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commodity on Earth:
water



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THE SECRET
HANDBOOK OF
**THE BLUE
CIRCLE**

For children aged 6+



University
of Cyprus

Facts about water by the Eternal Blue Circle Society



1. The existence of water is essential for life on Earth.
2. The smallest existing mass of water is the water molecule.
3. Water is made up of two elements, Hydrogen (H) and Oxygen (O). One atom of the chemical element Oxygen holds hands with two atoms of the chemical element Hydrogen. Its chemical formula is H₂O.
4. One drop of water contains 1.7×10^{21} water molecules.
5. Water can appear in three different states, the liquid, the solid and the gas, depending on how its molecules are spread in space. It is called **WATER** when it is in the liquid form, when it is in the solid form it is called **ICE** and when it is in gaseous form it is called **WATER VAPOUR**.
6. Water has a number of unique properties. For example, the same amount of water when is in solid form, it takes up more space, than that when it is in liquid form. This is the reason why a full bottle of water in the freezer, as soon as it becomes ice it will not fit in the bottle anymore and the bottle breaks.
7. Water has no color, smell or taste.
8. Water is everywhere and it sustains and hosts living organisms on land and in the sea.
9. Water covers the largest part (around 70%) of the Earth' s surface.
10. 97% of Earth' s water is salty (**saline water**). 2% is locked up in polar **ice** caps and only 1% is available as **fresh water**. This 1% should be used for all the needs (i.e. agricultural, residential, manufacturing, community, and personal needs).
11. Seawater is not potable since it contains a vast amount of dissolved salts. If someone drinks a lot of seawater, a high amount of salts will enter the body. In order to dissolve that much salt, our bodies will use not only the water we drank but also the fresh water

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stored in our cells. Thus, by drinking seawater, not only we will not quench our thirst, but we will also waste the water our body has saved, and we will be dehydrated.

12. The **water cycle** describes how water evaporates from the surface of the earth, rises into the atmosphere, cools and condenses in clouds into rain or snow, and falls again on the earth surface as precipitation. It is an eternal cycle that never stops.
13. At the **water treatment plants**, engineers are using a number of tricks to clean water, in order to make it safe for us to drink. This is necessary because during water cycle many substances are travelling together with the water.
 - a. **Sedimentation** is the process that is used to get rid of various solid particles, like sand and grit.
 - b. **Flocculation/coagulation** is the process that is used to remove particles from the water. This is realized by adding substances that make solid particles stick to each other and form bigger, heavier particles, known as flocs, which sink and then are removed from the water.
 - c. **Disinfection** is the process that is used at the end of the treatment to kill the bacteria present in water, by adding chlorine or by applying ultraviolet irradiation (UV).
14. Water is often polluted with chemicals and/or microorganisms (**water pollution/contamination**), originated from human activities, such as industry, agriculture, sewage systems, resulting thus in the degradation of the water quality and rendering it toxic to humans or the environment.
15. The water in the sewage system (i.e. wastewater) carries a lot of chemicals and microorganisms, which, in general, are called **pollutants**. These pollutants are coming for example from washing the clothes, the floors, the dishes and cars, the use of soaps, detergents, the disposal of food, and drink, sand, also from household chemical preparations, from faeces and urine from toilets, and medicines which are thrown down

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the toilet or the sink, or from the consumed medicines and which passed to the toilet via urine, bacteria from human faeces and so much more.

16. Nowadays, 1 billion people do not have access to clean (drinking) water and according to predictions, even more people on Earth may soon have trouble accessing clean water, putting them at risk of deadly infections and threatening progress in public health.
17. The most precious object on Earth is not gold or diamond, it is clean water, which is essential for our survival.
18. Tonnes of water from our houses (i.e. sink, shower, toilets, washing machines and dishwashers), the streets, schools, companies, hospitals and factories, end up in the 'water rubbish' system called **sewage system**.
19. **Urban Wastewater treatment plants** are the "factories" where the dirty water (i.e. wastewater) is cleaned.
20. **Urban wastewater** can be described as a mixture of domestic and industrial wastewater and run-off rainwater.
21. The objective of the **biological treatment** is to remove or reduce the concentration of organic and inorganic compounds using microorganisms, through metabolic processes.
22. **Contaminants of emerging concern (CECs)** are persistent pollutants from medicines, cosmetics & perfumes, detergents and other household products, which exist in very small quantities in urban wastewater. CECs attract the interest of many scientists all over the world, due to the fact that they are smart, know how to hide, twist and turn, change and persist.
23. **Antibiotic compounds** are a family of chemicals which are saving us from bacterial infections. An antibiotic is an organic substance that can kill the bacteria that trouble our body.
24. **Bacteria** are clever microorganisms. If the antibiotic is not used correctly and fails to kill the bacteria, then... the bacteria may learn the antibiotic's secrets and can find ways to

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avoid it or even destroy it. This means the bacteria will become resistant, get used to it and find ways to fight it and survive. However, this will not happen if people stick to the doctor's instructions about antibiotic's dose and duration of treatment.

25. The **antibiotic-resistant bacteria**, i.e. those bacteria that have learnt an antibiotic's secrets, may reach the wastewater treatment plant, where some of them may survive the treatment, and they will enter the environment through the discharge of the treated wastewater. There, they will multiply, they will meet other bacteria, transfer their secrets to them and thus more bacteria may become resistant. As a result, next time doctors have to fight against one of them, they may need to come up with a new antibiotic.