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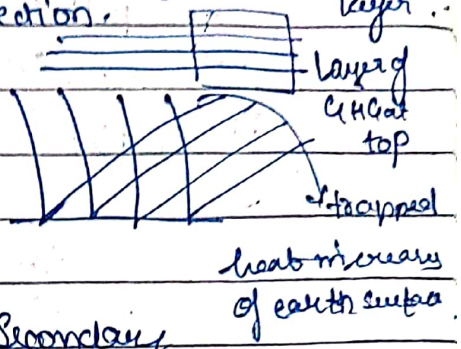
# Open Elective

**Green house effect** → GHG (Green House Gases)
→ $CO_2$ (60%) → Breaks the Ozone layer.
→ $CH_4$ (methane) (20%)

**Ozone layer** → UV rays → layer protection.




**Primary pollutant and Secondary pollutant**

Primary pollutant → naturally occurring

Secondary pollutant → + reaction with other pollutants

$\begin{pmatrix} SO_2 \\ SO_3 \end{pmatrix} + H_2O \rightarrow H_2SO_4 \,|\, H_2SO_3$

$\begin{pmatrix} SO_2 \\ SO_3 \end{pmatrix}$ → primary pollutant

$H_2SO_4 \,|\, H_2SO_3$ → Secondary pollutant

primary: C, H, O, N

$N + O_2 \rightarrow \cancel{NO_2}\ NO_2 \,/\, NO_3$ ($NO_x$)

N → primary

$NO_2 / NO_3$ → Secondary

Dynamic relationship with N and O, it can be $NO_2$ or $NO_3$ so we use $NO_x$

**Sources**

**Natural**
- $NO_2$ more here

**Anthropogenic (Man made)**
- Industries
- $SO_2$ more here

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## Two different types of fuel

NOx is harmful but it takes time to effect

Gaseous pollutants
(i) CO (Carbon monoxide)
(ii) Sulpher

$$\% HbCO = 0.005\, C^{0.65} (\alpha t)^{0.63}$$

(alpha)

Carbonyl haemoglobin

C = Conc$^n$ of CO (ppm)
t = time of exposure (min)
$\alpha$ = physical Activity level
: 1 (sedentary)
: 3 (normal)
: 3 (heavy work)

Ques: Make a rough Estimate of the saturation value of HbCO in the blood if CO breathe is 100ppm. Use the following eqn

Saturation $\dfrac{HbCO}{HbO_2} = m \dfrac{P_{CO}}{P_{O_2}}$

Soln

m = consH. (200-250) for human blood
$P_{CO}$ = 100 ppm
$O_2$ = 21% in normal air
1% = $10^4$ ppm
21% = $21 \times 10^4$ ppm
$P_{O_2} = 21 \times 10^4$ ppm

Saturation = $\dfrac{HbCO}{Hb} = \dfrac{200 \times 100}{2 \times 10^4} = 0.095 = 9.5\%$

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Lowest pt of South Pacific Ocean → Mariana Trench

Biosphere → The thin part b/w Earth's lowest pt to ~20K m above it where life exists is called Biosphere.

→ components of Biosphere → Ecosystem

- Biotic (Living)
- Abiotic (Non living)
  - Edaphic (Soil, nutrients, minerals, pH)
  - Climate (Sunlight, wind)

⟹ The ~~Continuous~~ Science of ~~Study~~ of living System with Non living System is called ecology

Imbalance b/w living and Non living components is called Pollution.

(PLV) = (BP + NP) (PREY)

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## Population Growth

USA → New World

$$[PGJ] = [(BR+IR) - (DR+ER)]$$

BR → Birth Rate, IR → Immigration Rate, DR → Death Rate, ER → Emmigration Rate

| Region | BR | DR | |
|---|---|---|---|
| World | 19 | 9 | 11 |
| Developed World | 11 | 10 | 1 |
| Developing | 25 | 9 | 16 |
| Africa | 38 | 14 | 24 |
| N. America | 14 | 9 | Eq |
| Europe | 10 | 11 | −1 |
| Asia | 22 | 8 | 14 |
| S. America | 24 | 6 | 18 |
| Oceania | 18 | 7 | 11 |

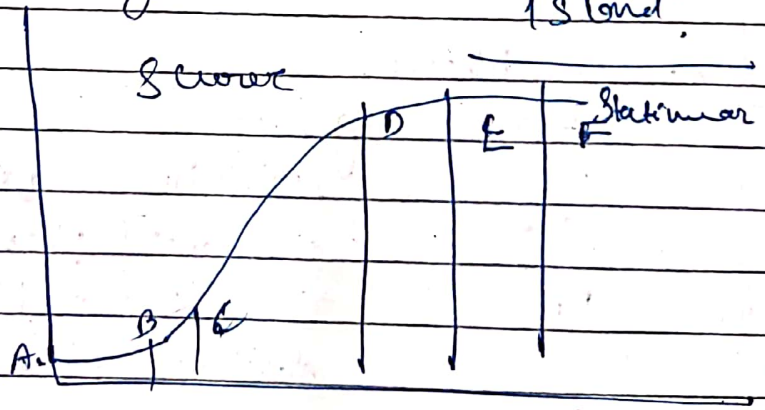
Shantinel &

SE → Social Segregated Shompen

ST → Physical → Tribe in Andaman Nicobar Island. Endangered.

Population growth

Growth




16.9.1. → India

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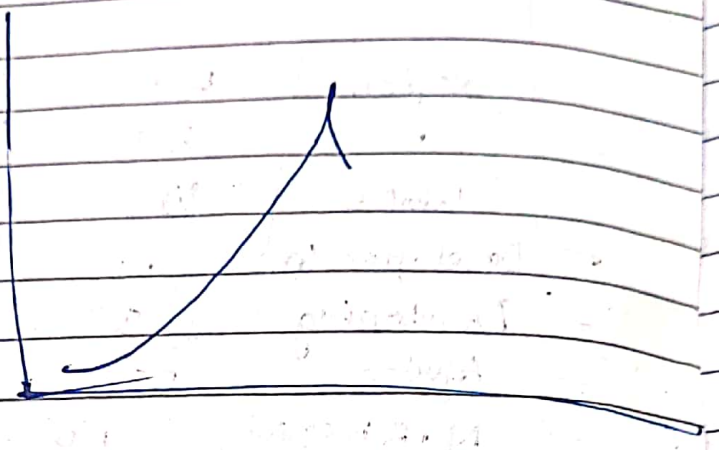
Population density in India
395 persons / per $km^2$ in 1999
415 persons / $Km^2$ in 2015



Reasons of population growth
(a) Early puberty
(b) Early marriages
(c) Social pressure for desire of male child
(d) Resistance in adoption of family planning messures
(e) Polygamy (Multiple wives)
(f) Improved health care
(g) Diff b/w BR and DR

Tubectomy (female)
Vasectomy (The most surgical operation)
MTP (Medical Termination of Pregnancy Abortion)

Sigmoid phases →
AB - lag phase
BC - positive accelerative phase
CD - exponential phase
DE - -ve acc. phase
EF - Stationary phase

AB $\frac{dP}{dt}$ q P

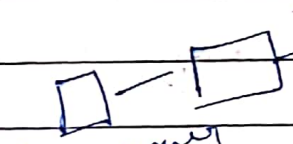
BC $\frac{dP}{dt}$ ~~constant~~ P

CD. $\frac{dP}{dt}$ = constt.

DE $\frac{dP}{dt}$ q (Ps - P) (Saturation population

21/09/22 OE

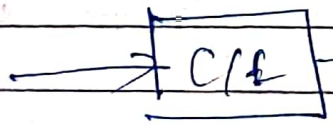
Airpollution – Control method & equipment




PM 10 } Bag filter
PM = 2.5 } ESP

x + y ⇌ A + (B) - SO2

x + z ⇌ (A) + C




Efficiency = $\frac{I - O}{I}$ x 100%

Gravitational settling chamber :-

used to remove particles with size greater than 50 μm

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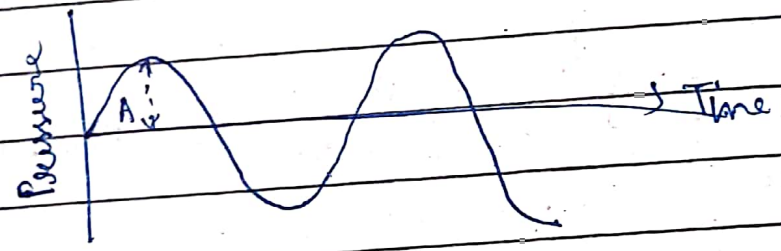
Function of inclination at bottom in cyclone seperator.

22/09/22

## Noise Pollution

Sound - Sound is physical pheromenan that stimulate the sense of hearing
- Sound is a Manifestation of vibration, travels in wave patterns through solids liquids and gases.
- Sound waves of equal amplitude with increasing frequency from top to bottom




Basic Terminology -

Frequency - is the no of cycles repeated in unit time relation.
- Its unit is cycles/sec or Hz

Intensity - Amount of Sound energy ~~its~~ generated in one cycle is called intensity.

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## Difference b/w Sound and Noise

| Sound | Noise |
|---|---|
| 1. Pleasant to hear | 1. Unpleasant to hear. |
| 2. Constant to pitch | 2. Constantly ranging pitch |
| 3. Regular periodic motion. | 3. Not so regular and periodic |
| 4. Produces meaningful communication. | 4. doesn't Produce meaningful communication |
| 5. Unit : Hz | 5. Unit - decibels (dB) |

## Level of noise

$$L = \log_{10}\left(\frac{\mathcal{I}}{\mathcal{I}_0}\right) \rightarrow \text{bels}$$

$$L = 10 \log_{10}\left(\frac{\mathcal{I}}{\mathcal{I}_0}\right) - \text{decibels}$$

**Noise Pollution** - Any unwanted sound that pollutes the environment.
- Any noise irritating ears comes in noise pollution

## Sources of noise

→ Machineries → Industries → Radio, TV
→ Vehicles → Loud Speakers AC, Appliances
→ Construction → Airplanes → Indoor sources.

## Noise Control Measures

Indian standard code - Max^m. dB

Industrial
Day time = 75 decibels
Night time = 70 dB

Commoical
Day - 65 dB
Night - 55 dB

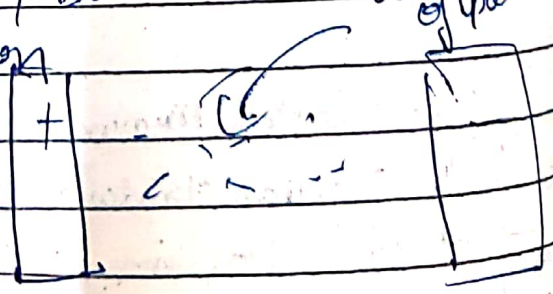
Residential
Day time - 55 dB
Night time - 45 dB

Effects of Noise Pollution -
→ Annoyance
→ Loss of hearing
→ Health effects
→ Interference in communication
→ Workingefficiency reduces

23/09/22

Cyclone → formula → Operating problems

(Imp) ESP (Electrostatic Precipitator)
Operating prins depends on charge of particles
(Adv / Disadv) → higher efficiency
→ diagram
→ Efficiency (formula)
→ Design Parameter
→ Adv / Disadv
→ Application



Fabric filter → cloth is used for filteration
→ widely used / cheaper
→ filter bag
→ Operating problems.
→ Materials used for bag filters.

Climate Change → IPCC
Inter Govt. Panel on Climate Change
— Chairman - RK Pachauri

Reasons → Anthropogenic
→ Monsoon
Phenomenon — El Nino
La Nino

Initiatives to Control Climate Change

→ UNEP Conf 1972 Stockholm (Sweden)
→ Rio Earth Summit - 1992 (Brazil)
(Rio De Janeiro)
— UNFCC - 1995
(United Nations framework on climate Change)
→ 1993 - 95 - 97
↓ ↓
COP1 COP3
COP1 → Berlin
COP2 — Geneva (Switz)
COP3 — Kyoto (Japan)
COP4 → ..

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COP
COP$_8$ → Delhi
Milan
COP$_{25}$ → Scotland (Glasgow)

Important COP

COP$_3$ → Kyoto → When all nations meeting decided that, in the year 2010 the total GHG emission should be 50% of 1992

Emission trading → traded emission of USA ~~wanted to emit~~ GHG gases in proportion to poor countries population with money.

→ administrative approach to cap and trade

NAPCC → National action plan on Climate Change

→

SDG
Sustainable
Dev. Goal

Vision
1
2 mission 5
1 2 objectives 3

lasgow)

ons meeting
the total
99 - 1992

ssion of
$CO_2$ & $CH_4$ gases
ries population

to cop

tion plan
change

NAPCC

→ 8 goals / mission

→ Mission for Solar
→ Mission for enhanced energy eff.
→ mission on sustainable habitat
→ " " agriculture
→ Water mission
→ Mission for green India
→ Strategic Knowledge mission
→ mission for sustaining the himalaya - an ecosystem

Midsem Syllabus

Unit 1 and Unit 3

Biosphere (Prof VC)

Ecology → Science of interaction living

Unit 3 Water pollution

Source + classification

Physical Pollutants

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Physical
- Colour
- Smell
- taste
- P/H
- temp
- Odour

Chemicals
- Alkanity
- Acidity
- hardness
- organics

Minerals
- Metallic
- Non metallic

Conc$^n$ of pollutant
- Conservative (Const)
- Non Conservative (Non Const)

Blue Baby disease

Hyde → raw skin of animal

tannery → factories

factory → to process end raw hyde to product

→ Cr is used in tannery

Sources
- Fluoride
- Chromium
- Nitrate

~~Itai~~

~~Minamata~~

Minamata incident

→ ~~Detection~~ of Death of more fishes

Deficiencies

~~Investigation~~

Nitrate

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# Unit 1

## Human Impact

→ loss of Biodiversity
→ Pollution
→ Climate change
→ Misuse of Natural Resources
→ Acid Rain
→ Global Warming
→ Erosion

## Consequences of Over population

→ Pressure on food, Clothing & Housing
→ Unemployment
→ Standard of living
→ Decrease of forest area
→ Environmental pollution
→ Education
→ Energy Crisis
→ Hygienic Condition
→ Eco degradation

## Environmental Issues

(1) Climate change
(2) Global warming
(3) Ozone layer depletion
(4) Pollution
(5) Solid Waste Management
(6) Deforestation
(7) Overpopulation

02/11/22

# UNIT-4 — EIA

EIA → Environmental Impact Assessment (EIA) refers to the evaluation of the environmental impacts likely to raise from a major project significantly affecting the environment.

Arts Science

(Change from baseline situation caused by an activity. → Condⁿ in absence of activity)

## Types of Impacts

| Ecological | Physio-chemical | Impact on Human Interest |
|---|---|---|
| Eutrophication | Erosion silation | Loss of agricultural lands, generation of employment opportunities, navigation and boat comm. |
| Fisheries | drainage / water logging | Commercial and service facilities. |
| Forest | Congestion | |
| Plantation | | |

History → NEPA (National Env. Policy Act 1969)

→ for considering possible impacts prior to a decision being taken on whether or not a proposal should be given approval to proceed.

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**Environmental Audits** (Proof)

**Audit** → Process of verifying whatever you are claiming.

→ Acc to USEPA (United State Env. Protection Agency) EA is a systematic documented periodic and objective review by a regulated entity of facility operations and practices related to meeting env. requirements.

Components of Audit → Assessment
→ Verification

**Water Pollution** (first type of Pollution which was realised)

→ Water Poll
→ Air Pol
→ Solid

Water Pollution
- Surface WP
- GWP

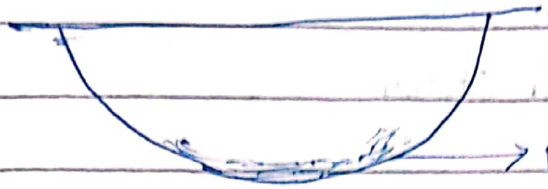
Solid Waste & Waste
- Happy CP's
- PD's

WP Characteristics
- Physical
- Chemical
  - Conservative
  - nutrients → N, P
  - Organic → BOD, COD
- Biological

**Eutrophication** → Natural ageing process of Lakes where there is excess of Nitrogen and Phosphorus in Lakes.

## Stages of Eutrophication

(Pure Lake) → Oligotrophic



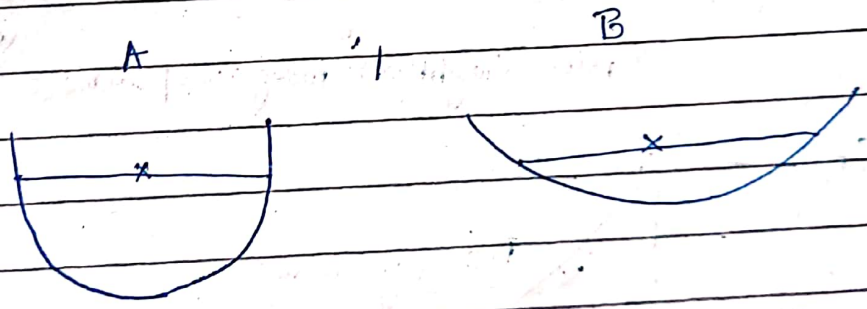
→ Mesotrophic (When nutrients are disposed in early phases)

Water hyacinth

Eutrophic (After 500 years, of disposal of waste Algae and other nutrient effect)

Marshy → (No sunlight)

BOD → Biochemical Oxygen Demand
COD → Chemical Oxygen Demand
DO → Dissolved Oxygen




If both of them are some river then B should be preffered ⇒

Cuz Dissolved oxygen is a function of velocity, surface area

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## Self purification capacity of Stream

→ Due to high speed of the streams continously flowing, the water itself gets purified

→ high DO

→ high Velocity

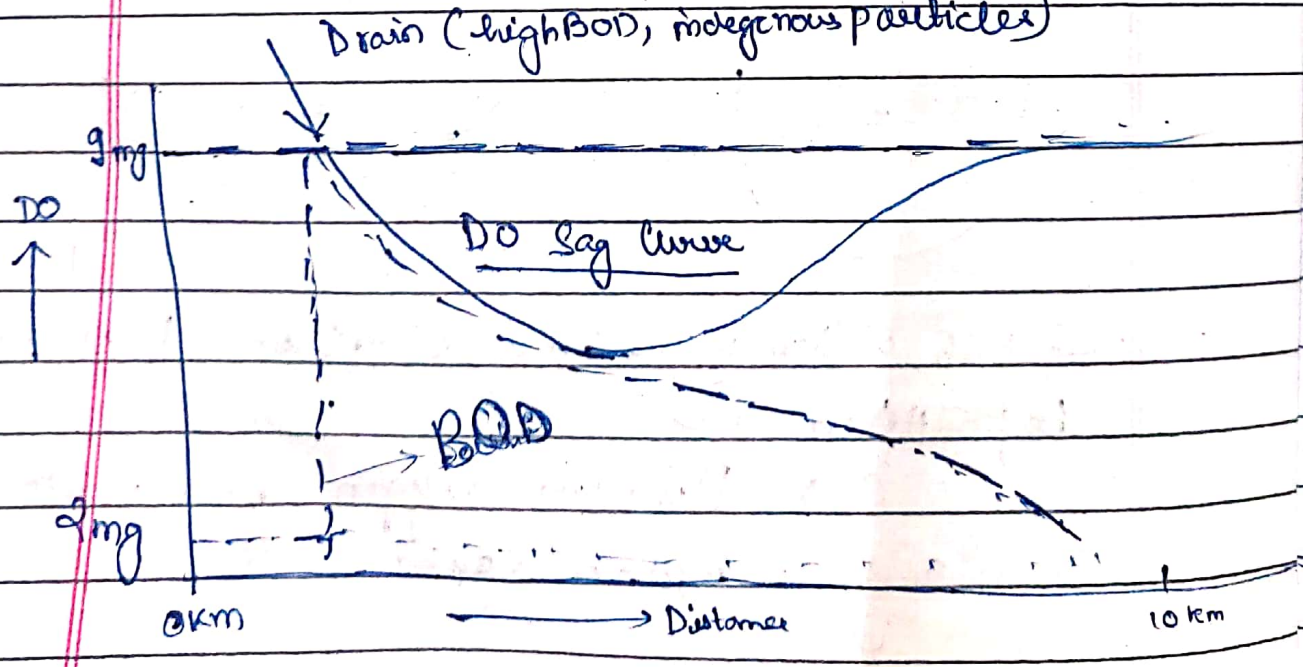
**BOD** - The amount of Oxygen required to oxidise the Organic ~~and Organic~~ matter present in waster water

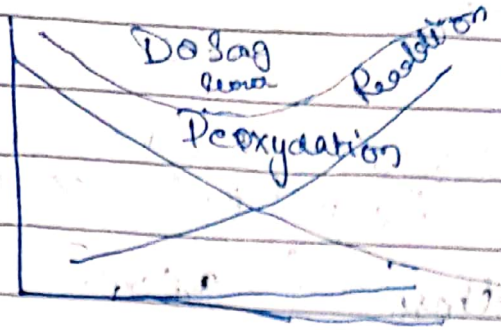
**COD** — ~~COD~~

organic + inorganic matter

**DO** - Total amount of Oxygen available

## #Imp. Longitudinal Profile of Dissolved Oxygen [For U.P]






The rate change of DO is directly proportional

$$\int \frac{dL}{dt} \propto \int_t$$

$$L = L_0 e^{-kt}$$

Assignment

Q1 What is the standard for National ambient air quality standard in India?

Q2 What is the CPCB guidelines for disposal of treated sewage in India?

CPCB (Central Pollution Control Board)
↓
SPCB (Under Minstry of Env. forest

→ CPCB classified water Bodies based on DBU
Water Bodies (DBU - Designated Best Use)

DO — Signifies cleanliness of water
BOD — Higher the BOD higher contamination
(Amount of organisms dissolved)
↳ Amount of oxygen required to oxidise organisms in the waste water.

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MPN / 100ml Sample

Surface

Classification of Water Bodies based on Designed Best Use Criteria

| SNo | DBU | Class | Criteria |
|---|---|---|---|
| 1 | DW source w/o conventional treatment | A | DO ≥ 6 BOD ≤ 2 PH 6.5 to 8 MPN/100ml ≤ 50 |
| 2 | Organised Outdoor | B | DO ≥ 5 BOD ≤ 3 MPN/100ml Sample ≤ 500 PH 6.5-8 |
| 3 | Drinking water source with conv. treatment | C | DO ≥ 4 BOD ≤ 3 MPN ≤ 5000 PH 6-9 |
| 4 | Wildlife prop. and | D | PH 6.5 to 8.5 DO ≥ 4 Free ammonia ≤ 0.2 BOD ≤ 2 |
| 5 | Irrigation Industry and controlled disposal of waste | E | PH - 6 to 8.5 EC 2250 micro moles/cm SAR ≤ 2.5 Boron ≤ 2 |

EC — Electrical conduction

SAR — Sodium Absorption ratio

DE

On the basis of Designated best use criteria (PCV) is classified into 5 categories,

1) Drinking water source without conventional water treatment

2) DO, 3) BOD

DO is an indicator of better health of river system

Higher DO higher purity level of water

Higher BOD lower or we can say that impure water

BOD → amount of oxygen required to oxidize the organic matter present in pure water.

4) pH

5) MPN (most probable no.) / sample 100 mL

Table: Classification of surface water bodies based on DBU criteria

| DBU | Class | Criteria |
|---|---|---|
| DW without conventional treatment | A | DO ≥ 6, BOD ≤ 2, MPN/100mL ≤ 50<br>pH → 6.5-8.5 |
| Organised outdoor bathing | B | DO ≥ 5, BOD ≤ 3, MPN/100mL ≤ 5<br>pH → 6.5 - 8.5 |
| DW with conventional treatment | C | DO ≥ 4, BOD ≤ 3, MPN/100mL ≤ 5<br>pH → 6 - 9 |
| wildlife propagation | D | DO ≥ 4, BOD ≤ 2<br>free ammonia (as N ≤ 0.2)<br>pH → 6.5-8.5 |
| Irrigation, | E | pH → 6-8.5<br>Electrical conductivity (EC) → 2250 μmho/cm<br>SAR ≤ 25 (Sodium absorption ratio)<br>Boron ≤ 2 |

OE

self purification capacity of streams

waste water treatment →

Physical separation of suspended solid; followed by removal of discolved/colloidal matter using indegenous microbes

↓

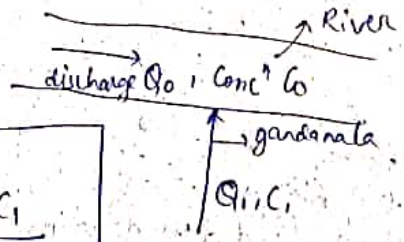
your own

Natural processes

1) Physical forces ← Dilution and dispersion
Sedimentation
Sunlight (photosynthesis $O_2 \uparrow\uparrow$)

2) Chemical process aide by biological forces
* Oxidation * Reduction.

Law of dilution ↓




$$Q_0 C_0 + Q_1 C_1 = Q_2 C_2$$

$$C_2 = \frac{Q_0 C_0 + Q_1 C_1}{Q_2}$$

Inland drainage → Those rivers which do not meet up a sea.

Diffusion

Property of pollutants (solute) when there is conc. gradient it is diffusion

Dispersion

Property of medium (solvent)

At is contained of velocity

Sedimentation, to take place velocity tends to zero.

velocity of Yamuna at Delhi = 0.2 km/sec

Benthos (oxygen required by these ) is called benthic oxygen demand)

Reaeration

2) Organised outdoor ~~ghat barrier~~ bathing.

3) Drinking water source with conventional treatment

4) Wildlife propagation and fisheries

5) Irrigation, industries purpose, control disposal of wastewater