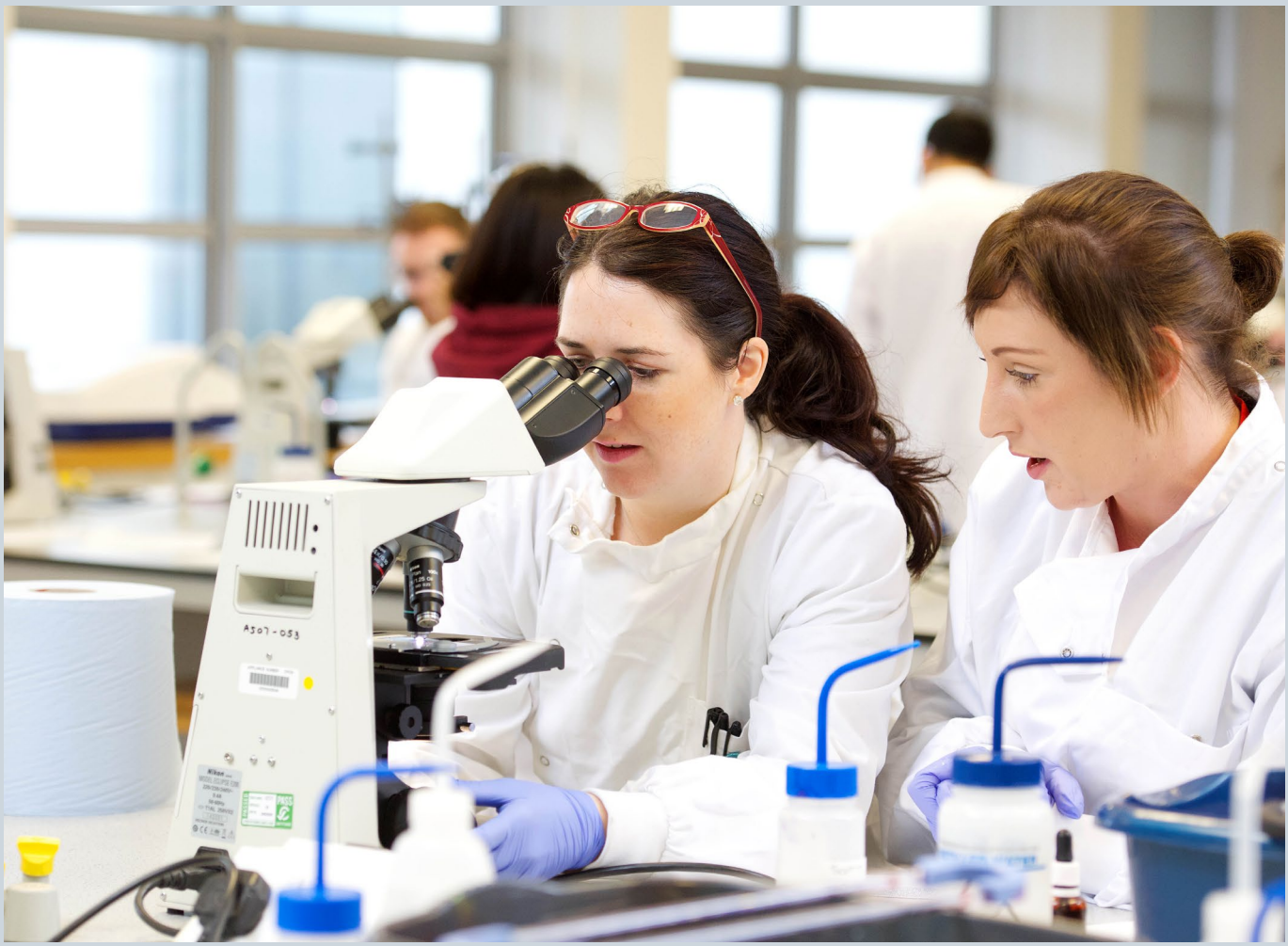
Programme
Guide

# Undergraduate Foundation Programme
# Life Sciences



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# Programme Details

## Who is this programme designed for?

This programme is designed to prepare international students, who have completed senior secondary education, for entry to undergraduate studies at the top universities across the UK.

The Undergraduate Foundation Programme (UFP) is set at level 3.

## How long will I study for?

This programme lasts one academic year (nine months). The year is divided into three terms of approximately 10 weeks. On average, you will undertake between 16 and (up to) 22 hours of classroom-based study per week.

At **ON**CAMPUS Loughborough students study a two semester programme that lasts one academic year [nine months]. Each semester includes, on average, 13 teaching weeks, one reading week and one assessment week. If English Language level is below the requirements for the 2 semester option, students will take an additional term of English Language study before starting this programme. On average, students will undertake 21 (and up to 25) hours of classroom-based study per week.

Please note: Minimum and maximum hours are estimated, hours may vary depending on the student's academic and English level and may be adjusted throughout their course.

English Language forms up to six hours of your timetable, is compulsory for students who are below the required level for progression, and will be integrated into the teaching of academic subjects as well as being taught separately if you need additional support. Students who are at or above the required English level for progression are likely to follow a reduced timetable.

You will be expected to timetable self-study hours in addition to the classroom-based hours.

## What will I study?

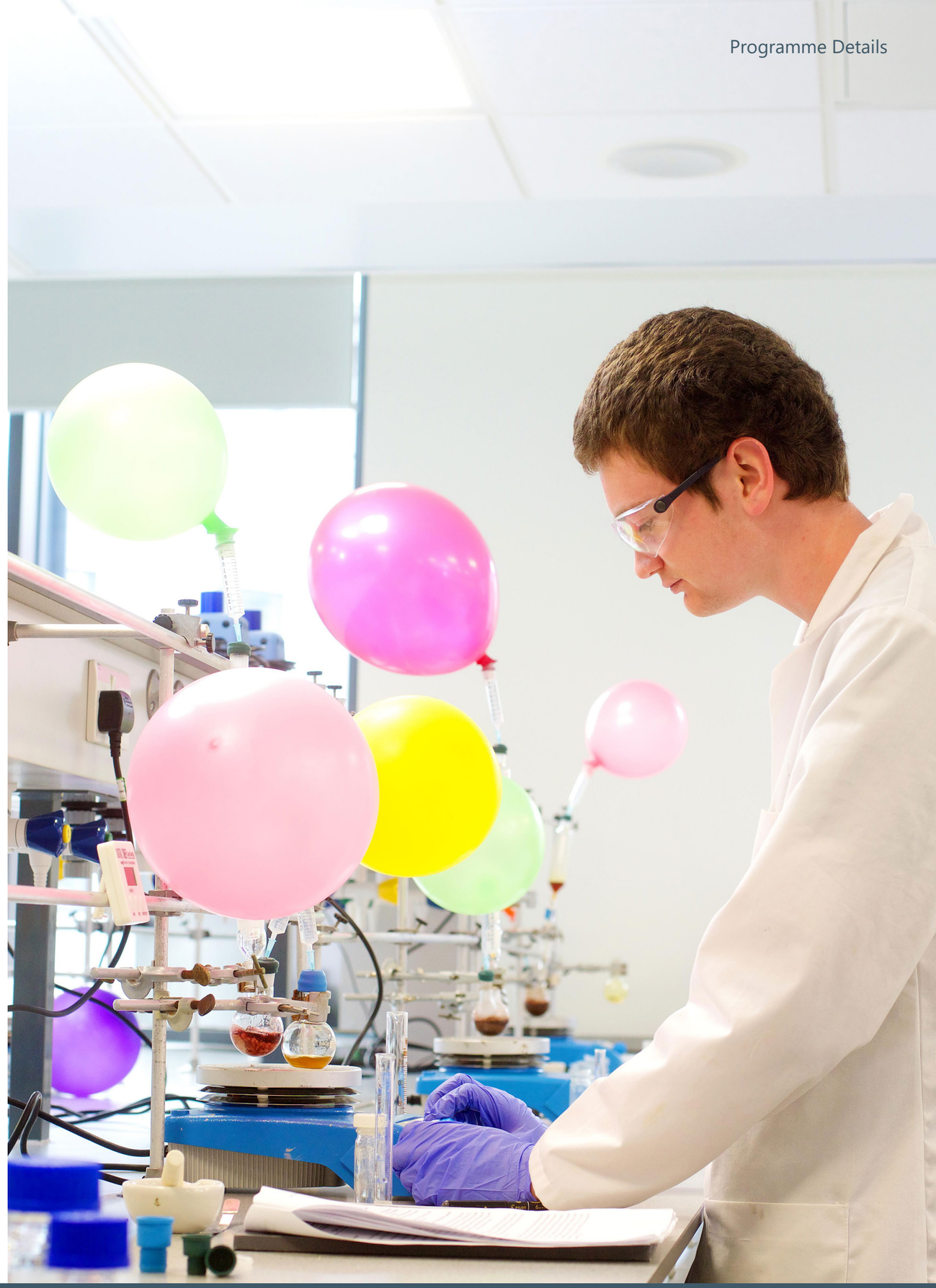
This programme includes English and three academic subject modules. English will be integrated into the teaching of academic subjects, as well as being taught separately if you need additional support to develop your English language.

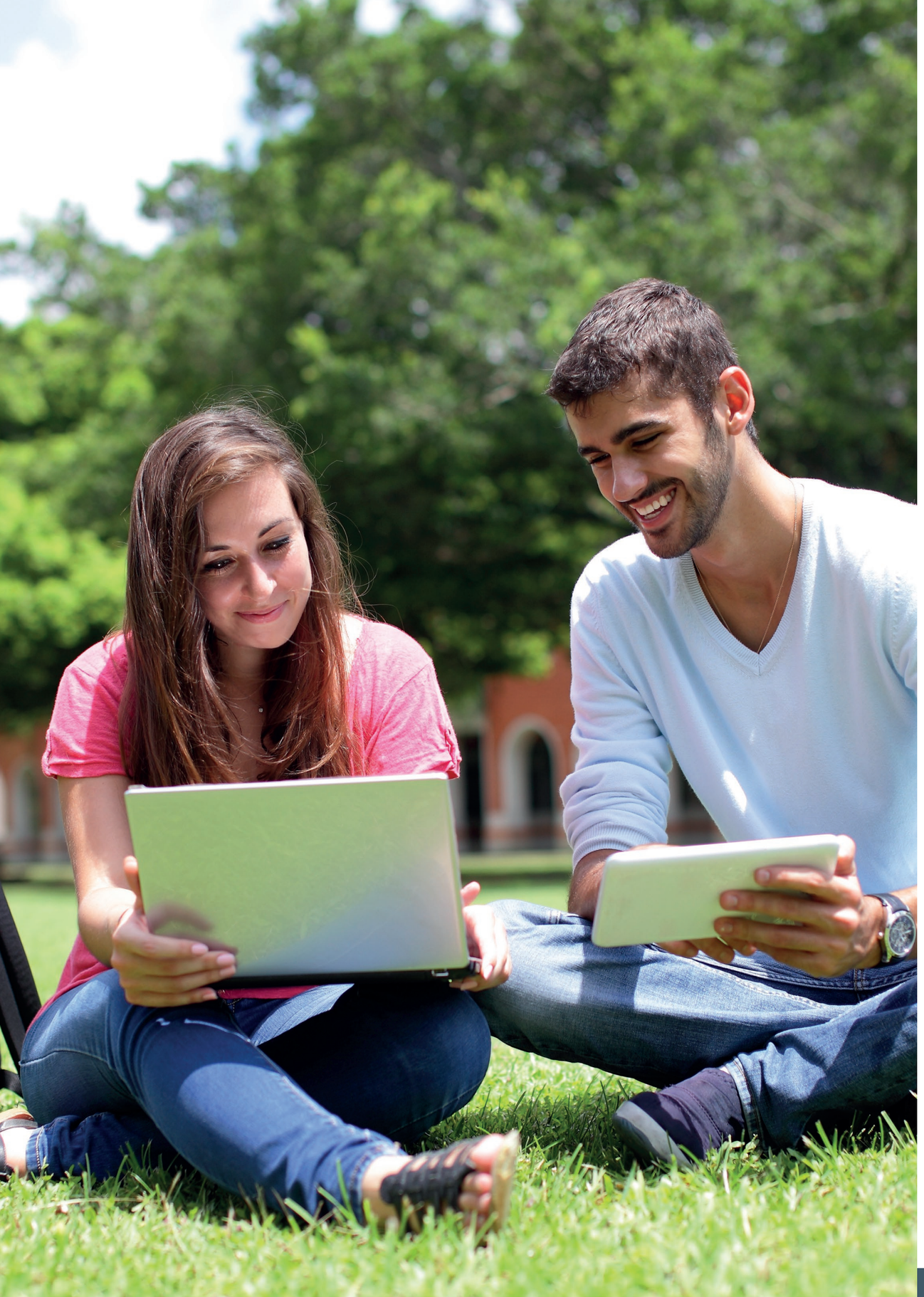
## How will I be assessed?

You will be assessed at regular intervals throughout the programme to ensure you are making the progress required to successfully complete the programme.

Final assessments for each module will be spread across the academic year.

Assessment methodologies are aligned to those that will be experienced in the University environment, and include project work, essays, presentations and unseen examinations.





# Modules

Modules taught on the ONCAMPUS Life Sciences pathway are as shown in the table below. All students will have English incorporated into their study plan.

| Centre | Biology for Life Sciences | Chemistry for Life Sciences | Skills for Science |
|---|---|---|---|
| ONCAMPUS LOUGHBOROUGH | ✔ | ✔ | ✔ |
| ONCAMPUS LONDON | ✔ | ✔ | ✔ |
| ONCAMPUS UK NORTH | ✔ | ✔ | ✔ |
| ONCAMPUS SOUTHAMPTON | ✔ | ✔ | ✔ |
| ONCAMPUS ASTON | ✔ | ✔ | ✔ |
| ONCAMPUS SUNDERLAND | ✔ | ✔ | ✔ |

# Chemistry for Life Sciences Module

Studying the different aspects of chemistry enables you to comprehend the combinations of physical, inorganic and organic principles. Practical work aims to complement theory and develop your observational, analytical and skills required for future scientific study.

The aim of the module is to enable you to develop your and comprehension of physical, inorganic and organic principles. You will gain experience of safe working practice in a laboratory setting and confidence in interpreting experimental data and observations. It gives you the opportunity to apply your knowledge to real life contexts and prepare you for future undergraduate studies within the subject area.

## Key Topics

### 01 Atoms and the Periodic table

1. Explain how and why elements are generally arranged on the Periodic Table
2. Name the family of elements in groups 1, 2, 7 and 8
3. Describe the difference between metals and non-metals
4. Describe the structure of atoms in terms of protons, neutrons and electrons
5. Describe the relative mass and relative charge of protons, neutrons and electrons
6. Draw Bohr's simple model of an atom for elements with atomic numbers 1-20
7. Define atomic number, mass number, isotopes, relative atomic mass, relative molecular mass'
8. Calculate number of protons, electrons, neutrons in an atom, isotope or ion
9. Calculate mass number of an element

### 02 Electrons in Shells

1. Describe and explain the trends and properties (chemical and physical) of elements in the same group or period (radii across a period, first ionisation energies, melting point, including groups 1, 2 and 7 and period 3)
2. Write balanced equations for reactions of group 1 with water, oxygen and halogens
3. Write balanced equations for reactions of group 2 metals with oxygen, chlorine and water, group 2 oxides and hydroxides with water and acids
4. Write balanced chemical equations for reactions of group 7 halogens with groups 1 and 2
5. Write electron configurations in terms of sub shell notation
6. Show how electrons fill sub shell orbitals
7. Classify an element as an s, p,d or f block element using its electron structure
8. Define Ionisation and Successive Ionisation Energies
9. Explain how ionisation energy data provides evidence for electron structure

### 03 Relative Atomic & Molecular Masses

1. Describe and explain the difference between empirical and molecular formulae
2. Complete calculations to find empirical formula from data giving composition by mass or percentage by mass
3. Deduce molecular formula from empirical formula and relative molecular mass
4. Define Avogadros constant
5. Complete calculations using the Avogadro constant
6. Calculate and write balanced equations
7. Calculate and write ionic equations
8. Demonstrate graphically how supply curves shift
9. Complete calculations involving moles
10. Complete calculations using mass, concentration, volume and amount of substance in a solution/ gases
11. Use and transpose the ideal gas equation pV = nRT with the variables in SI units

### 04 Bonding; Ionic, Covalent, Metallic

1. Ionic bonding
2. Define an ionic bond
3. Describe the structure of ionic compounds
4. Draw dot and cross diagrams to represent ionic bond formation.
5. Explain the properties of ionic compounds
6. Predict the formula of simple ions based on the position of the element in the Periodic Table and knowledge of common compound ions
7. Write the formula of ionic compounds
8. Covalent bonding Define a covalent bond
9. Describe the nature of covalent bonds
10. Draw annotated diagrams to represent covalent bond formation
11. Describe the structure of molecular substances
12. Explain the properties of molecular substances
13. Metallic bonding - Describe the nature of metallic bonding
14. Describe the structure of metals
15. Explain the properties of metals
16. Analysing types of bonds - Compare and contrast metallic, ionic and covalent bonding

# 05

## Bond Polarity and Intermolecular Forces

1. Define the concept of electronegativity
2. Predict and explain the trend in electronegativity down groups and across periods
3. Describe why some covalent bonds are polar and deduce whether a bond is polar
4. Explain why some molecules are polar and deduce whether a molecule has a permanent dipole
5. Describe intermolecular forces, van der walls forces, dipole- dipole forces and hydrogen bonding
6. Explain how each of the intermolecular forces arise
7. Explain how the melting points are influenced by these intermolecular forces
8. Explain trends in the relative strength of the three types of force
9. Explain the anomalous nature of ice and how its low density can be explained through a
10. Knowledge of hydrogen bonding

# 06

## Molecular shapes

1. Use VSEPR theory to deduce, name and sketch the shape of molecules and ions with up to six electron pairs surrounding the central atom, including bond angles
2. Explain using VSEPR theory (Valence Shell Electron Pair Repulsion Theory) why molecules and ions have the shapes that they do, including the effect on the bond angles of the great repulsion by lone (non-bonding) pairs

# 07

## Redox

1. Define oxidation, reduction, oxidising agent and reducing agent in terms of electron transfer
2. Recall the oxidation state of an element is zero
3. Determine oxidation states of each element in substances and ions
4. Write redox half equations
5. Combine redox half equations to produce full equations
6. Identify reduction and oxidation processes
7. Identify strong and weak oxidising agents
8. Identify strong and weak reducing agents
9. Define a spectator ion

# 08

## Rate of Reactions

1. Explain Collision Theory
2. Describe activation energy
3. Interpret energy profile diagrams
4. Explain that reactions can only take place when particles collide with energy greater than or equal to the activation energy
5. Perform calculations for reactions involving percentage yields and atom economies
6. Describe economic, ethical and environmental advantages for society and industry of processes with a high atom economy

# 09

## Factors Affecting Rates

1. Describe and explain how factors affect rates of reaction
2. Define a Catalyst
3. Explain how and why a catalyst affects the rate of reactions
4. Sketch and interpret Maxwell–Boltzmann distribution curves - at different temperatures, pressures, number of particles and with/ without catalysts
5. Describe Homogeneous and Heterogeneous catalysts

# 10

## Rates and the Arrhenius equation

1. Calculate the initial rate of a reaction from graphs
2. -Define the rate constant (k) as a number that links the rate of reaction to the concentration of reactants
3. Define the components of the Arrhenius equation
4. Describe how the rate constant changes with temperature and activation energy
5. Perform calculations using the Arrhenius equation

# 11

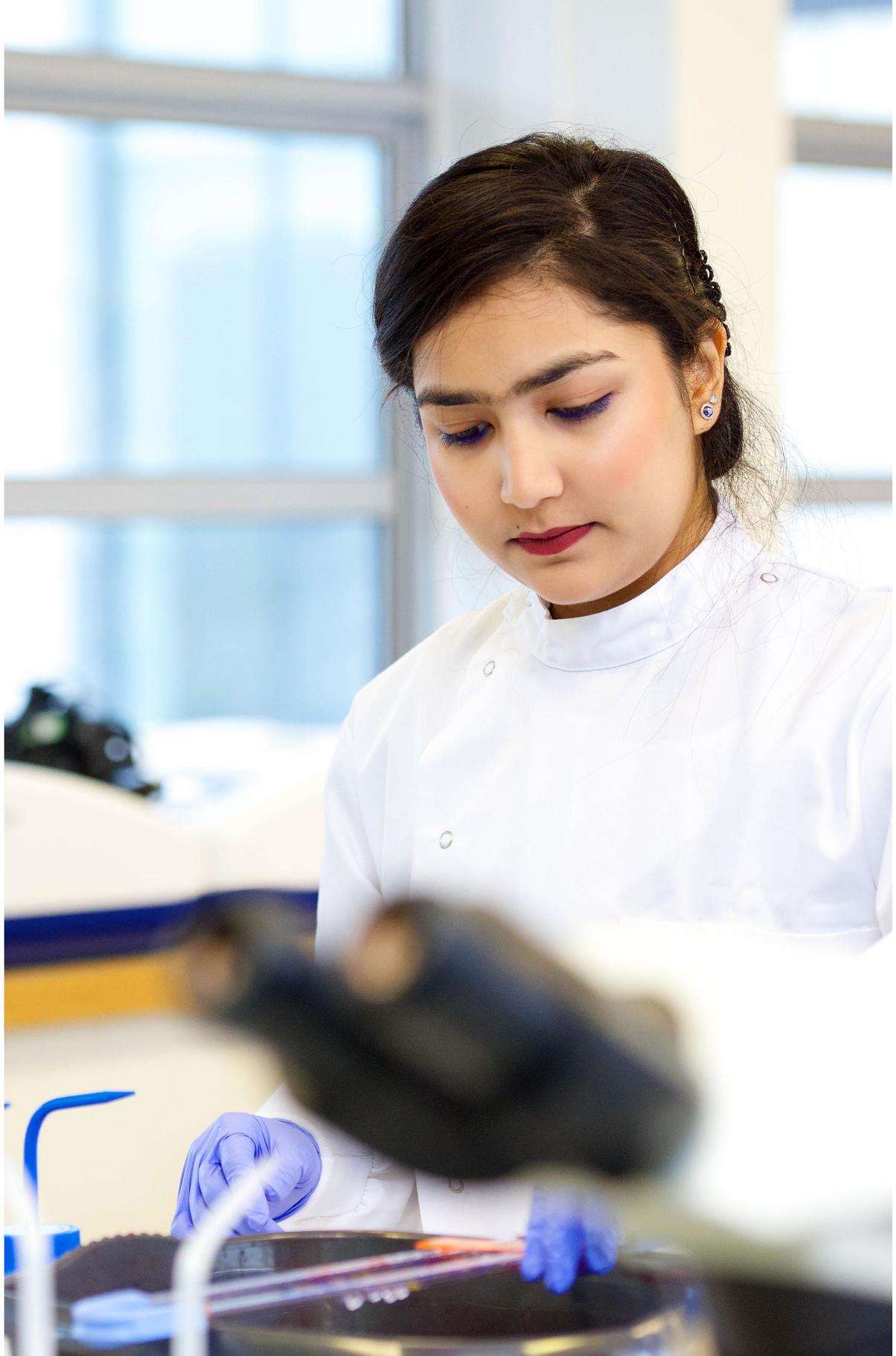
## Energetics

1. Define the terms exothermic and endothermic
2. Define enthalpy change
3. Define mean bond enthalpy
4. Calculate enthalpy change ($\Delta H$ ) using mean bond enthalpies
5. Explain why most bond enthalpies are mean values
6. Define standard enthalpy changes of combustion and formation
7. Recall and apply the equation for heat change $q = mc\Delta T$
8. Calculate $\Delta H$ using calorimetry data
9. Define Hess' Law including standard conditions
10. Use Hess's law to calculate enthalpy changes using enthalpies of formation and combustion
11. Explain why values from mean bond enthalpy calculations differ from those determined using Hess's law

# 12

## Chemical equillibria

1. Define Le Chatelier's principle
2. Define the term dynamic equilibrium
3. Describe and explain how changes in temperature, pressure and concentration affect the position of a system at equilibrium
4. Explain why compromise conditions of temperature and pressure may be used for a reversible reaction in an industrial process
5. Construct an expression for Kc for a homogeneous system in equilibrium
6. Calculate a value for Kc from the equilibrium concentrations for a homogeneous system at constant temperature
7. Perform calculations involving Kc
8. Predict the qualitative effects of changes of temperature on the value of Kc



# 13

## Acids and bases

1. Define Brønsted Lowry acids and bases
2. Identify species as Brønsted Lowry acids or bases in proton transfer reactions
3. Define a strong acid
4. Define a strong base
5. Define pH
6. Define kW
7. Calculate pH of a strong acid/ base from its Hydrogen ion concentration
8. Calculate the concentration of a strong acid/ base from its pH
9. Use Kw to calculate the pH of strong bases
10. Define a wek acid
11. Define a weak base
12. Write expressions for kA including units
13. Perform calculations linking Ka to concentration and pH
14. Draw, describe and explain pH curves pH against volume of acid or base
15. Use pH curves to decide which indicator to use in titrations
16. Deduce a suitable indicator for acid-base titrations
17. Calculate concentrations from titration results to include diprotic acids

# 14

## Organic Chemistry

1. Describe the characteristics of a homologous series
2. Define and identify functional groups
3. Describe positive chemical tests for Alkenes, Halogenoalkanes, Alcohols (primary and secondary), Aldehydes, Ketones and Carboxylic acids
4. Represent organic compounds using
   - empirical formula
   - molecular formula
   - general formula
   - structural formula
   - displayed formula
   - skeltal formula
5. Draw the structure of, and name aliphatic organic molecules using IUPAC rules
6. Describe alkanes as saturated hydrocarbons
7. Describe alkenes as unsaturated hydrocarbons
8. Write balanced equations for the complete and incomplete combustion of alkanes
9. Describe why pollutants may be formed when fuels are burned and how these can be reduced (eg NOx, CO, C SO2)
10. Draw and name alkenes
11. Describe how the double bond is an area of high electron density
12. Describe the test for the C=C bond using bromine water

**13.** Write equations and mechanisms for reactions of alkenes with BHr, BR2 and H2SO4

**14.** Define the term isomerism

**15.** Define the term stereoisomer

**16.** Draw the structure of name and chain, position and functional group isomers

**17.** Explain the cause of E-Z isomerism

**18.** Draw the structure of and name E-Z isomers (using Cahn-Ingold-Prelog priority rules)

**19.** Define an electrophile

**20.** Define a nucleophile

**21.** Define a free radical

**22.** Describe bond breaking (homolytivs & heterolytic) through diagrams

**23.** Draw and name halogenoalkanes

**24.** Write balanced equations for the reaction of halogens with alkanes

**25.** Write equations to show the mechanism for the reaction of halogens with alkanes

**26.** Explain the reaction of methane and chlorine as a free radical substitution mechanism involving initiation, propagation and termination stepsRepresent the unpaired electron in a radical using a dot

**27.** Construct equations and mechanisms for reactions of halogenoalkanes ( eg with OH- , CN– and NH3) to show nucleophilic substitution

**28.** Draw mechanisms with curly arrow diagrams

**29.** Construct equations and mechanisms for elimination reaction of halogenoalkanes (eg using OH–, such as 2-bromopropane with potassium hydroxide)

**30.** Draw and identify alcohols and classify them as primary, secondary or tertiary

**31.** Construct balanced equations to show oxidation reactions of alcohols (to aldehydes, carboxylic acids and ketones)

**32.** Describe oxidation of tertiary alcohols using potassium dichromate (unsuccessfully) and burning

**33.** Describe chemical tests to distinguish between aldehydes and ketones

# 15

## Experimental and investigative work

**1.** Development of practical skills

**2.** To become competent in the use of practical equipment

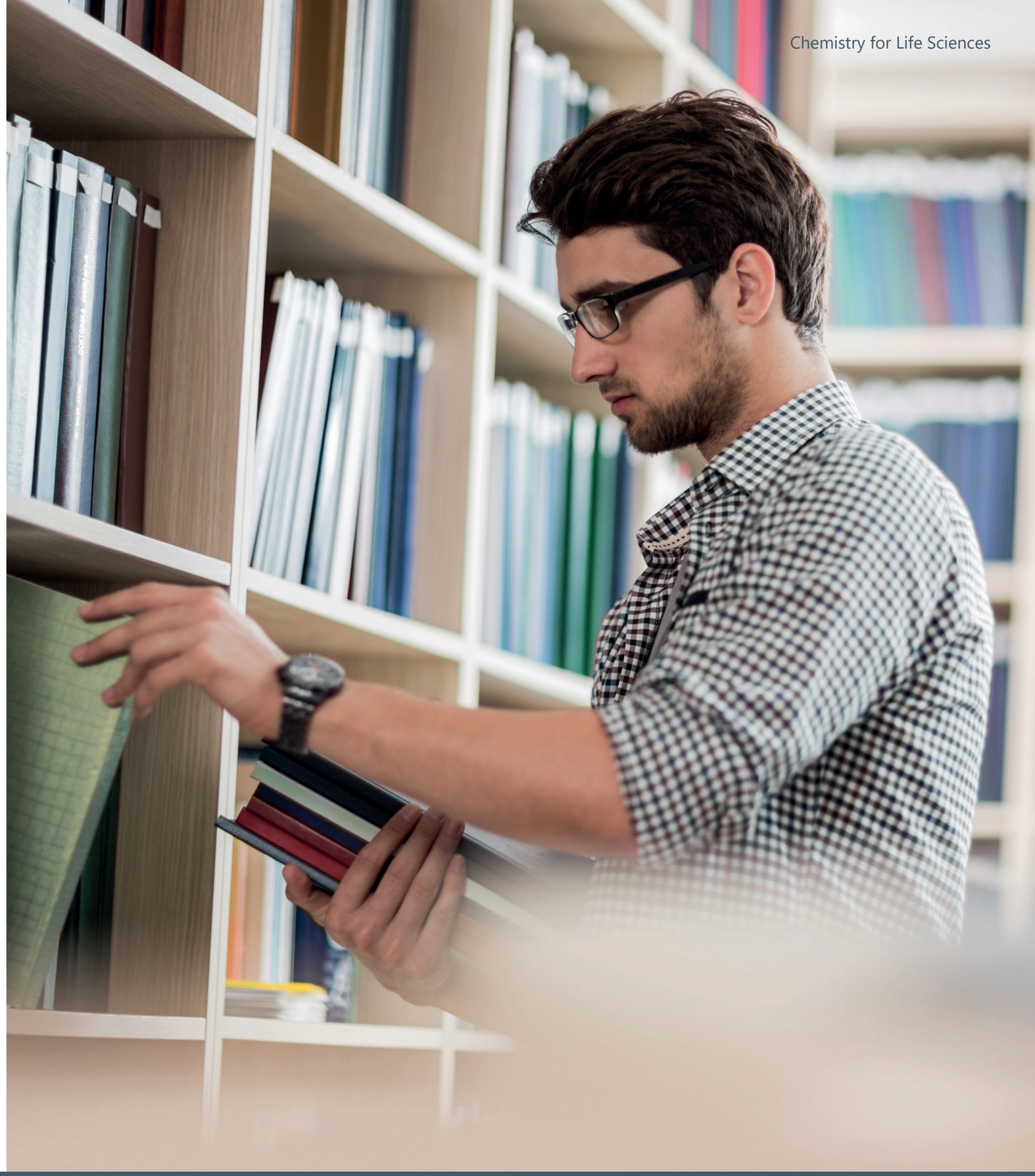
**3.** Enthalpy

**4.** Calculate ΔH using calorimetry data

**5.** Define Hess' Law including standard conditions

**6.** Use Hess's law to calculate enthalpy changes using enthalpies of formation and combustion

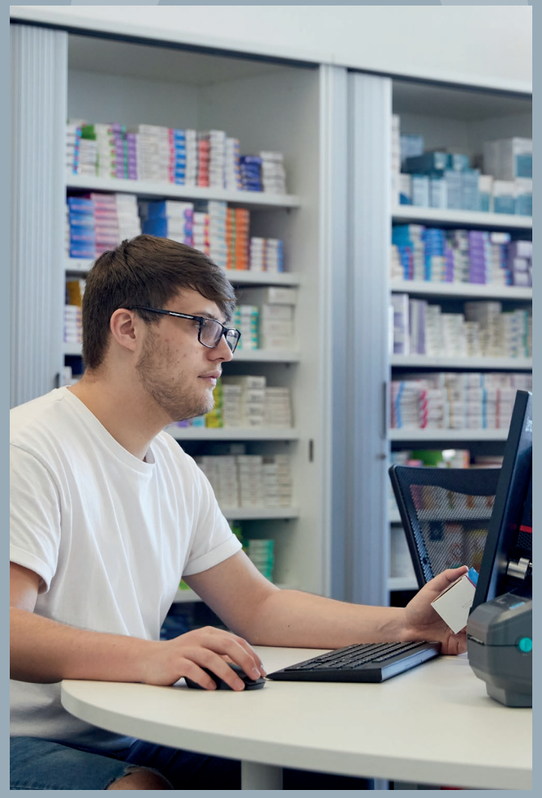
**7.** Explain why values from mean bond enthalpy calculations differ from those determined using Hess's law



# Biology for Life Sciences Module

Studying the different aspects of biology enables you to comprehend how the combinations of cells, tissues and organs work together to allow organisms to live and pass on genetic information.

The aim of the module is to enable you to develop your understanding of how the combination of cells, tissues and organs work together to allow organisms to live and pass on genetic information. You will gain experience of safe working practice in a laboratory setting and confidence in interpreting experimental data and observations. It gives you the opportunity to apply your knowledge to real life contexts and prepares you for future undergraduate studies within the subject area.





## Key Topics

### 01 Cells and viruses

1. Define cells, tissues, organs and organ systems
2. Identify examples of specialised eukaryotic cells
3. Evaluate adaptations that cells have to particular functions
4. Apply knowledge of eukaryotic cell features in suggesting the role of cells based on their adaptations
5. Define a eukaryotic cell and identify the characteristics of a generalised plant and animal cell
6. Describe and explain the structure and roles of different components and organelles within animal and plant eukaryotic cells. (including nucleus, nucleolus, rough and smooth endoplasmic reticulum, Golgi apparatus, lysosomes, mitochondria, ribosomes, cell membrane, centrioles, microtubules, chloroplasts and cellulose cell wall)
7. Relate the structure and roles of different components of prokaryotic cells. (including capsule, cell wall, the cell membrane, invaginations, flagella, bacterial chromosome, plasmids, glycogen granules and lipid droplets)
8. Interpret information, pictures, diagrams and electron micrographs to identify eukaryotic and prokaryotic cell components and organelles
9. Explain why viruses are not classified as living organisms
10. Relate the structure of a virus particles to replication within cells
11. Compare and contrast eukaryotes, prokaryotes and viruses

### 02 Biological Molecules

1. Identify and Describe the monosaccharides from which lactose, maltose and sucrose are made
2. Explain what is meant by a glycosidic bond and how they form through condensation
3. Describe how polymerisation of α-glucose can form starch or glycogen
4. Describe how polymerisation of B-glucose can form cellulose
5. Relate the structure to function of starch (amylopectin and amylose), glycogen and cellulose
6. Recount the tests for starch, a reducing and non-reducing sugar and interpret results
7. Describe the roles of lipids as energy stores, and, in protection, waterproofing and insulation
8. Recall the molecular structure of a triglyceride
9. Describe the formation/breakage of an ester bond
10. Explain saturated and unsaturated fatty acids
11. Relate the structure of a triglyceride to its functions
12. Recall the molecular structure of a phospholipid
13. Relate the structure of a phospholipid to its functions
14. Describe the emulsion test for lipids and interpret the results
15. Define amino acids as monomers in the formation of polypeptides and proteins; recall the general formula and general structure of amino acids
16. Describe the formation/breakage of a peptide bond
17. Recount protein primary, secondary, tertiary and quaternary structure and the importance in the structure of enzymes and other proteins
18. Justify the roles of ionic, hydrogen and disulphide bonds in the structure of proteins
19. Analyse the structure and roles of fibrous and globular proteins
20. Describe the biuret test for peptide bonds and interpret results
21. Explain the principle of chromatography to identify amino acids in a mixture and interpret chromatograms

### 03 Microscopes and measuring sizes

1. Compare and contrast optical light and electron microscopes.
2. Calculate sizes or magnifications of images/objects

### 04 Cell membranes

1. Describe the arrangement of proteins, glycoproteins, glycolipids, phospholipids and cholesterol in the fluid mosaic model of membrane
2. Analyse the structure, roles and importance of the constituent parts of the cell membrane to its role on the surface of cells and within cells
3. Define osmosis in terms of water potential. (diffusion of water molecules from a higher to a lower water potential through a selectively permeable membrane)
4. Discuss the effect of osmosis on plant and animal cells (including key terms turgid, flaccid, insipient plasmolysis, plasmolysis and ruptured cells)

5. Define the processes of diffusion and facilitated diffusion
6. Describe and explain the structure of proteins in their role as channel or carrier proteins
7. Compare and contrast the processes of facilitated diffusion and diffusion
8. Identify which substances rely on facilitated diffusion and why they cannot enter/leave cells by diffusion
9. Describe and explain the principles involved in active transport, endocytosis and exocytosis
10. Interpret data to identify when a substance is moving by facilitated diffusion, passive diffusion or active transport

# 05

## Enzymes

1. Define enzymes as globular proteins which catalyse metabolic reactions
2. Explain the mode of action of enzymes in terms of: lowering of activation energy, enzyme/substrate complex, active site, enzyme specificity.
3. Describe and explain the effect of enzyme concentration, substrate concentration, temperature, pH, competitive and non-competitive inhibitors on enzyme action
4. Draw and interpret investigative enzyme graphs
5. Evaluate the commercial uses of enzymes such as glucose oxidase in chemical identification
6. Discuss the advantages of the immobilisation of commercial enzymes, eg lactase

# 06

## DNA, DNA replication, protein synthesis and Genetic mutations

1. Determine the difference between the terms chromosome and gene.
2. Describe the structure of DNA, and explain the importance of base pairing and hydrogen bonding
3. Recall the basic structure of a mononucleotide; thymine, uracil and cytosine as pyrimidines; adenine and guanine as purines
4. Explain how the DNA base sequence is able to code for the primary structure of a polypeptide
5. Define the terms degenerate, universal and non-overlapping
6. Explain why much of eukaryotic DNA can be considered as non-coding
7. Explain what is meant by an intron and an exon
8. Compare and contrast DNA in eukaryotes with that in prokaryotes, mitochondria and chloroplasts
9. Explain how DNA replicates by semi-conservative means during interphase including the roles of the enzymes DNA Helicase, DNA Polymerase and DNA Ligase
10. Describe the structure of RNA, and explain the importance of base pairing and hydrogen bonding
11. Describe the formation of phosphodiester bonds

# 07

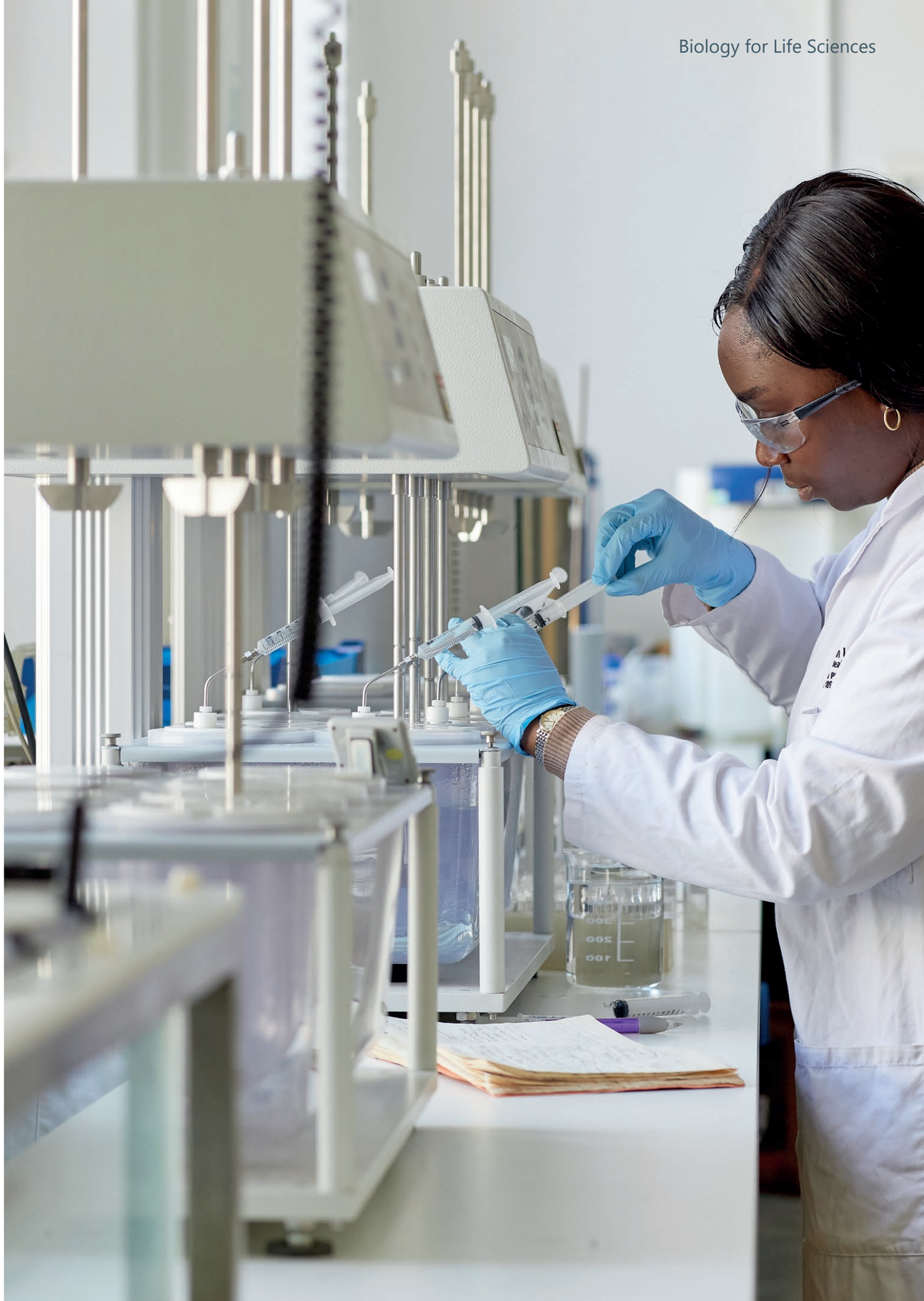
## Protein synthesis

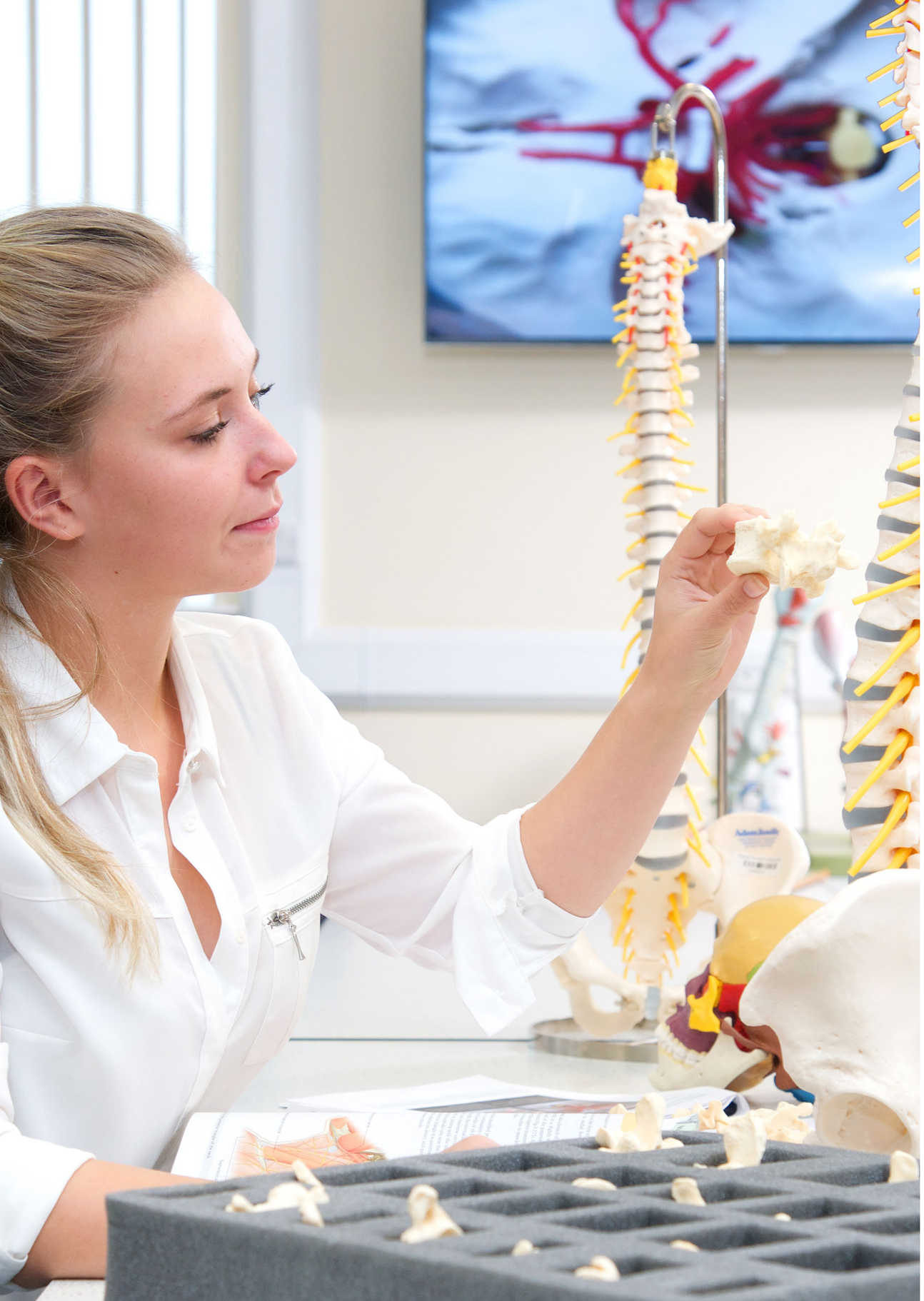
1. Describe how the information on DNA is used to construct polypeptides, including the role of messenger RNA, transfer RNA, ATP, ribosomes, helicase and RNA polymerase
2. State the difference between exons and introns
3. Analyse RNA codon tables to determine amino acid sequences
4. Apply knowledge of the base sequence of nucleic acids and relate to the amino acid sequence of polypeptides, when provided with suitable data about the genetic code
5. Describe what happens in substitution, addition and deletion mutations
6. Analyse information to relate the nature of a gene mutation to its effect on the encoded polypeptide

# 08

## Blood and Circulatory system

1. Relate the components of blood and their functions
2. Distinguish between the structure of red blood cells, phagocytes and lymphocytes
3. Connect the structure to the function of haemoglobin
4. Explain the oxygen dissociation curves of haemoglobin at different carbon dioxide levels (the Bohr effect)
5. Describe and explain the difference in affinity for oxygen between haemoglobin and foetal haemoglobin
6. Outline the structure of arteries, veins and capillaries
7. Depict the structure of arteries, veins and capillaries in relation to their functions
8. Recall that venules and arterioles are smaller veins and arteries and connect to capillaries
9. Describe the interchange of materials between capillaries and tissue fluid, including the formation and reabsorption of tissue fluid and the formation of lymph
10. Compare and contrast blood, tissue fluid and lymph





# 09

## The Mammalian heart

1. Describe the mammalian circulatory system
2. Define the external and internal structure of the mammalian heart
3. Explain the differences in the thickness of the different chambers of the heart in terms of their functions
4. Discuss the cardiac cycle in relation to the heart and circulatory system
5. Heart rate, with reference to the parasympathetic and sympathetic nervous system, acetylcholine and noradrenaline
6. Explain how heart action is initiated and controlled with reference to the SAN/AVN and the medulla oblongata
7. State the location of, and the role played by, chemoreceptors and pressure receptors
8. Summarise the effects of nicotine and carbon monoxide in tobacco smoke on the cardiovascular system
9. Refer to the causes, symptoms and risk factors associated with cardiovascular and heart disease, such as atherosclerosis, aneurism, thrombosis, myocardial infarction, coronary heart disease and strokes
10. Evaluate investigative data with reference to cardiovascular disease

# 10

## Immunity

1. Recall the meaning of the term immune response
2. Describe the mode of action of phagocytes
3. Relate the molecular structure of antibodies to their function – including monoclonal antibodies
4. Determine the roles of B-lymphocytes and T-lymphocytes in humoral and cell-mediated immune responses
5. Analyse primary and secondary immune responses
6. Explain the meaning of the term vaccination
7. Compare and contrast between active and passive immunities.
8. Outline the role of antibiotics in the treatment of infectious disease

# 11

## Lung and gas exchange in humans

1. Interpret a section of lung tissue to show the distribution of cartilage, ciliated epithelium, goblet cells and smooth muscle alveoli and blood vessels
2. Describe the functions of cartilage, cilia, goblet cells, smooth muscle and elastic fibres in the gaseous exchange system
3. Describe the structure and explain the function of the respiratory system (Nasal Cavity, mouth, epiglottis, larynx, trachea, cartilage rings, bronchi, bronchioles, alveoli, intercostal muscles ribs/ ribcage and diaphragm)
4. Explain how alveoli are adapted for efficient gas exchange
5. Describe the mechanism of ventilation
6. Identify and explain the meaning of the terms of lung volumes and capacities
7. Recall the principle of a spirometer and interpret spirometry data
8. Explain the control of ventilation to include chemoreceptors and the respiratory centre
9. Explain and explain the effects of lung disease (including pulmonary TB, Fibrosis, emphysema and asthma)
10. Describe the effects of tobacco smoke on the body including (CVD, stroke)
11. Explain the link between cigarette smoke and disease (including COPD and lung cancer
12. Evaluate the epidemiological and experimental evidence linking cigarette smoking to disease and early death

# 12

## Digestive system

1. Identify the components involved in (human) digestion
2. Relate the general structure and functions of organs within the digestive system and where key events in digestion happen including the mouth (teeth, tongue and the salivary glands), epiglottis, oesophagus, stomach (including the cardiac and pyloric sphincters), duodenum, gallbladder, pancreas, ileum, colon, appendix and rectum
3. Discuss the purpose of digestion
4. Describe and explain the function of mastication and the movement (peristalsis) of food along the gut
5. Describe and explain the digestion of carbohydrates, proteins and lipids

**6.** Explain the role of different enzymes in the digestive process and relate the specificity of enzymes back to protein structure

**7.** State the components of saliva as water (salivary amylase, sodium hydrogen carbonate and mucin) and describe their functions

**8.** Recall the components of gastric juice (to include Pepsin, Hydrochloric acid and mucus) and their functions

**9.** Discuss the nervous control of digestion and hormonal control of the secretion of gastric juice

**10.** Outline the basic functions of the hormones gastrin and enterogasterone

**11.** Recall the components of pancreatic juice (sodium hydrogen carbonate, proteases, pancreatic amylase, lipase) and describe their functions

**12.** Explain how endopeptidases and exopeptidases increase protein digestion

**13.** Clarify the role of bile salts

**14.** Identify the components involved in (human) absorption and the assimilation of the products of digestion

**15.** Recall the adaptations of intestinal epithelial cells to aid passive and active transport in the exchange of nutrients

**16.** Describe and explain the absorption of amino acids, monosaccharides, monoglycerides and fatty acids

# 13

## Homeostasis: Blood glucose control

**1.** Recall the meaning of the term immune response

**2.** Describe the mode of action of phagocytes

**3.** Relate the molecular structure of antibodies to their function – including monoclonal antibodies

**4.** Determine the roles of B-lymphocytes and T-lymphocytes in humoral and cell-mediated immune responses

**5.** Analyse primary and secondary immune responses

**6.** Explain the meaning of the term vaccination

**7.** Compare and contrast between active and passive immunities.

**8.** Outline the role of antibiotics in the treatment of infectious disease

# 14

## Homeostasis: The renal system

**1.** Describe osmoregulation as the control of the water potential of the blood

**2.** Relate the structure and function of the nephron, including associated blood vessels

**3.** Describe and explain the formation of glomerular filtrate (ultrafiltration)

**4.** Describe and explain the reabsorption of useful substances such as glucose and water by the proximal convoluted tubule

**5.** Examine the process of maintaining a gradient of sodium ions in the medulla by the loop of Henle

**6.** Discuss the reabsorption of water by the distal convoluted tubule and collecting ducts

**7.** Justify the roles of the hypothalamus, posterior pituitary and antidiuretic hormone (ADH) in osmoregulation

# 15

## Nervous system

**1.** Recall the basic structure of the nervous system to include the central nervous system, peripheral, somatic, autonomic, sympathetic and parasympathetic nervous system

**2.** Analyse and justify the importance of a simple reflex arc

**3.** Describe and explain the structure of a myelinated motor neurone

**4.** Outline what is meant by a resting and an action potential

**5.** Explain the events in establishing a resting potential

**6.** Justify the events in generating an action potential

**7.** Summarise the all or nothing principle

**8.** Explain how action potentials pass along unmyelinated neurones

**9.** Detail how action potentials pass along myelinated neurones by saltatory conduction, and explain why this is faster than conductance along unmyelinated neurones

**10.** Substantiate the importance of the refractory period

**11.** Examine the factors which affect the speed of nerve impulse conductance

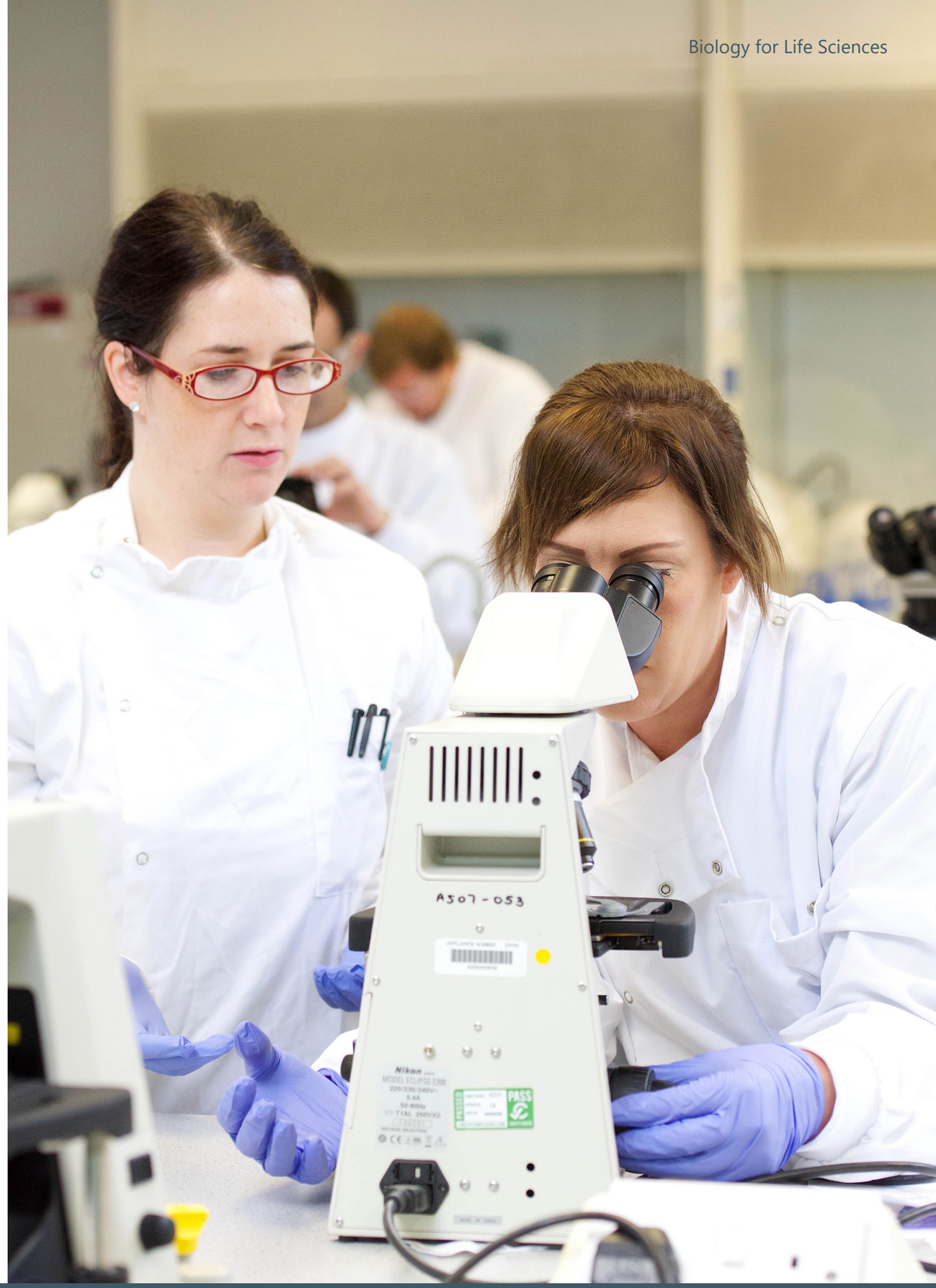
**12.** Describe the detailed structure of a synapse

**13.** Analyse the sequence of events involved in the transmission of an action potential from one neurone to another

**14.** Evaluate unidirectional synaptic transmission

**15.** Outline the importance of acetylcholinesterase (AChe) at synapses

**16.** Use information provided to predict and explain the effects of specific drugs on a synapse (NB the names of drugs are not required)

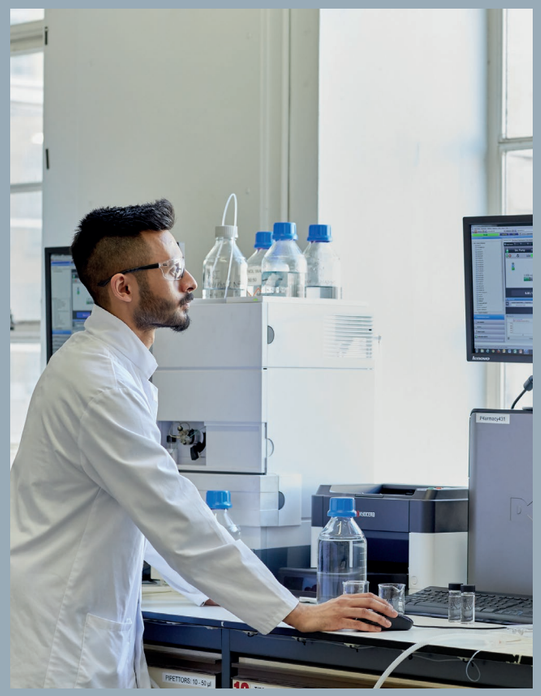


# Skills for Science Module

Progress in the sciences is made through scientific experimentation and interpretation of the results. In order to complete this accurately and safely it is important to understand experimental design and methodology and how to analyse results.

This module aims to prepare you for laboratory work, develop your data analysis skills and teach you how to report and critique your findings. It will also introduce you to the regulation of scientific and medical research and medical ethics.

You should, having completed the course, be able to draw conclusions from data, organise facts and figures in a logical way, test hypotheses in logical ways to find answers, and see the how a larger situation can be affected by smaller activities.



## Key Topics

### 01 Basic Mathematical Skills

1. Express data in decimal and standard form
2. Analyse and express appropriate units used in calculations
3. Convert between different types of units
4. Rearrange equations to change the subject
5. Perform calculations using equations
6. Calculate and convert percentages, fractions, and ratios
7. Identify the limits of the least accurate measurements
8. Identify appropriate numbers of significant figures and decimal places

### 02 Statistical tests

1. Calculate the mean, median and mode of a range of data, including from experimental data, frequency tables
2. Evaluate measures of dispersion including standard deviation
3. Perform a simple scientific investigation and perform statistical tests on the data recorded

### 03 Drawing tables and graphs

1. Represent data in a variety of appropriate forms, including tables, bar charts, histograms, line graphs, pie charts, log graphs
2. Analyse data in a variety of forms, including tables, bar charts, histograms, line graphs, pie charts, log graphs

### 04 Scientific communication

1. Demonstrate skills for reading
2. Demonstrate skills for writing
3. bar charts, histograms, line graphs, pie charts, log graphs
4. Analyse data in a variety of forms, including tables, bar charts, histograms, line graphs, pie charts, log graphs

## 05
### Handling data

1. Explain how to make and record observations
2. Collect and present raw data in a suitable table
3. Plot two variables from experimental or other data on a suitable graph
4. Construct and interpret frequency tables and diagrams, bar charts and histograms
5. Discuss which style of graph fits different types of data

## 06
### Laboratory reports

1. Construct laboratory reports with the following sections:
   - Introduction
   - Materials
   - Methods
   - Diagram
   - Results
   - Discussion
   - Conclusion

## 07
### Selecting and using a statistical test

1. Construct an appropriate null hypothesis
2. Calculate the test statistic given a standard scientific calculator and understand how to use probability for acceptance or rejection of the null hypothesis

## 08
### Chi-squared calculation

1. The chi-squared test to test the significance of the difference between observed and expected phenotypic ratios
2. Calculate and analyse students t-test

## 09
### Review of graphing

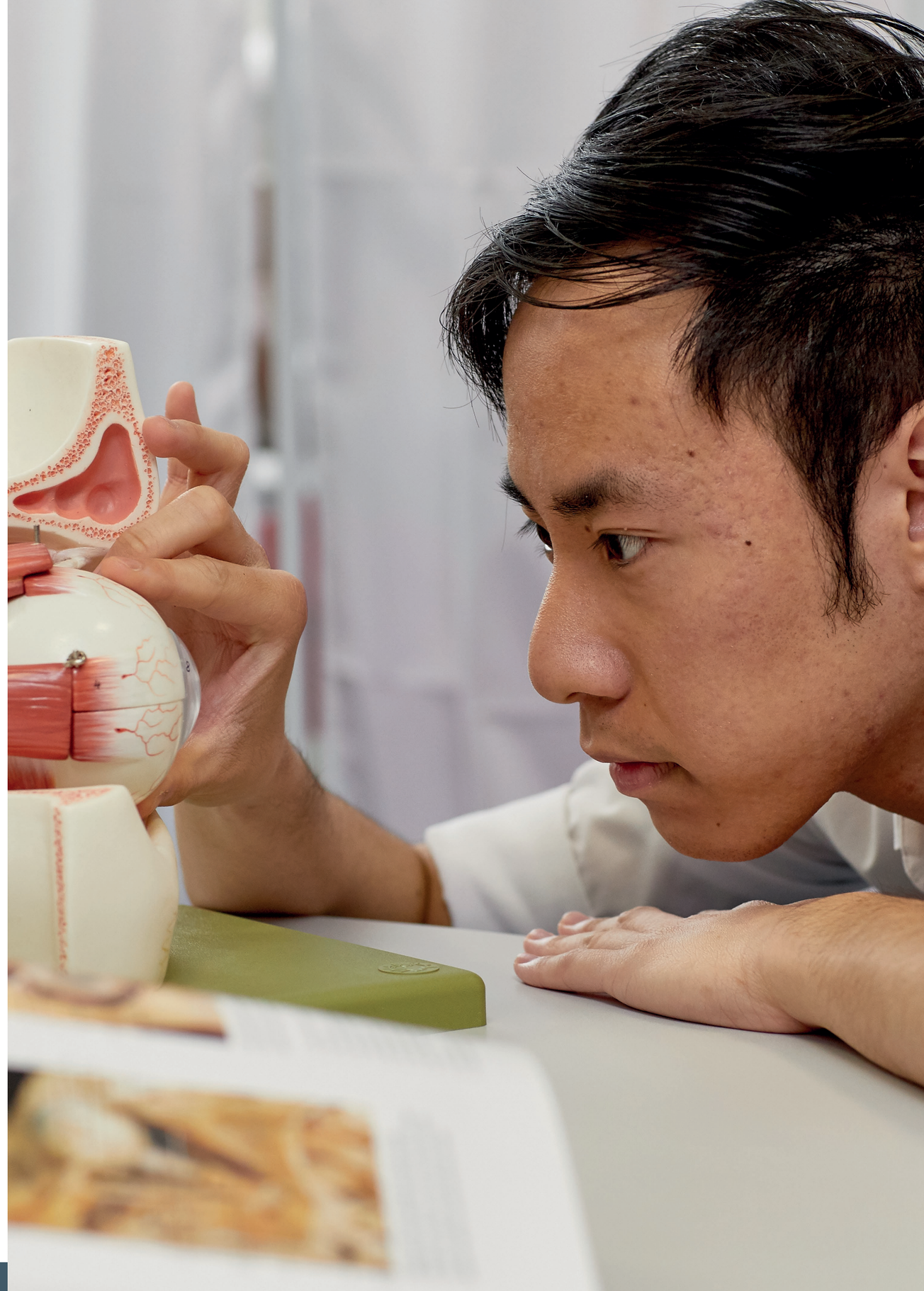
1. Understand that y = mx+ c represents a linear relationship
2. Determine the slope and intercept of a linear graph
3. Determine the appropriate graph to plot from a given equation in order to find an unknown
4. Including equations with exponentials
5. Students need to draw and use the slope of a tangent to a curve as a measure of rate of change

## 10
### Evaluation of errors

1. Qualitative and quantitative treatment of errors/ uncertainties.
2. Identify uncertainties in measurements and use simple techniques to determine uncertainty when data are combined by addition, subtraction, multiplication, division and raising to powers

## 11
### Vernier Calliper and Micrometer

1. Use of a Micrometer and Vernier Callipers for measuring
2. Reading Vernier and micrometer scales and their precision



# Resources and reading list

## Chemistry for Life Sciences

A-Level Chemistry: AQA Year 1 & 2 Complete Revision & Practice with Online Edition - ISBN: 9781789080292
OCR A Level Chemistry 1 by John Older & Mike Smith - ISBN 9781471827068
A-Level Chemistry for AQA: Year 1 & 2 Student Book with Online Edition - ISBN: 9781789080476
OCR Chemistry 1 by John Older and Mike Smith - ISBN: 9781471827068
Revise Edexcel AS/A Level Chemistry Revision Workbook Publisher: Pearson. Author: Nigel Saunders - ISBN: 9781447989943
Revise Edexcel AS/A Level Chemistry Revision Guide. Publisher: Pearson. Author: Nigel Saunders - ISBN: 9781447989974
Edexcel A Level Chemistry Student Book 2 by Graham Curtis and Andrew Hunt - ISBN: 9781471807497
Calculations for A-level Chemistry by E.N.Ramsden - ISBN 9780748758395

## Biology for Life Sciences

Cambridge International AS and A Level Biology - ISBN 9781444175349
Cambridge International AS and A Level Biology Revision Guide - ISBN-139781316600467
A-Level Biology: AQA Year 1 & 2 Complete Revision & Practice with Online Edition - ISBN: 9781789080261

## Skills for Science

A Level Chemistry: Science, Maths and Quality of Written Communication Paperback by Chris Conoley
A Level Physics: Science, Maths and Quality of Written Communication Paperback – 21 Mar 2014 by Ian Galloway
Science Skills - A Level Biology: Science, Maths and Quality of Written Communication Paperback – 3 Feb 2014
by Mike Boyle
Essential Maths Skills for A level Physics. Study notes, Examples and Practice questions Published by CGP - ISBN: 9781782944713





# Example Timetable

Please note this is an example timetable and will vary for every student. Students should anticipate lessons starting earlier than 9am or later than 5pm. Students will be expected to allocate self study and revision hours within their timetable which will be given at the start of the academic term.

| | 9-10 | 10-11 | 11-12 | 12-1 | 1-2 | 2-3 | 3-4 | 4-5 |
|---|---|---|---|---|---|---|---|---|
| Mon | English | English | | Lunch | Chemistry for Life Sciences | Chemistry for Life Sciences | | |
| Tues | Personal tutorial | Biology for Life Sciences | Biology for Life Sciences | Lunch | English | English | | |
| Wed | Skills for Science | English | English | Lunch | Chemistry for Life Sciences | Chemistry for Life Sciences | | |
| Thur | | Biology for Life Sciences | Biology for Life Sciences | Lunch | | | | Skills for Science |
| Fri | Chemistry for Life Sciences | Chemistry for Life Sciences | Skills for Science | Lunch | Biology for Life Sciences | Biology for Life Sciences | | |

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