leave no residue and have high calorific value

14. Which of the following is a non-renewable source of energy?
(a) Wood (b) Sun
(c) Fossil Fuels (d) Wind
Ans. (c) Fossil Fuels

15. Fuel used in thermal power plants is :
(a) water (b) uranium
(c) biomass (d) fossil fuel
Ans. (d) fossil fuel

16. Which is he ultimate source of energy ?
(a) Water (b) Sun
(c) Uranium (d) Fossil fuels
Ans. (b) Sun

17. Which one of the following forms of energy leads to least environmental pollution in the process of its harnessing and utilisation ?
(a) Nuclear energy (b) Thermal energy
(c) Solar energy (d) Geothermal energy.
Ans. (c) Solar energy

18. 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) tide arising out in the ocean.
Ans. (b) temperature difference at different levels in the ocean