



UNIVERSITY OF RUHUNA
FACULTY OF FISHERIES AND MARINE SCIENCES & TECHNOLOGY

Academic Year 2022/2023

Bachelor of Science Honours in Marine and Freshwater Sciences Degree

Level III Semester I Examination - April/May 2024

OCG 3181: Marine Chemistry

Time: 1 hour

Answer only Two (2) questions.

100 marks

1.

- a. With relevant processes and examples, explain the equilibrium fractionation and kinetic fractionation of carbon isotopes. (20 marks)
- b. Describe the variability of the values of $\delta^{13}\text{C}$ of dissolved inorganic carbon ($\delta^{13}\text{C}_{\text{DIC}}$) from the surface to the bottom of the ocean explaining the relevant associated processes. (20 marks)
- c. Briefly explain how the values of $\delta^{13}\text{C}$ of particulate organic carbon ($\delta^{13}\text{C}_{\text{POC}}$) can be used to identify different sources of organic matter in the ocean. (10 marks)

2.

- a. Explain how nutrient trapping in the Benguela Upwelling System leads to the suboxic/anoxic shelf environments. (25 marks)
- b. Explain the processes causing non-standard nutrient ratios or non-standard Redfield ratios of C:N:P in the northern Benguela Upwelling System describing the low N:P and high C:N ratios in the water column. (25 marks)

3. Explain the variability of anthropogenic CO_2 content and the factors affecting them in the following water masses.

- a. North Atlantic Deep Water (NADW)
- b. Antarctic Intermediate Water (AAIW)
- c. Antarctic Bottom Water (AABW)
- d. Subtropical Atlantic surface water
- e. Near-surface waters of the North Pacific Ocean

(10 marks x 5: 50 marks)

4. Write short notes on the following.

- a. Raleigh fractionation
- b. ^{13}C Suess effect
- c. Effects of Dimethylsulfide (DMS) in the ocean-atmosphere system
- d. Applications of stable carbon isotopes in marine science
- e. Processes affecting the cycling of metal pollutants in estuaries and shelf seas

(10 marks x 5: 50 marks)

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OCG 31B

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