



Physics

Aims and objectives

IB



Curriculum model

SL	Total teaching hours	150
Theory		110
Core		80
Options		30
Practical work		40
Investigations		30
Group 4 project		10
HL	Total teaching hours	240
Theory		180
Core		80
Additional higher level (AHL)		55
Options		45
Practical work		60
Investigations		50
Group 4 project		10



Physics is one of the group 4 subjects.

Through studying any of these subjects, you should be aware of :

- how scientists work and communicate with each other;
- The “scientific method” involves the formation, testing and modification of hypotheses through observation and measurement;
- What distinguishes the experimental sciences from other disciplines



Aims

- To apply and use a body of knowledge, methods and techniques which characterize science
- Develop an ability to analyze, evaluate and synthesize scientific information
- Develop experimental and investigative scientific skills



Aims

- Raise awareness of the moral, ethical, social, economic and environmental implications of using science and technology
- Develop an appreciation of the possibilities and limitations associated with science and scientists



You should achieve:

- **Demonstrate an understanding of:** scientific facts and concepts, scientific methods and techniques, scientific terminology;
- **Apply and use:** scientific facts and concepts, scientific methods and techniques, scientific terminology;



You should achieve:

- **Construct, analyse and evaluate:** hypothesis, research questions and predictions, scientific methods and techniques, scientific explanations;
- **Demonstrate the personal skills of** cooperation, perseverance and responsibility appropriate for effective scientific investigation and problem solving



Syllabus of Pre-IB course

- Physics and physical measurements
- Mechanics
- Thermal physics
- Electric field
- Electric current
- Practical work



Some physical concepts

- **Quantity** – 1) the aspect or property of anything that can be measured, weighed, counted, etc; 2) a specified magnitude or amount;
- **Magnitude** - a number assigned to a quantity, such as weight, and used as a basis of comparison for the measurement of similar quantities
- **Value** - a particular magnitude, number, or amount



Some physical concepts

- **Unit** - a standard amount of a physical quantity, such as length, mass, energy, etc., specified multiples of which are used to express magnitudes of that physical quantity
- **Physical phenomenon** – any change in nature



Action verbs

- **Define** – give the precise meaning of a word or phrase as concisely as possible
- **Draw** – represent by means of pencil lines
- **List** – give a sequence of names or other brief answers with no elaboration, each one clearly separated from the others



Action verbs

- **Measure** – find a value for a quantity
- **State** – give a specific name, value or other brief answer
- **Annotate** – add brief notes to a diagram, drawing or graph
- **Distinguish** – give the differences between two or more different items



Action verbs

- **Estimate** – find an approximate value for an unknown quantity, based on the scientific knowledge
- **Identify** – find an answer from a number of possibilities
- **Outline** – give a brief account or summary



Action verbs

- **Deduce** – reach a conclusion from the information given
- **Derive** – manipulate a mathematical equation to give a new equation or result
- **Evaluate** – assess the implications and limitations



Action verbs

- **Solve** – obtain an answer using algebraic and/or numerical methods
- **Suggest** – propose a hypothesis or other possible answer
- **Explain** – give a clear account including causes, reasons or mechanisms



What is Physics?

Universal:

Some sciences study specific objects or phenomena, for example

- The fish is an animal (biology)
- The stone consists of granite (geology)
- The battery is a source of electric voltage (engineering)

Physics studies properties which These have in common (universal phenomena)

- The stone/ fish/battery weighs 50 g (physics)
- The stone/ fish/battery falls down because of gravity (physics)
- The stone/ fish/battery consists of atoms (physics)



What is Physics?

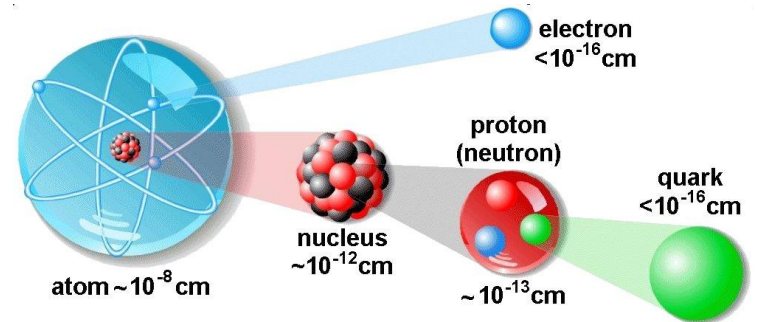
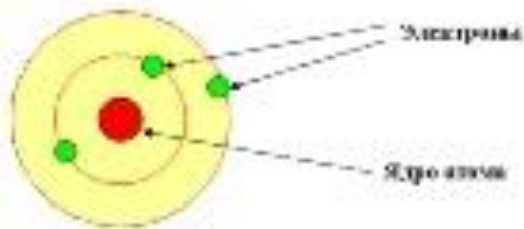
- *Experimental:*

This means that what is ultimately true is decided by experimental tests.

- *Mathematical:*

Both experiments and theories in physics often involve mathematical descriptions and analyses.

The realm of Physics



Diameter of solar system – 10^{13} m



Diameter of Universe – 10^{26} m

Physical quantity -the aspect or property of anything that can be measured, weighed, counted, etc

Physical quantity

Definition

Speed is a quantity equaled to the ratio of a distance moved to time taken

Formula
(math definition)

$$v = \frac{s}{t}$$

Magnitude
(numerical value)

10

Unit

ms⁻¹

Physical quantity –

is a physical property that can be quantified. This means it can be measured and/or calculated and expressed in numbers.

- Example:
- The value of power is written as

$$P = 45.3 \times 10^3 \text{ W} = 45.3 \text{ kW},$$

Then

P represents the physical quantity of power

45.3 x 10³ is a numerical value

K is the SI prefix kilo, representing 10³

W is the symbol for unit of power [P], the watt



The SI system

- **Fundamental (basic)**

Mass	Kilogram	kg
Length	Meter	m
Time	Second	s
Electric current	Ampere	A
Amount of substance	Mole	mol
Temperature	Kelvin	K
Luminous intensity	candela	cd

The SI of units (*derived*)

Physical Quantity	Symbol	Name and Symbol SI Unit	Fundamental Units Involved	Derived Units involved
frequency	f or ν	hertz (Hz)	s^{-1}	s^{-1}
force	F	newton (N)	$kg\ m\ s^{-2}$	$kg\ m\ s^{-2}$
work	W	joule (J)	$kg\ m^2\ s^{-2}$	Nm
energy	Q, E_p, E_k, E_{elas}	joule (J)	$kg\ m^2\ s^{-2}$	Nm
power	P	watt (W)	$kg\ m^2\ s^{-3}$	$J\ s^{-1}$
pressure	P	pascal (Pa)	$kg\ m^{-1}\ s^{-2}$	$N\ m^{-2}$
charge	Q	coulomb (C)	$A\ s$	$A\ s$
potential difference	V	volt (V)	$kg\ m^2\ s^{-3}\ A^{-1}$	$J\ C^{-1}$
resistance	R	ohm (Ω)	$kg\ m^2\ s^{-3}\ A^{-2}$	$V\ A^{-1}$
magnetic field intensity	B	tesla (T)	$kg\ s^{-3}\ A^{-1}$	$NA^{-1}\ m^{-1}$
magnetic flux	Φ	weber (Wb)	$kg\ m^2\ s^{-2}\ A^{-2}$	$T\ m^2$
activity	A	becquerel (Bq)	s^{-1}	s^{-1}
absorbed dose	W/m	gray (Gy)	$m^2\ s^{-2}$	$J\ kg^{-1}$



Units in accepted SI format

Note the use of the accepted SI format.

For example, the unit for acceleration is written as $m s^{-2}$ and **not $m/s/s$ or m/s^2** .

No mathematical denominators are used but rather inverse numerators are the preferred option.



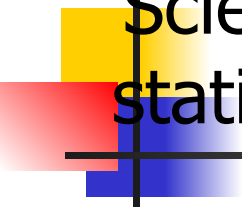
Prefixes

Submultiple

pico	p	10^{-12}
nano	n	10^{-9}
micro	μ	10^{-6}
milli	m	10^{-3}

Multiple

kilo	k	10^3
Mega	M	10^6
Giga	G	10^9
Tera	T	10^{12}



Scientists tend to use **scientific notation** when stating a measurement rather than writing lots of figures.

$1.2 * 10^6$ is easier to write and has more significance than 1 200 000.

In order to minimise confusion and ambiguity, all quantities are best written as a value between one and ten multiplied by a power of ten.

For example, we have that, $0.06 \text{ kg} = 6 * 10^{-2} \text{ kg}$