RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (Honours) Degree in Chemistry
Fourth Year - Semester I Examination – September / October 2019

CHE 4308 – ADVANCED ENVIRONMENTAL CHEMISTRY

Time: Three (03) hours

Answer all ~~only four (04)~~ questions.
Use of a non-programmable calculator is permitted

1. a) The Constitution of Sri Lanka ensures environment protection. Comment.

   b) Comment on Stockholm Convention signed by Sri Lankan Government in 2001.

   c) Organic pollutants are more dangerous than their inorganic analogs. Critically comment.

   d) How ancient Sri Lankans harvested rain water? Discuss the drawbacks of present day rainwater harvesting programs.

(25 × 4 marks)

2. a) Define the following terms.
   i. Sorbtion ii. Ion exchange iii. permanent surface charge
   iv. Surface complexes (20 marks)

   b) State the differences between the inner sphere and outer sphere surface complexes.

(20 marks)

   c) The CO_2 sorption on to activated carbon is shown below. Prove that the data is following the Langmuir model. State all assumptions made in the formulation of the Langmuir model.

p-CO2 mm Hg	Γ_{CO2} g/g
25	0.0669
50	0.0924
200	0.114
400	0.127

(30 marks)

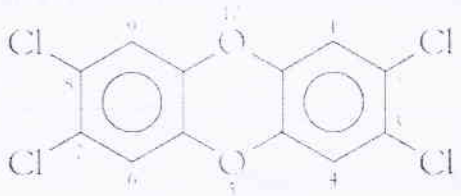
   d) How the electrical double layer is formed? Discuss its imporance in charged particulate removal in water. (30 marks)

3. a) Discuss physical transformation pathways of organic pollutants in the environment.

b) Discuss the origin of BTEX compounds in the environment. Discuss the oil pollution problem in Jaffna, Sri Lanka

c) State all organic compounds in POPs family. Discuss their origin in the environment. Why CFCs are not included in POPs family.

d) State a formation mechanism of the following compound.



2,3,7,8-tetrachlorodibenzo-*p*-dioxin
(2,3,7,8-TCDD)

(25× 4 marks)

4. It is very important to design infrastructure facility considering both current and future demand. Accordingly, it is required to design a water treatment facility for a town with 15,000 families to provide municipal water demand.

a) List down all the assumptions which shall be made under the above assignment (20 marks)

b) What is the total demand including domestic, commercial and institutional requirements of the town in 25 years time?

(20 marks)

c) Assuming the raw water source is a river with the maximum recorded turbidity as 450 NTU and average pH as 6.5, sketch the treatment train to provide above water demand to the town. (20 marks)

d) Find out the dimensions of sedimentation tank(s) and rapid sand filter(s) of the above proposed treatment train

(40 marks)

5. Understanding the characteristics of wastewater is very important in designing appropriate treatment facilities. Therefore, process designers shall give much attention to laboratory analysis before deciding the treatment facility.

a) What is an activated sludge process used in domestic wastewater treatment? (25 marks)

b) Discuss about the importance of having advanced oxidation as pretreatment technology in high strength wastewater treatment?

(25 marks)

c) The influent water quality of a leading distillery company is given below. According to the water quality results it has been identified that the present treatment process is not effective. Therefore, propose a suitable/missing treatment processes to overcome the above problems?

Influent water quality

pH	3.9 Influent
BOD(mg/l)	4,800
COD(mg/l)	19,000
Conductivity (µS/cm)	4,900

(50 marks)

6. Chlorination is one of the very important treatment processes in the conventional water treatment.

a) What is breakpoint chlorination? Describe in details with an appropriate sketch
(25 marks)

b) Compare the advantages of chlorination against other disinfection methods
(20 marks)

c) Discuss about the possibilities for by-product formation in chlorination process
(25 marks)

d) How do you explain the importance of maintaining low pH for effective chlorination process?
(30 marks)

— END —