

SOURCES OF ENERGY

Time: 1 hour
Maximum Marks: 34

General instructions:

- (i) All questions are compulsory.
- (ii) The question paper consists of 18 questions. Question number 1-10 are of 1 mark each, question number 11-14 are of 2 marks each, question number 15-16 are of 3 marks each, question number 17-18 are of 5 marks each.
- (iii) Internal choices have been provided in 5 marks questions. You have to attempt one of the choices in such questions.
- (iv) Write down the serial number before attempting the question.
- (v) Use of calculators is not permitted.

1. What is the nuclear fission process?
2. Name any two gases, which are major constituents of biogas.
3. What is a solar cell panel?
4. Give the names of any two devices that utilize solar energy.
5. Outline the energy conversion that takes place in a hydro power plant.
6. Why can CNG be considered as an environment friendly fuel?
7. Define anaerobic degradation.
8. What is the typical range of voltage and power of a solar cell, when exposed to the sun?
9. What is the condition under which ocean thermal energy can be trapped and used?
10. What is the cause of geothermal energy?

Time Tracker:

11. Define bio-mass. Give two examples.
12. What are the limitations of using wind energy?

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13. Why is it difficult to use hydrogen as a source of energy?
14. What is acid rain? What are its harmful effects?

Time Tracker:

15. What characteristics should an ideal fuel possess?
16. Give the advantages and disadvantages of solar cell panels.

Time Tracker:

17. (i) What is the use of black painted surface in a solar cooker?
- (ii) What is the unit in which nuclear energy is expressed? How is it related to joule?
- (iii) Give the disadvantage of generating hydro-electricity.

OR

Discuss the working of a hydro power plant using a labeled diagram.

STEPS

18. Explain the working of bio-gas plant by drawing a labeled diagram.

OR

- (i) What are the limitations of using fossil fuels?
- (ii) Name the different types of energy available from oceans.
- (iii) Mention the major hazards of nuclear power generation.

Time Tracker:

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SOLUTIONS

1. The process in which, the nucleus of a heavy atom when bombarded with low energy neutrons, can be split into lighter nuclei, is known as nuclear fission. [1]

2. Biogas mainly consists of
Methane (CH₄), Carbon dioxide (CO₂), Hydrogen (H₂), Hydrogen sulphide (H₂S) [½ × any 2]

3. A large number of solar cells, are combined in an arrangement called a solar cell panel. [1]

4. (i) Solar cells
(ii) Solar cooker
(iii) Solar water heater [½ × any 2]

5. The potential energy of stored water is converted to kinetic energy of turbines to ultimately generate electrical energy. [1]

6. CNG does not produce toxic gases on burning, as it is a lead free fuel that produces no sulphur oxides and upto 30% less CO₂ as comparison to other conventional fossil fuels. [1]

7. The decomposition that takes place in the absence of oxygen by anaerobic micro-organism is known as anaerobic degradation.

8. A Solar cell develops a voltage of 0.5-1 V [½]
and can produce about 0.7 W of electricity when exposed to the sun. [½]

9. The condition under which the ocean thermal energy can be trapped is that the temperature difference between the water at the surface and water at the depth upto 2 km is 293 K (20 °C) or more. [1]

10. Obstructed molten rocks coming in contact with a water reservoir producing high temperature steam. [1]

11. The material obtained in the bodies of plants and animals is called bio mass and can be used as fuels.[1]
Examples: Cattle dung, wood, sewage etc. [½ × any 2]

12. (i) The minimum wind speed of 15 km/hr is required in order to run a wind mill.

- (ii) It requires a very large area of land.
- (iii) The initial cost of establishment of the farm is quite high.
- (iv) It requires a high level of maintenance, since the tower and blades are exposed to the unpredictable change of nature like rain, storm and cyclones etc. [1 × any 2]

13. Due to the following reasons hydrogen cannot be used as energy source:

- Hydrogen is a energy transfer media rather than a primary source of energy
i.e. it requires other fuels or energy sources to produce and each of these has different energy conversion efficiencies which may pose limitation on their use in hydrogen manufacture.
- High infrastructure cost associated with the distribution and use.
- Due to low density of hydrogen, hydrogen fuel tanks must be large.
- Hydrogen has a low ignition temperature and it burns easily with explosion. [1 × any 2]

14. The oxides of carbon, nitrogen and sulphur that are released on burning fossil fuels are acidic oxides and give rise to acid rain. [1]

Harmful effects of acid rain:

- It effects our water and soil resources.
- It causes irritation in human eyes.
- It damages the historical buildings made of marbles. [½ × any 2]

15. An ideal fuel should possesses the following characteristics

- (i) It should have high calorific value, so that it may give more heat per unit weight.
- (ii) It should have a proper ignition temperature, so that it can be burned easily.
- (iii) It should burn without giving out any harmful gases, so that air is not polluted.
- (iv) It should not be valuable for some other purpose than a fuel.
- (v) It should be cheap and easily available.
- (vi) It should not leave much ash behind after burning.
- (vii) It should have a moderate rate of combustion and burn smoothly.
- (viii) It should be easy to handle, safe to transport and convenient to store. [1 × any 3]

16. **Advantages:**

- No moving parts involved
- Low maintenance is required
- Don't pollute the environment.
- No need of focusing mirrors is required as in solar cookers.
- Provides stable source of electrical energy
- Can be used in remote areas.

[½ × any 4]

Disadvantages:

- Provide low power.
- Installation cost is high
- Can not be used on a cloudy day.
- Acquire large space.

[½ × any 2]

17. (i) Black colour is a very good absorber of heat but a very poor reflector. It absorbs the maximum amount of heat from sunlight. It is used in solar heating devices for maximum absorption of heat and to minimize loss due to reflection. [2]

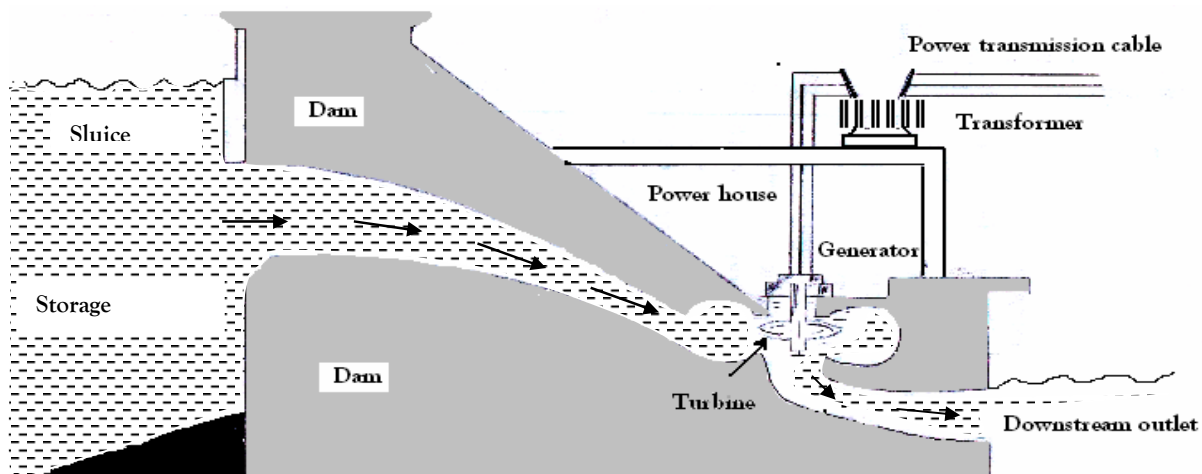
- (ii) Nuclear energy is expressed in eV. [½]
 $1\text{eV} = 1.6 \times 10^{-19}\text{J}$ [½]

- (iii) Disadvantage of generating hydro-electricity:

- Problems in construction of dams, as these dams can be constructed only in a limited number of places preferably in hilly terrains.
- It creates the problem of rehabilitating displaced people.
- Large area of agriculture and human habitation is to be sacrificed as it gets submerged.
- The vegetation which is submerged rots under anaerobic conditions and gives rise to the green house effect. [1 × any 2]

OR

Labeled diagram of Hydro Power Plant:



Hydro power plant

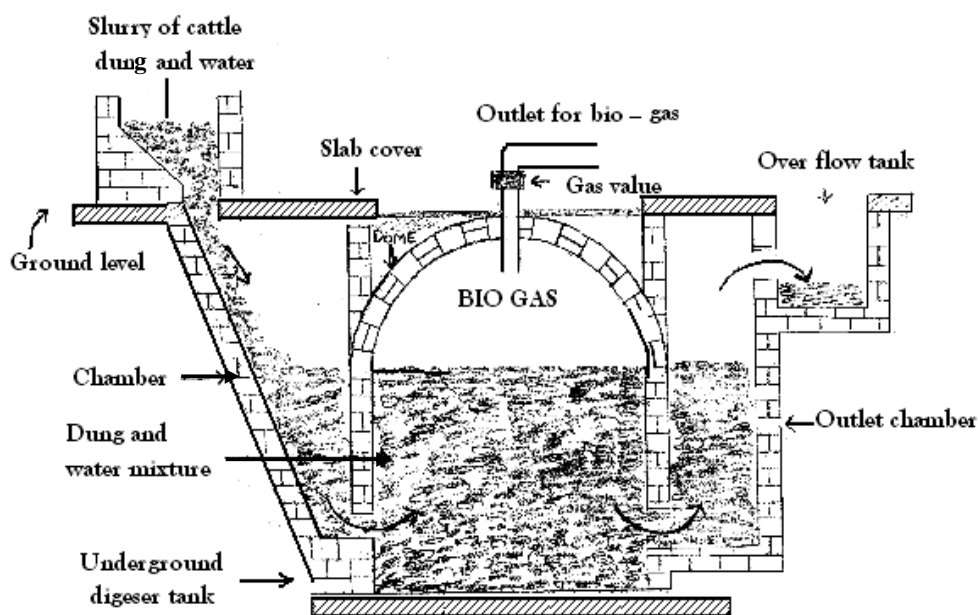
Figure marks [2]

Working:

Hydro power plant converts the potential energy of falling water into electricity. [1]

Usually water is stored in a large reservoir by obstructing the flow of a river by constructing a dam on it. As more and more water comes to this reservoir, the level of water (controllable by over flow gates in the dam) rises. Water from this reservoir is taken through pipes to the turbines at the bottom of dam and potential energy of water (in reservoir) changes to kinetic energy of water (flowing through pipes) which is further used to rotate turbines. Thus, electrical energy is produced. [2]

18.



[2]

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Working:

The plant has a dome like structure built with bricks. Slurry of cow dung and water is made in the mixing tank from where it is fed into the digester. Digester is a sealed chamber in which there is no oxygen.

Anaerobic micro-organisms that do not require oxygen decompose or break down complex compounds of the cow dung slurry. It takes a few days for the decomposition process to be complete and generate gases like methane, carbon-dioxide, hydrogen and hydrogen sulphide. The bio gas is stored in the gas tank above the digester from which they are drawn through pipes for use. [3]

OR

- | | | | |
|-------|---|--|------|
| (i) | ➤ Fossil fuels pollute the environment. | | [½] |
| | ➤ Fossil fuels cannot be reproduce quickly. | | [½] |
| | ➤ Fossil fuels are limited resources. | | [½] |
| | ➤ Fossil fuels can be used only once. | | [½] |
| (ii) | ➤ Tidal energy | | [½] |
| | ➤ Wave energy | | [½] |
| | ➤ Ocean thermal energy | | [½] |
| (iii) | The major hazard in nuclear power generation is the storage and disposal of spent or used fuels. Improper nuclear waste disposal results in the contamination of the environment. | | [1½] |