

## 5. Towards Green energy

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

**Ans.**

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

**2. Which fuel is used in thermal power plant? What are the problems associated with this type of power generation?**

**Ans.** (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.

(c) The coal reserves in the world are limited. They will be finished in next few hundred years and will not be replenished later. The scarcity of coal would result in energy crisis.

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

**Ans.** (1) The power plant based on natural gas and the nuclear power plants also used thermal energy for the power generation. Apart from these, solar energy is also used to produce heat and thereby create the power.

(2) In nuclear power plant the energy is released by carrying out fission of nuclei of atoms like Uranium or Plutonium. This energy is used to generate the steam of high temperature and high pressure. The steam rotates the turbine. The kinetic energy in steam drives the turbine and turbine in turn drives the generator.

(3) The combustion of natural gas produces gas, which is used to run the turbine. This gas is under high pressure and high temperature. This is used to produce thermal energy.

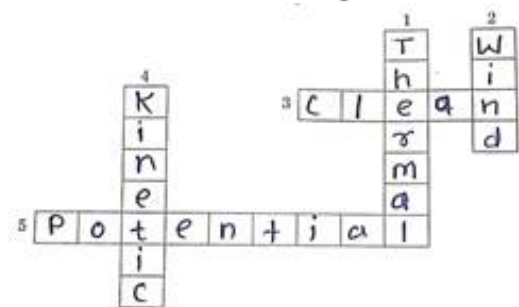
(4) In solar thermal power plant, thermal energy is generated with the help of solar radiation. For this reflectors and absorbers are used for concentrating solar radiation and converting it into thermal energy.

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

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



5. Solve the following crossword puzzle.



- Maximum energy generation in india is done using.... energy.
- Energy is a renewable source of energy
- Solar energy can be called.... energy.
- Energy of wind is used in wind mills.
- Energy of water in dams is used for generation of electricity.

Ans. 1. Thermal, 2. Wind, 3. Clean, 4. Kinetic, 5. Potential

6. Explain the difference.

- Conventional and Non-conventional Sources of energy.

Ans.

Conventional Sources of energy	Non-conventional Sources of energy
1. Conventional sources of energy are largely polluting, they release lot of carbon through its emissions.	1. Non-conventional sources of energy are not polluting. They do not release carbon or other toxic gases.
2. Conventional sources of energy are not ecofriendly.	2. Non-conventional sources of energy are ecofriendly.
3. The fuels produced from the conventional sources of energy are comparatively costlier.	3. The energy obtained from the non-conventional sources of energy are comparatively cheaper.
4. Conventional energy power plants require less area and its management cost is also less.	4. Non-conventional energy power plants require more area and its management cost is also more.
5. Conventional source of energy are non-renewable.	5. Non-conventional source of energy are renewable.
6. Conventional sources of energy are in the form of limited reserves. After few years they will be completely over. e.g. Fossil fuels, coal, crude oil, diesel, petrol, natural gas, etc.	6. Non-conventional energy sources are in abundance on the earth. They are persistent and sustainable. Thus they will not get over, e.g. Solar energy, wind energy, etc

- Thermal electricity generation and solar thermal electricity generation.

Ans.

Thermal electricity generation	Solar thermal electricity generation
1. After burning the coal, the heat that is produced is used in the generation of thermal electricity,	1. Solar radiations are used in solar thermal electricity production.



2. For producing heat, the coal is burnt in the boilers.	2. For production of heat, many reflectors are used which reflect the radiations of the sun into the absorbent.
3. The combustion of coal produces heat. This heat converts water into steam, which is under very high temperature and pressure. By its force the turbines move. The turbines in turn are connected to generator which rotates and produces energy,	3. Sun's heat convert the water into steam that rotates the turbine. The turbines then rotate the generators. This generates the electricity.
4. Thermal energy is polluting and not eco-friendly,	4. Solar energy is not polluting, it is eco-friendly.
5. The fuel here is coal, its reserves are limited.	5. The solar radiations are in abundance and are sustainable and persistent.

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

**Ans.** (1) Green energy means eco-friendly form of energy which does not cause environmental problems and are inexhaustible, perpetual and sustainable.

(2) These sources of energy do not produce toxic gases or other pollutants, therefore they are safe.

**(3) Examples of green energy:** (i) Hydroelectric energy

(ii) Wind Energy

(iii) Solar energy

(iv) Energy obtained biofuels.

**8. Explain the following sentence.**

**(1) Energy obtained from fossil fuels is not green energy.**

**Ans.** 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 like 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. Green energy is sustainable, renewable and abundant. It never creates any environmental problems and is non-polluting. Thus, energy obtained from fossil fuels is not at all a green energy.

**(2) Saving energy is the need of the hour.**

**Ans.** 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. Nuclear energy can be very hazardous. Lot of research is being done in the field of green energy, but the



tremendous human population always is in need of more energy. Therefore, each and every person should save the energy, as saving energy is the need of the hour.

### 9. Answer the following questions.

#### a. How can we get the required amount of energy by connecting solar panels?

**Ans.** (1) The photovoltaic solar cells can be connected in a series or in parallel to make a solar panel.

(2) When solar cells are connected in a series, the potential difference of individual cells are added in the combination, however the currents from individual cells are not added.

(3) When solar cells are connected in parallel, the currents of the individual cells are added in the combination, but the potential differences from individual cells are not added.

(4) Through such connections the required potential difference and current can be obtained.

(5) Many such solar panels are connected in series and in parallel to generate required current and potential difference.

(6) When many solar panels connected in series they form a solar string. Many solar strings connected in parallel make a solar array. In such manner we can get the required amount of energy by connecting solar panels.

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

##### **Ans. I. Advantages:**

(1) While generating the power through solar radiations, no fuel is burnt.

(2) Solar energy generation thus not create any type of pollution. The technology can be completely utilized in regions with abundant sunlight

(3) Solar energy is eco-friendly, green energy.

**II. Limitations:** (1) Sunlight is available only during day time. Thus solar cells can generate power only during day.

(2) In rainy season and in cloudy conditions, solar power generation suffers.

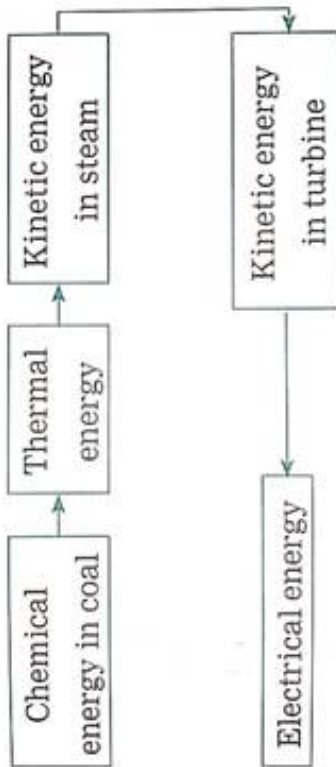
(3) The power present in the solar cells is DC while most of the domestic equipments work on AC.

### 10. Explain with diagram step by step energy conversion in.

#### 1. Thermal power plant:

**Ans. (Rotate your phone)**

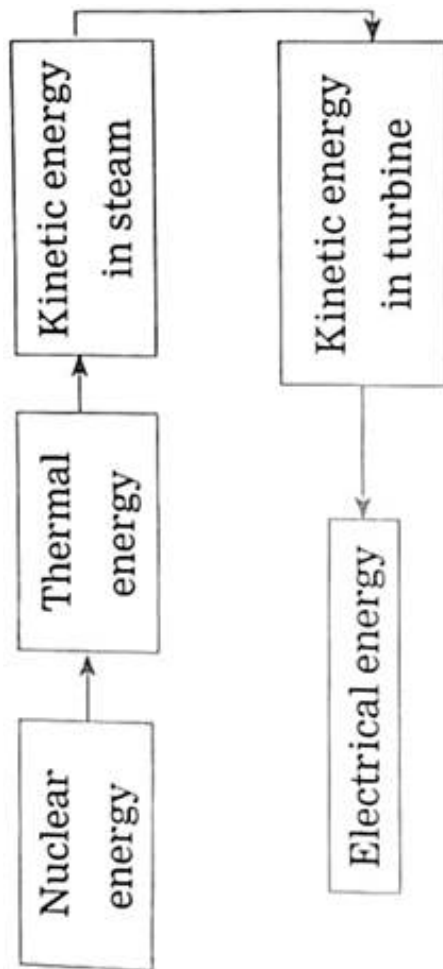




In thermal power plant the turbines are rotated using steam. Here the coal is burnt. The heat energy liberated from this burning is used to heat the water in the boiler. This water produces steam of very high temperature and pressure. The kinetic energy in the steam rotates the turbines. The rotation of turbines produces its own mechanical kinetic energy. The generators connected to turbines produce electrical energy. The steam is condensed in a condenser and converted back into water. In this way in thermal power plant, thermal energy to kinetic energy, kinetic energy into mechanical energy and mechanical energy to electrical energy, are the conversions that take place.

## (2) Nuclear Power Plant:

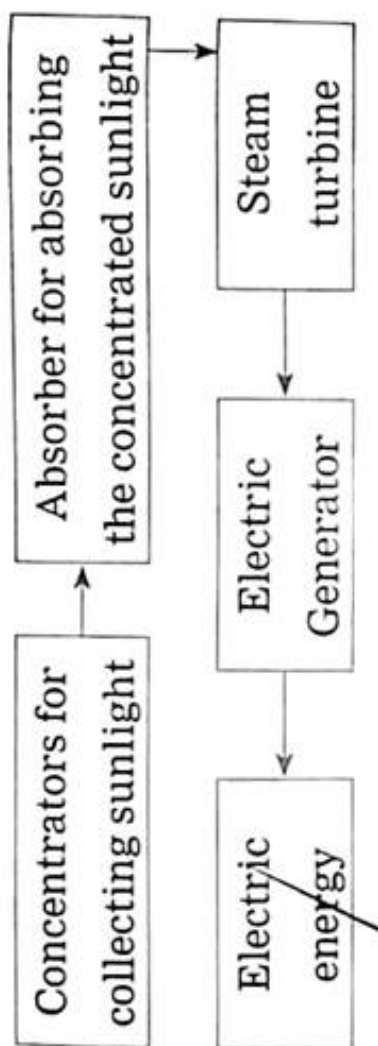
**Ans. (Rotate your phone)**



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

### 3. Solar thermal power plant:

**Ans. (Rotate your phone)**

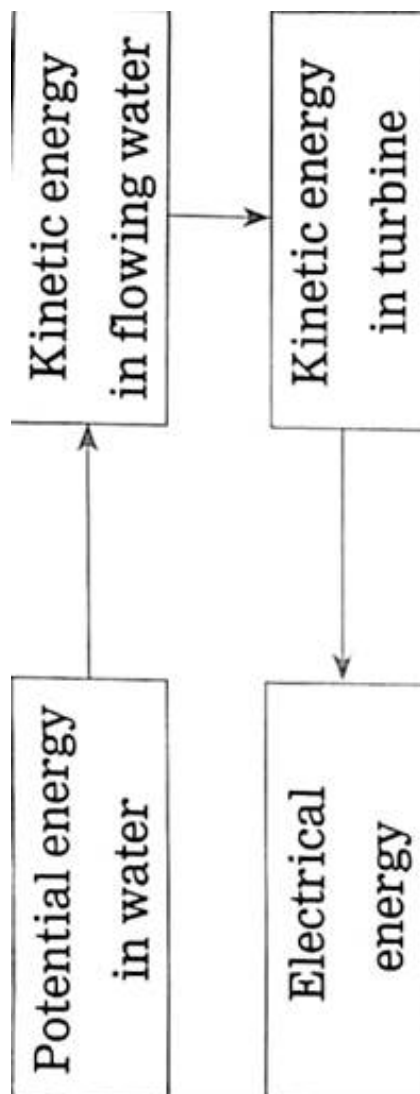


Solar radiation is used to produce thermal energy. For this purpose, many reflectors are used which

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.

#### 4. Hydroelectric power plant:

**Ans. (Rotate your phone)**



In hydroelectric plant the water stored in the reservoir is used as a source of potential energy. This water is made to fall at a great speed and hence there is production of kinetic energy in flowing.

#### 11. Give scientific reasons

##### a. The construction of turbine is different for different types of power plants.

**Ans.** 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. For rotation of a turbine, energy is needed. 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.

**Ans.** 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 it is absolutely necessary to control the fission reaction in nuclear power plants.

**c. Hydroelectric energy, solar energy and wind energy are called renewable energies.**

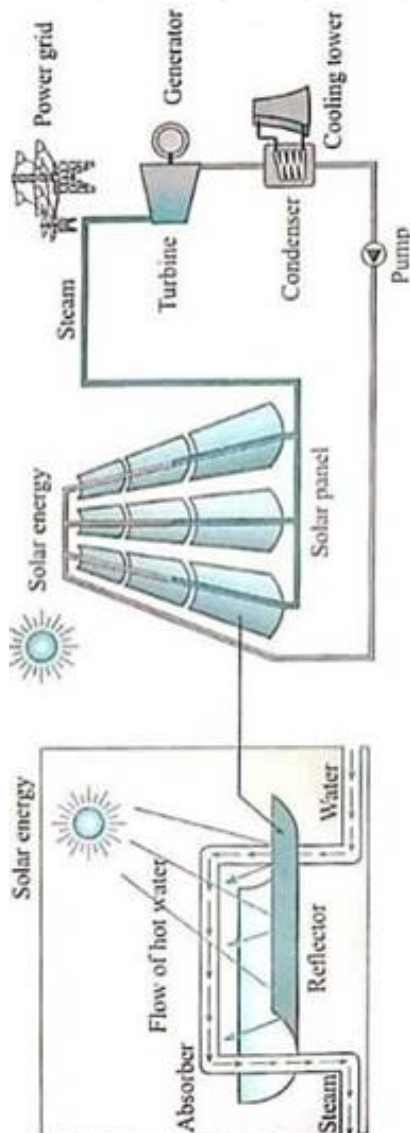
**Ans.** Hydroelectric energy, solar energy and wind energy is obtained respectively from flowing water, solar radiations and flowing wind. These sources, i.e. water reservoirs, sun and the wind are inexhaustible and sustainable. They will not be finished. On the contrary, the conventional energy sources 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.**

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

**14. Draw a schematic diagram of solar thermal electric energy generation.**

**Ans. (Rotate your phone)**



**13. Give your opinion about whether hydroelectric plants are environment friendly or not?**

Ans. (1) Hydroelectric plants are advantageous in some respect while in some aspects it does create problems.

(2) Hydroelectric power generation does not need burning of fuels. Therefore, there is no problem regarding combustion of fuels and release of toxic pollutants.

(3) Electricity can be obtained as and when required if there is enough water in the reservoir.

(4) Water is replenished every time when there is sufficient rainfall.

(5) All the above facts give an impression that hydroelectric power generation is eco-friendly but it is not.

(6) Many villages and settlements are submerged when a dam and reservoir is constructed. The displaced people are given re-settlement, but it causes lot of emotional trauma to people.

(7) Biodiversity is affected as forest lands is submerged. The river flow is obstructed by the dam which affects the aquatic organisms residing in such water.

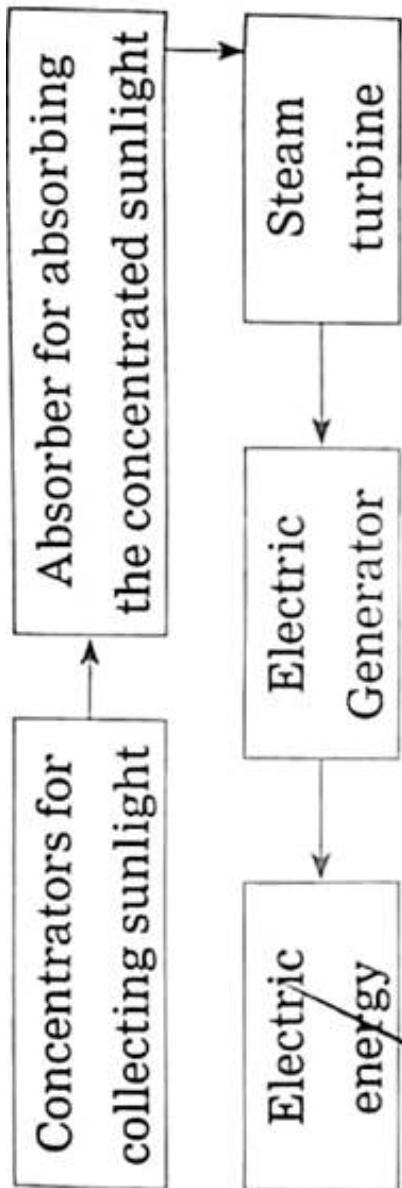
(8) Due to excessive pressure of water on land, it is said that the region gets prone to earthquakes.

**Q.14 Draw neat label the diagram.**

**1. Energy transformation in solar thermal electric energy generation.**

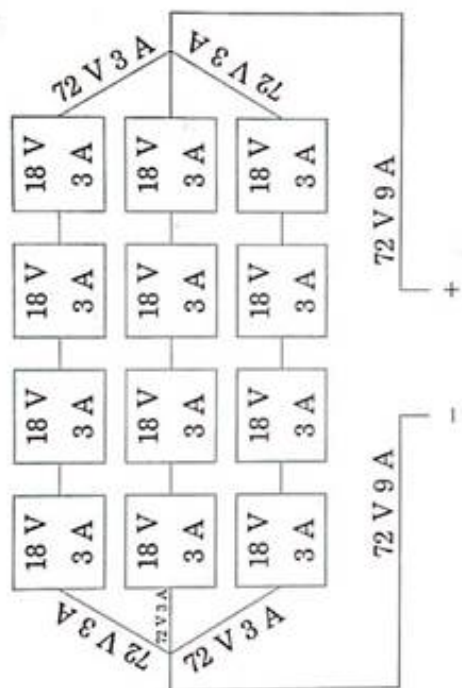


Ans. (Rotate your phone)



2. 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.

Ans. (Rotate your phone)



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 if they are connected in series. Current remains the same if connected in series but adds if connected in parallel

## 15. Write short note.

### 1. Electrical energy generation and Environment.

**Ans.** 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.