PHYSICS **COURSE DESCRIPTION**

WHAT IS PHYSICS?

It is not only the ***science about the laws of nature***; it is nowadays equivalent of what used to be called ***natural philosophy***, from which most of our modern sciences arose.

WHAT IS THE COURSE ABOUT?

We observe ***physical quantities*** by putting ***physical bodies*** in space and time and let them ***influence*** each other: ***motion, energy, work and power*** are the result. These topics are covered in the first part of the course – together with the basic knowledge students develop important skills which allow them to become active learners and inquierers. Through the second part of the course we leave the solid bodies to investigate ***fluids***: the behaviour of ***liquids*** and ***gases***, which we connect to ***heat*** effects to obtain and discuss a heat engine. Studying ***waves*** we open the door between physics and philosophy.
The topics are carefully chosen to cover different physical concepts and develop different skills, enough for possible further studies, but without overload. This year the energy topic is continued in MYP5.
Special topics are offered according to the time and interest.

The school offers three lessons on physics per week.

The teacher offers after school consultations for specific help for students who were absent for some time, have never studied physics before, want to discuss something to understand it better, want to participate to national competitions, want to check their own ideas experimentally or any other purposes.

TOPICS FOR MYP4:

THE SCIENCE OF PHYSICS
How are scientists able to understand the work of others and why should they?
- performing and analysing measurements using mathematical statistics
- concept of significant digits and appropriate measuring units
- scientific community – appropriate communication

special: CERN - community

FORCES
What makes the world go around?
- concept of force
- elementary forces vs. elementary particles
- other examples of forces (weight, friction, elastic force...), adding forces and resolving in components for specific perposes

special: black holes

MOTION
Is it possible to predict future?
- speed, velocity and acceleration
- motion graphs and equations of motion
- Newton's laws
- 2D, 3D and 4D motion ("time machine")

special: motion in time

ENERGY, WORK AND POWER
How does the world get its energy?
-concept of energy, work and power
-energy in different systems
-efficiency
-conservation laws

special: dark energy and antimatter

TOPICS FOR MYP5:

ENERGY, WORK AND POWER
How does the world get its energy?

-concept of energy, work and power
-energy in different systems
-efficiency
-conservation laws
special: dark energy and antimatter

PRESSURE
How are humans and their environments affected by change of pressure?

- pressure
- atmospheric, hydrostatic and hydraulic pressure
- buoyancy, floating and sinking
- simple hydrodynamics

special: creativity and estetics in science

HEAT AND THERMAL EFFECTS
How do heat engines work?

- internal energy, temperature and heat
- heat transfer
- the gas laws
- heat engine

special: temperature of absolute zero

WAVES
What are actually waves?

- origin and propagation of waves
- describing waves: wavelength and frequency
- reflection
- refraction
- interference
- waves around us
- particles or waves?

special: quantum mechanics

ELECTRICITY AND ELECTROMAGNETISM
Development of a theory – short optional topic at the end of the course

- show led by experiments

special: positive and negative, left and right

ASSESSMENT IN SCIENCES

Sciences in MYP are assessed through the four prescribed criteria according to their specific objectives as follows:

INTERIM OBJECTIVES – SCIENCES

A Knowing and understanding

YEAR 4	YEAR 5
At the end of the fourth year, students should be able to:	**At the end of the last year, students should be able to:**
i. describe and explain with some guidance scientific problems	i. explain scientific knowledge
ii. apply scientific knowledge and understanding to solve problems set in familiar and unfamiliar situations	ii. apply scientific knowledge and understanding to solve problems set in familiar and unfamiliar situations
iii. analyse and with some guidance evaluate information to make scientifically supported judgements	iii. analyse and evaluate information to make scientifically supported judgements

B Inquiring and designing

YEAR 4	YEAR 5
At the end of the fourth year, students should be able to:	**At the end of the last year, students should be able to:**
i. describe and explain with some guidance a problem or question to be tested by a scientific investigation	i. explain a problem or question to be tested by a scientific investigation
ii. formulate a testable hypothesis and explain it using scientific reasoning	ii. formulate a testable hypothesis and explain it using scientific reasoning
iii. describe and explain with some guidance how to manipulate the variables, and describe and explain with some guidance how data will be collected	iii. explain how to manipulate the variables, and explain how data will be collected
iv. design scientific investigation	iv. design scientific investigation

C Processing and evaluating

YEAR 4	YEAR 5
At the end of the fourth year, students should be able to:	**At the end of the last year, students should be able to:**
i. present collected and transformed data	i. present collected and transformed data
ii. interpret data, describe and with some guidance explain results using scientific reasoning	ii. interpret data and explain results using scientific reasoning
iii. discuss and with some guidance evaluate the validity of a hypothesis based on the outcome of the scientific investigation	iii. evaluate the validity of a hypothesis based on the outcome of the scientific investigation
iv. discuss and with some guidance evaluate the validity of the method	iv. evaluate the validity of the method
v. describe and with some guidance explain improvements or extensions to the method	v. explain improvements or extensions to the method

D Reflecting on the impacts of science

YEAR 4	YEAR 5
At the end of the fourth year, students should be able to:	**At the end of the last year, students should be able to:**
i. describe and with some guidance explain the ways in which science is applied and used to address a specific problem or issue	i. explain the ways in which science is applied and used to address a specific problem or issue
ii. discuss, analyse and with some guidance evaluate the various implications of using science and its application to solve a specific problem or issue	ii. discuss and evaluate the various implications of using science and its application to solve a specific problem or issue
iii. apply scientific language affectively	iii. apply scientific language affectively
iv. document the work of others and sources of information used	iv. document the work of others and sources of information used

Each criterion has 9 possible levels of achievement placed in 4 bands with their own descriptors as shown:

DESCRIPTORS FOR GRADING FOR SCIENCES

A Knowing and understanding

LEVEL	DESCRIPTOR	
	MYP4	**MYP5**
0	The student does not reach a standard identified by any of the descriptors below.	The student does not reach a standard identified by any of the descriptors below.
1-2	The student is able to: i. **recall** and **state with some guidance** scientific knowledge ii. apply scientific knowledge and understanding to **suggest solutions** to problems set in **familiar situations** iii. **apply** information to make **judgments**.	The student is able to: i. **state** scientific knowledge ii. apply scientific knowledge and understanding to **suggest solutions** to problems set in **familiar situations** iii. **interpret** information to make **judgments**.
3-4	The student is able to: i. **outline** scientific knowledge ii. apply scientific knowledge and understanding to **solve problems** set in **familiar situations** iii. **with some guidance interpret** information to make **scientifically supported judgments**.	The student is able to: i. **outline** scientific knowledge ii. apply scientific knowledge and understanding to **solve problems** set in **familiar situations** iii. **interpret** information to make **scientifically supported judgments**.
5-6	The student is able to: i. **describe** scientific knowledge ii. apply scientific knowledge and understanding to **solve problems** set in **familiar situations** and **suggest solutions** to problems set in **unfamiliar situations** iii. **interpret** information to make **scientifically supported judgments**.	The student is able to: i. **describe** scientific knowledge ii. apply scientific knowledge and understanding to **solve problems** set in **familiar situations** and **suggest solutions** to problems set in **unfamiliar situations** iii. **analyse** information to make **scientifically supported judgments**.
7-8	The student is able to: i. **explain** scientific knowledge ii. apply scientific knowledge and understanding to **solve problems** set in **familiar and unfamiliar situations** iii. **analyse** information to make **scientifically supported judgments**	The student is able to: i. **explain** scientific knowledge ii. apply scientific knowledge and understanding to **solve problems** set in **familiar and unfamiliar situations** iii. **analyse** and **evaluate** information to make **scientifically supported judgments**

B Inquiring and designing

LEVEL	DESCRIPTOR	
	MYP4	**MYP5**
0	The student does not reach a standard identified by any of the descriptors below.	The student does not reach a standard identified by any of the descriptors below.
1-2	The student is able to: i. **state** a problem or question to be tested by a scientific investigation ii. **state** a testable hypothesis iii. **state** the variables iv. **design** a method, **with limited success.**	The student is able to: i. **state** a problem or question to be tested by a scientific investigation ii. **outline** a testable hypothesis iii. **outline** the variables iv. **design** a method, **with limited success.**
3-4	The student is able to: i. **with some guidance describe** a problem or question to be tested by a scientific investigation ii. **formulate** a testable hypothesis **using scientific reasoning** iii. **with some guidance describe** how to manipulate the variables, and how **relevant data** will be collected iv. design a **safe method** in which he or she **selects materials and equipment**.	The student is able to: i. **outline** a problem or question to be tested by a scientific investigation ii. **formulate** a testable hypothesis **using scientific reasoning** iii. **outline** how to manipulate the variables, and **outline** how **relevant data** will be collected iv. design a **safe method** in which he or she **selects materials and equipment**.
5-6	The student is able to: i. **describe** a problem or question to be tested by a scientific investigation ii. **formulate and explain** a testable hypothesis **using scientific reasoning** iii. **describe** how to manipulate the variables, and **describe** how **sufficient, relevant data** will be collected iv. design a **complete and safe method** in which he or she selects **appropriate materials and equipment**.	The student is able to: i. **describe** a problem or question to be tested by a scientific investigation ii. **formulate and explain** a testable hypothesis **using scientific reasoning** iii. **describe** how to manipulate the variables, and **describe** how **sufficient, relevant data** will be collected iv. design a **complete and safe method** in which he or she selects **appropriate materials and equipment**.
7-8	The student is able to: i. **explain** a problem or question to be tested by a scientific investigation ii. **formulate and explain** a testable hypothesis **using correct scientific reasoning** iii. **explain** how to manipulate the variables, and **explain** how **sufficient, relevant data** will be collected iv. **design** a **logical, complete and safe method** in which he or she **selects appropriate materials and equipment**.	The student is able to: i. **explain** a problem or question to be tested by a scientific investigation ii. **formulate and explain** a testable hypothesis **using correct scientific reasoning** iii. **explain** how to manipulate the variables, and **explain** how **sufficient, relevant data** will be collected iv. **design** a **logical, complete and safe method** in which he or she **selects appropriate materials and equipment**.

C Processing and evaluating

LEVEL	DESCRIPTOR	
	MYP4	**MYP5**
0	The student does not reach a standard identified by any of the descriptors below.	The student does not reach a standard identified by any of the descriptors below.
1-2	The student is able to: i. **collect and present** data in numerical and/or visual forms ii. **interpret** data iii. **state** the validity of a hypothesis **with a reference** to a scientific investigation iv. **state** the validity of the method **with a reference** to a scientific investigation v. **state limited improvements** or extensions to the method.	The student is able to: i. **collect and present** data in numerical and/or visual forms ii. **interpret** data iii. **state** the validity of a hypothesis based on the outcome of a scientific investigation iv. **state** the validity of the method based on the outcome of a scientific investigation v. **state** improvements or extensions to the method.
3-4	The student is able to: i. **correctly collect and present** data in numerical and/or visual forms ii. **accurately interpret** data and **describe** results **using scientific reasoning**. iii. **state** the validity of a hypothesis based on the outcome of a scientific investigation iv. **state** the validity of the method based on the outcome of a scientific investigation v. **state** improvements or extensions to the method that would benefit the scientific investigation.	The student is able to: i. **correctly collect and present** data in numerical and/or visual forms ii. **accurately interpret** data and **explain** results iii. **outline** the validity of a hypothesis based on the outcome of a scientific investigation iv. **outline** the validity of the method based on the outcome of a scientific investigation v. **outline** improvements or extensions to the method that would benefit the scientific investigation.
5-6	The student is able to: i. **correctly collect, organize and present** data in numerical and/or visual forms ii. **accurately interpret** data and **with some guidance explain** results **using scientific reasoning.** iii. **discuss** the validity of a hypothesis based on the outcome of a scientific investigation iv. **discuss** the validity of the method based on the outcome of a scientific investigation v. **describe** improvements or extensions to the method that would benefit the scientific investigation.	The student is able to: i. **correctly collect, organize and present** data in numerical and/or visual forms ii. **accurately interpret** data and **explain** results **using scientific reasoning** iii. **discuss** the validity of a hypothesis based on the outcome of a scientific investigation iv. **discuss** the validity of the method based on the outcome of a scientific investigation v. **describe** improvements or extensions to the method that would benefit the scientific investigation.
7-8	The student is able to: i. **correctly collect, organize, transform and present** data in numerical and/ or visual forms ii. **accurately interpret** data and **with some guidance explain** results **using correct scientific reasoning** iii. **with some guidance evaluate** the validity of a hypothesis based on the outcome of a scientific investigation iv. **with some guidance evaluate** the validity of the method based on the outcome of a scientific investigation v. **explain** improvements or extensions to the method that would benefit the scientific investigation.	The student is able to: i. **correctly collect, organize, transform and present** data in numerical and/ or visual forms ii. **accurately interpret** data and **explain** results **using correct scientific reasoning** iii. **evaluate** the validity of a hypothesis based on the outcome of a scientific investigation iv. **evaluate** the validity of the method based on the outcome of a scientific investigation v. **explain** improvements or extensions to the method that would benefit the scientific investigation.

D Reflecting on the impact of science

LEVEL	DESCRIPTOR	
	MYP4	**MYP5**
0	The student does not reach a standard identified by any of the descriptors below.	The student does not reach a standard identified by any of the descriptors below.
1-2	The student is able to: i. **outline** the ways in which science is used to address a specific problem or issue ii. **outline** the implications of using science to solve a specific problem or issue, interacting with a factor iii. **apply** scientific language to communicate understanding but does so **with limited success** iv. document sources, with **limited success**.	The student is able to: i. **outline** the ways in which science is used to address a specific problem or issue ii. **outline** the implications of using science to solve a specific problem or issue, interacting with a factor iii. **apply** scientific language to communicate understanding but does so **with limited success** iv. document sources, with **limited success**.
3-4	The student is able to: i. **summarize** the ways in which science is applied and used to address a specific problem or issue ii. **describe** the implications of using science and its application to solve a specific problem or issue, interacting with a factor iii. **sometimes apply** scientific language to communicate understanding iv. **sometimes** document sources correctly.	The student is able to: i. **summarize** the ways in which science is applied and used to address a specific problem or issue ii. **describe** the implications of using science and its application to solve a specific problem or issue, interacting with a factor iii. **sometimes apply** scientific language to communicate understanding iv. **sometimes** document sources correctly.
5-6	The student is able to: i. **describe** the ways in which science is applied and used to address a specific problem or issue ii. **explain** the implications of using science and its application to solve a specific problem or issue, interacting with a factor iii. **usually apply** scientific language to communicate understanding clearly and precisely iv. **usually** document sources correctly.	The student is able to: i. **describe** the ways in which science is applied and used to address a specific problem or issue ii. **discuss** the implications of using science and its application to solve a specific problem or issue, interacting with a factor iii. **usually apply** scientific language to communicate understanding clearly and precisely iv. **usually** document sources correctly.
7-8	The student is able to: i. **explain** the ways in which science is applied and used to address a specific problem or issue ii. **discuss** the implications of using science and its application to solve a specific problem or issue, interacting with a factor iii. **consistently apply** scientific language to communicate understanding **clearly and precisely** iv. document sources **completely**.	The student is able to: i. **explain** the ways in which science is applied and used to address a specific problem or issue ii. **discuss and evaluate** the implications of using science and its application to solve a specific problem or issue, interacting with a factor iii. **consistently apply** scientific language to communicate understanding **clearly and precisely** iv. document sources **completely**.

According to the descriptors and with direct reference to them teachers provide the task-specific clarifications of expectations, which can be in the form of:

i. a task-specific version of the required assessment criteria
ii. a face-to-face or virtual classroom discussion
iii. a detailed task sheet or assignment

Graded can be not only written tests, investigations, lab reports and essays, but as well short quizzes and tasks with only one or several strands addressed, which (strands) is noted in the rubric for notes. In the same rubric homework tasks and class participation is noted according to the strands addressed. The final points in each criterion is formed as a "best-fit" judgement taking into account all points and notes, and the final grade according to the by the IB prescribed table.

According to the fact that physics, chemistry and biology have the same objectives and descriptors for grading, sometimes the levels of achievement can be aknowledged in more than one subject of the group.