RADIANT 2026

Physics

Heat and Energy

Lecture - 04

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Topics *to be covered*

1. SOURCES OF ENERGY
2. PRODUCTION OF ELECTRICITY FROM WIND ENERGY
3. HOPE'S APPARATUS
4. Questions

5) Conversion of Energy

Recap *of previous lecture*

1. SOURCES OF ENERGY
2. TYPES OF ENERGY
3. ENERGY CONVERSION
4. Questions


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SOURCES OF ENERGY

Classification of sources of energy:

From the point of view of availability, the energy sources are divided into the following two groups:

(1) renewable or non-conventional sources of energy, and

(2) non-renewable or conventional sources of energy.

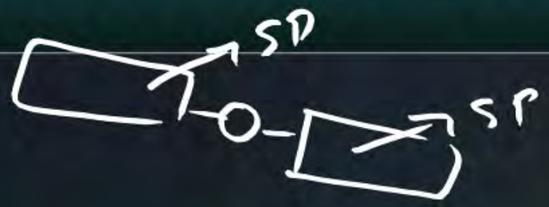
PRODUCTION OF ELECTRICITY FROM SOLAR ENERGY

- The sun is the most vast and direct source of energy.
- To obtain electricity from the solar energy, two devices are used a solar cell and a solar power plant.
- The device which converts solar energy directly into the electricity is called a **solar cell**.
- On the other hand, a solar heating device used to generate electricity from solar energy, is called a **solar power plant**.

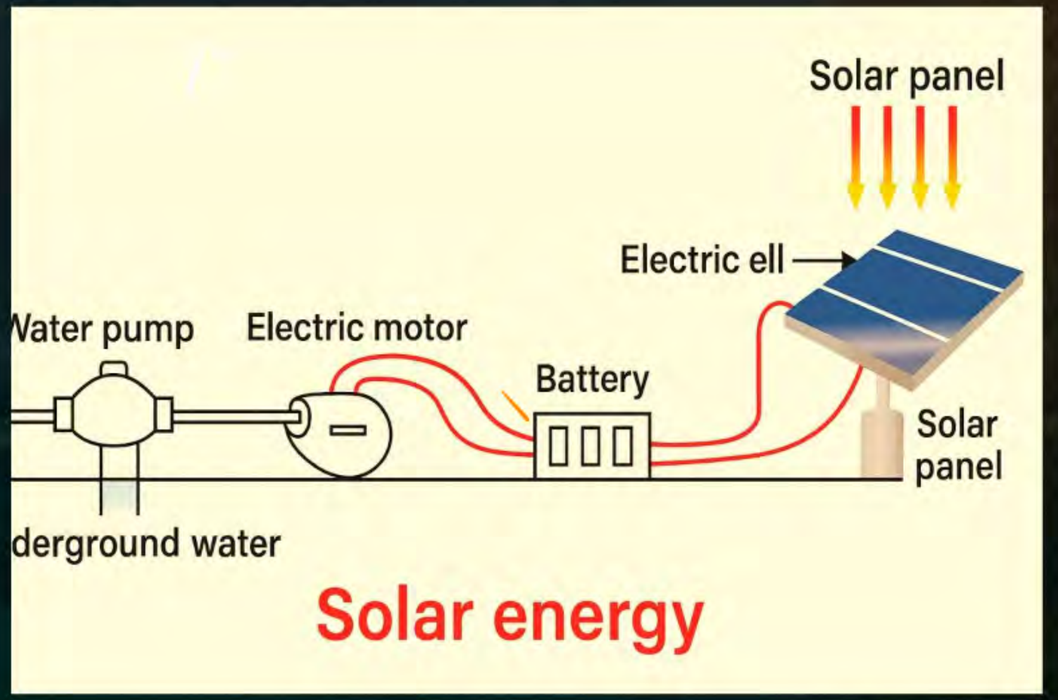
PRODUCTION OF ELECTRICITY FROM SOLAR ENERGY

(i) **Solar cell:** About a hundred years ago, it was discovered that when sunlight falls on a thin layer of selenium, an electric current is produced. Since only 0-6% of the solar energy incident on selenium could convert into electric.

PRODUCTION OF ELECTRICITY FROM SOLAR ENERGY



A solar panel gives electricity so long as sunlight is falling on it. Therefore a solar panel cannot produce electricity at night. To overcome this difficulty, the storage battery (or secondary cell) is charged by a solar panel during the day time and it can then be used at night to provide electricity. The solar panels are used to supply electricity in the artificial satellites.



Advantages of using solar panels:

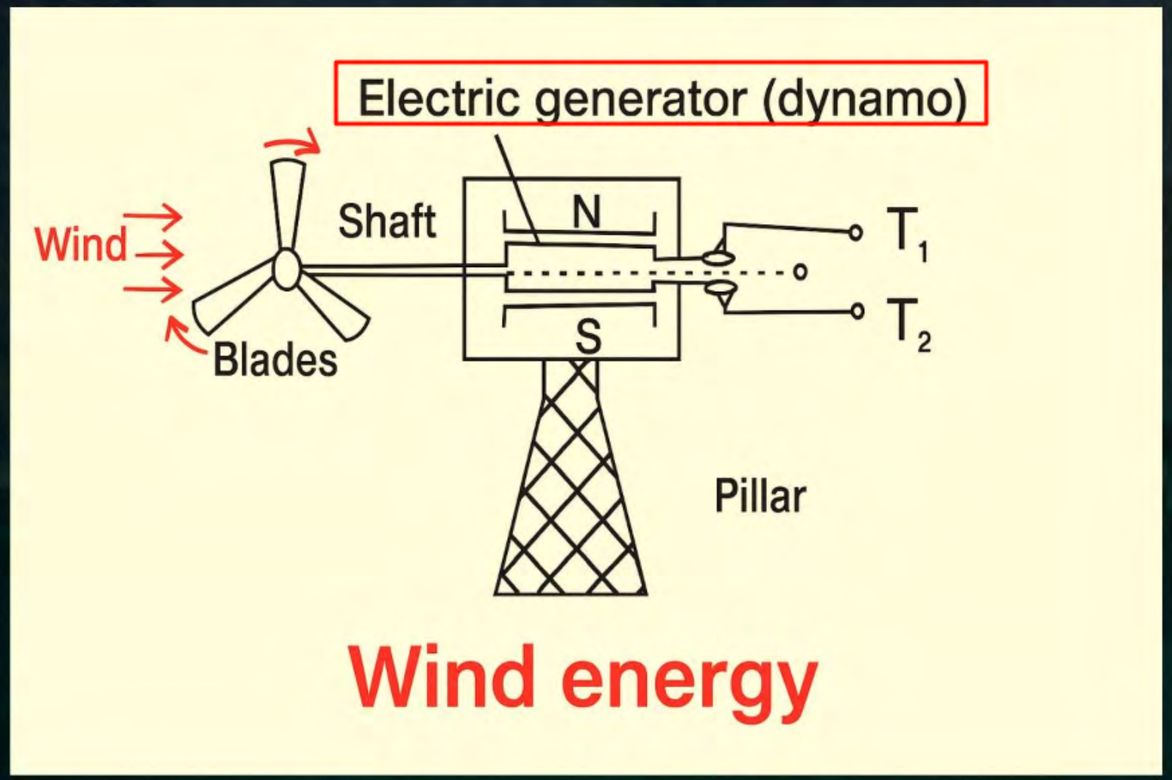
1. They do not require any maintenance.
2. They last over a long period of time.
3. Their running cost is almost nil.
4. They are most suitable for the remote, inaccessible, and isolated places where electric power lines cannot be laid.
5. They do not cause any pollution in the environment.

Disadvantages of using solar panels:

1. The initial cost of a solar panel is sufficiently high.
2. The efficiency of conversion of solar energy to electricity is low.
3. A solar panel produces d.c. electricity which cannot be directly used for many household purposes.

S.C.

PRODUCTION OF ELECTRICITY FROM WIND ENERGY



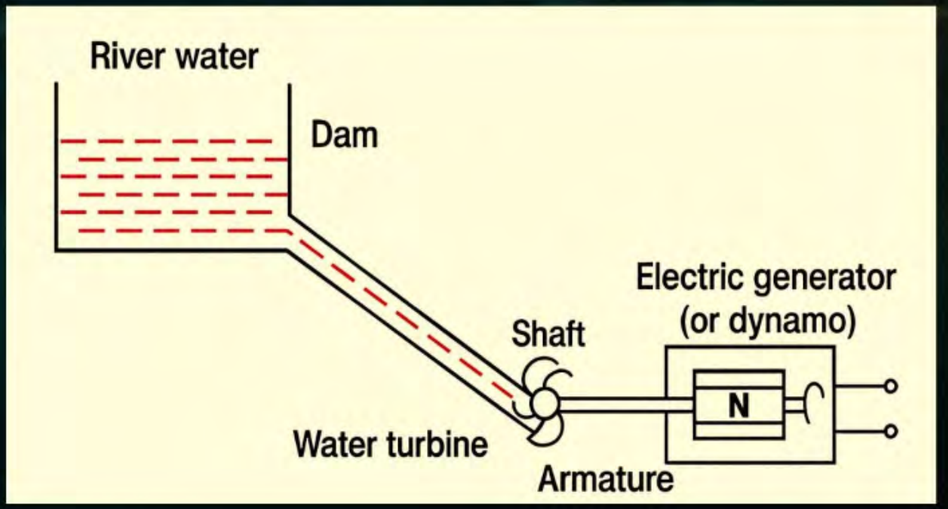
PRODUCTION OF ELECTRICITY FROM WATER (or hydro) ENERGY

Advantages of using the hydro energy:

(i) It does not produce any environmental pollution.

(ii) It is a renewable source of energy.

(iii) The dams constructed over rivers help us in irrigation and control of floods in rivers.



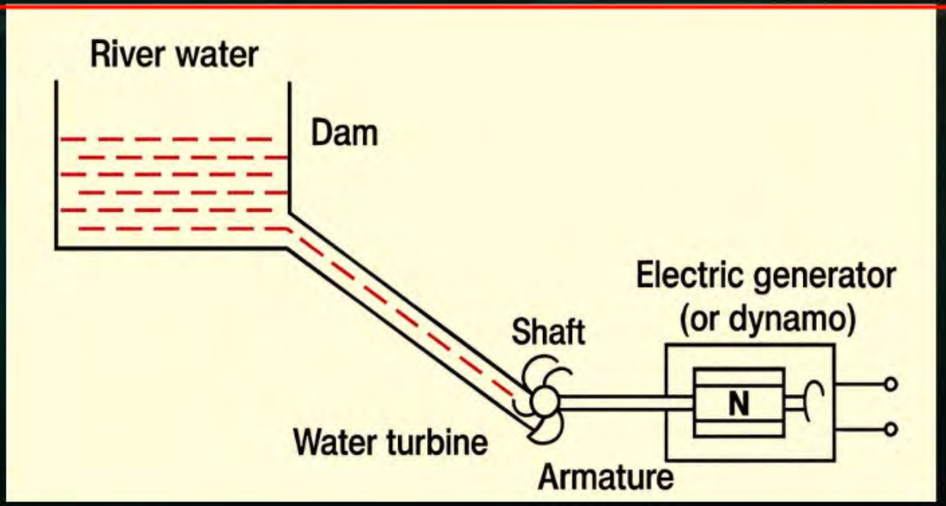
PRODUCTION OF ELECTRICITY FROM WATER (or hydro) ENERGY

Limitations of using hydro energy:

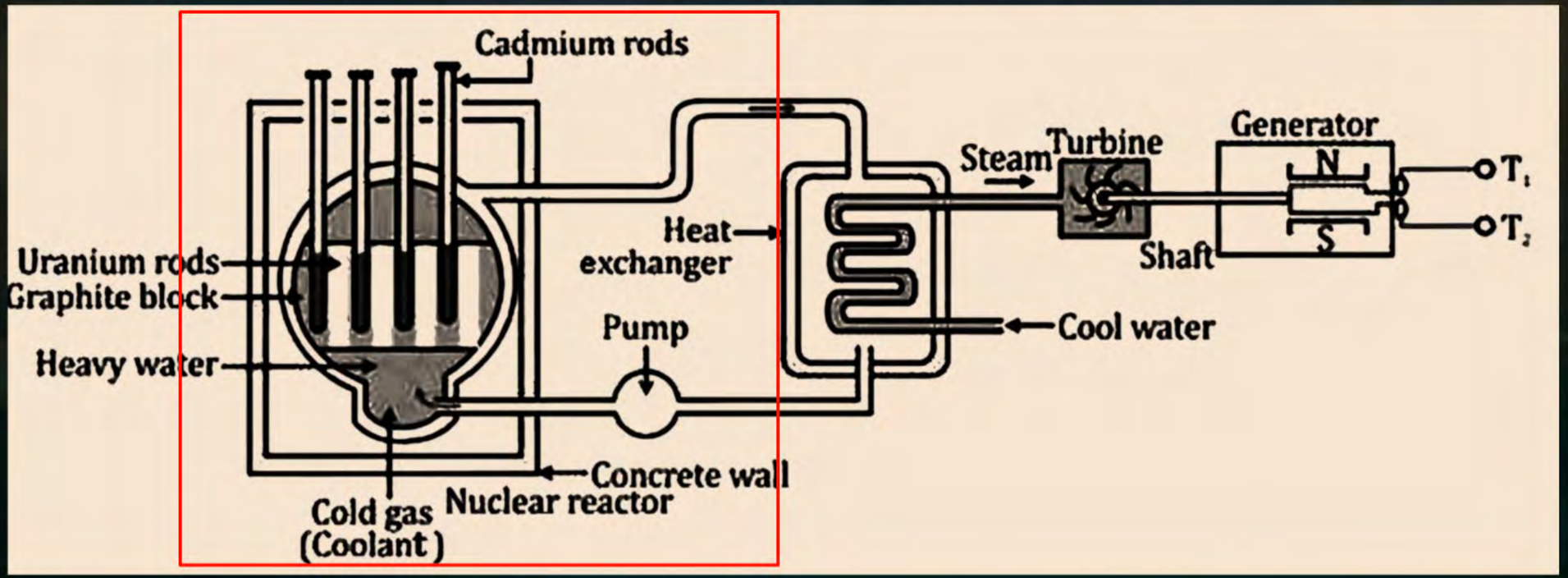
(i) The flowing water is not available every where.

(ii) Due to the construction of dams over the rivers, plants and animals of that place get destroyed or killed.

(iii) The ecological balance in the downstream areas of rivers gets disturbed.



PRODUCTION OF ELECTRICITY FROM WIND ENERGY



Advantages of Using the Nuclear Energy

(i) A very small amount of nuclear fuel (such as uranium-235) can produce a tremendous amount of energy.

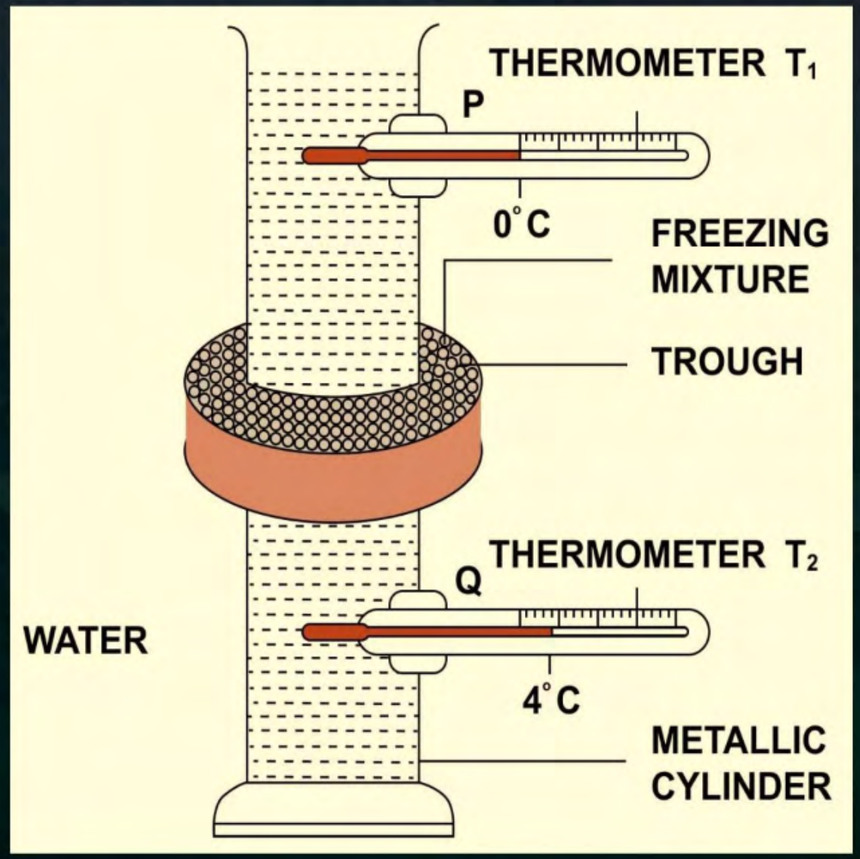
(ii) Once the nuclear fuel is loaded into a nuclear power plant, it continues to release energy over a long period.

Limitation of Use of Nuclear Energy

(i) It is not a clean source of energy because very harmful nuclear radiations are produced in the process which are highly energetic and penetrating. These radiations cause ionisation and are very harmful to the human body, so a high standard of protection is needed for the persons working in the power plant and also for the environment.

(ii) The waste obtained from the nuclear power plants causes a high degree of environmental pollution.

HOPE'S APPARATUS



HOPE'S APPARATUS

Observations:

1. Initially both thermometers T_1 and T_2 show same temperature (i.e., room temperature).
2. First the temperature recorded by lower thermometer T_2, starts decreasing and finally it becomes steady at 4°C, while the temperature recorded in upper thermometer T_1 remains almost unchanged during this time.

HOPE'S APPARATUS

Observations:

3. While the temperature recorded by lower thermometer T_2 remains constant at 4°C, the upper thermometer T_1 shows a continuous fall in temperature up to 0°C and then it also becomes steady.
4. At this stage, the lower thermometer T_2 shows the temperature 4°C at which water has the maximum density while the upper thermometer T_1 shows the temperature of water and ice at 0°C.

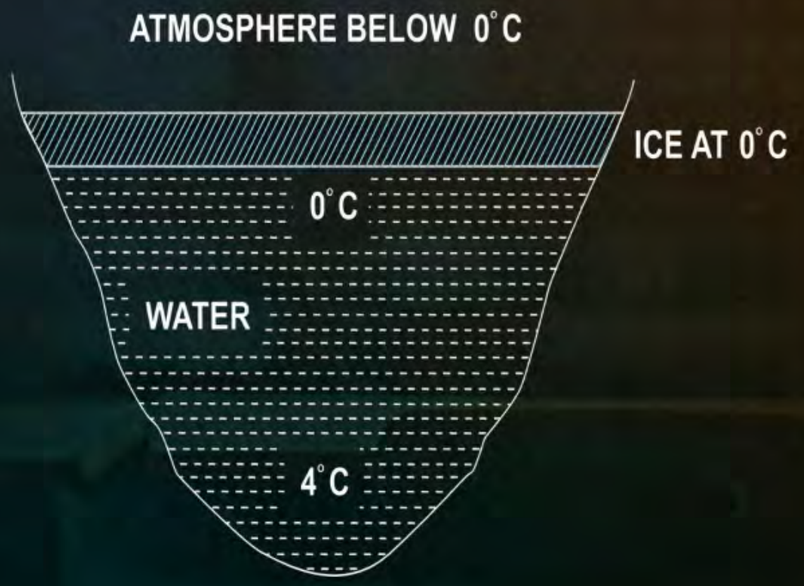
HOPE'S APPARATUS

Important consequences that follow due to this peculiar property of water (i.e., anomalous expansion of water) are:

1. It is responsible for bursting of water pipelines and destruction of crops during very cold nights.
2. It helps in preserving aquatic life during very cold weather.
3. In nature, during winter when the atmospheric temperature starts falling below 0°C, water at the surface of a pond initially at temperature above 4°C, begins to radiate heat to the atmosphere, so the temperature of water near the surface starts falling.

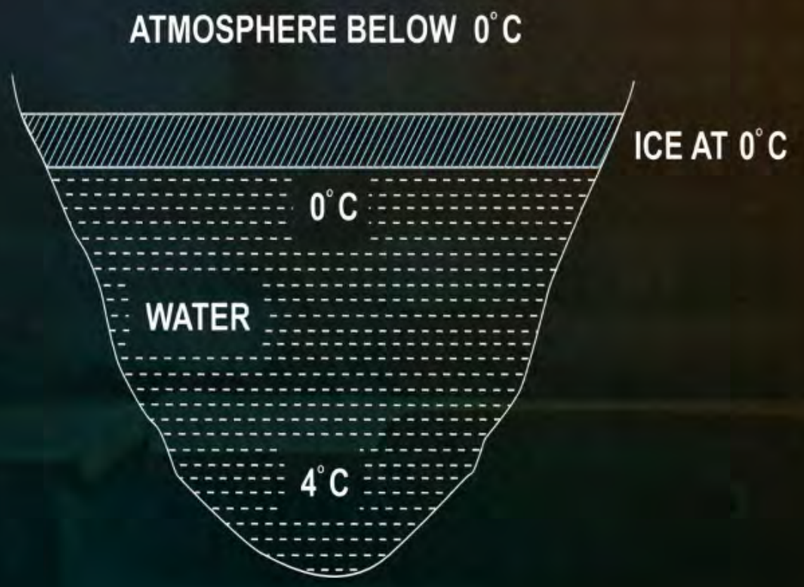
HOPE'S APPARATUS

- When temperature of water at the surface falls below 4°C, water contracts and it's density increases and therefore, it sinks to the bottom.
- This continues till temperature of entire water reaches to 4°C. Now, further cooling of top layers below 4°C results in expansion of water and so it's density decreases.
- As a result, water does not sink further, but it remains on the surface. When the temperature of atmosphere falls below 0°C, water on the surface looses further heat to the atmosphere and gradually freezes into ice, but water below the ice layer remains at 4°C.



HOPE'S APPARATUS

- The water layer just below the ice in contact with it will be at 0°C, as shown in figure. Since, ice is a poor conductor of heat, so ice now prevents the flow of heat from water of the pond to the atmosphere.
- Thus, temperature of water in contact with ice is at 0°C and that of layers below the ice gradually increases to 4°C. As a result, fish and other aquatic creatures remain alive in water of the pond (or lake), though water on the surface has frozen into ice. Nature thus protects the aquatic life during the winter season.



Question

The _____ energy of wind is called wind energy.

A potential

B chemical

C electric

D kinetic

Ans. **(D)** kinetic


Thank You