



# Physics

## Nature of the Subject

The IB Diploma Programme Physics course is designed to cultivate a deep understanding of the fundamental principles that govern the physical world. It explores the nature of the physical universe, from the smallest particles to the vastness of the cosmos. The course emphasizes the development of critical thinking, problem-solving skills, and a strong foundation in scientific inquiry. The course also instigates students to communicate and collaborate effectively as well as develop an awareness of the ethical, environmental, economic, cultural, and social impact of science locally and globally.

## Distinction between Higher and Standard Level:

The SL course provides students with a fundamental understanding of physics and experience of the associated skills. The HL course requires students to increase their knowledge and understanding of the subject, and so provides a solid foundation for further study at university level. This difference is reflected in the additional content studied by HL students, which is conceptually more demanding and explored in greater depth. The distinction between SL and HL is therefore one of both breadth and depth. The increased breadth and depth at HL result in increased networked knowledge, requiring the student to make more connections between diverse areas of the syllabus.

## Syllabus outline

The Physics course covers the following topics:

- A. Space, time, and motion
  - Kinematics\*, Forces and momentum\*, Work, energy and power\*
  - Rigid body mechanics\*\*\*, Galilean and special relativity\*\*\*
- B. The particulate nature of matter
  - Thermal energy transfers\*, Greenhouse effect\*, Gas Laws\*, Thermodynamics\*\*\*
  - Current and circuits\*
- C. Wave behavior
  - Simple harmonic motion\*\*
  - Wave model\*, Wave phenomena\*\*, Standing waves and resonance\*, Doppler effect\*\*
- D. Fields
  - Gravitational fields\*\*
  - Electric and magnetic fields\*\*, Motion in Electromagnetic fields\*, Induction\*\*\*
- E. Nuclear and Quantum physics
  - Structure of the atom\*\*, Quantum physics\*\*\*
  - Radiative decay\*\*, Fission\*, Fusion and stars\*

\* Topics taught to all students (SL and HL)

\*\* Topics taught to all students (SL and HL) with additional HL content

\*\*\* Topics taught to HL students only

## Prior Learning

- Linear, quadratic, and exponential/logarithmic functions with their graphs.
- Basic algebra, solving linear and quadratic equations.
- Basic trigonometric and geometric skills.
- Fundamental spreadsheet and word processing skills.

## Assessment Objectives

The assessment objectives for physics are formally internally assessed during the two years of the course and externally in the final IB examinations. Having followed the Diploma Programme course in Physics (SL and HL), students are expected to:

1. Understand, apply, and demonstrate knowledge of:
  - a. terminology, facts, and concepts
  - b. skills, techniques, and methodologies.
2. Analyze, evaluate, and synthesize:
  - a. experimental procedures
  - b. primary and secondary data
  - c. trends, patterns, and predictions.
3. Demonstrate the application of skills necessary to carry out insightful and ethical investigations.

## Teaching Approach

The IBDP approach to physics is multifaceted and consists of the following main approaches:

### **Conceptual understanding**

Conceptual understanding enables students to conceive multiple solutions to a problem, imagine different perspectives on issues, and understand more deeply how ideas change in different contexts.

### **Inquiry-based teaching - Experimental work**

Integral to the student experience of a physics course is the learning that takes place through scientific inquiry within the classroom, laboratory, or in the field. Students complete and develop experimental investigations to support their learning through structured, guided, or open-ended inquiry with a focus on laboratory experiments, databases, simulations, and modelling.

## Application in real-world situations

Setting learning in context gives relevance to the curriculum and allows students to connect their learning to their own experiences and the world around them. Students relate their learning to genuine applications of physics, highlighting the relevance to global issues, and developing an appreciation for the interaction between scientific solutions and potential ethical, environmental, or economic implications.

## Why students might choose this subject

Any student who wishes to pursue university studies in the fields of natural sciences and engineering: Higher Level Physics is a key requirement for pursuing in-depth studies in engineering and related sciences.

With a pragmatic approach, IBDP Physics equips students with the challenges of different academic pursuits, offering a solid grounding for their future endeavors.

## Course Assessment

The final assessment at the end of the two-year program for both SL and HL sections consists of two written exam papers and a scientific investigation:

### 1. External Assessment:

a) **Paper 1:** Multiple choice and data-based questions (SL duration of 1 hour 30 minutes, HL duration of 2 hours).

b) **Paper 2:** Short-answer and extended-response questions (SL duration of 1 hour and 30 minutes, HL duration of 2 hours and 30 minutes)

2. **Internal Assessment:** A personal scientific investigation by the student that is completed during the two years of study in the DP. It is assessed internally by the subject teacher and moderated externally by an IB examiner.