

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

SECOND SEMESTER EXAMINATION

CH424 – ENVIRONMENTAL CHEMISTRY II

WEDNESDAY 2<sup>ND</sup> NOVEMBER 2022 – 12:50 PM

**TIME ALLOWED: 2 HOURS**

**INFORMATION FOR CANDIDATES: -**

1. You will have 10 minutes to read the question paper. **YOU MUST NOT BEGIN WRITING** in the answer book during this time.
2. The exam is divided in two sections. **ANSWER ALL QUESTIONS IN EACH SECTION.**
3. All answers **MUST** be written in the **SEPARATE ANSWER BOOKS** provided.
4. Calculators are permitted in the examination room. Lecture notes, notebooks plain papers and textbooks are **NOT ALLOWED.**
5. Show all workings and calculations in the answer books.
6. **DO NOT** over write.
7. **MOBILE PHONES ARE NOT ALLOWED.** Switch off the mobile phones and put them away.
8. Write your name and student ID number clearly on the front pages of each of the answer books and label them appropriately as; **SECTION A** and **SECTION B** respectively. **DO IT NOW.**
9. **MARKING SCHEME:**  
SECTION A: [25 MARKS]  
SECTION B: [25 MARKS]  
  
TOTAL = 50 MARKS.

## SECTION A

## ANSWER ALL QUESTIONS

1. (a) Define isotopes. [1 mark]
- (b) Differentiate between radioactive and radiogenic isotopes of elements. [2 marks]
- (c) Give at least THREE features of the nucleus of an atom and state why the nucleus is not of primary importance to Chemists. [4 marks]
- (d) Briefly, describe the TWO approaches of studying the nuclear stability. [2 marks]

(Total = 9 marks)

2. (a) Many nuclei are radioactive and undergo radioactive decay. Briefly, describe what happens during the decay process. [2 marks]
- (b) Define nuclear transformation and describe how this process is achieved using a particle accelerator such as a cyclotron. [3 marks]
- (c) Name the TWO stable nitrogen isotopes and state the processes that discriminate between the two. [3 marks]

(Total = 8 marks)

3. (a) Briefly, discuss the input, output and internal cycling of nitrogen in the marine environment. [3 marks]
- (b) Name THREE chemical forms of nitrogen that can be measured when studying the nitrogen cycle in marine environment. [1.5 marks]
- (c) With reference to Question 3 (b) above, what analytical method/s can you use to measure these THREE chemical forms of nitrogen? [1.5 marks]
- (d) Briefly, discuss how stable nitrogen isotope ratios are used in studying nitrogen cycling in the marine environment? [2 marks]

(Total = 8 marks)

## SECTION B

## ANSWER ALL QUESTIONS

4. (a) ISO 14001 (2015) is the International Standard used by mining companies to setup their Environment Management System. State its significance. [2 marks]

(b) Define a "Pollutant" with reference to the USEPA definition. [2 marks]

(c) Complete the sentence below by filling in the missing words.

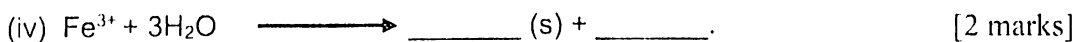
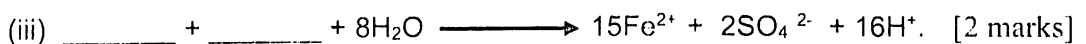
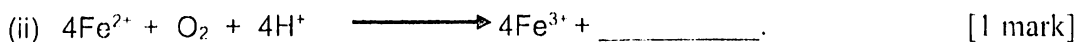
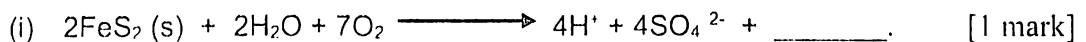
"A treaty comes into force as an attempt to end conflict or disagreement between a few countries whereas a convention is an attempt by many countries to discuss \_\_\_\_\_ and reach an agreement to be followed by signatories".

[1 mark]

(Total = 5 marks)

5. (a) List the FOUR sources of acid mine drainage (AMD). [2 marks]

(b) The overall AMD process involves microorganisms and consists of four reactions. Complete the reactions below and balance the equation/s as required.



(c) In your own words, describe the impact of acid mine waters to the natural environment and human health. [2 marks]

(d) Name any FOUR common impacts of Riverine Waste Disposal. [2 marks]

(Total = 12 marks)

6. (a) List TWO components of a Waste Management System and briefly explain one of them.
- (b) Describe the “reduce by design” approach to minimize waste.
- (c) List TWO characteristics of hazardous wastes.
- (d) State precisely the disadvantage of Developing Nations relating to the trade of Persistent Organic Pollutants (POPs).

(8 marks)