Science Foundation Course Learning Outcomes (19 - 20)

On successful completion of the course, students will be able to:

- Use ideas about chemical and biological building blocks and apply these concepts to explaining phenomena occurring within biological systems.

UNIT 1: Chemistry 1

1. Constituents of Matter

a) Defining the three states of matter (solids liquids and gases) and identifying their unique properties.
b) Understanding the physical changes that occur during transitions between states of matter
c) Definition of homogenous and heterogenous mixtures as distinguished from compounds and description of techniques to separate mixtures
d) Description of elements and compounds, atoms and molecules and their relationship to one another

2. Features of atomic structure:

a) Sub-atomic particles- protons, neutrons and electrons
b) Ions
c) Isotopes
d) Mass Number
e) Atomic Number
f) Relative Atomic Mass

3. Periodic table

a) Understanding the patterns of arrangement of elements into groups and periods
b) Patterns of reactivity within groups
c) Valency within groups
d) Electronic configuration and across periods
e) Atom size within groups and periods

4. Compound Formation

a) Understanding and explaining the role of the outer shell electron in chemical bonding and intramolecular forces:
b) Features of ionic Bonding- metal and non-metals; full transfer of electrons
c) Features of covalent bonding- two non-metals; sharing of electrons
d) Representing chemical reactions through writing word and balanced symbol equations
e)

5. System International

a) SI units of measurement
b) Scientific Notation
c) Order of Magnitude
d) SI units

UNIT 2: Chemistry 2

1. Intramolecular and Intermolecular Forces

a) Dative Bonding- electron pair contributed by one atom and shared by two
b) Dispersion forces/Hydrophobic forces
c) Dipole-dipole interactions
d) Hydrogen bonding

2. Acids and Alkalis

a) Definition of acids as proton donors and alkalis and proton acceptors and hydroxide group releasers
b) Testing for acids using Indicators
c) Measuring acidity and alkalinity using pH
d) Neutralisation

3. Introduction to Oxidation and Reduction

a) Definition of oxidation as loss of electrons and reduction as gain of electrons (redox reactions)
b) Explanation of the differences between an oxidising and reducing agents
c) Biological examples of redox reactions
d) Understanding oxidation numbers

4. Organic Chemistry and Functional Groups

a) The structure of Hydrocarbons
b) Alkanes, Alkenes and Alkynes
c) Alkyl Groups
d) Recognition of functional groups- Alcohols, Ethers & Carbonyl, Carboxylic Acids, Esters & Nitrogen-Based Groups, Amides, Thiols & Aromatic Compounds
e) Aromatic Compounds
f) Isomers - Structural and Stereoisomers (enantiomers- background info only)

UNIT 3: Biology and Biochemistry 1

1. Introduction to Amino Acids and Proteins

a) Role of protein within the body
b) Composition and generalised structure of amino acid
c) Essential and Non-essential Amino acids
d) Primary, Secondary, Tertiary and Quaternary structure of proteins

2. Enzymes and Catalysts

a) Role in lowering activation for increasing reaction rate
b) Effect of temperature and pH on enzymatic function
c) Enzyme Action: active site, substrate, co-enzymes, co-factors, inhibitors

3. Introduction to Carbohydrates

a) Composition of carbohydrates
b) Classification of carbohydrates
c) Monosaccharides, Disaccharides and Polysaccharides
d) Aldoses, Ketose, Hexoses and Trioses
e) Ring formation vs linear formation
f) Presence of carbohydrates within biological systems

4. Introduction to Lipids

a) Composition of lipids
b) Classification of lipids
c) Cis /Trans fats
d) Essential fatty acids
e) Simple / Complex lipids
f) Trans fatty acids and their implication to health

5. Cell Structure

a) Structure of Animals and Plant (eukaryotic cells) and prokaryotic cells
b) Organelles, cell wall, nucleus, mitochondria, golgi apparatus, endoplasmic reticulum, ribosomes, lysosomes, chloroplasts, cilia
c) Tissues and Organs

6. The Plasma Membrane and transport across it

a) The structure of the plasma membrane
b) Diffusion
c) Osmosis
d) Facilitated Diffusion
e) Active transport
f) Endocytosis and Exocytosis

7. Introduction to Nucleic Acids

a) Composition of nucleic acids- DNA, RNA, mRNA, tRNA
b) Role of nucleic acids
c) DNA replication
d) Transcription and Translation
e) Purpose of Mitosis/Meiosis and outline the stages within these

UNIT 4: Biology and Biochemistry 2

1. Introduction to Respiration

a) Respiration equation: $C_6H_6O_6 + 6O \longrightarrow CO_2 + H_2O + 32ATP$
b) Stages within respiration; Glycolysis, Link Reaction, Kreb's Cycle and Oxidative Phosphorylation
c) Alcohol metabolism

2. Chemistry of Supplements

a) Definition
b) Elemental Composition of vitamins and minerals
c) Supplement examples and labelling

3. Oxygen and Carbon Dioxide Transport

a) The transport of Oxygen in the body
b) The transport of Carbon Dioxide
c) The role of Haemoglobin as a buffer to maintain blood pH within a narrow range

4. Chemical Reactions and The Introduction to Free Radicals

a) Movement of electrons
b) Bond breaking
c) Reaction mechanisms
d) Homolytic vs Heterolytic cleavage
e) Understanding that free radicals form as a result of homolytic bond cleavage
f) Naming of some free radicals
g) Describing the key stages of free radical formation- Initiation, Propagation and Termination
h) Explanation how antioxidants inhibit propagation