Chapter 5: Towards Green Energy

Question 1.
Remake the table taking into account relation between entries in three columns.

I	II	III
Coal	Potential energy	Wind electricity plant
Uranium	Kinetic energy	Hydroelectric plant
Water reservoir	Nuclear energy	Thermal plant
Wind	Thermal energy	Nuclear power plant

Answer:

I	II	III
Coal	Thermal energy	Thermal plant
Uranium	Nuclear energy	Nuclear power plant
Water reservoir	Potential energy	Hydroelectric plant
Wind	Kinetic energy	Wind electricity plant

Question 2.
Which fuel is used in thermal power plant? what are the problems associated with this type of power generation?
Answer:
(1) The fuel used in the thermal power plant is **coal**. Coal contains chemical energy. Upon burning it releases heat energy. This heat is used for generation of electricity in the thermal power plants.
(2) **Problems associated with power generations by thermal power plant**:
(a) Air pollution: Due to burning of coal, there is emission of carbon dioxide, carbon monoxide, sulphur dioxide and nitrogen dioxide gases. These are harmful and toxic to health.
(b) Soot particles emitted during combustion can cause severe respiratory problems such as asthma.

Question 3.
Other than thermal power plant, which power plants use thermal energy for power generation? In what different ways is the thermal energy obtained?
Answer:

Other than thermal power plant, nuclear power plants, solar power plants use thermal energy for power generation. Different ways of generating thermal energy are:

- Using fossil fuels: By burning fossil fuels such as coal, petroleum, the chemical energy stored in them is converted into thermal energy.
- Using natural gas: Chemical energy in natural gas is converted into thermal energy.
- Using nuclear fuels: Controlled chain reaction in nuclear power plants releases huge amount of thermal energy.
- Using solar energy: Solar energy can be reflected and absorbed in aborbers where it gets converted to thermal energy.

Question 4.
Which type/types of power generation involve maximum number of steps of energy conversion? In which power generation is the number minimum?
Answer:

The steps of energy conversion are maximum in the thermal power generation. They are minimum in wind energy generation.

Question 5.

a. Maximum energy generation in India is done using ..... energy.
Answer:
Maximum energy generation in India is done using **thermal** energy.

b. ..... energy is a renewable source of energy.
Answer:
wind energy is a renewable source of energy.

c. Solar energy can be called ..... energy.
Answer:
Solar energy can be called **clean** energy.

d. ..... energy of wind is used in wind mills.
Answer:
kinetic energy of wind is used in wind mills.

e. ..... energy of water in darns is used for generation of electricity.
Answer:
Potential energy of water in darns is used for generation of electricity.

Question 6.
Explain the difference.
a. Conventional and Non-conventional Sources of energy.
Answer:

	Conventional sources of energy	Non-conventional sources of energy
i)	Conventional sources of energy are the sources that are commonly in use since a long time.	Non-conventional sources of energy refer to the sources that are identified a few decades ago.
ii)	Conventional sources of energy are limited and exhaustible.	Non-conventional sources of energy are abundant and inexhaustible.
iii)	They cause pollution.	They cause little or no pollution.
iv)	Fuels produced from conventional sources are comparatively expensive.	Fuels produced from non-conventional sources are comparatively cheaper.
v)	Conventional sources do not produce green energy.	Non-conventional sources produce green energy.
vi)	They are primarily used for industrial and commercial purposes.	They are mainly used for domestic purposes.
vii)	**Example:** fossil fuels such as coal, natural gas, etc.	**Example:** wind energy, solar energy, etc

b. Thermal electricity generation and Solar thermal electricity generation.
Answer:

Thermal electricity generation	Solar thermal electricity generation
It uses non-renewable source of energy for electricity generation such as fossil fuels, natural gas or nuclear fuels.	It uses renewable source of energy i.e. solar energy for electricity generation.
This method of electricity generation is not environment friendly. It causes air pollution.	This is environment friendly method of electricity generation. It does not cause air pollution.
This method requires maintenance.	This method does not require maintenance.

Question 7.
What is meant by green energy? Which energy sources can be called green energy sources and why? Give examples.
Answer:

Green energy is that energy which does not pollute the environment and is renewable in nature. The energy sources such as sunlight, wind, rain, tides, etc. can be called as green energy. This is because these are readily available on Earth, can be naturally replenished and do not even harm the environment much.

Question 8.
Explain the following sentences.
a. Energy obtained from fossil fuels is not green energy.
Answer:

Fossil fuels like petrol, diesel or natural gas when burnt, emit toxic gases and soot particles. Thus, fossil fuels cause air pollution. Burning of fossil fuels cause increased levels of carbon dioxide, carbon monoxide and nitrogen dioxide. The increased carbon dioxide emission results in global warming. Nitrogen oxide results later in acid-rain. Soot particles generated through burning of fuels cause respiratory problems iike asthma.

Moreover, the fossil fuels are non-renewable and exhaustible fuels. They have to be explored from the deeper layers of the earth causing lots of environmental problems. Thus, energy obtained from fossil fuels is not at all a green energy.

b. Saving energy is the need of the hour.
Answer:
In modern civilization, continuous energy supply is needed for the technology and development. The energy has become a basic need for man. Most of the energy used in India is obtained from thermal power plant. For this energy generation, various fuels are used. The coal and fossil fuels are limited. Due to over-exploitation, these reserves are getting fast depleted. Use of fossil fuels is also resulting in pollution and climate change. Therefore, each and every person should save the energy, as saving energy is the need of the hour.

Question 9.
Answer the following questions.
a. How can we get the required amount of energy by connecting solar panels?
Answer:

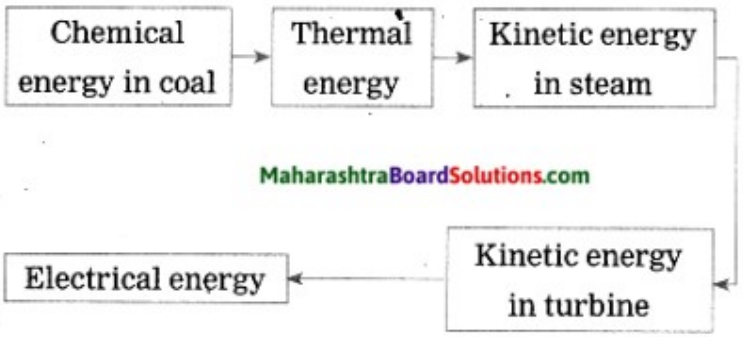
Many identical solar cells connected together forms a solar panel. Now, many such solar panels are connected in series in a form of solar string to get required voltage. Also, many such identical solar strings are connected in parallel to get the required current. Hence, in this way we get the required amount of energy by connecting solar panels.

b. What are the advantages and limitations of solar energy?
Answer:

I. Advantages:
- While generating the power through solar radiations, no fuel is burnt.
- Solar energy generation thus does not create any type of pollution. The technology can be completely utilized in regions with abundant sunlight.
- Solar energy is eco-friendly, green energy.

II. Limitations:
- Sunlight is available only during day time. Thus, solar cells can generate power only during day.
- In rainy season and in cloudy conditions, solar power generation suffers.
- The power present in the solar cells is DC while most of the domestic equipments work on AC.

Question 10.
Explain with diagram step-by-step energy conversion in
a. Thermal power plant.
Answer:

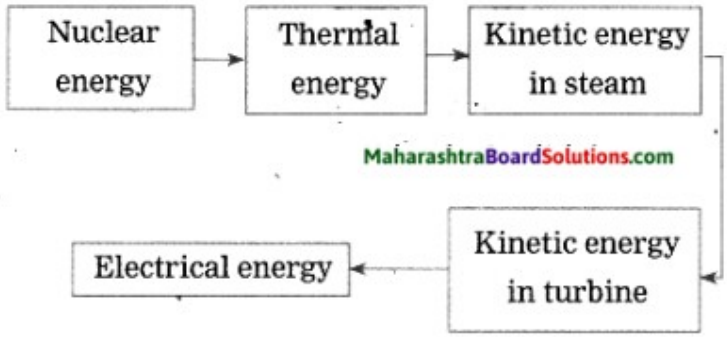


Flow chart showing energy transformation in thermal power plant

Water is heated in a boiler. Using the thermal energy released due to burning of coal, steam of very high temperature and pressure
is generated. The energy in the steam drives the turbine. Thus, the generator connected to the turbine rotates and electrical energy is produced.

b. Nuclear power plant.

Answer:

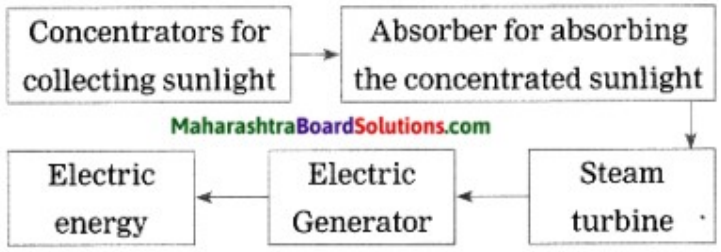


Flow chart showing energy transformation in nuclear power plant

In nuclear power plant, the energy is releasdd by fission of nuclei of atbms like Uranium or Plutonium. This energy is used to generate the steam or high temperature ind high pressure. The kinetic energy in the steam rotates the turbine. The turbine in turn drives the generator to produce electricity.

c. Solar thermal power plant.

Answer:

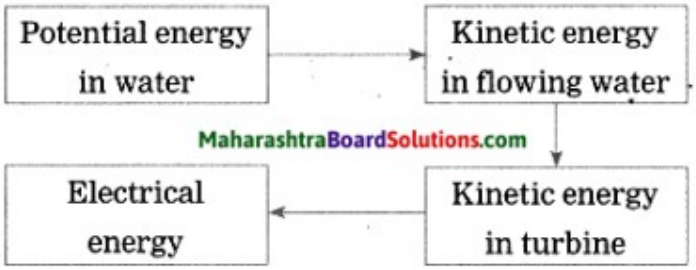


Flow chart showing different stages in solar thermal power plant

Solar radiation is used to produce thermal energy. For this purpose, many reflectors are used which concentrate the solar radiation on absorbers. The heat energy created due to solar

radiations is used to make steam. The steam possesses kinetic energy. This kinetic energy drives turbine and generator. The electrical energy is thus created from this kinetic energy.

d. Hydroelectric power plant:
Answer:



Flow chart showing energy transformation in hydroelectric power plant

In hydroelectric plant the water stored in the reservoir is used as a source or potential energy. This water is made to fall at a great speed and hence there is production of kinetic energy in flowing water. This fast flowing water ralling down from the reservoir is brought to the turbine at the lower levels. The kinetic energy of the flowing water in turn drives the turbine, The turbine then drives the generator and electrical energy is produced.

Question 11.
Give scientific reasons:
a. The construction of turbine is different for different types of power plants.
Answer:

- Generators work on the principles of electromagnetic induction.
- For this the generator must be rotated.
- For this purpose, there is a turbine for each generator.
- This rotation needs energy. The turbines are different according to the type of energy source that is used for its rotation.
- Therefore, the construction of turbine is different for each power plant.

b. It is absolutely necessary to control the fission reaction in nuclear power plants.
Answer:

- Nuclear fission reaction is a type of chain reaction.
- In nuclear power plants these reactions are closely controlled.
- If these reactions are not managed properly, there can be more production of neutrons in an uncontrolled way.
- Each released neutron further causes fission of 3 Uranium (U-235) atoms, such uncontrolled reactions can cause hazardous accidents, hence ft is absolutely necessary to control the fission reaction in nuclear power plants.

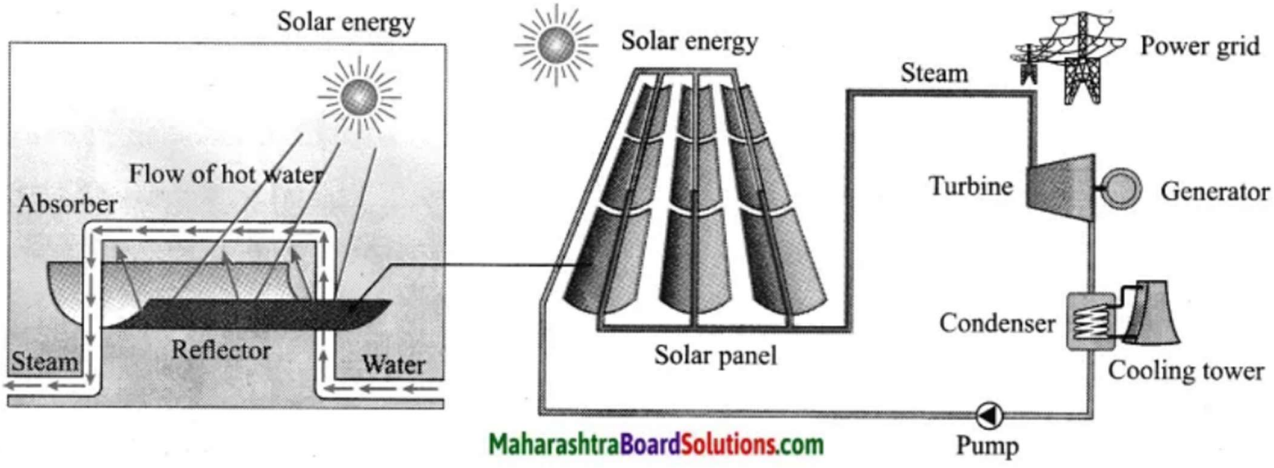
c. Hydroelectric energy, solar energy and wind energy are called renewable energies. (July '19, Board's Model Activity Sheet)
Answer:

- Hydroelectric energy, solar energy and wind energy is obtained respectively from flowing water, solar radiations and flowing wind.
- These sources, i.e. water reservoirs, sun and the wind are inexhaustible and sustainable. They will not be finished.
- On the contrary, the conventional energy sources such as coal and fossil fuels have limited reserves.
- They cannot be renewed and may get exhausted in future. Hydroelectric energy, solar energy and wind energy can be replenished and hence they are called renewable.

d. It is possible to produce energy from mW to MW using solar photovoltaic cells.
Answer:

1. Solar panels can be constructed by connecting solar photovoltaic cells in either series or in parallels.
2. The combinations are done in such a way that it can give the desired potential difference and the current.
3. Solar strings are then made by joining solar panels in a series.
4. When solar strings are joined in parallel; they form solar array.
5. Therefore, by proper combinations, it becomes possible to produce energy from mW to MW using solar photovoltaic cells.

Question 12.
Draw a Schematic diagram of Solar thermal electric energy generation.
Answer:

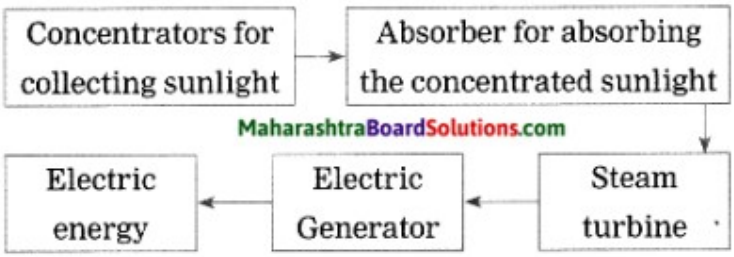


Solar thermal electric energy generation

Question 13.
Give your opinion about whether hydroelectric plants are environment-friendly or not?
Answer:

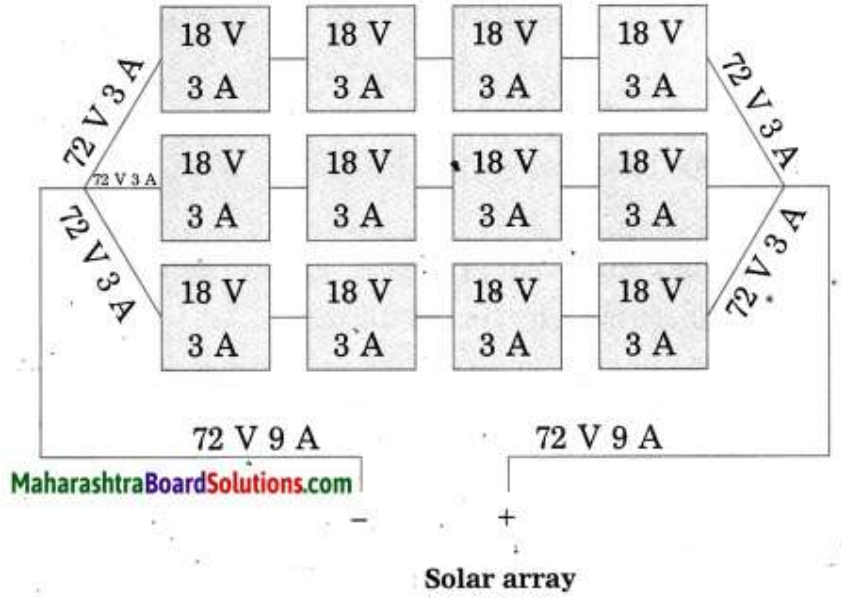
No waste products and harmful gases are released in water bodies and atmosphere when power is generated using hydroelectric power plants. Also, water is available in plenty on Earth and is renewable. Hence, there is no fear of this energy source dying out. Thus, it has no harmful effects on environment and hence is environment friendly.

Question 14.
Draw a neat labelled diagram.
a. Energy transformation in solar thermal electric energy generation.
Answer:



Flow chart showing different stages in solar thermal power plant

b. One solar panel produces a potential difference of 18 V and current of 3A. Describe how you can obtain a potential difference of 72 Volts and current of 9 A with a solar array using solar panels. You can use sign of a battery for a solar panel.
Answer:
Given Potential difference is 18 V and current is 3A. The requirement is potential difference of 72 V and current is 9A Voltage remains the same if connected in parallel and gets added it they are connected in series. Current remains the same if connected in series but adds if connected in parallel.



Solar array

Question 15.
Write a short note on Electrical energy generation and environment.
Answer:
The energy obtained through the fossil fuels as well as nuclear energy can cause degradation of the environment. If such energy sources are used, they can cause harm to the environment.

(1) The burning of fossil fuels cause air pollution. The incomplete combustion of fossil fuels cause release of carbon monoxide. Some more toxic gases and soot particles cause various respiratory diseases. The carbon dioxide produced is creating global warming and climate change. The nitrogen dioxide released through burning is responsible for acid rains.

(2) Fossil fuels are limited. They are getting fast depleted. It has taken millions of years for the fossil fuels to form. The exploration of such fuels also cause environmental degradation and marine pollution too.

(3) In production of nuclear energy, there is a great risk of accidents. The safe disposal of nuclear waste is also a problem.

(4) Hydroelectric power from water reservoirs, wind power from wind, solar energy from sun and electricity from biofuels are eco-friendly alternatives.