**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. Setting bodies and particles in motion we produce ***electricity*** and ***waves***: studying ***light*** and ***electromagnetism*** we open the door between physics and philosophy.

**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?**

- 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 (gravity, weight, friction, elastic force)

**special: CERN – objectives and results; 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:**

**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: black holes**

**HEAT AND THERMAL EFFECTS**

How do heat engines work?

* internal energy, temperature and heat
* heat transfer and states of matter
* the gas laws
* heat engine

**special: dark matter and energy**

**WAVES**

What are actually waves?

* origin and propagation of waves
* describing waves: wave length and frequency
* reflection
* refraction
* interference
* waves around us
* particles or waves?

**special: quantum mechanics**

**ELECTRICITY AND ELECTROMAGNETISM**

How has electricity changed our lives?

* electric charge, potential and field
* voltage, current and electric circuits
* electric energy and power
* magnets and magnetic fields
* magnetic effect of a current and electromagnetic induction
* electric motors and generators

**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

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| **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

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| --- | --- | --- |
| 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**

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| --- | --- | --- |
| 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**

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| 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

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| 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, oral exams, investigations, lab reports and essays, but as well short quizzes and tasks with only one or several strands addressed, which is marked 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.

If a student is not at school on the due day, he/she is obliged to present their written work during the first lesson on the corresponding subject.

The written work consisting of more than one third of citations put in the quotation marks will be awarded zero points.

In a case of not presenting a piece of work on the due day, a student is awarded zero points on the work.

In a case of malpractice, including academic infringement, a student is awarded zero points on the work. In both cases student is obliged to rewrite their work and present it within the 48 hours. In the case of academic infringement the corrected work will be graded and both grades will be considered in forming the final grade.