Uva Wellassa University of Sri Lanka
Faculty of Applied Sciences
Department of Science and Technology
300 Level 1st Semester Examination – July /August 2019
MRT 371-3 Basic Water Chemistry

Instructions

Index Number:-

Duration: 03 hours
Number of questions: Part A: Structured Essay – 10 Questions, Part B: Essay – 05 Questions
Number of questions to be answered: All in Part A and B
Mark allocation: 600 marks (Part A: 100 marks, Part B: 500 marks)
Illustrate your answers with sketches/diagrams where necessary.

Use standard notation without a definition

Part A

Answer within the given space. Ten (10) marks per each question

1. a. State the global water distribution.

   i. Seawater

   ii. Ice caps

   iii. Groundwater

   iv. Surface water

   b. State two unusual properties of water.

2. a. Water analysis provides the following concentrations (in mg/L): Ca^{2+}, 94, Mg 24^{2+}, Na^{+} 19, bicarbonate 344, sulfate 85, chloride 9.0 and pH 7.2. Express each concentration in meq/L

   meq/L

   Ca^{2+}

   Mg^{2+}

   Na^{+}

Bicarbonate

Sulfate

Chloride

Molar mass (g/mol): Ca = 40.08, Mg = 24.31, Na = 22.99, H = 1.01, O = 16.00, C = 12.01, S = 32.06, Cl = 35.45

3. Determine water hardness in mg/L $CaCO_3$ (Molar mass (g/mol): Ca = 40.08, Mg = 24.31).

4. Define the term total alkalinity in H_2O- CO_2 system. A water sample has a pH 11.0. State the mode of alkalinity of the water sample.

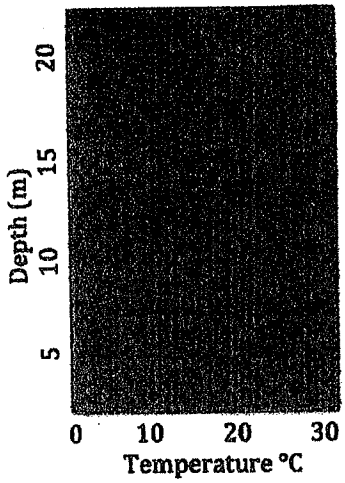
5. What is the buffer capacity of water? Prove that the buffer capacity values are always positive.

6. Calculate p^0e and Eh^0 of the half reaction: $H^+ + e = ½ H_2$.

7. State different natural organic matter fractions. Which fraction is dominant in natural water?

8. The K_{SP} and IAP values of calcite are $10^{-8.37}$ and $10^{-8.60}$, respectively. Calculate SI value. What happens to calcite, i.e. dissolve or precipitate?. Give a reason for your answer.

9. The temperature profile of Kandy Lake is shown below. Name different zones.



10. Davis activity model is shown below. Identify all terms therein.

$$-\log f_{\pm} = 0.5 z_1 z_2 \left(\frac{\sqrt{I}}{1+\sqrt{I}} - 0.30I \right)$$