الثلاثاء ٢٠٢٠/١/٢١

نموزج اجابة امتحان مقرر جيولوجبا المياه (ج ٣٦٥) المستوي الثالث شعب جيولوجيا وجيوفيزياء و كيمياء جيولوجيا والمستوي الرابع شعبة حيوان كيمياء

كلية العلوم – قسم الجيولوجيا

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Benha University	**Hydrogeology Exam. (365 G)**
Faculty of Science	**January 2020**
Geology Department	**Time 2 hours**

<u>Third level Geology & 4th level Zoology & Chem.</u>

1- Compare between the following: ***(24 marks)***

A) The Dendritic and rectangular drainage patterns
B) The Confined and unconfined aquifers
C)The Cone of depression in confined and unconfined aquifers
D)The saturated and unsaturated zones

2-Explain the following: ***(24 marks)***

A- Convective and Orographic Precipitation
B-The factors responsible for evaporation
C- Hydrograph components
D- The factors that affect infiltration
E- Groundwater flow nets
F) Groundwater velocity

1- Compare between the following: (24 marks)

A) The Dendritic and rectangular drainage patterns

Dendritic drainage patterns	Rectangular drainage patterns
-Dendritic drainage: is characterized by irregular branching in all directions with tributaries joining the main stream at all angles. -It develops where rocks offer uniform resistance in horizontal directions e.g. flat-lying beds and plateaus, in massive crystalline rocks, or in rocks differing in composition but of equal resistance e.g. metamorphic. -Geologic structures cannot be readily interpreted it	-Rectangular drainage is characterized by right angle bands in both the main stream and its tributaries. -Structural control is prominent as the pattern is directly conditioned by the right-angle jointing faulting of rock

B) The Confined and unconfined

Unconfined aquifer	Confined aquifer
-water only partly fills an aquifer; the upper surface of the saturated zone is free to rise and decline. -Unconfined aquifers are also widely referred to as water-table aquifers -Wells open to unconfined aquifers are referred to as water table wells	-water completely fills an aquifer that is overlain by a confining bed -confined aquifers are referred to as artesian aquifers. -Wells drilled into confined aquifers are referred to as artesian wells

C) The Cone of depression in confined and unconfined aquifers

Cone of depression in unconfined aquifer	Cone of depression in confined aquifer
-Withdrawal of water cause decline in water table -Storage coefficient equal the specific yield, so, the cone of depression expand slowly -Dewatering of the aquifer cause decrease in transmissivity	-Withdrawal of water cause a drawdown in artesian pressure -Storage coefficient is very small than the specific yield, so, the cone of depression expand rapidly, and cone of depression expected -Do not cause dewatering of the aquifer

D) The Saturated and unsaturated zones

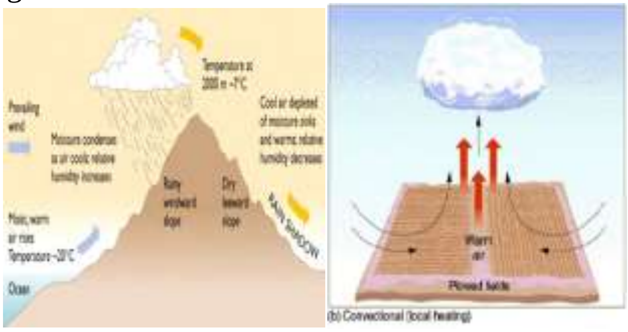
Unsaturated zone	Saturated zone
-This zone, occurs immediately below the land surface in most areas, contains both water and air	-This zone in which all interconnected openings are full of water
-This zone may be divided usefully into three parts: the soil zone, the intermediate zone, and the upper part of the capillary fringe -Water is under a negative hydraulic pressure-that is, it is under a pressure less than the atmospheric (barometric) pressure	-Water in this zone is available to supply wells and springs and is the only water to which the name ground water is correctly applied -Below the water table, the hydraulic pressure increases with increasing depth

2-Explain the following: (24 marks)

A- Convective and Orographic Precipitation

Convective precipitation is caused by natural rising of warmer, lighter air in colder, denser surroundings. Generally, this kind of precipitation occurs in tropics, where on a hot day, the ground surface gets heated unequally, causing the warmer air to lift up as the colder air comes to take its place. The vertical air currents develop tremendous velocities. Convective precipitation occurs in the form of showers of high intensity and short duration.

Orographic precipitation is caused by air masses which strike some natural topographic barriers like mountains, and cannot move forward and hence rise up, causing condensation and precipitation. All the precipitation we have in Himalayan region is because of this nature. It is rich in moisture because of their long travel over oceans.



(b) Convectional (local heating)

***B*-The factors responsible for evaporation**

1. Latent heat responsible for evaporation provided by sun
2. Temperature: Both of air and evaporating surface. Temperature depends on:

-Latitudes - Time of day -Time of year -elevations -degree of cloud cover

3. Air humidity**:** increases of air humidity decreases evaporation. If the air already has a high concentration of the substance evaporating, then the given substance will evaporate more slowly. If the air is already saturated with other substances, it can have a lower capacity for the substance evaporating
4. Barometric pressure inversely proportional with evaporation. Evaporation happens faster if there is less exertion on the surface keeping the molecules from launching themselves.
5. Wind speed: is directly proportional with evaporation. If fresh air is moving over the substance all the time, then the concentration of the substance in the air is less likely to go up with time, thus encouraging faster evaporation.
6. Nature and area of evaporating surface. A substance that has a larger surface area will evaporate faster, as there are more surface molecules that are able to escape.
7. Types of plants and stage of growth
8. Solute: An increase of salinity is inversely proportional with evaporation. The higher the density the slower a liquid evaporates

C- Hydrograph components

two components of the hydrograph :

1 .Direct runoff the flow that results directly from the rainfall event. Include surface runoff, channel precipitation, interflow

2. Base flow (groundwater flow) that is unrelated to the rainfall event.

D- Factors that affect infiltration

Precipitation: The greatest factor controlling infiltration is the amount and characteristics (intensity, duration, etc.) of precipitation that falls as rain or snow. Precipitation that infiltrates into the ground often seeps into streambeds over an extended period of time, thus a stream will often continue to flow when it hasn't rained for a long time and where there is no direct runoff from recent precipitation.

Soil characteristics: Some soils, such as clays, absorb less water at a slower rate than sandy soils. Soils absorbing less water result in more runoff overland into streams.

Soil saturation: Like a wet sponge, soil already saturated from previous rainfall can't absorb much more ... thus more rainfall will become surface runoff.

Land cover: Some land covers have a great impact on infiltration and rainfall runoff. Vegetation can slow the movement of runoff, allowing more time for it to seep into the ground. Impervious surfaces, such as parking lots, roads, and developments, act as a "fast lane" for rainfall - right into storm drains that drain directly into streams. Agriculture and the tillage of land also change the infiltration patterns of a landscape. Water that, in natural conditions, infiltrated directly into soil now runs off into streams.

Slope of the land: Water falling on steeply-sloped land runs off more quickly and infiltrates less than water falling on flat land.

Evapotranspiration: Some infiltration stays near the land surface, which is where plants put down their roots. Plants need this shallow groundwater to grow, and, by the process of evapotranspiration, water is moved back into the atmosphere

E- Groundwater flow nets

Flow nets consist of two sets of lines. One set, referred to as equipotential lines, connects points of equal head and thus represents the height of the water table, or the potentiometric surface of a confined aquifer, above a datum plane. The second set, referred to as flow lines, and depicts the idealized paths followed by particles of water as they move through the aquifer. Because ground water moves in the direction of the steepest hydraulic gradient, flow lines in isotropic aquifers are perpendicular to equipotential lines-that is, flow lines cross equipotential lines at right angles.

There are an infinite number of equipotential lines and flow lines in an aquifer. However, for purposes of flow-net analysis, only a few of each set need be drawn. Equipotential lines are drawn so that the drop in head is the same between adjacent pairs of lines. Flow lines are drawn so that the flow is equally divided between adjacent pairs of lines and so that, together with the equipotential lines, they form a series of "squares."

Flow nets not only show the direction of ground-water movement but can also, if they are drawn with care, be used to estimate the quantity of water in transit through an aquifer. According to Darcy's law, the flow through any "square" is

$$q=Kbw\,(dh)/(dl) \qquad (1)$$

and the total flow through any set or group of "squares" is

$$Q = nq \qquad (2)$$

Where K is hydraulic conductivity, b is aquifer thickness at the midpoint between equipotential lines, w is the distance between flow lines, dh is the difference in head between equipotential lines, dl is the distance between equipotential lines, and n is the number of squares through which the flow occurs.

F) Groundwater velocity

The ground-water velocity equation can be derived from a combination of Darcy's law and the velocity equation of hydraulics.

$$\mathbf{Q=KA(dh/dl)} \qquad \text{(Darcy's law)}$$

$$\mathbf{Q=Av} \qquad \text{(velocity equation)}$$

where Q is the rate of flow or volume per unit of time, K is the hydraulic conductivity, A is the cross-sectional area, at a right angle to the flow direction, through which the flow Q occurs, dh/ldl is the hydraulic gradient, and v is the Darcian velocity, which is the average velocity of the entire cross-sectional area . Combining these equations, we obtain

$$\mathbf{Av=KA(dh/dl)}$$

Canceling the area terms, we find that

$$\mathbf{v=K(dh/dl)}$$

Because this equation contains terms for hydraulic conductivity and gradient only, it is not yet a complete expression of ground-water velocity. The missing term is porosity (n)because, as we know, water moves only through the openings in a rock. Adding the porosity term, we obtain:

$$\mathbf{v=K(dh/ndl)} \qquad (1)$$