

WATER

Introduction – Pre-reading

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

Why is water a very unusual earth material? Give at least two reasons.

Help: Look at fig. 7-1, p.336 in Addison-Wesley (AW) textbook.

Answer: 1/

2/

Where is water found as a liquid?

-
-
-

Where is water found as a solid?

-
-
-
-

Where is water found as a gas? Why can we not see it?

-

Table 7-1, p.337 in AW textbook shows the distribution of water on the earth.

Task: Describe the table. Compare.

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

What happens when water

- **freezes** –
- **condenses** –
- **evaporates** -

What affects the rate of evaporation from the surface or just below? –

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 this process? –*

During all the years between the formation of the earth and now, water has been moving continuously into and out of the atmosphere. *How do we call this process? (Clue: recycle) water cycle or hydrologic cycle. Write the definition:*

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

Answer:

Task: Make groups of 4 and prepare a poster, describing the combination of processes

Step 2: Choose a delegate who will compete in front the class.

Help on figure 7-2 in AW textbook, 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

Our Science Heritage – Water and Ancient Civilizations

Task: Read the text on p. 339 and write a short summary. What are the main ideas of individual paragraphs? Add their headlines and compare with your neighbor.

- 1.
- 2.
- 3.
- 4.
- 5.

- 6.

Check if you have written what happened 11 000, 9 500, 8 500 and 5 000 years ago:

- 11 000 –
- 9 500 -
- 8 500 –
- 5 000 –

Conversation Topic

Think of a stream near your home. Where does the water in the stream come from and into what larger body of water does it flow? Is it pleasant-sounding? Does it provide a habitat for many plants and animals? If so, give examples. If no, can you remember any pleasant sounds of nature near your home? If there are none, think of any place on the earth. If you have not been anywhere, imagine such a place.

Key words: spring (pramen, pramenit), stream (potok, pramínek, říčka), streamlet (potůček, strouha, pramének); the upper reaches of a river (horní tok); brook, creak (potok), watercourse (řечиště, koryto)

Homework

1. Find the synonyms of the following words. Use Lingea2002 preferably.

River:

Spring: noun (pramen) -
verb –

Watercourse (tok, řečiště, koryto):

2. Read about the formation of a glacier in the 2nd semester texts (section Erosion) and try to sum it up only in two sentences:

The Earth's Fresh Water

How many percent does it form?

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 depths dug enough even melts soaked supply

Water can return to the earth as rain or snow which may pile up to great _____. Increasing pressure on the bottom layers _____ that snow to change to ice. Most of the earth's fresh water _____ 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** 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.

Language corner

Say with the pronunciation: sponge [], gouging [], swamp [], reservoir []

Meaning: gouge –

, scoop out –

hollow –

, sponge –

, marsh, bog –

, peat bog –

Task: Give a brief description of the pictures in AW textbook, p. 340-342 that show four places where fresh water collects on the earth. Say the definitions of the terms.

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**. (See Fig.7-7, p.343.)

Note: Divide is watershed in Br English, but that means something else in Am English! See later on.

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 **watershed** in Am (Br **river basin**).

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 in Am and Br English?*
4. *What are tributaries?*

Homework

1. *Visit a nearby lake or pond. Find out how it was formed. Is there any evidence that the lake was higher or lower than it was when you observed it? Is the lake filling in with sediments and plants? Where does the lake get its water? Prepare a report that answers such questions.*
2. *Make a list of all the terms and definitions of section 1.*

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?

What does permeability depend on? – 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 the 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.*

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. 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.

Homework – Make a list of all the terms and definitions of section 2

The Earth's Fresh Water – Revision test