

CHEMISTRY 324

Class Examination

Wednesday, 15 July, 2009

Instructions: Section A: Answer **ALL** questions
Section B: Answer **ONE** question

Time allowed: 55 minutes

Total marks: 50

SECTION A – ANSWER *ALL* QUESTIONS

1. Briefly explain the role of control charting (such as the use of Shewhart Charts) in the quality system of a laboratory. (5 marks)
2. List 4 procedures which a commercial laboratory client can use to maximise their confidence in their sample results from the laboratory. Give a brief explanation of each procedure. (10 marks)
3. The $\delta^{13}\text{C}$ of these endangered native plants growing on the beach at Motunau Island, North Canterbury is c. -27% whereas the $\delta^{15}\text{N}$ of the same plant is c. $+16\%$. By discussing the basis of δ scales, briefly explain how isotopic enrichment results can give either positive or negative values. (5 marks)

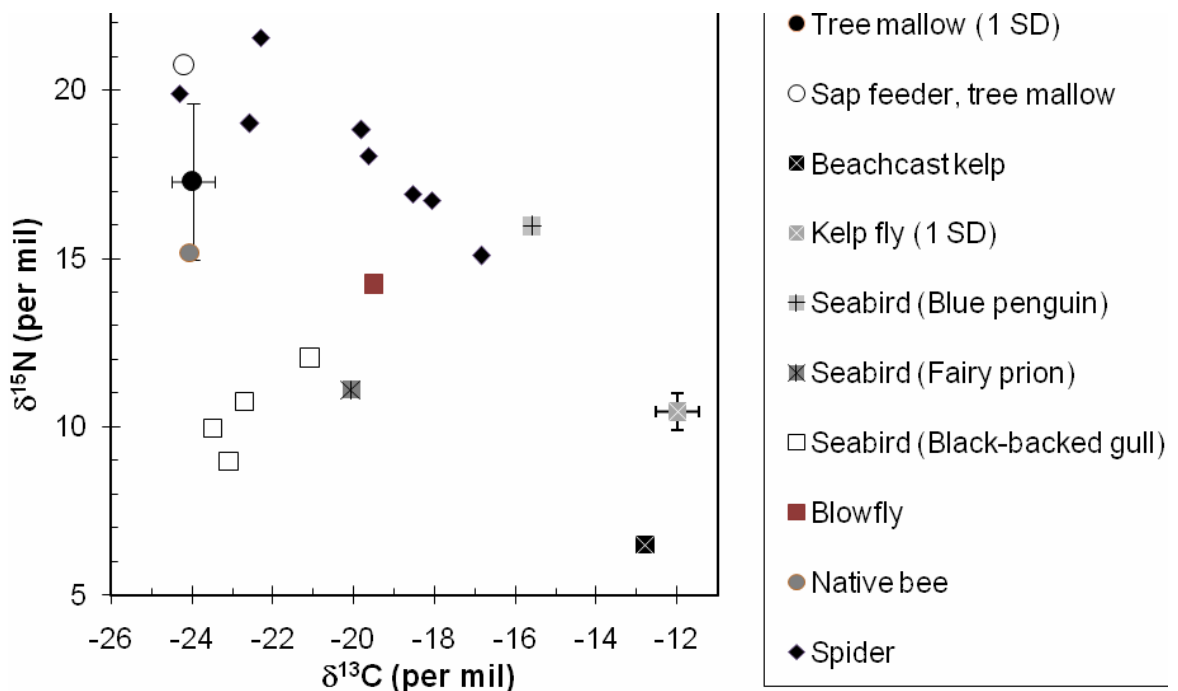


4. The following scatter plot gives the isotopic enrichment of various elements of the biota on Motunau Island. Use the following information to answer the questions below.

- Tree mallow is the most common plant on the island
- Spiders eat flying insects
- Sap feeders are flying insects that feed on tree mallow
- Beach-cast material is material thrown up on the island's beach by the sea
- Dead seabirds are commonly found on the beach
- Blowflies feed on dead seabirds; kelp flies feed on beach-cast seaweed ("kelp")
- Carbon travels through food webs with little fractionation between ^{13}C and ^{12}C

(a) Evaluate the uptake of marine vs terrestrial carbon by spiders. (10 marks)

(b) Decide which species of dead seabird is providing the most marine carbon to blowflies, and justify your choice. (5 marks)



5. Give the name and chemical formula of the predominant Fe(II) mineral in acid sulphate soils. (1 mark)
6. Briefly explain how estimates of atmospheric CO₂ concentrations obtained from ice cores have been validated. (2 marks)
7. Briefly explain why plant-reactive N (N_r) is presently accumulating in the environment. (2 marks)

SECTION B

ANSWER *ONE* QUESTION FROM THIS SECTION

8. In soils subject to deposition of animal fecal material, values for $\delta^{15}\text{N}$ tend to be much higher than those of the original fecal material. Explain this observation, referring to the relative volatility of $^{14}\text{NH}_3$ and $^{15}\text{NH}_3$, the solubility of nitrate, and the affinity of nitrate for solid surfaces. You should note that the product of most chemical reactions is isotopically lighter than the substrate. (10 marks)
9. Explain why increasing atmospheric $p\text{CO}_2$ has major ecological consequences for the oceans. (10 marks)

END OF PAPER