Sciences

Middle Years Programme

Guide

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International Baccalaureate Organization

Buenos Aires Cardiff Geneva New York Singapore

Middle Years Programme
Sciences—guide

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MYP111

IBO mission statement

The International Baccalaureate Organization aims to develop inquiring, knowledgeable and caring young people who help to create a better and more peaceful world through intercultural understanding and respect.

To this end the IBO works with schools, governments and international organizations to develop challenging programmes of international education and rigorous assessment.

These programmes encourage students across the world to become active, compassionate and lifelong learners who understand that other people, with their differences, can also be right.

Contents

Introduction to the Middle Years Programme

The Middle Years Programme (MYP) of the International Baccalaureate Organization (IBO) is a course of study designed to meet the educational requirements of students aged between 11 and 16 years. The curriculum may be taught as an entity in itself, but it is flexible enough to allow the demands of national, regional or local legislation to be met.

Early and present curriculum developers of the Middle Years Programme have shared a common concern to prepare young people for the changing demands of life in the twenty-first century.

MYP students are at an age when they are making the transition from early puberty to mid-adolescence: this is a crucial period of personal, social, physical and intellectual development, of uncertainty and of questioning. The MYP has been devised to guide students in their search for a sense of belonging in the world around them. It also aims to help students to develop the knowledge, attitudes and skills they need to participate actively and responsibly in a changing and increasingly interrelated world. This means teaching them to become independent learners who can recognize relationships between school subjects and the world outside, and learn to combine relevant knowledge, experience and critical thinking to solve authentic problems.

The eight subject groups provide a broad, traditional foundation of knowledge, while the pedagogical devices used to transmit this knowledge aim to increase the students' awareness of the relationships between the subjects. Students are encouraged to question and evaluate information critically, to seek out and explore the links between subjects, and to develop an awareness of their own place in the world.

The MYP aims to encourage students to develop:

- the disposition and capacity to be lifelong learners
- the capacity to adapt to a rapidly changing reality
- problem-solving skills, practical skills and intellectual rigour
- the capacity and self-confidence to act individually and collaboratively
- an awareness of global issues and the willingness to act responsibly
- the ability to engage in effective communication across frontiers
- respect for others and an appreciation of similarities and differences.

Fundamental concepts

Adolescents are confronted with a vast and often bewildering array of choices. The MYP is designed to provide students with the values and opportunities that will enable them to develop sound judgment. Learning how to learn and how to evaluate information critically is as important as the content of the disciplines themselves.

From its beginning, the MYP has been guided by three fundamental concepts that underpin its development, both internationally and in individual schools:

- holistic learning
- intercultural awareness
- communication.

These concepts form the basis for the MYP's curriculum framework, which is shared by different types of schools in all parts of the world. The fundamental concepts of the MYP should be the guiding principles in designing the curriculum and school activities.

Holistic learning

Holistic learning emphasizes the links between the disciplines, providing a global view of situations and issues. Students should become more aware of the relevance of their learning, and come to see knowledge as an interrelated whole. Students should see the cohesion and the complementarity of various fields of study, but this must not be done to the detriment of learning within each of the disciplines, which retain their own objectives and methodology.

Intercultural awareness

Intercultural awareness is concerned with developing students' attitudes, knowledge and skills as they learn about their own and others' social and national cultures. By encouraging students to consider multiple perspectives, intercultural awareness not only fosters tolerance and respect, but may also lead to empathy.

Communication

Communication is fundamental to learning, as it supports inquiry and understanding, and allows student reflection and expression. The MYP places particular emphasis on language acquisition and allows students to explore multiple forms of expression.

Areas of interaction

Students are required to experience and explore each of the five areas of interaction in every year of the programme:

- **approaches to learning (ATL)**, in which students take increasing responsibility for their learning
- **community and service**, through which students become aware of their roles and their responsibilities as members of communities
- ***homo faber***, **environment**, **health and social education**, broad areas of student inquiry where personal as well as societal and global issues are investigated and debated.

The areas of interaction give the MYP its distinctive core. These areas are common to all disciplines and are incorporated into the MYP so that students will become increasingly aware of the connections between subject content and the real world, rather than considering subjects as isolated areas unrelated to each other and to the world. The MYP presents knowledge as an integrated whole, emphasizing the acquisition of skills and self-awareness, and the development of personal values. As a result, students are expected to develop an awareness of broader and more complex global issues.

The areas of interaction are explored through the subjects, thereby fulfilling their integrative function. Some aspects, however, may also be approached as separate modules and interdisciplinary projects throughout the MYP. Student participation in the areas of interaction culminates in the personal project.

Further information on the personal project is available in the *Personal Project* guide.

Curricular framework

The MYP offers a five-year curricular framework that allows school-specific requirements to be met while maintaining the mission and philosophy of the IBO. To ensure this, the IBO prescribes the aims and objectives of all subject groups and the personal project.

Aims and objectives

The objectives of each subject group are skills based and broad enough to allow a variety of teaching and learning approaches. The precise choice and organization of content is left to schools in order to preserve flexibility. In some subjects the content is not specified while in others a framework of concepts or topics is prescribed for all students to address over the five years. Such prescription is kept to a minimum and schools are asked to expand their scope of topics and depth of treatment according to their individual needs and preferences.

The aims and objectives of the subject groups address all aspects of learning including knowledge, understanding, skills and attitudes.

- **Knowledge:** the facts that the student should be able to recall to ensure competence in the subject
- **Understanding:** how the student will be able to interpret, apply or predict aspects of the subject
- **Skills:** shown through tasks that allow the student to apply what has been learned to new situations
- **Attitudes:** the ways in which the student is changed by the learning experience

The IBO provides final objectives for students completing the fifth year of the programme, and examples of interim objectives that describe what a student may be able to achieve after earlier years of the programme while aiming for the final objectives. The final objectives for students completing the fifth year of the programme form the basis for the assessment criteria that are intended for use in the final assessment of students' work at the end of year 5. Whether or not schools request IBO-validated grades for their students, they are all required to organize learning and assessment in a way that is consistent with the prescribed objectives.

Schemes of work

It is each school's responsibility to produce schemes of work that enable students to reach the objectives of each subject. Sample schemes of work or sample activities for all subject groups have been written by practising teachers as a suggested means of achieving this. Teachers may choose to adopt the samples offered, amend them to suit their own requirements, or write an alternative scheme of work.

Whichever schemes of work schools adopt, the final MYP objectives are prescribed. The areas of interaction should remain an integral part of the subject teaching and learning process, and must be at the core of the personal project.

Assessment

The MYP uses a criterion-referenced model of assessment. Teachers should ensure that both formative and summative assessment processes are used.

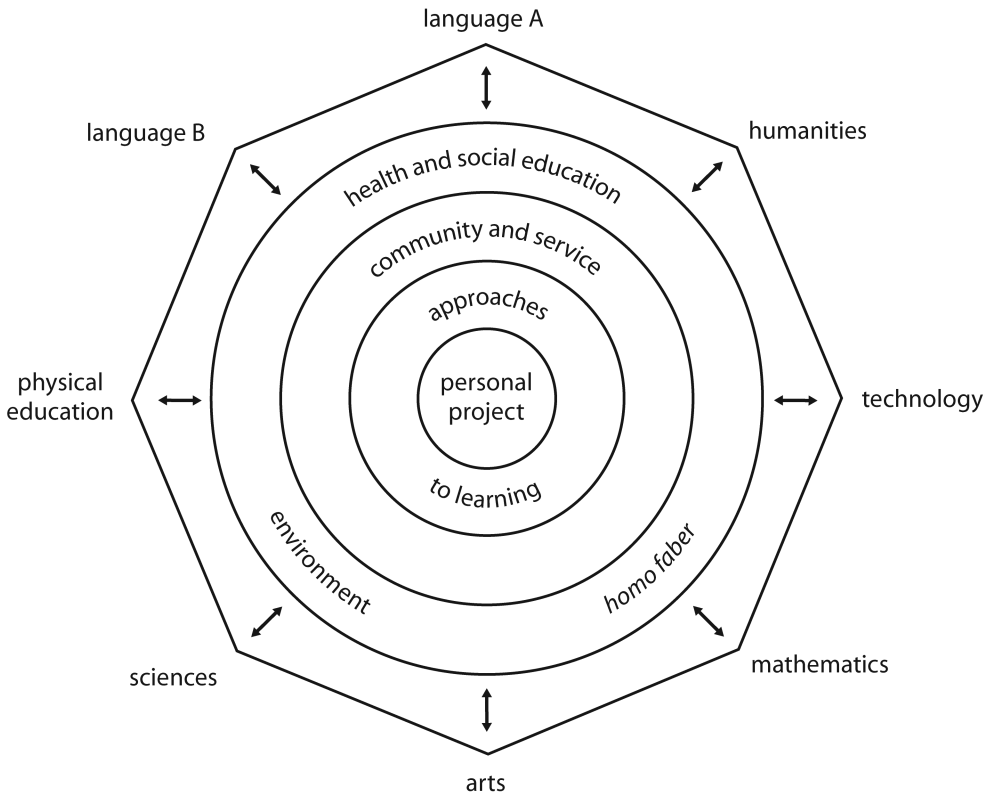
Teachers may modify the assessment criteria published in this guide to suit years 1–4 of the MYP; for example, they may create task-specific rubrics to assess student work. In schools that do not request IBO-validated grades, the assessment criteria may also be modified in the final year of the programme, as long as the published standards are not compromised.

Schools that request IBO-validated grades and MYP certification for students must submit work that has been assessed internally, using the published criteria, to IBCA for external moderation.

Programme evaluation

Programme evaluation is mandatory for all schools. It is a means of ensuring the quality of programmes in participating schools, while assisting schools in their self-evaluation and curriculum development procedures. Evaluation occurs at regular, predetermined intervals.

Programme model



This diagram represents the programme model of the MYP. The five areas of interaction connect the development of the individual (at the centre) with the educational experience in all subject groups (at the outer points of the octagon). These interactive areas are common to all disciplines with each subject developing general and specific aspects of the areas. In this way, the subject groups are also linked by the areas of interaction, demonstrating the interdisciplinary potential of the MYP. The five areas of interaction have no clear boundaries, but merge to form a context for learning that contributes to the student's experience of the curriculum.

Introduction to MYP sciences

In this rapidly changing world, education should prepare students for life in the twenty-first century. The MYP holistic approach to teaching and learning, along with the perspectives of the areas of interaction, provides a structure for the development of thinking skills, attitudes and dispositions characteristic of independent, lifelong learners.

The sciences and their methods of investigation offer a way of learning through inquiry that can contribute to the development of an analytical and critical way of thinking. MYP sciences emphasizes the role of inquiry and encourages the development of not only scientific inquiry skills but also transferable thinking skills.

MYP sciences aims to be inclusive of all students and should challenge all students by providing opportunities for different needs and learning styles. MYP sciences should nurture all students to become confident and curious learners.

The MYP sciences course must be relevant to the interests of students, providing them with opportunities to explore the role of science in historical and contemporary contexts. MYP sciences aims to help students appreciate the links between science and everyday life as well as the dynamic interactions between science and society.

MYP sciences, in conjunction with the other subject groups and the areas of interaction, contributes to helping students broaden their understanding of themselves as individuals and as collective members of society and the natural environment.

This guide will give both teachers and students clear aims and objectives for MYP sciences. It includes conceptual and skill requirements of the course, as well as details on final assessment requirements. IBO-produced teacher support material will complement this guide and will aid in implementing the course in schools. This teacher support material will include sample schemes of work developed through the areas of interaction, integrated and non-integrated unit plans, and assessed pieces of student work.

Fundamental concepts

Teaching and learning MYP sciences is underpinned by the fundamental concepts of the MYP:

- holistic learning
- intercultural awareness
- communication.

Holistic learning

Holistic learning emphasizes the links between the disciplines, providing a global view of situations and issues.

The MYP sciences course seeks to acknowledge that real-world science is a universal and cooperative venture between individuals from different disciplines within the international community. Students should become aware of how science and scientists work in the real world and how important the contribution of different disciplines is to the development of scientific ideas and knowledge. Students should also appreciate the relevance of other MYP subjects in developing their own learning in science.

This holistic approach implies the need for MYP sciences teachers to:

- work closely with their colleagues, both within the science department and in other departments
- provide opportunities for the coordination and integration of subject matter across all scientific disciplines and other subjects
- provide opportunities for students to appreciate the contribution that science makes to society and to the quality of life
- help students to reflect upon the way that science and scientific knowledge have developed and evolved over the years.

Holistic learning breaks down the artificial barriers of the different subjects commonly found on a school timetable, and this is an essential part of the MYP. It requires coordination and integration within sciences and across the curriculum. Effective development of the sciences course through the areas of interaction is an excellent method of enhancing holistic learning.

Intercultural awareness

Intercultural awareness is concerned with developing students' attitudes, knowledge and skills as they learn about their own and others' social and national cultures.

The MYP sciences course can contribute to the development of intercultural awareness by providing opportunities for students to explore scientific issues locally and globally. Addressing the global dimension of science implies dealing with global issues such as sustainability, interdependence, diversity, equity and so on, with the aim of developing attitudes of global citizenship.

Dealing with the global dimension of science provides students with the opportunity to develop their understanding of how science and society are interrelated and how social, economic, political, environmental, cultural and ethical factors are interdependent. Encouraging students to explore issues critically from a global and multicultural perspective can foster the development of attitudes and values such as tolerance, respect and empathy. Moreover, students will have the opportunity to reflect upon their roles and responsibilities in their community and in the wider world.

The opportunity to develop intercultural awareness through science can only be fully achieved in conjunction with the other subjects and the areas of interaction. Schools are encouraged to explore local and global issues from similar and contrasting cultures to their own in developing and implementing their courses.

Communication

Communication is fundamental to learning as it supports inquiry and understanding. Learning the language of science can be seen as learning a new language. MYP sciences focuses on the importance of developing the skills to understand and communicate scientific ideas effectively. In order to develop communication skills, students should be given opportunities to read, write and talk about science. Students should be encouraged to select and use a range of modes of communication. This may include oral and written language, visual representation (images, diagrams, tables, charts, graphs, models), mathematical symbols and multimedia.

Information and communication technologies (ICT) should be used as appropriate to support and enhance teaching and learning in science.

Requirements

Developing the curriculum in the school

All MYP subjects including sciences provide a curricular framework with set final aims and objectives. Schools are responsible for structuring their science courses so that they provide opportunities for students to meet the final aims and objectives effectively by the end of the programme (five years).

Depending on local requirements and preferences, schools can opt to structure and teach MYP sciences as an integrated course, as discrete science disciplines or as a combination of both throughout the programme. Regardless of the approach chosen, schools need to ensure that the teaching and learning is structured using the aims and objectives for MYP sciences.

Discrete science courses

Many MYP schools teach biology, physics and chemistry as traditional discrete courses. However, schools could offer other courses, such as environmental sciences, sport sciences or health sciences, to suit their local needs and preferences. All courses need to be structured within the framework of the aims and objectives for MYP sciences.

Integrated science courses

Alternatively schools might prefer to structure their science courses in an integrated way. Variations of this approach might include integrated sciences, coordinated sciences or interdisciplinary sciences. All these options are valid and schools are encouraged to use them as they contribute to the notion of holistic learning. However, it is important that schools ensure that these courses allow all students to meet the final aims and objectives prescribed by the IBO for MYP sciences.

The assessment criteria for MYP sciences should be used to assess both discrete and integrated courses.

Planning the curriculum

Vertical planning

Vertical planning occurs when teachers map and plan the learning experiences that students will encounter as they move from one year to the next in the programme.

In planning the sciences course teachers should develop a set of outcomes to achieve the final aims and objectives.

Student learning should be carefully sequenced to develop the main ideas of science, scientific inquiry skills and personal attitudes over the five years of the programme.

The MYP sciences course should be structured so that all students are exposed to and work towards meeting the final aims and objectives of MYP sciences every year of the programme. The breadth and depth of the curriculum and the expectations for students will vary considerably from one year to the next and for different groups according to specific learning styles and needs. However, all students should be given the opportunity to gradually build their knowledge and develop their skills and attitudes as they progress through the programme.

For example, students of MYP year 1 might not be fully ready to plan and carry out an investigation independently. However, they should start to develop the concept of fair testing and the skills of scientific inquiry. Equally, for students to engage in discussions about the impact of science on global issues, they need to start developing the skills of formulating scientifically supported arguments in the earlier years. If they can identify scientific evidence and can judge the credibility of claims, providing scientifically supported arguments and counter arguments, then they will be prepared to engage in more sophisticated discussions in the years that follow.

Horizontal articulation and interdisciplinary approaches

Holistic learning for the MYP implies that the teaching and learning should contribute to developing in students the awareness that knowledge is interrelated and that the knowledge, skills and attitudes developed in one subject can also be successfully transferred, applied or adapted to others.

Horizontal articulation, which occurs when teachers of the same year group work together planning the curriculum, is crucial to help students identify the connections within subjects and also to help them reflect upon their own learning. The areas of interaction offer teachers the possibility to explore issues from broader and deeper perspectives to enhance understanding.

Therefore it is important that teachers of different subjects collaborate with each other as much as possible to plan and teach the curriculum. In this way, they can provide students with opportunities to develop a comprehensive understanding of how the different subjects rely on and contribute to each other.

Contact hours

It is essential that teachers be allowed the number of contact hours necessary to meet the requirements of the sciences course in their particular school. Although the prescribed minimum teaching time in any given year for each subject group is 50 teaching hours, the IBO recognizes that, in practice, more than 50 teaching hours per year will be necessary to meet not only the programme requirements over the 5 years, but also to allow for the sustained, concurrent teaching of disciplines that enables interdisciplinary study.

In addition, schools must ensure that students are given sufficient time and tuition to allow them the opportunity to meet the final objectives for sciences.

Language of instruction

The importance of the use of language in science has been recognized and is supported by the science final objectives, in particular objective B, “Communication in science”.

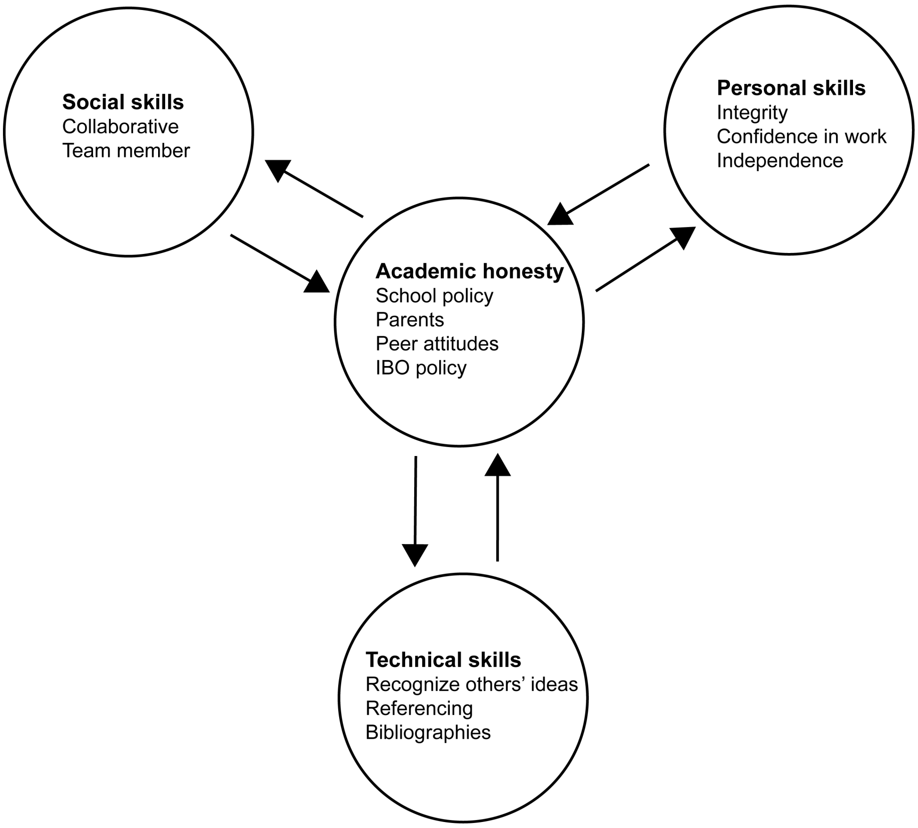
Students are expected to use and understand specific scientific words, many of which might be exclusive to science such as “cathode” and “electron”, but many of which have different meanings when dealt with in a scientific context and when used in everyday speech and writing such as “work”, “energy” and “power”.

The fact that many words used in science also require the understanding of the concept, such as “atom”, “gene” and “force”, poses an additional problem for all students and in particular for those who access the curriculum in a second language and for those with special educational needs.

In those schools where the language of instruction of sciences is not the mother tongue of some of the students taking the course, measures must be implemented to ensure that these students are not disadvantaged and have the full opportunity to demonstrate the highest achievement level in the final objectives. These measures may include teacher training, differentiation of assessment tasks, modification of language in materials, and parallel resources in students’ mother tongues. For further information, please refer to the MYP document *Second-language Acquisition and Mother-tongue Development: a guide for schools*.

Academic honesty

Academic honesty is a set of values that promotes personal integrity and good practice in learning and assessment, and in the MYP is part of approaches to learning. The IBO recognizes that academic honesty is influenced by factors that include peer pressure, culture, parental expectations, role modelling and taught skills. Academic honesty can be demonstrated through the dynamic relationship between personal, social and technical skills.



Teachers are encouraged to contribute to the development of their own academic-honesty policies that show encouragement of honesty, guidelines on teaching students how to use all forms of resources adequately (including ICT), and that also include information on procedures for when dishonesty is discovered. Academic honesty is the responsibility of schools, teachers and students in the MYP.

Specific areas of academic honesty that can be focused on in sciences include:

- **personal skills**—discussions on integrity, confidence in one's own work, willingness to work independently
- **social skills**—discussions on how to work collaboratively, how to contribute to a team, how to acknowledge work by other team members
- **technical skills**—recognition of when others' ideas should be acknowledged, which sources of information should be acknowledged and how, how to construct a bibliography and how to reference correctly.

Special educational needs

As the MYP is an inclusive curriculum framework, teachers will find that students in their classrooms have a range of backgrounds and academic abilities. Some of the students may have a recognized, diagnosed special educational need (SEN); other students may have special needs that have not yet been diagnosed. Examples of these special needs include:

- specific learning difficulties (dyslexia, dyscalculia)
- language and communication disorders (aphasia, dysphasia, articulation problems)
- emotional and behavioural difficulties
- physical disabilities affecting mobility

- sensory impairments (visual, hearing)
- medical conditions (asthma, epilepsy, diabetes)
- mental health conditions (attention deficit hyperactivity disorder, depression, eating disorders, anxiety)
- gifted and talented students.

In the MYP, it is expected that students who have special educational needs will aim to achieve the objectives of each subject group, and aim to achieve the highest levels in each. In the case of gifted and talented students, they may aim to exceed the final objectives before the end of year 5. Teachers therefore need to develop teaching practices so that all students in their classrooms have these opportunities. Teachers will need to differentiate their teaching so that students' potentials are maximized, and may need to allow students to demonstrate their understanding in different ways.

In particular, in sciences, teachers may wish to receive information and/or training on how to cater for students undertaking scientific inquiry (laboratory skills, safety, manipulative and observational skills), research projects (research skills, note taking, self-motivation), essay-writing tasks and presentations (organization, articulation of ideas) or may want advice on how to create alternative learning and assessment opportunities for students.

For information and support on how to create a classroom that is inclusive of students with special educational needs, please refer to the SEN page, SEN resources and forums on the online curriculum centre.

Resources

Laboratory

MYP sciences encourages the use of practical work to develop scientific inquiry skills. However, schools are responsible for ensuring the conditions for a safe and healthy environment for teaching and learning sciences. Science laboratories should be well equipped and maintained. Risk assessment of potential health hazards should be identified and addressed. Good science practice should be encouraged when dealing with equipment, materials and living organisms. Class size and supervision of practical work should be considered to minimize risk and hazards. Schools have a responsibility to design and implement health and safety codes and procedures in accordance with risk assessment and to meet their local or national requirements.

Library

Schools should provide teachers and students with a good variety of resources to support teaching and learning in sciences. A well-resourced and up-to-date library equipped with books, magazines and multimedia can contribute to sustaining students' curiosity and stimulating their interest in science and scientific issues.

Effective use of information and communication technologies

Information and communication technologies (ICT) should be used whenever possible as an important means of expanding students' knowledge of the world in which they live, and as a new channel for developing skills. Information and communication technologies provide a range of resources and applications for teachers to explore and enhance the teaching and learning experience, both in sciences and in other subject groups. The resources used and tasks assigned should be carefully chosen and prepared so that the objectives can be met and the assessment criteria can be applied. The choice of resources within a school will also need to reflect the ability range within that school. The school library and the ICT room have an essential role to play in this process and should, for example, have available good choices of application software and up-to-date supplementary works and books. In addition, the online curriculum centre is a valuable resource for teachers in the MYP. It contains discussion forums and resource banks, as well as official IBO publications that can be downloaded. Please see your MYP coordinator for a school code and password.

To achieve a successful implementation of ICT across the curriculum, schools must ensure a whole-school approach is in place that provides not only adequate resources but also appropriate teacher training and allocates time for teachers to plan effective uses of ICT in their lessons.

Some of the possible uses of ICT in sciences might include:

- databases and spreadsheets to log and process data, detect trends and patterns, make predictions and test hypotheses
- software to present and transform data and information in different ways (tables, graphs, charts, presentations)
- simulations software to allow students to gain experience of phenomena and experiments
- modelling software to allow students to design models of phenomena and explore the relationships between variables
- data logging (microcomputer-based laboratories) for data analysis and interpretation (data logging uses electronic sensors to measure and process experimental data and produce real-time graphical displays of the results)
- the Internet to access, collect and process relevant information from non-relevant information
- multimedia, interactive CD-Roms to access information or to engage students in virtual experiments especially for hazardous laboratory work.

Developing the curriculum in the classroom

When planning a unit of work in MYP sciences, teachers should ensure that:

- whenever possible at least one area of interaction is a major focus
- interdisciplinary teaching is explored and used where appropriate
- contemporary topics and everyday-life science issues are included
- local and global environmental issues are used to promote discussion and opinion forming
- health issues are addressed and provide a framework for informed decision making
- local issues and students' interests are considered when selecting themes for teaching and learning science
- opportunities to read, talk about and discuss science issues are included throughout the curriculum
- a wide range of sources such as newspaper articles, magazines, leaflets, and the Internet are used to develop critical thinking and evaluation of sources
- scientific inquiry skills are systematically taught and developed through scientific inquiries and investigations
- good laboratory practice is observed and supervised during practical work
- the learning outcomes match the MYP objectives
- the final assessment criteria are modified for use at each year level and for individual assignments where appropriate
- student achievement of the objectives is measured against the assessment criteria (see "Sciences assessment criteria"); please note that the use of assessment criteria may be modified outside the context of external moderation, and particularly in years 1–4.

Addressing the areas of interaction

There are five areas of interaction:

- approaches to learning (ATL)
- community and service
- *homo faber*
- environment
- health and social education.

These areas provide a means of broadening student experience, placing learning in context and helping students to develop attitudes and values based on knowledge and skills. They form the basis of the MYP and contribute to an education resulting in global awareness, international understanding and an appreciation of cultural diversity. They should be at the core of the teaching of all subject groups and the primary approach to the areas of interaction must be through the curriculum.

The areas of interaction should be used as "lenses" through which to view the curriculum, and to provide a base for teachers upon which they can encourage student reflection on the issues at hand. Teachers should consult the MYP *Areas of Interaction* guide to become familiar with the aims, objectives and dimensions of each area. This will help to identify links to relevant topics and issues, and base schemes of work and units of work in these areas.

It is important to note that some of the examples that follow could easily fit into more than one category. The areas of interaction should be seen as overlapping throughout the programme.

Approaches to learning

How do I learn best?
How do I know?
How do I communicate my understanding?

Approaches to learning (ATL) skills are central to the learning experience in the MYP. This area of interaction is concerned with providing opportunities for the development of skills and attitudes to learning. ATL skills should enable students to become competent in identifying, monitoring and managing their own learning.

MYP sciences should contribute to the development of thinking skills by providing students with a curriculum that offers challenging opportunities that enable them to question, investigate and evaluate data and information presented to them.

ATL skills and attitudes include:

- **learning skills**—communication, information processing, organizational skills, higher-thinking strategies
- **personal attitudes**—responsibility, collaboration, integrity and reflection (metacognition).

MYP sciences should provide opportunities for the development of subject-specific skills and allow time and space for the development of attitudes and dispositions to learning.

Specific ATL skills and attitudes that may be developed through sciences include:

- **knowledge-acquisition skills**—forming concepts and understanding scientific ideas and concepts
- **application of knowledge**—using strategies to solve problems in familiar and unfamiliar situations, in both scientific and other contexts
- **observation skills**—focusing attention on objects and phenomena; recording and communicating observations; annotations, sketches and drawings
- **information-processing and organizational skills**—gathering and sorting information and data; comparing, classifying, ordering; constructing tables, organizational charts, outlines and graphic organizers (concept and mind maps)
- **communication skills**—oral, listening and writing skills; using scientific terminology and scientific conventions appropriately; using appropriate modes of communication (graphs, tables, drawings, diagrams etc) as well as appropriate scientific communication formats: laboratory reports, investigations, research papers, argumentative essays
- **scientific inquiry skills**—formulating research questions; hypothesizing, inferring, predicting and elaborating explanations; designing, planning and conducting scientific experiments and investigations
- **analysing skills**—identifying parts and components; recognizing relationships, trends and patterns in data and scientific information
- **integrating and summarizing skills**—connecting, combining, synthesizing and reconstructing information for meaning and understanding
- **evaluation skills**—using critical-thinking skills to evaluate information and make scientifically supported arguments; judging the value of evidence and the credibility of sources when scientific information is presented in media and non-scientific articles; developing criteria for judging the value of their own work and that of others
- **collaboration**—working within a team; recognizing the contribution of others as well as exchanging and integrating ideas
- **responsibility**—approaching scientific investigation responsibly; working safely and paying attention to potential hazards and environmental impact
- **integrity**—respecting others' work, acknowledging their work and ideas appropriately; working in an ethical manner, paying attention to the authenticity of data
- **reflection (metacognition)**—reflecting upon their understanding and evaluating their own thinking and their preferred ways of learning.

These skills and processes are by no means part of a taxonomy; the categories overlap and complement each other. These skills are not an end in themselves but a means to help students manage their own learning. ATL skills cannot be developed in isolation but through an integrated and interdisciplinary approach and in connection with regular classroom content.

For more information about skills and processes in sciences, please refer to the "Framework for sciences".

Community and service

How do we live in relation to each other?
How can I contribute to the community?
How can I help others?

The emphasis of community and service is on developing community awareness and a sense of responsibility towards the community so that students become engaged and empowered to act in response to the needs of the community. Students should be encouraged to look beyond the classroom, so that they discover the social reality of self, others and communities, and this awareness, in turn, may initiate involvement and service. Student reflection on the needs of the community and their ability to participate in and respond to the needs of the community will contribute to the development of caring and responsible citizens.

Incorporating community and service into the study of sciences encourages responsible citizenship as students deepen their knowledge and understanding of the world around them. The MYP sciences course should also help students reflect upon the role of science in society and the responsibility of scientists and scientific developments in a global setting. Often, by considering local science-based issues, students can pursue community and service activities for themselves, and find ways in which a scientific approach can be applied to solve a community problem in the health, environment and technological fields. For example, the study of a river may lead to a clean-up activity.

Activities that may be considered to promote community and service through sciences include:

- investigating scientific issues and their impact in the local community and/or the global society
- researching service and aid initiatives in school, local, regional and global communities
- promoting awareness campaigns of environmental and health initiatives in the school or local community
- organizing individual and group responses to community needs
- reflecting on topics studied and services undertaken.

Homo faber

Why and how do we create?
What are the consequences?

Homo faber allows students to focus on the evolution, process and products of human creativity and their impact on life and society. *Homo faber* aims to provide opportunities for students to appreciate the human capacity to invent, create, transform, enjoy and improve the quality of life. *Homo faber* is at the heart of inquiry and helps students to examine, question and reflect upon the processes and products of human creativity.

The study of MYP sciences provides many opportunities to incorporate *homo faber* into the curriculum. Scientific and technological developments and innovations can be assessed from a social, economic, political, environmental, cultural and ethical perspective.

Activities that may be considered to promote *homo faber* through sciences include:

- development of an understanding of the evolution of scientific ideas and the rigour of scientific thought
- evaluation of the social and ethical impact of scientific and technological developments
- development of an awareness of the tentative nature of science and ability to tolerate scientific uncertainties

- appreciation of the nature of scientific inquiry and real-life scientific endeavour
- clarification of misconceptions about the universal approach of the scientific method unravelling alternative approaches used by scientists in the real world.

Environment

Where do we live?
What resources do we have or need?
What are my responsibilities?

This area of interaction is concerned with raising students' awareness of the interdependence of human beings and the natural and man-made environment. It aims to help students develop an understanding of the concepts of conservation and sustainable development and how decisions and actions affect the delicate balance of the natural life support system. This area of interaction aims to help students develop attitudes and dispositions of concern and respect for the environment in the context of everyday decision making.

MYP sciences should provide opportunities for students to address local and global environmental issues and recognize the interdependence of political, economic and social factors. MYP sciences can help students become aware of their rights and responsibilities as world citizens and prepare them to make responsible choices about environmental issues locally and globally.

Activities that may be considered to promote environment through sciences include:

- investigating the impact of human intervention on natural environments in areas such as climate change, species loss, deforestation, overpopulation, pollution of air and water, and diminishing of natural resources
- exploring the interdependence of human conditions (activities and actions) and the environment, its resources and its sustainability for future generations
- discussing how social, economic and political dimensions affect actions and decisions about issues of environmental importance
- exploring how human activity and exploitation of natural resources play a role in the sustainability of the natural capital
- developing plans to address a local environmental problem and to help maintain an environmental balance
- evaluating the effectiveness of actions to protect the environment in local or global contexts.

Health and social education

How do I think and act?
How am I changing?
How can I look after myself and others?

Health and social education deals with issues that contribute to leading a healthy and complete life as individuals and as members of society. This area of interaction is concerned with physical, social and emotional health. It aims to develop in students an awareness of the conditions that enhance and threaten health and well-being, individually and collectively. It is hoped that students develop a sense of responsibility for their own well-being and that of others in the society.

Health and social education goes beyond the sole provision of information and acquisition of knowledge and encourages the development of critical-thinking skills and attitudes that play an important role when making decisions and confronting life options.

Health and social education encourages respect for the self as well as respect for others. This enables students to understand how personal decisions and actions can affect themselves as well as others.

MYP sciences can contribute to developing knowledge and understanding of health-related issues that can threaten or enhance health. This awareness can contribute to the development of healthy habits and behaviours. Psychological, sociological, economic and ethical aspects of health and welfare should also be addressed in the science class. Moreover, cooperative learning activities encourage the development of social skills.

Activities that may be considered to promote health and social education through sciences include:

- researching malnutrition in different cultural and economic settings—from eating disorders to hunger and famine
- investigating how society and peer pressure can endanger health, including aspects such as diet, alcohol, tobacco and drugs
- researching health and social issues in different parts of the world, reflecting on how they compare and contrast
- discussing the advantages and disadvantages of biotechnology and genetic engineering goods in any of the following areas—pharmaceutical, agricultural, environmental, medical treatment
- discussing social, cultural and economic ramifications of scientific developments related to health—in vitro fertilization, cloning, and genetic engineering
- devising health and social awareness campaigns within the school and local community based on students' research.

Aims and objectives

MYP sciences aspires to develop scientifically informed, caring and responsible individuals who can think critically and make informed choices about themselves, the environment and society.

Aims

The aims of any MYP subject and of the personal project state in a general way what the teacher may expect to teach or do, and what the student may expect to experience or learn. In addition they suggest how the student may be changed by the learning experience.

The aims of the teaching and study of sciences are to encourage and enable students to:

- develop inquiring minds and curiosity about science and the natural world
- acquire knowledge, conceptual understanding and skills to solve problems and make informed decisions in scientific and other contexts
- develop skills of scientific inquiry to design and carry out scientific investigations and evaluate scientific evidence to draw conclusions
- communicate scientific ideas, arguments and practical experiences accurately in a variety of ways
- think analytically, critically and creatively to solve problems, judge arguments and make decisions in scientific and other contexts
- appreciate the benefits and limitations of science and its application in technological developments
- understand the international nature of science and the interdependence of science, technology and society, including the benefits, limitations and implications imposed by social, economic, political, environmental, cultural and ethical factors
- demonstrate attitudes and develop values of honesty and respect for themselves, others, and their shared environment.

Objectives

The objectives of any MYP subject and of the personal project state the specific targets set for learning in the subject. They define what the learner will be able to do, or do better, as a result of studying the subject.

The objectives of sciences listed below are final objectives and they describe what students should be able to do by the end of the course. These objectives have a direct correspondence with the final assessment criteria, A–F (see “Sciences assessment criteria”).

A One world

This objective refers to enabling students to understand the interdependence between science and society. Students should be aware of the global dimension of science, as a universal activity with consequences for our lives and subject to social, economic, political, environmental, cultural and ethical factors.

At the end of the course, and within local and global contexts, students should be able to:

- describe and discuss ways in which science is applied and used to solve local and global problems
- describe and evaluate the benefits and limitations of science and scientific applications as well as their effect on life and society
- discuss how science and technology are interdependent and assist each other in the development of knowledge and technological applications
- discuss how science and its applications interact with social, economic, political, environmental, cultural and ethical factors.

B Communication in science

This objective refers to enabling students to develop their communication skills in science. Students should be able to understand scientific information, such as data, ideas, arguments and investigations, and communicate it using appropriate scientific language in a variety of communication modes and formats as appropriate.

At the end of the course, students should be able to:

- communicate scientific information using a range of scientific language
- communicate scientific information using appropriate modes of communication
- present scientific information in a variety of formats, acknowledging sources as appropriate
- demonstrate honesty when handling data and information, acknowledging sources as appropriate
- use where appropriate a range of information and communication technology applications to access, process and communicate scientific information.

C Knowledge and understanding of science

This objective refers to enabling students to understand the main ideas and concepts of science and to apply them to solve problems in familiar and unfamiliar situations. Students are expected to develop critical and reflective thinking and judge the credibility of scientific information when this is presented to them.

At the end of the course, students should be able to:

- recognize and recall scientific information
- explain and apply scientific information to solve problems in familiar and unfamiliar situations
- analyse scientific information by identifying components, relationships and patterns, both in experimental data and ideas
- discuss and evaluate scientific information from different sources (Internet, newspaper articles, television, scientific texts and publications) and assess its credibility.

D Scientific inquiry

This objective refers to enabling students to develop scientific inquiry skills to design and carry out scientific investigations.

At the end of the course, students should be able to:

- define the problem or research question to be tested by a scientific investigation
- formulate a hypothesis and explain it using logical scientific reasoning
- design scientific investigations that include variables and controls, material/equipment needed, a method to be followed, data to be collected and suggestions for its analysis
- evaluate the method, commenting on its reliability and/or validity
- suggest improvements to the method.

E Processing data

This objective refers to enabling students to record, organize and process data. Students should be able to collect and transform data by numerical calculations into diagrammatic form. Students should be able to analyse and interpret data and explain appropriate conclusions.

At the end of the course, students should be able to:

- collect and record data using appropriate units of measurement
- organize and transform data into numerical and diagrammatic forms, including mathematical calculations and visual representation (tables, graphs and charts)
- present data in a variety of ways using appropriate communication modes and conventions (units of measurement)
- analyse and interpret data by identifying trends, patterns and relationships
- draw conclusions supported by scientific explanations and a reasoned interpretation of the analysis of the data.

F Attitudes in science

This objective goes beyond science and refers to encouraging attitudes and dispositions that will contribute to students' development as caring and responsible individuals and members of society.

This objective is set in the context of the science class but will pervade other subjects and life outside school. It includes notions of safety and responsibility when working in science as well as respect for and collaboration with others and their shared environment.

During the course, students should:

- carry out scientific investigations using materials and techniques safely and skillfully
- work effectively as members of a team, collaborating, acknowledging and supporting others as well as ensuring a safe working environment
- show respect for themselves and others, and deal responsibly with the living and non-living environment.

Framework for sciences

This framework is organized into three domains and includes concepts, skills, processes and attitudes that must be developed for the sciences course. While the domains are mandatory for structuring the sciences course, the examples of content areas are provided for guidance only.

MYP sciences encourages the development of a scientific way of knowing that enables students to investigate, understand and explain the world they live in. This scientific way of knowing encompasses two types of understanding: conceptual understanding and procedural understanding. Conceptual understanding is concerned with the development of scientific knowledge and an in-depth understanding of the main scientific ideas and concepts of science. Procedural understanding is concerned with the skills and processes that students need to develop to understand how science and scientists work and to evaluate scientific evidence. Conceptual understanding and procedural understanding cannot be developed independently. Students' understanding of the skills and processes used in science enables them to construct their understanding of scientific concepts, and this insight provides the driving force for the development of further scientific inquiries.

MYP sciences aims to help students develop personal attitudes. Students should be aware of wider world issues and have a sense of their responsibilities as individuals, towards others and towards the natural and man-made environment. Therefore it is very important that the content that teachers select to address is relevant to students' interests and relates to personal, local and global issues. It is expected that students' engagement, interest and enjoyment in science will foster a positive response to science and contribute to the development of opinion-forming, decision-making as well as ethical-reasoning skills.

The purpose of the sciences framework is to provide guidance for teachers to structure the science curriculum and develop the context in which the aims and objectives of the MYP sciences course can be met.

The framework for sciences is organized into three main domains.

- **Skills and processes** (procedural understanding)
- **Concepts of science** (conceptual understanding)
- **Personal, social and global awareness** (attitudes and beliefs)

The domains of the framework list concepts, skills, processes and attitudes that must be developed. However, the content areas selected to address the domains are not mandatory. Teachers should select content areas and contexts that are appropriate and relevant to their students as well as to their local and national requirements. The domains are interconnected and activities will incorporate aspects of each.

Schools must structure their courses of study so that **elements** of each domain are included in every year of the programme. However, the proportion of time devoted to each will vary from year to year depending on the progression of learning planned by the school.

Skills and processes

Learning science gives students the opportunity to develop a way of knowing and working in a scientific way. Working scientifically involves students acquiring both practical and intellectual skills that will enable them to understand the main scientific ideas and the way science and scientists work.

Groups of skills taken together, or occasional single skills, make up the process by which scientific understanding has developed and progressed. Thus the process of scientific inquiry requires a multiplicity of skills, both practical and intellectual.

This domain is also clearly articulated with approaches to learning and contributes to the development of general transferable skills common to other subjects as well as science-specific skills.

The following table presents a summary of some of the skills and processes developed in science; they must become part of the students' experience in the classroom and of their participation in scientific investigations.

Skills and processes	Explanation	Key words
Analysing	Examining and breaking information into parts, identifying patterns, relationships, causes, main ideas and errors	Compare, contrast, examine, identify, infer, conclude
Classifying	Ordering according to properties, characteristics or relationships	Sort, group, identify, decide, label, compare, order, collect data, record
Communicating	Expressing information in a variety of forms—oral, written accounts, visual representations (graphs, diagrams, equations, tables, presentations using ICT applications, etc)	Record, present findings, demonstrate, describe, explain, report, show, outline
Controlling variables	Manipulating variables—changing one factor that may affect the outcome while the other factors remain constant	Experiment, fair test, control
Defining	Giving the precise meaning of a word, phrase or physical quantity	Involves factors such as appearance and function
Evaluating	Assessing the validity of information or quality of the work based on criteria	Judge, assess, decide, prove, support, appraise, defend, conclude
Experimenting	Testing a hypothesis (at the core of scientific investigation)	Explore, discover, check, identify and control variables, investigate, try, verify
Hypothesizing	Stating a problem in the form of a question, prediction, scientific explanation that can be verified by a process of experimentation	Question, observe, predict, infer
Inferring	Making judgments based on observations and past experience	Predict, explore, refine, discuss
Inquiring	Formulating questions in order to clarify issues and understand meaning	Define problems, research, question, ask questions, discuss

Skills and processes	Explanation	Key words
Interpreting data	Observing information and offering explanations, organizing data, drawing conclusions and predictions	Explain, interpret, predict, conclude, revise
Measuring	Using appropriate instruments and techniques to collect and record data on weight, mass, temperature, time, volume etc	Compare, match, estimate, determine
Modelling	Describing and explaining relationships between ideas often using simplified mathematical or diagrammatical representation	Physical, verbal or mental representation of an idea (eg atomic model, DNA model, solar system model)
Observing	Using the senses and instruments to focus the perception on some phenomenon, object or process	Distinguish, recognize, look, feel, touch
Predicting	Offering statements, suggestions or hypotheses based on observations, experience and knowledge to anticipate the outcome of a situation	Interpret, construe, deduce, infer
Recognizing patterns	Articulating interrelationships between parts and components	Analyse, compare, contrast, categorize, distinguish relationships, examine, discover
Recording	Collecting, showing and presenting data, findings and conclusions	Record, present, construct, organize, draw
Synthesizing	Combining information in a different way to construct meaning	Combine, create, propose, adapt, develop, infer, predict, elaborate, restructure, improve
Using numbers	Quantifying measurements, comparisons, classifications	Count, divide, graph
Using time–space relationships	Describing spatial relationships as affected by time	Motion, direction, sequence, symmetry

Concepts of science

Concepts are powerful ideas that have relevance within and across disciplines. Students must develop an understanding of the following science concepts over the course at increasing levels of sophistication.

- The concept of change
- The concept of energy
- The concept of structures, patterns and systems

The concept of change

Students can explore the concepts of constancy and equilibrium in order to be able to understand change. The following content areas are suggested.

- Chemical and physical change: substances can undergo physical and chemical changes that will affect their properties. These changes occur in both living and non-living systems and are influenced by the same factors.
- Forces: forces hold the universe and us together. Unbalanced forces give rise to changes in shape, size or motion. The concept of conservation of momentum and Newton's laws of motion can be explored as well as the effect of electrical, magnetic and gravitational forces.
- Constancy and change in life forms: living organisms reproduce and maintain constancy of structures and functions by passing genetic information from one generation to the next. The value of change, mutation and variation should be explored as a means to explain diversity and evolution.
- Natural cycles: the occurrence of natural cycles. Seasons, life cycles, geological cycles, nutrient cycles can be explored to develop the idea of regularity and constancy.
- Homeostasis: the maintenance of a constant internal environment and the role of corrective feedback mechanisms to achieve equilibrium can be explored in different organisms and systems.

The concept of energy

Energy is central to science and provides one of the most fundamental laws of science: the law of conservation of energy along with the conservation of mass and the conservation of momentum. Students can explore the multiplicity of energy transformations within and between living and non-living systems, different means of energy storage and the uses made of energy.

Students should realize that energy can be manifested in different ways such as heat, chemical energy, potential energy, kinetic energy, electrical energy, nuclear energy, light and sound.

The following content areas are suggested to explore the concept of transformation of energy.

- Energy in cells (photosynthesis and respiration)
- Energy flow in an ecosystem
- Chemical reactions
- Conversion between potential, kinetic and mechanical energy
- Conversions in electrical circuits

The following content areas are suggested to explore the concept of transport and transfer of energy.

- Heat conduction, convection and radiation
- Wave phenomena
- Distribution of electricity
- Living systems

The following content areas are suggested to explore the uses of energy.

- Effect of atmosphere heating and its link to climate change
- Fuels and energy production
- Use of electricity in the chemical industry
- Propulsion methods (motors, heat engines, rockets and jet engines)

The concept of structures, patterns and systems

The concept of structures, patterns and systems can be developed through a number of content areas that range from the subatomic level in the organization of matter to the macro level in the organization of organisms in populations, communities, the Earth and the universe.

Science explores the structure of atoms, subatomic particles, simple and complex molecules, compounds and crystals, cells, the complex nature of individual organs, organisms, groups of organisms, the Earth and the universe. At all these levels of organization, structures and patterns become evident that help explain function, natural phenomena and behaviour.

The concept of structures, patterns and systems can be explored through the study of the following content areas.

Structure of matter

Atomic theory powerfully explains many phenomena in science. However, due to its complexity and abstraction it requires teachers to use evidence and explanations from several stories to gradually develop the concept. The idea that all matter is made up of atoms that are invisible, and that the number of subatomic particles and their structure determine the properties of materials could be developed. The distinction between atoms, subatomic particles, elements, molecules, compounds as well as the attractive forces between them such as intermolecular and intramolecular bonding could be explored in order to understand the structure and properties of matter.

The following content areas are suggested.

- Atomic model and the concept of particulate nature of matter
- States of matter and arrangements of particles
- Changes of state and forces between particles, intermolecular forces
- Gas properties
- Physical and chemical reactions, atomic arrangement of reactants and products, chemical equations
- Compounds, elements and solubility rules
- Chemical substances and reactions in everyday life and their environmental significance
- Safe use of chemicals in the laboratory and everyday life
- Idea of conservation of mass

Living systems

Cells are the structural and functional units of all living things, and all the instructions necessary to direct their activities are contained in the DNA (deoxyribonucleic acid). The DNA from all organisms shares similar chemical and physical properties. The differential expression of this information will result in different cells having specific structure and function. Students could explore the pattern of differentiation in cells, tissues, organs, systems and organisms in order to understand the great diversity of life on Earth.

The following content areas are suggested.

- Chemical composition of nucleic acids (DNA, RNA) and their role in the genome
- Structure and function of plant and animal cells
- Classification of organisms—criteria
- Biological diversity within and across species
- Similarities in DNA sequences between organisms
- Evolution—molecular DNA evidence supports anatomical evidence
- The theory of natural selection as a mechanism for evolution—the origin of new hereditable characteristics in organisms and their selective advantage for survival

Students can develop a sophisticated understanding of how living organisms function, develop and evolve. Some teachers may choose to focus on the human body and physical health.

Earth and space

Students could develop an understanding of the architecture of the universe and the place of the Earth in the cosmos. They could become aware of the scientific aspects of the origin and structure of the universe. Explanations of day and night, and the phases of the moon and the seasons, could be developed and clarified.

The following content areas are suggested.

- The solar system, its composition and the role of gravity
- The theories about the origin of the universe
- The sun as a star in the solar system
- Evolution of the Earth as a planet
- Structure of the Earth and the conditions for life
- Atmospheric phenomena, heat energy and the water cycle, and their effect on global climate
- Conditions for life on Earth including the gravitational force, the atmosphere, sun radiation and the water cycle

Personal, social and global awareness

This domain summarizes three aspects of the development of students: as individuals, as members of their surrounding community and as global citizens. Therefore emphasis should be placed on providing opportunities for students to develop in each of these aspects. Environment, health and social education, and community and service provide natural opportunities to develop these attitudes.

The development of students as informed, responsible and caring individuals is key to their personal well-being and to their role as members of society and the wider world.

This domain provides an opportunity to raise questions and discuss ethical issues so that students become more critical when interpreting, communicating and making choices about scientific issues. Confronting students with ethical dilemmas will encourage them to develop opinion-forming skills based on critical reasoning that can contribute to their development as informed and responsible citizens when making decisions and taking action.

The global dimension of science offers students opportunities to develop global awareness by exploring real issues and understanding the interactions between science and social, economic, political, environmental, cultural, and ethical factors.

The following content areas are suggested.

- The concept of sustainable development and the capacity of human society to maintain the delicate balance between man and the natural environment
- The use and management of natural resources (air, water, soil, and solar energy), and their transformation into human capital, goods, tools, machines
- The role and responsibilities of individuals and societies in the sustainable use and exploitation of natural resources
- The analysis of social, economic, political, cultural and ethical aspects in relation to sustainable development initiatives
- Health-related issues such as nutrition, alcohol, tobacco, drug abuse, and their effect on the individual and the society as a whole
- Health care and preventative care in developed and developing countries
- Controversial science issues* such as climate change, genetically modified crops, cloning, MMR (measles, mumps, rubella) vaccination, and their social, economic, political, environmental, cultural and ethical implications
- The role of science in society and its relationship with technology through specific examples in developed and developing countries

***Note**
These examples seem relevant at the time of writing; teachers should select examples that are pertinent to their local and current environment.

Introduction to assessment

There is no external assessment by the IBO within the Middle Years Programme (MYP) and so there are no formal externally set or externally marked examinations. All assessment within the MYP is carried out by teachers in participating schools and relies on their professional expertise in making qualitative judgments, as they do every day in the classroom. In line with the general IBO assessment philosophy, a norm-referenced approach to assessment is not appropriate to the MYP. Instead, MYP schools must follow a criterion-referenced approach. Students' work should therefore be assessed against defined assessment criteria and not against the work of other students.

This section provides:

- advice on assessment in years 1–5
- guidelines for final assessment
- the assessment criteria and final level descriptors
- the moderation procedures that teachers must follow if their school decides to register students for IBO-validated grades
- the monitoring of assessment procedures that teachers must follow if their school opts for this service
- the final grade descriptors.

All MYP schools are expected to develop assessment procedures and methods of reporting to parents that reflect the philosophy and objectives of the programme. All schools are therefore expected to use the assessment criteria published in this guide for final assessment, although local or national requirements may involve other assessment models and criteria as well.

It is highly recommended that the procedures for assessment and the MYP assessment criteria are shared with both students and parents as an aid to the learning process.

For schools that request **IBO-validated grades**, the criteria and corresponding achievement levels listed in this guide **must** be used as a basis for the levels submitted to IBCA. For these schools, standardization of assessment is ensured through a process of external moderation of teachers' internal assessments.

The *MYP Coordinator's Handbook* provides further details concerning the registration of students for certification and the process of external moderation.

Assessment in years 1–5

Formative and summative assessment

Assessment in the MYP should be an integral part of teaching and learning. The use of assessment in a formative sense, to judge regularly the effectiveness of both teaching and learning processes, is essential in allowing teachers and students to identify strengths and weaknesses. The purpose and means of assessment should be clearly explained to the students.

- **Formative assessment** is an integral part of the learning experience and should not be an artificial "add-on". The objectives addressed by specific assessment tasks should be shared with students, with feedback taking place as soon as possible.
- **Summative assessment** is the judgment made by the teacher of the standard of achievement reached by each student at the end of each stage of the programme. Assessment tasks should reflect the objectives and assessment criteria of the programme. They must be carefully chosen to measure the achievement level expected for the relevant age group.

The forms of assessment and reporting to parents and students will vary from one school to another. The flexibility of the MYP offers schools the opportunity to design their schemes of work according to their needs, and/or the constraints of their own national curriculum, while working towards the attainment of the MYP objectives.

Formative and summative assessment should:

- allow both the student and teacher to assess what the student can do, and how he/she can use knowledge, concepts and skills
- measure the application of knowledge, concepts and skills rather than the mere recall of facts
- reflect achievement against the criteria for the subject
- involve student participation and reflection; for example, students should know the assessment criteria for a given task and, on occasion, help devise an assessment grid (rubric) to measure various aspects of their performance
- provide students with an opportunity to analyse their own learning and to recognize what areas need improvement
- be based on agreed standards of performance for a particular year group, with expectations set by teams of classroom teachers and clearly communicated to students and parents
- be informative for students, parents and teachers, and provide direction for future instruction
- provide equal opportunities for all students regardless of gender, culture and special needs.

Depending on circumstances, students will reach the objectives at different times and in different ways. The MYP provides schools with a series of example objectives for years 1–4 of the programme (*Examples of school-specific objectives, assessment criteria, tasks and rubrics*) and final (year 5) objectives for each subject, and schools are free to organize both teaching and assessment according to their needs.

Assessment tasks

In general, MYP teachers are free to devise the exact nature of the assessment tasks that they use. Assessment should be based on a variety of types of activity since no one task will cover all of the objectives of an MYP subject. Projects, exhibitions, oral presentations, performances and demonstrations as well as written papers or essays all provide evidence for the assessment of student learning. The tasks set, however, should stem from learning activities and ideally will be learning experiences themselves. Tasks can be designed to allow the assessment of different objectives against relevant criteria.

Students may experience various levels of support in assessment tasks, since peer-conferencing, teacher-conferencing, editing and correcting are all essential learning tools.

Using the assessment criteria

The assessment criteria published in this guide correspond to the objectives of this subject group. The achievement levels described have been written with year 5 final assessment in mind. In years 1–4, schools may wish to adapt the relative importance, focus and expected achievement levels for each criterion according to the progression of learning organized by them. Schools may add other criteria and report on these internally to parents and students.

The descriptors for each criterion are hierarchical. When assessing a student’s work, teachers should read the descriptors (starting with level 0) until they reach a descriptor that describes an achievement level that the work being assessed has **not** attained. The work is therefore best described by the preceding descriptor that corresponds to a markband.

Care should be taken to apply criteria only to pieces of work for which they are appropriate. Where it is not clearly evident which level descriptor should apply, teachers must use their judgment to select the descriptor that best matches the student’s work.

If the work is a good example of achievement in a markband, the teacher should give it the upper level in the band. If the work is a poor example of achievement in that band, the teacher should give it the lower level in the band.

General principles

Only whole numbers should be recorded; partial levels, fractions and decimals are not acceptable.

The levels attributed to the descriptors must not be considered as marks or percentages, nor should it be assumed that there are arithmetical relationships between descriptors. For example, a level 4 performance is not necessarily twice as good as a level 2 performance.

Teachers should not think in terms of a pass/fail boundary for each criterion, or make comparisons with the MYP 1–7 grade scale, but should concentrate on identifying the appropriate descriptor for each assessment criterion.

The highest descriptors do not imply faultless performance, but should be achievable by students aged 16. Teachers should therefore not hesitate to use the highest and lowest levels if they are appropriate descriptors for the work being assessed.

A student who attains a high achievement level for one criterion will not necessarily reach high achievement levels for the other criteria. Conversely, a student who attains a low achievement level for one criterion will not necessarily attain low achievement levels for the other criteria.

Teachers should not assume that the results of a group of students being assessed will follow any particular distribution plan.

For schools that request IBO-validated grades, the assessment results submitted to IBCA **must** be based **only** on the criteria and achievement levels listed in this guide. The teacher's final assessment of each student should be the total of the achievement levels that best reflect the student's abilities at the **completion** of the programme.

Sciences assessment criteria

Please note that the assessment criteria in this guide are for first use in final assessment in the year 2006. For final assessment in 2005, please use the assessment criteria as published in the previous MYP *Sciences* guide (August 2000).

The following assessment criteria have been established by the IBO for sciences in the Middle Years Programme. The final assessment required for IBO-validated grades and certification at the end of the MYP must be based on these assessment criteria.

Criterion A	One world	Maximum 6
Criterion B	Communication in science	Maximum 6
Criterion C	Knowledge and understanding of science	Maximum 6
Criterion D	Scientific inquiry	Maximum 6
Criterion E	Processing data	Maximum 6
Criterion F	Attitudes in science	Maximum 6

For each assessment criterion, a number of band descriptors are defined. These describe a range of achievement levels with the lowest represented as 0.

The descriptors concentrate on positive achievement, although failure to achieve may be included in the description for the lower levels.

Detailed descriptions of the assessment criteria and band descriptors appear on the following pages.

Criterion A: one world

Maximum 6

Students should understand the interdependence of science and society. Students are expected to discuss how science is applied and used to solve specific problems in life and society. Students should be given the opportunity to explore local and global scientific issues and evaluate the interaction between science and scientific developments with social, economic, political, environmental, cultural and ethical factors.

Assessment tasks should allow students to demonstrate their understanding of the role of science in society through the development of analysis and critical thinking. Suitable assessment tasks to assess this criterion include essays, case studies and research projects, but also debates and oral presentations.

Achievement level	Descriptor
0	The student does not reach a standard described by any of the descriptors given below.
1–2	The student **describes** how science is applied to addressing a specific local or global issue. The student **states some** of the benefits **or** limitations of science in addressing the issue.
3–4	The student describes how science is applied to addressing a specific local or global issue. The student **describes some** of the benefits **or** limitations of science in addressing the issue. The student **describes** how science and its applications interact with at least **one** of the following factors: social, economic, political, environmental, cultural and ethical.
5–6	The student **explains** how science is applied to addressing a specific local or global issue. The student **explains some** of the benefits **and** limitations of science in solving the issue. The student **discusses** how science and its applications interact with **some** of the following factors: social, economic, political, environmental, cultural and ethical.

Criterion B: communication in science

Maximum 6

Students should be able to demonstrate understanding when communicating scientific information. Students should use appropriate scientific language, a range of communication modes and the most appropriate communication format.

Suitable assessment tasks to assess this criterion include scientific investigation reports, research essays, case studies, interdisciplinary projects, and media presentations.

Depending on the tasks, students will be expected to acknowledge the sources of information and document these appropriately.

Achievement level	Descriptor
0	The student does not reach a standard described by any of the descriptors given below.
1–2	The student **attempts** to communicate scientific information using **some scientific language**. The student presents some of the information in an appropriate form using some symbolic or visual representation when appropriate. The student attempts to acknowledge sources of information but this is **inaccurate**.
3–4	The student communicates scientific information using **scientific language**. The student presents most of the information appropriately using symbolic and/or visual representation according to the task. The student acknowledges sources of information **with occasional errors**.
5–6	The student communicates scientific information **effectively** using **scientific language correctly**. The student presents all the information appropriately using symbolic and/or visual representation accurately according to the task. The student acknowledges sources of information **appropriately**.

Criterion C: knowledge and understanding of science

Maximum 6

Students should show their understanding of the main scientific ideas and concepts of science, by applying these to solve problems in familiar and unfamiliar situations. Students should develop critical-thinking skills to analyse and evaluate scientific information.

Suitable assessment tasks to assess this criterion include complex questions in tests, critical analysis of case studies, research projects or media articles on scientific issues. Assessment tasks should provide opportunities for students to demonstrate their understanding by solving problems in familiar and unfamiliar situations, and by analysing and evaluating scientific information presented to them.

Achievement level	Descriptor
0	The student does not reach a standard described by any of the descriptors given below.
1–2	The student **recalls** some scientific ideas and concepts and applies these to solve **simple problems**.
3–4	The student **explains** scientific ideas and concepts and applies scientific understanding to solve **problems in familiar situations**. The student **analyses** scientific information by identifying parts, relationships or causes. The student provides an **explanation** that shows understanding.
5–6	The student explains scientific ideas and concepts and applies scientific understanding to solve **problems in familiar and unfamiliar situations**. The student **analyses** and **evaluates** scientific information by making **scientifically supported judgments** about the information, the validity of the ideas or the quality of the work.

Unfamiliar situation: Refers to a problem/situation where the context or the application is modified to be considered unfamiliar for the student.

Criterion D: scientific inquiry

Maximum 6

Students are expected to design and carry out scientific investigations independently.

Students should be able to (i) state a problem that can be tested by an investigation; (ii) formulate a suitable hypothesis; (iii) identify and manipulate variables; (iv) plan an appropriate investigation including the method and materials; (v) evaluate the method.

Assessment tasks for scientific inquiry should provide students with the opportunity to design, plan and carry out scientific investigations independently. Suitable assessment tasks to assess this criterion include laboratory experiments and field studies.

Achievement level	Descriptor
0	The student does not reach a standard described by any of the descriptors given below.
1–2	The student **attempts to define** the purpose of the investigation and makes references to variables but these are **incomplete** or not fully developed. The method suggested is **partially complete**. The **evaluation** of the method **is either absent or incomplete**.
3–4	The student **defines** the purpose of the investigation and provides an **explanation/prediction** but this is not fully developed. The student acknowledges **some of the variables** involved and describes how to manipulate them. The method suggested is **complete** and includes appropriate materials/equipment. The **evaluation** of the method **is partially developed**.
5–6	The student **defines** the purpose of the investigation, **formulates a testable hypothesis** and **explains** the hypothesis using scientific reasoning. The student identifies the relevant variables and **explains how to manipulate** them. The student **evaluates** the method commenting on its **reliability** and/or **validity**. The student suggests improvements to the method and makes suggestions for further inquiry when relevant.

Reliability: Refers to measurement of the data. This depends upon the selection of the measuring instrument, the precision and accuracy of the measurements, errors associated with the measurement, the size of the sample, the sampling techniques used, the number of readings.

Validity: Refers to the success of the method at measuring what the investigator wishes to measure. This includes factors such as the choice of the measuring instrument and whether this measures what it is supposed to measure, the conditions of the experiment, and variable manipulation (fair testing).

Criterion E: processing data

Maximum 6

Processing data refers to enabling students to organize and process data. Students should be able to organize and transform data by numerical calculations into diagrammatic form (tables, graphs and charts) and draw and explain appropriate conclusions.

Suitable assessment tasks to assess this criterion include scientific investigations carried out by students, or by others, as well as laboratory reports and studies that provide students with raw data for further processing and analysis.

Achievement level	Descriptor
0	The student does not reach a standard described by any of the descriptors given below.
1–2	The student **organizes** and presents data using **simple numerical or diagrammatic forms** and draws an **obvious conclusion**.
3–4	The student organizes and **transforms** data into **numerical and diagrammatic forms** and presents it using **appropriate communication modes**. The student draws a **conclusion consistent with the data**.
5–6	The student organizes and transforms data into numerical and diagrammatic forms and presents it logically and clearly, using appropriate communication modes. The student **explains trends, patterns or relationships** in the data, comments on the reliability of the data, draws **a clear conclusion** based on the correct interpretation of the data, and explains it using **scientific reasoning**.

Criterion F: attitudes in science

Maximum 6

This criterion refers to encouraging students' attitudes of safety, respect and collaboration. Students are expected to:

- carry out scientific investigations using materials and techniques skillfully and safely and showing respect for the living and non-living environment
- work effectively as a member of a team, collaborating, acknowledging and respecting the views of others as well as ensuring a safe working environment.

Evidence of performance of this criterion should be collected from the observation of students when working in science, individually and in groups. This criterion should be internally assessed but it is not externally moderated.

Achievement level	Descriptor
0	The student does not reach a standard described by any of the descriptors given below.
1–2	The student requires **guidance** and **supervision** when using laboratory equipment. The student can work safely and cooperate with others but may **need reminders**.
3–4	The student uses most equipment competently but might require occasional guidance; on most occasions **pays attention to safety** and works responsibly with the living and non-living environment. The student **generally cooperates** well with other students.
5–6	The student **works largely independently**; uses equipment with precision and skill; **pays close attention to safety** and deals responsibly with the living and non-living environment. The student consistently **works effectively as part of a team**, collaborating with others and respecting their views.

Determining the final grade

This section explains the process by which a student's overall achievement level (in terms of the assessment criteria) is converted to a single grade.

1. Collecting the information

Teachers use assessment tasks to make judgments of their students' performance against the assessment criteria at intervals during the final year in the subject. Many of the assessment tasks will allow judgments of levels to be made with regard to more than one criterion. Some tasks (for example, extended research projects) will allow judgments to be made against all the criteria.

For the purposes of final assessment, teachers **must** ensure that, for each student, they make **several judgments against each criterion**. This can be achieved by using some kinds of assessment task more than once, or by incorporating other types of assessment activity. MYP sciences has **six** criteria and so **at least twelve** judgments (two per criterion) must be made for each student in the final year for the purposes of final assessment. However, as more complex tasks will normally assess several criteria, final assessment may rest on a limited number of tasks.

Important: if more than one teacher is involved in one subject for a single year group the school must ensure **internal standardization** is used to provide a common system for the application of the assessment criteria to each student. In joint assessment, internal standardization is best achieved by:

- the use of common assessment tasks
- shared marking between the teachers
- regular contact between the teachers.

In certain schools, students may be grouped according to ability within the same subject. In such cases, the teachers' final assessment of student performance across all groups must be based on a **consistent application of the assessment criteria to all students**. A different standard should not be applied to different groups.

2. Making a final judgment for each criterion

When the judgments on the various tasks have been made, teachers will be in a position to establish a final profile of achievement for each student by determining the **single most appropriate level for each criterion**. Where the original judgments for a criterion differ for specific assessment tasks, the teacher must decide which level best represents the student's final standard of achievement. (Note: teachers should not average the levels gained in year 5 for any given criterion, but make a professional judgment as to which level best corresponds to a student's general level of performance for each of the criteria towards the end of the programme.)

3. Determining the final criterion levels total

The final levels for each criterion must then be added together to give a **final criterion levels total** for sciences for each student. As students have the opportunity to gain a maximum level of six (6) for each criterion, the maximum final criterion levels total for sciences will be thirty-six (36). (This is the total that will be submitted to IBCA via IBIS.)

4. Determining the final grade for sciences

Grade boundaries must be applied to the criterion levels totals to decide the final grade for each student.

Please see the *MYP Coordinator's Handbook* for the table of grade boundaries for sciences.

All MYP subjects receive final grades in the range from 1 (lowest) to 7 (highest) on IBO documents. The general MYP grade descriptors describe the achievement required for the award of the subject grade. After using the conversion table to determine a student's final sciences grade, teachers should check the general grade descriptor table to ensure that the description equally reflects the student's achievement.

Important

Schools requiring **IBO-validated grades** are required to use **only** the MYP subject-specific criteria, level descriptors and grade boundaries as a basis for the final results that they submit to the IBO (both for moderation and as final assessment for certification).

Other schools (those not requiring IBO-validated grades) will use the criteria together with those they have developed independently, and report internally to students and parents. These schools may decide on their own grade boundaries, or use the boundaries published by the IBO.

Sciences: moderation

The following details apply **only** to schools that request **IBO-validated grades**.

Teachers should note that there are three distinct phases to the moderation process.

- Phase 1—submission of moderation samples
- Phase 2—submission of criterion levels totals
- Phase 3—award of MYP grades

Purpose of moderation

The external moderation procedure in all MYP subjects and the personal project exists to ensure that students from different schools and different countries receive comparable grades for comparable work, and that the same standards apply from year to year.

All MYP assessment is carried out by the students' own classroom teachers (or by the supervisors in the case of the personal project). The IBO moderation procedures ensure that the final judgments made by these teachers all conform to an agreed scale of measurement on common criteria.

To ensure this comparability and conformity, moderation samples submitted to IBCA **must** be assessed using the assessment criteria and achievement levels listed in this guide.

Phase 1: submission of moderation samples

Schools that request IBO-validated grades must submit a moderation sample to IBCA. Each moderation sample must include **eight folders of students' work** with each folder representing the work of a single student. In each folder teachers must include a completed coversheet *Form F3.1*. An additional folder containing descriptions of the assessment tasks and background information for each piece of student work must be supplied.

Prescribed minimum

To meet the required number of judgments (two) against each criterion, the following pieces of work **must** be submitted in each folder.

- A **scientific investigation** designed independently by the student, including a hypothesis, suitable method for the collection of data, analysis of the data, and evaluation of the method and results.
- An end-of-unit or end-of-term **test** that requires the application of scientific knowledge and understanding to solve problems in familiar and unfamiliar situations. It should include evidence of evaluation of scientific information.
- A **piece of writing** by the student, dealing with the application of science in society and its interaction with social, economic, political, environmental, cultural or ethical factors. It should be approximately 700–1,200 words in length (or 1,000–1,500 characters for those written in Chinese). Students will be expected to acknowledge the sources of information and document these appropriately.

The same tasks for all students in the sample should be included wherever possible. Tasks should be submitted in English, French, Spanish or Chinese.

Additional student work

Each folder may only contain additional pieces of student work (including assessment tasks and background information) if these are necessary to meet the required number of judgments (two) against each criterion.

Important notes

- In the moderation sample, teachers' assessments of students' work must be based entirely on the criteria published in this guide.
- Each of the criteria A–F must have two judgments made against it for the purposes of moderation, even criterion F, which is not externally moderated.
- Teachers should ensure that the correct number of judgments is recorded for each criterion on the coversheet *Form F3.1*. The reverse of the coversheet *Form F3.1* may contain information on extenuating circumstances for individual students if it is not already contained in the background information.
- Tasks for final assessment and moderation must be devised to give students the opportunity to reach the highest bands of each criterion.
- Descriptions of the assessment tasks and background information should be compiled into a ninth folder. This information does not need to be added into each of the eight student folders.
- Background information should document details that may be useful to the moderators, such as time allocation for an assessment task, degree of teacher support, conditions under which the task was completed.
- In the background information, evidence illustrating the teacher's application of the assessment criteria should also be documented, such as markschemes (with a copy of the relevant worksheet, test paper, etc), comments on student work, and descriptions of the ways the assessment tasks were presented to the students.
- Background information in sciences should also indicate which concepts and skills were the specific focuses of the assessment tasks.

- Student work submitted should reflect the types of assessment tasks used by the teacher for final assessment; ideally there should be a range of assessment tasks.
- Where possible, original student work should be submitted rather than photocopies.
- Although group work is encouraged in practice, it is preferable that group work is not submitted for moderation purposes. It is sometimes difficult for moderators to ascertain a student's actual contribution to a piece of work that was undertaken in a group situation.
- Teachers may have devised tasks to focus on only one or two of the criteria, and therefore do not make two judgments against each criterion with the three prescribed minimum tasks. In this case it is acceptable to enclose additional tasks in the sample until each criterion has been assessed twice. If a criterion has been assessed more than twice in the sample, the extra assessment(s) will not be moderated.
- The scientific investigation should be designed and carried out independently by the student. Recipe-type experiments where students simply follow a procedure are not suitable tasks to assess criterion D.
- The test submitted must include questions that require well-developed answers showing analysis and evaluation of the scientific information presented. Students should be given the opportunity to evaluate scientific information using scientifically supported arguments in order to reach the highest bands of the criteria.
- Anything in the moderation sample that differs from the stated requirements should be explained in the background information.

> The submission date for moderation samples is likely to come well before the end of a school's academic year. Schools must continue to make further assessments of students' work after moderation samples have been submitted.

The *MYP Coordinator's Handbook* provides the coversheet *Form F3.1* and further guidance on submitting moderation samples in each subject. The sciences teacher support material provides an example of key components of a moderation sample.

Phase 2: submission of criterion levels totals

Phase 1 of the moderation process takes place before the end of most schools' academic year. After submitting moderation samples teachers should continue to assess students' work until **final assessment**.

After final assessment, teachers should use the procedure described in "Determining the final grade" to arrive at a **criterion levels total** for each student registered for certification.

The MYP coordinator will then enter each registered student's criterion levels total on **IBIS**, and submit this to IBCA.

Phase 3: award of MYP grades

Following moderation in each subject, IBCA may, where appropriate, apply a moderation factor to the criterion levels totals submitted by a school. Final grades will then be determined by applying grade boundaries to these moderated totals.

Schools will receive notification of the final grades for their students and IBCA will also provide a general and a school-specific moderation report for each subject in which students were registered.

The *MYP Coordinator's Handbook* provides further guidelines on submitting criterion levels totals in each subject.

Sciences: monitoring of assessment

The following applies to schools **not** requesting IBO-validated grades.

Definition

Monitoring of assessment is a service available to authorized MYP schools whereby schools can send samples of assessed student work to IBCA to receive feedback from an experienced MYP assessor in the form of a report. This service is subject to a fee.

Monitoring of assessment is aimed at providing support and guidance in the implementation and development of the programme with regard to internal assessment procedures and practices. To achieve this it calls on the expertise of trained assessors. Monitoring of assessment has been developed to help schools apply MYP assessment principles to their own local circumstances, without requiring them to follow every detail of the IBO system of grading.

Monitoring of assessment is not linked to validation of students' grades, and therefore differs from the process of external moderation. Monitoring of assessment is currently limited to assessment conducted in the final two years of the programme.

Details on registering for monitoring of assessment are available in the *MYP Coordinator's Handbook*. Examples of a completed *Form F4.2* and a completed *Form F4.4* are available in the sciences teacher support material.

Purpose

There are three reasons why schools might send in a monitoring of assessment sample:

1. as a requirement for the school's programme evaluation visit
2. as a pre-check before sending in samples for moderation
3. to receive guidance on a particular subject.

Programme evaluation visit

If a school is due to receive its programme evaluation visit and has not registered students for moderation, it is a requirement that the school sends in a sample of work from each subject group and the personal project before the visit (usually spread over the two years before the due date of the visit). The regional office will provide the school with information and timelines for this requirement. Following the evaluation visit, a school may be required to send in further samples in some subjects as part of the recommended action in the evaluation report.

Moderation pre-check

If a school plans to register students for moderation in the future, the school can use the monitoring of assessment service to receive feedback on its assessment in some or all subjects and/or the personal project before sending in samples for moderation.

> Schools planning to submit samples for moderation in the future are strongly encouraged to use monitoring of assessment the previous year. This will allow the school to put in place any adjustments recommended by the assessors, therefore allowing the school to submit appropriate samples when actual moderation takes place.

Guidance on a particular subject

This would not be linked with the school's programme evaluation or plans for moderation. A school may simply require advice on the assessment of a particular subject.

Nature of schools' samples

Please note that the samples sent for monitoring of assessment are not returned to the school.

The content of the samples will vary depending on the reasons why the school is sending the sample for monitoring of assessment. Therefore, this section is split into three:

1. samples that are being submitted for the purposes of the evaluation visit
2. samples that are being submitted prior to moderation
3. samples that are being submitted for general advice/guidance.

Samples for the evaluation visit

The sample for each subject **must** include the components listed below.

1. An outline of the subject coursework for the year, including background information on the organization of the course (time allocation, possible integration with other subjects, involvement in multidisciplinary projects).
2. Assessed student work addressing the subject's assessment criteria and objectives. Teachers must:
    - choose different kinds of assessment tasks that reflect clearly the application of the criteria; teachers are advised to use the minimum requirements for a moderation sample for guidance as those give an even spread over the criteria (see "Sciences: moderation")
    - favour more-complex tasks reflecting several criteria; it is better to include a limited number of more-complex tasks than a series of very limited assignments or tests
    - favour tasks reflecting the areas of interaction
    - include work from four students for each task; the same students do not have to be used for each task.

For each task included in the sample, teachers must submit the following documents:

- instructions, worksheets and any guidance notes given to the students
- a blank copy of the task/test and the teacher's corrected version
- information on the application of criteria to each piece of work
- descriptions of any individual criteria and amended descriptors of achievement levels used in the summative assessment of students in that year. This should take the form of an assessment scheme showing the relative importance of the MYP criteria in the assessment of students.

Each task must be accompanied by the coversheet *Form F4.4*.

Important note

Schools submitting samples as part of their evaluation visit are expected to use the MYP assessment criteria to assess students' progress against the MYP objectives. However, **schools can adapt/amend the level descriptors of the published assessment criteria**.For example, schools must still use "Criterion A: one world", to assess the relevant objectives as published in this guide, but they can amend the levels and the level descriptors of this criterion if they wish. These amendments must be appropriate and in the spirit of MYP criterion-referenced assessment. If the assessor feels the amendments are not appropriate, for example they may not assess some of the objectives, then this will be mentioned in the report. The schools are not required to use the IBO's 1–7 grading system.

Samples prior to moderation

The samples should follow the requirements for a moderation sample (but should include work from **four** students rather than eight) and should include the components listed below.

The samples should comprise folders of work from four students (two around the average level of ability within the school, one comparatively good student, one comparatively weak student).

Each folder of sciences work must:

- represent the work of only one student
- contain work that has been assessed against each criterion
- contain at least the minimum tasks specified (see "Sciences: moderation")
- represent overall two identified judgments against each criterion
- include the same tasks as other students represented in the sample wherever possible
- be submitted in English, French, Spanish or Chinese.

Other documents that are essential for the assessment of student performance are:

- worksheets or instructions/guidance notes given to students
- a blank copy of tasks/tests/examination papers used and the teacher's corrected versions
- a description of the conditions under which the work was completed (in class, at home, length of preparation prior to task, time allowed to complete task, etc)
- all relevant markschemes.

The work of each student must be in a separate folder and include a completed coversheet *Form F4.2*. This will facilitate treatment by assessors in conditions matching those of a true moderation sample where feedback on the criterion levels awarded is essential.

Samples for general advice/guidance

The content of the samples sent for general advice/guidance is at the discretion of the school. Schools may wish to send in a complete sample, similar to that for the evaluation visit or prior to moderation. Alternatively, schools may wish to send in a single task for feedback, and this is also acceptable.

Schools must understand that the reports received will vary in length and detail depending on the nature of the sample sent.

Samples sent for general advice/guidance may or may not be accompanied by coversheets depending on the nature of the sample. If coversheets are to be used, then those designed for the evaluation visit are likely to be the most appropriate.

Choice of tasks for monitoring of assessment

For evaluation visit/general advice

The tasks listed in “Sciences: moderation” are suggestions and therefore do not need to be followed strictly. However, these groups of tasks are designed to give an even spread over the sciences assessment criteria (A–F) and so should be carefully considered.

Prior to moderation

If the school is requesting monitoring of assessment in preparation for future moderation, the tasks in the following list **must** be included in the sample. These are the required minimum tasks listed in the section “Sciences: moderation”.

- A **scientific investigation** designed independently by the student, including a hypothesis, suitable method for the collection of data, analysis of the data, and evaluation of the method and results.
- An end-of-unit or end-of-term **test** that requires the application of scientific knowledge and understanding to solve problems in familiar and unfamiliar situations. It should include evidence of evaluation of scientific information.
- A **piece of writing** by the student, dealing with the application of science in society and its interaction with social, economic, political, environmental, cultural or ethical factors. It should be approximately 700–1,200 words in length (or 1,000–1,500 characters for those written in Chinese). Students will be expected to acknowledge the sources of information and document these appropriately.

General grade descriptors

The generic grade descriptors that illustrate the MYP 1–7 scale are stated below. They should be considered as broad descriptions: simpler, more-generalized statements about the skills and knowledge mastered by the student. They are not specific to any particular subject-group assessment criteria.

The assessment philosophy established for the MYP requires a criterion-referenced approach rather than one that is norm-referenced. Therefore, the inclusion of normative type statements such as “above average” has been avoided. The approach relies on teachers’ professional expertise in making qualitative judgments similar to those that they make every day in the classroom.

IBCA uses these descriptors to determine grade boundaries for subject groups and the personal project.

Grade	Descriptors
Grade 1	**Minimal** achievement in terms of the objectives.
Grade 2	**Very limited** achievement against all the objectives. The student has difficulty in understanding the required knowledge and skills, and is **unable** to apply them fully in normal situations, **even with support**.
Grade 3	**Limited** achievement against most of the objectives, or clear difficulties in some areas. The student demonstrates a **limited understanding** of the required knowledge and skills and is **only able to apply** them fully in normal situations **with support**.
Grade 4	**A good general understanding** of the required knowledge and skills, and the ability to apply them effectively in **normal** situations. There is **occasional** evidence of the skills of analysis, synthesis and evaluation.
Grade 5	**A consistent and thorough understanding** of the required knowledge and skills, and the ability to apply them in a variety of situations. The student **generally** shows evidence of analysis, synthesis and evaluation where appropriate and **occasionally** demonstrates originality and insight.
Grade 6	A consistent and thorough understanding of the required knowledge and skills, and the ability to apply them in a **wide variety** of situations.There is **consistent** evidence of analysis, synthesis and evaluation where appropriate. The student **generally** demonstrates originality and insight.
Grade 7	A consistent and thorough understanding of the required knowledge and skills, and the ability to apply them **almost faultlessly** in a wide variety of situations. There is consistent evidence of analysis, synthesis and evaluation where appropriate. The student **consistently** demonstrates originality and insight and **always** produces **work of high quality**.

Frequently asked questions

General

Can a school offer an integrated sciences course in the MYP?

Yes. MYP sciences provides a curriculum framework with aims and objectives to be met by the end of the programme. The nature of this framework allows schools to design and structure their sciences course to best suit their local needs and preferences.

Depending upon local requirements, schools can opt to structure and teach MYP sciences as an integrated course, as discrete disciplines or as a combination of both throughout the duration of the programme. However, it is important to remember that the courses should be structured to ensure that students are given the opportunity to meet all the science objectives by the end of the programme. (For more information please refer to the section “Requirements” in this guide.)

Does the MYP allow for non-traditional science courses such as environmental sciences, sports sciences, health sciences?

The MYP allows for flexibility and creativity in the design of academic courses. A school can opt to offer a non-traditional science course as long as this course is structured in a way that allows students to meet the aims and objectives of MYP sciences. The choice of the course will reflect specific local needs and preferences. For example, a school may decide to offer environmental sciences to provide a foundation for further studies in environment.

Why do I need to integrate the areas of interaction into my units of work?

The areas of interaction form the core of the MYP. By making sure a unit of work is developed through one or more areas, teachers are giving that unit of work the opportunity to be integrated with other subject groups in the MYP. Integration of subject groups through the areas of interaction allows students to make their own connections in knowledge, concepts and skills and hence the opportunity for enhanced cognitive development. This integration also supports the MYP fundamental concept of holistic learning.

How do I integrate the areas of interaction into my units of work?

Rather than “integrate the areas of interaction into units of work”, it is preferable to think of using the areas of interaction as “lenses” and “looking at the unit through the lenses of the areas of interaction”. By having one or more areas as a starting point it is easier to bring focus to the unit. For example, students could study energy conservation through the area of environment, or the development of cellular theory through the area of *homo faber*, looking at the historical context and technological advancements that led to the development of the cellular theory as known today.

Do I need to stick to the contents of the framework for sciences to structure the sciences course in my school?

No. The purpose of the framework is to provide guidance for teachers to structure the sciences course and develop the context for teaching and learning sciences. The domains of the framework list concepts, skills, processes and attitudes that must be developed in order to meet the final aims and objectives of the sciences course. However, the content areas listed in the framework are neither mandatory nor exhaustive but present a starting point for teachers to structure their sciences course. It is advisable that teachers design and structure their sciences course bearing in mind their local requirements, demands and preferences, and that they include relevant historical and contemporary contexts that engage students while contributing to their achievement of the final aims and objectives of MYP sciences.

How can I detect plagiarism? How can I avoid it in the first place?

If you suspect that work has been plagiarized, one way to check is to conduct an Internet search. Using a major search engine, type in a selection of the work in inverted commas (one sentence should be sufficient). If the work has been taken directly from a web site it will be detected. Your school may also subscribe to a plagiarism detection site. Plagiarism from other sources can be more difficult to detect, depending on how familiar the teacher is with all the resources available to the students.

The best solution is to avoid setting tasks that are easy to complete through plagiarism, or other forms of academic dishonesty. For example, if a task requires students to discuss the safety of mobile phones, it is important that students are challenged to differentiate between scientific evidence and interpretation of the information. Tasks should also be challenging, but not so difficult that students are tempted to use dishonest means to complete them, and support should be available when students require it.

Does the IBO recommend any particular style of referencing/quoting/footnoting?

There is no set style for referencing in the MYP. Schools need to decide on one or more recognized styles of referencing that suits the needs of the students and the school. For more information on some appropriate styles, please see the sciences teacher support material.

Can we use teaching resources if we do not have a clear idea of where the resources came from?

Teachers need to adhere to the guidelines of academic honesty as much as the students. Therefore teachers need to make every effort to reference and acknowledge the work of others that they use in the classroom.

Assessment

I want to assess my students in a wide variety of ways without being restricted to the choice of a piece of writing, an end-of-unit test, and a scientific investigation. Can I assess in other ways as well?

Yes. The piece of writing, end-of-unit test and scientific investigation are the required minimum tasks for moderation/monitoring of assessment, and are only a snapshot of what is assessed in schools. Student abilities should be assessed through a wide range of assessment activities such as oral discussions, multimedia presentations, mind maps, fieldwork, experimental reports and formulating scientifically supported arguments.

My students cannot achieve the objectives in years 1–4. It's hard to assess years 1–4 against the criteria. What can I do?

The science objectives are designed in such a way that students should be able to achieve them by the end of five years of study in the MYP. It is not expected that students in the earlier years of the programme will be able to achieve them, but it is expected that they will be working towards achieving them.

For years 1–4 of the programme, teachers are welcome to modify the assessment criteria to better suit the needs of their students. Teachers may modify the descriptors (to lower the expectations, make them task specific, or both), or adjust the number of bands to give more or less weight to a certain criterion.

My students have difficulty understanding the descriptors. What can I do?

As mentioned in the previous answer, teachers may modify the assessment criteria descriptors—in this case, it is quite acceptable to simplify the language so that students can understand it.

Can I modify the criteria in year 5 to be task specific?

Yes. Modifying the criteria in any year level is of great help to the students in defining what is expected of them in given tasks. However, when assessing tasks to determine final grades, and tasks that are to be sent for moderation, teachers should always assess year 5 students against the assessment criteria as published.

Can I adapt the assessment criteria for my students who are accessing the curriculum in their second language?

The assessment criteria may be adapted in years 1–4 either in terms of difficulty, language, or both. In the final year of the MYP, students need to be assessed against the criteria as published, though students may have a personal copy of the criteria written in more accessible language. The MYP document, *Second-language Acquisition and Mother-tongue Development: a guide for schools*, gives further information on how schools can provide programmes to ensure second-language students have the opportunity to achieve all objectives at the highest levels in all subjects.

Can I adapt the assessment criteria for my students who are designated as having special educational needs?

The assessment criteria may be adapted in years 1–4 either in terms of requirements, difficulty, language, or a combination of the three, according to the need of the student. In the final year of the MYP, students need to be assessed against the criteria as published. If a diagnosed special need makes assessment of some science objectives impossible, the MYP coordinator should follow the guidelines in the "Special Cases" section of the *MYP Coordinator's Handbook* so that the student is not disadvantaged when registering and submitting the levels/grade for certification.

What is the connection between the criterion levels and the final grade?

A criterion level only gives a partial assessment of MYP sciences. For example, a level for criterion C shows the student's achievement in "knowledge and understanding of science" in a specific situation or when solving a specific problem. More than one assessment task will be needed to make a final judgment of the student's final achievement for a particular criterion. Teachers will use their professional judgment to establish the final profile of achievement for each student in each criterion.

To work out a student's final grade, a teacher must have taken into account levels from all of the criteria, giving a balanced final result. In summary, the final grade is an overall view of the student's achievement in the subject; the criterion levels show student achievement in components of the subject.

Moderation

What is “background information”? What should I include?

Background information is the information provided in a moderation or monitoring of assessment sample that tells the moderator or assessor details of the tasks, what the expectations were, and under what conditions the tasks were completed. Examples of background information include worksheets, instructions or notes given to students, information on time allocation/length of preparation, degree of teacher or peer support allowed, blank copies of tasks/tests/examination papers used and the teacher’s corrected versions, relevant markschemes, and comments on student work. In sciences, it is important that background information indicates the degree of assistance the students received for their scientific investigation and, in the case of the test, teachers should indicate which problems or questions are unfamiliar to the students.

If the sample differs from the stated requirements in any way, this should also be explained in the background information.

In my school we teach biology, chemistry and physics. Can we send a combined sample including student work in biology, chemistry and physics for moderation?

No. In order to moderate the internal assessment of a school the moderation team needs to see what is effectively happening in the school. Therefore the moderation sample should provide evidence of how the subject is taught and assessed in the school. In other words if sciences is taught as discrete subjects then the moderation should apply to single subjects. Conversely if the subject is taught in an integrated way it is appropriate to submit a sample that shows how the school has managed to integrate and has applied the concept and skills to an integrated course.

The *MYP Coordinator’s Handbook* says: “...note that schools that 'teach' integrated subjects within a subject group have the option of registering students and submitting samples for moderation in the subject group rather than discrete disciplines”. The option is for those schools with integrated subject courses already in place. If the school teaches discrete sciences disciplines (biology, physics and chemistry as discrete courses) it is appropriate to moderate the internal assessment of the discrete courses and register students accordingly.

For moderation in sciences, could a school opt to register students for another non-traditional subject such as environmental systems or nutrition? Can they be moderated in this?

If a school is interested in implementing a non-traditional science course, it is necessary that they contact IBCA and seek advice on whether the course can meet the aims and objectives of the sciences course. Further discussion may then take place regarding moderation.

I can never find students who are, for example, “average” in all tasks. What do I do for moderation?

The aim of moderation is to check that teachers are setting appropriate tasks, and that they are marking the work appropriately, that is, that average work is awarded an average level and good work is awarded a good level.

Often, students do not fit into one “category”, so when submitting samples, teachers will need to tick the “comparatively good”, “average” or “comparatively weak” boxes using the principle of best fit. For example, a student with two excellent pieces of work and one average piece of work may be designated “comparatively good”; a student with one excellent, one average and one poor piece of work may be designated “average”. The important thing is to ensure there is a range of abilities displayed so that the moderator can check that good work is awarded a good level, poor work is awarded a low level, etc.

It is hard to get samples of good year-5-level work when I have to send moderation samples so early in the school year. Are students penalized by this?

No. The moderation process checks that teachers are assigning appropriate levels to student work. Moderators take into account that most of the work sent is from the first half of the final year of the MYP.

Could we present an assessment plan early in the course for feedback rather than find out during moderation that something is not appropriate?

Yes. Schools that wish to have feedback on their courses or assessment procedures as a check before submitting for moderation are welcome to apply for monitoring of assessment. Monitoring of assessment reports will give schools this type of feedback; any changes in grades as a result are for feedback purposes only and do not affect the final grades of the students. (Fees for monitoring of assessment are listed in the *MYP Coordinator's Handbook*.)

Can we use the test students take at the end of the term/semester as one of the tasks to be assessed using criterion C?

The task you choose should provide students with the opportunities to show knowledge and understanding of scientific ideas by applying these to solve problems in familiar and unfamiliar situations. However, in order to allow students to reach the maximum level descriptor the task must include questions that challenge students to analyse and evaluate scientific information by making scientifically supported arguments.

Misconceptions of scientific concepts can be used to derive arguments, as well as observations of scientific investigations and theories. Students could be asked to analyse scientific information from various sources such as newspaper articles, TV interviews, and the Internet, and construct scientifically supported arguments to assess the credibility of information presented to them.

Objective A, "One world", expects students to "discuss how science and technology are interdependent and assist each other in the development of knowledge and technological applications". What does technology mean in this context?

In this context technology is used in its broadest sense of the discipline and its applications. Students are expected to identify the relationship between science and technology, identifying evidence of scientific application in technological developments. These developments may be in past and current examples of everyday life where science feeds the technological advances and these promote further scientific inquiries. For example, advances in DNA recombinant technologies and cloning; electromagnetic radiation; and the development of mobile phones.

What is the role of communication in science?

Communication is one of the fundamental concepts of the programme. Learning science relies on understanding and using the language of science. The language of science involves more than learning technical scientific vocabulary. Students should demonstrate understanding when using scientific words. They should be able to use the appropriate scientific vocabulary and language when communicating scientific ideas in both oral and written communication.

The way science is communicated involves using a range of communication modes (oral and written, visual, graphical and symbolic) that are specific to science, as well as precise communication genres such as laboratory reports, explanations, argumentative essays, oral expositions to present arguments to mention some.

What is the difference between moderation and monitoring of assessment?

Similarities
Both monitoring of assessment and moderation: • use the services of trained moderators and MYP subject specialists selected by the IBO • are offered only in the four service languages of the MYP—English, French, Spanish, Chinese • are conducted on a per-subject basis • consider samples of student work representing achievement in the MYP subjects and personal project • are based on the application of MYP objectives and assessment criteria • involve the mailing to IBCA of sets of selected student work assessed according to the MYP assessment criteria • involve IBCA sending a report to the school providing constructive feedback to teachers.

Differences	
Monitoring of assessment:	**Moderation:**
• aims to provide advice and guidance regarding general assessment principles within a subject	• is linked to validation of schools' results in a specific subject
• is **optional** for all authorized MYP schools, but is **required** as part of the programme evaluation process for schools that do not submit to moderation	• is **required** only for schools requesting IBO-validated results
• requires the school to pay a fixed fee per subject	• requires the school to pay variable fees depending on the number of registered students
• leads to the production by the IBO of a school-specific report providing feedback and guidance on assessment within the subject(s)	• leads to the production of MYP documentation (records of achievement and certificates) as well as a report providing feedback and guidance
• is based on samples of student work completed in the final two years of the MYP	• is based on samples of work representing final achievement in the subject

Differences	
• involves no change to the school's grades	• may lead to changes to the school's final grades on MYP records of achievement
• takes place at any time between September and March, with two months' advance notice	• takes place according to a fixed schedule (see "Assessment" section of the *MYP Coordinator's Handbook*)
• may involve school-specific descriptors of achievement levels within the MYP criteria for the subject.	• considers only the application of IBO descriptors of achievement levels, as stated in the subject's assessment details.

Does my school need to undergo moderation and/or monitoring of assessment for programme evaluation?

Yes, moderation **or** monitoring of assessment is compulsory for programme evaluation.

Schools that have not requested IBO-validated grades for their students in the final year of the programme are required to apply for monitoring of assessment in at least one subject per subject group and the personal project within two years, and at least three months prior to the evaluation visit. Alternatively, these schools could also apply for moderation.

Schools that are being evaluated and wish to have IBO-validated grades for their students in the final year of the programme must apply for moderation in all subject groups and the personal project.

What can I do if my questions are not answered here?

Your MYP coordinator may be able to answer your questions. If not, posting a message on the online curriculum centre can often prompt answers from other teachers in the MYP world. Alternatively, your coordinator may pass your query on to be answered by your regional office or IBCA.

Glossary of MYP and sciences terms

achievement level	The level given when student work reflects the corresponding descriptor. Achievement levels are shown in the left-hand column of the assessment criteria.
aims	Aims state, in a general way, what the teacher may expect to teach or do, what the student may expect to experience or learn and how the student may be changed by the learning experience.
analyse	To identify parts and relationships, and interpret information to reach a conclusion.
approaches to learning (ATL)	One of the areas of interaction; it is concerned with the development of thinking skills, strategies and attitudes and the ability to reflect on one's own learning.
area leaders	Schools may designate leaders for each of the areas of interaction; they are entrusted with liaison between the teachers involved, parents, students and, if necessary, the community.
areas of interaction	The five central elements of the MYP, embedded within and across the subject groups of the programme. They are: • approaches to learning (ATL) • community and service • *homo faber* • environment • health and social education.
assessment criteria	Criteria against which a student's performance is measured as evidenced by work produced. Subject guides provide assessment criteria to be used for final assessment for each subject group, and for the personal project.
assessment grid (rubric)	A matrix used to assess a student's performance according to specific criteria. Rubrics consist of a fixed number of levels and specific descriptors of performance for each level.
assessment task	A teacher-designed assignment used to measure student success with meeting objectives. The task will generate work that can be assessed using previously agreed assessment criteria.
communication format	Possible formats to communicate ideas and scientific investigations: eg laboratory reports, experimental accounts, explanations, essays, expositions, audio-visual presentations, oral discussions.
communication mode	Oral, written, visual representation (graphs, tables, charts) and use of information and communication technologies in sciences.
community and service	One of the areas of interaction; it is concerned with developing community awareness and a sense of responsibility through service activities.

criterion levels total	The sum of the levels awarded in each criterion for final assessment in each MYP subject. The levels total is then converted to a grade from 1–7 by applying the grade boundaries.
criterion-referenced assessment	An assessment process based on awarding grades against previously agreed criteria. MYP assessment is criterion referenced.
data	Measurements of a parameter that can be quantitative such as volume, temperature, PH, or qualitative such as colour, shape, texture.
dependent variable	The variable in which values are measured in an experiment.
describe	To give a detailed account.
descriptors	These describe the achievement levels that are assessed within each criterion.
discuss	To give an account including, where possible, a range of arguments for and against, the relative importance of various factors and comparisons of alternative hypotheses.
document	To “document” work is to fully credit all sources of information used through referencing and the bibliography according to one recognized academic convention.
environment	One of the areas of interaction; it is concerned with the interdependence of human beings and their environments, and with sustainable development.
ethics	The process of rational inquiry to decide on issues as right (good) or wrong (bad) as applied to people and their actions.
evaluate	To assess the implications and limitations; make judgments about the value of ideas, works, solutions or methods in relation to selected criteria.
explain	To give a clear account including causes and reasons or mechanisms.
external moderation	See **moderation**.
fair test	An experiment where only the independent variable is manipulated and is allowed to affect the dependent variable. All the other variables that can affect the experiment are controlled.
final assessment	The summative assessment of student work at the end of the final year of the MYP.
formative assessment	Ongoing assessment aimed at providing information to guide teaching and improve student performance.
fundamental concepts	The basic educational principles of the MYP. They include holistic learning, intercultural awareness and communication.
grade boundaries	The lowest and highest criterion levels totals corresponding to a particular grade in final assessment. These are determined for each subject group and published in the *MYP Coordinator’s Handbook*.
grades	This refers to the number reached by converting the criterion levels total using the grade boundaries table, and can only be arrived at when all subject-specific criteria have been used for assessment. Final grades for student work in the MYP range

	from 1 (lowest) to 7 (highest). Schools may also use this scale for assessment other than final assessment.
health and social education	One of the areas of interaction; it is concerned with mental and physical health, and the interactions between the student and community.
holistic learning	One of the fundamental concepts of the MYP; it stresses the interrelatedness of various disciplines and issues.
homo faber	One of the areas of interaction; it is concerned with the evolution, processes and products of human creativity, and their impact on society and on the mind.
hypothesis	A tentative explanation for an observation or phenomenon that requires experimental confirmation. It can take the form of a question, explanation or prediction of a possible cause and effect relationship, and uses scientific reasoning.
IBCA	International Baccalaureate Curriculum and Assessment Centre.
IBIS (formerly IBNET)	A service that allows MYP coordinators to complete administrative procedures and obtain news and information from the IBO via a password-protected web server.
ideas (scientific ideas)	Facts, definitions, laws, processes, theories, models and concepts.
independent variable	The variable that is selected and manipulated by the investigator in the experiment.
integrated subjects	School-specific subjects that integrate elements of several disciplines within or across MYP subject groups.
internal assessment	The assessment of a student’s work that is carried out by the student’s teacher.
internal standardization	The process by which teachers of one subject or subject group in a school ensure a common understanding and application of criteria and descriptors.
investigation	Complex problem-solving activities that attempt to determine the relationship between variables or between data. Investigations take different forms such as laboratory-based experiments, data analysis and field studies.
issue of results	The issue of MYP records of achievement and certificates by the IBO, following the moderation of the schools’ internal assessment. The documents are sent directly to schools following their submission of internal assessment results (this applies only to schools that request IBO-validated grades).
judgment	The consideration of a student’s work against an individual assessment criterion.
metacognition	Refers to the awareness of and reflection upon one’s thinking and learning.
Middle Years Programme (MYP)	The IBO’s programme designed for students between the ages of 11 and 16 years. It is organized according to the fundamental concepts of holistic learning, intercultural awareness and communication.
moderation	The procedure by which sample assessed work from teachers is reviewed and adjusted externally to ensure assessment has been carried out according to MYP criteria and standards (this applies only to schools that request IBO-validated grades).

moderation factor	A moderation factor is applied to the internal assessment results sent in by the school, where samples of students' work submitted by the school show that the standards applied by the teachers vary significantly from MYP standards.
moderation registration	All schools requesting IBO-validated final grades for their students are required to register subjects for moderation using the IBIS online moderation registration form.
monitoring of assessment	A service that provides support and guidance to MYP schools with regard to internal assessment procedures. It is offered to all schools, and required as part of the programme evaluation procedure for schools not submitting to moderation.
MYP certificate	The official IBO document stating that the student has fulfilled a number of requirements, as stated in the *MYP Coordinator's Handbook*.
MYP coordinator	The pedagogical leader of the MYP in the school who oversees the effective development of the programme. The MYP coordinator ensures effective communication about the programme within the school, and between the school and the IBO.
norm-referenced assessment	Norm-referenced assessment distributes students' scores above and below a pre-set pass or fail line, and students are measured against each other. MYP assessment is not norm-referenced.
objective	One of a set of statements for a subject or the personal project, describing the skills, knowledge and understanding that will be assessed in the course/project. The assessment criteria correspond to the objectives.
online curriculum centre (OCC)	A web-based service to schools that aims to support the Primary Years Programme, Middle Years Programme and Diploma Programme. Teachers can take part in online discussions, access selected IBO publications, exchange ideas and resources, read news and information from the IBO, and participate in special events.
peer-conferencing	Student discussions with fellow students to gain insight into the task, topic, concepts and skills at hand, and to provide feedback and suggestions on draft work.
personal project	The manifestation of a student's experience of the areas of interaction. It is completed during the last year of the MYP.
personal project supervisor	The member of staff within a school who is responsible for working directly with the student on the completion of the personal project.
portfolio of achievement	A folder provided by the IBO for each of a school's graduating students, whether or not they have registered for IBO-validated grades. The school and the student include IBO documents as well as school-produced records and statements in this portfolio.
programme evaluation	A mandatory process for all authorized MYP schools, whereby the IBO assists schools in their own self-evaluation procedures as well as ensuring the quality of programmes.
record of achievement	The official IBO document issued to all students registered for IBO-validated grades. It lists final grades in each subject and the personal project and, where relevant, the satisfactory completion of community and service.
reference	To acknowledge sources within text. This includes in-text documentation and footnoting. See also **document**.

reliability (of the method)	Refers to measurement of the data. This depends upon the selection of the measuring instrument, the precision and accuracy of the measurements, errors associated with the measurement, the size of the sample, the sampling techniques used, the number of readings.
rubric	See **assessment grid**.
sample schemes (units) of work	These samples, published in teacher support material, provide some suggested means of enabling students to achieve the prescribed objectives. Schools may use these examples or write their own schemes (units) of work.
samples of work	Samples of students' work are submitted by schools for moderation or monitoring of assessment, on the instructions of IBCA. They are then reviewed by IBO-appointed moderators/assessors.
science	An organized body of knowledge and a systematic process of inquiry that seeks to propose explanations for observations of natural phenomena through experimentation.
scientific investigation	Practical experiment or investigation planned and designed by the student. The student should formulate a hypothesis, identify and manipulate variables, and plan an appropriate scientific method to collect, analyse and evaluate data.
scientific language	Scientific terminology, vocabulary, symbolic language, units of measurement.
state	To give a specific name, value or other brief answer without explanation or calculation.
student registration	All schools requesting IBO-validated final grades are required to register each student with the IBO using the IBIS online student registration form.
subject group	The MYP curriculum model includes eight subject groups: language A, language B, humanities, sciences, mathematics, arts, physical education and technology.
subject group guide	A guide, published by the IBO for each of the subject groups, stating the mandated objectives and assessment details.
summative assessment	The culminating assessment for a unit, term or course of study, designed to provide information on the student's achievement level against specific objectives.
teacher-conferencing	Student discussions with the teacher to gain insight into the task, topic, concepts and skills at hand, and to provide feedback and suggestions on draft work.
teacher support material	Teacher support material published by the IBO includes examples of units of work, and assessed student work for the subject groups and the personal project. This material may appear as paper documents or online publications. It is intended to give practical help to aid understanding and implementation of the theory in the subject guides.
teaching hour	The length of teaching periods varies from school to school. For practical reasons, the IBO refers to one teaching hour as the equivalent of 60 minutes.
unfamiliar situation	Refers to a problem or situation where the context or application is modified to be considered unfamiliar to the student.
unit of work	A series of lessons, often linked by a topic or theme, designed to enable students to achieve some of the objectives of MYP sciences. Examples of units of work are contained in the sciences teacher support material.

validity (of the method)	Refers to the success of the method at measuring what the investigator wishes to measure. This includes factors such as the choice of the measuring instrument and whether this measures what it is supposed to measure, the conditions of the experiment, and variable manipulation (fair testing).
weighting	A measure of the relative importance of each assessment criterion.

