THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

FIRST SEMESTER EXAMINATIONS

CH461 ENVIRONMENTAL CHEMISTRY II

MONDAY 15TH JUNE, 2020 – 12:50 P.M.

TIME ALLOWED: 2 HOURS

INFORMATION FOR CANDIDATES:

1. You have ten minutes to read the paper. You must not begin writing in the answer book during this time.
2. **ANSWER ALL QUESTIONS.**
3. All answers must be written in the answer books provided.
4. Calculators are permitted in the examination room.
5. **NOTES, MOBILE PHONES AND TEXTBOOKS ARE NOT ALLOWED.**
6. Show all workings and calculations in the answer book.
7. **DRAW** any **FIGURES** clearly and visibly.
8. **DO NOT** over write.
9. Write your name and student number clearly in the front page. **DO IT NOW.**

MARKING SCHEME

[TOTAL = 60 MARKS]

1. (a) Define environmental chemistry and differentiate between it and environmental science. [2 marks]

   (b) Define water quality monitoring and name the THREE types of monitoring activities. [4 marks]

   (c) Define sampling and discuss its importance in the chemical analysis process. [2 marks]

   (Total = 8 marks)

2. (a) Name the FOUR main types of water quality sampling programs. [4 marks]

   (b) List any THREE factors that may affect sampling. [3 marks]

   (c) Define the following:

   (i) analyte

   (ii) composite sample

   (iii) grab sample

   (iv) isokinetic sampling

   [4 marks]

   (Total = 11 marks)

3. (a) When determining total acidity in a water sample, what is the sample titrated against, and to what end-point? [2 marks]

   (b) Name FOUR chemical processes happening in the aquatic environment that affects aquatic chemistry. [4 marks]

   (Total = 6 marks)

4. The acid-base chemistry of natural waters is greatly influenced by certain chemical species. Study the reactions below and fill in the missing blanks.

   a. $HCO_3^- \rightleftharpoons$ _____ $+ \quad H^+$

   b. _____ $+ \quad H^+ \rightleftharpoons \quad CO_2(aq) \quad + \quad H_2O$

   c. $CaCO_3(s) + CO_2(aq) + H_2O \rightleftharpoons Ca^{2+} +$ _____

   [6 marks]

5. If organic matter of biological origin is represented by the formula $\{CH_2O\}$ and the consumption of oxygen in water by the degradation of organic matter is expressed by the following biochemical reaction:

$$\{CH_2O\} + O_2 \rightarrow CO_2 + H_2O$$

Calculate the weight of organic matter required to consume 8.3 mg of O_2 in a litre of water in equilibrium with the atmosphere at 25°C using simple stoichiometric calculation (refer to page 3 for relevant data).

[8 marks]

6. When preparing soil samples for chemical analysis:
   (a) What is the maximum temperature for drying the soil and why?
   (b) What is maximum sieve size for sizing the soil samples and why?
   (c) What are the appropriate storage containers for storing prepared soil samples?

[6 marks]

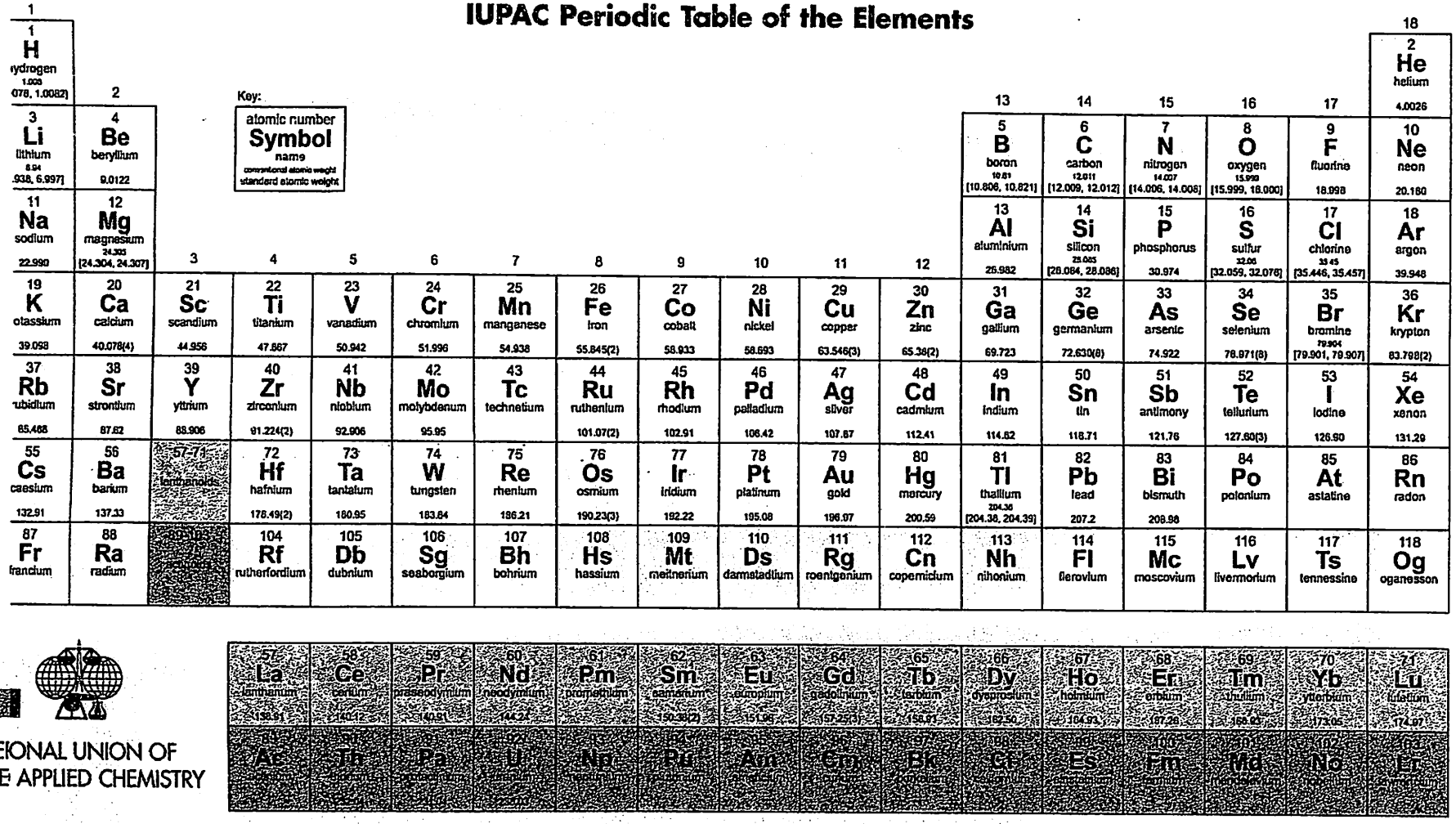
7. (a) State TWO reasons for carrying out plant analysis.
   (b) State the TWO types of tests carried out on plant samples.
   (c) What are the TWO acids used for organic digestion of plant samples?

[6 marks]

8. (a) Name TWO main categories of atmospheric pollution. [2 marks]
   (b) Name THREE common atmospheric pollutants. [3 marks]
   (c) What TWO common mineral acids constitute "acid rain"? [2 marks]
   (d) Name one manual and one instrumental air quality monitoring techniques. [2 marks]

(Total = 9 marks)

IUPAC Periodic Table of the Elements



INTERNATIONAL UNION OF PURE APPLIED CHEMISTRY

For notes and updates to this table, see www.iupac.org. This version is dated 28 November 2016.