IBH Level Chemistry – L6

Curriculum Intent

Chemistry is the study of matter, its properties, how and why substances combine or separate to form other substances, and how substances interact with energy. The IB Higher Chemistry course provides stimulating opportunities to appreciate the study and creativity associated with chemistry within a global context.

The course aims for all students to: ·

- Acquire, apply and use knowledge, methods and techniques that characterise chemistry
- Develop an ability to analyse, evaluate and synthesise chemistry information
- Develop a critical awareness of the need for, and the value of, effective collaboration and communication during scientific activities
- Appreciate the possibilities and limitations of chemistry while becoming critically aware, as global citizens, of the ethical implications of using chemistry
- Develop and understanding of the relationships between scientific disciplines and their influence on other areas of knowledge
  Promote students' interest in and enthusiasm for the subject.

"All truths are easy to understand once they are discovered; the point is to discover them"
Galileo Galilei

Students will learn: -

Autumn Term – Term 1

Atomic structure and periodic table; Bonding, structure and properties; Organic structures; Energy from fuels; Transition elements and compounds.

Spring term – Term 2

Spectroscopic analysis; Stoichiometric relationships "How much?"; Energetics, enthalpy, entropy and free energy.

Summer term – Term 3

Kinetics "How fast?"; Equilibria "How far?"; Individual research investigation (Internal Assessment, IA). Group 4 Sciences collaborative research project.

What does excellence look like?

- Carrying out practical processes logically, precisely, and accurately.
- Linking ideas together to answer questions logically and sequenced.
- Linking ideas to the IB Core.
- Linking big ideas to answer real life Chemistry problems. For example. Linking the quantum mechanical model of the atom to the periodic table. Deducing Lewis structures, electron domain and molecular geometries of oxoanions. Explanation of structure, bonding, and properties of aluminium chloride. Evaluation of scientific discovery by reasoning, experimentation, serendipity, and creativity. Using molecular orbital theory to explain colour of TM complex ions. Unstructured calculations in unfamiliar contexts. Identifying an unknown by linking spectroscopy and elemental analysis.

Knowledge, understanding & skills

Term 1: Knowledge, understanding, application, analysis, and evaluation of: Particulate nature of matter; The nuclear atom: Structure of the atom, mass spectrometry, use of nuclear notation, isotopic abundance calculation. Electron configuration: Hydrogen emission spectrum; application of the Aufbau principle, Hund's rule and the Pauli exclusion principle to electron configuration in terms of s-, p- and d-orbitals in subshells; first ionisation energy, successive ionisation energies; application of E = hν. Ionic bonding and structure, covalent bonding, covalent structures, VSEPR theory, intermolecular forces, metallic bonding. Further aspects of covalent bonding: σ- and π-bonding in terms of molecular orbitals; formal charge; exceptions to the octet rule; delocalisation; resonance; hybridisation. Fundamentals of organic chemistry: Identification of classes and functional groups; construction of models, nomenclature. Combustion and its challenges. Properties and uses of transition elements; coloured complexes, spectrochemical series.

Term 2: Index of hydrogen deficiency, mass spectrometry, infrared and high resolution ^1H NMR spectroscopy; x-ray crystallography. The mole concept, reacting masses and volumes, gas laws. Formula determination, relative atomic mass investigation, standard solutions, titration, uncertainties and errors in measurement and results. Calorimetry, experimental limitations, graphical techniques. Bond enthalpies; Hess's law: application using cycles and summation. Born-Haber cycles, enthalpy of solution, hydration, and lattice enthalpy. Entropy and spontaneity: entropy changes and Gibbs free energy.

Term 3: Rate of chemical change, kinetic molecular theory, collision theory, experimental techniques, use of spreadsheets, catalysts. Dynamic equilibrium, application of le Chatelier's principle to predict the qualitative effects of changes of conditions; the equilibrium law, K_c, reaction quotient Q. Exploration: Application of scientific method, enquiry cycle, scientific context, researching and referencing skills. Pilot study: Application of formulating a hypothesis, variables, risk assessment, design. Data collection; analysis; evaluation; communication. Collaborative nature of science; interdisciplinary skills, application of 21st century communication skills, critical awareness of ethical implications of the use of science and technology, international and local dimensions.

What does excellence look like?

Using the calculation of propagated experimental uncertainty to report results appropriately. Evaluating the validity of a conclusion drawn from experimental data. Explaining the link between Gibbs free energy and equilibrium constant. To what extent should scientists be held morally responsible for their actions? High level of personal engagement in the IA: significant curiosity, independent thinking, creativity or initiative in design and implementation. Formulation of a precise research question, depth of relevant exploration, full and valid conclusion, critical evaluation of the investigation.

How will we assess impact?

- Peer, self and teacher assessment in lessons
- Previous lesson recap quiz
- Teacher questioning
- Landmark tasks
- End of Topic tests

Entry requirements:

To study IB HL Chemistry students require grade 6 or above in GCSE Chemistry or 66 or above in Combined Science including grade 6 or above in Chemistry components. Grade 6 or above in GCSE Mathematics is also required.

How can you enhance your learning at home?

- Chemguide
- Isaac chemistry
- Inthinking chemistry
- Royal Society of Chemistry

Suggested homework tasks

- Learn definitions of key terms.
- Group and independent research projects
- Past examination questions practice

Practical activity preparation, simulations, and follow-

International Opportunities

Visits Programme

- **Chemistry in Action lecture visit on international themes with globally renowned speakers.**
- **International day across the school.**
- **Potential opportunities to engage in science in exchange partner schools exploring different approaches to science and teaching methods.**

Within the curriculum

The Chemistry IBH Level curriculum is designed to deepen understanding and appreciation of how our international society makes decisions about global scientific issues. Students can compete in the International Chemistry Olympiad, Cambridge L6th Chemistry Challenge and Royal Society of Chemistry Schools' Analyst Competitions.

Students are encouraged to research each theme beyond lessons and set work to ensure that they can draw on a worldwide knowledge of the skills, techniques and theoretical understanding required for the further study of Chemical Sciences at an international level.

The IBDP collaborative sciences project provides an excellent opportunity for students to engage with global issues.