XV. GIMNAZIJA
International Baccalaureate Department
Diploma Programme

CHEMISTRY SL & HL
Year 1 and 2
COURSE OUTLINE

WHAT IS THE COURSE ABOUT?

Chemistry is an experimental science that combines academic study with the acquisition of practical and investigational skills. Chemical principles combine both the physical environment in which we live and all biological systems. Also, knowledge taught in this course is needed in higher education, such as medicine, biological science and environmental science, and serves as useful preparation for employment. The Diploma Programme chemistry course includes the essential principles of the subject but also, through selection of an option, allows teachers some flexibility to tailor the course to meet the needs of their students. The course is available at both standard level (SL) and higher level (HL), and therefore accommodates students who wish to study chemistry as their major subject in higher education and those who do not. At the school level both theory and experiments should be undertaken by all students. They should complement one another naturally, as they do in the wider scientific community. The Diploma Programme chemistry course allows students to develop traditional practical skills and techniques and to increase facility in the use of mathematics, which is the language of science. It also allows students to develop interpersonal skills, and digital technology skills, which are essential in 21st century scientific endeavour and are important life-enhancing, transferable skills in their own right.

AIMS:

The course enables students, through the overarching theme of the NOS, to:

1. develop conceptual understanding that allows connections to be made between different areas of the subject, and to other DP sciences subjects
2. acquire and apply a body of knowledge, methods, tools and techniques that characterize science
3. develop the ability to analyse, evaluate and synthesize scientific information and claims
4. develop the ability to approach unfamiliar situations with creativity and resilience
5. design and model solutions to local and global problems in a scientific context
6. develop an appreciation of the possibilities and limitations of science
7. develop technology skills in a scientific context
8. develop the ability to communicate and collaborate effectively
9. develop awareness of the ethical, environmental, economic, cultural and social impact of science.

OBJECTIVES:

The assessment objectives for chemistry reflect those parts of the aims that will be formally assessed either internally or externally. It is the intention of this course that students are able to fulfil the following assessment objectives.

1. Demonstrate knowledge of:
    a. terminology, facts and concepts
    b. skills, techniques and methodologies.
2. Understand and apply knowledge of:
    a. terminology and concepts
    b. skills, techniques and methodologies.
3. Analyse, evaluate, and synthesize:
    a. experimental procedures
    b. primary and secondary data
    c. trends, patterns and predictions.
4. Demonstrate the application of skills necessary to carry out insightful and ethical investigations.

ASSESSMENT

IB Diploma Programme assessment

The final IB Chemistry assessment consists of Paper 1, Paper 2 and one internally assessed Scientific Investigation.

Component	SL	HL	Weighting	Description
Paper 1	1 h 30 min	2 h	36%	Paper 1A: multiple-choice questions; Paper 1B: data-based questions.
Paper 2	1 h 30 min	2 h 30 min	44%	Short-answer and extended-response questions.
Internal assessment	10 h	10 h	20%	One Scientific Investigation; internally assessed by the teacher and externally moderated by IB.

External assessment accounts for 80% and internal assessment for 20%. The Scientific Investigation is a single research task in which the student investigates and answers an original research question.

School-based assessment

- **Unit test:**
  After the completion of each unit. Duration of a test is 1 school hours. This test will consist of two parts; the first part being multiple choice questions and the second part consisting of data analysis and/or short answer questions.
- **Progress test:**
  When big units are taught (like Organic chemistry) for monitoring the Student's progress during the unit, duration of progress test is 1 school hour, frequency of progress tests is one per big unit
- **Lab reports:**
  Lab reports are assessed against DIP Internal assessment criteria, frequency is after each performed experiment
- **Semester/Year Exam:**
  Two Papers at the end of DIP 1 Year and two papers in February of DIP 2 Year. Two grades are provided (P1 and P2 for each part of the exam.

During the course teacher use **formative assessments.** This assessment aims to the continuous supervision of a student's progress by a wide range of assessment tools. While preparing students for the summative assessments, teachers use a variety of formative assessments to scaffold student development of content knowledge and skills.

All pieces of work will be marked on the 1 to 7 grading scale.

All tests, exams and all prescribed practicals (lab reports) will be graded according to the grade boundaries provided.

Grade boundaries					
Grade	**Tests**	**Exam**	**Lab reports/practicals**		
			1 criterion/6	**2 criteria/12**	**3 criteria/18**
7	91-100%	86-100%	6	11-12	16-18
6	81-90%	71-86%	5	9-10	14-15
5	71-80%	55-70%	4	7-8	12-13
4	61-70%	45-54%	3	5-6	10-11
3	51-60%	31-44%	2	3-4	8-9
2	31-50%	15-30%	1	1-2	6-7
1	0-30%	0-14%	0	0	0-5

Term Grades and Final grade will be determined according to the table below.

Component				
DIP 1 and DIP 2	**Paper 1** 20%	**Paper 2** 20%	**Tests** 40%	**Internal assessment (lab reports)** 20%

IMPLEMENTATION:
DP Year 1 and 2
The school offers 3/4 lessons per week (SL) and 5/7 lessons per week (HL), depending on the year. During DIP 1 course in taught in combined group (joined SL and HL), and in DIP 2, regarding the number of students choosing SL or HL, the group can be divided into two separated groups; one being SL and second being HL. At the beginning of DIP 2 (First semester) all students will work on their chosen Individual investigations.

Topics:
The syllabus for the Diploma Programme Chemistry course is divided into 2 parts; Core material and additional HL material. The **Core material** is compulsory and is divided into two concepts: Structure and Reactivity. Each concept is divided into three sub-concepts:

Syllabus content

Structure 1. Models of the particulate nature of matter

Structure 2. Models of bonding and structure

Structure 3. Classification of matter

Reactivity 1. What drives chemical reactions?

Reactivity 2. How much, how fast and how far?

Reactivity 3. What are the mechanisms of chemical change?

All concepts and sub-concepts will be taught through 10/11 units:

Topics and unit arrangement

IB Chemistry syllabus is organized into six overarching topics rather and the school units below group the new syllabus content into the familiar sequence.

No. of unit	IB syllabus alignment	Nature of Science emphasis
UNIT 0 **Measurement and data processing**	Skills in the study of chemistry — integrated throughout the course: experimental techniques; technology; mathematics; exploring and designing; collecting and processing data; concluding and evaluating.	Making quantitative measurements with replicates to ensure reliability; correlation; improvements in instrumentation; models developed to explain phenomena that may not be directly observable.
UNIT 1 **Stoichiometric relationships**	**Structure 1** — Models of the particulate nature of matter: 1.1 Introduction to the particulate nature of matter; 1.4 Counting particles by mass: The mole; quantitative relationships and chemical equations.	Making quantitative measurements with replicates; using evidence and mathematical relationships to explain chemical phenomena.
UNIT 2 **Atomic structure**	**Structure 1** — Models of the particulate nature of matter: 1.2 The nuclear atom; 1.3 Electron configurations; atomic structure, isotopes and electron arrangements.	Evidence and improvements in instrumentation; developments in scientific research follow improvements in apparatus; models and theories are used to explain natural phenomena.
UNIT 3 **Periodicity**	**Structure 3** — Classification of matter: periodic classification of the elements and patterns/trends in the periodic table.	Obtaining evidence for scientific theories by making and testing predictions; looking for patterns, trends and discrepancies; classification and models.
UNIT 4 **Chemical bonding and structure**	**Structure 2** — Models of bonding and structure: 2.1 The ionic model; 2.2 The covalent model; 2.3 The metallic model; 2.4 From models to materials.	Scientists use models as representations of the real world; models have limitations; evidence can support, falsify or replace models and theories; looking for trends and discrepancies.
UNIT 5 **Energetics / thermochemistry**	**Reactivity 1** — What drives chemical reactions?: 1.1 Measuring enthalpy changes; 1.2 Energy cycles in reactions; 1.3 Energy from fuels; HL extension: entropy and spontaneity.	Making careful observations and quantitative measurements; hypotheses, models and theories; theories can be superseded as new evidence becomes available.
UNIT 6 **Chemical kinetics**	**Reactivity 2** — How much, how fast and how far?: the rate of chemical change, factors affecting rate, collision theory and quantitative analysis of reaction rates.	The principle of Occam's razor; theories can be supported or falsified and replaced by new theories; quantitative evidence is used to evaluate models.
UNIT 7 **Equilibrium**	**Reactivity 2** — How much, how fast and how far?: the extent of chemical change, dynamic equilibrium, equilibrium constants and factors affecting equilibrium.	Obtaining evidence for scientific theories; common language across disciplines; employing quantitative reasoning to describe and predict chemical systems.
UNIT 8 **Acids and bases**	**Reactivity 3** — What are the mechanisms of chemical change?: proton transfer reactions, acid–base models, pH, buffers, titrations and related quantitative applications.	Falsification and supersession of theories; public understanding of science; obtaining evidence for theories; improved instrumentation and quantitative analysis.
UNIT 9 **Redox processes**	**Reactivity 3** — What are the mechanisms of chemical change?: electron transfer reactions, oxidation states, electrochemical cells and redox applications.	How evidence is used; ethical implications of research and technology; experimental outcomes can provide further evidence for scientific claims.
UNIT 10 **Organic chemistry**	**Structure 3** — Classification of matter: functional groups and classification of organic compounds; and Reactivity 3: electron sharing, electron-pair sharing and organic reaction mechanisms.	Serendipity and scientific discoveries; ethical implications; use of data and analytical techniques to investigate structures and reaction pathways.

IB SYLLABUS OVERVIEW

The IB recommends 150 teaching hours for SL and 240 hours for HL. The syllabus content is supported by an experimental programme and by the development of skills in the study of chemistry.

IB topic	SL hours	HL hours	Main focus
Structure 1 — Models of the particulate nature of matter	17	21	Particles, atoms, electron configurations, mole and gases
Structure 2 — Models of bonding and structure	20	30	Ionic, covalent and metallic models; materials
Structure 3 — Classification of matter	16	31	Periodic classification and organic functional groups
Reactivity 1 — What drives chemical reactions?	12	22	Enthalpy, energy cycles, fuels, entropy and spontaneity
Reactivity 2 — How much, how fast and how far?	21	31	Amount, rate and extent of chemical change
Reactivity 3 — What are the mechanisms of chemical change?	24	45	Proton transfer, electron transfer, electron sharing and electron-pair sharing
Experimental programme	40	60	Practical work, collaborative sciences project and scientific investigation

Skills in the study of chemistry

- Tool 1: Experimental techniques — safety, measurement and practical techniques.
- Tool 2: Technology — collecting and processing data, sensors, databases, spreadsheets and modelling.
- Tool 3: Mathematics — arithmetic, algebra, ratios, logarithms, rates, statistics, scientific notation and estimation.
- Inquiry 1: Exploring and designing.
- Inquiry 2: Collecting and processing data.
- Inquiry 3: Concluding and evaluating.

Nature of Science

Nature of Science is an overarching theme of DP Chemistry. Students consider how observations, patterns and trends, hypotheses, experiments, measurement, models, evidence, theories, falsification, collaboration and the global impact of science contribute to the construction, communication and evaluation of scientific knowledge.

Textbooks:

- Sergey Bylikin, Gary Horner, Brian Murphy, David Tarcy; *Oxford IB Diploma Programme IB Chemistry Course companion,* Oxford 2023
- Geoffrey Neuss; *Oxford IB Diploma Programme IB Chemistry Study Guide, Oxford 2023*

Document adapted from:
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