

The IB Diploma Programme, for students aged 16 to 19, is an academically challenging and balanced programme of education that prepares students for success at university and life beyond. Students take courses in six different subject groups, maintaining both breadth and depth of study. Chemistry higher level (HL) is in group 4, experimental sciences. In addition, three core elements—the extended essay, theory of knowledge and creativity, action, service—are compulsory and central to the philosophy of the programme.

**About the IB:** For over 40 years the IB has built a reputation for high-quality, challenging programmes of education that develop internationally minded young people who are well prepared for the challenges of life in the 21st century and able to contribute to creating a better, more peaceful world.

The IB subject briefs illustrate four key course components in the IB Diploma Programme,

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## Overview of the chemistry higher level course and curriculum model

### I. Course description and aims

The IB Diploma Programme chemistry course combines academic study with the acquisition of practical and investigational skills through the experimental approach. Students learn the chemical principles that underpin both the physical environment and biological systems through the study of quantitative chemistry, periodicity, kinetics and other subjects. The chemistry course covers the essential principles of the subject and, through selection of options, allows teachers some flexibility to tailor the course to meet the needs of their students.

Throughout this challenging course, students become aware of how scientists work and communicate with each other. Further, students enjoy multiple opportunities for scientific study and creative inquiry within a global context. In addition, the course is designed to:

- provide opportunities for scientific study and creativity within a global context that will stimulate challenge students
- provide a body of knowledge, methods and techniques that characterize science and technology
- enable students to apply and use a body of knowledge, methods and techniques that characterize science and technology
- develop an ability to analyse, evaluate and synthesize scientific information
- develop experimental and investigative scientific skills
- engender an awareness of the need for, and the value of, effective collaboration and communication during scientific activities
- develop and apply the students' information and communication technology skills in the study of science
- raise awareness of the moral, ethical, social, economic and environmental implications of using science and technology
- develop an appreciation of the possibilities and limitations associated with science and scientists
- encourage an understanding of the relationships between scientific disciplines and the overarching nature of the scientific method.

### II. Curriculum model overview

#### Chemistry higher level

Theory		180 hours
<i>Core</i>	80 hours of instruction on 11 topics <ul style="list-style-type: none"> <li>• Quantitative chemistry</li> <li>• Atomic structure</li> <li>• Periodicity</li> <li>• Bonding</li> <li>• Energetics</li> <li>• Kinetics</li> <li>• Equilibrium</li> <li>• Acids and bases</li> <li>• Oxidation and reduction</li> <li>• Organic chemistry</li> <li>• Measurement and data processing</li> </ul>	80 hours
<i>Additional higher level</i>	55 hours of instruction on five topics <ul style="list-style-type: none"> <li>• Atomic structure</li> <li>• Periodicity</li> <li>• Bonding</li> <li>• Energetics</li> <li>• Kinetics</li> <li>• Equilibrium</li> <li>• Acids and bases</li> <li>• Oxidation and reduction</li> <li>• Organic chemistry</li> </ul>	55 hours
<i>Options</i>	45 hours of instruction on two additional topics <ul style="list-style-type: none"> <li>• Modern analytical chemistry</li> <li>• Human biochemistry</li> <li>• Chemistry in industry and technology</li> <li>• Medicines and drugs</li> <li>• Environmental chemistry</li> <li>• Food chemistry</li> <li>• Further organic chemistry and conservation</li> </ul>	45 hours
Practical work		60 hours
<i>Investigations</i>		50 hours
<i>Group 4 project</i>		10 hours
Total teaching hours		240 hours

### III. Assessment model

#### Assessment for chemistry higher level

The IB assesses student work as direct evidence of achievement against the stated goals of the Diploma Programme courses, which are to provide students with:

- a broad and balanced, yet academically demanding, programme of study
- the development of critical-thinking and reflective skills
- the development of research skills
- the development of independent learning skills
- the development of intercultural understanding
- a globally recognized university entrance qualification.

The assessments aim to test all students' knowledge and understanding of key concepts through:

- applying and using scientific methods, techniques and terminology
- constructing, analysing and evaluating scientific hypotheses, research questions and predictions, scientific methods and techniques, and scientific explanations
- demonstrating both the personal skills of cooperation, perseverance and responsibility appropriate for effective scientific investigation and problem-solving and the manipulative skills necessary to carry out scientific investigations with precision and safety.

Students' success in the chemistry higher level course is measured by combining their grades on external and internal assessment.

Even multiple-choice questions require that students know what each term or concept means in order to respond correctly, demonstrating an understanding of both basic facts and complex concepts. Calculators are not permitted in the multiple-choice examination but students are expected to carry out simple calculations.

The internal assessment is of each student's practical or laboratory work. This includes the group 4 project, a total of 10 hours within the higher level course of 240 hours, in which students from different group 4 subjects collaborate in addressing a scientific or technological topic, allowing for concepts and perceptions from across the disciplines that "encourage an understanding of the relationships between scientific disciplines and the overarching nature of the scientific method".

#### Assessment at a glance

Type of assessment	Format of assessment	Time (hours)	Weighting of final grade (%)
<b>External</b>			<b>76</b>
<i>Paper 1</i>	Multiple choice	1	20
<i>Paper 2</i>	Data analysis, short answer and open response	2.25	36
<i>Paper 3</i>	Short answer and extended response	1.25	20
<b>Internal</b>			<b>24</b>
<i>Practical work</i>	Short laboratory practicals and long-term practicals or projects; general laboratory work and fieldwork		
	Group 4 collaborative, interdisciplinary project		

### IV. Sample questions

The following questions appeared in previous IB Diploma Programme chemistry higher level examinations.\*

1. Which compound can exist as optical isomers? (Paper 1)
  - A.  $\text{H}_2\text{NCH}_2\text{COOH}$
  - B.  $\text{H}_3\text{CCONH}_2$
  - C.  $\text{H}_3\text{CCHBr}$
  - D.  $\text{HCOOCH}_3$
2. The molecular formula,  $\text{C}_3\text{H}_4\text{Cl}_2$  represents several isomeric compounds. Some isomers are cyclic and some are unsaturated. (Paper 2)
  - (a) Draw the structures of two cyclic compounds that are structural isomers and state the names of both isomers.
  - (b) Two of the non-cyclic compounds have geometrical isomers. Draw the structures of these compounds and their geometrical isomers.
3. Describe aerobic respiration of glucose in the human body, with reference to oxidation and reduction. (Paper 3)

\* the syllabus for examinations current until 2016

Learn more about how the IB Diploma Programme prepares students for success at university by going online to [www.ibo.org/universities](http://www.ibo.org/universities) or email us at [recognition@ibo.org](mailto:recognition@ibo.org).