

In the secondary school, science lessons are designed to give students the opportunity to enjoy science as a practical, hands-on activity through which they will:

- value and challenge each other's ideas, hypotheses and theories.
- develop their practical skills.
- learn the application and importance of technology.
- maintain and direct their natural spirit of enquiry.
- develop an understanding of scientific methods and concepts.
- acquire a broad base of scientific knowledge.
- learn to communicate scientific ideas and findings.
- become aware of the influence of science and technology on society (and vice versa).
- discuss the ethical implications of science and the moral responsibilities of scientists.

In the IB Diploma lessons for Chemistry, these aims are still valid, but there is a more specific focus on the scientific method, and in particular to the importance of measurement, accuracy, precision and error estimation. In addition to practical work, in depth understanding of chemistry is developed via a thorough and rigorous theoretical teaching and learning programme.

Internationalism is naturally built in to the course as science is such an international activity. A historical approach is taken whenever appropriate, with famous scientists from many countries being discussed in context with their discoveries. The experiences of students and staff in moving around the world are used to talk about the use of materials in different contexts. Industrial use and production of chemicals is used as a theme to highlight the international importance of the subject.

Assessment is both formative and summative, with regular feedback on all aspects. Peer and Self Assessment are regular features of the programme, enabling students to better understand the assessment criteria.

Topics:

The teaching of the IB Chemistry programme follows the syllabus sections closely, with ample time at the end of the course to revisit each topic in a revision programme. Topic 11 is addressed initially as a short introductory topic, but is also addressed throughout the course in the regular practical lessons. Both HL and SL students study together, with HL students having 2 extra lessons in which they deal with the Additional Higher Level material, as indicated in the following draft schedule.

Term	SL & HL	HL Only
1	Topic 11 Measurement and Data Processing Topic 2 Atomic Structure Topic 3 Periodicity	Topic 12 Atomic Structure Topic 13 Periodicity
2	Topic 1 Quantitative Chemistry Topic 4 Bonding	Topic 14 Bonding
3	Topic 5 Energetics Topic 6 Kinetics	Topic 15 Energetics Topic 16 Kinetics
4	Topic 11 Organic Chemistry	Topic 20 Organic Chemistry
Summer Project	Study Project on First Option Topic	
5	First Option Topic Topic 7 Equilibrium	Topic 17 Equilibrium Topic 8 Acids and Bases
6	Topic 8 Acids and Bases (SL only) Topic 9 Oxidation and Reduction	Topic 18 Acids and Bases Topic 19 Oxidation and Reduction
7	Second Option Topic Final Preparation of the Internal Assessment Portfolio Revision Programme & Past Papers	
8	Final Revision Exam	

Assessment:

All five assessment objectives are assessed through a series of experiments and laboratory investigations. Assessment of experiment design, data collection and processing, conclusions and evaluations, are an integral part of the weekly teaching programme. Detailed feedback is given to each student before the next practical session, using the specific IB criteria.

Practical skills are assessed by teacher observation during each practical session, with a summative assessment mark being awarded at the end of the course. A project is organized with other subjects once during the two-year course, in which students work in multi-disciplinary groups on an investigation of their own (guided) choice. Personal skills are assessed during this project through self, peer and teacher evaluation.

Objectives 1, 2 and 3 are further addressed through regular testing of the theoretical aspects in topic tests and exams. A mock exam towards the end of the course is used to give summative feedback to enable students to better prepare for the final exam.

Resources:

Laboratory materials, both basic items found in any laboratory, as well as more specific items for the practical scheme of work being developed.

Numerous websites on chemistry topics.

Books on option topics (to be ordered)

Relevant Chemistry Text Books such as the following:

- Clark, J *Calculations in AS/A Level Chemistry*, Longman, UK
- Ramsden, E *Calculations for A-level Chemistry* Stanley Thornes, Cheltenham, UK
- Fullick, A *Chemistry*, Heinemann Advanced Science, Oxford, UK
- Geoff Neuss *Chemistry for the IB Diploma* OUP, UK
- AS and A Level *Chemistry through Diagrams* Michael Lewis, OUP, UK
- Ratcliff, et al, *Chemistry AS and A Level*, Cambridge University Press, UK

Curriculum Overview

IB Chemistry – Grade 11 and 12

Resources:

Books:

Clark J., *Calculations in AS/A Level Chemistry*, Longman, UK
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 Geoff Neuss *Chemistry for the IB Diploma*, OUP, UK
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Websites:

Topics	Learning Outcomes	Activities	Methods of Assessment
Measurements and Data Analysis 4h	<ul style="list-style-type: none"> Measurements and Data Analysis Scientific method Lab. Procedures and safety Percentage and absolute error 	<ul style="list-style-type: none"> Reading different scales on different devices and on instruments. Quote precision/accuracy Graphing procedures 	<ul style="list-style-type: none"> Written assignments Topic Test Experiment Reports
Stoichiometry (I.B.SSC Topic 1) 12.5h	<ul style="list-style-type: none"> Some fundamental concepts The types of atoms The mole concept and the Avogadro constant Formulae Chemical equations Mass relationships in chemical reactions Limiting reagents Solutions 	<ul style="list-style-type: none"> Calculation of empirical and molecular formulas Using mole ratios to compute amounts of reactants and products Concentrations of solutions and dissolutions 	<ul style="list-style-type: none"> Practical Assessment on: <ol style="list-style-type: none"> Determination of the empirical formula of Manganese oxide or Magnesium oxide Titration of acid / base Topic Test Written assignments
Atomic Theory (I.B.SSC Topic 2 and AHL Topic 12) 4h	<ul style="list-style-type: none"> The nuclear atom The mass spectrometer Electron arrangement Electronic structure of atoms Radioactivity Half life 	<ul style="list-style-type: none"> History of the atom internet search Dice tossing for the study of radioactive decay 	<ul style="list-style-type: none"> Practical Assessment on: <ol style="list-style-type: none"> Flame tests and spectrometer Graph values of ionization energies Topic Test Experiment Reports Written assignments

Periodicity (I.B.SSC Topic 3 and AHL Topic 13) 6h	<ul style="list-style-type: none"> • The Periodic Table • Physical properties • Chemical properties • Periodic Trends • D-block Elements (First Row) • Learn there are trends in the periodic table 	<ul style="list-style-type: none"> • List the first 50 elements • Make a correlation of chemical properties with location in the periodic table 	<ul style="list-style-type: none"> • Practical Assessment on: 1. Physical and chemical properties of third period elements 2. Reactivity between halogens and halides • Written assignments • Topic Test
Bonding (I.B.SSC Topic 4 and AHL Topic 14) 12.5h	<ul style="list-style-type: none"> • - Ionic Bond • - Covalent Bond • - Shapes of molecules and ions • - Multiple Bonds • - Hybridization • - Delocalization • - Intermolecular forces • - Metallic bond • - Physical properties 	<ul style="list-style-type: none"> • Models of giant molecules: Giant ionic and covalent structures • Shear forces between layers 	<ul style="list-style-type: none"> • Practical Assessment on: 1. Physical and chemical properties of ionic and covalent compounds 2. Graph of boiling points out from data • Topic Test • Written assignments •
States of Matter (I.B.SSC Topic 5 and AHL Topic 15) 6h	<ul style="list-style-type: none"> • Three states of matter • Phase changes • Mixture of states and processes • Gaseous state and gas laws • Dalton's law 	<ul style="list-style-type: none"> • Demo of Boyles' equipment 	<ul style="list-style-type: none"> • Practical Assessment on: 1. Determine the molar mass of an unknown gas 2. Determine the amount of carbon dioxide gas dissolved in water • Topic Test • Written assignments
Energetics (I.B.SSC Topic 6 and AHL Topic 16) 12h	<ul style="list-style-type: none"> • Exothermic and endothermic reactions • Calculation of enthalpy changes • Hess' law • Bond enthalpies • Standard enthalpy changes of reaction • Lattice enthalpy • Entropy • Spontaneity of a reaction (free energy) 	<ul style="list-style-type: none"> • Heat measurements through specific heat capacity of water • The problem with insulation 	<ul style="list-style-type: none"> • Practical Assessment on: 1. Determine the enthalpy change of a reaction 2. Determine the enthalpy of combustion of an alcohol • Topic Test • Experiment Reports • Written assignments
<ul style="list-style-type: none"> • Kinetics (I.B.SSC Topic 7 and AHL Topic 17) 5h 	<ul style="list-style-type: none"> • Rates of reaction • Collision theory • Rate Expression • Reaction mechanism • Collision theory 	<ul style="list-style-type: none"> • Review on solutions and timing • Models and mechanisms • 	<ul style="list-style-type: none"> • Practical Assessment on: 1. Experimental determination of the factors that alter the rate of a chemical reaction • Topic Test • Written assignments

	<ul style="list-style-type: none"> • Activation energy • 		
<ul style="list-style-type: none"> • Equilibrium (I.B.SSC Topic 8 and AHL Topic 18) 5h • 	<ul style="list-style-type: none"> • Dynamic equilibrium • Le Chatelier's principle • The position of equilibrium • Phase equilibrium • The equilibrium law 	<ul style="list-style-type: none"> • Balancing of equations and exponent theory review 	<ul style="list-style-type: none"> • Practical Assessment on: 1. Equilibrium of chromate/dichromate ions • Topic Test • Written assignments •
<ul style="list-style-type: none"> • Acids and bases (I.B.SSC Topic 9 and AHL Topic 19) 6h • 	<ul style="list-style-type: none"> • Properties of acids and bases • Bronsted-Lowry acids and bases • Strong and weak acids and bases • The pH scale • Lewis theory • Calculations involving acids and bases • Buffer solutions • Salt solutions • Acid-base titrations • Indicators 	<ul style="list-style-type: none"> • Models on conjugates acids and bases 	<ul style="list-style-type: none"> • Practical Assessment on: 1. Typical reactions of acids and bases in test tubes • 2. Titration curves for acids and bases using PHmeter probes • Topic Test • Written assignments •
<ul style="list-style-type: none"> • Oxidation and reduction (I.B.SSC Topic 10 and AHL Topic 20) 7h • 	<ul style="list-style-type: none"> • - Oxidation and reduction • - Electrolysis of a molten salt • - Reactivity • - Redox equations • - Standard electrode potentials • - Electrolysis 	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • Practical Assessment on: 1. Electrolysis of solutions • 2. Determination of a reactivity series • Topic Test • Written assignments •
<ul style="list-style-type: none"> • Organic chemistry (I.B.SSC Topic 11, AHL Topic 21, Option A and Option H) 12h • 	<ul style="list-style-type: none"> • - Homologous series • - Physical properties • - Naming Organic Compounds • - Determination of structure • - Isomerism • - Stereoisomerism • - Hydrocarbons • - Free Radical substitution reactions • - Compounds of C, H and O • - Molecules with atoms other than C, H and O • - Polymers 	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • Practical Assessment on: 1. Tests to determine physical and chemical properties related to functional groups • 2. Preparation of nylon 6,6 • Topic Test • Written assignments •
<ul style="list-style-type: none"> • Option D: Environmental 	<ul style="list-style-type: none"> • - Primary air pollution • - Ozone depletion 	<ul style="list-style-type: none"> • Visit to our water treatment plant GROUP 4 PROJECT 	<ul style="list-style-type: none"> • Practical Assessment: 1. Preparation of acid rain and analysis of

<ul style="list-style-type: none"> • Biochemistry • 15h 	<ul style="list-style-type: none"> • - Global warming • - Acid rain • - Oxygen demanding wastes • - Smog • - Toxic substances in water • 		<ul style="list-style-type: none"> • the effects on limestone and plants • 2. Simple tests on water pollution • 3. Sea water distillation • Topic Test • Written assignments •
<ul style="list-style-type: none"> • ALTERNATIVE • • Option E: Chemical Industries • 15h 	<ul style="list-style-type: none"> • - Energy • - Principles of extraction and production • - Metal - iron and aluminum • - Air • - Equilibrium processes • - The oil industry • - Other chemical industries • - Silicon • - Ellingham diagrams • - The organic chemicals industry • 	<ul style="list-style-type: none"> • Visit to a chemical plant 	<ul style="list-style-type: none"> • Practical Assessment: 1. Extraction of different minerals from their ores • 2. Fractional distillation of petrol • Topic Test • Written assignments •
<ul style="list-style-type: none"> • Option F: Fuels and Energy • 15h 	<ul style="list-style-type: none"> • - Energy sources • - fossil fuels • - Enthalpy of combustion of a compound • - Pollutants produced by fossil fuels • - Fractional distillation of oil • - Increasing the yield of the gasoline fraction • Coal gasification and liquefaction • - Nuclear energy • - Solar energy • - Electrochemical energy • Storage of energy and limits of efficiency • Nuclear stability • - Radioactive decay • Photovoltaics 		<ul style="list-style-type: none"> • Practical Assessment: 1. Determine the combustion energy of several fuels • 2. Prepare ethanol by fermentation/distillation • 3. Compare different kind of batteries • Topic Test • Written assignments •