BANGLADESH UNIVERSITY OF PROFESSIONALS

Military Institute of Science and Technology

B.Sc. in Environmental, Water Resources, and Coastal Engineering, Term Final (Fall) Examination 2021: Jan-Feb 2022

Student Group: 0 < Earned Credit Hours ≤ 36

Subject: EWC 105, Environmental Chemistry

Full Marks: 180

me: 3.00 hours

STRUCTIONS:

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** questions out of **THREE** 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^{-3} mole of phenol (C_6H_5OH) is added to sufficient water to make 1 liter solution at 25°C. Determine the equilibrium concentration of chemical species involved using numerical solution method. Ignore activity corrections. Given, $pK_a = 9.1$. — 15

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

Question 2

a. Explain how pH 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? — 10

b. Draw logC vs. pH diagram for an aqueous carbonate system exposed to atmosphere. Derive all necessary expressions for all chemical species present in the carbonate system. — 20

Question 3

a. What are the basic differences between co-ordination compounds and organometallic compounds? Explain the chelation process. Explain why chelates are of more importance than the unidentate ligands in natural water.
How organic pollution occurs in aquatic systems? Explain. — 15

b. In addition to carbonate system, phenol (C_6H_5OH) equilibrium is also present in an aquatic system. Given, $k_A = 1.2 \times 10^{-10}$. Write the expression for- i) P-alkalinity, ii) M-alkalinity and iii) Carbonate alkalinity along with the respective characteristics of pH and PRL. Write the criteria of any chemical species for being a PRL. — 15

Question 4

a. 10^{-5} mole of Hypobromous acid (HoBr) is added to sufficient water to make 1 liter solution at 25°C. Determine the equilibrium concentration of the chemical species involved using graphical approach. Derive all necessary expressions and ignore activity corrections. Given, $k_A = 2.3 \times 10^{9}$. — 20

b. Explain the phenomenon of soil acidity and alkalinity. How the soil — 7+3=10

acidity and alkalinity can be adjusted for plant growth.
$Ag_2CrO_4(s)$ is in equilibrium with water. Calculate the equilibrium concentration of Ag^+ and CrO_4^{2-}. Given,pK_{sp}=12.0

SECTION-B

Question 5 (Compulsory)

a. Bangladesh is routinely mentioned as one of the world's most climate vulnerable nations. Discuss what impact could climate change have on the Sundarbans. **06**

b. What characteristics of the chloroflurocarbons (CFCs) make them damaging to the environment? **04**

c. Explain how ozone is formed in the troposphere and what happens when it does. **10**

d. In Bangladesh, the national ambient air quality standard for CO is 10 mg/m^3.Express the standard in ppm. **10**

Question 6

a. What is biosphere? Give examples of 3 biotic and abiotic factors. Describe how biotic and abiotic factors interact in ocean ecosystem. **12**

b. What becomes of the visible light once the earth absorbs it? **06**

c. Define Dobson Unit. Why is the Antarctic ozone hole more prominent in the spring? **2+10**

Question 7

a. Each element has a fixed quantity which are recycled continuously within and among various components of the environment. Discuss this statement with the example of C-cycle. **08**

b. What are the challenges we face in our country in case of managing waste? How can the 3R play a role in reducing the amount of waste going into the landfills? **10**

c. What is the difference between photosynthesis and chemosynthesis? **04**

d. What do you understand by the primary pollutants of the atmosphere and in which processes the emission of primary pollutants occur? **08**

Question 8

a. Ibuprofen is a non-steroidal anti-inflammatory drug. Explain how green chemistry played a role in the development of a cleaner synthesis process. **06**

b. What are short lived climate pollutants? **04**

c. What causes incomplete combustion and why is it dangerous? **10**

d. It has been estimated that each chlorine atom may destroy approximately 100000 molecules of ozone over a period of 1 or 2 years. How does chlorine destroy ozone? 06

e. Define Criteria Pollutants and Air Toxins. 04