

## Unit - II - Air Pollution.

① Definition, sources sources.

\* ~~②~~ ~~se~~ classification of Air Pollution.

③ Ambient Air quality standards.

④ Climate change, Global warming / Pollution from combustion system.

⑤ Acid rain.

⑥ Photo chemical smog.

⑦ Green house effect.

⑧ Formation and depletion of Ozone.

⑨ Bopal Gas disaster. ~~Tr~~ Tragedy.

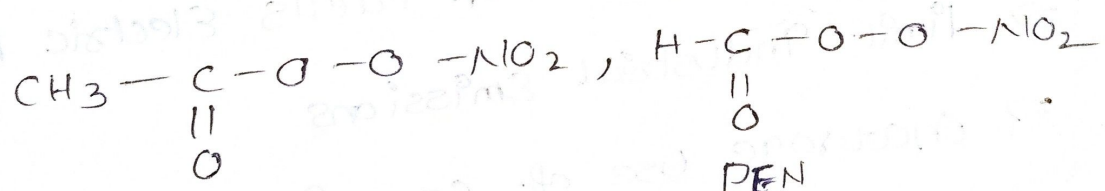
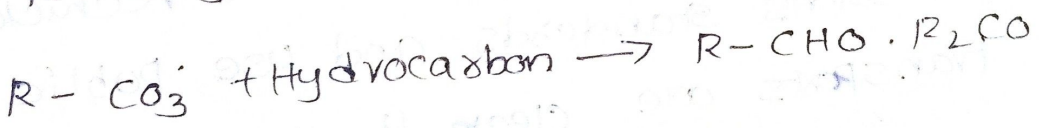
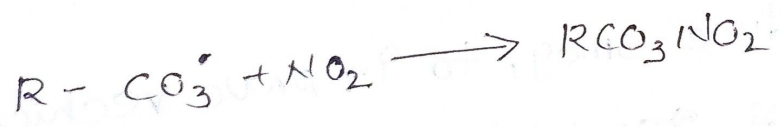
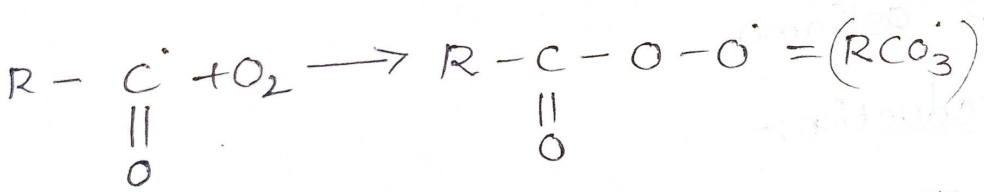
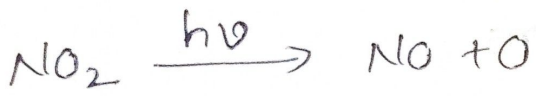
⑩ Instrumental technique to monitor Pollution / controlling methods of Air Pollution.

Short ①

### Photo chemical smog :-

Photochemical smog is a type of air pollution formed when sunlight reacts with pollutants like nitrogen oxides (NOx) and volatile organic compounds (VOCs) of vehicles and strong sunlight.

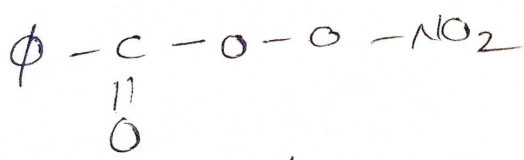
### Key reaction :-



PAN

PFN

(peroxy formyl nitrate)



PB<sub>2</sub>N

peroxy benzoic nitrate

Note:- This ground level ozone is harmful unlike the protective ozone layer in the stratosphere.

It also forms other harmful compounds like PAN (peroxy Acetate Nitrate).

Harmful effects:-

- => Eye and throat
- => breathing problems
- => damage the respiratory system
- => lung infections
- => cancers
- => asthma

Reduction:-

- => To reduce smog, to improve vehicle emissions standards and use public transports are clean fuels electric bikes
- => limit industrial emissions
- => encourage use of eco-friendly products

## ② Classification of Air Pollution.

Air Pollution means the presence of harmful substances in the air that we breathe.

These substances can harm living beings and the environment. Air pollutants <sup>may</sup> come from natural sources like volcanic ~~eruption~~, eruption, forest fires (or) Man made sources like vehicles, industries ~~and~~ <sup>are</sup> burning of ~~fuel~~ fossil fuels.

Air pollutants are ~~also~~ generally classified into 3 ~~two~~ types.

A) Based on the physical state of pollutants

i) Gaseous pollutants

These are present in gas form in the atmosphere.

Ex:- ① CO / release from vehicles ~~exgestes~~.

incomplete combustion.

② Sulphur dioxide / <sup>(H<sub>2</sub>S)</sup> from burning of coal ~~and~~ oil.

③ Nitrogen oxides (NO and NO<sub>2</sub>)

from vehicles and power plants emissions.

④ Ozone / Formed by reaction of sunlight with Nitrogen ~~oxide~~ <sup>side</sup> and Hydrogen carbons

## (ii) Particulate Pollutants

These are solids or liquid particles suspended in air. They include dust

- (1) Dust / from roads, construction
- (2) smoke / from burning wood or trash
- (3) ~~air~~ Aerosols / tiny liquid droplets (spray)
- (4) soot / from diesel engines.  
diesel

## (B) Based on the origin of pollutants

### (i) Primary Pollutants

These are directly emitted into the air.

Ex:- CO, SO<sub>2</sub>, NO, NO<sub>2</sub>, particulate matter

PM<sub>10</sub>, PM<sub>2.5</sub>

### (ii) Secondary Pollutants

These are formed in the atmosphere by the chemical reaction between Primary pollutants.

Ex:- Ozone, PAN, H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub> (Nitric acid)

formed from NO<sub>x</sub> react with water vapour.

③ Based on source of emission.

① Natural sources

Volcanic eruption (<sup>release</sup> SO<sub>2</sub>, Ash), Forest fires (release CO<sub>2</sub>, CO, PM<sub>10</sub>), Pollen, sea spray)

② Anthropogenic sources (Man made).

Industries and factories, vehicles, power plants, house hold burning of wood and waste.

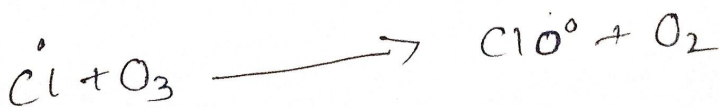
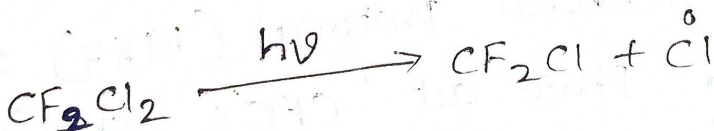
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short Ozone depletion:

The ozone layer in the stratosphere protect Earth from harmful UV rays

Ozone depletion :- ozone depletion occurs when chlorofluoro carbons (CFC) from air conditioner, refrigerator and sprays break down ozone.

Reaction:-



a single chlorine atom can destroy thousands of ozone molecules.



Nitrogen oxide coming out of the supersonic jets directly enters in the stratosphere and decomposes the ozone present there.

Ozone holes especially observed in Antarctica, increases UV exposure leading to

- i) skin cancer
- ii) eye problems
- iii) harm to plants and animals
- iv) reduce the soil fertility
- v) eggshells are ~~fragile~~ fragile

Note:-

The Montreal Protocol (1987) Sep 16<sup>th</sup> helped phase out CFC's showing Global Cooperation in solving environmental issues.

### 3) Bhopal gas tragedy.

The Bhopal gas tragedy occurred on December 3<sup>rd</sup> 1984 in Bhopal at Madhya Pradesh. A pesticide plant <sup>owned</sup> ~~built~~ by Union Carbide leaked a highly toxic gas called methyl isocyanate (MIC).

Chemical Formula:-



In the early morning Dec 3<sup>rd</sup> just outside the city of Bhopal a massive release of MIC from a storage tank of Union Carbide plant. The dense gas floated across the surroundings, landscape killing more than 15,000 people and living more than 3 lakh affected severely by the exposure.

Causes for the accident:-

- ① poor maintenance, failure the cooling agent unit.
- ② leakage of water into the tank.
- ③ failure of several safety devices.
- ④ loss of nitrogen pressure above the MIC.
- ⑤ negligence.

MIC is a volatile liquid extremely hygroscopic. It is stored in moisture free refrigerator tank.

## Adverse effects:-

- ① It causes burning sensation in ~~the~~ <sup>Eyes</sup>
- ② expels oxygen out lungs causing death due to ~~shocking~~ <sup>choking</sup> <sub>long term</sub>
- ③ Thousands of suffered + health issues (lung damage, blindness, birth defects)

Note:- It is considered the world's worst industrial disaster. So, that tragedy leads to stricter environmental laws in India and the formation of the Environmental Protection Act- (1986). It remains a powerful lesson in the importance of industrial safety and environmental responsibility.