

STD X SCIENCE 2
CHP 5: TOWARDS GREEN ENERGY

Q1. Match the following:

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

Q2. 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 and releases heat energy on burning. This heat is used for generation of electricity in the thermal power plants.

2. Problems associated with thermal this type of power generation are as follows:

a) Air pollution. Due to burning of coal, there is emission of carbon monoxide, sulphur dioxide and nitrogen dioxide gases. These are harmful and toxic to health.

b) Soot particles emitted during combustion (burning) can cause severe respiratory problems such as asthma.

c) Since the coal reserves in the world are limited, they will be finished in the next few hundred years and will not be replenished later. This scarcity (shortage) of coal can lead to energy crisis.

Q3. 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 are also used for thermal energy for 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 steam oh 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 temperature and high pressure and 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.

Q4. 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 and minimum in wind energy generation.

Q5. Solve the crossword puzzle / Fill in the blanks:

- Maximum energy generation in India is done using thermal energy.
- Wind energy is a renewable source of energy
- Solar energy can be called clean energy.
- Kinetic energy of wind is used in wind mills.
- Potential energy of water in dams is used for generation of electricity.

Q6. Explain the difference:

1. Conventional and non-conventional sources of energy

	Conventional sources of energy	Non-conventional sources of energy
1.	They release a lot of carbon through its emissions and hence cause pollution.	They do not release carbon or any other toxic gases and hence do not cause pollution.
2.	They are not eco-friendly.	They are eco-friendly.
3.	These energy sources are non-renewable.	These energy sources are renewable.
4.	These sources require thousands of years to form. Example: Coal, Crude oil.	These sources are abundantly available in nature. Example: Solar energy, wind energy.

2. Thermal electricity generation and Solar thermal electricity generation

	Thermal electricity generation	Solar thermal electricity generation
1.	In thermal power plant, coal, natural gas, etc. are used as fuel (source)	In these solar radiations are the source.
2.	Working of thermal power plant can cause pollution.	Solar power plant does not cause pollution.
3.	The rate of electric power generation is very high.	The rate of electric power generation is very less.
4.	They are not eco-friendly.	They are eco-friendly.

Q7. What is meant by green energy? Which energy sources can be called as green energy sources and why? Give example.

Ans. 1. Green energy means eco-friendly form of energy which does not cause environmental problems and are non-exhaustible, perpetual and sustainable.
2. These sources of energy do not produce toxic gases or other pollutants and therefore, they are safe.
3. Examples of green energy: Hydroelectric energy, wind energy, solar energy, energy obtained from biofuels.

Q8. Explain the sentences:

a) Energy obtained from fossil fuels is not green energy.

Ans. 1) Fossil fuels cause pollution on combustion. Burning of coal results in emission of gases like carbon dioxide which are harmful to health.
2) Coal and oil release soot and sulphur dioxide, which causes problems related to respiration and acid rain.
3) As fossil fuels harm the environment, they cannot be considered as green energy.

b) Saving energy is the need of the hour.

Ans. 1) In modern civilization, energy has become one of the basic needs.
2) Continuous energy supply is needed for technology and development.
3) If we do not harness new sources of energy, the reserves of fossil fuels would get exhausted forever.
4) It is estimated that the current reserves would get over in nearly 200 years.
5) If we save energy today, we may be able to use it for a longer period of time.
6) Thus, it is important to save energy.

Q9. Answer the following:

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

Ans. 1) Solar cells contain Silicon which is a semiconductor.
2) A Silicon panel of 1cm^2 can generate 30mA of electricity and 0.5V potential difference is obtained.
3) If two solar cells are connected in series, the potential difference gets added to 1V but electric current remains the same.
4) If two solar cells are connected in parallel, the current becomes 60mA but the potential difference remains the same.
5) In this way, we can get the required potential difference and electric current.

b) What are the advantages and limitations of solar energy?

Ans. Advantages of solar energy are as follows:

- 1) Solar energy is a clean source of energy.
- 2) It is eco-friendly source of energy.

- 3) Since there is no combustion of fuels, there is no air pollution.
- 4) Solar energy can be easily converted into electricity for use.

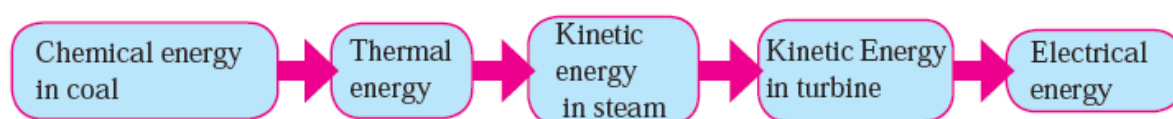
Limitations of solar energy are as follows:

- 1) Solar radiations are available only in the day time.
- 2) Storage equipment is costly and initial installation cost is very high.
- 3) Radiation intensity is not constant throughout the day; hence it is not a uniform source of energy.
- 4) Solar panels occupy a lot of space; hence installation becomes an issue.
- 5) The power present in solar cells is DC, while most of the domestic equipment work on AC.

Q10. Explain with diagram step by step energy conversion in:

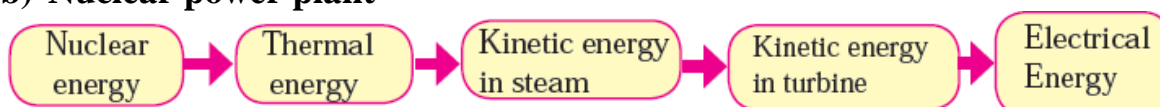
a) Thermal power plant.

- i) Coal has stored chemical energy and is used as a fuel.
- ii) Coal is burnt to obtain heat energy which is used to boil water to get steam.
- iii) Steam of very high pressure and temperature is generated.
- iv) The kinetic energy of steam drives the turbines.
- v) Thus, the generator connected to the turbines rotate and electricity is generated.



5.6 Energy transformation in thermal power plant

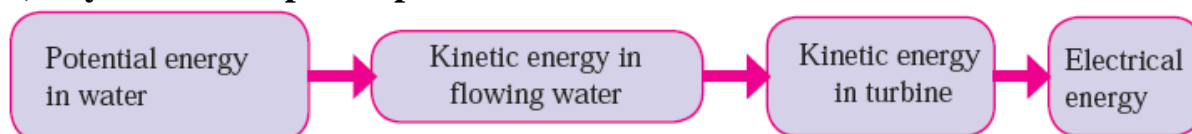
b) Nuclear power plant



5.9 Energy transformation in nuclear power plant

- i) When neutron is bombarded on an atom of Uranium (U-235) it absorbs and converts to U-236. This isotope of U-236 is unstable and splits into Krypton and Barium by nuclear fission releasing 200 MeV of energy.
- ii) By using this energy, water is boiled to form steam.
- iii) By using kinetic energy of steam, the turbine is rotated.
- iv) Kinetic energy of turbine is used to work the generator and electricity is produced.

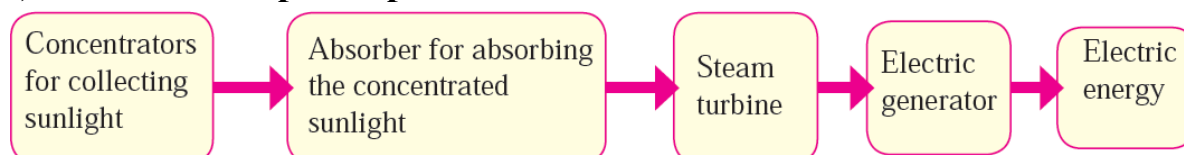
c) Hydroelectric power plant



5.16 Energy Transformation in hydroelectric power plant

- i) The water reservoir in the dam has tremendous potential energy.
- ii) When this water flows, the potential energy gets converted into kinetic energy.
- iii) With the help of this kinetic energy, the turbines start to rotate.
- iv) This turbine then drives the generator to work and electricity is produced.

d) Solar thermal power plant



5.29 Different stages in solar thermal power plant

- i) Solar energy is converted into heat by concentrating it.
- ii) The absorbed sunlight is used to boil water and steam is obtained.
- iii) Kinetic energy of steam is used to move turbines.
- iv) The kinetic energy of turbine is passed to the generator which produces electricity.

Q11. Give scientific reasons:

a) The construction of turbines is different for different types of power plants.

- Ans.** i) Every power plant uses a different kind of medium to rotate the turbine.
- ii) In thermal and nuclear power plants, steam produced rotates the turbine.
- iii) In hydroelectric power plant, water is used to rotate the turbine and wind is the medium in windmills.
- iv) The power output of every power plant is different.
- v) Hence, there should be turbines of different designs and different patterns at the power generating stations.

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

- Ans.** i) Nuclear power plants work on the principle of controlled chain reaction.
- ii) If these reactions are not managed properly, there can be more production of neutrons in an uncontrolled way.

- iii) Each released neutron further causes fission of 3 Uranium (U-235) atoms.
- iv) Such uncontrolled reactions can cause hazardous accidents and 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. i) Hydroelectric energy, solar energy and wind energy is all obtained without burning of a fuel. Hence, no air pollution is caused and they are eco-friendly.

ii) By setting up hydroelectric power plant, solar panels and wind mills, we can obtain these energies continuously and uninterrupted at a low cost.

iii) Hence, these sources are called renewable sources of energy.

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

Ans. i) A Silicon cell of dimension 1cm^2 generates a current of about 30mA and potential difference of 0.5V.

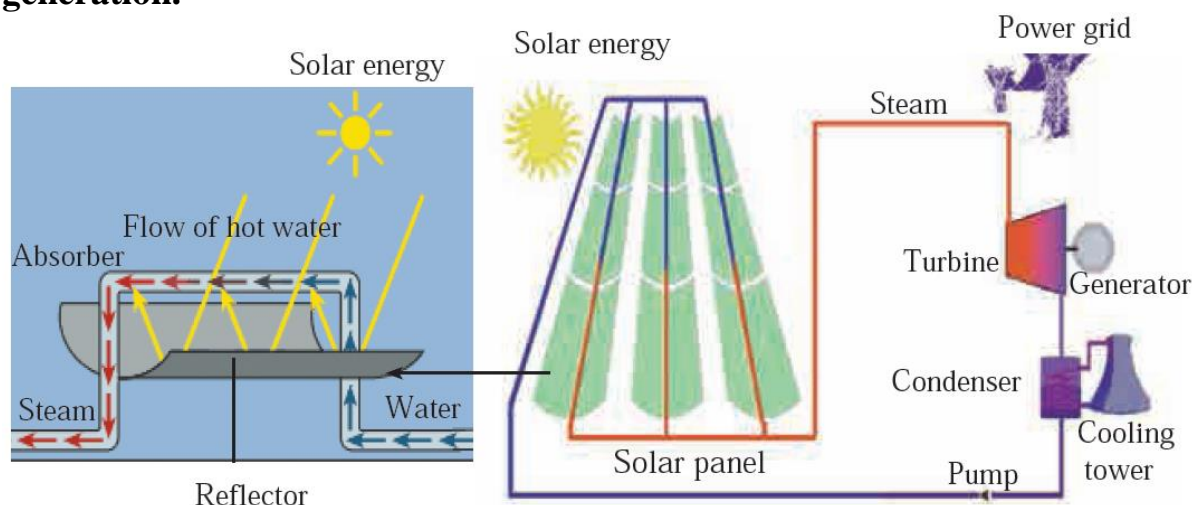
ii) If solar cells are connected in series the potential difference gets added but the current remains the same.

iii) If solar cells are connected in parallel, the potential difference remains the same but the current generated is the addition of current from individual cells.

iv) By using this principle, we can obtain the power of desired quantity.

v) Hence, photovoltaic cells can be used to obtain mW to MW power.

Q12. Draw a schematic diagram of solar thermal electric energy generation.



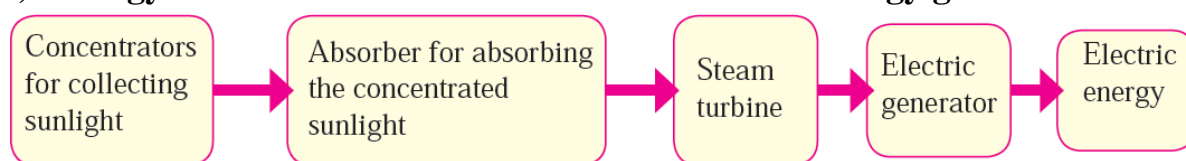
5.29 Schematic of solar thermal power plant

Q13. Give your opinion about whether hydroelectric plants are environment friendly or not.

- Ans.** i) In the hydroelectric power plant, kinetic energy of water gets converted into electricity.
 ii) In this, as no fuel is burnt, there is no air pollution.
 iii) As the water does not get polluted, it can be used for agricultural purposes.
 iv) Hence, compared to thermal and nuclear power plants, the hydroelectric power plant is eco-friendly.

Q14. Draw neat and labelled diagram:

a) Energy transformation in solar thermal electric energy generation.

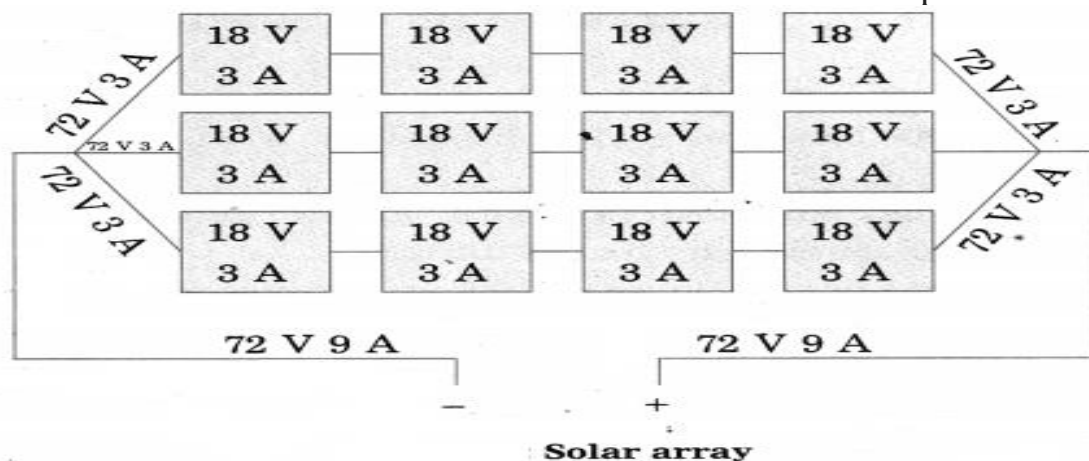


5.29 Different stages in solar thermal power plant

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



Q15. Write short note on: Electrical energy generation and environment.

- Ans.** i) The environment impact of electricity generation is significant because modern society needs large amount of electrical power.
 ii) The power is normally generated at power plants that converts some other kind of energy into electrical power.

- iii) Each system has some advantages and disadvantages, but many of them pose environmental concerns.
- iv) Thermal power plants give out CO₂, NO₂, SO₂ which causes air pollution.
- v) Nuclear power plant poses the threat of disposal of nuclear waste and radiation leakage.
- vi) Wind mills and solar power plants are eco-friendly but installation cost is high and hence they are used less frequently.
- vii) Hydroelectric power plants are eco-friendly and generate sufficient electricity but rehabilitation of people is necessary whose land is used for the construction of the dams.
