KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER
MAIN EXAMINATIONS
FOR THE DEGREE OF BSC (CHEMISTRY)

COURSE CODE: SCH 316

COURSE TITLE: ENVIRONMENTAL CHEMISTRY

DATE: 13/12/2022 **TIME:** 9:00-11:00AM

INSTRUCTIONS TO CANDIDATES:

TIME: 2 Hours

Answer **question ONE** and **any TWO** of the remaining

Question 1 [30 Marks]

a. Define ecology [2 Marks]
b. Discuss the circumstances under which a contaminant become a pollutant [2 Marks]
c. Distinguish among geosphere, lithosphere, and crust of the Earth. [6 Marks]
d. Describe the oxygen and carbon cycles and explain how they are related. [5 Marks]
e. Explain how toxicological chemistry differs from environmental biochemistry. [2 Marks]
f. Name the process shown by the reaction below? [1 Mark]

$$2CH_2O_{(g)} \rightarrow CO_{2(g)} + CH_{4(g)}$$

i. How is this process related to aerobic respiration? [2 Marks]

g. Explain the difference between point and nonpoint sources of pollution. Give an example of each. [4 Marks]
h. Describe the role of organisms in the nitrogen cycle. [2 Marks]
i. Define BOD [2 Marks]
j. Explain the importance of green chemistry in environmental conservation [2 Marks]

Question 2 [20 Marks]

a. Highlight the 5 main processes in the nitrogen cycle? [10 Marks]
a. Describe the 4 main processes in the carbon cycle? [8 Marks]
b. Use the abbreviations At, Hy, An, Bi, Ge for atmosphere, hydrosphere, anthrosphere, biosphere and geosphere respectively. Then place each of the following with the appropriate arrow, indicating the direction of its movement with a notation such as $At \rightarrow Ge$ [2 Marks]
   i. Iron ore used for steel making
   ii. waste heat from coal-fired electricity generation
   iii. water from the ocean as it enters the hydrologic cycle
   iv. argon used as an inert gas shield for welding

b.

Question 3 [20 Marks]

a. Briefly describe two common methods of secondary treatment of sewage [8 marks]
b. List the gases which are responsible for greenhouse effect [5 Marks]
c. What is the importance of greenhouse gases and how would their absence affect the earth? [5 Marks]
d. Explain why carbon monoxide is more dangerous than carbon dioxide [2 Marks]

Question 4 [20 Marks]

a. The COD of a water sample is 25 mg of O_2 per litre. What volume of 0.0010 mol L^{-1} $Na_2Cr_2O_7$ solution is required to titrate a 40 mL sample to end-point? [The dichromate ion oxidizes 1.5 times the material that molecular oxygen does.] [13 marks]

b. In an experiment, it is found that 0.00124 mg of hexachlorobenzene (HCB) can be dissolved in exactly 200.0 mL of water.

i. What is the solubility of HCB in water, in units of ppm? [4 marks]
ii. What is the solubility of HCB in water, in units of moles per litre? [3 marks]

Question 5 [20 Marks]

a. Differentiate between LD_{50} and LOD_{50} [4 Marks]
b. List two commercial uses of asbestos. [4 Marks]
c. Given that the average bond energy of C−Cl is 320 kJ mol^{-1}, determine the maximum wavelength of light that could be used to cleave this bond. [6 Marks]

d. Write the chemical equation that illustrates the formation and dissociation of ozone. [6 Marks]