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CNELM

CHEMISTRY (Level 3) Bioscience Entry Course

Aims:

This course is designed to enable students to gain access to Higher Education (HE) qualifications postgraduate 'MSc/PGdip Personalised Nutrition' programmes which CNELM offer in collaboration with Middlesex University (MU). It can also be studied to gain access to other health science courses across the UK and abroad, subject to the university or training provider accepting it as entry to their programme.

The course assumes no prior knowledge of the subject and will take you from basic chemistry to the more advanced aspects of organic chemistry.

Unit 1 – Introduction to Chemistry

By the end of this unit you will be able to understand:

- State the atomic hypothesis.
- Name the sub-atomic particles that make up an atom.
- Name the physical force that is at work in chemistry and explain how it holds atoms together.
- Explain how the number of protons and neutrons in the nucleus determine an atom's weight and position on the periodic table.
- Describe kinetic energy and collision theory and explain their role in chemistry.
- Describe how Biochemistry underpins Nutrition, Organic Chemistry underpins Biochemistry and Inorganic Chemistry underpins Organic Chemistry.
- Name some major classes of biomolecules.
- Define the difference between: an element and a species; an atom and a molecule.
- Explain why terminology and concepts in chemistry are often anachronistic.

Unit 2 – Atoms in Detail

By the end of this unit you will be able to understand:

- Explain that the electromagnetic force holds electrons in place around the nucleus in orbitals that fall into levels and sub-levels.
- Name and identify the different types of electron shells and sub-shells and state the maximum number of electrons in any given shell or subshell.
- Explain how the number of protons and the number of shells determines electronegativity, and how this determines the number of electrons an atom can hold on to.
- Explain why the charge of an atom changes as it gains and loses electrons, and when its net charge is zero.
- Use diagrams to draw out the structure of atoms in different oxidation states.
- Explain how the electronic structure of an element determines its location on the periodic table.
- Use the position of an element of the periodic table to draw out a diagram of its electron configuration.

Unit 3 – Bonding: Interactions Between Atoms

By the end of this unit you will be able to understand:

- Explain why the electromagnetic force means that electrons can move between atoms.
- Explain why this movement results in intramolecular bonds.
- Explain the similarities and differences between ionic and covalent bonding.
- Describe metal-like behaviour and non-metal-like behaviour.
- Define the concept of oxidation state in covalently bonded molecules.
- Use the concept of multiple oxidation states to explain why elements can sometimes behave like metals and sometimes like non-metals.
- Name simple ionic and covalent compounds
- Draw diagrams for simple Ionic compounds and work their formulas given their names using these diagrams
- Draw dot and cross diagrams and Lewis diagrams for simple covalent compounds given their chemical formula.
- Explain the similarity between the concept of oxidation state and the older concept of valency.

Unit 4 – Intermolecular Forces and the States of Matter

By the end of this unit you will be able to understand:

- Explain how the difference in electronegativity between atoms in a compound creates an uneven distribution of charge.
- Explain how the uneven distribution of charge in a compound results in permanent dipoles that allow it to form solids and liquids.
- Explain how the strength of a dipole, together with pressure and gravity, determine the melting and boiling points.
- Describe the different classes of intermolecular bond and explain how they result from the difference in electronegativities between the constituent atoms.
- Explain how Van der Walls intermolecular forces allow non-polar molecules to form solids and liquids.
- Describe the dissociation of polar molecules in a polar solvent (like water) and explain how this allows them to dissolve into the solvent.
- Describe when covalent molecules dissolve in water.

Unit 5 – Describing Chemical Reactions using Chemical Equations

By the end of this unit you will be able to understand:

- Write out the simple chemical formula for simple ionic and covalent compounds.
- Explain why we use chemical formula, and the meaning of the subscript notation.
- Translate simple word questions into unbalanced equations.
- Use a simple procedure to balance simple chemical equations.
- Draw diagrammatic representations of unbalanced and balanced equations.
- Explain the purpose of balanced equations.

Unit 6 – Moles: Scaling up Chemical Equations for Practical Chemistry

By the end of this unit you will be able to understand:

- Determine the molar mass of compounds.
- Perform basic gram- mole conversion problems.
- Use balanced chemical equations to determine the relationship between quantities of reactants and products.
- Calculate the molarity of a solution.
- Explain the difference between acids, alkalis and bases.
- Explain the process of neutralisation.

- Explain the difference between strength and concentration for acids and alkalis.
- Describe what the pH scale measures.
- Apply to the principles of collision theory to understand how changing temperature, volume, pressure and surface area can affect the rate of a reaction.
- Classify the type of a simple chemical reaction from its equation and other sources: for example, determine if a reaction is a neutralisation reaction.

Unit 7 – The Structure of Organic Molecules Part 1

By the end of this unit you will be able to understand:

- Draw skeletal diagrams of covalently bonded organic molecules.
- Determine the constituent atoms of a molecule from its skeletal diagram.
- Draw a skeletal diagram from a structural formula and determine a structural formula from a skeletal diagram.
- Draw the structural formula and skeletal diagram of an alkane and alkene given its name.
- Explain when two molecules are structural isomers.
- Name the structural isomers of Alkanes.
- Differentiate between cis and trans forms of an unsaturated molecule.
- Differentiate between different stereo-isomers of the same molecule.

Unit 8 – The Structure of Organic Molecules Part 2

By the end of this unit you will be able to understand :

- Define the concept of a homologous series.
- Identify and name alcohols, aldehydes and ketones, esters, carboxylic acids, amines, amides and aromatic compounds based on their skeletal diagrams or structural formulas.
- Draw skeletal diagrams or write out the structural formulas of name alcohols, aldehydes and ketones, esters, carboxylic acids, amines, amides and aromatic compounds based on their names.
- Name and draw the skeletal diagrams the positional isomers of alcohols, aldehydes and ketones, esters, carboxylic acids, amines, amides and aromatic compounds.
- Describe the structure of natural polymers: i.e. proteins fats and carbohydrates.
- Explain how phospholipids form cell membranes.

Unit 9 – Reactions in Organic Chemistry and Biochemistry

By the end of this unit you will be able to understand:

- Define a free-radical
- Explain the difference between homolytic and heterolytic fission.
- Define nucleophiles and electrophiles.
- Understand the process of electrophilic addition and nucleophilic substitution.
- Describe the formation of alcohols, esters, haloalkanes, ketones, aldehydes and carboxylic acids.
- Explain how enzymes affect the reaction rates of biochemical equations.