



COURSE SYLLABUS

NATURE OF SCIENCE

DIPLOMA PROGRAMME

2021
2021

COURSE OVERVIEW

What has science contributed to human development since man's appearance and what are the global challenges to ourselves and the environment? What do we know about the first 3.7 billion years of the universe before man's existence and how do we know it? What global problems can science solve?

This is a pilot course which is divided equally between Biology, Chemistry and Physics topics. It was designed to keep students interested in the sciences and promote critical thinking and analysis skills. At the centre of the course is an emphasis on the science that promotes an understanding of how scientists justify knowledge claims and an understanding of the scientific world view. What is science? Are there different types of science? What is the difference between pure science, applied science and technology? Is science good or bad?

There are 4 basic modules to the DP SL Nature of Science course. The course begins with a module that outlines the Nature of science, the overarching theme that guides. The second module illustrates the philosophical methods that science uses to answer questions about our origins and the origins of the universe. The basic question to be addressed will be: How do we know about the past origins of ourselves and our environment even though we cannot observe them directly? In the third module, contexts will be used to examine unfolding sciences and technologies of the 21st century. Contexts include: food science (a broad area that includes deep ethical considerations, eg genetic modification), modern materials (an area that can include areas such as the use of technology to build on the output of pure science), transport issues (modelling, etc). Finally, the fourth module is an exercise in creating solutions to current problems related to man's impact on the environment and sustainability. The IB recognize that this may be the last exposure to formal science teaching for many who graduate from it. The over-riding concern is that students should emerge as individuals fully aware of the power of the scientific process, of the ethical issues that surround its practice, and of the wider interaction of science with society in general. This course will focus on 4 major topics, a group 4 project and practical work totaling 150 hours. The distribution of time devoted to each portion of this course is defined below:

Core Work: 125 hours

IA Practical Work: 15 hours

Group 4 Project: 10 hours

LEARNING OUTCOMES

Through studying Group 4 subjects, students should 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 that characterizes these subjects.

The aims enable students, through the overarching theme of the nature of science, to:

- appreciate scientific study and creativity within a global context through stimulating and challenging opportunities
- acquire a body of knowledge, methods and techniques that characterize science and technology
- apply and use a body of knowledge, methods and techniques that characterize science and technology
- develop an ability to analyze, evaluate and synthesize scientific information
- develop a critical awareness of the need for, and the value of, effective collaboration and communication during scientific activities
- develop experimental and investigative scientific skills including the use of current technologies
- develop and apply 21st-century communication skills in the study of science
- become critically aware, as global citizens, of the ethical implications of using science and technology
- develop an appreciation of the possibilities and limitations of science and technology
- develop an understanding of the relationships between scientific disciplines and their influence on other areas of knowledge.

UNIT OVERVIEWS

Unit 1 – Energy and particles

Approximate Length: 4 Weeks

Unit description: This unit focuses on the understanding of basic physics concepts that will be the foundation for later application.

Key concepts: The concept of fields was developed to help explain the “action at a distance” observed in the motion of masses, charges and magnetic materials in the presence of each other.

Learning outcomes:

- electric and magnetic fields
- Newton's laws of motion
- fundamental particles.

Unit 2 – The universe**Approximate Length:** 5 Weeks

Unit description: The nature of our universe will be explored, including the technological advancements that have furthered our understanding.

Key concepts: Observations, initially through the naked eye and then using advancing technologies such as optical telescopes, X-ray telescopes, radio telescopes and so on, together with theoretical developments of a mathematical nature have led to our present knowledge of the universe.

Learning outcomes:

- origin of the universe
- galaxies
- stars
- solar systems

Unit 3 – The nature of our planet**Approximate Length:** 4 Weeks

Unit description: The focus narrows to our own planet's geological structure, climate and atmosphere.

Key concepts: The origin of the Earth and the way it has metamorphosed into its current state are not open to experimental investigation. Scientists have had to base their ideas on detailed studies of the Earth as it now exists and rely on inferences and models that can explain their findings.

Learning outcomes:

- origin of the earth
- plate tectonics
- equilibrium and climate change

Unit 4 – Evolution**Approximate Length:** 4 Weeks

Unit description: This unit explores the development of species over time and explain the broad diversity of Earth's inhabitants.

Key concepts: Scientists have proposed hypotheses, models and theories to explain the diversity of life on Earth which has ontological and chronological characteristics. Evolution is a unifying principle of the life sciences with great explanatory power.

Learning outcomes:

- origin of life
- natural selection,
- evidence for evolution
- human evolution

Unit 5 – Energy and physical resources**Approximate Length:** 7 Weeks

Unit description: The focus of the course now moves to applied science. Students will explore the use of physical resources to obtain energy and raw materials for industry.

Key concepts: Models of electrical energy have developed with time as our understanding of the science has developed. With this man has created a multitude of devices to harness the power and flexibility of electricity..

Learning outcomes:

- electrical energy
- portable electricity
- centralized electricity production
- renewable and non-renewable energy
- forces and physical properties
- uses of physical resources

Unit 6 – Transport**Approximate Length:** 2 weeks

Unit description: This unit explores the relationship between laws of motion, sources of energy, and transportation services.

Key concepts: Science and technology have produced mass transportation of people and goods around the globe that has changed our way of life. However, this mass movement has a major impact on the environment and is not sustainable.

Learning outcomes:

- unbalanced forces
- transportation systems

Unit 7 – Communication**Approximate Length:** 5 weeks

Unit description: The physics of communication systems is explored in this unit, focusing on applied science and technological developments.

Key concepts: The unifying concept of electromagnetic waves and the imagination to use them for transmitting information in many forms together form the basis for developments in global communications.

Learning outcomes:

- introduction to communication systems
- electromagnetic induction
- electromagnetic waves
- digital signals
- optical fibres
- communication networks

Unit 8 – Food Security**Approximate Length:** 3 weeks

Unit description: The science behind the production of food for our ever-growing population is explored in this unit.

Key concepts: Agriculture has improved food yields through the domestication of animals and plant cultivation, contributing to the quality of modern life and an increase in life expectancy but at some detriment to the environment.

Learning outcomes:

- nutritional requirements
- agricultural science
- biotechnology

Unit 9– Medicine**Approximate Length:** 2 weeks

Unit description: Evidence-based medicine has resulted in major improvements in health, quality of life, increased life expectancy and population growth.

Key concepts: Advances in technology and collaboration between the scientific community, pharmaceutical industry and governments have been instrumental in improving the diagnosis and treatment of many of the diseases and disorders that threaten health.

Learning outcomes:

- modern medicine
- science and health

ASSESSMENT

The assessment objectives for the nature of science reflect those parts of the aims that will be formally assessed either internally or externally. It is the intention of these courses that students are able to fulfill the following assessment objectives:

1. Demonstrate knowledge and understanding of:
 - a. facts, concepts, and terminology
 - b. methodologies and techniques
 - c. communicating scientific information.
2. Apply:
 - a. facts, concepts, and terminology
 - b. methodologies and techniques
 - c. methods of communicating scientific information.
3. Formulate, analyze and evaluate:
 - a. hypotheses, research questions and predictions
 - b. methodologies and techniques
 - c. primary and secondary data
 - d. scientific explanations.
4. Demonstrate the appropriate research, experimental, and personal skills necessary to carry out insightful and ethical investigations.

Students will be evaluated using formative and summative assessments.

Formative assessment is used to inform both teaching and learning. It is concerned with providing accurate and helpful feedback to students and teachers on the kind of learning taking place and the nature of students' strengths and weaknesses in order to help develop students' understanding and capabilities. Formative assessment can also help to improve teaching quality, as it can provide information to monitor progress towards meeting the course aims and objectives. Formative assessments will take many forms with the goal of scaffolding the knowledge, skills and the critical thinking required to successfully complete summative assessments.

Summative assessment gives an overview of previous learning and is concerned with measuring student achievement. All summative assessments will be graded on the 1-7 IB scale. All reports will reflect the IB 1-7 grading scale and will be based the best-fit approach to assessment. Grade Boundaries for each summative will be published to students by the teacher after the summative assessments are graded.

Paper 1**Assessment Description:**

Students will practice paper 1-style question during each unit, during semester exams, and during mock exams. This test consists of some multiple choice questions worth 1 mark, and some short answer questions worth 2 to 4 marks. It is worth a total of 40 marks.

It has a weighting of 40% of the final IB grade. The questions on paper 1 test assessment objectives 1,2 and 3.

Duration: 1 hour 30 mins

Paper 2**Assessment Description:**

This paper focuses on nature of science themes and mathematical requirements. While questions of this nature are included on unit tests, exclusively paper 2 assessments are given during semester exams and mock exams only. This paper is worth 30 marks.

It has a weighting of 30% of the final IB grade. The questions on paper 2 test assessment objectives 1,2 and 3.

Duration: 1 hour

Internal Assessment

All students will conduct an individual investigation as a part of their NoS coursework. They will demonstrate knowledge and understanding of scientific methodologies and terminology. They will apply facts, concepts and techniques for communicating scientific information. They will formulate, analyze and evaluate their own work. They will demonstrate the appropriate research, experimental, and personal skills to carry out an insightful investigation or research paper. The IA has a weighting of 30% of the final IB grade.

Group 4 Project

There is a compulsory Group 4 project where all students studying science will work together collaboratively. All DP Chemistry students must participate in this collaborative project as part of the syllabus. Participation at GWA consists of learning the Experimental Sciences from new perspectives in a real-life setting. The theme is 'Theme Park Science' and an **off campus** trip will happen during October of Grade 11.

The Group 4 Project is assessed internally by a Digital Story Submission by each group in November.

Course Grade Descriptors**Grade 7**

Displays comprehensive knowledge of factual information in the syllabus 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/or qualitative data thoroughly. Constructs detailed explanations of complex phenomena and makes appropriate predictions. Solves most quantitative and/or qualitative problems proficiently. Communicates logically and concisely using appropriate terminology and conventions. Shows insight or originality.

Demonstrates personal skills, perseverance and responsibility in a wide variety of investigative activities in a very consistent manner. Works very well within a team and approaches investigations in an ethical manner, paying full attention to environmental impact. Displays competence in a wide range of investigative techniques, pays considerable attention to safety, and is fully capable of working independently.

Grade 6

Displays very broad knowledge of factual information in the syllabus and a thorough understanding of concepts and principles. Selects and applies relevant information, concepts and principles in most contexts. Analyses and evaluates quantitative and/or qualitative data with a high level of competence. Constructs explanations of complex phenomena and makes appropriate predictions. Solves basic or familiar problems and most new or difficult quantitative and/or qualitative problems. Communicates effectively using appropriate terminology and conventions. Shows occasional insight or originality.

Demonstrates personal skills, perseverance and responsibility in a wide variety of investigative activities in a very consistent manner. Works well within a team and approaches investigations in an ethical manner, paying due attention to environmental impact. Displays competence in a wide range of investigative techniques, pays due attention to safety and is generally capable of working independently.

Grade 5

Displays broad knowledge of factual information in the syllabus. Shows sound understanding of most concepts and principles and applies them in some contexts. Analyses and evaluates quantitative and/or 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.

Demonstrates personal skills, perseverance and responsibility in a variety of investigative activities in a fairly consistent manner. Generally works well within a team and approaches investigations in an ethical manner, paying attention to environmental impact. Displays competence in a range of investigative techniques, pays attention to safety and is sometimes capable of working independently.

Grade 4

Displays reasonable knowledge of factual information in the syllabus, though possibly with some gaps. Shows adequate comprehension 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 deal with new or difficult situations. Communicates adequately although responses may lack clarity and include some repetitive or irrelevant material.

Demonstrates personal skills, perseverance and responsibility in a variety of investigative activities, although displays some inconsistency. Works within a team and generally approaches investigations in an ethical manner, with some attention to environmental impact. Displays competence in a range of investigative techniques, pays some attention to safety although requires some close supervision.

STUDENTS RESPONSIBILITIES

Academic Honesty**Protocol For In-School Malpractice**

The following steps will be followed in cases of malpractice:

1. Teachers will advise students of suspicion of misconduct
2. A record of the incident will be forwarded to the Diploma Programme Coordinator
3. The Diploma Programme Coordinator will discuss the incident with the teacher
4. The Diploma Programme Coordinator will interview the student involved
5. The Diploma Programme Coordinator will action appropriate disciplinary measures commensurate to the offense making note of the incident in the SIS which will in turn prompt a communication with parents.

Malpractice on Assessments to be Submitted to the IB

According to the Academic Honesty (2009) document, in cases of malpractice on assessments or exam that are intended for submission to the IB, the following protocol has been put in place.

Once a candidate has submitted his or her work to a teacher (or the coordinator) for external or internal assessment together with the coversheet signed (or authenticated electronically) to the effect that it is the final version of the work, neither the work nor the coversheet can be retracted by the candidate. If the candidate is subsequently suspected of plagiarism or collusion, it is no defense to claim that the incorrect version of the work was submitted for assessment.

After a candidate has signed and dated the coversheet (or authenticated electronically) to the effect that his or her work is authentic and constitutes the final version of that work, the candidate's teacher (or supervisor in the case of an extended essay) must also sign and date the coversheet to the effect that to the best of his or her knowledge it is the authentic work of the candidate. Any suspicion of malpractice that arises after the candidate has signed the coversheet must be reported to the coordinator help desk at IB Cardiff for investigation. However, if there is no tangible evidence of malpractice (such as the source of plagiarism) the candidate must be given the benefit of any doubt and the coversheet must be signed by the teacher/supervisor. It is not acceptable for the teacher to:

- delete the declaration and then sign the coversheet
- submit the work for assessment without his or her signature
- sign the declaration and then write comments on the work or coversheet that raise doubts about the work's authenticity.
- In the above circumstances the IB will not accept the work for assessment (or moderation) unless confirmation is received from the school that the candidate's work is authentic.

If a teacher is unwilling to sign a coversheet owing to a suspicion of malpractice, the matter must be resolved within the school. The coordinator has the option of informing the coordinator help desk that the work will not be submitted on behalf of the candidate (resulting in no grade being awarded for the subject or diploma requirement).

Malpractice in Testing Situations:

Students may not:

- take unauthorized material into an examination room (see below)
- leave and/or access unauthorized material in a bathroom/restroom that may be visited during a test
- pass on information to another student about the content of an examination, this includes facilitating the exchange information between other students in any way
- steal examination papers
- using an unauthorized calculator during an examination

Students must not have unauthorized material (for example, own rough paper, notes, a mobile/cell phone or an electronic device other than a permitted calculator) in their possession during a testing situation. "In their possession" may be taken to mean on the person of the student, in the student's immediate proximity (such as on the floor or desk) or placed somewhere (such as a bathroom/restroom) for access during the test. It is very important to note that guilt will be confirmed by the school administration regardless of whether this material is used, was or was not intended for use or contains information relevant or potentially relevant to the test. The actual possession of unauthorized material constitutes malpractice; the school administration is not required to establish whether the student used or intended to use the material. No leniency is shown to a candidate who claims that they were unaware the material was in their possession.

Late Assessment PolicyLate Assessments:

Should a student not complete a summative assessment on time (this includes summative drafts) teachers will:

- Speak with the student to find out why the assessment has not been submitted.
- An email home will be sent to parents detailing the missed assessment and the student will be asked to stay in school until it is completed.
- If the assessment is pending, once received, they log the infraction in the “reward and conduct” tab in iSAMS regarding the tardiness of the assessment.
- If a student does not attend after school to work on the assessment, the teacher will confer with the student and, if necessary, refer the incident to the Grade Leader. The Grade Leader will discuss the situation with the student to see if support is required or consequences need to be imposed. The Grade Leader will subsequently record the incident in iSAMS. Further incidents of truancy will be escalated to the Secondary School Administration.
- If there is a second incident of a late submission of an assessment, the teacher will report it in an email to the Grade Leader who may contact parents for a meeting where you may be included. The Grade Leader will record their actions in iSAMS.
- Further incidents of late assessments will be reported to Grade Leaders who will forward the incident(s) to the Secondary School administration who, if warranted, will initiate an in-school suspension where students will complete the assessment until it is completed to standard. A record of the suspension will be recorded in iSAMS and prompt a communication with parents.
- Any subsequent incidents of late assessments will necessitate a parent meeting with a member of the Secondary School Administration to determine the best way forward.

Tests Absenteeism

- In cases where students are not in school on a test day, a communication from parents will be required.
- The student will need to present their teacher with a doctor’s note upon their return to class if the test is to be administered with no consequence.
- Should an authorized absence not be received, the student may not be permitted to write the test and an “NA” representing an “incomplete” will appear on the next quarterly report.
- If this incident reoccurs, the issue will be escalated to the Head of Senior School and will receive a ‘O’.
- Aside from school activities, all test absences will be recorded in iSAMS by the teacher with a note in the “record description” whether the test absence was authorized or not. The Grade Level Leader may follow-up with the student, if necessary.

Teacher Assessment Commitments**All teachers will:**

- Provide feedback on all formative assessments within one calendar week of receipt.
- Post on Managebac (shaded in purple) any formative assessment (including homework) no later than 5:00PM the day it is assigned. If the formative assessment is not posted by this time there is no expectation that the assessment will be completed for the next day.
- Discuss with students prior to posting summative assessments and provide at least one calendar week lead time for students to prepare. Summative assessments will be posted on Managebac at least one week in advance of the due date (shaded in blue).
- Work collaboratively with their teacher colleagues and coordinator to work toward the goal of students having no more than 2 summative assessments on a given day.
- Return summative assessments to students with feedback no later than three calendar weeks after the due date.
- Update Managebac immediately upon completion of marking/feedback.
- Communicate, in a timely fashion, with colleagues and administration about students who are turning in late formative and summative tasks in order to implement late assessment procedures, as outlined in the Assessment Policy. Late assessment procedures are outlined below.
- Communicate with parents when assignments/assessments are not turned in on the due date and clearly articulate the next steps for the student.