

Water Notes

Water is Polar Molecule why ????

Water chemical structure is Oxygen atom bonded to two hydrogen atoms by covalent bond , bond electrons strongly attracted to Oxygen so Oxygen have slightly negative charge and hydrogen have slightly positive charge ,these difference in charges called **polarity**

Hydrogen Bond in water formed between hydrogen atom from water molecule and oxygen atom from another water molecule , responsible for many properties of water

Water is only substance on earth exist in three phases solid (ice) , liquid , Gas(vapor or steam)

Hydrological cycle (water cycle)

Water recycle system on Earth starts with vaporization of water by solar radiation and become steam which rises in atmosphere then cooled and condensed and precipitated on earth as surface water or penetrates ground moving down incisions forming aquifers . part of surface water and underground water leads to sea

Evaporation : increase in temperature of water increase its movement and become faster and break its hydrogen bond

Condensation : when water vapor molecules slow down they join together forming liquid

Water is universal solvent why ??

Water can dissolve more things than any other substance

Properties of water as solvent : interact with polar molecules and repelled by nonpolar molecules , small size of molecules allow it to saturate areas , can convey other substance in solution

Dissolving salts by water:

Salt consists of oppositely charged ions attracted together , when placed in water these ions attracted to weakly charged water molecules , so salt dissociate and dissolve

Water pollution :

- Water pollution : Any physical or chemical change in water that adversely affects the health of humans and other organisms.
- Water quality: It is important to utilize a good quality and unpolluted water. The quality criteria may vary depending on the use.

Water Quality parameters :

Physical properties : color , odor, temperature , solids ,turbidity , oil content , grease content

Chemical properties : PH – Conductivity – Nitrate – Orthophosphate – Pesticides – Dissolved Oxygen (DO)

Chemical Oxygen Demand (COD) – Biological Oxygen Demand (BOD)

Biological properties :

Coliforms : نوع من البكتيريا موجود بالجهاز الهضمي

Pathogens : عامل حيوي مسبب للمرض

Viruses : الفيروسات

1-PH : measure of hydrogen ion concentration in water, indicates acidity or alkalinity of water if PH=7 neutral ,PH<7 acidic , PH>7 alkaline

Fresh water PH 6.5-8.5

If PH <4 indicate dissolved toxic metal ions , sour taste

If PH >11 indicate deprotonated species , soapy taste

If PH = 4-6 indicate toxic dissolved metals as lead

2- **Conductivity**: ability of water to conduct electrical current ,indirect measure of ion concentration

High conductivity indicate more ions such as carbonate , bicarbonate , Na ,K ,Ca,Mg

Conductivity unit is microsiemens per centimeter and quality range of water (0-70)

3- **Turbidity** : measure of clarity or light scattering properties of water or amount of solids suspended in water , increasing suspended solids called cloudiness or muddiness

Turbidity unit is nephelometric turbidity units (NTU)

4- **colour** : measure of light absorbed by water and measured by comparing with standard solutions or by instruments measure colour directly , colour is very PH dependant

5- **Temperature** : affect chemical properties of water as dissolved oxygen DO, raising temperature decrease DO level

6- **phosphorus** : indicate pollution from agriculture or domestic sewage , common concentration is 0.2 mg\l and measured colorimetrically

Types of pollution:

Point source : single large source located at specific places and easy to identify , monitor and regulate

Example : industrial plants ,sewage pipes , oil tanker

Non point source : broad diffuse areas , difficult to identify and control ,expensive to clean up

Example : acid rain by industrial emission , automobiles ,fertilizers

Water treatment : removing contaminates harmful to human , make water look ,taste ,smell bad

Two types of water treatment process :

Chemical : include oxidation – coagulation –disinfection

Physical : include flocculation – sedimentation-filtration-adsorption – disinfection using UV

Solides in water are 3 types :

1-**Suspended particles** : either fine or coarse easily removed by settlement or filtration

2- **Dissolved solids** : removed by reverse osmosis , cannot be removed by physical method

Reverse osmosis : forcing water to pass through membrane to remove many contaminates

3- **colloids** : difficult to remove classified to hydrophilic (water loving) and hydrophobic (water hating)

Coagulation and flocculation-sedimentation

Removing of solids from water by collecting small particles to produce particles with size that can be removed by settlement or filtration

Coagulation occurs quickly but flocculation take long time to form larger particles from small particles formed by coagulation

Coagulant : chemicals used to make particles coagulate such as aluminum sulfate , ferric sulfate, ferric chloride , some chemical help coagulant as activated silica , clay polymer