

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 inquirers. 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.

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 – development and community

FORCES

What makes the world go around?

- concept of force, 1st and 3rd Newton's law
- elementary forces vs. elementary particles
- other examples of forces (weight, friction, elastic force...)
- adding forces and resolving in components for specific purposes

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

WORK AND ENERGY

What is actually energy?

- concept of work and energy
- kinetic and potential energy

special: mass and energy

TOPICS FOR MYP5:

ENERGY, WORK AND POWER

How does the world get its energy?

- energy in different systems
- conservation laws
- power and efficiency

special: dark energy

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 (heureka)

HEAT AND THERMAL EFFECTS

How do heat engines work?

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

special: antimatter

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: waves and quantum mechanics

ELECTRICITY AND ELECTROMAGNETISM

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

- show led by experiments from the electric charge to the electric generator

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 acknowledged in more than one subject of the group.