IB Chemistry 11/12 HL

Core / Additional Higher Level (AHL)

IB Chemistry 11 HL	IB Chemistry 12 HL
Topic 1: Stoichiometric Relationships 1.1 Introduction to the particulate nature of matter and chemical change 1.2 The mole concept 1.3 Reacting masses and volumes	**Topic 6/16: Chemical Kinetics** 6.1 Collision theory and rates of reaction 16.1 Rate expression and reaction mechanism 16.2 Activation energy
Topic 2/12: Atomic Structure 2.1 The nuclear atom 2.2 Electron configuration 12.1 Electrons in atoms	**Topic 7/17: Equilibrium** 7.1 Equilibrium 17.1 The equilibrium law
Topic 3/13: Periodicity/Transition Metals 3.1 Periodic table 3.2 Periodic trends 13.1 First-row d-block elements 13.2 Coloured complexes	**Topic 8/18: Acids And Bases** 8.1 Theories of acids and bases 8.2 Properties of acids and bases 8.3 The pH scale 8.4 Strong and weak acids and bases 8.5 Acid deposition 18.1 Lewis acids and bases 18.2 Calculations involving acids and bases 18.3 pH curves
Topic 4/14: Chemical Bonding And Structure 4.1 Ionic bonding and structure 4.2 Covalent bonding 4.3 Covalent structures 4.4 Intermolecular forces 4.5 Metallic bonding 14.1 Covalent bonding and electron domain and molecular geometries 14.2 Hybridization	**Topic 9/19: Redox Processes** 9.1 Oxidation and reduction 9.2 Electrochemical cells 19.1 Electrochemical cells
Topic 5/15: Energetics/Thermochemistry 5.1 Measuring energy changes 5.2 Hess's Law 5.3 Bond enthalpies 15.1 Energy cycles 15.2 Entropy and spontaneity	**Topic 10/20: Organic Chemistry** 10.1 Fundamentals of organic chemistry 10.2 Functional group chemistry 20.1 Types of organic reactions 20.2 Synthetic routes 20.3 Stereoisomerism
Topic 11: Measurement And Data Processing 11.1 Uncertainties and errors in measurement and results 11.2 Graphical techniques	**Topic 21: Measurement And Analysis** 21.1 Spectroscopic identification of organic compounds (11.3)

Option (IB Chemistry 12 HL)

A: Materials	**B: Biochemistry**
A.1 Materials science introduction	B.1 Introduction to biochemistry
A.2 Metals and inductively coupled plasma (ICP) spectroscopy	B.2 Proteins and enzymes
A.3 Catalysts	B.3 Lipids
A.4 Liquid crystals	B.4 Carbohydrates
A.5 Polymers	B.5 Vitamins
A.6 Nanotechnology	B.6 Biochemistry and the environment
A.7 Environmental impact—plastics	B.7 Proteins and enzymes
A.8 Superconducting metals and X-ray crystallography	B.8 Nucleic acids
A.9 Condensation polymers	B.9 Biological pigments
A.10 Environmental impact—heavy metals	B.10 Stereochemistry in biomolecules
C: Energy	**D: Medicinal Chemistry**
C.1 Energy sources	D.1 Pharmaceutical products and drug action
C.2 Fossil fuels	D.2 Aspirin and penicillin
C.3 Nuclear fusion and fission	D.3 Opiates
C.4 Solar energy	D.4 pH regulation of the stomach
C.5 Environmental impact—global warming	D.5 Anti-viral medications
C.6 Electrochemistry, rechargeable batteries and fuel cells	D.6 Environmental impact of some medications
C.7 Nuclear fusion and nuclear fission	D.7 Taxol—a chiral auxiliary case study
C.8 Photovoltaic and dye-sensitized solar cells	D.8 Nuclear medicine
	D.9 Drug detection and analysis

Assessment Outline–HL

Component	Details	Overall Weighting (%)	Duration (Hours)
External Assessment Paper 1 (Marks: 40)	40 multiple-choice, no calculators, periodic table provided, no deductions for incorrect answers	20	1
External Assessment Paper 2 (Marks: 95)	Short-answer, extended-response, calculators permitted, data booklet provided	36	2¼
External Assessment Paper 3 (Marks: 45)	A: Data-based, short-answer on experimental work B: Short-answer, extended-response from one option, calculators permitted, data booklet provided	24	1¼
Internal Assessment	Individual investigation	20	10

IB Grade (Markbands)	UBC % Equivalent
7 (Excellent)	98-100
6 (Very Good)	96-97
5 (Good)	90-95
4 (Satisfactory)	86-89
3 (Mediocre)	76-85
2 (Poor)	70-75
1 (Very Poor)	50-69

Science and Theory of Knowledge (TOK)

Theory of knowledge identifies eight ways of knowing: reason, emotion, language, sense perception, intuition, imagination, faith and memory. It is now widely accepted that there is no one scientific method. Instead, the sciences utilize a variety of approaches in order to produce explanations for the behaviour of the natural world. The different scientific disciplines share a common focus on utilizing inductive and deductive reasoning, on the importance of evidence. Knowledge questions are open ended questions about knowledge, such as: How do we distinguish science from pseudoscience? What is the relationship between a scientist's expectation and their perception? How does scientific knowledge progress? What is the role of imagination and intuition in the sciences? What are the similarities and differences in methods in the natural sciences and the human sciences?

Approaches to Teaching and Learning

Approaches to teaching and learning across the Diploma Programme refer to deliberate strategies, skills and attitudes which are intrinsically linked with the learner profile attributes, that enhance student learning and assist student preparation for the Diploma Programme assessment and beyond. The five approaches to learning (thinking skills, social skills, communication skills, self-management skills and research skills) along with the six approaches to teaching (inquiry based, conceptually focused, contextualized, collaborative, differentiated and informed by assessment) are developed through Lectures, Laboratories, Group 4 Projects, Internal/External Assessments and Extended Essays.

Practical Work and Internal Assessment

The practical scheme of work (PSOW) is the practical course planned by the teacher and acts as a summary of all the investigative activities carried out by a student. The range of practical work carried out should reflect the breadth and depth of the subject syllabus at each level, but it is not necessary to carry out an investigation for every syllabus topic:

Flexibility: Labs, Projects, Simulations, Databases, Models, Questionnaires, Surveys, Data-Analysis, Fieldwork

Practical Activities	40 hours
Individual Investigation (Internal Assessment—IA)	10 hours
Group 4 Project	10 hours

The internal assessment task will be one scientific investigation taking about 10 hours and the writeup should be about 6 to 12 pages long. Investigations exceeding this length will be penalized in the communication criterion as lacking in conciseness. Some of the possible tasks include: a hands-on laboratory investigation; using a spreadsheet for analysis and modelling; extracting data from a database and analysing it graphically; producing a hybrid of spreadsheet/database work with a traditional hands-on investigation; using a simulation provided it is interactive and open-ended.

Internal Assessment Criteria

Personal Engagement	Exploration	Analysis	Evaluation	Communication	Total
2 (8%)	6 (25%)	6 (25%)	6 (25%)	4 (17%)	24 (100%)

Personal Engagement
This criterion assesses the extent to which the student engages with the exploration and makes it their own. Personal engagement may be recognized in different attributes and skills. These could include addressing personal interests or showing evidence of independent thinking, creativity or initiative in the designing, implementation or presentation of the investigation.

Exploration
This criterion assesses the extent to which the student establishes the scientific context for the work, states a clear and focused research question and uses concepts and techniques appropriate to the Diploma Programme level. Where appropriate, this criterion also assesses awareness of safety, environmental, and ethical considerations.

Analysis
This criterion assesses the extent to which the student's report provides evidence that the student has selected, recorded, processed and interpreted the data in ways that are relevant to the research question and can support a conclusion.

Evaluation
This criterion assesses the extent to which the student's report provides evidence of evaluation of the investigation and the results with regard to the research question and the accepted scientific context.

Communication
This criterion assesses whether the investigation is presented and reported in a way that supports effective communication of the focus, process and outcome**.**

Group 4 Project

The group 4 project is an interdisciplinary activity in which all Diploma Programme science students must participate. The intention is that students from the different group 4 subjects analyse a common topic or problem. The group 4 project allows students to appreciate the environmental, social and ethical implications of science and technology. It may also allow them to understand the limitations of scientific study, for example, the shortage of appropriate data and/or the lack of resources. The emphasis is on interdisciplinary cooperation and the processes involved in scientific investigation, rather than the products of such investigation.

Project Stages: Planning, Action, Evaluation