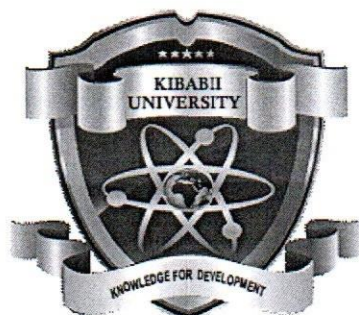# KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER
SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: SCH 351

COURSE TITLE: AQUATIC CHEMISTRY

DURATION: 2 HOURS

DATE: 11/10/ 2018   **TIME: 3 – 5 PM**

<u>**INSTRUCTIONS TO CANDIDATES**</u>
- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of **4** printed pages. Please Turn Over

Question 1

a) Explain what is meant by the following terms;   **[3marks]**

   i.   PH
   ii.   Alkalinity
   iii. acidity

b) If a solution contains a concentration of H^+ as 8.6×10^{-9} moldm^{-3}, calculate the PH of the solution.   **[3marks]**

c) Discuss any two physical parameters used to measure the quality of drinking water. [4mks]

d) A sample of water having a pH of 7.2 has the following concentrations of ions;

Ion	Conc. (mg/L)	Molecular weight (mg/mmol)	Conc. (mol/L) x10^{-3}	Conc. (mg/L) as CaCO$_3$
Ca^{2+}	40.0	40.1	0.998	99.8
Mg^{2+}	20.0	24.3		41.2
Na$^+$	11.8	23.0		25.7
K$^+$	7.0	39.1		8.95
HCO$_3^-$	110.0	61.0		90.2
SO$_4^{2-}$	67.2	96.1		69.9
Cl$^-$	11.0	35.5		15.5

I) Complete the table by calculating concentration in moles/litre each kind of ion in water.   [6mks]

II) Calculate the;

   i.   Total hardness (TH)   [1marks]
   ii.   Alkalinity (given $H_2CO_3 \leftrightharpoons CO_3^{2-} + H^+$ and k $= 10^{-10.33}$ at 25 °C).   [8mks]
   iii. Carbonate Hardness (CH)   [1mk]

e) State four advantages of hard water.   [4marks]

Question 2

a) Explain the importance of dissolved oxygen in water.   [4mks]

b) A series of dilutions were prepared in 300 mL BOD bottles using settled raw sewage and unseeded dilution water. The dilution range, initial DO, final DO, and depletions are given in the Table below.

Bottle #	mL Seed	Initial DO	Final DO	Depletion
1	3	7.95	5.20	2.75
2	6	7.95	3.85	4.10
3	9	7.90	2.40	5.50
4	12	7.85	1.35	6.50

Determine the BOD of each seed dilution and then calculate the average seed BOD. **[10mks]**

c) The BOD of a sewage incubated for one day at 30°C has been found to be 100 mg/L. determine the rate constant K at 30°c hence find the five day 20°C BOD. Assume K = 0.12 at 20°C, and θ = 1.056   [6marks]

Question 3

a) State five domestic uses of water   [5mks]

b) Describe the specifications of water for domestic purposes.   [5mks]

c) Explain clearly how suspended solids are removed in the treatment of water for drinking. [4mks]

d) Identify three chemicals added to the final stages of the treatment of water for drinking. State the purpose of adding each chemical identified.   [6mks]

Question 4

a) State five types of water pollution.   [5mks]

b) Explain how a water collection reservoir may affect.

   i.   Suspended solids carried by the river downstream.   [3mks]
  ii.   The climate of the area.   [3mks]

c) Explain five effects of water pollution.   [5mks]

d) State any **four** ways that help minimize water pollution.   **[4mks]**

Question 5

a i) What is meant by *heat of vaporization?*   [1mk]

ii) Explain three Benefits of water's high heat of vaporization.   [3mks]
iii) Other than having high *heat of vaporization,* state other four extraordinary properties of water
    that make it unique.   [5mks]

b) Explain how solar energy drives the water cycle.   [2mks]

c) Explain the following terms;

    I.   The critical point (CP)   [1mk]
    II.   The triple point (TP)   [1mk]

d) Draw the phase diagram for water existing in three phases at equilibrium and on it label;
    triple point and critical point.   **[4mks]**
e) State any three major sources of water.   **[3mks]**