

MRT 453-1 Water Quality Data Management

Instructions to candidates

Total Two (02) question

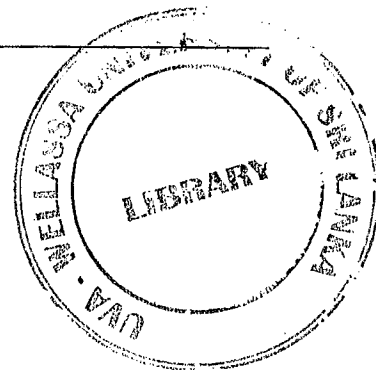
Answer all questions

Time allocated: One (01) hour

All symbols carry standard meanings.

Use of standard symbols without a definition is allowed

Use scientific calculators.



1. The variations of chemical composition of water samples are illustrated in Figures A and B on page 3. Answer following questions.

- Name these diagrams (10 marks)
- How many water samples are plotted? (10 marks)
- State advantages and disadvantages of the representation of chemical data as shown (the answer should contain at least one reasoning from each category). (20 marks)
- Chemically classify the sample data shown in Figure B. (20 Marks)
- State in a flowchart the essential steps involved in plotting Figures A and B. Assume that the initial concentrations scale of measurements of chemical data is ppm. (10 marks)
- The chemical composition of a water sample is given below in ppm. Plot the data. You may use the same Figures given. (30 marks)

Calculate (i) charge balance error, (ii) TDS, and (iii) Total hardness in (CaCO₃ ppm)

Ca ²⁺	Mg ²⁺	Na ⁺	K ⁺	HCO ₃ ⁻	SO ₄ ²⁻	Cl ⁻	NO ₃ ⁻	pH
48	3.6	2.1	0.1	152	3.2	8.0	0.01	7.51

(Na = 23.0; H=1.00; O = 16.0; C =12.0; S=32.0; N=14.2; Cl=35.5; Ca = 40.; Mg = 24.3)

2. Computer codes designed to solve for the equilibrium speciation of chemical systems have been used widely to simulate chemical systems. Many of the codes organize data in a tableau which is partially filled by the user and partially from the program's database.

Part A:

Specify the input data for computer analysis of a solution of 1.0×10^{-3} M HAc plus 0.3×10^{-3} M NaAc that has been adjusted to pH 7.5.

- a. Identify components for the system. (10 marks)
- b. Identify all possible species in the system. (10 marks)
- c. Write down the system stated in tableau form. (20 marks)
- d. Determine the mass balance equation for each component as identified in section (a). (10 marks)
- e. Determine the concentration of each species listed under section (b) in terms of components. Convert these expressions into generalized matrix notation. (20 marks)

Part B

- a. What are the commonly used activity correction models in computer codes? (10 marks)
- b. What are species with fixed activities? (10 marks)
- c. What do you mean by finite solids and infinite solids? Give an example for each case. (10 marks)

