SCHOOL OF THE NATIONS
聯國學校

2023-2025 COURSE OUTLINE

International Baccalaureate
Biology SL & HL
Form 5 and Form 6

The School of the Nations course outline provides parents and students with information about the overall structure of the courses of study, the assessments and expectations.

1. Course Overview

As one of the three natural sciences in the IB Diploma Programme, biology is primarily concerned with the study of life and living systems. Biologists attempt to make sense of the world through a variety of approaches and techniques, controlled experimentation and collaboration between scientists. At a time of global introspection on human activities and their impact on the world around us, developing and communicating a clear understanding of the living world has never been of greater importance than it is today.

Through the study of DP biology, students are empowered to make sense of living systems through unifying themes. By providing opportunities for students to explore conceptual frameworks, they are better able to develop understanding and awareness of the living world around them. This is carried further through a study of interactions at different levels of biological organization, from molecules and cells to ecosystems and the biosphere. Integral to the student experience of the DP biology course is the learning that takes place through scientific inquiry. With an emphasis on experimental work, teachers provide students with opportunities to ask questions, design experiments, collect and analyse data, collaborate with peers, and reflect, evaluate and communicate their findings.

DP biology enables students to constructively engage with topical scientific issues. Students examine scientific knowledge claims in a real-world context, fostering interest and curiosity. By exploring the subject, they develop understandings, skills and techniques which can be applied across their studies and beyond.

International Mindedness

Science has been, and continues to be, a truly international endeavour. From the beginnings of seismology in China, through material science in Mesopotamia to astronomy in the Islamic Golden Age, the search for an objective understanding of the natural world transcends the limitations imposed by national boundaries. The scientific process, requiring curiosity, insight and an open-minded approach, benefits from the widest possible participation across genders and cultures through inclusivity and diversity. Given the global nature of many scientific issues, international organizations often have a focus on the engagement of science with the public domain. The World Health Organization and the Intergovernmental Panel on Climate Change are two well-known examples that model a responsibility to inform nations of scientific progress on an equitable basis. Underlying this responsibility is the interest of promoting a peaceful and sustainable future.

Advancements in technology, along with the cost of modern research facilities, continues to reinforce the role of international collaborative work. This was clearly demonstrated through the global initiatives focused on addressing the COVID-19 pandemic. Specifically, the initiatives that were undertaken to develop the necessary knowledge and technology to create vaccines.

The importance of collaboration in contemporary science is reflected by the large number of international organizations tasked with collating and sharing data with the scientific community. Access to shared knowledge through websites and databases must be integrated into classroom teaching as it plays an important role in validating experimental work.

In addition to integrating technology and collaborative work, the collaborative sciences project provides an excellent opportunity for students to engage with global issues.

2. Course 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.

3. Core Components

3.1 Creativity, Activity, Service (CAS)

The CAS component of the DP core provides many opportunities for students to link science concepts and topics to practical experiences. Teachers can highlight how knowledge and understanding developed through the course might inform meaningful experiences. Outside the classroom, CAS experiences might also ignite students' passion for addressing topics inside the biology classroom.

Some examples of relevant CAS experiences are as follows.
• Organizing a science club for students in lower years
• Implementing environmental initiatives within the school or local community, such as recycling, composting and roof gardens
• Organizing or participating in a social media outreach or advocacy campaign, for example, on an environmental or health concern

CAS experiences can be a single event or may be an extended series of events. It is important that CAS experiences be distinct from and not submitted as part of a biology assessment.

3.2 Theory of Knowledge (TOK)

The TOK course plays a special role in the DP by providing opportunities for students to reflect on the nature, scope and limitations of knowledge and the process of knowing through an exploration of knowledge questions.

The areas of knowledge (AOK) are specific branches of knowledge, each of which can be seen to have a distinct nature and sometimes use different methods of gaining knowledge. In TOK, students explore five compulsory AOK: history, the human sciences, the natural sciences, mathematics and the arts.

There are several different ways in which aspects of the biology course can be connected to the exploration of knowledge. During the teaching and learning of the biology course, teachers and students evaluate knowledge claims by exploring questions concerning their validity, reliability, credibility and certainty, as well as individual and cultural perspectives on them.

Exploration of the relationship between knowledge and TOK concepts can help students to deepen their understanding and make connections between disciplines. For example, while discussing the depletion of energy sources and the constant need for new energy resources to meet energy demands, students can explore the concepts of responsibility, power and justification.

Many aspects of the biology course lend themselves to the exploration of knowledge questions. Some examples are provided in the following table.

Learning opportunities	Knowledge question
D3.2 Inheritance	What factors contribute to the refinement or replacement of knowledge in the natural sciences?
A2.1 Origin of cells	What is the role of imagination and intuition in the creation of hypotheses in the natural sciences?
D1.1 DNA replication	How do the tools that we use shape the knowledge that we produce?

A3.2 Classification and cladistics	To what extent do the classification systems we use in the pursuit of knowledge affect the conclusions that we reach?
D4.1 Natural selection	What is the role of paradigm shifts in the progression of scientific knowledge?

3.3 The Extended Essay (EE)

Students who choose to write an EE in biology undertake independent research as part of an in-depth study of a focused topic. The topic for study may be generated from the biology course or may relate to a subject area beyond the syllabus content. This detailed study will help develop research, thinking, self-management and communication skills, which will support students' learning in the biology course, and in further studies.

Examples of areas for research topics

• Context: An assessment of the factors affecting species population, using databases or other secondary sources.

Example: The impact of predation by the red fox (Vulpes vulpes) on Canada geese (Branta canadensis) nesting populations in Alaska. Nature of biology 10 Biology guide

• Context: Experiments on factors affecting all aspects of plant growth, flowering and germination

Example: A comparison of the effect of salt (sodium chloride) concentration on germination in radishes (Raphanus raphanistrum) and beet (Beta vulgaris).

• Context: Factors affecting enzyme-based reactions in cells.

Example: The effect of processing temperature (60–120°C) of soybean (Glycine max) meal on urease activity in freshly powdered soybeans.

• Context: Using microorganism growth assays to monitor the presence of toxic chemicals in the environment.

Example: The viability of yeast stained with methylene blue in aqueous ethanol solutions (0– 4.0%). World studies (context: environmental and/or economic sustainability)

• Context: Trade in seed plants and food security based on agricultural practices.

Example: Sustainable food security in Nepal based on a range of millet species and the need to protect genetic diversity.

4. Course Content

Syllabus Component	Recommended Teaching Hours SL	HL
Syllabus content	**110**	**180**
A: Unity & diversity	19	33
B: Form & function	26	39
C: Interaction & interdependence	31	48
D: Continuity & change	34	60
Experimental programme	**40**	**60**
Practical work	20	40
Collaborative sciences project	10	10
Scientific investigation	10	10
Total teaching hours	**150**	**240**

5. IB Approaches to Teaching and Learning

Approaches to teaching and learning are deliberate strategies, skills and attitudes that permeate the IB teaching and learning environment.

The approaches to *teaching* are:

- focused on conceptual understanding
- developed in local and global contexts
- focused on effective teamwork and collaboration
- differentiated to meet the needs of all learners
- informed by formative and summative assessment

The approaches to *learning* are:

- Thinking skills
- Communications skills
- Social skills
- Self-management skills
- Research skills

6. IB Learner Profile

The aim of the IB programme is to develop internationally minded people who, recognizing their common humanity and shared guardianship of the planet, help to create a better and more peaceful world.

IB learners strive to be:

- Inquirers
- Knowledgeable
- Thinkers
- Communicators
- Principled
- Open-minded
- Caring
- Risk-Takers
- Balanced
- Reflective

The IB Lerner Profile closely reflects the SON Learner Profile, identifying elements of identity which prepares world citizens who will become active, positive and conscientious participants in the advancement of society and in their own development. Each element is composed of a set of attitudes, qualities, understandings, skill and habits. These are incorporated in the teaching and learning process. The details of the SON Learner Profile can be found in the Student and Parent Handbook.

7. Grading

7.1 School Internal Grades

7.1.1 *Academic Achievement*

The School's grading system for the IB Diploma Programme follows the IBO scale of 1 to 7. A student's performance in individual subjects is graded as follows:

Grade	Interpretation
7	Excellent
6	Very Good
5	Good
4	Satisfactory
3	Basic Standard

2	Poor
1	Very Poor

Note: Because of School's internal requirements such as attendance, timeliness and accuracy of homework, special projects, or performance on formative and summative tests in the classroom, students' performance may vary between School assigned grades and IB assessments.

7.1.2 Effort

Effort marks are given and recorded in the report cards for Forms 5 and 6 for all subjects.

Grade	Descriptor
5	Consistently demonstrating a high degree of effort in all areas of the subject
4	Frequently demonstrating a high degree of effort in all areas of the subject
3	Generally demonstrating a significant degree of effort in all areas of the subject
2	Occasionally demonstrating effort in some areas of the subject
1	Rarely, if ever, demonstrating effort in some areas of the subject

7.1.3 Project Week (Form 5 only)

The mid-year assessment is comprised of a full week of collaborative project-based learning. During the project week students develop various cross curricular soft skills. Assessment and reporting of learning is based on the following rubric.

Project Week Assessment Rubric						
Collaboration 合作	She/he demonstrates effective collaboration skills by: • actively contributing to the group's processes of planning, decision making and action • being sensitive and respectful towards others and as well as responsive to their needs • actively listening to others' points of view and considering others' perspective willingly • fully supporting and whole-heartedly applying the decisions of the group • completing assigned tasks effectively and using feedback from others to improve work • supporting others to achieve their goal 她/他通過以下方式展示有效的合作技能： • 積極參與團隊的計劃、決策和行動流程 • 對他人善解人意和尊重，並回應他們的需求 • 積極傾聽他人的觀點，樂意地考慮他人的觀點 • 完全支持並全心全意地應用團隊的決定 • 有效完成分配的任務並利用他人的反饋改善工作成果 • 支持他人實現目標	1	2	3	4	5
Organisation 組織	She/he demonstrates effective organisation skills by: • having a clear goal and a thought-through plan of how to achieve it • being methodical and systematic in approach • following through with assigned tasks in a timely manner • monitoring progress and addressing challenges • staying focused on tasks and remaining positive despite challenges 她/他通過以下方式展示有效的組織技能： • 有一個明確的目標，並對如何實現目標有一個深思熟慮的計劃 • 方法有條理和系統化 • 及時完成分配的任務 • 監測進展並應對挑戰 • 專注於任務並在面臨挑戰時保持積極的態度		Emerging 萌芽		Achieving 實現中	Excelling 優秀

Research and Critical Thinking 研究及批判性思維	She/he demonstrates critical thinking skills by: • striving to independently investigate and understand issues • actively seeking answers to questions • investigating the purpose, evidencing research and producing reasoning • being open-minded and fair-minded when considering new ideas and perspectives • making connections by looking for links between ideas and concepts • seeking out reliable and accurate information through independent research 她/他通過以下方式展示批判性思維技能： • 努力獨立調查和理解問題 • 積極尋求問題的答案 • 調查目的、證明研究和推理 • 在考慮新想法和觀點時保持開放和公正的態度 • 通過尋找想法和概念之間的聯繫來建立連結 • 通過獨立研究尋找可靠和準確的信息			
Presentation 報告及展示	She/he demonstrates effective presentation skills by: • ensuring the group's presentation/project uses relevant, well-chosen descriptions/facts/details • ensuring the group's presentation/project includes all the required elements • ensuring the presentation/project is well structured and coherent • ensuring the presentation stays within the allocated frame • keeping eye contact with the audience (most of the time) • using a clear voice with appropriate tone and volume • using appropriate language, demonstrating command of formal English • responding to questions from the audience 她/他通過以下方式展示有效的報告技能： • 確保小組的展示文稿/項目使用相關的、精心挑選的描述/事實/細節 • 確保小組的展示/項目包括所有必需的元素 • 確保展示/項目結構良好且連貫一致 • 確保展示文稿保持在分配的框架內 • 與觀眾保持目光接觸（大部分時間） • 使用清晰的聲音和適當的語氣和音量 • 使用適當的語言，表現出對正式英語的掌握 • 回答觀眾的問題			
Reflection 學生反思	She/he demonstrates effective reflection skills by: • effectively analysing experiences to identify those which have led to growth/learning • accurately identifying areas of strength and weakness • generating creative solutions to problems/ways to improve in the future • demonstrating the ability actively and effectively reflect with her/his team members 她/他通過以下方式展示有效的學生反思技能： • 有效地分析經驗以確定那些經驗導致成長/學習 • 準確識別優勢和劣勢領域 • 為問題提出創造性的解決方案/未來改善的方法 • 展示積極有效地與團隊成員進行反思的能力			

7.2 IB Subject Grade Descriptors

The following outlines the IBDP Biology grade descriptors:

Grade	Descriptor

7	Displays comprehensive subject knowledge and a thorough command of concepts and principles. Selects and applies relevant information, concepts and principles in a wide variety of contexts. Analyses and evaluates quantitative and qualitative data thoroughly. Constructs detailed explanations of complex phenomena and makes appropriate predictions. Evidences great proficiency in solving problems, including those that are challenging or unfamiliar. Communicates logically and concisely using appropriate terminology and conventions. Shows insight or originality. Approaches investigations in an ethical manner, paying full attention to environmental impact and safety where applicable. Investigations demonstrate insight and independence to design and complete innovative practical work with highly competent investigative and analytical techniques, and with innovative and effective conclusions to resolve authentic problems.
6	Displays very broad subject knowledge and a thorough understanding of concepts and principles. Selects and applies relevant information, concepts and principles in most contexts. Analyses and evaluates quantitative and qualitative data with a high level of competence. Constructs explanations of complex phenomena and makes appropriate predictions. Solves basic or routine problems and evidences competency in solving those that are challenging or unfamiliar. Communicates effectively using appropriate terminology and conventions. Shows occasional insight or originality. Approaches to investigations in an ethical manner, paying significant attention to environmental impact and safety where applicable. Investigations demonstrate some innovative thinking and independence to design and complete practical work with competent investigative and analytical techniques, and with highly competent and reasonable conclusions to resolve authentic problems.
5	Displays broad subject knowledge and shows sound understanding of most concepts and principles, and applies them in some contexts. Analyses and evaluates quantitative and qualitative data competently. Constructs explanations of simple phenomena. Solves most basic or familiar problems and some new or difficult quantitative and/or qualitative problems. Communicates clearly with little or no irrelevant material. Approaches investigations in an ethical manner, paying attention to environmental impact and safety where applicable. Investigations demonstrate appropriate investigative and analytical techniques with relevant and pertinent conclusions to resolving authentic problems.
4	Displays reasonable subject knowledge (though possibly with some gaps) and shows adequate understanding of most basic concepts and principles, but with limited ability to apply them. Demonstrates some analysis or evaluation of quantitative or qualitative data. Solves some basic or routine problems but shows limited ability to solve challenging or unfamiliar problems. Communicates adequately, although responses may lack clarity and include some repetitive or irrelevant material. Generally, approaches investigations in an ethical manner, with some attention to environmental impact and safety where applicable. Investigations demonstrate an ability to complete routine practical work with some appropriate investigative and analytical techniques, and with some conclusions relevant to the problem under study.
3	Displays limited subject knowledge and shows a partial understanding of basic concepts and principles, and weak ability to apply them. Shows some ability to manipulate data and solve basic or routine problems. Communicates with a lack of clarity and some repetitive or irrelevant material. Sometimes approaches investigations in an ethical manner, with some attention to environmental impact and safety where applicable. Investigations demonstrate an ability to

	complete a basic investigation with simple analytical techniques, and with some partial conclusions of some relevance to study.
2	Displays little subject knowledge and shows weak understanding of basic concepts and principles, and little evidence of application. Exhibits minimal ability to manipulate data and little or no ability to solve problems. Offers responses which are often incomplete or irrelevant. Occasionally approaches investigations in an ethical manner, but shows very limited awareness of environmental impact and safety. Investigations demonstrate an ability to undertake basic investigative work requiring considerable guidance and instruction, and attempts at conclusions that are largely incorrect/irrelevant.
1	Fragmentary subject knowledge and shows very little understanding of any concepts or principles. Rarely demonstrates personal skills, perseverance or responsibility in investigative activities. Rarely approaches investigations in an ethical manner or shows an awareness of environmental impact and safety. Investigations demonstrate an ability to undertake very basic practical work with complete dependence on supervised instruction, with attempts at conclusions are either absent or completely incorrect/irrelevant.

8. Assessments

8.1 Assessment Objectives

The assessment objectives for biology 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.

8.2 School-based Assessments

School-based assessments are ongoing and are intended to measure student learning and provide constructive feedback. These assessments include a variety of formative and summative assessments. Forms of assessment vary and may include but are not limited to assessment tools such as quizzes, topic tests, graphic organizers, reports, essays, group projects and observational evidence during lessons.

8.2.1 Weightages

The following represents the percentage weight for each academic year:

	Term 1	Term 2	Mid-Year Assessment	Term 3	Final Exam
Form 5	28%	28%	Project Week See passing criteria	28%	16%
Form 6	30%	30%	Mid-Year Exam 15%	N/A	25%

8.2.2 Passing Criteria

F5 Students whose total score is 23 points or above in the six IB Subject Groups will be promoted to the next level, along with:

- satisfactory completion of the Extended Essay requirements for DP year 1
- a final mark of a C or higher in Theory of Knowledge for year 1
- satisfactory completion of CAS (Creativity, Action & Service) activities for year 1
- a total of 12 HL points for students who are on the full diploma track
- no grade 2 or lower in any Higher Level (HL) subject
- the grade for project week is a 3 (out of 5) or higher

To graduate from Secondary at the end of F6, students must gain 23 points or above in the six IB Subject Groups, along with:

- completion of the Extended Essay
- a final mark of a C or higher in Theory of Knowledge
- completion of CAS (Creativity, Action and Service) activities
- a total of 12 HL points for students who are on the full diploma track
- no grade 2 or lower in any Higher Level (HL) subject

Should a student's academic performance falls below standard, the School reserves the rights of not registering a student for the full diploma track.

8.3 Official IBDP Assessments

8.3.1 Internal Assessment

Internal assessment is an integral part of the course and is compulsory for both SL and HL students. It enables students to demonstrate the application of their skills and knowledge, and to pursue their personal interests, without the time limitations and other constraints that are associated with written examinations. The internal assessment requirements at SL and at HL are the same.

The internal assessment consists of one task: the scientific investigation. This component is internally assessed by the teacher and externally moderated by the IB at the end of the course. (Total 24 marks) There are four IA criteria for the scientific investigation. The marks and weightings are as follows.

Criterion	Maximum number of marks available	Weighting (%)
Research design	6	25
Data analysis	6	25
Conclusion	6	25
Evaluation	6	25
Total	**24**	**100**

8.3.2 External Assessment Components

Type of assessment	Format of assessment	Time (hours)		Weighting of final grade
		SL	HL	
External		**3**	**4.5**	**80**

Paper 1	Paper 1 A: Multiple-choice questions Paper 1 B: Data-based questions and questions on experimental work	1.5	2	36%
Paper 2	Short answer and extended -response questions	1.5	2.5	44%
Internal		**10**		**20%**
Internal assessment	Scientific Investigation	10		20

8.3.3 External Assessment Details

Paper 1
Duration: 1 hour and 30 minutes
Weighting: 36%
Marks: 55

Paper 1 is presented as two separate booklets.

Paper 1 A - 30 marks
- 30 multiple-choice questions on standard level material only
  No marks are deducted for incorrect answers.

Paper 1 B - 25 marks
- Data- based questions
- Questions on experimental work

- Paper 1A and Paper 1B are to be completed together without interruptions.
- The questions on paper 1 test assessment objectives 1, 2 and 3.
- The use of calculators is permitted.
- Each student must have access to a clean copy of the Chemistry data booklet during the examination.

Paper 2
Duration: 1 hour and 30 minutes
Weighting 44%
Marks: 50
- *Short answer and extended-response questions on standard level material only.*
- The questions on paper 2 test assessment objectives 1, 2 and 3.
- The use of calculators is permitted.
- Each student has access to a clean copy of the Chemistry data booklet during the examination.

External assessment details -Standard Level (HL)

Paper 1
Duration: 2 hours
Weighting: 36%
Marks: 75

Paper 1 is presented as two separate booklets.

Paper 1 A - 40 marks
- 40 multiple-choice questions on standard level and higher-level material
  No marks are deducted for incorrect answers.

Paper 1 B - 35 marks

- Data- based questions
- Questions on experimental work

- Paper 1A and Paper 1B *are to be completed together without interruptions.*
- The questions on paper 1 test assessment objectives 1, 2 and 3.
- The use of calculators is permitted.
- Each student must have access to a clean copy of the Chemistry data booklet during the examination.

Paper 2

Duration: 2 hours and 30 minutes

Weighting 44%

Marks: 90

- *Short answer and extended-response questions on standard level and higher-level material.*
- The questions on paper 2 test assessment objectives 1, 2 and 3.
- The use of calculators is permitted.
- Each student must have access to a clean copy of the Chemistry data booklet during the examination.

9. Academic Integrity

Students are expected to uphold a high standard of academic honesty and integrity. All homework, assignments, tests and exams are expected to represent the student's own effort. All forms of cheating or copying on assignments, tests or exams, plagiarism and other forms of deception to obtain credit are universally recognized as improper and dishonest conduct. Such behaviour is not acceptable and marks will not be awarded for work that does not represent the students' personal effort. For details of the policy regarding academic integrity please refer to Student and Parent Handbook.

10. Late Submission of Work

Assignments and homework are an important component of the teaching-learning process and are expected to be completed with quality and submitted on time. Assignments and homework tasks will be posted Managebac.

The following policy will apply for late work submission:

School-based Assessments

Late submission of work may result in a lower effort grade.

IB Official Assessments

Students may receive a zero for a given component of work if it is not submitted by the assigned deadline. Missing any of the required component grades may result in 'no grade' in the official IB results.

11. Classroom Materials and Procedures

Students will need to bring the following items to their lessons unless otherwise specified by the teacher:

- notebook
- folders
- assigned textbook and workbooks (if any)
- pen, pencil, eraser, ruler, highlighter
- calculator

Students will be informed in advance if any additional items, such as laboratory coats, safety goggles or other items are expected to be purchased.