

Ollscoil na hÉireann, Gaillimh
THE NATIONAL UNIVERSITY OF IRELAND, GALWAY

SUMMER EXAMINATIONS, 2000

FIRST MARINE SCIENCE EXAMINATION

CHEMISTRY C P102

Professor R.C.F. Jones
Professor R.N. Butler
Dr. A.V. Savage

Time allowed: Two hours

Answer *four* questions, one from each section.

All questions carry equal marks.

Section A

1.

(a) Write balanced chemical equations for the following reactions:

- (i) hydrochloric acid with sodium hydroxide
- (ii) hydrochloric acid with aluminium hydroxide
- (iii) hydrochloric acid with sodium carbonate
- (iv) hydrochloric acid with calcium carbonate

(b) When 16.0 g of marble chips (calcium carbonate) are treated with 50.0 cm³ of HCl (density 1.096 gcm⁻³), the marble dissolves, giving a solution and releasing carbon dioxide gas. The solution weighs 66.4g. How many litres of carbon dioxide gas are released? The density of the gas is 1.798 gdm⁻³.

2.

- (a) Draw a heating curve for gases, liquids and solids and compare their properties.
- (b) Predict the osmotic pressure, π , of a solution of 35 g sugar, C₁₂H₂₂O₁₁ in 1 dm³ solution.

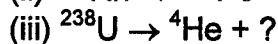
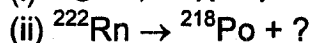
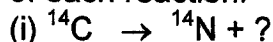
Section B

3. Answer (a) *or* (b)

(a)

- (i) Define, giving examples, the terms (i) isotope, (ii) mass number, (iv) relative atomic mass. Explain why relative atomic mass is usually not a whole number.
- (ii) Describe the main features of the Bohr model of the atom. Use this model to describe the arrangement of electrons in an atom of (i) sodium, (ii) copper, (iii) fluorine and (iv) argon. Discuss how the arrangement of electrons contributes to chemical and physical properties in each case.

- (b) Complete the following nuclear equations and write notes on the significance of each reaction:



4.

- (a) Define each of following giving examples: (i) strong acid, (ii) weak acid, (iii) strong base, (iv) weak base.
- (b) Calculate the pH of a solution made by mixing 20 cm^3 $0.1\text{M H}_2\text{SO}_4$ with 30 cm^3 0.2M NaOH .

Section C

5. Discuss *three* of the following:

- (i) the photochemical chlorination of methane
- (ii) the addition of HBr to propene
- (iii) the structure of benzene
- (iv) the formation of a soap
- (v) the structure of any amino acid

6. The acid-catalysed addition of water to compound **A** C_3H_6 gave compound **B** $\text{C}_3\text{H}_8\text{O}$ which in turn was oxidised to give compound **C** $\text{C}_3\text{H}_6\text{O}$.

- (i) Give structures and names for compounds **A**, **B** and **C**.
- (ii) Comment briefly on the structure of each compound.
- (iii) Suggest a reagent for the step **B** to **C**.
- (iv) Discuss any reaction which compound **C** might undergo.

Section D

7.

- (a) Discuss the main dissolved constituents of sea water.
- (b) Outline how magnesium metal is recovered from sea water.

8. Discuss the chemistry of *two* of the following:

- (i) Acid rain
- (ii) Ozone in the ozonosphere and in smog
- (iii) The greenhouse effect