THE COLLEGE OF THE BAHAMAS
SCHOOL OF NATURAL SCIENCES & ENVIRONMENTAL STUDIES
CHEMISTRY DEPARTMENT

CHEM 115 – INTRODUCTORY CHEMISTRY

COURSE OUTLINE

1. ORGANIC CHEMISTRY (2½ wks)

Definition. Unique properties of carbon. Classification of hydrocarbons. Homologous series. Alkanes, alkenes and alkynes. Alcohols and acids. Systematic nomenclature of simple hydrocarbons. Isomerism (chain and positional only). Reactions of alkanes: - combustion, addition reactions with Cl_2, Br_2, H_2O, HX (Markovnikoff's Rule). Addition polymerization. Chemistry of alcohols: - preparation by fermentation or hydration, dehydration, esterfication, oxidation to acids. Acids: - formation from alcohols, esterfication. Throughout the topic, equations will be introduced wherever appropriate.

2. THE MOLE (2½ wks.)

The mole concept. Avogadro's constant. Relative atomic and molecular masses. Molar mass. Molar concentrations of solutions. Molar volume of gases. Percentage composition, empirical and molecular formulae (not calculation thereof). Simple stoichiometric calculations involving balanced equations.

3. THE PERIODIC TABLE (1 wk.)

Revision of the periodic Classification of elements by their properties, and properties of metals and non-metals, all related to electronic configuration. Electropositivity and electronegativity in qualitative terms. Trends and patterns in physical and chemical properties of the elements and their compounds:

a) across the first three periods, with reference to physical state, m.p. and b.p., conductivity, type of bonding, properties of simple binary compounds e.g. chlorides and oxides.

b) down the groups, as exemplified by Groups 1 and 7, with reference to physical state, m.p., b.p., chemical reactivity (with illustrative reactions and equations). Latter related to atomic size and ease of formation of ions, without formal definition of ionization energy or electron affinity.

4. ELEMENTARY QUALITATIVE ANALYSIS (½ wk)

Brief review of flame tests, effects of heat on substances, and tests for gases, as a background to laboratory work. Equations for the reactions involved.

5. REACTIVITY SERIES (1 wk.)

The reactivity series for the metals K, Na, Ca, Mg, Al, Zn, Fe, Pb, Cu, Hg, Ag and Au, including full and/or net ionic equations with state symbols where appropriate, as illustrated by :

a) their reactions with air , water, acids, and displacement reactions.

b) the relative thermal stabilities of their oxides, hydroxides, nitrates and carbonates.

Relationship between the reactivity series and the discovery of metal and methods of extraction from their ores.

6. CHEMICAL KINETICS AND EQUILIBRIA (2 wks.)

Definition and measurement of reaction rate. Basic interpretation of simple rate curves. Factors affecting reaction rates (concentration/pressure, temperature, light, surface area, catalysts). Simple explanation using collision theory and activation energy. Energy changes in reactions related to bond making and breaking. Energy level/progress of reaction graphs. Reversible reactions and dynamic equilibria. Effect of changes of concentration, pressure, temperature on positive of equilibrium explained using Le Chatelier's Principle. Effect of catalysts on reversible reactions.

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7. ELECTROCHEMISTRY AND REDOX (2½ wks.)

The action of electricity on matter - solids, liquids and aqueous solutions. Conductors and non-conductors, electrolytes and non-electrolytes. Electrolysis related to movement and discharge of ions. Weak and strong electrolytes. Electrolysis of molten salts and of aqueous solutions. Ionic half-equations for the electrode reactions. Factors affecting ions discharged :

i) ease of discharge ; discharge series for anions and for cations (related to electrochemical series)
ii) relative concentration of competing ions
iii) nature of the electrode

Applications of the electrolysis : extraction from raw materials, purification of metals, electroplating, anodizing. Oxidation and reduction defined in terms of gain or loss of oxygen or hydrogen, and in terms of gain or loss of electrons. Oxidizing and reducing agents. Oxidation and reduction applied to electrode reactions in electrolysis.

LABORATORY WORK

The laboratory work translates the theoretical principles met in the lecture course into practical laboratory situations. Laboratory handbooks/manuals will be issued.

1. An Investigation of the Alkanes
2. An Investigation of the Properties of Some Alcohols, Carboxylic Acids and Esters
3. A Study of Some Group 2 Elements
4. Flame Tests
5. Heating Substances, Making Observations and Testing for Gases.
6. An Investigation of the Effect of Concentration of Reaction Rates
8. An Investigation of the Effect of Temperature on Reaction Rates.
9. An Investigation of Some Other Factors Influencing Reaction Rates.
10. Reversible Reactions and Equilibria.
11. An Investigation of the Conduction of Electricity by Aqueous Solutions and Liquid Compounds.

EVALUATION

Tests and assignments	20%
Mid-Term test	15%
Laboratory work	15%
Final Examination	50%

TEXTBOOK

Lewis, M. & Waller, G. Thinking Chemistry
GCSE Ed. Oxford University Press, 1986. ISBN 0-19-914257-2

READING LIST

Cohen, P.S. & Rothman, M.A. Basic Chemistry
1st Ed. Allyn and Bacon Inc., 1986. ISBN 0-205-08516-4

Daube, G.W. & Seese, W.S., Basic Chemistry
Alternate Ed. Prentice Hall, 1992. ISBN 0-13-059452-0

Dickson, T.R. Introduction to Chemistry
5th Ed. Wiley, 1987. ISBN 0-471-84675-9

Malone, L.J. Basic Concepts of Chemistry
3rd Ed. Wiley, 1989. ISBN 0-471-84930-8