

Science Chapter 14

Sources of Energy

SOURCES OF ENERGY

(Plants, winds, water, coal, bio-gas, natural gas etc.)

It should not affect the environment. It should be eco-friendly.

Biogas is a mixture of methane (75%) CO₂, hydrogen and traces of hydrogen sulphide.

Methane is an extremely good fuel

Environmental Consequences

- Air pollution and acid rain
- Green house effect
- Damage to water bodies and to human life.

Types of Sources of Energy

- Renewable Sources of Energy
- Non- Renewable Sources of Energy

Renewable Sources of Energy

Which can be easily generated and whose supply is unlimited.

Hydro Power Plants

The potential energy of falling water is converted into electricity.

- Limited Dams
- Construction needs a large area
- Eco-systems are destroyed
- High cost of installation
- About 20% of the power generated in India comes from hydro power plants

Wind Energy

When wind blows with a sufficient speed, it gets ability to do some work

It doesn't pollute the air like power plants that rely on combustion of fossil fuels

Wind mill

It is a device which is used to convert wind energy into electrical energy. More than 25% of the electricity needs are generated through a vast network of wind mills.

Wind farm and power plants

It is basically used to generate electricity on a commercial basis, (large scale)

Wind power plants need high maintenance and high wind speeds

Wind farms are noisy and may spoil the view for people living near them

Biomass

It means any organic matter from which we get energy on a renewable basis

Solar Energy

The energy coming with the rays of the sun. The ultimate source of energy

Solar Cooker

It is a device that uses solar energy to cook food

Solar Panel

It is a combination of large number of solar cells to draw high voltage for commercial purposes

Solar Cells

It is a device which converts solar energy into electric energy

Solar cells can be used in many small appliances like calculators and spacecrafts

Energy from the Sea

Form of energy obtained from the ocean in the form of tidal waves; wind blowing etc.

Tidal energy

It is a form of energy which is obtained from the ocean in the form of tidal waves

Wave energy

It is a another type of ocean based energy source that uses the power of waves to generate electricity

Ocean thermal energy (OTE)

This energy is obtained from using the temperature difference between deep cold ocean water and warm surface water

Geothermal energy

It is the energy which is stored in the form of heat inside the earth

Characteristics of good sources of energy

- Easy storing and transportation
- Easy access
- Large amount of work per unit volume or mass
- Economical

Non-Renewable Sources of Energy

Which cannot be generated easily and whose supply is limited

Advantages

- High in energy
- Profitable

- Easy to use
- Cost effective

Disadvantages

- Time consuming to extract
- Dangerous for humans
- Contribution to acid rain
- Not viable for future generations

Fossil Fuels

These are hydrocarbons based natural resources that were formed 300 millions years ago.

Thermal Power Plant

Fuel is burnt to produce heat energy which is converted into electrical energy

Advantages

- Smaller space is required as compared to hydro power plant
- Running costs are less compared to gas plants or diesel

Major Hazards

Causes Air Pollution Green House Effect and Acid Rain

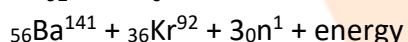
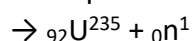
Nuclear Energy

Energy released during nuclear reactions

Types of Nuclear Energy

Nuclear Fission

It is a process in which a heavy nucleus splits up into two lighter nuclei



This principle is used in atom bomb

Moderator

Slow down fast moving neutrons e.g.: heavy water, graphite

Coolant

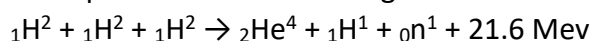
Remove heat e.g.: cold water, liquid oxygen

Control rods

Absorb neutrons e.g.: boron, cadmium

Nuclear Fusion

It is a process in which two lighter nuclei combine together to form a heavier nucleus



This principle is used in hydrogen bomb

Major Hazards

- Storage of spent fuels.
- Disposal of spent fuels.
- High cost of Installation
- Limited availability of fuel.

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Q- 1

What is a good source of energy?

Answer:

A good source of energy is one that

1. does a large amount of work per unit volume or mass
2. can be easily accessible
3. is easy to store and transport, and
4. is economical.

Q- 2

What is a good fuel ?

OR

Write any three characteristics of a good fuel. **[AICBSE 2015]**

Answer:

A good fuel is one which has the following properties :

1. It should be fairly cheap.
2. It should be easily available.
3. Its ignition temperature should be well above normal temperature.
4. It should be conveniently handled and transported.
5. It should not produce any poisonous material during burning.
6. Its combustion rate should be steady and controllable.
7. It should not leave any residue or ash after burning.
8. A good fuel should have high calorific value so that higher amount of heat may be obtained by burning a little fuel.

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

Answer:

I would prefer to use cooking gas like LPG. It fulfils many of the criteria of a good fuel like its ignition temperature, good calorific value and non-polluting characteristics.

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Q- 1

What are the disadvantages of fossil fuels ?

Answer:

- (i) The burning of fossil fuels produces large amount of carbon dioxide that causes increased greenhouse effect.
- (ii) The burning of fossil fuels (such as coal) produces smoke which pollutes the air.

(iii) The burning of fossil fuels produces acidic gases such as sulphur dioxide and nitrogen oxide. These acidic gases cause acid rain that affects our water and soil resources.

(iv) Fossil fuels cannot be replenished in short time because it takes millions of years to form them.

Q- 2

Why are we looking at alternate sources of energy ?

Answer:

We are looking at alternate sources of energy because of the following reasons.

- The fossil fuels and nuclear fuels on the earth are limited which may not last for long.
- The undesirable effects of pollution, both from the burning of fossil fuels and from the radioactive nuclear wastes of nuclear power plants are creating threat to our environment.

Q- 3

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

Answer:

- (i) Wind mill farms are constructed to produce electricity.
- (ii) The traditional use of energy of flowing water has been modified by establishing hydro-power plants. At hydro-power plants, the energy of falling water or flowing water is tapped by using a water turbine and then made to drive generators.

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Q- 1

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

Answer:

A concave mirror would be best suited in a solar cooker because it focuses the sunlight in a

very small area of the solar cooker and a high temperature is produced in it which is sufficient to cook the food.

Q- 2

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

Answer:

The energy from the oceans can be obtained mainly in three forms. These are

(i) tidal energy

(ii) wave energy and

(iii) ocean thermal energy

- **Limitations of Tidal Energy :**

- (i) There are very few sites around the world which are suitable for building tidal dams.

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

- **Limitations of wave energy :** The movement of ocean waves is associated with kinetic energy. Such sites in the world are limited where the waves strike the shore lines with sufficient power.

- **Limitations of ocean thermal energy :** NCERT Solutions for Class 10 Science Chapter 14 Sources of Energy To convert ocean thermal energy into electricity, a temperature difference of 20°C (or more) between the surface water of ocean and deeper water is needed for operating OTEC power plants. This involves high cost.

Q- 3

What is geothermal energy ?

Answer:

Energy stored as heat in certain regions of the earth (called hot spots) is called geothermal energy. Hot spots are the locations below earth's crust where upward moving magma gets collected due to geological changes. When underground water comes in contact with the hot spots, steam is generated. This steam is utilised to generate electricity using pipes and turbines. Sometimes hot water from the hot spot finds outlet at the surface. Such outlets are called hot springs.

Q- 4

What are the advantages of nuclear energy ?

Answer:

The advantages of nuclear energy are that :

1. It produces a large amount of useful energy from a very small amount of a nuclear fuel (like uranium-235).
2. Once the nuclear fuel (like uranium-235) is loaded into the reactor, the nuclear power plant can go on producing electricity for two to three years at a stretch. There is no need for putting in nuclear fuel again and again.

3. It does not produce gases like carbon dioxide which contributes to greenhouse effect or sulphur dioxide which causes acid rain.

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Q- 1

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

Answer:

No source of energy can be pollution free because even if it is clean, its assembly could have caused some environmental damage.

Q- 2

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

Answer:

Hydrogen is cleaner fuel than CNG. This is because the burning of hydrogen produces only water, which is totally harmless. On the other hand, burning of CNG produces carbon dioxide gas and water. The carbon dioxide can produce greenhouse effect in the atmosphere and lead to the excessive heating of the environment in long run.

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Q- 1

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

Answer:

- (i) Energy derived from biomass is a renewable source of energy because waste products are continuously produced. Plants and trees are also grown at reasonable intervals.
- (ii) The energy derived from flowing water, wind, sun and ocean are renewable sources because these sources can be harnessed into energy so long as the present solar system exists.

Q- 2

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

Answer:

Fossil fuels like coal and petroleum are exhaustible sources of energy. The estimated reserves of these fuels are said to last us for about another 200 years, while it takes millions of years for these to be formed.

Science Chapter 14 Textbook Chapter End Questions

Q- 1

A solar water heater cannot be used to get hot water on

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

Answer:

- (b) A cloudy day.

Q- 2

Which of the following is not an example of a biomass energy source ?

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

Answer:

- (c) Nuclear energy.

Q- 3

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

- (a) Geothermal energy
- (b) Wind energy
- (c) Nuclear energy
- (d) Biomass

Answer:

- (a) Geothermal energy.

Q- 4

Compare and contrast fossil fuels and the sun as direct sources of energy Ans

Answer:

Fossil fuels	Sun
(i) Non-renewable source of energy.	(i) Renewable source of energy.
(ii) Cause a lot of air pollution.	(ii) Pollution-free, doesn't cause any pollution.
(iii) They will exhaust in future.	(iii) It is a non-exhaustible source.
(iv) Energy can be tapped throughout the year.	(iv) Energy cannot be tapped during night and cloudy and rainy days.

Q- 5

Compare and contrast biomass and hydro-electricity as sources of energy. Ans.

Answer:

Biomass	Hydroelectricity
(i) Renewable source of energy.	(i) Renewable source of energy.
(ii) Biomass plants can be installed at any place to produce biomass as energy source.	(ii) Plants can be installed only at the places where dams can be constructed.
(iii) To collect waste materials is a tough and costly process.	(iii) Once the plants start to work, it is not difficult to collect water.

Q- 6

What are the limitations of extracting energy from

(a) the wind ?

(b) waves ?

(c) tides ?

Answer:

(a) Limitations of wind energy

(i) Wind energy farms cannot be established everywhere. The wind energy farms can be established only at those places, where wind blows for most part of the year.

(ii) The wind required for generating electricity should be strong and steady to maintain the desired level of generation. The minimum wind speed necessary for satisfactory working of the wind generator is about 15 km/h. This is not always so.

(iii) The wind energy farms require a large area of land.

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

(b) Limitations of wave energy : The harnessing of sea-waves energy would be a viable proposition only at those places where sea-waves are very strong. This has constraints of time and location.

(c) Limitations of tidal energy :

(i) There are very few sites around the world which are suitable for building tidal dams.

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

Q- 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 ?

Answer:

(a) Renewable sources : The sources of energy which are being produced continuously in nature and are inexhaustible, are called renewable sources of energy. The energy derived from flowing water, wind, tides, ocean waves, or wood are examples of energy from such sources.

Non-renewable sources : These sources are produced over million of years under special conditions. Once consumed, these are not replaceable for a very long time. Fossil fuels like coal, petroleum and natural gas are non-renewable sources.

(b) Exhaustible sources are non-renewable sources, while inexhaustible sources are renewable sources.

Yes, the options given in (a) and (b) are the same.

Q- 8

What are qualities of an ideal source of energy ?

Answer:

An ideal source of energy

- Must give an adequate amount of net energy.
- Must be convenient to use so as to give energy at a steady rate.
- Must be easy to store and transport.

Q- 9

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

Answer:

Advantages of using solar cooker :

1. The use of solar cooker for cooking food saves precious fuels like coal, kerosene and LPG.
2. The use of solar cooker does not produce smoke due to which it does not pollute air.
3. When food is cooked in solar cooker, its nutrients do not get destroyed. This is because in a solar cooker, food is cooked at a comparatively lower temperature.
4. In a solar cooker, up to four food items can be cooked at the same time.

Disadvantages of using solar cooker :

1. The solar cooker cannot be used to cook food during night because sunshine is not available at that time.
2. If the day sky is covered with clouds, even then solar cooker cannot be used to cook food.
3. The direction of reflector of solar cooker has to be changed from time-to-time to keep it facing the sun.

Sources of Energy

4. The box-type solar cooker cannot be used for baking (making chappattis, etc.) or for frying.

The places that receive rain most of the year or where the sky remains cloudy, the solar cooker has limited utility.

Q- 10

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

Answer:

Some of the environmental consequences of the increasing demand for energy are the following :

1. The combustion of fossil fuels is producing acid rain and damaging plants (crops), soil and aquatic life.
2. The burning of fossil fuels is increasing the amount of greenhouse gas carbon-dioxide in the atmosphere. It has also affected the rainfall.
3. The cutting down of trees from the forest for obtaining fire-wood is causing soil erosion and destroying wild life.
4. The construction of hydro-power plants is disturbing ecological balance.
5. Nuclear power plants are increasing radioactivity in the environment.

The following steps can be taken to reduce energy consumption :

1. Switch off lights, fans, TV. and other such electrical appliances when not needed, to save electricity.
2. Use energy efficient electrical appliances to save electricity. This can be done by using compact fluorescent lamps (CFL) and tube lights in place of conventional filament- type electric bulbs.
3. Good quality stoves should be used to burn fuels like kerosene and LPG so as to obtain maximum heat.
4. Pressure cookers should be used for cooking food to save fuel.
5. Solar cookers should be used to cook food whenever possible and solar water heaters should be used to get hot water.
6. The use of biogas as fuel should be encouraged in rural areas.
7. Bicycles should be used for short distances to save fuel like petrol which is used in cars, scooters and motorcycles.

Science Chapter 14 Sources of Energy

Sources of energy : Different forms of energy, conventional and non-conventional sources of energy: Fossil fuels, solar energy; biogas; wind, water and tidal energy; Nuclear energy, Renewable versus non-renewable sources of energy.

Q- 1

What is a good source of energy?

Solution:

A good source of energy would be one,

- i) Which would do a large amount of work per unit volume or mass.
- ii) Be easily accessible.
- iii) Be easy to store and transport, and
- iv) Perhaps most importantly, be economical.

Q- 2

What is a good fuel?

Solution:

A good fuel would be one,

- i) Which is easily available.
- ii) It should not produce too much of smoke.
- iii) On burning should release less amount of heat.