Anglo-Chinese School (Independent)
Science Department (Physics)
IBDP Physics

"Physics is a tortured assembly of contrary qualities: of scepticism and rationality, of freedom and revolution, of passion and aesthetics, and of soaring imagination and trained common sense."

Leon M Lederman (Nobel Prize for Physics, 1988)

INTRODUCTION

Physics is the most fundamental of the experimental sciences, as it seeks to explain the universe itself from the very smallest particles – currently accepted as quarks, which may be truly fundamental – to the vast distances between galaxies. Essentially, it is the study of the four fundamental forces or interactions in the universe.

Classical Physics, encompassing areas of Physics such as Newtonian Mechanics, Thermodynamics and Electromagnetism continue to be taught, and form the foundations of the subject. Topics in Modern Physics, such as Quantum Physics and Particle Physics, are also introduced.

Previously, Physics, as it was taught in schools, used to be rather heavy on mathematics, focusing on a quantitative approach to the subject. Students were to solve problems based on simulated scenarios which were crafted to match concepts that were intended to be assessed.

In recent years, there has been a shift towards a more qualitative approach. Students are required to understand concepts and apply them when solving authentic real-world problems. Command terms such as *Explain, Suggest,* or *Predict* require students to analyze the given contexts, dissect them, and make sense of them. There is a reduced focus on tedious mathematical manipulations. While the physics concepts that students are required to learn are clearly stipulated in the syllabus, no syllabus can limit the application of these concepts, hence students need to have a flexible and analytical mind in order to do well in the subject. Repetitive drill and practice serves little to help students improve, but the aim of practicing a wide range of problems is to expose students to the multitude of applications that physics concepts can be extended to.

The teaching of IB Physics at ACS (Independent) aims to not only develop students in the cognitive domain, but also in all aspects of the IB Learner Profile, enabling students to eventually contribute back to society in later years.

CHOOSING GROUP 4 SUBJECTS

One or Two Group 4 Subjects?

The study of sciences in the IBDP is much more rigorous compared to that at the secondary school level. The nature of practical work is also more independent and self-driven. Students who wish to take two Group 4 subjects must consider whether they have the aptitude for studying the sciences.

Higher Level (HL) or Standard Level (SL)?

Both Physics HL and SL students will study a common set of core topics. HL students will tackle additional HL topics, which includes new topics as well as an in-depth expansion of the core topics.

The internal assessment requirements for Physics HL and SL are identical.

To take Physics SL, students must have passed Physics (Grade 4 or C6) at the secondary school level. To take Physics HL, students must have obtained at least a Grade 6 or A2 at the secondary school level.

COURSE CONTENT
A core curriculum is offered to both Standard Level and Higher Level students.

Core Topics (both SL and HL) and AHL (Additional HL) Topics

A. Space, time and motion
A.1 Kinematics
A.2 Forces and momentum
A.3 Work, energy and power
A.4 Rigid body mechanics (AHL)
A.5 Galilean and special relativity (AHL)

B. The particulate nature of matter
B.1 Thermal energy transfers
B.2 Greenhouse effect
B.3 Gas laws
B.4 Thermodynamics (AHL)
B.5 Current and circuits

C. Wave behaviour
C.1 Simple harmonic motion
C.2 Wave model
C.3 Wave phenomena
C.4 Standing waves and resonance
C.5 Doppler effect

D. Fields
D.1 Gravitational fields
D.2 Electric and magnetic fields
D.3 Motion in electromagnetic fields
D.4 Induction (AHL)

E. Nuclear and Quantum physics
E.1 Structure of the atom
E.2 Quantum physics (AHL)
E.3 Radioactive decay
E.4 Fission
E.5 Fusion and stars

PRACTICAL WORK
Experimental investigations are integral to the learning of sciences. Students are trained to design experiments, make observations, collect robust data, conduct objective analysis of the data and make appropriate conclusions of their experiments. This takes the form of a series of practical activities in the laboratories, the Group 4 Project, and the Internal Assessment.

ASSESSMENT
Internal Assessment (20 %)
The internal assessment requirements at SL and at HL are the same.
This comprises of an in-depth individual scientific investigation, cumulating in a formal written report.

External Assessment (80 %)
2 written papers of varying duration and format covering multiple choice, data-based, short-answer and extended-response questions. The weighting of each paper is as follows:

Level	Paper	Duration	Weightage
SL	1	1 h 30 min	36%
SL	2	1 h 30 min	44%
HL	1	2 h	36%
HL	2	2 h 30 min	44%

ADVANCED SCIENCE PROGRAMME (ASP)
The ASP is a differentiated 2-year programme offered by ACS (Independent) for Year 5 and 6 students with special science talents. Students in this programme have a strong affinity for science, and are nurtured to participate in science competitions and olympiads, both at the national and international levels.

Prospective students may indicate their interest for selection into the program. Details for the selection are provided at the subject briefing during the orientation period.

UNIVERSITY COURSES AND CAREERS
Generally, the following university courses accept Physics as a pre-requisite subject: *Architecture, Computing, Dentistry, Engineering, Medicine, Pure and Applied Sciences*.

However, it should be noted that eligibility requirements vary across universities, hence students are strongly advised to consult the university websites and prospectus for specific details. University eligibility criteria also may change from year to year.

Questions?

For clarifications and queries, please e-mail
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