

WATER

Introduction

How many percent of the earth's surface is covered by water? –

Task: Read the Table 7-1, which shows the distribution of water on the earth.
- page 337 (in AW textbook)

Note: Cz miliarda = US one billion = Br one thousand million

*What happens when water **freezes**?*

*What happens when water **condenses**?*

*What happens when water **evaporates**?*

As green plants make food, they give off water vapor to the atmosphere through pores in their leaves in a process called **transpiration**.

Water also evaporates from the surface of a human skin when our body gets rid of its moisture. *How do we call that process?*

During all the years between the formation of the earth and now, water has been moving continuously into and out of the atmosphere in a process called **water cycle** or **hydrologic cycle**.

Task: Describe the process in pairs. (Fig. 7-2 on p.338)

Key words: cool, cause (as a verb), enter, fall (back), return, soak into, stay on the surface, run off, precipitation, (under) ground water supply

Grammar revision: 1.vyjádření stejné míry
2.vyjádření přímé úměry

Why is this process, on a worldwide basis, a balanced system?

Our Science Heritage – Water and Ancient Civilizations (p.339 or in IS)

Task: Find the synonyms in the text to fit the following meanings:

Belonging to times long past -

Need (par.1) -

Cultivate by growing (2) -

Proof (3) -

Began/developed/originated - (4)

Supplying dry land with water by means of ditches etc. (4) -

Task: Find the opposites in the text to fit the following meanings:

Interrupted (1) -

Set free into nature (3) -

Come to an end (4) -

Fall (5) -

Decrease (5) -

Conversation Topic

*Describe a **stream near your home**.*

*Where does it **start**? Try to give the exact **location**.*

*What **larger body of water** does it **flow into**?*

*Is it **clean or polluted**?*

*What **causes the pollution**?*

*Is there a **hope for improvement**?*

*Does it provide a **habitat** for many plants and animals?*

Key words: **spring, start** (pramen, pramenit), **stream** (potok, pramínek, říčka), **streamlet** (potůček, strouha, pramének); **the upper reaches of a river** (horní tok); **brook, creek** (potok)

Find some more expressions on this topic:

Pramen=		pramenit=	
studna=	zřídlo, vřídlo=		“vyvěračka”=
řečiště, koryto=		splavný tok=	
průliv=		průplav=	
přehrada: nádrž		hráz	

Add some more expressions of your choice:

Define aqueduct -

Homework: Remind the formation of a glacier (JAG02 - Erosion) and prepare the test on the following page.

The Earth's Fresh Water

How many percent of all the earth's water is fresh water?

Section 1 Water on the Ground

Water collects on the ground

Task: Fill in the missing gaps with one of the following words:

Almost as body **causes** **dam** damming dug (inf=)
 enough even melts soaked **supply**

Warning: causes, dam, supply = nouns or verbs?

Water can return to the earth as rain or snow which may **pile up** to great depths. Increasing pressure on the bottom layers _____ **that** snow to change to ice. Most of the earth's fresh water _____ is stored in glaciers and other forms of ice. Glaciers, moving masses of ice and snow, flow downhill and out of their center. They usually move very slowly, **gouging** and reshaping the land _____ they go. In order for glaciers to exist, more snow must fall than _____ each year. Most of the glaciers are located near the poles where the energy from the sun, _____ in summer, is not strong _____ to melt all the ice and snow.

Water collects in lakes, ponds, and swamps. A lake forms when water collects in a hole or depression in the earth's surface. The Great Lakes are the largest body of fresh water on earth. Their content of water is _____ twice as much as all the water in the earth's atmosphere! They are thought to have been formed about 250 000 years ago, when a glacier _____ the lake beds out of the rock surface. The rock and soil that were **scooped out** of the **hollow** formed natural _____. When the southern part of the glacier melted, water filled the huge hollows and formed the lakes. Many lakes of the world were formed that way. Some lakes form when water fills the craters of inactive volcanoes. **Reservoirs** are lakes usually formed by _____ a river.

A **pond** (Us) is a _____ of water that is smaller and shallower than a lake. Ponds and lakes that are filled with water and vegetation are called **swamps** (the word comes from a Greek word meaning **sponge**.) They are low-lying water-_____ **marshes** and **bogs**. Swamps provide a home for many varieties of plants and animals.

Pronounce correctly: supply [_____], gouging [_____], swamp [_____], sponge [_____], reservoir [_____], soak [_____]

What do these words mean in Czech?

to pile up=	to gouge=	scoop out=	dig out
to dam (damming)=	a dam=		
a hollow =	sponge=		
marsh=bog=	peat bog =		

Grammar: a) vazba akuzativ+ infinitiv:

b) vazba nominative+infinitiv:

Find the examples in the text above.

Task: Look at the pictures in AW textbook, p. 340-342 and read the figure notes.

Water runs off the ground

A large amount of liquid water that falls to the earth has no place to collect. Much of this water flows directly off the surface and is known as runoff which occurs in two ways:

- **Sheet runoff** has no channels to direct its flow. It runs off as broad flat sheets of water.
- In **streams** water flows in channels between banks of soil, rock and other material. The banks give the direction of the flow.

When water falls onto a mountain ridge or when snow melts on the ridge, water will run off on both sides of the ridge. The highest land that separates the direction in which water will run off is called a **divide (Br watershed)**. See Fig.7-7, p.343.

The mightiest river systems in the world begin as small flows that feed into little stream channels and these flow into larger ones until they form a river. Streams and small rivers that empty into one large river system are called **tributaries**. Eventually the large main river empties into the sea.

All the area of land that drains into a river, along with its system of streams and other tributaries, is called a **river basin, or a catchment area**.

Check yourself in a pair

1. What are two ways in which runoff occurs? How are they different?
2. *What is a divide?*
3. *What are the names of the entire area that serves as a source of runoff for a river system?*
4. *What are tributaries?*
5. *What is the opposite of **broad**? Which word is similar?*

Homework

*Prepare a **short report** on a lake or a pond near your home. Find out how it was formed. Is there any evidence that the lake was higher or lower than it was when you observed it? Where does the lake get its water?*

Is the lake filling in with sediments and plants?

You may add any interesting information.

Useful vocabulary:

Br pond = Us small lake = rybník, pool = tůňka, tarn = mountain lake

moorland = vřesoviště, marsh = travnatá bažina, swamp = sezonně zaplavovaná

bažina, peat bog = rašeliniště, alga, pl.algae = řasy, blue green = sinice;

liquid wastes, sewage = odpadní vody, carp = kapr, pike = štika, trout = pstruh, eel = úhoř, catfish = sumec; punt = pramice, mud, muddy = bláto, blátivý

Do the ROPOT of this section.

Section 2 Water in the Ground

Water soaks into the ground - Porosity and permeability

Most of the earth's liquid fresh water is found neither in lakes nor in rivers, but in the ground. Water can soak into or flow into a material through **pore spaces** between particles in a process called **infiltration**. The total volume of the pore spaces in a certain volume of material is called **porosity**. Pore spaces among round-shaped particles of loose materials like sand can account for about one third of the total volume. Sandstone, therefore, is quite porous because of frequent pore spaces between the sand grains and the cementing material. Other kinds of rock, such as granite, which may consist of interlocking crystals or tightly pressed layers, will have a very low porosity or no porosity at all.

Water does not infiltrate into all materials at the same rate. It will soak into a dry sandy soil almost immediately, but on the other hand, it may form a puddle on top of clay soil. We say that sand has a high **permeability** – the ease with which water flows through a material.

Does rock with a high porosity necessarily have a high permeability?-

Permeability depends on the number and size of the pore spaces and whether these pore spaces are interconnected. Clay is made up of flat, irregular particles that may be many times smaller than sand particles. When they fill the pore spaces among sand particles, they greatly reduce the permeability of the material.

Another factor that affects the size of pore spaces and permeability is packing. Water will pass more quickly through loosely packed soil, but when soil is tightly packed, the flat particles of clay can fit together almost like a jigsaw puzzle. Water passes through very slowly, if at all.

What does the packing of soil depend on? –

Where and why is soil more tightly packed? –

Are pore spaces always needed for high permeability? Can you describe a situation in which a material has a low porosity but a high permeability? –

Check yourself

Explain the difference between porosity and permeability. Give examples of materials.

Give the opposites of: rounded tightly permeable regular porous

Conversation Topic

*Some people claim they can find underground water with a stick. This is called **witching** or **dowsing [au]**. Have you ever tried this technique? If so, have you succeeded? If no, have you seen someone using it? Is it scientific? Support your reasoning.*

Zones of water in the ground

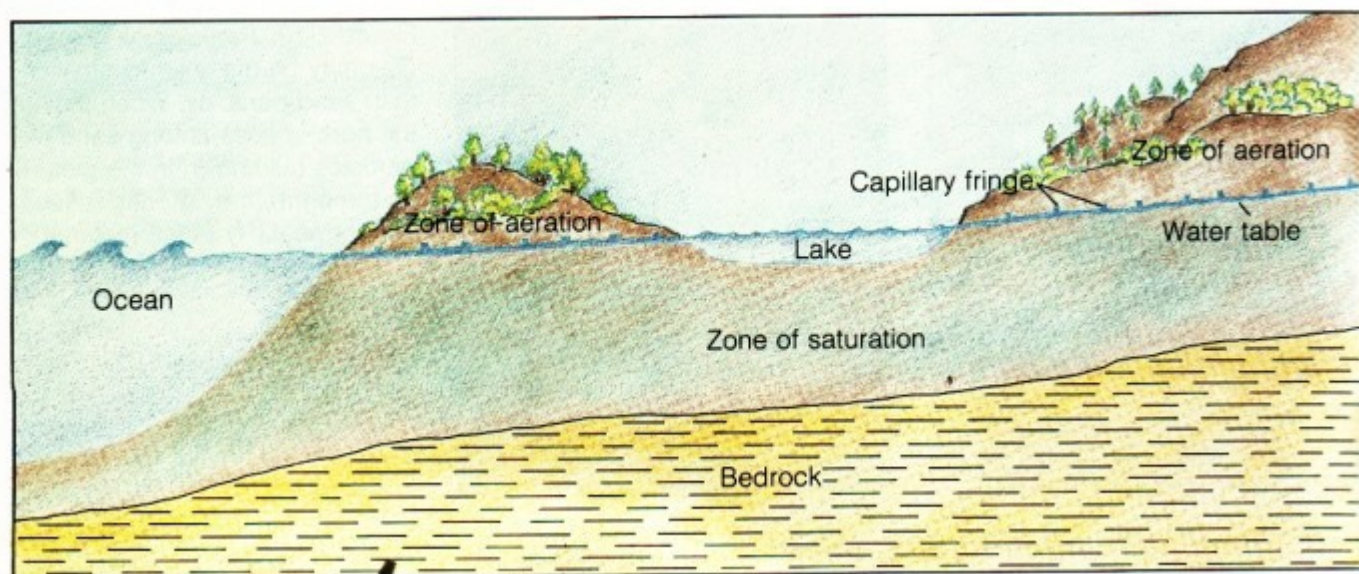


Figure 7-14.

The water that infiltrates the earth's surface becomes part of the huge supply of the ground water. Gravity acts on ground water, pulling it downward through the pore spaces, cracks, and other openings in the ground.

The amount of water in soil often varies, depending on the depth of the soil below the surface. After a rain has soaked into the ground, the layer of soil near the surface is usually moist, but not soaking wet. Most of the rainwater has passed down through the pore spaces of this layer and is in a lower layer of soil. But some water does remain behind, clinging to the soil particles at or near the surface. This layer of the soil is known as the **zone of aeration** (see Figure 7-14) because the pore spaces in this layer contain air as well as water.

Water clings to soil particles in the zone of aeration because water molecules are attracted to many other kinds of molecules. This attraction of water molecules to other kinds of molecules is called **adhesion**. It is this process of adhesion that keeps the soil in the zone of aeration damp long after it rains.

As long as the ground is permeable, gravity continues to pull ground water deeper into the earth. But at some point the ground water reaches a layer of soil or rock that is **impermeable**. It allows no water to pass through. Once the descending ground water hits an impermeable layer (the **bedrock** in Figure 7-14), it begins to collect there. Ground water will fill up the pore spaces above the impermeable layer. As the pore spaces fill with water, the soil or permeable rock becomes saturated. This saturated layer of soil or permeable rock is known as the zone of saturation. The boundary, which is the top of the **zone of saturation**, is called the **water table**.

Some water in the soil moves upward, against the downward pull of gravity. This upward movement of water in soil is called **capillary action**. You can observe capillary action at home by taking a small amount of water, placing the end of a paper towel in the water, and watching what happens. Capillary action is caused by cohesion and adhesion. **Cohesion** is the attraction of one molecule to another molecule of the same kind. By the process of adhesion, water molecules at the top of the water table

are attracted to molecules of the soil particles above. Then, when water molecules have attached themselves to molecules of soil particles, they attract other water molecules to themselves by the process of cohesion. In soil, these forces of adhesion and cohesion lift a little water upward from the zone of saturation to an area called the **capillary fringe**, which is just above the water table. (See Figure 7-14).

The damp soil in the zone of aeration receives its moisture from water that infiltrates down from the surface. The soil particles in the capillary fringe get their moisture from the zone of saturation by capillary action. If the pore spaces in the capillary fringe are small, the water will rise higher than if the pore spaces are large. The height of the capillary fringe ranges from about 2.5 cm or less in sands and gravels to as much as 60 cm or more in silty soils.

Check yourself

1. What is found in the pore spaces in the zone of aeration? in the capillary fringe? in the zone of saturation?

PERMEABILITY

Translate the following story. Use proper grammar rules. Check the words in bold.

Učitel filozofie jednoho dne přišel do třídy. Když se studenti usadili, vzal ze šuplíku

nádobu a naplnil ji až **po okraj** kameny. Potom se **zeptal** studentů, zda si **myslí**, že **je** nádoba plná? Studenti s ním souhlasili, že je. (sousednost!)

Potom profesor vzal krabičku s kaménky a **vysypal** je do nádoby s kameny,

zatřásl nádobou a samozřejmě, že kaménky propadaly mezi kameny. Profesor se zeptal znovu. Je teď nádoba plná? Studenti se pousmáli a souhlasili, že je.

Ale profesor vzal krabičku s velmi **jemným** pískem a vysypal ho do nádoby. Samozřejmě písek vyplnil i ty nejmenší **mezírky** mezi kameny. Ted už byla nádoba opravdu plná.

Potom profesor řekl: „Touto ukázkou jsem chtěl **znázornit**, že život je jako tato nádoba.

Kameny **znázorňují** důležité věci ve vašem životě, jako jsou vaše rodina, partner, zdraví, děti..., všechno, co je tak důležité, že kdybyste to ztratili, bylo by to velmi **zničující**.

Kaménky znázorňují ostatní, méně důležité věci. Například vaše zaměstnání, dům, auto...

A písek je všechno ostatní. **Drobnosti.**

Když dáte písek do nádoby jako první, nezůstane vám žádné místo pro kameny.

To stejné platí i v životě. Když budete ztrácet čas a energii na drobnosti - materiální věci, nikdy nebudete mít čas na věci, které jsou skutečně důležité.“

Pak přistoupil student a ptá se profesora. Myslíte, že je nádoba už plná? Profesor **připustil**, že ano. Student vzal půllitr piva a vлил ho do nádoby. Pivo se **vsáklo** do písku.

Ponaučení? Na pivo se vždycky **místo** najde!!

Homework – Listening test in ROPOT: Geysers and Hot springs

Geysers and hot springs

1. How are geysers and hot springs **formed**?
2. Which **types of conduits** does the speaker describe?
3. **How** do open conduits **act**?
4. What happens in **more restricted conduits**?

Geysers in Yellowstone National Park (YNP)

1. Which **famous geyser** are the tourists expecting to see?
2. What time is the **next prediction**?
3. Are there any **active volcanoes** in Yellowstone National Park?
4. What was said about **past eruptions**?
5. How far from the earth surface does a column of hot magma **below** Yellowstone National Park (YNP) rise?
6. Are geysers **the only** magma driven features in YNP?

Water comes out of the ground

In general, the water table is more or less parallel to the earth's surface. But if, as shown in Fig. 7-14, the ground slopes or the impermeable layer slopes, then gravity will cause ground water to move slowly toward the lowest level. *What will happen if the water table intersects the earth's surface on a slope?* It will flow out of the ground in a **spring**. Many ponds and lakes are **fed** by underwater springs, but if they are not located in a hollow or basin, they can also feed water into a stream finding or creating a channel over a period of time. There is a type of spring that is not fed by water from the local water table. In a special arrangement of underground rock layers there is a middle layer of permeable rock which passes between two layers of impermeable rock. This combination is called an **artesian system** shown in Fig. 7-15 on p.359. Water can pass through the middle layer called **aquifer** (from two Latin words that mean to carry water). Depending on the length of the aquifer, it may take hundreds or even thousands of years for water to travel the full length.

What materials form aquifers?

Which rock is commonly found in the impermeable top and bottom layers?

What is the speed of water in an aquifer? Why?-

The downward flow and the weight of the water **force** it to the surface wherever there is a crack or break in the layer of impermeable rock above the aquifer. The flow of water from an aquifer is called an **artesian spring**. Due to pressure in the aquifer, water sometimes **gushes up** above the surface like a fountain.

Sometimes water **erupts** from the earth in a spectacular way – see fig.7-16, p.361. In areas of volcanic activity, ground water may **sink** to great depths through very deep cracks and be heated by hot magma or by hot igneous rocks. Because the pressure is much greater at these depths, the boiling point of water is **raised** well above 100°C. Suddenly, the superheated water changes to steam which forces the water resting on it out through openings in the rock above.

What is the spelling and pronunciation of this feature in English? –

Where can they be found?

Why do you think Old Faithful got its name? –

Check yourself

1. Describe an artesian system.
2. How does an artesian spring originate? What causes an artesian spring to gush up out of the ground? Draw a diagram that shows this.
3. Compare an artesian spring and a geyser. How are they similar and how are they different?

Conversation Topic

Read about a **career of a hydrologist** on p. 358 and discuss your possible interest.

Do the ROPOT of this section, Revision test ROPOT and prepare the written test.

*The Earth's Fresh Water – Revision test***Translate:**

Čím vyšší je propustnost, tím rychleji může tekutina procházet horninou.

Přehřátá voda se mění na páru a ta žene vodu, která spočívá na ní, ven otvory v hornině nad ní.

V pouštní oblasti dochází k odpařování z půdy brzy po té, co se přežene bouřka.

Odhaduje se, že Velká jezera obsahují dohromady téměř dvakrát více vody než je jí v atmosféře.

Domníváme se, že Velká jezera se vytvořila asi před 250 000 lety.

Use nominative+ infinitive construction.

The Great Lakes ...

Sumerové zvýšili obsah soli v půdě **do takové miry**, že se již nedaly pěstovat plodiny.

Add suitable nouns from the texts above:

Permeable
Recycling
Invisible
Melting
Sheet

Example: ancient *people*

loose
irregular
cemented
capillary
inactive

Give synonyms (words of similar meaning):

sink into –
moist –
rapid –

Example: proof - *evidence*

gouge –
cling to –
flow into –

Form the nouns (Vytvoř tvary podstatných jmen):

Contain -
Evaporate -

deepen -
dry -

widen -
freeze -

empty -

Give the other forms (minulý čas a přičestí trpné) of these verbs:

cling –
sink –
soak –
feed –
dig-

raise –
rise –
flow –
fly –
lie -