

Sources of Energy



ANSWERS

Topic 1

- A good source of energy is one which :
 - performs a large amount of work per unit volume or mass,
 - is easily accessible, (iii) is easy to store and transport,
 - is economical.
- A good fuel is one which:
 - has high calorific value, which means, it produces large amount of heat on burning completely in air or oxygen,
 - produces less smoke on burning,
 - has low cost and is easily available,
 - has an ignition temperature that is well above the normal temperature.
- Natural gas can be used for heating and cooking food because it is a clean source of energy. It does not produce huge amount of smoke on burning. Although it is highly inflammable, it is easy to use, transport, and it produces a huge amount of heat on burning.
- Various disadvantages of fossil fuels are :
 - Fossil fuels cause air pollution.
 - Fossil fuels produce gases like, CO_2 , SO_2 , SO_3 , NO_2 . The gases such as SO_2 , SO_3 and NO_2 cause acid rain.
 - Excess of CO_2 contributes to the global warming due to its greenhouse effect.
- 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 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.
- Traditional use of wind and water energy have been modified in the following ways:
 - Wind energy : Through windmill. It can be used for running waterpump, grinding grains and generating electricity.
 - Water energy : Through the use of hydroenergy, by constructing dams and setting up hydroelectric power stations.
- The reserves of fossil fuels are limited, *i.e.*, exhaustible whereas solar energy is available in abundance (and that too without any cost), *i.e.*, is inexhaustible.
 - 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.

- Bio-mass is a renewable source of energy only if we plant trees in a planned manner which is not the case with hydroelectricity.
 - The energy from bio-mass can be obtained by using a chullha or a go-bar-gas plant whereas hydroelectricity requires construction of dams on rivers.
 - Bio-mass provides pollution-free energy only when converted into biogas whereas hydroelectricity is totally pollution-free.

9. (a) Energy sources can be classified as renewable and non-renewable on the following basis:

- Quantity available in nature
- Mode of replenishment
- 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.

10. An ideal source of energy should possess the following characteristics.

- It should be capable of giving an adequate amount of useful energy.
- It should be convenient to transport, store and use.
- It should be economical.
- It should be capable of supplying the desired quantity of energy at a steady rate over a long period of time.

Topic 2

- A concave mirror is best suited for use in 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.
- The energy obtained from the oceans is :
 - 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. The heat energy of the interior of the earth is called geothermal energy. It is the naturally occurring thermal energy found within rock formations and the fluids held within those formations.

4. 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 8.25×10^7 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 can operate for years.

5. 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 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.

7. (i) Water energy (hydro-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.

(ii) Bio-mass energy : Bio-mass 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.

8. (i) Coal (ii) Petroleum and natural gas.

Both of 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 ago under special conditions.

9. (b) : Because on a cloudy day, heat radiation coming from the sun do not reach the solar water heater.

10. (c) : Nuclear energy uses uranium which is a mineral.

11. (a, c) : The correct answers are (a) and (c).

Geothermal energy and nuclear energy are not, in any way, derived from the sun's energy.

12. (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 place 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.

13. 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.

Cooking by using a solar cooker takes more time. A solar cooker gets energy directly from the sun. Therefore, it cannot be used in the absence of sunlight.

14. (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 ecosystems which get submerged under water in the dams. Further, large amounts of methane (which is a greenhouse gas) is produced when submerged vegetation rots under anaerobic conditions.

In order to reduce energy consumption:

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

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

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

