CHAPTER 3 UNDERGROUND WATER

Objectives

After studying this chapter, students should be able to:

- define underground water.
- describe the water table and its levels of saturation.
- state and explain the features of underground water.
- mention the importance and problems of underground water to man.

3.1 Definition and Features of Underground Water

Underground water refers to the water sinking into the ground or water entering the rocks. Rocks can be classified into the following groups based on the ability of rocks to allow water to pass through:

1. Porous rocks: It refers to rocks which are made up of little grains separated by spaces between them called *pore spaces*. Rain water finds its way underground through these pore spaces and through cracks and faults in the rocks e.g. granite.
2. Permeable rocks: Rocks which allow water to pass through them are said to be permeable e.g. sandstone is a permeable rock.
3. Impermeable rocks: Rocks which do not allow water to pass through them are said to be impermeable. Clay is an impermeable rock. We need to take note that clay is porous (water enters it) but it is impermeable.
4. Pervious rocks: This refers to rocks which have joint or faults into which water can infiltrate or enter an example is granite.

The amount and rate of run-off, evaporation and percolation are controlled by the nature of rocks, the nature of slope and the climate. Evaporation is

greater in dry climates than humid climate.

The Water Table or the Level of Saturation

Water entering the surface rocks moves downward until it comes to a layer of impermeable rock when further downward movement ceases.

It forms a spring when there is an easy outlet for the groundwater. The permeable rock in which water is stored is called acquifer. The depth of water table depends on factors such as relief of the area, types of rock, seasons and presence of springs.

Water level zones

The three water zones below the surface are:

(i) The zone of non-saturation: This lies immediately below the surface. Water passes through but never remain in the pores of the rocks of this zone.

(ii) The zone of intermittent saturation: The pores of the rocks of this zone contain water only during or after heavy rainfall.

(iii) The zone of permanent saturation: The pores of the rock of this zone are always filled with water.

Features of underground water

These features include:

(a) Springs: When water flows naturally out of the ground, it is called a spring. There are many types of springs. Some of them can be formed when:

(i) a permeable rock is lying on top of an impermeable rock in a hill.

Fig. 3.3: Formation of springs

(ii) water is held back by a dyke.

(iii) well-jointed rocks form hilly country.

(iv) chalk or limestone escarpments overlie impermeable rocks.

(v) there are gently sloping alternating layers of permeable and impermeable rocks.

(b) Wells: A well is a hole sunk in the ground far below the water table. Water then seeps out of the rocks into the well. If a well is not sunk below the water table it will contain no water.

(c) Artesian basin: An artesian basin consists of a layer of permeable rock lying between two layers of impermeable rock, such that the whole forms a shallow syncline with one or both ends of the permeable rock layer exposed to the surface. Rain water enters the permeable layer as its exposed ends. This layer becomes saturated with water and it is called aquifer.

(d) Artesian well: If a well is sunk in the aquifer of an artesian basins and the pressure of water is sufficient to cause the water to flow out of it, then the well is called an artesian well.

3.2 Importance of Ground Water to Man

1. Springs and wells have played an important part in the siting of settlements.
2. Ground water is used for irrigating the land for the purpose of agriculture and the wells have given rise to numerous oases.
3. Water taken from many wells which tap the aquifer of the basins is often too salty for irrigation but may be used for watering large herds of cattle.
4. Similar artesian basins and wells raise water for use in cattle ranching.
5. Water from wells and springs is used for domestic purposes, such as drinking, sanitation, etc.

Problems

1. Water gradually escape by seepage (the process by which a liquid flows slowly and in small quantity) through the ground.
2. Excessive withdrawal of water from wells may lead to water shortage or insufficient supply of water to the environment.

Summary

Underground water refers to the water sinking into the ground or water entering the rocks.

Rocks can be classified based on the ability of rocks to allow water to pass through such as porous rocks, permeable rocks, impermeable rocks and pervious rocks.

The three water level zones are the zones of non-saturation, intermittent saturation and permanent saturation.

Features of underground water are springs, wells, artesian basin and artesian well.

Ground water is important to man in the following ways: water is used for irrigation, siting of settlements, domestic purposes, for use in cattle ranching and watering large herds of cattle.

Its problems include water escaping by seepage and excessive withdrawal of water from wells which may lead to shortage of water to the environment.

Revision Questions

Objective

1. Man-made distribution of water to farmlands in areas which suffer from inadequate rainfall is called
   A. water resource management
   B. irrigation
   C. mulching
   D. arable farming
2. The use of water transport is limited by all the following EXCEPT
   A. wide valleys
   B. water falls
   C. floating vegetation
   D. seasonality
3. A well will always contains water if it is dug
   A. above the water table
   B. below the water table
   C. to reach sand bearing water
   D. below the earth's basin

4. One advantage of inland water-ways is that
   A. they are flexible
   B. they are fast
   C. goods are transported
   D. rivers at times flow through areas of limited commercial value
5. Which of the following are water pollutants?
   A. Aquatic animals
   B. Shrimps
   C. Dissolved fertilizers
   D. Water plant
6. A place where water issues out from the ground naturally is called a
   A. pond
   B. spring
   C. stream
   D. river
7. Water pollution is caused by all the following except
   A. increase silt load
   B. sand filling
   C. sewage disposal
   D. industrial effluent
8. Sharp, slender, downward growing pinnacles that hang from the cave roots are called
   A. pillar
   B. stalagmites
   C. stalactites
   D. resurgence
9. The enlarged joints are called
   A. pavement
   B. sink holes

C. clinks

D. grikes

10. When the roof of an underground tunnel/cave collapses, it forms a

A. cavern

B. gorge

C. spring

D. stalactite

Answers

1. B 2. A 3. B 4. C 5. C 6. B 7. B 8. C 9. D 10. B

Essay

1(a.) Explain the term "limestone region".

(b.) Outline the importance of limestone region to man.

2(a.) Name four surface features of a karst region.

(b.) With suitable diagrams, discuss two of these features.

3(a.) List 4 underground features of a karst feature.

(b.) With suitable diagrams, explain two of these features mentioned above.

4(a.) Using suitable diagrams, describe the appearance and mode of formation of any two of the following landforms:

(i) swallow hole (ii) stalagmite (iii) cave

(b.) Explain with examples, any two ways in which limestone regions are important to man. (SSCE 1994)

5. Write short notes on any four of the following:

(i) caves and caverns (ii) limestone pavement (iii) polje (iv) spring or resurgence