

- Q1.** State the two forms in which energy is mainly utilised at our homes.
- Q2.** What is a fuel?
- Q3.** Name the gaseous fuel which has the highest calorific value?
- Q4.** Name the major sources of energy that largely fulfils the growing demand of energy in our country.
- Q5.** The use of dry wood as domestic fuel is not considered as good. State two reasons for it.
- Q6.** What are the two disadvantages of burning fossil fuels?
- Q7.** What is wind energy?
- Q8.** What is the chief source of wind energy?
- Q9.** What is the minimum wind velocity required for obtaining electric power with a windmill generator?
- Q10.** How has the traditional use of wind energy been modified for our convenience?
- Q11.** Construction of dams submerges large areas of forests. How does this contribute to the greenhouse effect?

Or

How does construction of dams across the river get linked with the production of green house gases?

- Q12.** What is the function of a hydroelectric power plant?
- Q13.** List any one harm that is caused to environment by hydropower plant.
- Q14.** What is bio-mass?
- Q15.** Give the composition of the slurry fed into the digester of a go-bar-gas plant.
- Q16.** What is bio-gas?
- Q17.** Which one of the following gases is the major constituent of bio-gas?
Carbon monoxide, Hydrogen, Methane, Carbon dioxide.
- Q18.** How does bio-gas plant help to reduce the problem of pollution?
- Q19.** Write the full form of CNG.
- Q20.** State the ultimate source of the energy of fossil fuels.
- Q21.** Name two alternative sources of energy.
- Q22.** Name the reaction responsible for large energy production in the Sun.
- Q23.** Give examples of any two activities from our daily life in which we use solar energy.
- Q24.** For what purpose box type solar cooker be used?

Q25. What type of reflector is used in box type solar cooker?

Or

Mention the main purpose of using a plane mirror in solar cookers.

Q26. Why is the solar cooker box covered with a plane glass plate?

Q27. Name some devices used for harnessing solar energy.

Q28. In solar cooker, why is its inner surface blackened?

Q29. Name the device that directly converts solar energy to electric energy.

Q30. Which material is best suited for making solar cells?

Q31. Name chief component of solar cells. Which energy conversion takes place in a solar cell?

Q32. Mention two situations where solar cells are being used.

Q33. List two main advantages associated with solar cells.

Q34. What is a solar panel?

Q35. What type of energy is possessed by huge waves near the sea shore?

Q36. Name a non-conventional renewable source of energy which can be harnessed for 24 hours throughout the year.

Q37. Define the term "nuclear fission".

Q38. Which process is the basic cause of nuclear energy?

Q39. Write one advantage of nuclear fission reaction.

Q40. Suggest any two reasons which make the large scale usage of nuclear energy prohibitive.

Q41. How is nuclear energy generated during nuclear fusion?

Q42. Name the volatile liquid boiled with the warm surface water of oceans for running ocean thermal energy plants.

Or

Write the name of the substance whose vapours are used to run the turbine of the generator of ocean thermal energy plant.

Q43. Name two sources of energy which are pollution free.

Q44. Name any two renewable sources of energy.

Q45. Which one of the following is a renewable resource?

Natural gas, Petroleum, Ground water, Coal.

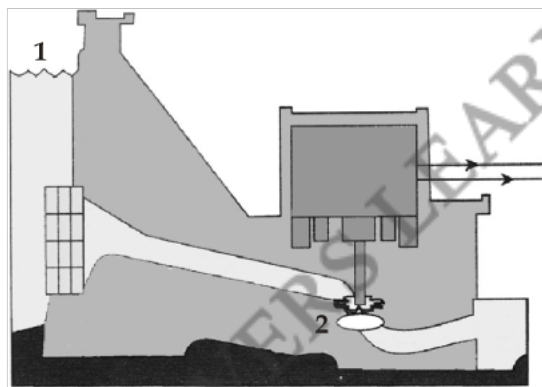
Q46. What do you mean by a clean fuel? Is an absolute clean fuel available?

Q47. Would you consider hydrogen to be a cleaner and more efficient fuel than CNG? If yes, why is it not used in everyday life?

Q48. You have wood, kerosene and LPG. Which one source of energy would you use for cooking your food and why? Give three reasons.

Q49. Explain, why fossil fuels are classified as non-renewable sources of energy.

- Q50.** Why is the use of wood as a fuel not advised, although forests can be replenished?
- Q51.** What is a wind energy farm? What is its importance?
- Q52.** State the energy transformation taking place at hydropower plants. List two advantages of setting up hydropower plants.
- Q53.** What is the principle of solar cookers? Name the common type of solar cooker.
- Q54.** What do you mean by alternative sources of energy? Give two examples too.
- Q55.** Why do we prefer to set up thermal power plant near coal or oil fields?
- Q56.** What is a thermal power plant? How does it work?
- Q57.** Mention three ways to reduce the pollution caused by fossil fuels.
- Q58.** Bio-gas is considered to be a boon to farmers. Give reasons.
- Q59.** Name the process for obtaining charcoal from wood. What are the advantages and disadvantages of burning charcoal over wood?
- Q60.** Name the different constituents of bio-gas.
- Q61.** 'Bio-gas is considered as an ideal fuel for domestic use'. List any four reasons to justify this statement.
- Q62.** Study the following diagram (see figure) and answer the following questions:
- (a) Label the parts (1) and (2).



- (b) Suggest a suitable heading for the above diagram.
- Q63.** How is wind energy converted into electrical energy?
- Q64.** Out of two solar cookers one was covered by a plane glass slab and other was left open. Which of two solar cookers will be more efficient and why?
- Q65.** Explain why: (a) Solar cookers are covered with glass plate. (b) The solar cooker is painted black from inside.
- Q66.** You are given two solar cookers, one with a plane mirror as reflector and the other with concave mirror as reflector. Which one is more efficient and why?
- Q67.** How is a solar panel prepared? What is its power output?
- Q68.** How does a solar panel lights up a bulb or tube during night time when no solar radiation is present at that time?
- Q69.** List three technological application for solar panel.

- Q70.** Why is energy of water flowing in a river considered to be an indirect form of solar energy?
- Q71.** Briefly describe, the principle of using tidal energy to produce electricity.
- Q72.** Name two forms in which solar energy manifests itself in oceans.
- Q73.** What are the advantages of geothermal energy?
- Q74.** Write the general principle involved in generating nuclear energy. Name one fuel used in a nuclear reactor.
- Q75.** How is electrical power produced in a nuclear reactor? What is its main advantage?
- Q76.** What are the main hazards of nuclear power generation?
- Q77.** What is the source of energy in the Sun and the Stars? What are the conditions needed?
- Q78.** Differentiate between renewable and non-renewable sources of energy with one example of each.

Or

List in tabular form two major differences between renewable and non-renewable sources of energy.

- Q79.** Write two advantages of classifying energy sources as renewable and non-renewable.
- Q80.** (a) What is a fuel?
(b) Write any two characteristics of a good fuel.
- Q81.** What are fossil fuels? List four disadvantages of burning fossil fuels.
- Q82.** State in brief the process of harnessing kinetic energy of the wind to do work. Mention limitations of harnessing wind energy on a large scale.
- Q83.** What is meant by wind energy farms? Write one of its practical applications. Give any two limitations of using wind energy.
- Q84.** Explain, how does a hydro power plant produce electricity.
- Q85.** Why is the construction of dams opposed by the environment and social activists? List three reasons for the opposition of such projects.
- Or
- Write the problems faced in construction of big dams.
- Q86.** Describe how electricity is generated at hydropower plants. List two advantages of producing hydroelectricity.
- Q87.** Mention advantages and disadvantages of producing hydro electricity by building dams on rivers.
- Q88.** (a) Name the four gases commonly present in bio-gas.
(b) List two advantages of using bio-gas over fossil fuels.
- Q89.** Suggest two materials that can be used to produce bio-gas. Mention two uses of bio-gas and two advantages of bio-gas plant.
- Q90.** Describe the steps involved in obtaining bio-gas and explain what is meant by anaerobic decomposition.

Or

Write the sequence of events taking place in a bio-gas plant.

Q91. Why is the use of bio-mass to generate heat: (a) discouraged from burning it directly in ovens (chulahs) and (b) encouraged for obtaining bio-gas through a bio-gas plant?

Q92. State the advantages of obtaining bio-gas from animal dung and bio-wastes.

Q93. What is bio-mass? Explain the principle and working of a bio-gas plant using a labelled schematic diagram.

Q94. Explain the function of digester in a bio-gas plant. List the two main components of bio-gas.

Q95. Name an efficient fuel obtained from cow dung and other animal and plant wastes. Also mention its constituents.

Q96. Answer the following questions on the basis of the diagram of a bio-gas plant given below:

(a) What is bio-mass? How is bio-gas obtained from bio-mass?

(b) Why is bio-gas considered an ideal fuel?

(c) Name the parts labelled A, B and C in the diagram.



Q97. What is geothermal energy? Briefly describe the principle of harnessing this energy. What is its advantage?

Q98. Name three forms in which energy from oceans can be used. Explain briefly the working of OTEC plant.

Q99. How can one say that Sun is the main source of energy on the earth?

Q100With the help of a diagram, explain the construction and working of a box type solar cooker.

Q101Name two semiconductors used in solar cell. What is solar cell panel? State two main advantages of solar panel.

Q102Why is not possible to make use of solar cells to meet all our energy needs? State at least three reasons to support your answer.

Q103Mention any four areas where solar cells are being used as a source of energy.

Q104What are the main advantages of solar energy?

Q105How is nuclear energy generated? State in brief the process of utilising this energy in the production of electricity. Mention the major hazard of nuclear power generation.

Q106What are the two most commonly used forms of energy? What are their sources?

Q107What is the main basic cause for winds to blow? Name a part of India where wind energy is commercially harnessed. Compare wind power and power of water flow in respect of generating mechanical and electrical energies. What is the hindrance in developing them?

Q108Name the major fuel component of bio-gas. What are its other combustible components? Draw a simple labelled diagram of a fixed dome type bio-gas plant. What is the use for the residual slurry and why?

Q109What is bio-gas? How is it obtained from cow-dung? Draw a labelled diagram of a fixed dome type bio-gas plant.

- S1.** Heat energy and electrical energy.
- S2.** Fuel is that which produces heat energy on burning *e.g.*, firewood, charcoal, coal, petroleum, cooking gas etc.
- S3.** Hydrogen gas.
- S4.** Fossil fuels like coal and petroleum.
- S5.** (a) Dry wood produces a lot of smoke on burning, which causes air pollution.
(b) It is a non-renewable source and its calorific value is not high.
- S6.** (a) Burning of fossil fuels produce smoke, which causes air pollution.
(b) Oxides of carbon, nitrogen and sulphur released on burning fossil fuels cause green house effect as well as acid rain.
- S7.** The kinetic energy possessed by air due to its motion is called wind energy.
- S8.** Sun (or solar energy). Wind is caused by unequal heating of land mass and water bodies by solar radiation.
- S9.** 15 km h^{-1} .
- S10.** The rotatory motion of the traditional windmill is used to turn the turbine of the electrical generator so that wind energy is converted into electrical energy.
- S11.** The vegetation of submerged areas of forests rots under anaerobic conditions and gives rise to methane, which is a greenhouse gas.
- S12.** To produce electrical energy at the expense of potential energy of stored water.
- S13.** Large eco systems are destroyed when submerged under the water in dams constructed for hydropower plants.
- S14.** Remains of dead animals, animal waste, agricultural waste etc., constitute bio-mass *e.g.*, cow dung, sewage, husk, vegetable waste etc.
- S15.** Slurry consists of mixture of bio-mass (cow dung) and water.
- S16.** Gases produced by anaerobic decomposition of plant and animal waste are called bio-gas.
- S17.** Methane gas.
- S18.** In a bio-gas plant huge quantity of bio waste and sewage is used in a safe and efficient manner. Thus, it helps in reducing pollution.
- S19.** Compressed Natural Gas (CNG).
- S20.** Sun.
- S21.** Bio-gas, solar energy and ocean energy

- S22.** Nuclear fusion reaction taking place in the interior of the Sun.
- S23.** (a) For drying clothes after washing, (b) For drying of crops and various food products.
- S24.** To prepare food items that require slow heating *e.g.*, boiling of rice, pulses and vegetables etc.
- S25.** The plane mirror reflects sun rays so that these reflected rays fall on the item to be cooked.
- S26.** The glass plate allows solar radiation to pass through it but the heat radiation from inside are not allowed to escape by the glass plate. Thus, it helps in maintaining temperature inside solar cooker high.
- S27.** Solar cooker, solar water heater, solar cell etc.
- S28.** Because black surface easily absorbs solar radiation incident on it.
- S29.** A solar cell.
- S30.** Silicon.
- S31.** Silicon is the chief component of solar cells. A solar cell converts solar energy into electrical energy.
- S32.** (a) In artificial satellites, (b) In traffic lights.
- S33.** (a) They have no moving parts and require little maintenance.
(b) They can be set up even in remote areas.
- S34.** A solar panel consists of a large number of solar cells combined together so that it can deliver enough electricity for practical use.
- S35.** Tidal energy, wave energy and ocean thermal energy are the different ways of harnessing energy from ocean.
- S36.** Geothermal energy.
- S37.** Splitting up of a nucleus of uranium, when bombarded by neutrons, into two lighter nuclei along with release of a large amount of energy is called nuclear fission.
- S38.** Nuclear fission of a nucleus of a heavy atom (uranium, plutonium and thorium) when bombarded by a slow moving neutron.
- S39.** In a nuclear fission reaction large amount of energy is released by a small quantity of nuclear fuel, which can be easily converted into electrical energy.
- S40.** High cost of installation of a nuclear power plant and problems of safe disposal of nuclear waste are two main reasons.
- S41.** When two nuclei of deuterium join together to form a helium nucleus, large amount of energy is released by conversion of a small amount of mass in to energy.
- S42.** Ammonia.
- S43.** Solar energy and wind energy.
- S44.** Solar energy, wind energy, ocean wave energy, bio-energy etc.
- S45.** Ground water.

- S46.** A clean fuel is that which does not cause environmental damage when used to produce energy.
No fuel is absolutely clean. Some environmental damage (pollution) is caused either directly or indirectly by the fuel. Burning of fossil fuels cause air pollution directly at the time of working. The actual operation of solar cell is pollution free but some pollution would have caused during the assembly stage of solar cells. Hence, we can only call one energy source as less or more cleaner than other.
- S47.** Yes, hydrogen is a cleaner fuel because burning of hydrogen produces water vapour which is non-polluting. Hydrogen is not used in everyday life due to storage and transportation problems on account of its explosive nature.
- S48.** We shall use LPG because (i) it is convenient to use and does not produce smoke, (ii) it has high calorific value, and (iii) no residue is left after burning of LPG.
- S49.** Fossil fuels were formed due to certain very slow changes occurring inside the earth under special circumstances spread over millions of years. Since these conditions are not prevailing now, it is not possible to replenish the amount of fossil fuels being consumed. Hence, these are classified as non-renewable sources of energy.
- S50.** Although wood can be obtained by cutting tree, tree takes more than fifteen years to mature. Hence, replenishment of forests taken an extraordinarily long time. It is due to this reason that the use of wood as a fuel is not advised.
- S51.** A wind energy farm consists of a number of windmills erected over a large area such that the energy output of each windmill in a farm is coupled together. A wind energy farm can, thus, generate electricity on a commercial scale.
- S52.** The potential energy of water stored in a dam is transformed into electrical energy in a hydropower plant. The advantages of setting up hydropower plants are:
(a) The hydropower energy is a renewable energy.
(b) Once constructed, a hydropower plant produces electric energy for a long period at a very low cost.
- S53.** Solar cookers use solar radiation. The heat absorbing property of black surfaces and the greenhouse effect of glass are utilised in making of solar cooker. Commonly "Box type solar cooker" is used as its design is simple and it is easy to operate.
- S54.** Those renewable sources of energy, which were previously not being used conventionally and which can be employed now, are known as alternative sources of energy. Ocean energy, bio-energy and wind energy are some examples of alternative sources of energy.
- S55.** We prefer to set up thermal power plants near coal or oil fields. It is because transmission of electricity is more efficient than transporting coal or petroleum over the same distance.
- S56.** Thermal power plant is a large sized assembly in which fuel is burnt to produce heat energy which is converted into electrical energy.
In a thermal power plant, large amount of fossil fuel is burnt everyday to heat up water to produce steam. This steam is utilised to run the turbine to generate electrical energy.
- S57.** Three ways to reduce the pollution caused by fossil fuels are:
(a) Increase the efficiency of the combustion process.
(b) Adequate techniques must be employed so as to reduce the escape of harmful gases and ash into the surroundings.
(c) The fossil fuel may be used to generate electricity, which can then be used in homes and industry.
- S58.** Bio-gas is a boon to farmers because (i) it produces a clean fuel from animal dung and agricultural waste, (ii) it produces good quality manure for use in his fields.

S59. Charcoal is obtained by destructive distillation of wood.

Advantages: (i) It burns easily producing no smoke. (ii) It gives twice as much heat as is obtained by burning the same mass of wood.

S60. Bio-gas contains methane, carbon dioxide, hydrogen and hydrogen sulphide gases. However, about 75% quantity of bio-gas is methane.

S61. (a) It burns without smoke.

(b) It does not produce any ash.

(c) It can be used directly for heating, lighting and generating electricity.

(d) The slurry that is left behind in a bio-gas plant is used as manure rich in nitrogenous and phosphorus compounds.

(e) It is efficient source of energy.

S62. (a) (i) Water reservoir, (ii) Turbine

(b) Hydroelectric power plant.

S63. Windmill structure is similar to a large electric fan created at a suitable height. In fast wind, the windmill begins to rotate. The rotatory motion of the windmill is used to turn the turbine of the electric generator so as to produce electrical energy.

S64. The solar cooker covered by a plane glass slab is more efficient. It is on account of the fact that the glass covering allows solar radiation into the solar cooker but does not allow higher wavelength radiation emitted by solar cooker to escape outside.

S65. (a) The glass plate covering helps in retention of heat inside the solar cooker on account of greenhouse effect. As a result, inside temperature is higher and maintained constant.

(b) The black surface is a good absorber of thermal radiation. Hence, all solar radiation incident on the solar cooker are easily absorbed by it.

S66. The solar cooker with a concave mirror as a reflector is more efficient because a concave reflector focuses all the incident solar energy on to the food item to be cooked.

S67. Electricity output of a single solar cell is quite small. Hence, to have larger output power we combine together a large number of solar cells using silver conductor. Such an arrangement is called a solar panel. Its power output depends upon the number of solar cells joined in one panel.

S68. The electricity generated by a solar panel during day time is utilised to charge storage batteries. These batteries operate an inverter system during night time and the inverter supplies required alternating current to light up the bulb, tube or other appliances.

S69. (a) Solar panels are used as the main source of energy in all artificial satellites.

(b) Solar panels are used as a source of electricity for radio or wireless transmission and at TV relay stations.

(c) Solar panels are used in traffic lights.

S70. During evaporation process at sea level, a part of the solar energy gets converted into potential energy of water molecules, which rise up in the air to form clouds. The potential energy of water molecules in clouds gets converted into kinetic energy during rain and snowfall. Thus, energy of water flowing in a river is an indirect form of solar energy.

S71. To harness tidal energy, a dam is constructed across a narrow opening to the sea. The water moves in and out of the openings in the dam during high and low tides. As the water moves through the openings, it flows over the turbines fixed inside the dam that generate electricity.

- S72.** (a) The energy of waves that continuously sweep the ocean coasts is a manifestation of solar energy.
 (b) The difference in temperature between warm surface waters heated by the Sun and colder waters found at ocean depths is also on account of solar energy. It is known as ocean thermal energy.
- S73.** (a) It can be harnessed for 24 hours throughout the year.
 (b) It is clean and environment friendly.
 (c) The cost of electricity produced is nominal.

S74. Nuclear fission is the process in which the nucleus of a heavy atom such as uranium (U-235), plutonium and thorium is splitted up into two lighter nuclei when bombarded with low energy neutrons. In nuclear fission, the mass of the original nucleus is just a little more than the sum of the masses of the fission products. This mass loss is transformed into energy in accordance with Einstein's mass-energy relation.

S75. In a nuclear power reactor, the nuclear fuel (compound of uranium or plutonium) is a part of a self-sustained nuclear fission chain reaction. Thus, energy is released at a controlled rate. The released energy is used to produce steam. Steam drives the turbine of electric generator and generates electricity.

Main advantage of a nuclear reactor is that comparatively very large amount of energy is released by the nuclear fuel. Fission of one atom of uranium produces 10^7 times the energy produced by the combustion of an atom of carbon from coal.

- S76.** Main hazards of nuclear power generation are as given below:
 (a) The most important problem is the storage and disposal of spent or used fuel because it is highly radioactive. Improper nuclear waste storage and disposal may lead to environmental contamination.
 (b) There is a risk of accidental leakage of nuclear radiation from the nuclear reactor.
 (c) Cost of installation of nuclear power plant is very high.

S77. Energy in the Sun and Stars is generated by nuclear fusion. In nuclear fusion two or more lighter nuclei join to form a heavier nucleus alongwith release of an extremely high amount of energy.

The cause of energy generation is conversion of a small part of mass into energy in accordance with Einstein's mass energy relation.

For nuclear fusion to take place temperatures of millions of degrees and extreme pressure of millions of pascals are needed and there should be lot of hydrogen. These conditions are fulfilled in central part of Sun and Stars.

S78.

Renewable sources of energy	Non-renewable sources of energy
These are the energy sources which are inexhaustible <i>i.e.</i> , can be replenished and can be used to produce energy again and again. Solar energy, energy of flowing water, wind energy are renewable sources of energy.	These are the energy sources which are exhaustible <i>i.e.</i> , cannot be replenished after being once consumed. Fossil fuels <i>e.g.</i> , coal, petroleum, natural gas and wood are non-renewable sources of energy.

- S79.** The classification of energy sources as renewable and non-renewable helps us to know:
 (a) which energy source should be judiciously used.
 (b) how to conserve non-renewable sources of energy and find alternate sources of energy.
- S80.** (a) A fuel is that which produces heat energy on burning. Wood, coal, charcoal, CNG etc., are examples of fuels.
 (b) A good fuel is that which is available easily at an economic rate, releases more heat on burning and does not produce smoke.

S81. Fossil fuels are fossil remains produced by the decay of plants and animals that were buried in the earth millions of years ago. Coal and petroleum are fossil fuels.

There are following disadvantages of fossil fuels like coal and petroleum:

- (a) Burning of coal or petroleum causes air pollution.
- (b) Acidic oxides like oxides of carbon, nitrogen and sulphur are released on burning fossil fuels. These oxides lead to acid rains, which affect our water and soil resources.
- (c) Carbon dioxide gas also causes greenhouse effect in atmosphere.
- (d) Fossil fuels are non-renewable sources of energy.

S82. The kinetic energy of the wind is utilised in running windmills. A windmill may do mechanical work like pumping out water or grinding foodgrains. Now-a-days windmills are used to run turbines of electric generators and thereby producing electrical energy.

Limitations of harnessing wind energy:

- (a) Wind energy farms can be established at those places only, where wind blows for the greater part of a year.
- (b) For wind energy, the wind speed should be higher than 15 km h^{-1} .
- (c) A wind farm requires large area and initial cost of establishment of wind farm is high.
- (d) It requires high level of maintenance because the tower and blades are exposed to rain, sun, storm etc.
- (e) It requires a back-up with batteries for periods when there is no wind.

S83. A wind energy farm consists of a number of windmills erected over a large area such that output of all these windmills is coupled together.

A wind energy farm is a renewable source of energy generating electricity on a commercial scale.

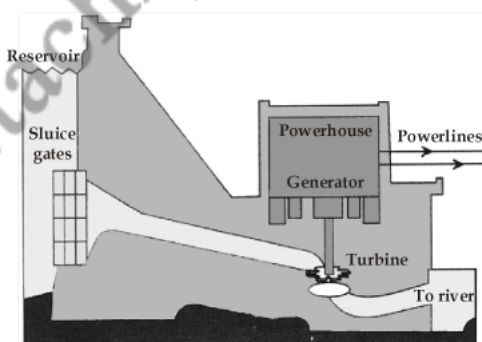
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- (e) It requires a back-up with batteries for periods when there is no wind.

S84. A hydro power plant converts the potential energy of stored water into electricity.

To produce hydro power electricity, a high rise dam is constructed at a suitable place on the river to obstruct the flow of water and thereby collect water in a large sized reservoir. Due to rise of water level, the kinetic energy of flowing water is transformed into potential energy of stored water.

The water from the high level in the dam is carried through sluice gates and pipes to the turbine of electric generator, which is fitted at the bottom of the dam. Due to flowing water, turbine is rotated at a fast rate and electricity is produced.



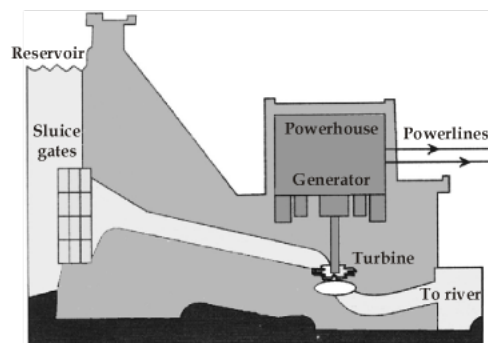
S85. Construction of dams is opposed by the environment and social activists because:

- (a) Dams can be constructed at a limited number of places only.
- (b) Large areas of land get submerged when dams are built on rivers. This causes many long term environmental and social problems.
- (c) It adversely affects the ecosystem of adjoining as well as downstream regions.

S86. A hydro power plant converts the potential energy of stored water into electricity.

To produce hydro power electricity, a high rise dam is constructed at a suitable place on the river to obstruct the flow of water and thereby collect water in a large sized reservoir. Due to rise of water level, the kinetic energy of flowing water is transformed into potential energy of stored water.

The water from the high level in the dam is carried through sluice gates and pipes to the turbine of electric generator, which is fitted at the bottom of the dam. Due to flowing water, turbine is rotated at a fast rate and electricity is produced.



Advantages:

- (a) The potential energy of water at the top of the dam is readily available to rotate the turbine blades at the bottom of the dam.
- (b) The available water is used for irrigation purposes.
- (c) Occurrence of floods during rainy seasons can be controlled by constructing dams.
- (d) Since the water in the reservoir should be refilled each time it rains, hydro power is a renewable source of energy.

S87. Advantages:

- (a) The potential energy of water at the top of the dam is readily available to rotate the turbine blades at the bottom of the dam.
- (b) The available water is used for irrigation purposes.
- (c) Occurrence of floods during rainy seasons can be controlled by constructing dams.
- (d) Since the water in the reservoir should be refilled each time it rains, hydro power is a renewable source of energy.

Disadvantages:

- (a) Dams can be constructed at a limited number of places only.
- (b) Large areas of land get submerged when dams are built on rivers. This causes many long term environmental and social problems.
- (c) It adversely affects the ecosystem of adjoining as well as downstream regions.

S88. (a) The four gases commonly present in bio-gas are methane, carbon dioxide, hydrogen and hydrogen sulphide.

(b) Main advantages of using bio-gas over fossil fuels are as given below:

- (i) Bio-gas burns completely and leaves no residue *i.e.*, ash.
- (ii) Bio-gas is a renewable, convenient and efficient source of energy.
- (iii) It gives us a safe method to dispose off wastes like animal dung, human excreta and other bio-wastes.

S89. Animal dung, sewage, crop residue etc., can be used to produce bio-gas.

Two uses of bio-gas:

- (a) It can also be used for production of electricity.
- (b) It does not leave any residue after burning.

Advantages of a bio-gas plant are:

- (a) It provides an efficient and safe method to dispose off waste materials.
- (b) The slurry left in a bio-gas plant can be used as manure because it is rich in nitrogenous and phosphorus compounds.
- (c) A bio-gas plant can be installed any where at a small cost.
- (d) It does not cause any pollution or contamination of environment.

S90. The following steps are involved in obtaining bio-gas:

- Bio-mass suitable for production of bio-gas is collected. Bio-mass includes animal dung, sewage, crop residues, vegetable wastes etc.
- A slurry of bio-mass with water is made in a mixing tank called digester for degrading, by anaerobic micro-organisms. These tanks are sealed chambers.
- In order to get a continuous supply of bio-gas, the plant is fed regularly with waste.

Anaerobic decomposition means breaking down the complex compounds of bio-bass in the slurry in the presence of water by micro-organisms.

S91. (a) Use of bio-mass to generate heat by burning it directly in open chulahs is discouraged because it is not an efficient way to produce heat and lot of smoke and ash is produced.

(b) Use of bio-mass is encouraged to obtain bio-gas because it utilises waste material and helps control pollution. The bio-gas is a very good fuel and good quality manure is obtained as a by-product.

S92. (a) Bio-gas is an efficient source of energy having high thermal efficiency.

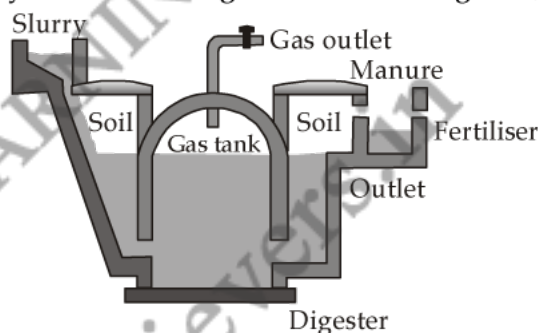
(b) It can also be used for production of electricity.

(c) It does not leave any residue after burning.

(d) The slurry that is left in a bio-gas plant, is an excellent source of nitrogenous and phosphorus compounds and hence a good manure.

(e) The bio-gas production results in efficient and safe method to dispose off wastes.

S93. Animal dung, crop residue, vegetable waste and sewage constitute the bio-mass. A bio-gas plant is shown in figure. In a bio-gas plant slurry of animal dung or other types of bio-waste and water is made in the mixing tank and then fed into the digester. The digester is usually a closed underground tank. In digester, the action of micro-organisms decomposes the complex compounds of the bio-mass in the slurry. In the presence of water anaerobic micro-organisms degrade the bio-mass in the digester. As anaerobic micro-organisms do not require oxygen, the digester is designed like a sealed chamber. The complete degradation process takes few days, during which bio-gases are produced. Now, the bio-gas can be supplied to consumers through pipes. Periodically the slurry, that is left behind in the digester, is removed and it serves as an excellent manure.



S94. In the digester of a bio-gas plant the bio-mass present in the slurry is degraded due to anaerobic micro-organisms. During this degradation process, which takes few days, bio-gas is produced.

Two main constituents of bio-gas are methane and hydrogen.

S95. Bio-gas is an efficient fuel obtained from animal waste and plant waste in a bio-gas plant.

Constituents of bio-gas are methane, carbon dioxide, hydrogen and hydrogen sulphide gases.

S96. (a) Cow dung, various plant materials like the residue after harvesting the crops, vegetable waste and sewage are known as bio-mass. Bio-gas is obtained by anaerobic decomposition of bio-mass.

(b) Bio-gas is considered an ideal fuel, because:

(i) Bio-gas burns completely and leaves no residue *i.e.*, ash.

(ii) Bio-gas is a renewable, convenient and efficient source of energy.

(iii) It gives us a safe method to dispose off wastes like animal dung, human excreta and other bio-wastes.

(c) Part A is mixing tank in which slurry is prepared. Part B is overflow tank from which spent slurry is removed. Part C is the gas tank.

S97. Geothermal energy is yet another form of energy. The deeper regions of the earth's crust are very hot. This heat melts the rocks. The molten rocks are pushed upward due to geological changes and are trapped in certain regions called the 'hot spots'. The underground water in contact with these hot spots turns into steam which gets compressed to high pressure. If this steam is extracted by sinking pipes through holes drilled up to hot spots, the steam coming out at high pressure can be utilised to turn the turbine of electric generator. This form of energy can be harnessed round the clock throughout the year.

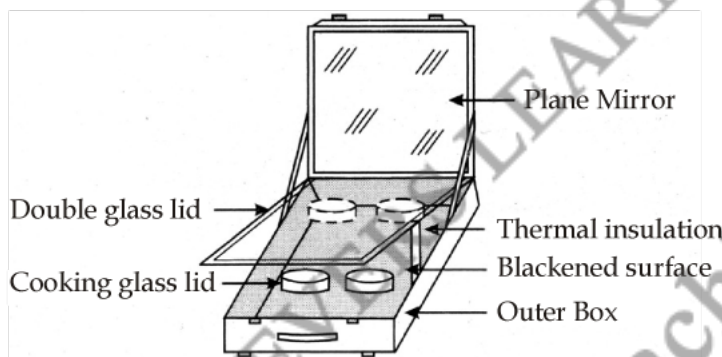
S98. Three forms in which energy from oceans is made available for use are: (i) Tidal energy, (ii) Ocean thermal energy and (iii) Ocean wave energy.

OTEC (Ocean Thermal Energy Conversion) power plants are devices used to harness ocean thermal energy *i.e.*, the energy obtained from ocean water due to the difference in temperature at the surface and in deeper section of ocean. For operating an Ocean Thermal Energy Conversion power plant, a temperature difference of 20 °C or more between surface water and water at depths up to 2000 m is required. The warm surface water is used to boil a liquid like ammonia or CFC. The vapour of the liquid is then used to drive turbine of generator. The cold water from the ocean depths is pumped up to convert the vapour again into liquid.

OTEC systems can be operated for 24 hours throughout the year. This advantage is not possible in other ocean energy generating systems.

S99. Solar energy manifests itself in many forms through many processes both biological and physical. Plants utilise solar energy for photosynthesis. The solar energy trapped by land and water bodies brings about many physical changes resulting in wind, storm, ocean waves etc. Also fossil fuels *e.g.*, coal, natural gas, petrol etc., have been formed due to very slow changes which occurred millions of years ago and were related to solar energy. Energy of bio-gas etc., is also derived from solar energy.

S100. Construction: The box of the solar cooker is made of non-conducting material *e.g.*, plastic or fibre glass with thick inner walls. These walls are painted in black. A plane mirror is hinged on the top so that it reflects sunlight into the box.



Working: The purpose of the box is to increase the effective area for collection of solar energy. Whole box is covered with glass sheets. These glass sheets prevent the loss of longer wavelength infrared radiation from inside the box to outside. Within two to three hours, the temperature inside rises to about 140 °C.

S101 Silicon and gallium are two semiconductors used in solar cell.

A solar panel is an arrangement in which a large number of solar cells are combined so that it can deliver enough electricity for practical use

Solar panels have following advantages:

- They have no moving parts, require little maintenance and work quite satisfactorily without the use of any focussing device.
- These can be set up in remote and inaccessible hamlets or very sparsely populated areas where laying of a power transmission line is not commercially viable.

S102. Although solar cell panels provide a clean, pollution-free and environment-friendly source of electricity, yet they can be used for a limited purpose and fail to meet all our domestic needs of electricity due to the following reasons:

- (a) Their installation cost is very high on account of following:
 - (i) Special grade silicon required for making solar cells is only limited.
 - (ii) Technology to obtain silicon in pure form is expensive.
 - (iii) Silver conductor is to be used for connecting solar cells in a solar panel, which is again very expensive.
- (b) There is a practical problem of availability of efficient systems that can store electricity generated by solar cells and make it available when required. Storage batteries and inverters are to be used. It again enhances the cost and reduces the efficiency.
- (c) Solar panels cannot work on cloudy and rainy days.

S103(a) In artificial satellites as source of energy.

- (b) As source of electricity for radio broadcast and TV relay stations.
- (c) Traffic lights and research centres in remote areas.
- (d) In calculators and toys.

S104. Main advantages of solar energy are as follows:

- (a) No fuel or electricity is needed for harnessing solar energy.
- (b) The solar energy is available in abundance and it can be obtained anywhere, even in remote areas.
- (c) The upkeep and maintenance of solar energy devices requires nominal expenditure only.
- (d) It is environmental friendly.
- (e) There is no residue like ash, which is to be disposed off.

S105. Nuclear fission is a process in which the nucleus of a heavy atom like uranium, plutonium or thorium, when bombarded with low energy neutrons, is split up into two lighter nuclei along with the release of a large amount of energy. The fission of a uranium nucleus produces 10^7 times the energy produced by the combustion of an atom of carbon from coal.

In a nuclear reactor, self-sustained fission chain reaction of the nuclear fuel (uranium or plutonium) releases energy at a controlled rate. The energy released is used to produce steam. This steam is used to do work for rotating the turbine of an electric generator and thus to generate electricity.

Nuclear power generation has certain disadvantages. Main hazard is storage and disposal of used fuels. There is a risk of leakage of nuclear radiation. High cost of nuclear power plant, high risk of environmental contamination and limited availability of nuclear fuel are some other limiting factors.

S106. Two most commonly used forms of energy are:

- (a) Thermal (heat) energy and it is obtained by burning of fuels like firewood, cow-dung cakes, charcoal, coal, petroleum products, natural gas, etc.
- (b) Electrical energy, which is generated by harnessing different of sources of energy. Some examples are hydro-electric power plants using energy of flowing water, thermal power plant in which heat is produced by burning fuels and then the heat energy is converted into electrical energy, nuclear power plants harnessing nuclear energy, solar panels, windmill, OTEC power plants etc.

S107 Solar energy is the main basic cause for winds to blow.

Near Kanyakumari in the state of Tamil Nadu, a wind energy farm has prospects of producing about 380 MW.

Energy	Wind power	Power of water flow
(a) Generation of mechanical energy	In a water lifting pump, the rotational motion of windmills is utilised to do mechanical work.	The energy of flowing water is still used to transport heavy logs of wood from inaccessible areas of forests in hilly areas.
(b) Generation of electrical energy	To produce electricity, the rotatory motion of windmills is utilised to rotate the armature of a electric generator.	Energy of flowing water is utilised on a large scale at hydro electric power plants. Water is stored in a high rise dam. Through pipes water from the top of dam is allowed to fall, which rotates the turbine of power plant.

The following are hindrances in developing:

(a) **Wind power:**

- (i) Wind power can be harnessed only at places where winds are flowing for most part of the year.
- (ii) In order that a windmill is workable, a wind velocity of atleast 15 km/h is essential.

(b) **Power of water flow:**

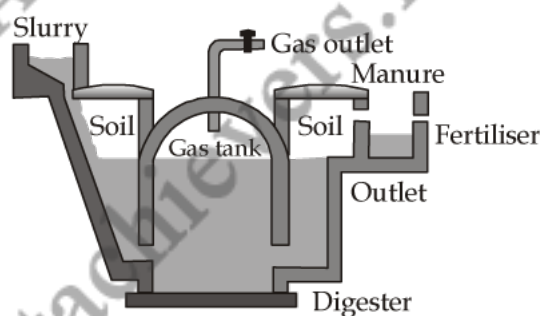
- (i) To harness water flow power, dams are to be constructed resulting in deluge of a large part of land with consequent environmental problems.
- (ii) In hills, the power from water flow can be harnessed where the water falls from the height of at least 10 metres.

S108 The major fuel component of bio-gas is methane gas. it constitutes about 75% of total bio-gas.

Other combustible components of bio-gas plant are hydrogen and hydrogen sulphide gases.

Labelled diagram of a fixed dome type bio-gas plant is given in figure.

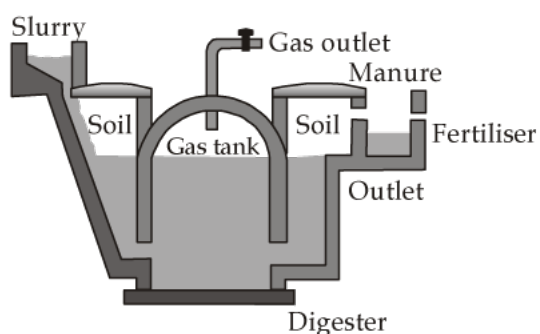
Residual slurry from bio-gas plant is used as manure because it is rich in nitrogen and phosphorous.



S109 Bio-gas is a self-sustaining source of fuel and electricity, and therefore, it has gained acceptance by both rural and urban population.

Bio-gas is a mixture of gases produced during decay of bio-mass in the absence of oxygen. Methane is the main constituent of bio-gas.

The floating dome type gas plant is generally used to prepare bio-gas from cow-dung. A slurry of cow-dung and water is fed into an underground tank made of bricks called digester. In the digester, the action of micro-organisms breaks down or decomposes the complex compounds of the bio-mass into simpler compounds. In this process of anaerobic decomposition, mixture of gases like methane, carbon dioxide, hydrogen and hydrogen sulphide are produced which constitute bio-gas.



For labelled diagram of a fixed dome type bio-gas plant (see figure).