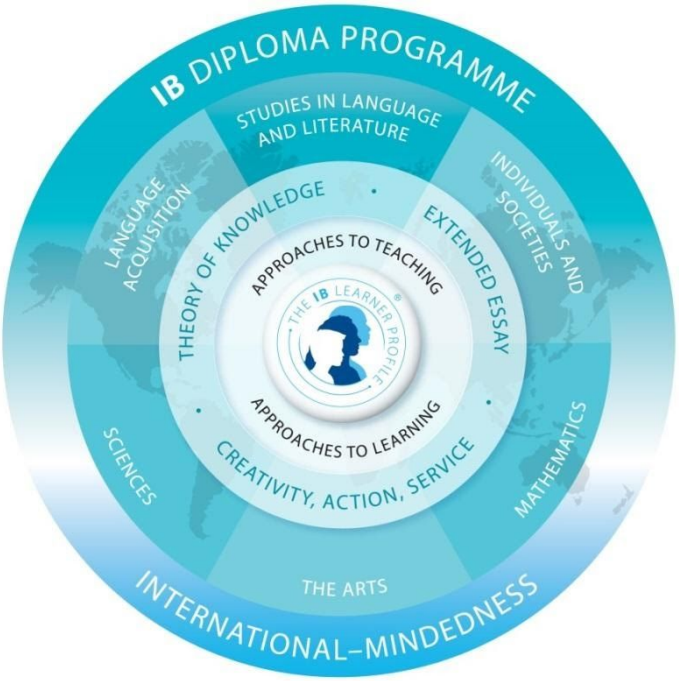
Mattlidens Gymnasium provides excellence in teaching and learning, in a tolerant, compassionate and open-minded international environment.

We support students in developing their potential as critical thinkers and creative life-long learners, by actively involving them in the learning process and their community.



The curriculum aims to develop learners with an IB learner profile who are:

- inquirers
- knowledgeable
- thinkers
- communicators
- principled
- open-minded
- caring
- risk takers
- balanced
- reflective

The IB Diploma Programme - general information about subjects offered

The International Baccalaureate Diploma Programme is an internationally recognized matriculation examination which qualifies candidates for admission to universities and colleges all over the world. The programme consists of a two-year course (grades 11-12), which in Finland is often preceded by a preparatory year (grade 10). The IB Programme is demanding and it differs in many respects from the programme in the Finnish national curriculum. For instance, in languages the emphasis is on literature, in the sciences 25% of class time is spent on laboratory work, and in all subjects the students write essays, reports etc.

The IB Curriculum consists of six subject groups and students must choose at least one subject from each of the groups. Three of the subjects must be studied at higher level (HL) and three at standard level (SL). Standard level courses are taught 5,5 courses and HL 8,5 courses (1 course = roughly 30 hours).

The subjects offered in the different subject groups in Mattlidens Gymnasium are as follows:

Studies in language and literature
English A: Literature (HL/SL)
Finnish A: Literature (HL/SL)
Swedish A: Literature (HL/SL),
Language A Literature school-directed self-taught (SL)
English A: Language and Literature (HL/SL)

Language acquisition
Finnish B (HL/SL)
French B (SL)
Swedish B (SL)
Spanish B (SL)

Individuals and Societies
History (HL/SL)
Economics (HL/SL)
Global Politics (HL/SL)

Sciences:
Biology (HL/SL)
Chemistry (HL/SL)
Physics (HL/SL)

Mathematics:
Mathematics: Analysis and Approaches (HL/SL)
Mathematics: Applications and Interpretations (SL)

The Arts
Visual Arts (SL)
Music (SL)
Note: Instead of a subject from this group, students can choose an additional subject from one of the other groups (excluding mathematics) for their sixth subject.

Due to factors such as the size of the groups and timetable clashes, it can be difficult to carry out all desired combinations of subjects and levels. For a group to start or a higher level subject to be taught there needs to be a sufficient number of students interested in studying this particular subject and level. Thus we cannot guarantee that all languages and all HL subjects will be taught every year.

When students choose their DP subjects in pre DP, they cannot take more than three subjects at HL or more than six subjects. In the beginning of DP1, students may be allowed to take a fourth HL subject or an additional (7th) subject if it can be arranged within the existing schedule and groups and

the student has a good academic standing in preDP. These options must be approved by the DP coordinator and the subject teachers beforehand.

Before choosing their subjects the students have classes with the DP coordinator, guidance counsellor and the subject teachers who inform them about the different subjects, the differences between HL and SL subjects and important aspects to bear in mind when choosing their diploma programme subject (workload, university requirements etc.)

Subject group	**Studies in language and literature**
Subject	**Language A: literature (English, Finnish, Swedish, school-supported self-taught language A)** **English A: language and literature**
Level(s)	**HL/SL (SSST is at SL only)**

Nature of the Subject

All courses in studies in language and literature are designed for students from a wide variety of linguistic and cultural backgrounds who have experience of using the language of the course in an educational context. The focus of the study developed in each of the subjects varies depending on the subject's individual characteristics.

The language profile of students taking these courses will vary, but their receptive, productive and interactive skills should be strong and the expectation is that the course will consolidate them further. Students are expected to develop their proficiency, fluency and linguistic range, and in particular to acquire the vocabulary appropriate to the analysis of texts. They will also deepen their understanding of a wide variety of concepts explored through literary and non-literary texts in order to interpret, analyse, evaluate and then communicate this understanding in clear, organized and developed products.

All courses explore elements of language, literature and performance and focus on:

- the relationships between readers, writers and texts
- the range and functions of texts across geographical space and historical time
- aspects of intertextuality.

Within this framework, each course has its own emphases.

To fulfill the requirements of the IB Diploma Programme (DP), students must study (at least) one of the courses in the studies in language and literature group. To be awarded a bilingual diploma, two studies in language and literature courses can be taken, each in a different language.

Language A: literature
Students will focus exclusively on literary texts, adopting a variety of approaches to textual criticism. Students explore the nature of literature, the aesthetic function of literary language and textuality, and the relationship between literature and the world.

Language A: language and literature
In this course, students will study a wide range of literary and non-literary texts in a variety of media. By examining communicative acts across literary form and textual type alongside appropriate secondary readings, students will investigate the nature of language itself and the

ways in which it shapes and is influenced by identity and culture. Approaches to study in the course are meant to be wide-ranging and can include literary theory, sociolinguistics, media studies and critical discourse analysis among others.

Aims

The aims of all subjects in studies in language and literature are to enable students to:

1. engage with a range of texts, in a variety of media and forms, from different periods, styles, and cultures
2. develop skills in listening, speaking, reading, writing, viewing, presenting and performing
3. develop skills in interpretation, analysis and evaluation
4. develop sensitivity to the formal and aesthetic qualities of texts and an appreciation of how they contribute to diverse responses and open up multiple meanings
5. develop an understanding of relationships between texts and a variety of perspectives, cultural contexts, and local and global issues, and an appreciation of how they contribute to diverse responses and open up multiple meanings
6. develop an understanding of the relationships between studies in language and literature and other disciplines
7. communicate and collaborate in a confident and creative way
8. foster a lifelong interest in and enjoyment of language and literature.

Links to TOK

- How language shapes meaning and understanding - are there universal concepts in literature?
- Language in literature
- Oral expression, use of language/ voice
- Cultural values in literature
- Context
- Debating, justifying
- Effects of genre on meaning
- Comparison of writers' choices
- Questions about reading and literature
- Exploring questions of identity
- How meaning shapes language
- What factors affect language use
- How language and meaning are shaped by culture and history
- How language and meaning are used to distort or bias culture and history
- How language can be convincing

Links to CAS

- Drama activities (creativity)
- Discussions about global issues (linked to works being studied)
- Creative writing (part of learner portfolio)
- considering the ethics of choices and actions

Links to language and learning

- Learning terms for textual analysis
- Presentation skills
- Learning the features of different texts types and genres
- How to read texts closely
- Essay and commentary writing

- Planning and preparing an individual oral

Subject group	**Language acquisition**
Subject	**Language B (Finnish, French, Spanish, Swedish)**
Level(s)	**HL (Finnish B only)/SL**

Nature of the Subject

Language B is an additional language-learning course designed for students with some previous learning of that language. The main focus of the course is on language acquisition and the development of language skills. These language skills should be developed through the study and use of a range of written and spoken material. Such material will extend from everyday oral exchanges to literary texts, and should be related to the culture(s) concerned. The teaching should, as much as possible, be in the 'B' language concerned. Using the target language as the medium of instruction vastly increases learners' ability to comprehend. The material should be chosen to enable students to develop mastery of language skills and intercultural understanding. It should not be intended solely for the study of specific subject matter or content.

Aims and objectives

- to develop students' intercultural understanding
- to enable students to understand and use the language in a range of contexts and for a variety of purposes
- to encourage, through the study of texts (including literature) and through social interaction, an awareness and appreciation of the different perspectives of people from other cultures
- to develop students' awareness of language in relation to other areas of knowledge (TOK)
- to communicate clearly and effectively in a range of situations, demonstrating linguistic competence and intercultural understanding
- to use language appropriate to a range of interpersonal and/or cultural contexts
- to understand, analyse and respond to a range of written and spoken texts
- to understand and use works of literature written in the target language of study (HL only)

Links to TOK

- Social media – effects?
- Internet and language
- Language and identity
- Global issues and media -> how presented?
- Picture as a text type
- Cultural aspects
- When we learn an additional language, do we learn more than "just" vocabulary and grammar?
- How are values encoded differently in different languages (for example, family, friendship, authority)?
- Does the concept of intercultural understanding mean the ability to demonstrate an

understanding of cultural diversity and/or similarity between the target culture(s) and one's own?
- By learning another culture, are we able to enrich our own?
- What is the relationship between language and thought? Do you think differently in different languages? If so, does it make a practical or discernible difference to how you interpret the world?
- When, if ever, is it possible to make a perfect translation from one language into another? What might "perfect" mean in this context?
- If you were to learn a language from a textbook only, how would this differ from learning through interaction only?
- Do you understand the world differently when you learn another language? How (for example, time, humour, leisure)?
- Do you understand the world differently when you learn another language? How (for example, time, humour, leisure)?

Links to CAS

Links to Language and Learning
- Group work
- Practicing different examination papers / questions / tasks
- Creative writing
- Differences between spoken and written language
- Mechanics of a language (grammar, vocabulary, pronunciation)

Subject group	**Individuals and Societies**
Subject	**Economics**
Level(s)	**HL/SL**

Nature of the Subject

The economics programme has a strong emphasis on internationalism, developing economies and environmental sustainability.

Aims and objectives

After completing the programme the students should be confident in their:
- disciplined skills of economic reasoning.
- ability to use data and apply the tools of economic analysis to past and contemporary situations; explaining their findings clearly.
- understanding of how individuals, organisations, societies and regions pursue their economic objectives.
- ability to evaluate economic theories, concept, situations and data in a rational way while recognising bias.

- awareness of the diversity of economic realities in which individuals, organisations and societies function

Links to TOK

- Rationality of human beings
- Hierachy/inviduality of Western philosophy versus balance/society of Eastern philosophy
- Profit maximisation and its effect on society
- Ethical and moral implications of development, macro-economic theory and policy, economic policy, profit maximisation, monopoly power etc.
- Alternative paradigms in economics
- Measuring the quality of life
- Abuse of statistics in economics
- The normative and positive measures of macro-economics
- Economics integration and the loss of independence
- WTO and moral/ethical issues
- Subjective nature of development

Links to CAS

Links to Language and Learning

- Learning terms for economic theory analysis
- Presentation skills
- Analysing media texts with economic terms and theory
- Applying mathematical concepts to economic theory analysis
- Applying economic terms in mathematical formulae
- Analysing the use and abuse of statistics in media
- Application of economic terms in society and politics
- Statistical language; use and abuse
- Applying economic statistics to the quality of life
- Analysing and evaluating statistics and through economic concepts and terms
- Applying mathematical concepts to economic theory analysis

Subject group	**Individuals and Societies**
Subject	**Global Politics**
Level(s)	**HL/SL**

Nature of the Subject

Global Politics introduces students to international relations theory and interdisciplinary approaches to global political issues from the perspectives of individuals, communities, nations, and international institutions.

As teaching does not divide evenly across the periods of instruction, the curriculum has been broken down into its four units as well as the HL extension.

Aims
The aims of the global politics course at SL and HL are to enable students to: 1. understand key political concepts and contemporary political issues in a range of contexts 2. develop an understanding of the local, national, international and global dimensions of political activity 3. understand, appreciate and critically engage with a variety of perspectives and approaches in global politics 4. appreciate the complex and interconnected nature of many political issues, and develop the capacity to interpret competing and contestable claims regarding those issues
Links to TOK ● How theories shape our understanding of the world ● Ideological biases in news reporting ● Speaking truth to power ● The translation of reality and ethics into law ● How definition shapes meaning ● How definitions shape perception
Links to CAS ● Exploring political issues ● Awareness of how to get involved in human rights issues ● Awareness of how to get involved in issues surrounding development ● Develop a critical understanding of efforts and organizations that do or don't contribute to sustainable development ● Awareness of how to get involved in issues surrounding conflict and violence ● Understanding of the importance of various forms of civil disobedience ● Explore global politics issues of interest to student (community)
Links to Language and Learning ● Note-taking skills ● How to write an effective expositional essay ● Learn the legal vocabulary surrounding human rights ● Learn the economic vocabulary and indices of development ● Different ways of understanding "violence" ● Learn how to use tools to research global politics and to interpret empirical data

Subject group	**Individuals and Societies**
Subject	**History**
Level(s)	**HL/SL**
Nature of the Subject	
The IB Diploma Programme (DP) history course is a world history course based on a comparative and multi-perspective approach to history. It involves the study of a variety of types of history,	

including political, economic, social and cultural, and provides a balance of structure and flexibility. The course emphasizes the importance of encouraging students to think historically and to develop historical skills as well as gaining factual knowledge. It puts a premium on developing the skills of critical thinking, and on developing an understanding of multiple interpretations of history. In this way, the course involves a challenging and demanding critical exploration of the past.

Aims

The aims of the history course are to:

- develop an understanding of, and continuing interest in, the past
- encourage students to engage with multiple perspectives and to appreciate the complex nature of historical concepts, issues, events and developments
- promote international-mindedness through the study of history from more than one region of the world
- develop an understanding of history as a discipline and to develop historical consciousness including a sense of chronology and context, and an understanding of different historical perspectives
- develop key historical skills, including engaging effectively with sources
- increase students' understanding of themselves and of contemporary society by encouraging reflection on the past.

Links to TOK

- What is history?
- What is the role of the historian?
- Do we learn from history?
- Who produces history?
- Who decides which events are historically significant?
- What is the difference between bias and selection?
- What methods do historians use to gain knowledge?
- To what extent does studying history help us to better understand ourselves in the present?
- What is the role of individuals in history?
- Do we learn from history?
- To what extent does studying history help us to better understand ourselves in the present?

Links to CAS

Links to Language and Learning

- Essay writing skills
- Source evaluation
- How to build an argument
- Debating skills
- Presentation skills
- Research skills
- Responding to examination prompts

Subject group	**Sciences**

Subject	Biology
Level(s)	HL/SL

Nature of the Subject

Biology is the study of life. The first organisms appeared on the planet over 3 billion years ago and, through reproduction and natural selection, have given rise to the 8 million or so different species alive today. Estimates vary, but over the course of evolution 4 billion species could have been produced. Most of these flourished for a period of time and then became extinct as new, better adapted species took their place. There have been at least five periods when very large numbers of species became extinct and biologists are concerned that another mass extinction is under way, caused this time by human activity. Nonetheless, there are more species alive on Earth today than ever before. This diversity makes biology both an endless source of fascination and a considerable challenge.

An interest in life is natural for humans; not only are we living organisms ourselves, but we depend on many species for our survival, are threatened by some and co-exist with many more. From the earliest cave paintings to the modern wildlife documentary, this interest is as obvious as it is ubiquitous, as biology continues to fascinate young and old all over the world.

The word "biology" was coined by German naturalist Gottfried Reinhold in 1802 but our understanding of living organisms only started to grow rapidly with the advent of techniques and technologies developed in the 18th and 19th centuries, not least the invention of the microscope and the realization that natural selection is the process that has driven the evolution of life.

Biologists attempt to understand the living world at all levels using many different approaches and techniques. At one end of the scale is the cell, its molecular construction and complex metabolic reactions. At the other end of the scale biologists investigate the interactions that make whole ecosystems function.

Many areas of research in biology are extremely challenging and many discoveries remain to be made. Biology is still a young science and great progress is expected in the 21st century. This progress is sorely needed at a time when the growing human population is placing ever greater pressure on food supplies and on the habitats of other species, and is threatening the very planet we occupy.

Aims

Through studying biology, chemistry or physics, 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:

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.

Links to TOK

- There is a difference between the living and the non-living environment. How are we able to know the difference?
- The world that we inhabit is limited by the world that we see. Is there any distinction to be drawn between knowledge claims dependent upon observations made by sense perception and knowledge claims dependent upon observations assisted by technology?
- The explanation of the structure of the plasma membrane has changed over the years as new evidence and ways of analysis have come to light. Under what circumstances is it important to learn about theories that were later discredited?
- Biology is the study of life, yet life is an emergent property. Under what circumstances is a systems approach productive in biology and under what circumstances is a reductionist approach more appropriate? How do scientists decide between competing approaches?
- A number of scientific discoveries are claimed to be incidental or serendipitous. To what extent might some of these scientific discoveries be the result of intuition rather than luck?
- Claims about the "memory of water" have been categorized as pseudoscientific. What are the criteria that can be used to distinguish scientific claims from pseudoscientific claims?
- There are conflicting views as to the harms and benefits of fats in diets. How do we decide between competing views?
- Development of some techniques benefits particular human populations more than others. For example, the development of lactose-free milk available in Europe and North America would have greater benefit in Africa/ Asia where lactose intolerance is more prevalent. The development of techniques requires financial investment. Should knowledge be shared when techniques developed in one part of the world are more applicable in another?
- The story of the elucidation of the structure of DNA illustrates that cooperation and collaboration among scientists exists alongside competition between research groups. To what extent is research in secret 'anti-scientific'? What is the relationship between shared and personal knowledge in the natural sciences?
- There is a link between sickle cell anemia and prevalence of malaria. How can we know whether there is a causal link in such cases or simply a correlation?
- In 1922 the number of chromosomes counted in a human cell was 48. This remained the established number for 30 years, even though a review of photographic evidence from the time clearly showed that there were 46. For what reasons do existing beliefs carry a certain inertia?
- Mendel's theories were not accepted by the scientific community for a long time. What factors would encourage the acceptance of new ideas by the scientific community?
- The use of DNA for securing convictions in legal cases is well established, yet even universally accepted theories are overturned in the light of new evidence in science.

What criteria are necessary for assessing the reliability of evidence?

- The precautionary principle is meant to guide decision-making in conditions where a lack of certainty exists. Is certainty ever possible in the natural sciences?
- Evolutionary history is an especially challenging area of science because experiments cannot be performed to establish past events or their causes. There are nonetheless scientific methods of establishing beyond reasonable doubt what happened in some cases. How do these methods compare to those used by historians to reconstruct the past?
- Natural Selection is a theory. How much evidence is required to support a theory and what sort of counter evidence is required to refute it?
- The adoption of a system of binomial nomenclature is largely due to Swedish botanist and physician Carolus Linnaeus (1707–1778). Linnaeus also defined four groups of humans, and the divisions were based on both physical and social traits. By 21st-century standards, his descriptions can be regarded as racist. How does the social context of scientific work affect the methods and findings of research? Is it necessary to consider the social context when evaluating ethical aspects of knowledge claims?
- A major step forward in the study of bacteria was the recognition in 1977 by Carl Woese that Archaea have a separate line of evolutionary descent from bacteria. Famous scientists, including Luria and Mayr, objected to his division of the prokaryotes. To what extent is conservatism in science desirable?
- Our current understanding is that emotions are the product of activity in the brain rather than the heart. Is knowledge based on science more valid than knowledge based on intuition?
- In medicine the concept of death is defined in terms of brain function, but sometimes conflicts can occur when the medical criteria for death differ from the family's criteria for death. To what extent should the views of the family members be given priority when making decisions in medical ethics? What criteria should be used to make ethical decisions?
- Other organisms can detect stimuli that humans cannot. For example, some pollinators can detect electromagnetic radiation in the non-visible range. As a consequence, they might perceive a flower as patterned when we perceive it as plain. To what extent, therefore, is what we perceive merely an individual construction of reality?

Links to CAS

Links to Language and Learning

Subject group	**Sciences**
Subject	**Chemistry**
Level(s)	**HL/SL**

Nature of the Subject

Chemistry is an experimental science that combines academic study with the acquisition of practical and investigational skills. It 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.

Earth, water, air and fire are often said to be the four classical elements. They have connections with Hinduism and Buddhism. The Greek philosopher Plato was the first to call these entities elements. The study of chemistry has changed dramatically from its origins in the early days of alchemists, who had as their quest the transmutation of common metals into gold. Although today alchemists are not regarded as being true scientists, modern chemistry has the study of alchemy as its roots. Alchemists were among the first to develop strict experimentation processes and laboratory techniques. Robert Boyle, often credited with being the father of modern chemistry, began experimenting as an alchemist.

Despite the exciting and extraordinary development of ideas throughout the history of chemistry, certain things have remained unchanged. Observations remain essential at the very core of chemistry, and this sometimes requires decisions about what to look for. The scientific processes carried out by the most eminent scientists in the past are the same ones followed by working chemists today and, crucially, are also accessible to students in schools. The body of scientific knowledge has grown in size and complexity, and the tools and skills of theoretical and experimental chemistry have become so specialized, that it is difficult (if not impossible) to be highly proficient in both areas. While students should be aware of this, they should also know that the free and rapid interplay of theoretical ideas and experimental results in the public scientific literature maintains the crucial link between these fields.

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

Through studying biology, chemistry or physics, 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 analyse, 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.

Links to TOK

- The "language" of chemistry
- How does scientific knowledge progress
- The magnitude of Avogadro´s constant
- The role of reason, perception, intuition and imagination in developing scientific models
- Things are made of atoms (indirect knowledge through technology)
- Heisenberg's Uncertainty Principle
- An electron can behave as a wave or a particle depending on the experimental conditions.
- Is it meaningful to talk of properties which can never be observed from sense perception?
- inductive and deductive reasoning in the development of the periodic table and in science in general
- the demarcation between scientific and pseudoscientific claims
- the "risk-taking" nature of science
- how classification and categorization helps and hinder the pursuit of knowledge
- How many exceptions have to exist for a rule to cease to be useful?
- What evidence do we have for the existence of ions?
- What role has the pseudoscience of alchemy played in the development of modern science?
- What criteria do we use in assessing the validity of a scientific theory?
- How does a specialized vocabulary help and hinder the growth of knowledge?
- To what extent is having alternative ways of describing the same phenomena a strength or a weakness?
- What is the relationship between the natural sciences, mathematics and the natural world? Which role does symmetry play in the different areas of knowledge?
- What criteria do we use in judging discrepancies between experimental and theoretical values? Which ways of knowing do we use when assessing experimental limitations and theoretical assumptions?
- What are the challenges and limitations of applying general principles to specific instances? (the Conservation of Energy)
- How important are technical terms, such as entropy, in different areas of knowledge?
- Are physical properties such as temperature invented or discovered (the Kelvin vs. Celsius scale)?
- What is the role of empirical evidence in scientific theories? Can we ever be certain in science?
- Which ways of knowing allow us to move from the macroscopic to the microscopic?
- Does our vocabulary simply communicate our knowledge, or does it shape what we can know?
- How does the social context of scientific work affect the methods and findings of science? Should scientists be held morally responsible for the applications of their discoveries (Fritz Haber during World War I) ?
- What is the role of deductive reasoning in science?
- Do we create mathematics to mirror reality or because reality is intrinsically mathematical?
- What is the role of intuition in problem solving?

- How are the explanations in chemistry different from explanations in other subjects such as history?
- Why is it important to have just one "scientific" language?
- Does scientific vocabulary simply communicate our knowledge in a neutral way or can it have value-laden terminology?
- In what ways do technologies, which extend our senses, change or reinforce our view of the world?
- Do we judge competing theories by their universality, simplicity or elegance?
- Is a pH curve an accurate description of reality or an artificial representation?
- Does science offer a representation of reality?
- Chemistry has developed a systematic language that has resulted in older names becoming obsolete. What has been lost and gained in this process?
- Are artificial conversions, such as oxidation states, a useful or valid way of clarifying knowledge?
- Is energy just an abstract concept used to justify why certain types of changes are always associated with each other? Are concepts such as energy real?
- Would our scientific knowledge be the same if we chose different references?
- The label "organic chemistry" originates from a misconception.
- Kekulé claimed that the inspiration for the cyclic structure of benzene came from a dream. What role do the less analytical ways of knowledge play in the acquisition of scientific knowledge?
- Graphs are a visual representation of data, and so use sense perception as a way of knowing.
- What are the limitations of sense perception as a way of knowing?
- What are the roles of imagination, intuition and reasoning in finding solutions to practical problems?
- Which ways of knowing allow us to connect indirect evidence to our theories?
- One of the challenges for the scientist and the artist is to represent the three dimensional world in two dimensions.
- Why is mathematics such an effective tool in science? Is mathematics the science of patterns?
- Different countries have very different standards towards food labelling. Is access to information a human right? What knowledge should be universally available?
- What are the different responsibilities of government, industry, the medical profession and the individual in making healthy choices about diet? Public bodies can protect the individual but also limit their freedom. How do we know what is best for society and the individual?
- Should scientists be held morally responsible for the adverse consequences of their work?
- What are the ethical considerations in adding supplements to commonly consumed foods, such as fluoride to water or iodine to salt?
- What is the role of authority in communicating scientific knowledge to the public?
- How are metaphors and models used in the construction of knowledge?
- DNA stores information but not knowledge. What are the differences between information and knowledge?
- What is the role of collaboration in advancing knowledge?
- Who has the right to access knowledge of an individual's DNA?
- How do the different senses interact in giving us empirical knowledge about the world?

Links to CAS

- CAS for Lab technicians

Links to Language and Learning

Subject group	**Sciences**
Subject	**Physics**
Level(s)	**HL/SL**

Nature of the Subject

Physics is the most fundamental of the experimental sciences, as it seeks to explain the universe itself from the very smallest particles—currently accepted as quarks, which may be truly fundamental—to the vast distances between galaxies.

Classical physics, built upon the great pillars of Newtonian mechanics, electromagnetism and thermodynamics, went a long way in deepening our understanding of the universe. From Newtonian mechanics came the idea of predictability in which the universe is deterministic and knowable. This led to Laplace's boast that by knowing the initial conditions—the position and velocity of every particle in the universe—he could, in principle, predict the future with absolute certainty. Maxwell's theory of electromagnetism described the behaviour of electric charge and unified light and electricity, while thermodynamics described the relation between energy transferred due to temperature difference and work and described how all natural processes increase disorder in the universe.

The scientific processes carried out by the most eminent scientists in the past are the same ones followed by working physicists today and, crucially, are also accessible to students in schools.

Physics is therefore, above all, a human activity, and students need to be aware of the context in which physicists work. Illuminating its historical development places the knowledge and the process of physics in a context of dynamic change, in contrast to the static context in which physics has sometimes been presented. This can give students insights into the human side of physics: the individuals; their personalities, times and social milieux; their challenges, disappointments and triumphs.

The Diploma Programme physics 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 SL and HL, and therefore accommodates students who wish to study physics as their major subject in higher education and those who do not.

The Higher Level Physics course is an intensive course in general Physics. The syllabus gives a non-calculus presentation of the fundamental parts of physics. The distinction between SL and HL is one of breadth and depth.

Aims

Through studying biology, chemistry or physics, 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:

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
    a. 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.

Links to TOK

- Different system of units; Scientific language; Empirical and theoretical approach
- Different temperature scales; Why and how? Meaning of 'ideal'; Feeling of hotness and coldness; Same temperature means same danger? Waves and Medium? Huygens and light.
- SHM or not SHM? Effecting components; Observation & understanding; Current as motion of charged particles: Definition, agreement or complication?
- Concept strong or weak forces; Importance and existence of the Electric-magnetic-Gravitational fields of everyday life;
- Radioactivity: good or bad? Scientific recognition as a result of luck or failure; Energy from fusion? Development of atomic models: How do we know?
- Alternating current versus Direct current; Health issues
- Duality of matter: Violation of classical physics?
- GOD and/or Science?
- Certainty or Assumption?

Links to CAS

Links to Language and Learning

Subject group	**Mathematics**
Subject	**Mathematics: Applications and Interpretations**
Level(s)	**SL**

Nature of the Subject

Mathematics has been described as the study of structure, order and relation that has evolved from the practices of counting, measuring and describing objects. Mathematics provides a unique language to describe, explore and communicate the nature of the world we live in as well as being a constantly building body of knowledge and truth in itself that is distinctive in its certainty. These two aspects of mathematics, a discipline that is studied for its intrinsic pleasure and a means to explore and understand the world we live in, are both separate yet closely linked.

Mathematics is driven by abstract concepts and generalization. This mathematics is drawn out of ideas, and develops through linking these ideas and developing new ones. These mathematical ideas may have no immediate practical application. Doing such mathematics is about digging deeper to increase mathematical knowledge and truth. The new knowledge is presented in the form of theorems that have been built from axioms and logical mathematical arguments and a theorem is only accepted as true when it has been proven. The body of knowledge that makes up mathematics is not fixed; it has grown during human history and is growing at an increasing rate.

The side of mathematics that is based on describing our world and solving practical problems is often carried out in the context of another area of study. Mathematics is used in a diverse range of disciplines as both a language and a tool to explore the universe; alongside this its applications include analyzing trends, making predictions, quantifying risk, exploring relationships and interdependence.
While these two different facets of mathematics may seem separate, they are often deeply connected. When mathematics is developed, history has taught us that a seemingly obscure, abstract mathematical theorem or fact may in time be highly significant. On the other hand, much mathematics is developed in response to the needs of other disciplines.

Applications and Interpretation course recognizes the increasing role that mathematics and technology play in a diverse range of fields in a data-rich world. As such, it emphasizes the meaning of mathematics in context by focusing on topics that are often used as applications or in mathematical modelling.

The course makes extensive use of technology to allow students to explore and construct mathematical models. Mathematics: applications and interpretation will develop mathematical thinking, often in the context of a practical problem and using technology to justify conjectures. Students who choose Mathematics: applications and interpretation should enjoy seeing mathematics used in real-world contexts and to solve real-world problems.

Aims

The aims of all DP mathematics courses are to enable students to:

1. develop a curiosity and enjoyment of mathematics, and appreciate its elegance and power
2. develop an understanding of the concepts, principles and nature of mathematics
3. communicate mathematics clearly, concisely and confidently in a variety of contexts
4. develop logical and creative thinking, and patience and persistence in problem solving to instil confidence in using mathematics
5. employ and refine their powers of abstraction and generalization
6. take action to apply and transfer skills to alternative situations, to other areas of knowledge and to future developments in their local and global communities
7. appreciate how developments in technology and mathematics influence each other
8. appreciate the moral, social and ethical questions arising from the work of mathematicians and the applications of mathematics
9. appreciate the universality of mathematics and its multicultural, international and historical perspectives
10. appreciate the contribution of mathematics to other disciplines, and as a particular “area of knowledge” in the TOK course
11. develop the ability to reflect critically upon their own work and the work of others
12. independently and collaboratively extend their understanding of mathematics

Links to TOK

- Is mathematics discovered or invented ?
- How an infinite series can have a finite limit?
- Who 'invented' Pascal's triangle?
- How important is application of mathematics in various area of life ?
- How accurate is visual representation of a mathematical concept ?
- The need for use of radians vs. degrees
- Use and development of trigonometry in various cultures
- How can we link algebra with geometry?
- How statistics is used in order to mislead/manipulate people
- Can gambling be considered as an application of mathematics
- To what extent does mathematics offer models of real life?
- What value does the knowledge of limits have?
- How to form and test a hypothesis?
- What impact the development of calculus had on other areas e.g. natural sciences and engineering?

Links to CAS

Links to Language and Learning

Subject group	**Mathematics**
Subject	**Mathematics: Analysis and Approaches**
Level(s)	**HL/SL**

Nature of the Subject

Mathematics has been described as the study of structure, order and relation that has evolved from the practices of counting, measuring and describing objects. Mathematics provides a unique language to describe, explore and communicate the nature of the world we live in as well as being a constantly building body of knowledge and truth in itself that is distinctive in its certainty. These two aspects of mathematics, a discipline that is studied for its intrinsic pleasure and a means to explore and understand the world we live in, are both separate yet closely linked.

Mathematics is driven by abstract concepts and generalization. This mathematics is drawn out of ideas, and develops through linking these ideas and developing new ones. These mathematical ideas may have no immediate practical application. Doing such mathematics is about digging deeper to increase mathematical knowledge and truth. The new knowledge is presented in the form of theorems that have been built from axioms and logical mathematical arguments and a theorem is only accepted as true when it has been proven. The body of knowledge that makes up mathematics is not fixed; it has grown during human history and is growing at an increasing rate.

The side of mathematics that is based on describing our world and solving practical problems is often carried out in the context of another area of study. Mathematics is used in a diverse range of disciplines as both a language and a tool to explore the universe; alongside this its applications include analyzing trends, making predictions, quantifying risk, exploring relationships and

interdependence.
While these two different facets of mathematics may seem separate, they are often deeply connected. When mathematics is developed, history has taught us that a seemingly obscure, abstract mathematical theorem or fact may in time be highly significant. On the other hand, much mathematics is developed in response to the needs of other disciplines.

Mathematics: analysis and approaches recognizes the need for analytical expertise in a world where innovation is increasingly dependent on a deep understanding of mathematics. This course includes topics that are both traditionally part of a pre-university mathematics course (for example, functions, trigonometry, calculus) as well as topics that are amenable to investigation, conjecture and proof, for instance the study of sequences and series at both SL and HL, and proof by induction at HL.

The course allows the use of technology, as fluency in relevant mathematical software and hand-held technology is important regardless of choice of course. However, Mathematics: analysis and approaches has a strong emphasis on the ability to construct, communicate and justify correct mathematical arguments.

Aims

The aims of all DP mathematics courses are to enable students to:

1. develop a curiosity and enjoyment of mathematics, and appreciate its elegance and power
2. develop an understanding of the concepts, principles and nature of mathematics
3. communicate mathematics clearly, concisely and confidently in a variety of contexts
4. develop logical and creative thinking, and patience and persistence in problem solving to instil confidence in using mathematics
5. employ and refine their powers of abstraction and generalization
6. take action to apply and transfer skills to alternative situations, to other areas of knowledge and to future developments in their local and global communities
7. appreciate how developments in technology and mathematics influence each other
8. appreciate the moral, social and ethical questions arising from the work of mathematicians and the applications of mathematics
9. appreciate the universality of mathematics and its multicultural, international and historical perspectives
10. appreciate the contribution of mathematics to other disciplines, and as a particular “area of knowledge” in the TOK course
11. develop the ability to reflect critically upon their own work and the work of others
12. independently and collaboratively extend their understanding of mathematics

Links to TOK

- Concept of infinitely small and large; Radian or Degree? Why both?
- Concept of limit with removing finite number of elements from infinitely many.
- Graphs for mathematics or sciences? Why different?
- Is there more or less meaning of mathematical calculations and representation when it is applied in physics?
- Vectors: Complicate or simplify problems
- Exponential growth or not? What is the difference?
- Why do we need ‘imaginary’ numbers?
- Isn’t mathematics complex enough without complex numbers?
- Relation between Population and Sample statistics: Can we trust the general interpretation of statistical data? Probability of an event defined under different conditions.

- Should we be able to see the Bell curve of normal distribution for the IB results?
- Meaning of LLN (law of large numbers)
- Do we get the exact answers using calculators or computers?

Links to CAS

Links to Language and Learning

Subject group	**The Arts**
Subject	**Music**
Level(s)	**SL**

Nature of the Subject

This course enables students to develop their music skills through solo or/and group performance, to develop their perceptual skills in response to a wide variety of music (classical, jazz, pop&rock and crossover styles) and to explore the diversity of music throughout the world. Students also undertake investigations into topics of their choice. This course assists students in developing their potential as a musician, both personally and collaboratively. The student is exploring music as a researcher, creator and performer and all three music roles are equal.

Guidelines for Course Entry:
Two to three years' experience on an instrument prior to starting the IB course, or experience of playing/singing in a group. It's recommended that the students have individual instrumental or vocal tuition throughout the two-year IB course.

Aims

- Knowledge, understanding and perception of music in relation to time, place and cultures.
- Appropriate musical terminology to describe and reflect your critical understanding of music.
- Comparative analysis of music in relation to time, place and cultures.
- Creative skills through exploration, control and development of musical elements.
- Performance skills through solo music making and/or group music making.
- Critical-thinking skills through reflective thought.
- Experiment, create, perform, arrange, improvise, explore.

Links to TOK

- Who am I as a musician?
- What is music?
- Do artists have moral responsibilities?
- How do we judge art?

Links to CAS

Links to Language and Learning

Subject group	**The Arts**
Subject	**Visual Arts**
Level(s)	**SL**

Nature of the Subject

The visual arts are an integral part of everyday life, permeating all levels of human creativity, expression,communication and understanding. They range from traditional forms embedded in local and wider communities, societies and cultures, to the varied and divergent practices associated with new, emerging and contemporary forms of visual language. They may have sociopolitical impact as well as ritual, spiritual, decorative and functional value; they can be persuasive and subversive in some instances, enlightening and uplifting in others. We celebrate the visual arts not only in the way we create images and objects, but also in the way we appreciate, enjoy, respect and respond to the practices of art-making by others from around the world. Theories and practices in visual arts are dynamic and ever-changing, and connect many areas of knowledge and human experience through individual and collaborative exploration, creative production and critical interpretation.

The IB Diploma Programme visual arts course encourages students to challenge their own creative and cultural expectations and boundaries. It is a thought-provoking course in which students develop analytical skills in problem-solving and divergent thinking, while working towards technical proficiency and confidence as art-makers. In addition to exploring and comparing visual arts from different perspectives and in different contexts, students are expected to engage in, experiment with and critically reflect upon a wide range of contemporary practices and media. The course is designed for students who want to go on to study visual arts in higher education as well as for those who are seeking lifelong enrichment through visual arts.

Supporting the International Baccalaureate mission statement and learner profile, the course encourages students to actively explore the visual arts within and across a variety of local, regional, national, international and intercultural contexts. Through inquiry, investigation, reflection and creative application, visual arts students develop an appreciation for the expressive and aesthetic diversity in the world around them, becoming critically informed makers and consumers of visual culture.

Aims

The aims of the arts subjects are to enable students to:

1. enjoy lifelong engagement with the arts
2. become informed, reflective and critical practitioners in the arts
3. understand the dynamic and changing nature of the arts
4. explore and value the diversity of the arts across time, place and cultures
5. express ideas with confidence and competence
6. develop perceptual and analytical skills.

The IB Diploma Programme visual arts course encourages students to challenge their own creative and cultural expectations and boundaries. It is a thought-provoking course in which students develop analytical skills in problem-solving and divergent thinking, while working towards technical proficiency and confidence as art-makers. In addition to exploring and comparing visual arts from different perspectives and in different contexts, students are expected to engage in, experiment with and critically reflect upon a wide range of contemporary practices and media. The course is designed for students who want to go on to study visual arts in higher education as well as for those who are seeking lifelong enrichment through visual arts.

In addition, the aims of the visual arts course at SL and HL are to enable students to:

1. make artwork that is influenced by personal and cultural contexts
2. become informed and critical observers and makers of visual culture and media
3. develop skills, techniques and processes in order to communicate concepts and ideas.

Links to TOK

- Art and meaning
- Exploring the cultural significance of place and the cultural influences of your surroundings
- How does cultural understanding influence our interpretation of an artwork?
- Art and knowledge - the viewer response
- Art and meaning - the ready made

Links to CAS

Links to Language and Learning

- Building art vocabulary
- Collecting artist statements
- Text and layout in portfolio
- Presentation of your work in a class critique