SUBJECT: Composition and properties of underground water

Plan:

1. Chemical composition of underground water formation

2. Physical properties of groundwater 3. Chemical composition of groundwater 4. Chemical properties of groundwater

List of main literature: 1.G.U. Yusupov., B.M. Holbaev " Basics of Geology and Hydrogeology" Tashkent-2003 2. GU Yusupov, BM Holbaev "Basics of Geology and Hydrogeology" Tashkent-2005.

List of additional literature: 1.G.U. Yusupov., S.E. Nurzhanov "Geology, hydrogeology and geomorphology" Tashkent-2007

Groundwater is divided into the following types according to its appearance and **chemical composition** during the development of the earth's crust:

1. Waters formed by the influence of the air layer 2. Caldic waters 3.

Magmatic waters 4.

Metamorphic waters. For us,

the first type of water is very

- important. Water formed under the influence of the air layer (atmosphere) originates ***from the pores*** *and* ***cracks*** of atmospheric precipitation , as well as from the seepage of river, ash and other surface waters, the entry of water vapor into the rock and its subsequent blackening.

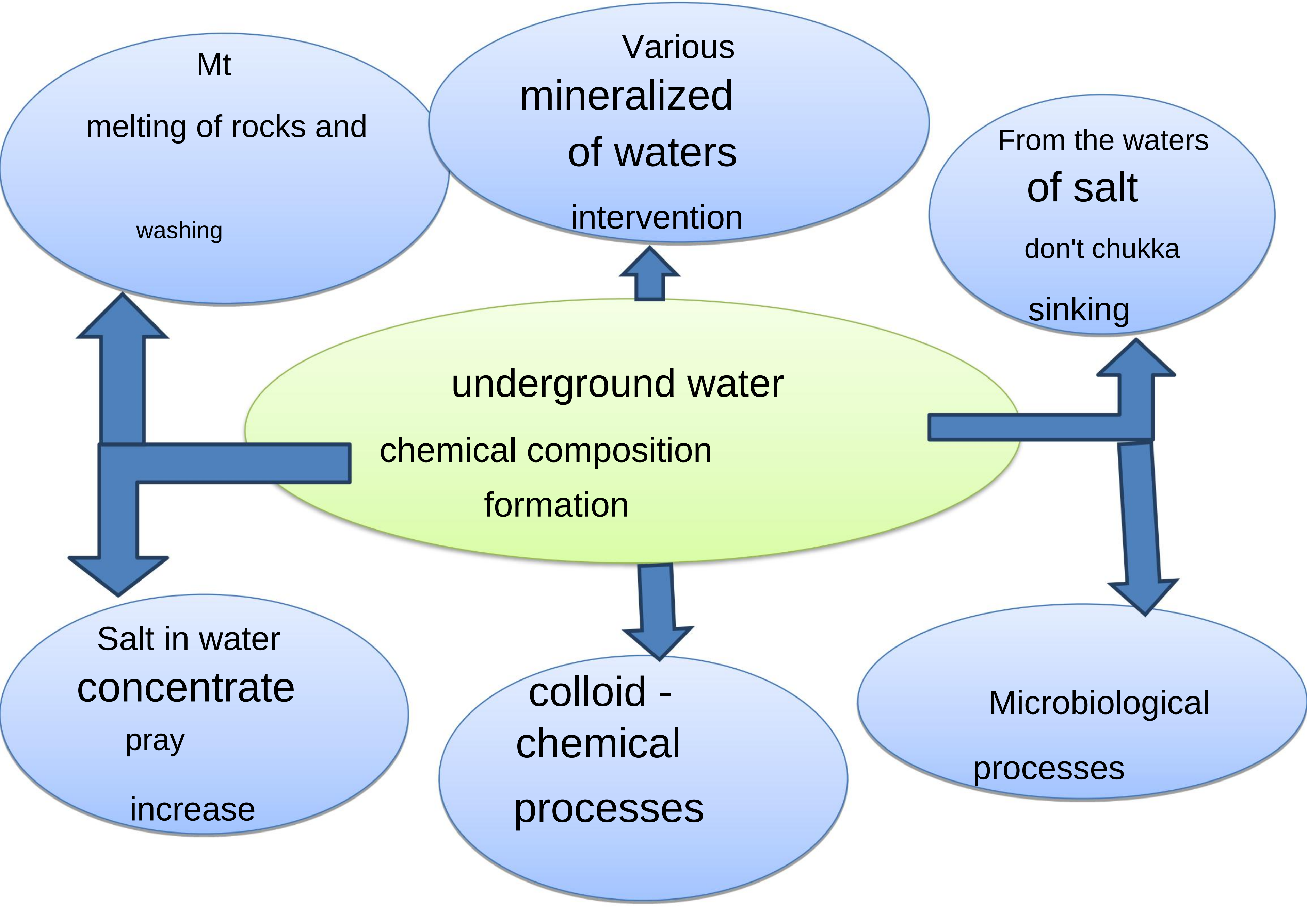
- Usually atmospheric precipitation contains dissolved salts and they has a certain chemical composition. **HCO3 - , SO4 Ca2+ , Mg2+ , and Na+** ions are **2-, CL-,** abundant ***in atmospheric precipitation .*** The

- chemical composition of the underground water formed due to the influence of the air layer is formed in the process of seepage of the precipitation water from the aeration zone, in the process of movement of underground water in the rock layers, and as a result of other complex processes.

Processes in **the chemical composition of** groundwater

the following are important **in its formation :** ***1. Melting and washing of rocks; 2. Mixing of different mineralized waters; 3. Sinking of salt from the waters into the chukma; 4. Increase in salt concentration in water; 5. Colloid - chemical processes; 6. Microbiological processes. Melting and washing.*** As a result of these processes, the minerals contained in the rock are dissolved under the influence of underground water. First of all, easily soluble salts **are NaCl,** then **Na_2SO_4 , $MgSO_4$, $CaSO_4$, Na_2CO_3 ,** and sulfur, carbonate salts and magnesium. In the development of this process, the lithological composition of the rocks and the amount and type of salts in the composition are of great importance.

Water mixing is a widespread process in nature. A large amount of underground water is involved in this process. The mixing of water with different chemical composition is observed in the interaction ***of caldic waters with infiltration waters ,*** in the precipitation of water from large depressions through tectonic cracks to the waters close to the surface of the earth, in the feeding of non-pressure waters with pressurized waters in the foothills, and in other cases. As a result, new composition waters with different chemical composition, type and properties are formed. As a result of the mixing of underground waters of different composition, carbonates, calcium, magnesium, iron, and gypsum silicas are deposited in large quantities.

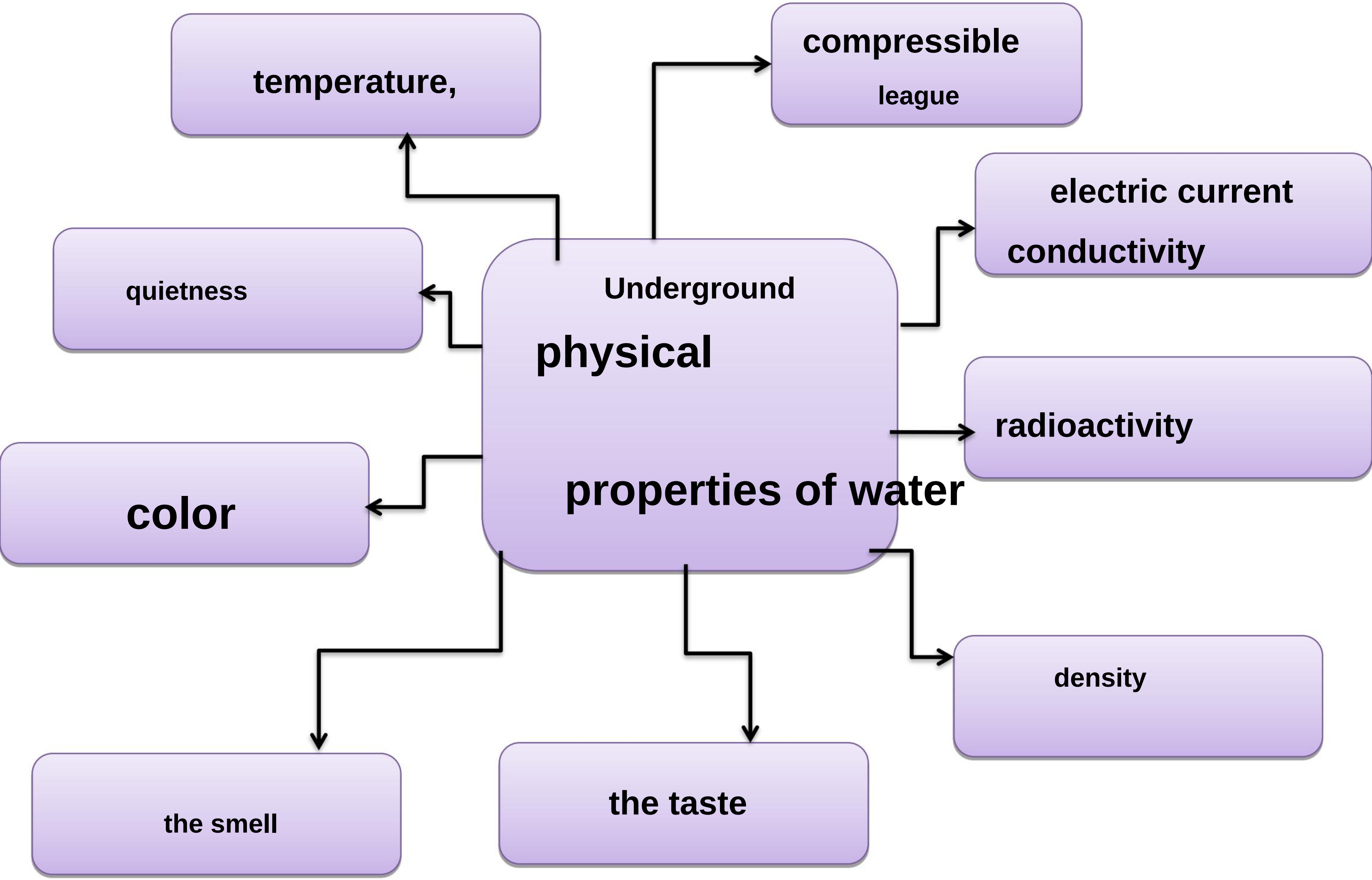

Mt
melting of rocks and
washing
Various
mineralized
of waters
intervention
From the waters
of salt
don't chukka
sinking
underground water
chemical composition
formation
Salt in water
concentrate
pray
increase
colloid -
chemical
processes
Microbiological
processes

Physical properties of groundwater

The physical properties of groundwater include its temperature, clarity, color, odor, taste, density, compressibility, viscosity, electrical conductivity, and radioactivity . *The*

temperature of underground water varies greatly and depends on the geological structure of the land, the physical geographical conditions and the mode of nutrition. The temperature of the underground water in the regions where many-year glaciers are dispersed is -50oC, in the latitudes where the underground water is located close to the surface of the earth it can be +5+15oC, and in the regions with developed volcanic activity it can be +100oC and more

The temperature of water used for drinking purposes should be 7-11oC, and the temperature of water used for medicine should be 35-37oC. Temperature has a great influence on the course of physico-chemical processes in the earth's crust and the chemical composition of underground water . For example, as the temperature rises, the solubility of salts increases or the solubility of gases decreases.


temperature,
compressible
league
electric current
conductivity
quietness
Underground
physical
properties of water
radioactivity
color
density
the smell
the taste

The clarity of underground water depends on **the amount of mineral substances dissolved in the water, its mechanical compounds, organic matter and colloids.**

According to the degree of clarity, underground waters are divided into four categories: 1) clear waters; 2) muddy waters; 3) turbid waters; 4)

very turbid waters. Most of the groundwater is still water. Clarity of drinking water should not exceed 1.5 mg/l.

Dependence on the color, chemical composition and various compounds **of groundwater .** Groundwater is usually colorless. Hard waters are bluish, iron oxide and sulfur give a greenish-purple color to water, organic compounds give yellow to water, and mineral particles give gray to water. *Groundwater is mostly odorless,* but

under certain conditions it can have an odor. If there is organic sulfur in the water, then the water will smell like eggs, and the pond water will smell like mud. The smell of water is mainly due to bacteria that break down organic matter

it was determined that

Drinking water should be odorless. According to the requirements of DAVST 2874-82 (Uz DAV St 950:2000), the smell of water should not exceed 2 points when heated to 200ÿ and 600ÿ . Dissolved compounds, gases and foreign impurities give the water

taste. If calcium and magnesium bicarbonate, carbonic acid are present in water, *it will have a watery taste.* If water contains organic compounds, it tastes sweeter, if it contains sodium chloride, it tastes sour, if it contains magnesium and sodium sulfates, it tastes bitter.

The density of water shows the ratio of its mass to its volume at a given temperature. The unit of water density is the density of distilled water at a temperature of 40C . The density of water

depends on its temperature, the amount of salts and gases dissolved in it, and mechanical compounds. The density of underground water varies from 1 to 1.4 g/cm3.

The change in volume of water under the influence of pressure **is called its compressibility.** The compressibility of water depends on the amount of gases dissolved in it, temperature and chemical composition.

Viscosity represents the internal resistance to the movement of the liquid particles. The viscosity of

groundwater depends on its temperature and the amount of dissolved salts in its composition. As the temperature rises, the stickiness decreases, and with an increase in mineralization, the stickiness increases.

Groundwater conducts electricity because it is an electrolyte solution. Electrical conductivity is directly proportional to the amount of dissolved salts in water, distilled water does not conduct electricity. ***Radioactivity.*** This property is

determined by the presence of uranium, radium and radon (gaseous emanation of radium) in groundwater.

Chemical composition of underground

water *The composition of underground water consists of macro and micro components and radioactive elements.* Apart from these, organic substances and microorganisms are dissolved in natural water

there are gases, as well as colloids and technical mixtures.

Macrocomponents (main components) include elements and complex compounds found in large quantities in groundwater, which form the basis of water composition and determine its chemical type and main properties.

The main mass of water is hydrogen and oxygen. Cl- CO2- Ca2+ , Mg2+

determines the chemical type and main properties of water . ,

SO_4^{2-}, HCO3 -, , Na+,

Macrocomponents are the main mineral part of natural waters, i.e. more than 90-95% in fresh waters, 99% in highly mineralized waters. Fresh and brackish waters contain HCO3 - , CO3

$^{2-}$, Cl- and Na+ ions are

abundant in Ca2+ saline and nomopic waters , while SO4 2- and Mg2+ ions are widely distributed in moderately mineralized waters.

Below we give brief information about the main chemical components of water. **Chlorine ion.** Chlorides are found

in small quantities in the earth's crust. As the main component, chlorides are found in minerals of igneous and metamorphic rocks (sodalite, apatite).

Chlorine ion is widely distributed in groundwater, especially in water layers located at great depth. **Sulfate ion.** Sulfate

ion is widely distributed from poorly mineralized groundwater. It differs from the chlorine ion in that its amount depends on the solubility of the Ca2+ ion in water . Ca2+ ion and SO4 ion form Ca2 SO4 which is slowly $^{2-}$ soluble in water .

Hydrocarbonate (HCO3-) and carbonate (CO_3^{2-}) ions. These ions are mainly distributed in fresh and brackish waters, their amount is not very large.

Carbonate ion is found in groundwater in very small amounts or may not be present at all.

Sodium ion is isolated in underground water, but it is widely distributed in underground water located in deep layers.

Magnesium ion. Mg^{2+} ion is rarely found in underwater waters. Waters containing more magnesium ions than other ions are rare. **Calcium ion (Sa2+).** Calcium ion

is found in various mineralized waters. In fresh and salt water, calcium ion is found in combination with bicarbonate and sulfate ions, and in nomocopic water, it is combined with chlorine ion.

Microcomponents are found in groundwater in amounts less than 10 mg/l. Microcomponents

include the following elements: Li, V, F, Ti, U, Cz, Mn, Co, Ni, Cu, Jn, As, Bz, Sz, Mo, J, Ba, Pb U, Ra, Rn in groundwater from radioactive elements and radioactive isotopes are found.

Dissolved in groundwater are oxygen (O), carbonic acid (SO_2), hydrogen sulfide (N_2 S), hydrogen (H_2), methane (CH_4), and nitrogen (N_2).

Organic matter enters groundwater from atmospheric precipitation, surface water, soil, seawater, and rock. At depths close to the surface of the

earth, organic substances are found in colloidal solutions in the form of humic compounds and give the water a yellow color. Humic compounds do not have a harmful

effect on the human body, but give water an unpleasant smell and taste. It is not recommended to drink such waters.

Microorganisms are found in groundwater in the form of various bacteria. Bacteria are spread to depths (4-5 km) where the temperature is 1000C. Bacteria actively

participate in the formation of the chemical composition of underground water and process organic and inorganic compounds as a result of their activity.

Chemical properties of groundwater

in the composition . of ions, Water Mineralization the sum of molecules and various compounds is his shows mineralization. Mineralization of waters is dry chukma orkal is expressed. The amount of dry chukma is water It is analyzed by boiling and drying (1100C) the part that fell into the chukma . It contains dissolved minerals and organic substances in water substances and colloids.

Kuruk chukma milligram liter, gram liter, or shur and Nomocopic waters are expressed in milligrams, grams.

Depending on the amount (mineralization) of dry chukma O.A. Alyokin divides natural waters into five classes:

Classes *Dry powder, g/ l*

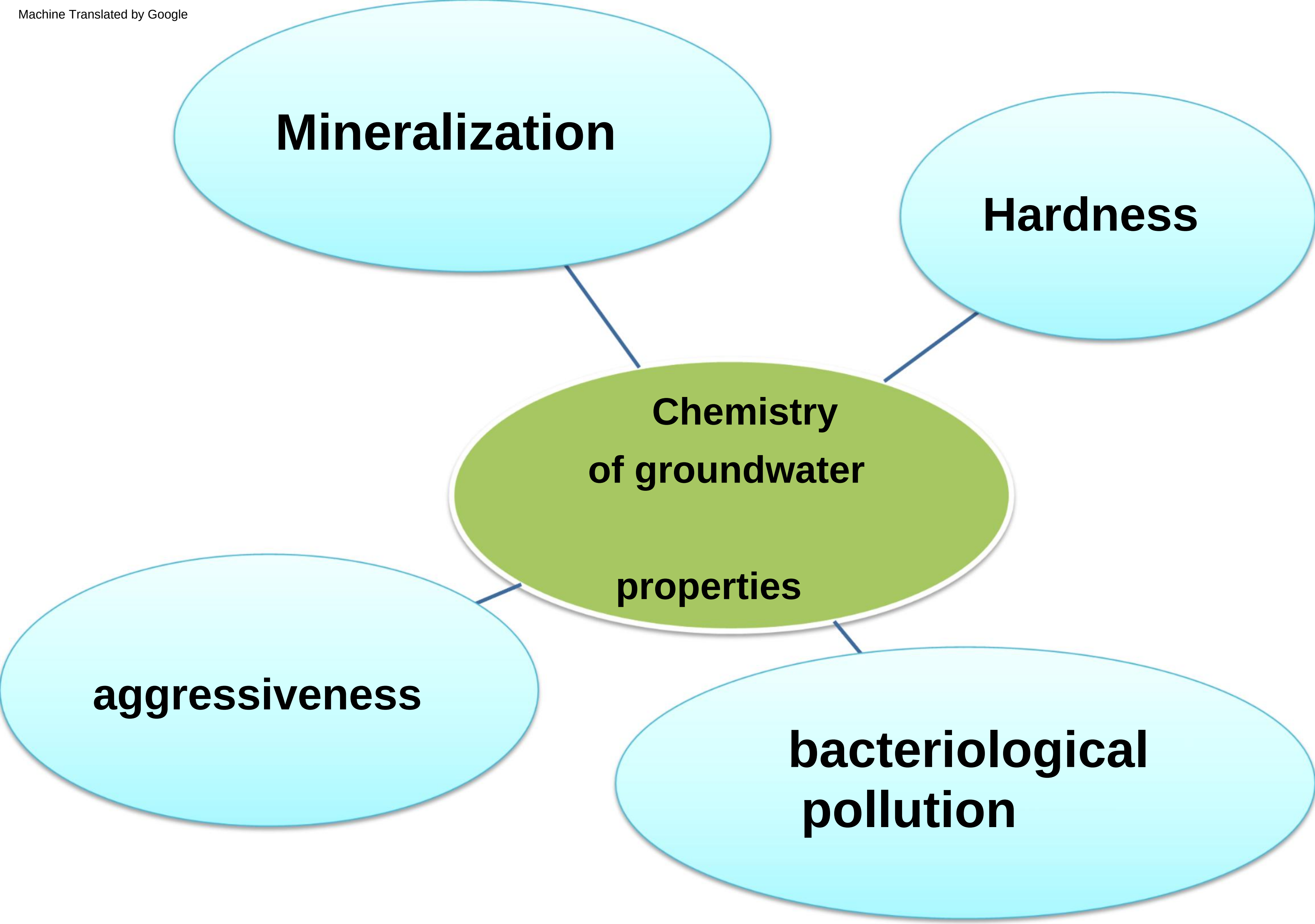
1. Fresh waters 0 – 1

2. Brackish waters 1-3

3. Brackish 3-10

waters 4. Strong brackish waters 10 – 35

5. Nomokop waters >35


Mineralization
Hardness
Chemistry
of groundwater
properties
aggressiveness
bacteriological
pollution

Water hardness. *Water hardness* depends on the amount of *Sa2+ and Mg2+* ions *in it . Water hardness is divided into three types : general hardness; temporary (dissolving, carbonate); permanent (cold, intractable) stiffness.* The total hardness of water is the sum of Sa2+ , Mg2+ and other ions contained in it . Sa2+ , Mg2+ , ions are enough to annihilate it . NSO3 - , SO4 *Vaccinal hardness* refers to the amount of 2- calcium and magnesium hydrocarbonate and carbonate salts in water .

Permanent stiffness distinguishes between total stiffness and temporary stiffness.

- ***According to the level of hardness, natural waters are divided into classes according to O.A. Alyokin: 1. Very soft waters <1.5 mg.eq/ l 2. Soft waters 1.5-3.0 mg. eq/ l 3. Hard water 3.0-6.0 mg.eq/ l 4. Hard water 6.0-9.0 mg. eq/ l 5. Very hard waters > 9.0 mg. eq/ l.*** Total hardness in water used for drinking purposes should not exceed 7 mg-eq/l.

Aggressiveness of waters. The ability of underground water to destroy rocks and reinforced concrete structures *is called aggressiveness of water.* ***There are different types of aggressiveness: carbonic acid (SO_2), dissolving, general acid, sulfate, magnesium, oxygen.*** Due to *the aggressiveness of carbonic acid (SO_2),* water dissolves calcium carbonate ($SaSO_3$) in concrete and rocks, destroying concrete and rocks.

$$CaCO_3 + H_2O + CO_2 < Ca^{2+} +$$

2 NSO_3 - The equilibrium between the amount of bicarbonate ion (NSO_3) and certain amounts of calcium carbonate ($SaSO_3$) results in a certain amount of free carbonic acid (SO_2). If the amount of carbonic acid in the free state exceeds the required for equilibrium , as a result of the action of such water, solid $SaSO_3$ begins to dissolve.

- The melting process is a balance between quantities continues until

- With free carbonic (SO_2) acid $SaSO_3$ the one who reacts and spends, aggressive called cupric acid.

- To determine aggressiveness, the amount and of mineralization of NSO_3 in water is also taken into account circumstances under which aggression occurs dirty (filtration of construction thickness, coefficient, pressure of the structure, cement variety) is taken into account.

- In hazardous conditions, the amount of SO_2 is from 3 mg/l not increase, from 8.3 mg/l in low risk conditions should not increase.

Dissolution aggressiveness is seen in the leaching of calcium hydrate oxide from the concrete composition due to the dissolution of calcium

very small carbonate . if the amount of SO2 is and if the equilibrium amount of NSO3 is less than the equilibrium amount of SO2 in the atmosphere , such wate always dissolves SaSO3 . This process occurs in water 2- SO3 and because they are not satiated with their ions NSO3 - . Groundwater becomes aggressive in conditions where the amount of NSO3 is very low (0.4-1.5 mg.eq) .

Acid aggressiveness

(pN) depends on the amount of free hydrogen ions in water. If the pH value is 5.0-6.8, the water is aggressive.

- **Sulfate aggressiveness** occurs when the amount of sulfate ion is increased in water. When water enters the pores of concrete, salt (SaSO4 *2H2O) is formed as a result of crystallization of sulfate, and concrete is damaged by the force of crystallization. Assessment of sulfate aggressiveness
  for, the conditions of water exposure to the structure and the amount of chlorine ion are taken into account.
- If 4000 mg/l sulfate-resistant cement is used for aggressive with an increase the structure , it can become in SO4 - , if ordinary cements are used , the aggressiveness of water will start with an increase in the amount of 250 mg/l SO4 - .

Magnesium aggressiveness occurs when the magnesium ion is found in too much water. Taking into account the type of cement, construction and working conditions of the structure, as well as the amount of SO4, magnesium aggressiveness appears when the amount of magnesium exceeds 750 mg/l.

Aggressiveness of oxygen affects the relationship with dissolved oxygen in water and metal structures. In order to determine the aggressiveness of different types of concrete as a result of the chemical analysis of the aggressiveness of water, the selection of the type of cement and the concrete

is studied to increase its durability.

If there is some kind of aggressiveness in relation to the type of cement selected during the construction , then concrete strength is ensured by special measures (waterproofing, reduction of aggressiveness level, drainage).

Thank you for your attention!!!