

**CHUKA UNIVERSITY EXAMINATIONS (2019/2020)**

**CHEM 448: ENVIRONMENTAL CHEMISTRY II**

**STREAMS: BSc (CHEM)**

**TIME: 2 HRS**

**INSTRUCTIONS**

Answer question **One** (Compulsory) and any other **Two** questions

**QUESTION ONE [30 MARKS]**

- (a) State the sources and health effects of water pollution by cadmium (**3 marks**)
- (b) Explain the causes and effects of cultural eutrophication (**5 marks**)
- (c) The following data was obtained for a water sample. All of the tests were performed using a sample size of 100mL. Tare mass of evaporating dish = 52.1533 g; Mass of evaporating dish plus residue after evaporation at 105 °C = 52.1890 g; Mass of evaporating dish plus residue after ignition at 550 °C = 52.1863 g; Tare mass of Whatman GF/C filter = 1.5413 g; Residue on Whatman GF/C filter after drying at 105 °C = 1.5541 g; Residue on Whatman GF/C filter after ignition at 550 °C = 1.5519 g. Determine in mg/L: (**5 marks**)
- (i) Concentration of total solids                      (ii) Total volatile solids
- (iii) Total suspended solids                              (iv) Total dissolved solids
- (v) Total volatile suspended solids
- (d) Discuss the health effects of various noise levels (**5 marks**)
- (ii) A 25ml of a water sample was titrated with 0.0010M  $K_2Cr_2O_7$  and required 8.3ml to reach the end point. Calculate the COD in mg of oxygen per liter of sample (**2 marks**)
- (e) Explain the sources of the major soil pollutants (**4 marks**)
- (f) Discuss three methods that are used to remediate polluted ground water (**6 marks**)

**QUESTION TWO [20 MARKS]**

- (a) Discuss the design and operation of the conventional raw sewage treatment plant (**10 marks**)
- (b) Discuss three technologies that are used to remove  $SO_2$  from flue gases in coal powered power plants (**10 marks**)

### **QUESTION THREE [20 MARKS]**

(a) Discuss the following technologies for control of NO<sub>x</sub> emissions from internal combustion engines (**10 marks**)

(i) NO<sub>x</sub> storage reduction (NSR)      (ii) Selective catalytic reduction (SCR)

(b) A bioassay was carried out on shrimp in aquaria and the following data obtained after 24 hours:

Number of Shrimp Surviving (of 200/aquarium)	Concentration in Aquarium Water (µg/l)
200	11.0
164	14.5
124	19.1
72	21.9
22	30.2
0	57.5

Estimate graphically the LC<sub>50</sub> and LC<sub>80</sub> values (**6 marks**)

(c) Compare and contrast microbial degradation via growth metabolism and co-metabolism (**4 marks**)

### **QUESTION FOUR [20 MARKS]**

(a) State six factors that determine the toxicity of a compound (**3 marks**)

(b) Discuss the steps of the environmental impact assessment (EIA) process (**10 marks**)

(c) Describe three technologies that are used to control emission of volatile organic compounds (**7 marks**)