PROBLEM #3 – 25 points

WRITE ANSWERS TO THE FOLLOWING QUESTIONS ON THE NEXT PAGE, SHOW YOUR WORK. These questions are repeated on the next page for your convenience.

Evaluate the water analysis shown below. Provide calculations to support your answer.

a) **(15) Is the water analysis shown below of sufficient quality to use for an aquifer water chemistry study?**

b) **(5pts) Plot the analysis on the attached Piper Diagram (page 9 of this exam).**

c) **(2pts) What type of water is this sample?**

d) **(3pts) If the analysis of another sample from a well 50 miles down gradient in the same aquifer plotted at location [A] on the piper diagram of page 9 what could you say about groundwater in the aquifer?**

TEMP	15	C
HCO_3^-	198.4	mg/L
Cl^-	114.9	mg/L
K^+	9.9	mg/L
Ca^{+2}	74.4	mg/L
Mg^{+2}	18.1	mg/L
Na^+	130	mg/L
SO_4^{-2}	227.1	mg/L
Total Dissolved Solids	733	mg/L
Alkalinity as $CaCO_3$	162.6	mg/L
pH	7.37	units

g/m	charge	meq/L	
61	−1	−3.25	
35.5	−1	−3.24	
39	+1	+0.25	cations
40.1	+2	+3.7	cations
24.3	+2	+1.5	cations
23	+1	+5.7	cations
96	−2	−4.73	

ION BALANCE

Σ cations = 11.15 Σ anions = 11.22

% diff $100 \frac{(11.15-11.22)}{11.15+11.22} = \boxed{-0.3\%}$ OK!

Calculate TDS

$= 0.6$ Alkalinity $+ Na + K + Ca + Mg + Cl + SO4 + SiO_2 + NO_2N + F$

$= 0.6 \left(162.6 \frac{mg}{L}\right) + 130 + 9.9 + 74.4 + 18.1 + 119.9 + 227.1$

$= 671.96 \sim 672 \frac{mg}{L}$

$\frac{\text{Meas TDS}}{\text{Calc TDS}} = \boxed{1.09} = \left(\frac{733}{672}\right)$, OK!

PROVIDE CALCULATIONS AND ANSWERS TO PROBLEM 3 HERE

a) (15) Is the water analysis on the previous page of sufficient quality to use for an aquifer water chemistry study?

yes shown on previous page

b) (5pts) Plot the analysis on the attached Piper Diagram (page 9 of this exam).

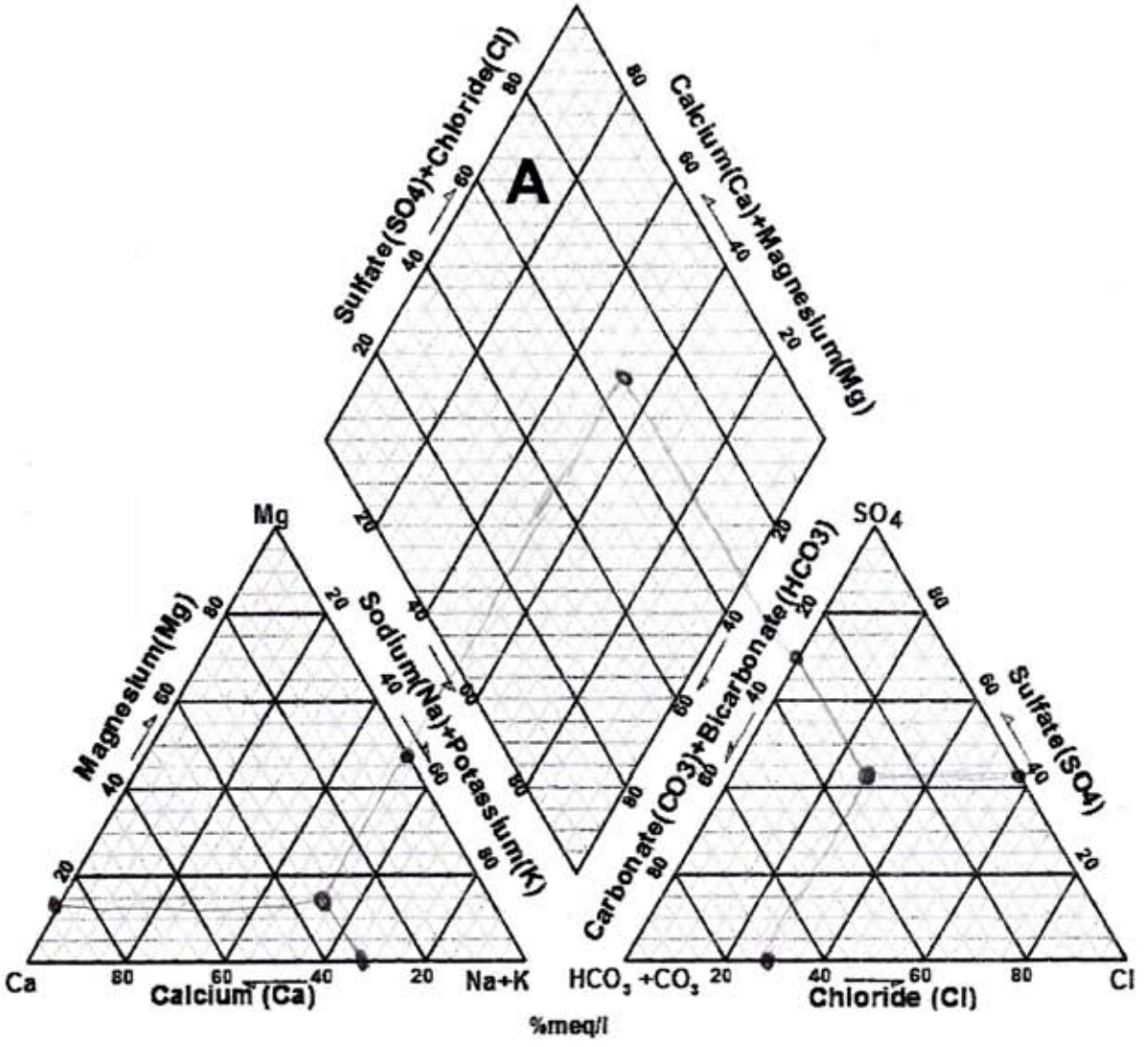
Na+K	5.95	53%	Cl	3.24	29%
Ca	3.7	33%	HCO_3	3.25	29%
Mg	1.5	13%	SO_4	4.73	42%
	11.15	99		11.22	100

c) (2pts) What type of water is this sample?

NaCl type

d) (3pts) If the analysis of another sample from a well 50 miles down gradient in the same aquifer plotted at location [A] on the piper diagram of page 9 what could you say about groundwater in the aquifer?

Water is dissolving Limestone Dolomite &or Gypsum along flow path


A
Sulfate(SO4)+Chloride(Cl)
Calcium(Ca)+Magnesium(Mg)
Mg
Magnesium(Mg)
Sodium(Na)+Potassium(K)
Ca
Calcium (Ca)
Na+K
SO4
Carbonate(CO3)+Bicarbonate(HCO3)
Sulfate(SO4)
HCO3 +CO3
Chloride (Cl)
Cl
%meq/l