RADIANT 2026

Physics

Heat and Energy

Lecture - 05

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Topics *to be covered*

1. GREEN HOUSE EFFECT
2. GLOBAL WARMING
3. TECHNOLOGICAL, ECONOMIC and POLICY MEASURES
4. QUESTIONS



Recap *of previous lecture*

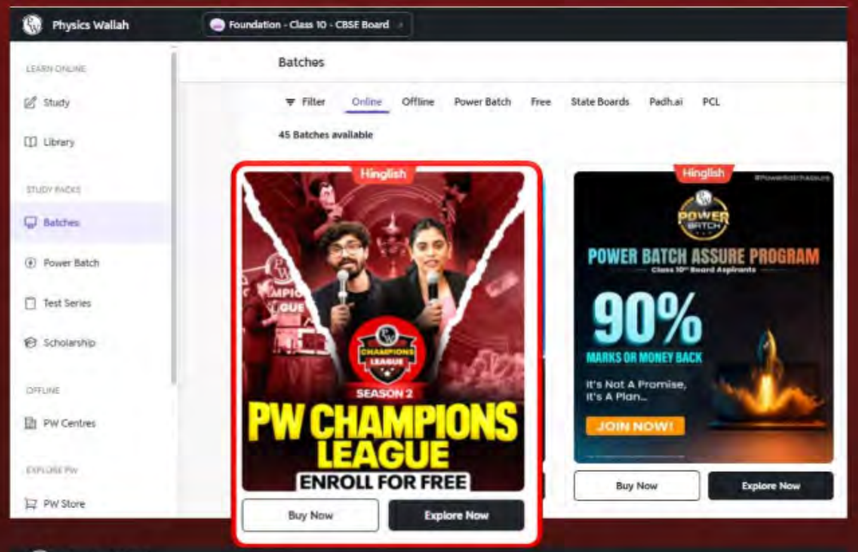
1. SOURCES OF ENERGY
2. PRODUCTION OF ELECTRICITY FROM WIND ENERGY
3. HOPE'S APPARATUS
4. Questions



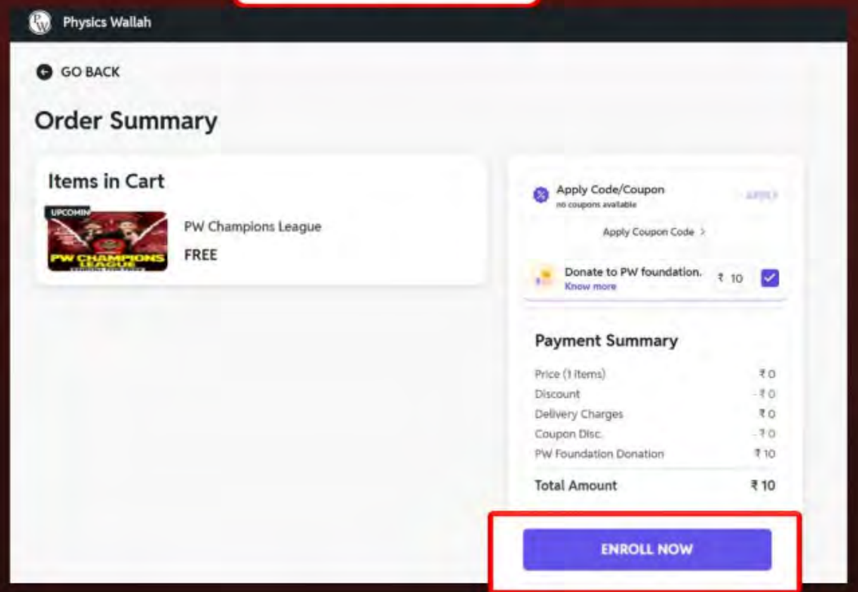

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SEASON - 02

How to enroll?

CHAMPIONS LEAGUE
SEASON-02



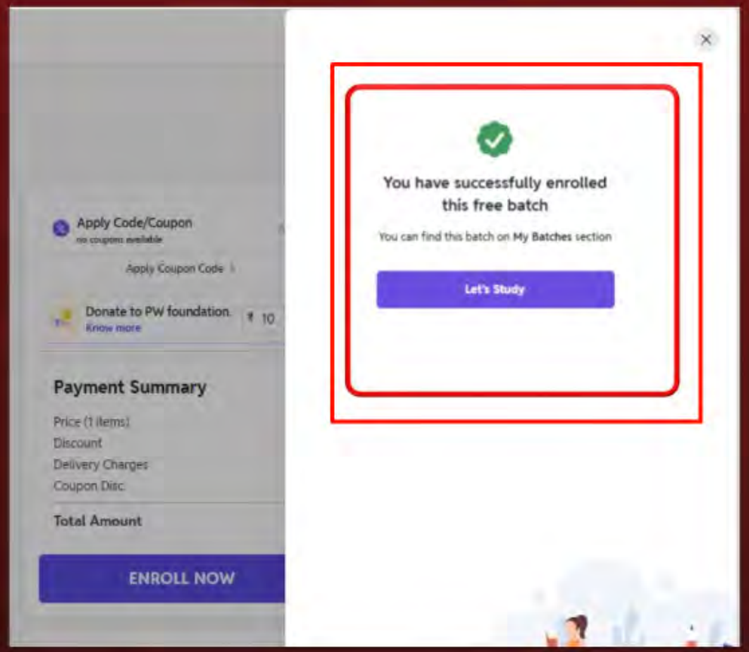
STEP 1: Under the Batches section, lookout for PW Champions League batch and click on Buy Now



STEP 2: Click on Enroll Now button!

How to enroll?

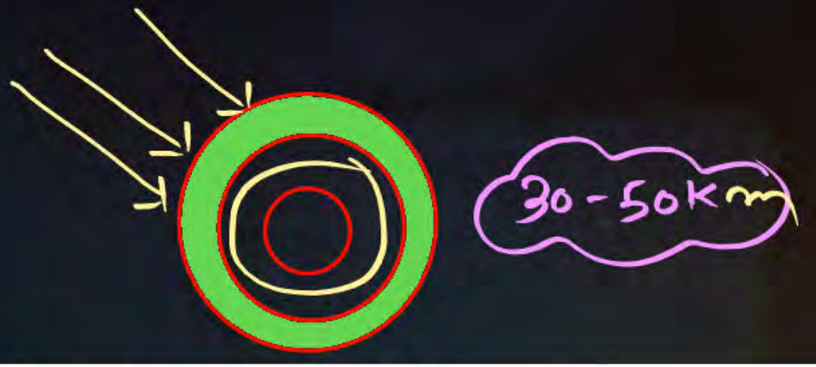
PW CHAMPIONS LEAGUE SEASON-02



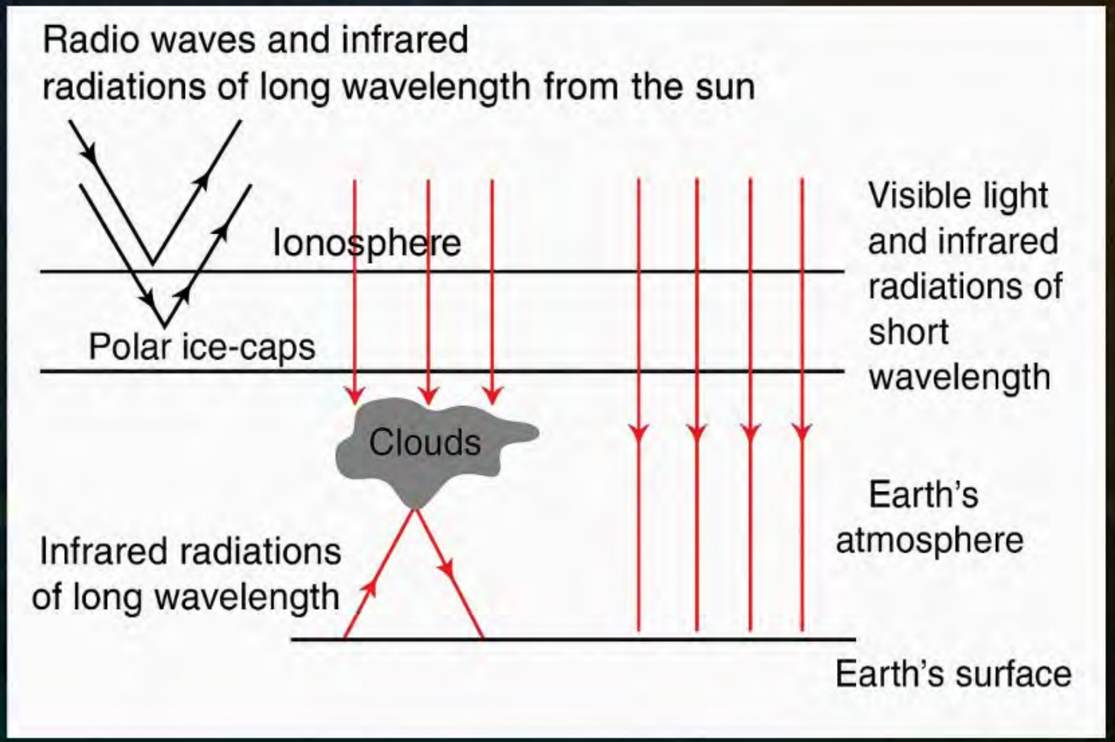
STEP 3: Congrats Champs, you've successfully enrolled into PW Champions League!

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GREEN HOUSE EFFECT



- In 1824, Joseph Fourier discovered the green house effect. It is the process of warming of planet's surface and its lower atmosphere by absorption of infrared radiations of long wavelength emitted out from the surface of planet.
- The solar radiations coming from sun have high energy radiations such as gamma rays, X-rays, ultra-violet rays and low energy radiations.



Future Projections

- In the recent decades, it has been observed that the effective temperature of earth's surface has risen by 0.74 ± 0.18°C per decade for the last 50 years since 1900.
- The rate of increase is 2.5°C per decade (nearly three times since 1970) and since 2000, it is much more. So it is expected that by the end of this century, the earth's temperature will rise up to 64°C.

Future Projections

- The reason for this is the increase in the proportion of the green house gases present in the earth's atmosphere. Due to their increase, more heat radiations radiated from the earth's surface are trapped in its atompshere.
- It is believed that the human activities are responsible for the increase in the green house gas namely the carbon dioxide in the earth's atmosphere.

Future Projections

The main human activities responsible for increase of the carbon dioxide gas are given below:

(i) The burning of fuels, deforestation, transportation and industrial production (particularly cement factories).

(ii) Increase of population (human beings emit nearly 32 giga tonnes of carbon dioxide each year).

(iii) Imbalance of carbon dioxide cycle (the ocean does not absorb full amount of carbon dioxide and the vegetables are not able to change all the carbon dioxide into oxygen).

GLOBAL WARMING

Global warming means the increase in average effective temperature near the earth's surface due to an increase in the amount of green house gases in its atmosphere.

Cause of Global Warming

The cause of global warming is the increase in concentration of green house gases present in the atmosphere of earth due to human activities. The increase in different green house gases is as follows:

(i) The concentration of carbon dioxide has increased up to 25% due to industrial growth, combustion of fossil fuels, clearing of forests etc.

(ii) The concentration of methane has doubled due to agricultural sources such as rice cultivation and animal husbandry, natural gas exploration, burning of biomass, clearing of forests and leakage in natural gas pipe lines.

(iii) The concentration of chlorofluorocarbons has increased at a rate of 5% per year.

Cause of Global Warming

Thus increase in green house gases in atmosphere enhances the green house effect and hence causes global warming.

Impacts of global warming on life on the earth:

The increase in proportion of green house gases in the atmosphere has the following impacts on the life on earth:

(1) The variable changes in the climate in different parts of the world which has created difficulties and forced the people and animals to migrate from one place to the other.

Cause of Global Warming

(2) The change in blooming different plants. season of

(3) The change in regional climate which has an immediate effect on simple organisms and plants.

(4) The change in the world's ecology.

(5) The increase in the heat stroke deaths.

Future Predictions

With the present rate of increase of green house effect and global warming, it is predicted that the average temperature of earth's surface will become 64°C by the end of the year 2100. Although it is not possible to make very accurate predictions on its impact for the future, but still looking at the changes in some natural phenomenon which we are facing now, following predictions can be made.

Future Predictions

(1) Dislocation and disappearance of plant and animal species:

At the present rate of increase of green house effect, it is expected that nearly 30% of the plant and animal species will vanish by the year 2050 and up to 70% by the end of the year 2100. This will disrupt ecosystem. The animals from the equatorial region will shift to higher latitude in search of ice and cold region. The absorption of carbon dioxide by ocean will cause acidification due to which marine species will migrate.

Future Predictions

(2) Warming of Ocean:

The temperature of ocean water will increase due to which many species in the ocean will either die or they will disappear, while various other species which prefer warm water will increase tremendously.

Future Predictions

(3) **Melting of glacier:**

Due to global warming, the frozen tundra in Siberia has started melting. Greenland has experienced 32 glacial earth quakes in one year. The Arctic snow cover is expected to be ice-free by the end of September 2037. The global average sea level has risen at a rate of 3.1 mm per year. This rate of rise is expected to increase in future. It is also expected that the amount of oxygen dissolved in ocean will decrease which will have adverse effect on the marine life.

Future Predictions

(4) Shift in farming region:

In the near future, warming of nearly 3°C will result in poor yield in farms in low latitude regions and will increase the rise of malnutrition. The crop yield is expected to increase in middle and high latitude regions. Therefore farmers will have to shift their farming region from low latitude to high latitude.

Future Predictions

(5) Increase in new diseases and heat related deaths:

Due to global warming, many new diseases will emerge because bacteria can survive better in increased temperature and they can multiply faster. It will extend the distribution of mosquitoes due to increase in humidity levels and their frequent growth in warmer atmosphere. This will result in increase of many new diseases. Apart from it, the deaths due to heat stroke will also increase.

Future Predictions

(6) Change in regional climate:

It is expected that the warming over land will increase and it will be maximum at high northern latitudes while minimum over the southern ocean. The frequency of hot extremes, heat waves and heavy precipitation will also increase.

Future Predictions

(7) Variable changes in the climate:

The variable changes in the climate will result in increase in the number of people suffering from death diseases and injuries from floods, storms and droughts.

Future Predictions

(8) Increase in cost of air conditioning:

Due to warming effect, the cost of air conditioning will increase as it will consume more electric energy.

Future Predictions

(9) Change in sea level:

Due to melting of ice, the area of sea ice around both the poles is shrinking. It is expected that in the next 50 years, the ice at both the poles will melt completely and therefore the sea level will rise.

TECHNOLOGICAL MEASURES

The economic growth and population growth, each increases consumption of fuel and hence both are responsible for the release of green house gases. We need to check them and use the following three technological measures :

(a) Use of renewable sources of energy to generate electricity in place of generating electricity from the fossil fuels based power plants,

(b) Change of transportation vehicles, and

(c) Use of bio-char stoves for cooking.

TECHNOLOGICAL MEASURES

(a) Use of renewable sources of energy for generation of electricity in place of electricity from the fossil fuel based power plants:

The fossil fuel based power plants are the main source of generation of the green house gases. = They produce nearly 21.3% of the total green house gases. Therefore alternate energy sources such as wind energy, solar energy, tidal energy, geo thermal energy, etc. must be used to generate electricity in place of fossil fuel based power plants. The fossil fuel based power plants must be banned.

TECHNOLOGICAL MEASURES

(b) Change of transportation vehicles:

Vehicles such as lorry, truck etc. that are presently in use for transportation are run by the internal combustion engine and they contribute nearly 14% of the total green house gas emission. Such vehicles must be switched to battery operated vehicles which will reduce carbon dioxide emission drastically. For charging the battery, electricity generated from renewable sources must be used. Further the vehicles must be used at their full capacity and the size of vehicles must be reduced.

TECHNOLOGICAL MEASURES

(c) Use of bio-char stoves for cooking:

In developing countries, bio-mass is mostly used for cooking which also contributes significantly in the increase of green house gases. For burning the bio-mass, new technology must be used to burn it in absence of air in a specially constructed stove known as bio-char stove. It will release the smokeless combustible gases methane and hydrogen, leaving a charcoal residue which can be buried in soil.

ECONOMIC MEASURES

The industrial growth and deforestation for population growth have caused the increase in green house effect. To check them, following two economic measures are needed:

(a) Reforestation and sustainable use of land, and

(b) Industries to pay carbon tax.

ECONOMIC MEASURES

(a) Reforestation and sustainable use of land:

In developing countries, the pressure of population and industrial growth has resulted in unsustainable agricultural practices which are responsible for 90% of deforestation. These countries must be asked to reforest and maintain forest habitats. Their loss must be verified by satellite imaging before compensating them by the international agencies.

ECONOMIC MEASURES

(b) Industries to pay carbon tax:

Since industries emit carbon dioxide to a good extent, so to check them, they must be asked to pay carbon tax. This tax can be calculated on the basis of carbon emission from the industry, number of employee hour and turn over of the industry. This will encourage the industry to use the energy efficient offices and to avoid the travelling of its employees by having tele-conferencing.

POLICY MEASURES

To check global warming, Government must take the following two policy measures:

(a) Educating children to live sustainable life style, and

(b) Controlling population through family planning, welfare reforms and the empowerment of women.

POLICY MEASURES

(a) Educating children to live sustainable life style:

We need to educate children that genuine happiness lies in a less competitive and more cooperative society. Consuming more and buying more must not be the aim of life. For a sustainable life, we must make full use of what we have. The materialistic gain gives a temporary pleasure.

POLICY MEASURES

(b) Controlling population through family planning, welfare reforms and the empowerment of women:

The world population is expected to increase from 7-1 billion in the year 2012 to 9-15 billion by the year 2050 with most of the growth taking place in the developing countries. This needs to be controlled. Population growth can be controlled through various measures such as

(i) free and easy access to family planning,

(ii) welfare provisions to encourage smaller families, and

(iii) the empowerment of women through education and freedom to choose their future career (because the educated women are more conscious about family planning due to their career commitments).

POLICY MEASURES

Recently in 'the 21st yearly 2015 United Nations Climate Change conference CUP21/ CMP11' held in Paris from November 30 to December 12, 2015 each nation has expressed a deep concern on the present rate of increase of green house gases and it is committed to limit the global warming to below 2-0°C compared to pre-industrial level by the year 2100 for which a goal of zero carbon emission is to be achieved between 2030 to 2050.


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