

20-2-18

2nd - In Sem.

Natural Resources

- Soil is the ^{physical} component of physical land.
- Water, energy resources, land, mineral resources, forests
- We are concerned about its degradation and conservation so it is necessary to study about it.
- ENERGY



Conventional or

Non-renewable Energy

e.g. fossil fuel,
nuclear, hydropower

energy

Non-Conventional

Renewable Energy

Solar, wind, biomass,
ocean, geothermal

Consumption Pattern

33% petrol + diesel

27% coal

5% nuclear fuels

Renewable Energy Resources

- : Unlimited supply
- : fits into sustainable development concept
- : Decentralised energy production
- : Clean



Solar Energy

- 2000 kWh/m² per year for about 200 - 300 days in a year. Daily: 5-7 kWh/m²
- Solar energy is diffuse energy. (opp of diffuse) → Major limitation
- 10 times more expensive than thermal power because η of conversion of light to electricity is 18% only.
- What is diffused energy.
- S.E. available for 45 minutes is more than enough for a day.
- Photovoltaic cell (PV).
 - : p-type + n-type
 - : close contact
 - : solar rays fall on top layer of p-type, the e⁻ from valence band jump to conduction band and cross p-n junction into n-type
 - : ΔV is created b/w 2 layers which causes flow of electricity.

Solar heat collectors are also used:

Widely used conventional energy- coal & petrol

Wind Energy: contains stored energy from the sun through the process of photosynthesis.

- Wind velocity : 6.5 m/s : suitable for installation of wind mills
- Standard wind mills : ~~50~~ 55 kW per day

Ocean and Tidal Energy

Mechanical to Electrical

1 m height tide \rightarrow 90 kW. On ocean shore : 25 - 70 kW

- Constructing tidal barrage to harness tidal energy

Geo-Thermal Energy

- T of earth \uparrow at a rate of $20-75^\circ\text{C}$ per km when we move down the earth
- Energy harnessed from high temp present inside the earth : geothermal energy.

Biomass Energy

- contributes $> 14\%$ of global energy supply.
- Main component used : Methane.

Wood: biggest source of biomass energy

Non-Renewable: (Rate of consumption $>$ Rate of regeneration)

Wood:

Rate of regeneration

Most conventional.

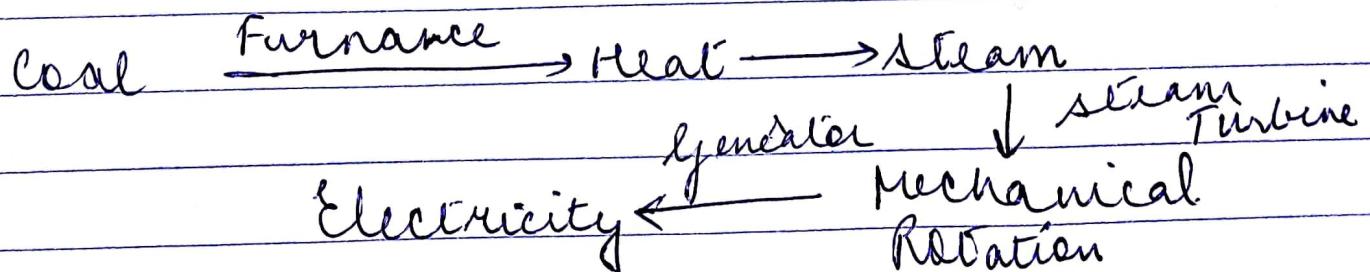
Characteristics:

Problems:

Large Machinery - Expensive, flora & fauna is local people migration disturbed.

Coal

- 7×10^{12} metric tons = 5×10^{22} calo.
- Anthracite carbon content = 90%.
- Bituminous, Lignite, Peat: 80%, 70%, 60%.
- India: 5% world coal. Not good coz of poor heat capacity.
- Combustion emits SO_2 , CO , CO_2 . SO_2 forms H_2SO_4 in air and causes acid rain.
- Excavation of coal followed by soil subsidence / depression endangers residential areas.
- Fly ashes: small problem.
- High grade ash-free coal is produced as SRC (solvent-refined coal). Pulverised coal suspended in solvent. Product is semi-solid, 170°C having high calorific value of 16,000 BTU per pound.



BTU: Energy required to raise temp of 1 pound of material by 1°F .

Petrol

S, O, N.

- Crude oil = Hydrocarbons + small amt's S, O, N.
- Hydrocarbons are separated by fractionating the crude oil.
- Fractional Distillation : uses diff in Boiling Point [Learn the order]

40°C -

110°C -

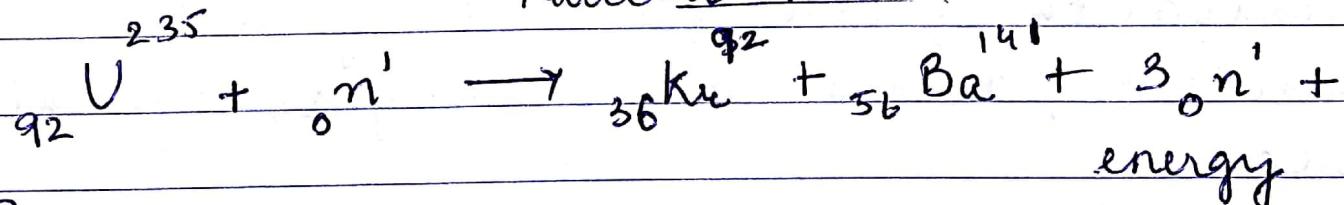
180°C -

260°C -

340°C -

Nuclear Energy

Nuclear Fission



- Clean Energy but releases radioactive fission products

High speed neutrons bombard on heavy nucleus. leads to nuclear fission.

Half-life: Time taken for the initial energy becomes half.

Land Resources

- provides food, fibre, wood, medicine
- soil is mixture of organic + inorganic materials. (dead plant matter) (rocks & minerals)
- Top soil is classified as renewable resources
↳ Quite fertile

Land degradation : Process of degradation of soil or loss of fertility of the soil.

Causes of Land degradation :

- Population
- Urbanisation
- Soil erosion
- Fertilizers & Pesticides
- Water logging
- Damage of top soil

Water logging : saturation ; all soil pores are filled with H₂O.

Causes of erosion :

- | | |
|---|--|
| <u>Water</u> | <u>Wind</u> |
| <ul style="list-style-type: none"> - splash erosion - sheet erosion - Rill erosion - Gully erosion - Stream bank erosion | <ul style="list-style-type: none"> - Saltation - Suspension - Surface creep |

erosion → where soil materials are loose & are developed by sedimentation

Control Of soil erosion:

- No till-farming / Conservation till farming
- Contour farming (across the slope or along the slope ??)
- Fall Terracing

Alluvial soil near & in Gandhinagar.

- Alley cropping or Agroforestry
- Wind breaks or shelter belts

Water Resources

Groundwater storage : Max freshwater storage which is directly available

Water shed management:

- People's participation - & greater public involvement and ensures sustainability of interventions planned.
- Tasks such as modelling, monitoring & reporting under watershed framework - saves money, time.
- Managing land and water - Resources become a focal point in order to understand factors that contribute the problem.
- Watershed approach - appropriate to solve various resources problems for planning, implementation and management.

- Principles of Watershed Management
- B) Watershed Complications
- Conserve Water

* Forest Resources

- It is a CO_2 sink. Very critical; to reserve ^{ing}
- So Carbon sequestration happens on large scale.
- R Helps in condensation of atmospheric moisture.

Q. Define Forest (by UN): More than 10%

of the area is covered by woods.

Boreal forest (33%)

Forest & Woodland Temperate moist (11%)

/ \ subtropical forest (9%)

Tropical moist forest (42%)

Tropical dry forest (5%)

Q. What is boreal forest? usually in tundra & temperate region. Russia, Canada, etc cold regions

Carbon stock in Indian Forests

In forest ecosystem, enormous C is stored in 5 pools (3 groups & 5 levels)

Living portion of biomass C → ^{Above ground}_{Below} (AGB) (BGB)

Dead Organic Matter → Dead wood (③)
Litter (④)

5th Pool is soil organic matter (SOM). (⑤)

Define biodiversity? Variations and differences in species.

- Forest Right Act by govt.

How do deforestation and degradation release C? } part
what drives deforestation?

- Methane, H_2S , CO_2 : Biogas constituent
- P-type to p-n junction
into n-type ① ② ③ ④
- ~~Street~~ Bill session a), a), c), c),
⑤ a), ⑥ True ⑦ False ⑧ False ⑨ True
⑩ True

soot particles

Air Resources

% / Volume $\times 10$

Major
1

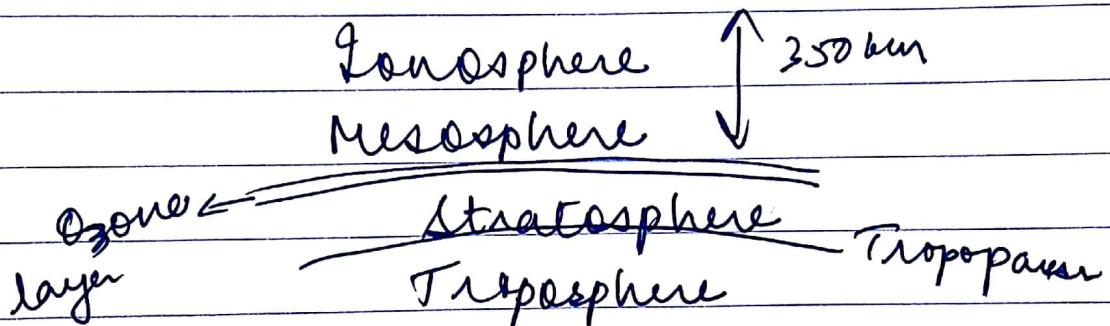
N 78.09
O 20.94
W.Vapour 0.1

Minor
Components

{ Argon 0.9
CO₂ 0.032

Trace
Components

{ Neon 0.0018
Helium 0.0005
CH₄ 0.0002



Temp ~~Profile~~ (*) Vs Altitude in km
showing Negative lapse & negative lapse

Stratosphere : very strategic for us
due to presence of Ozone layer.
what is Ozone hole?

Mesosphere: coolest (-2 to -92°)
Thermosphere: (-92 to 1200°C) 85-500

What is pollution? Definition (Prayoj)

SO_2 - irritate our eyes & lungs
fine particulates penetrate ^{into and} lungs
airborne metals enter our blood stream

CO_2 is not a pollutant

CO_2 , CH_4 , CO , Non-methane hydrocarbons, NO_x , SO_x , SPM

SO_2 , Nitrogen oxides, CO , ozone, lead & particulate matter : 6 major pollutants conventional / criteria / primary.

know the source

Many pollutants come from a point source such as a smokestack. Fugitive / non point source : do not go through a smokestack.

Primary : harmful when reacted.

Sec : harmful after they react with other substances / gases eg. photochemical oxidants

at the end of monsoon. It cools sea temps
③ 'Asian brown cloud' drifts over Indian Ocean

② Produced by forest fires, burning of agricultural wastes, Asian smog layer cuts the amt of solar energy reaching the earth's surface beneath up to 15%, could disrupt monsoon weather patterns and cut rainfall over central Asia, northern Pakistan, Afghanistan, western China up to 40%.

CO
NO_x
HC
SO_x

Particulates

Primary
790% contribution
to global air
pollution

~~Soot~~ Source
Transportation

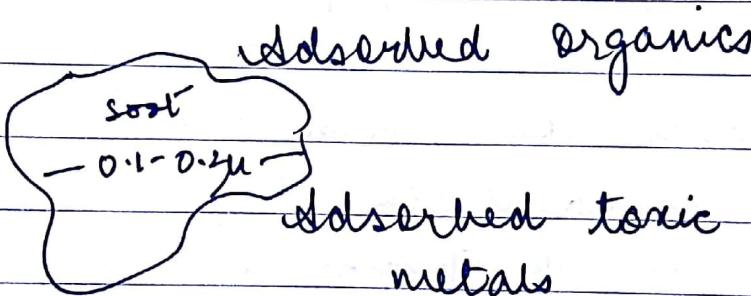
Pollutant

CO

} Max.

A) Particulate

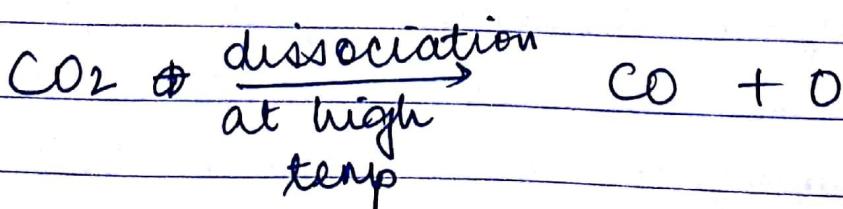
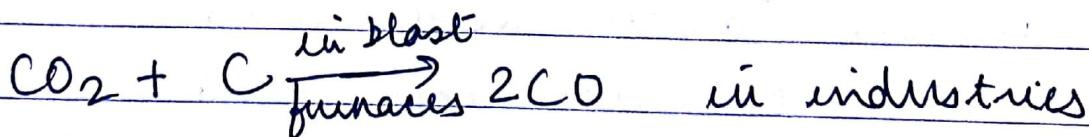
- 0.0002 to 500 μ natural sources
- discharge 800- 2000 million tons & man-made source 200- 500 "
- small solid particles & liquid droplets



B) CO

Diesel & petroleum engines, ~~gas~~ gas
is responsible for 70% of emissions

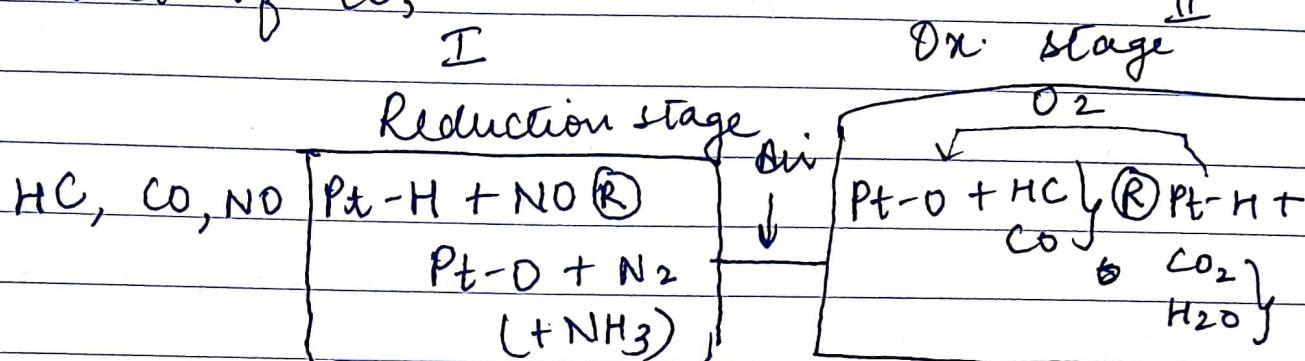
Incomplete comb. of fuel / C compounds



Sinks

- Part of CO is lost in upper atm.
- soil micro-organisms : major sink
(28 g can remove 120 ppm CO from air in 3 hrs).

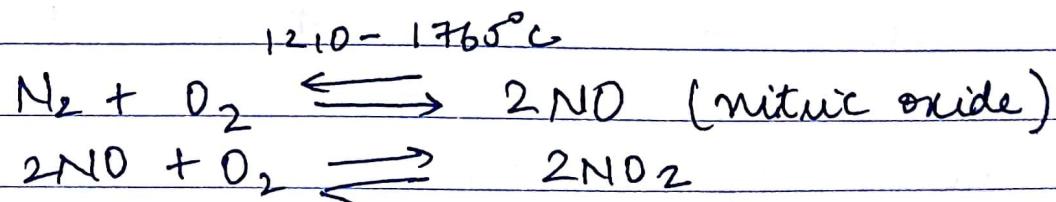
Control of CO,



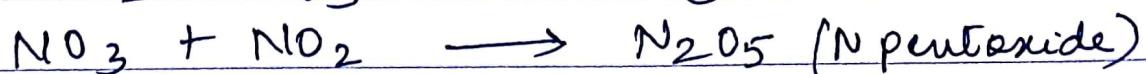
Pt-H : Platinum hydrogen compound
 Pt-O : " Oxygen "

Use of catalytic converters

c) NO_x



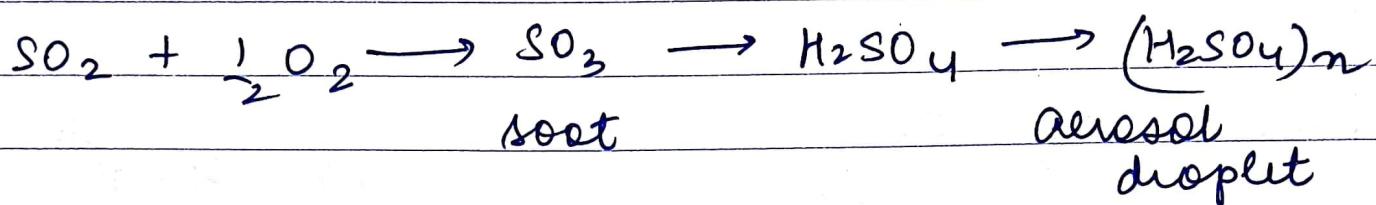
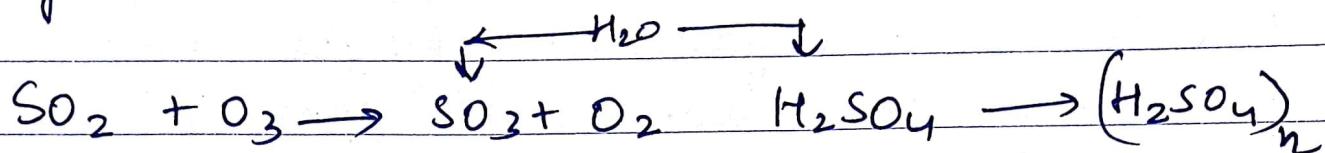
Exhaust consists of NO_x which is converted to HNO₃ known as acid rain (nitroxide)



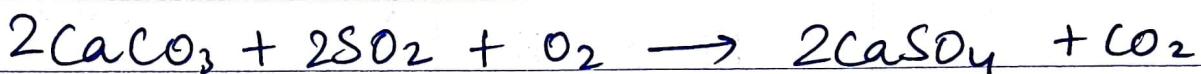
Mix of NO and NO₂ gives Nitrogen oxides

E) SO₂ : lignite when burnt produces SO

Soot particles containing metal oxides, catalyse the oxidation



Control of SO_x Pollution

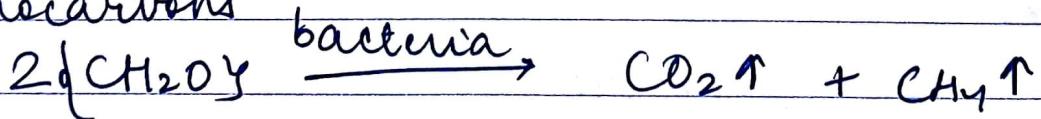


Chemical scrubbing ↴

Soot Particles

: originate from fuel combustion & consist of highly

automobiles are significant sources of hydrocarbons

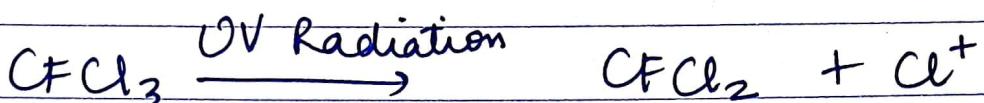
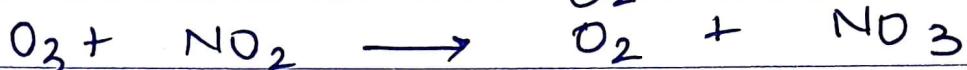


CH₄ raises temp. of atm.

Residence time of CO₂ is high.

ENV

from jet aircrafts



→ CFC slowly passes from tropos & stratos
and then stays for > 100 yrs.

→ 1 molecule of ~~CFC~~ CFC consume 1 lac molecules
of ozone.

→ Ozone layer thickness was reduced by 30%
over Antarctica.

→ Kyoto Treaty : for reducing GHG

"Dilution is the solution to pollution"

Pt-Palladium & rhodium catalysts
used in car to remove 90% of NO_x,
hydrocarbons and CO.

Trading pollution credits is one approach.

→ market based "cap and trade" system.
Pollution hotspots

→ Marble Cancer : Taj Mahal

Water Resources

Water Pollution: Point source / Non-Point Source
Pollutants

Organic ? Drainage
Inorganic
Sediments

Radioactive materials.

Thermal pollutants
✓ coz:

Higher temp lowers O₂ in water.
↓ is a pollutant.

Downstream relationship of BOD & O₂ sag
1. Groundwater Pollution
Vermi Composting

Climate Change is not a local phenomena.

2. Ocean heating is known as
 Most successful
 endangered species
1. CITES : maintains a list of threatened &
2. Montreal Protocol : Protects stratospheric ozone
3. Basel Convention
4. UN framework convention on Climate
 Change
5. COP21 : Committee of Nations (Partners)
 21st such convention : 2015

Buy carbon credits

Bill: written proposal to legislature

Environmental Laws

Law: Generic in nature

1. Indian Forest Law
2. Atomic Energy Act
3. Wildlife Protection Act
4. Water Act
5. Forest Conservation Act
6. Environment Act

Act: More specific of law. Not general.

It is statutory. Have to abide by that.

Cultivating before 2005 can take ownership

7. Ozone depleting Substances Rules 2000

8. Biological Diversity Act 2002

9. Disaster Management Act 2005

10. CRZ Notification 2011 (Coastal Regulation Zone)

Drugs - developed from diverse plants
(Morphine)

80% of food depends on diverse species.

Brings strength against some disease

G: imp of native species

11. National Renewable Energy Act 2015

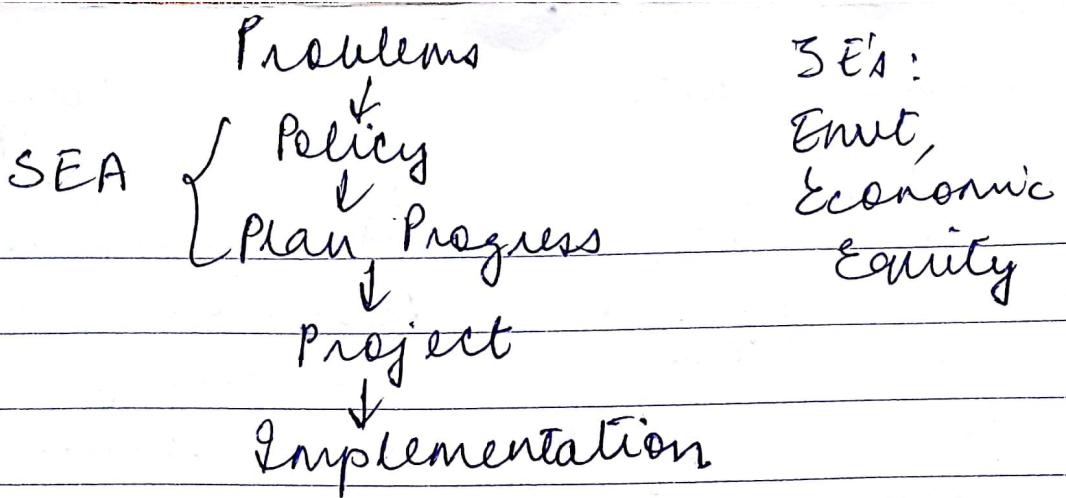
12. Solid waste Management Rules, 2016

* intervention at project level.

Environment Impact Assessment (EIA)

Strategic Env't Assessment (SEA)

G' ensure at policy level: see compatibility
of diff projects.



Environmental categories for field projects

Category A, B, C. (FAO)

Overview of EIA process

Steps in EIA process

Project Screening

" Scoping

Development Action

EIA cycle:

Climate Change

explainingclimatechange.ca/Climate Change/