

Exercise 3 - Groundwater

ENV 601

Show all work. Keep units with your numbers.

[helpful hint: convert distances in km to m and areas in km² to m² (careful) before any calculations]

Part A

1. a) What is the porosity of a sample of sand in a graduated cylinder that takes 12 ml of water to bring the water level up to the top of the sand at the 60 ml mark?

b) What is the effective porosity if when the water is poured out, while retaining the sand, 10.5 ml of water is recovered?

c) What is the specific retention?

2. a) What is the storativity for an aquifer with an aerial extent of 100 km² (10 km by 10 km, or 10,000 m by 10,000 m) where the withdrawal of 20 million m³ of water results in the lowering of water levels by 2 m?

b) Is this a confined or unconfined aquifer?

c) How much water (m³) is withdrawn from each square meter of aquifer for each meter reduction in water level?

d) Convert this to gallons.

3. a) For an unconfined aquifer with a specific yield (effective porosity) of 18%, a saturated thickness of 25 m, and an aerial extent of 100 square kilometers, how much available (gravitational) water is stored at any moment in time?

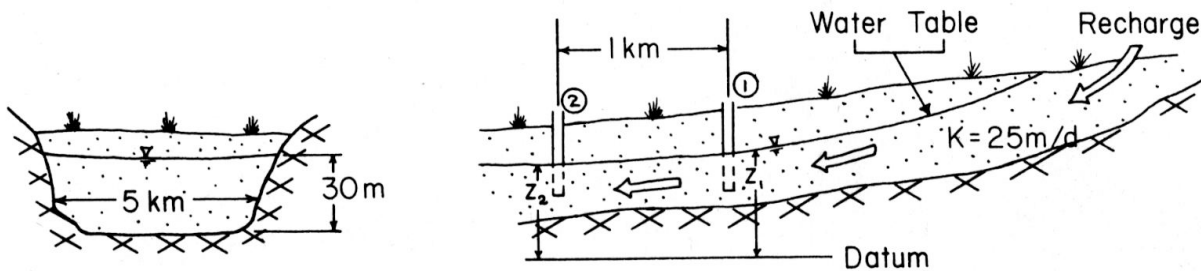
b) Convert this to gallons.

Part B Complete the following problems (modified from Rahn, 1996).

4. “The Fontaine de Vancluse, with an average discharge of $20 \text{ m}^3/\text{s}$, is the largest spring in France (Blavoux et al., 1992). The Cretaceous limestone catchment area ($1,000 \text{ km}^2$) has an average annual precipitation of 1.12 m . What percent of the precipitation recharges ground water?” (Rahn, 1996)

5. Refer to the diagram below (from Rahn, 1996)

- What is the discharge through the aquifer if the difference in elevation of the water table between well 1 and 2 is 8 m ?
- How long (days) will it take for water to travel from well 1 to well 2 if the aquifer has a porosity of 20% ?



6. The map below (Rahn, 1996) from a section of the Gulf coast of Florida shows contour lines of the potentiometric surface of the confined Floridan Aquifer. Calculate the groundwater discharge rate from the Floridan Aquifer to the Gulf of Mexico (m^3/day) along a 50 km stretch of coast from Sarasota southeastward. For hydraulic gradient use the distance between the 16 m contour of the potentiometric surface in Hardee County and the 4 m contour along the shoreline in southern Sarasota County (~75 km). The transmissivity is $8000 m^2/day$ and the aquifer thickness is 400 m.

