IB Chemistry

What is the course about?

The IB Chemistry course at BISC is designed for leaners to approach;

1. What is science and what is the scientific endeavour?

The scientists have used, and do use, different methods at different times to build up their knowledge and ideas. Scientists use a wide variety of methodologies which make up the process of science. Evidences obtained by observation or experiments are used to develop theories, generalise from data to form laws and propose hypotheses.

To interpret evidences, a fundamental common understanding must be mastered, including a common terminology and a common reasoning process, which involves using deductive and inductive logic through analogies and generalizations. They share mathematics, the language of science.

2. The understanding of science

Experimentation in a controlled environment, generally in laboratories, is the other way of obtaining evidence in the form of data. Leaners must have a common understanding about what makes them all scientifically valid.

Much modern science is carried out using instrumentation and sensors that can gather information remotely and automatically in areas that are too small, or too far away, or otherwise beyond human sense perception.

In Internal Assessment (more details later), which is an exciting and challenging adventure involving much creativity and imagination as well as exacting and detailed thinking and application. To be scientific, an idea (for example, a theory or hypothesis) must focus on the natural world and natural explanations and must be testable. And then hypotheses and theories developed in investigations are compatible with accepted principles and that simplify and unify existing ideas.

3. The objectivity of science

In two-year course work, leaners will conduct and write up laboratory reports. Data is the lifeblood and may be qualitative or quantitative. They analyse data and look for patterns, trends and discrepancies, attempting to discover relationships and establish causal links. It is important to take repeated measurements and large numbers of readings can improve reliability in data collection.

Learners need to be aware of random errors and systematic errors and use techniques such as error bars and lines of best fit on graphs to portray the data. There is a need to consider whether outlying data points should be discarded or not.

Leaners need to understand the difference between errors and uncertainties, accuracy and precision, and need to understand and use the mathematical ideas of average, mean, mode, median, etc. Statistical methods such as standard deviation and chi-squared tests are often used. It is important to be able to assess how accurate a result is.

In recent decades, the growth in computing power, sensor technology and database has allowed scientists to collect large amount of data. Leaners may face researches analysing large amounts of this data, stored in databases, looking for patterns and unique events.

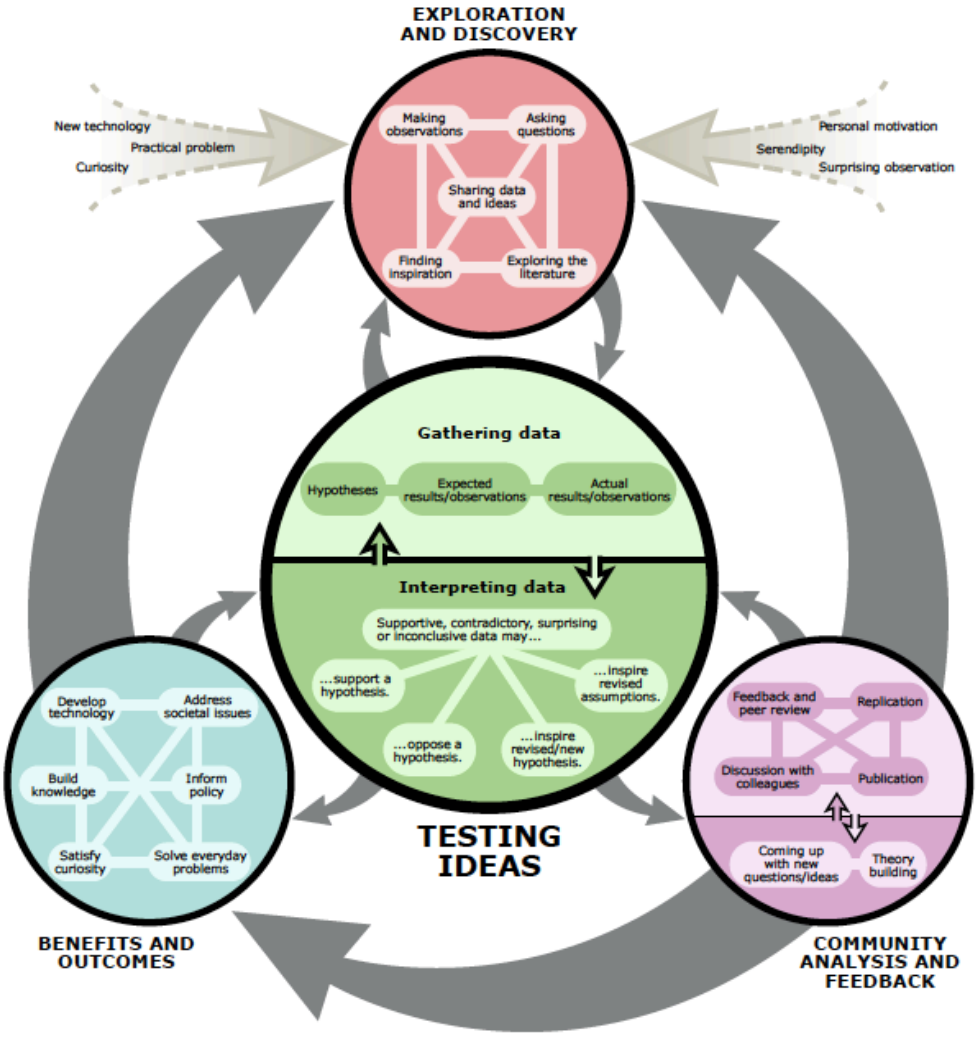
Obtained data may or may not be correlated. The ideas of correlation are very important in science. A correlation can be positive or negative and a correlation coefficient can be calculated that will have a value between +1, 0 and -1. A strong correlation (positive or negative) between one factor and another suggests some sort of causal relationship between the two factors but more evidence is usually required before scientists accept the idea.

4. The human face of science

By communicating with scientific histories and articles, leaners will understand teamwork to take place with the common understanding that science should be open-minded and independent of religion, culture, politics, nationality, age and gender. Science involves the free global interchange of information and ideas.

The integrity and honest representation of data is paramount in science—results should not be fixed or manipulated or doctored. To help ensure academic honesty and guard against plagiarism, all sources are quoted and appropriate acknowledgment made of help or support.

Science has been used to solve many problems and improve man's lot, but it has also been used in morally questionable ways and in ways that inadvertently caused problems. Ethical discussions, risk-benefit analyses, risk assessment and the precautionary principle are all parts of the scientific way of addressing the common good.



How is the course structured?

Year	Core	Additional Higher Level (AHL)
1	1. Stoichiometric relationships 2. Atomic Structure 3. Periodicity 4. Chemical bonding and structure 5. Energetics/thermochemistry 6. Chemical kinetics 7. Equilibrium 8. Acids and bases 11. Measurement and data processing	12. Atomic structure 13. The periodic table – the transition metals 14. Chemical bonding and structure 15. Energetics/thermochemistry 16. Chemical kinetics 17. Equilibrium 18. Acids and bases 21. Measurement and analysis
	Group 4 project	
2	9. Redox processes 10. Organic chemistry Option D. Medicinal Chemistry	19. Redox processes 20. Organic chemistry Option D. Medicinal Chemistry
	Mock examinations	

Both SL and HL students will explore Core topics for 4 periods per week. In addition, for 2 periods per week, HL students will study HL topics.

Each topic is consisted of Core (SL and HL) and Advanced (HL only) sub-topics.

In the second year, after main topics are covered, Option topic (Option D, Medicinal Chemistry) is studied.

In May-June in the first year, Group 4 project takes place, in which all students are involved to collaborative, interdisciplinary activities where the emphasis is on the processes involved in, rather than the products of an activity.

After learning the Organic Chemistry (around late November in the second year), students are ready to conduct the Internal Assessment, in which students design, prepare, and implement individual investigation. This is followed by writing up a report which is internally and externally assessed.

After the mock examinations, time will be spent on revision and study leave for the IB examination (after Easter break).

What distinguishes this course from others?

1. Practical scheme of work

Students experience various and significant amount of practical activities, which allow students to interact directly with natural phenomena and secondary data sources. These experiences provide the students with the opportunity to design investigations, collect data, develop manipulative skills, analyse results, collaborate with peers and evaluate and communicate their findings. By carrying out hands-on experimentation, students experience the nature of scientific thought and investigation.

It is important that students are involved in an inquiry-based practical programme that allows for the development of scientific inquiry. It is not enough for students just to be able to follow directions and to simply replicate a given experimental procedure; they must be provided with the opportunities for genuine inquiry. Developing scientific inquiry skills will give students the ability to construct an explanation based on reliable evidence and logical reasoning.

IB Chemistry programme has required students to spend a minimum hour for practical work.

Practical scheme of work	**SL** (hours)	**HL** (hours)
Practical activities	**20**	**40**
Individual investigation (Internal assessment – IA)	**10**	**10**
Group 4 project	**10**	**10**

The second column gives suggestions to teachers about relevant references to international-mindedness. It also gives examples of TOK knowledge questions (see *Theory of knowledge* guide published 2013) that can be used to focus students' thoughts on the preparation of the TOK prescribed essay. The "Links" section may link the sub-topic to other parts of the subject syllabus, to other Diploma Programme subject guides or to real-world applications. Finally, the "Aims" section refers to how specific group 4 aims are being addressed in the sub-topic.

How is the course assessed?

External assessments are consisted of written examinations (three papers) and Internal assessment (IA).

SL		
Component	Over all weighing (%)	Exam duration
Paper 1 (Multiple choice)	20	45 mins
Paper 2 (Open-end questions)	40	1 h 15 mins
Paper 3 (Selective for option topic and practical based questions)	20	1 h
IA	20	10 h

HL		
Component	Over all weighing (%)	Exam duration
Paper 1 (Multiple choice)	20	1 h
Paper 2 (Open-end questions)	36	2 h 15 mins
Paper 3 (Selective for option topic and practical based questions)	24	1 h 15 mins
IA	24	10 h

Internal assessments are consisted of chapter tests and written reports in practical work. Time management is a key for a success in the IB chemistry programme. Effective revision skills to prepare for chapter tests as well as daily study at home and meeting dues for written reports are not easy.

Are there any requirements?

Chemistry requires to have sufficient command of scientific language in order to express scientific ideas and to explain science in written.

To enter SL, students should have achieved at least grade B in IGCSE or equivalent.

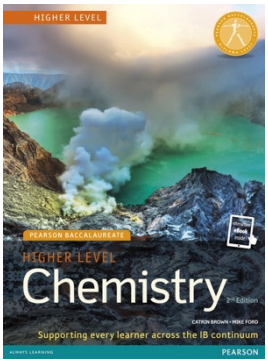
To enter HL, students should have achieved A or A* in IGCSE or equivalent.

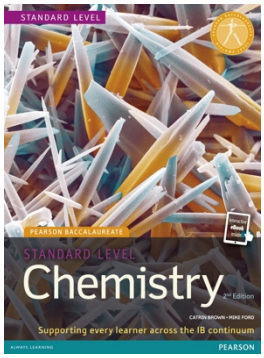
If students have not been formally assessed at the end of Year 11, students are required to take an entry test which will determine their readiness to cope with the demands of the course.

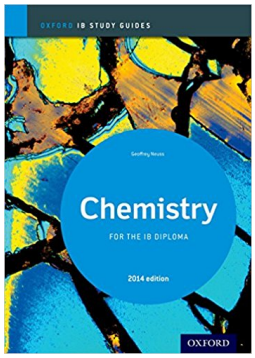
What materials will students need?

Students must have a sufficient mathematical skill. Chemical mathematics is very important throughout the programme.

Course book is provided (by registering with our library) and buying a study guide would be beneficial for revision work.







The school library has subscribed to New Scientist. It is strongly recommended for students to read various and updated scientific articles.

In addition, materials are available on Schoology, the virtual learning environment used by the school.

What will students learn?

Through studying chemistry, students become aware of how scientists work and communicate with each other. While the scientific method may take on a wide variety of forms, it is the emphasis on a practical approach through experimental work. Students are able to;

1. appreciate scientific study and creativity within a global context through stimulating and challenging opportunities
2. acquire a body of knowledge, methods and techniques that characterize science and technology
3. apply and use a body of knowledge, methods and techniques that characterize science and technology
4. develop an ability to analyse, evaluate and synthesize scientific information
5. develop a critical awareness of the need for, and the value of, effective collaboration and communication during scientific activities

6. develop experimental and investigative scientific skills including the use of current technologies
7. develop and apply 21st century communication skills in the study of science
8. become critically aware, as global citizens, of the ethical implications of using science and technology
9. develop an appreciation of the possibilities and limitations of science and technology
10. develop an understanding of the relationships between scientific disciplines and their influence on other areas of knowledge.

In what ways does the chemistry syllabus promote the attributes of the IB learner profile?

The syllabus promotes the attributes in the following ways:

Inquirer – we are enthusiasm to learn how we live in science. We are curious about how substances are made, why chemical reactions occur.

Reflective – at the end of any laboratory work, we need to think about what went well, what did not go so well, and most importantly why did it not go so well!

Knowledgeable – we are fascinated and inspired by chemistry and are aware of the fact that the more we know, the more we realise how little there is that we acually don't know! Knowledgeable is when we know what labs will work well and what won't work well. We know the mistakes and are able to pass this onto others to stop it happening.

Principled – we through acquiring scientific integrity in handling their own and other people's data and ideas and also referencing other people work.

Caring – we understand the implications of human activities and scientific achievements on environment and society.

Risk-taker – we challenge for new discovery and design investigations.

Thinkers – we learn to acquire critical skills to evaluate hypothesis, research questions and methods both in students' work and in the work of others.

Communicators – we collaborate with others in practical activities and Group 4 project. We also use the appropriate scientific language both written and oral work.

Open-minded – scientists must not be biased by religions, culture, and gender etc. We purely appreciate any scientific work including theories and laws as well as history how science has developed.

Balanced – science is largely attributed to well-being of human, animal, and environment.

What from the course can make worthwhile extended essay questions?

Extended Essay in Chemistry will involve some research into the background or theory of the topic selected. Therefore, students may choose any of the following approaches:

Experimental—design and implementation of an experiment, then personal collection and analysis of the data

Data-based—location and extraction of raw or processed data, which is then further refined and analysed

Theoretical—development of a quantitative or semi-quantitative description of the phenomenon, development or construction of a model, predictions about its behaviour and limitations.

For example;

- Contamination of drinking water by heavy metals – determining the concentration of transition metal ions by chelating titration using EDTA
- Oxidation of carbon-carbon double bonds of vegetable oil by heating with different period – determining unsaturation index
- Synthesis of bio-diesel and determining enthalpy change of combustion.

The EE is not an extension of the internal assessment, or any other assessment component, and students must ensure that they do not use material submitted for any other assessment component as part of the EE submission.

Can an interest in Chemistry lead to a CAS project?

Yes, it can, as can any subject for that matter.

Here are examples of possible CAS projects:

1. Participation to Science festival run by communities and universities
2. Tutoring chemistry for young learners
3. Charities or fund-rising activities related to environments, pollutions, and the Earth.

What is the relationship between TOK and Chemistry?

TOK provides a space for students to engage in stimulating wider discussions about questions such as what it means for a discipline to be a science, or whether there should be ethical constraints on the pursuit of scientific knowledge.

Knowledge questions are open-ended questions about knowledge, and include questions such as:

- How do we distinguish science from pseudoscience?
- When performing experiments, 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?

Examples of relevant knowledge questions are provided throughout the sub-topics in the syllabus content. Students should be encouraged to raise and discuss such knowledge questions in both their science and TOK classes.

What career paths are open to me?

Chemistry is often called the central science, as chemical principles underpin both the physical environment in which we live and all biological systems. Apart from being a subject worthy of study in its own right, chemistry is a prerequisite for many other courses in higher education, such as medicine, biological science and environmental science, and serves as useful preparation for employment.

Former chemistry students enter universities to study medicine, pharmacy, pharmacology, and engineering.

Where can I find more information about the course?

Please download and read IB Chemistry subject guide (available on Schoology) for more information. Please also feel free to email the Chemistry teacher at k.osanai@bisc.krakow.pl.