BANGLADESH UNIVERSITY OF PROFESSIONALS
Military Institute of Science and Technology
B.Sc. in Environmental, Water Resources, and Coastal Engineering,
Term Final (Fall) Examination 2023: Dec 2023- Feb 2024

Student Group: 0<Earned Credit Hours ≤ 36

Subject: EWCE 105, Environmental Chemistry

Time: 3.00 hours **Full Marks: 180**

INSTRUCTIONS:

a. Use **SEPARATE** answer scripts for each section.
b. **Question-1** in **Section-A** and **Question-5** in **Section-B** are compulsory
c. Answer any other **TWO** rest of the **THREE** questions from each section.
d. Figures in the margin indicate full **marks**.
e. Assume reasonable data if necessary.
f. **Symbols** and **abbreviations** used have their usual meanings.

SECTION-A

Question 1 (Compulsory)

a. 10^{-2} mole of Hypochlorous acid (HOCl) is added to sufficient water to make 1 liter solution at 25°C. Determine the equilibrium concentrations of the species involved using graphical method and ignoring activity corrections. Given, $K_A = 2.9 \times 10^{-8}$. **20**

b. Explain how p^H affects the dissolution and precipitation processes of metal oxides and hydroxides in an aquatic system along with relevant mathematical derivations and diagrams. How these effects can control the mechanism of lime-soda softening process? **07 + 03 = 10**

Question 2

a. Draw the Log C VS p^H diagram for an aqueous closed carbonate system along with all necessary expressions for all chemical species present in the carbonate system. **25**

b. Define the point and non-point sources of surface water pollution. Briefly explain the characteristics of POPs. **02 + 03 = 05**

Question 3

a. Explain the aerobic and anaerobic decomposition processes of organic matter with relevant expression. Compile the major effects of organic pollution in the aquatic environment. **04 + 06 = 10**

b. Briefly explain the importance of colloid chemistry from the perspectives of water pollution. Explain how to adjust soil acidity and alkalinity for plant growth. **04 + 06 = 10**

c. What are the basic differences between the coordination compounds and the organometallic compounds? Explain the chelation process. Why chelates are of more importance than the unidentate ligands in natural water? **02 + 05 + 03 =10**

Question 4

a. Explain the Langmuir and the Frendlich Isotherms for adsorption with relevant mathematical expressions and plots of the respective isotherms. **15**

b. Total carbonate concentration for two water samples are given as 0.5 mM and 1 mM respectively. p^H of the samples are 5.5 and 6.5 **15**

respectively. Using the capacity diagram shown in figure Q4(b), evaluate the alkalinity and p^H of the mixture of two water samples. To increase the p^H of the mixture by 1 unit, determine –

(i) how much HCO_3^- is to be added?

(ii) how much CO_3^{2-} is to be added?

(iii) how much base is to be added?

SECTION-B

Question 5 (Compulsory)

a. State some of the common indoor air pollutants and the ways to control indoor air pollution. **03 + 03 = 06**

b. Write short notes on the following divisions of Environmental chemistry: **12**

(i) Aquatic Chemistry
(ii) Atmospheric Chemistry
(iii) Geo Chemistry
(iv) Green Chemistry

c. Briefly describe any six principles of Green Chemistry which focuses on reuse, reduction and recycling. **12**

Question 6

a. State the positive and negative impacts of technology on the environment. **06**

b. Briefly explain the steps followed in photochemical reactions and in the formation of hydroxyl radical. **06 +06 = 12**

c. Describe the following particulate matter deposition mechanisms in the respiratory system: **12**
Impaction, Settling, Diffusion and Interception.

Question 7

a. Define ozone and briefly explain the ways in which ozone is created in the Earth's stratosphere. Also, state the problems if ozone is inhaled even in low levels. **02 + 06 + 04 = 12**

b. Briefly describe the following steps in the nitrogen cycle process: Nitrogen Fixation, Nitrification, Denitrification and Ammonification. Also, state the impacts of human activities of nitrogen cycle. **08 + 04 = 12**

c. Draw the temperature profile the atmosphere representing different layers. **06**

Question 8

a. Describe the four layers of the atmosphere. **12**

b. Briefly explain the two types of nitrogen oxides formed during combustion and the major sources of nitrogen oxides. Also, state the effects of nitrogen oxides. **06 + 02 +04 = 12**

c. State some of the effects if wastes are not managed properly and also some of the challenges of waste management. **06**

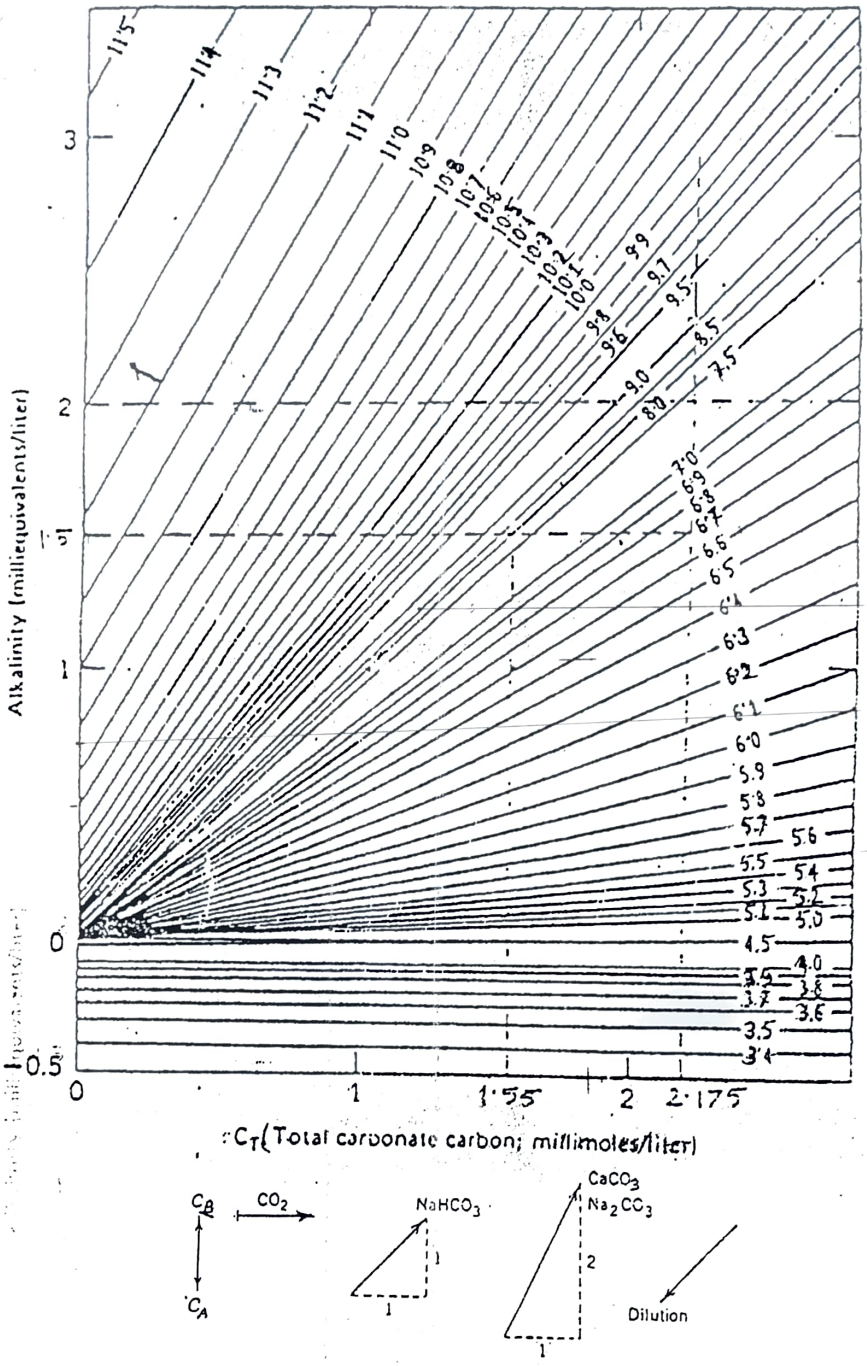


Figure Q4(b): Capacity Diagram